

# A STUDY OF CROSS COUNTRY EXPERIENCES IN PREPARING AND PUBLISHING HOUSING PRICE INDICES

Occasional Paper No. III



राष्ट्रीय आवास बैंक



NATIONAL HOUSING BANK





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EXPERIENCES IN PREPARING AND  
PUBLISHING HOUSING  
PRICE INDICES**

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**NATIONAL HOUSING BANK**  
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## National Housing Bank

National Housing Bank (NHB) is the apex financial institution for housing in India, wholly owned by the Reserve Bank of India. It was established in 1988 under an Act of Parliament. NHB has three main functions viz. to regulate the housing finance companies, to promote and develop the housing finance market and to provide financial assistance to housing finance institutions and others. NHB's current focus is on addressing the needs of the unserved and the underserved.

This publication is part of NHB's Occasional Paper Series, which seeks to disseminate the findings of the studies and research programmes conducted by the NHB on issues related to housing.

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*Prepared by RESIDEX & Housing Policy Cell of*  
**National Housing Bank**

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## FOREWORD

Housing is one of the basic necessities of life, just next to food and clothing. Apart from shelter, home ownership also serves to fulfil many other fundamental objectives viz. raising the quality of family life in terms of health, education, sanitation and serves as an asset that can be financially leveraged. It generates a sense of physical and emotional satisfaction and achievement. At the macro level, housing generates considerable employment and dispersed economic activity.

Housing has always been an important agenda for the governments in developing as well as developed countries; because it is a visible output where the development can be seen. It is a vital sector of the national economy creating jobs and generating taxes and wages that positively influence the quality of life. Thus, the government policies on the housing front have a direct impact on the health of the economy. The buying or selling of a dwelling is typically the largest transaction for a private middle class household. Changes in residential property prices are, therefore, likely to influence substantially the personal finances and saving decisions of the average citizens. Changes in prices of houses and flats also have an impact on the wealth of owners of dwellings, given that it is often the largest asset in their portfolio.

Property prices can be both a source of strength and weakness in the economy, both nationally and internationally. In the long run, increasing housing prices are likely to lead to asset price bubbles. House price risk has attracted much attention in recent years, with many countries in the world having experienced housing price bubbles. Housing wealth can, at times, distort capital allocation and investment decisions.

Measurement of housing prices and tracking them is of immense value to policy makers, investors, lenders and consumers. Internationally, it has been observed that most of the developed countries and some developing countries prepare and publish such real estate price indices regularly on the basis of transaction data that is captured. In these countries, there is an effective and statutory system of capturing required data to produce a standardised measure of true price change over time.

National Housing Bank has brought to the Country the first official residential property index by launching NHB RESIDEX in July, 2007 covering five cities viz. Bhopal, Bangalore, Delhi, Kolkata and Mumbai; covering five years from 2001 to 2005 with 2001 as the base year. It was well received in official circles as well as in the market. NHB RESIDEX has since expanded to cover fifteen cities viz. Ahmedabad, Bangalore, Bhopal, Chennai, Delhi, Faridabad, Hyderabad, Jaipur, Kochi, Kolkata, Lucknow, Mumbai, Patna, Pune and Surat and updated to December, 2008. NHB has been studying the experiences of other countries in preparing and releasing housing price indices. The exercise has helped the Bank to benchmark itself and to learn a great deal on the subject. This publication is an attempt by the National Housing Bank towards providing some insights in the cross country experiences in housing price indices. This paper is a part of the Bank's efforts in contributing to greater informed opinion and to awareness building amongst all concerned people. As the apex financial institution for housing, NHB has initiated a slew of measures for promoting housing sector in India.

We hope that this paper will make a small contribution to public policy formulation. NHB will be happy to consider action consistent with its mandate as well as carry out followon studies based on comments and suggestions received.

I seek valuable comments of readers.

New Delhi  
30th June, 2009

**(S. Sridhar)**  
Chairman & Managing Director  
National Housing Bank

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## LIST OF ABBREVIATIONS

<i>FSI</i>	<i>Financial Soundness Indicators</i>
<i>NHPI</i>	<i>New Housing Price Index</i>
<i>RSR</i>	<i>Repeat Sales Regression</i>
<i>CML</i>	<i>Council of Mortgage Lenders</i>
<i>SML</i>	<i>Survey of Mortgage Lenders</i>
<i>NCREIF</i>	<i>National Council of Real Estate Investment Fiduciaries</i>
<i>FHFA</i>	<i>Federal Housing Finance Agency</i>
<i>WRS</i>	<i>Weighted-Repeat Sales</i>
<i>MSA</i>	<i>Metropolitan Statistical Areas</i>
<i>R&amp;VD</i>	<i>Rating and Valuation Department</i>
<i>INSEE</i>	<i>National Institute of Statistics and Economic Studies</i>
<i>ECB</i>	<i>European Central Bank</i>
<i>PR</i>	<i>Price Relatives</i>
<i>ABS</i>	<i>Australian Bureau of Statistics</i>
<i>RBA</i>	<i>Reserve Bank of Australia</i>
<i>ACS</i>	<i>Australian Construction Services</i>
<i>ÖSTAT</i>	<i>Austrian Central Statistical Office</i>
<i>HPX</i>	<i>German House Price Indices</i>
<i>SCB</i>	<i>Swedish Statistical Office</i>
<i>NAR</i>	<i>National Association of Realtors</i>

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# CHAPTER I

## INTRODUCTION

1.1 In recent years countries developed as well as developing, all over the world are having widespread swings in housing prices. There are good reasons why the public and policymakers should monitor house price developments closely. The buying or selling of a dwelling is typically the largest transaction a private household enters into. Changes in residential property prices are, therefore, likely to influence substantially the budget plans and saving decisions of the potential buyers and sellers. Changes in prices of houses and flats also have an impact on the wealth of owners of dwellings, given that it is the largest asset in their portfolio. Furthermore, as the purchases of houses are predominantly funded by mortgage loans originated by financial institutions, and that real estate property is widely used as a major collateral asset for bank loans, there are strong linkages between the residential property cycle and the credit cycle, and by extension the banking sector and the macro economy. Besides, for meeting the regulatory

requirements and also to manage their risk, financial institutions are required to specify their risks with regard to their mortgage portfolios by estimating the actual liquidation value for every home in their portfolio. Another application of a house price indices is to allow brokers and homeowners to calculate the current value of an individual dwelling as well as the amount of equity gained (or lost) through house price appreciation (or depreciation). Finally, housing prices can provide important insights for financial stability analysis, since sharp increases and declines in prices can have a detrimental impact on financial sector health and soundness, by affecting credit quality and the value of collateral.

1.2 Furthermore, the housing prices are a key determinant of affordability, which is one of the major public policy goals in many countries. Therefore, to understand the behavior of housing prices and their influence on the economy, it is crucial to have an accurate measure of aggregate housing prices. Reflecting these, the Financial



Sector Assessment Program (FSAP), which was introduced by the IMF and the World Bank in 1999, recommended including real estate prices in the encouraged set of financial soundness indicators (FSIs).

1.3 Property prices can be both a source of strength and a source of weakness in the economy, both nationally and internationally. Rising house prices, together with low interest rates encourage people in to take out larger mortgages and to re-mortgage their homes, with the latter, in particular contributing to increased consumer spending and economic growth. However, in the long run, increasing housing prices are likely to lead to asset price bubbles. House price risk has attracted much attention in recent years. A number of industrialized economies, including the United States, the United Kingdom and Spain, have witnessed a protracted period of significant increases in house prices until recently. The perceived lower risk encouraged more lax lending criteria in mortgage markets, which lie at the heart of the ongoing sub-prime crisis.

1.4 Thus, the importance of an authentic database on real estate market, driven price trends and price indices, cannot be overemphasized as a crucial element of market development and enhancing the transparency and efficiency of market process. However,

measuring house prices accurately over time is not simple or straightforward. It involves complex conceptual, methodological and data issues. Housing is an extremely heterogeneous good and sales of houses are infrequent. Besides, the composition of houses transacted in the market changes over time and the quality of houses is not constant.

1.5 There are two categories of data that might be used to construct house price indices; household surveys, such as the Survey of English Housing, that ask respondents to estimate the current value of their home; and administrative data on actual transactions. Although, the former offers the potential advantage of considering the prices of an identical or at least comparable group of houses, the disadvantage is its relying on estimated as opposed to actual prices. Actual transactions have their own problems. Like all administrative data they have to be adjusted to fit statistical purposes. If transactions data from mortgage lenders is used, it is likely to provide adequate information in cases where the property transactions have been financed by availing housing loans, it would miss out on those transactions that have been done without availing housing loans. The proportion of such transactions could be fairly large.

1.6 Internationally, it has been



observed that most of the developed countries and some developing countries prepare and publish such real estate indices regularly on the basis of transaction data that is captured. In these countries, there is an effective system of capturing required data to produce a standardised measure of true price change over time.

There are numerous methods for constructing house price indices, each with their own advantages and disadvantages. Some of these methods are based on simple summary measures, such as the median price of houses transacted in a particular period. The advantage of these methods lies in their relative simplicity, both in terms

of computation and the interpretation of results. However, such simple measures are likely to suffer from compositional and quality problems. Recent advances in more sophisticated methods (such as hedonic regression and repeat sales methods) have enabled price statisticians to adequately account for compositional and quality changes. However, these methods are also not without limitations. Most notably, they are data intensive and their practical use is limited by the lack of comprehensive data on housing characteristics. The advantages and drawbacks of main methods of preparing house price indices are summarized in Table No. 1.

**Table No. 1 - Advantages and drawbacks of main methods of preparing house price indices**

Type	Advantage	Drawback
1. Average prices-mean, median, mode	Easy to collect and calculate	No correction for quality differences
2. Representative property method	Avoid most quality change problems	Focuses only on one set of properties and ignores developments of other properties
3. Hedonic regression models	Controls for quality changes Takes into account all possible houses	Requires huge data Potential bias for incorrect model specifications
4. Repeat sales method from the hedonic price model	Less data requirements Less dependent on model	Requires at least two sales, Quality of the same property may change during intervening period





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## CHAPTER II

### CROSS-COUNTRY EXPERIENCES

In the above context, an attempt has been made to study cross-country experiences in preparing and publishing housing price indices. Many countries are having their housing price indices with different objectives, parameter, scope, coverage area, methodology and mechanism for collecting the data. They update their HPIs regularly (on monthly or quarterly or yearly basis) depending upon the number of transactions and data availability. Experiences in nine countries namely, Canada, United Kingdom, United States, Hong Kong, France, Australia, Austria, Germany and Sweden, have been studied under this report.

#### 2.1 INDIA

In India National Housing Bank, on the behest of the Ministry of Finance undertook a study to examine the feasibility of preparing an index in a national level. Based on the result of the study the first official housing price index for the country named as NHB

RESIDEX was launched in July, 2007. Details of NHB RESIDEX are given in Appendix I.

#### 2.2 CANADA

2.2.1 In Canada, the New Housing Price Indices (NHPI) has been developed by Statistics Canada to measure inter-temporal changes in the selling prices of new residential houses constructed by builders/real estate developers. Although the NHPI is updated on a monthly basis, the housing attributes are kept constant between two consecutive periods. For most metropolitan areas, new house price indices are available from 1981, although prices from 1969 are recorded for selected areas. Besides the NHPI, independent indices have been developed for land prices and construction cost. The primary data for constructing the NHPI include builders' estimates of the current value of land (valued at market price). The residual, total selling price less land value, which mainly relates to the current cost of the

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<sup>1</sup> Source: Website of Statistics Canada





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structure, is independently indexed. The NHPI (1997=100) includes residential units in 21 metropolitan areas covering builders constructing single unit houses in sufficient numbers so that they can report selling prices for comparable transactions.

**2.2.2 Survey Instruments** - The survey instruments include data variables on house price and estimated market price of land component, as well as detailed attributes of the model house being transacted including physical and non-physical attributes. In the new housing price survey, reported prices are adjusted for changes in quality of structure and land. Most often the estimate of the value of the quality change provided by the respondent is used to adjust the reported price to an estimate of "pure" price, unaffected by quality changes.

**2.2.3 Sampling** - The sample builders for each metropolitan area are determined through the use of local market intelligence and building permit data. Where possible, the sample includes builders developing entire subdivisions, usually on large tracts of land. However, builders producing fewer units are frequently included where comparable models can be priced over a period of time. Model houses are selected in consultation with the builders and the price movement is

tracked for representative houses from the current construction portfolio of each builder. The sample for a given builder is structured in such a way that the price changes of the model house are representative of the residential layout developed by the builder.

**2.2.4 Prices** - Prices collected for these indices relate to the 15th of the month or the nearest business date. Subsequently, the selling prices are adjusted for any changes in quality of the structure and the serviced lot. These indices do not measure shelter costs and prices changes for existing houses, as the same are excluded from these price surveys. Contractors' mid-month selling prices are collected directly in 21 metropolitan areas through a combination quarterly visits and telephone contacts. House prices reported by sample builders are adjusted for changes in quality of both the structure and the services lots including intangible variations of location to ensure similarity of specifications.

**2.2.5 Data Collection** - It is a mandatory obligation of the builders/real estate developers to respond to the survey for developing NHPI. The data collection is through the use of personal interviews carried out by enumerators from the regional offices of Statistics Canada. Face-to-



face interviews are conducted quarterly while telephone interviews are used in the intervening months.

**2.2.6 Data Validation** - Housing sector specialists, with in-depth knowledge of market developments, review the reported price changes, and directly validate the data and ensure that the data are representative of the price movement as a whole. Outliers (extreme values) and incorrect prices are identified in the initial data processing stage and cross-checked and validated by the enumerators with the respondents.

**2.2.7 Weight Base** - To prepare a contractors' selling price indices for a metropolitan area, the price reports from the sample of builders are given equal weights in indices calculations. Amongst metropolitan areas, weights are derived from housing completion data.

**2.1.8 Indices Formula** - A Chain-Laspeyre's indices formula is used, the weights for which are derived from housing completions for the previous three years valued at prices for the 1997 base year.

**2.2.9 Estimation** - A price adjusted three-year moving average of the value of building completions for each

metropolitan area is calculated for the house construction cost component, and then aggregated up to provide provincial and national indices. In the case of land, the house to land ratios, based on survey data, are employed to estimate the corresponding land value data, also using a three-year moving average and aggregated in the same way. The total value, including house and land components, is then calculated.

**2.2.10 Disclosure control** - Statistics Canada is prohibited by law from releasing any data which would divulge information obtained under the Statistics Act that relates to any identifiable person, business or organization without prior knowledge or consent in writing of that person, business or organization. Various confidentiality rules are applied to all data that are released or published to prevent the publication or disclosure of any information deemed confidential. If necessary, data are suppressed to prevent direct or residual disclosure of identifiable data.

## **2.3 UNITED KINGDOM**

**2.3.1 House Price Indices (HPIs)** have been produced in the UK since around 1973 and have traditionally been generated by government bodies

<sup>2</sup> *SModel house concept adopted in Canada follows the representative-property method of developing real estate price indices*



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as part of official statistics and mortgage lenders as part of their marketing and public relations efforts. In more recent times, property market websites have begun to produce them. There are two dominant methods of indices, the Hedonic regression (also known as the characteristic based) method and Repeat Sales Regression.

2.3.2 A number of house price indices exist in the UK, which are calculated by a variety of different players in the UK Property Market.

2.3.3 Land Registry House Price Indices - The Land Registry House Price Indices (calculated on behalf of HM Land Registry by Calnea Analytics) uses Land Registry's own data, which consists of the transaction records of all residential property sales in England and Wales. The number of monthly transactions is approximately 100,000 per month. It is the only indices in the UK to use the Repeat Sales Regression (RSR) technique. The indices exclude sales from repossession and at auction on the grounds these "do not represent full market price".

2.3.4 Communities and Local Government House Price Indices - The Communities and Local Government House Price Indices (formerly compiled by the Office of the Deputy Prime Minister (ODPM)) uses the mix-

adjusted method, which is based on weighted averages. The data used in this HPI is mortgage completion data supplied by a few large lenders.

2.3.5 Nationwide House Price Indices and Halifax House Price Indices - The Nationwide House Price Indices and Halifax House Price Indices, are calculated by the respective Banks and Building Societies. They use Hedonic regression (also known as the characteristics based method), to establish changes in the property market, using their own internal datasets compiled from their mortgage lending. The Nationwide and Halifax have a longer time-series than the Governmental HPIs. Two other indices are constructed by two companies having interest in housing markets viz. Hometrack and Rightmove.

2.3.6 In addition, there are two main survey based housing price indices produced by the Royal Institutes of Chartered Surveyors and the House Builders Association.

2.3.7 These indices use varied techniques for prices (hedonic regression model and mixed quality adjustment) and various weighting diagrams based on volume and value of houses. Wood (2003) critically examines the methodology, database and weighting diagrams of these indices. The data and methods used to



construct these indices are different and they have both advantages and disadvantages depending on the purpose for which these are used. The Land Registry Indices uses the most complete dataset, but the data set does not record the details of dwelling characteristics. The indices differ in their use of current or base weights, transactions or stock weights, volume or value weighted. The Table 2 given below gives a comparison of the

method used to construct the seven main UK house price indices.

2.3.8 The Halifax House Price Indices is the UK's longest running monthly house price series since January 1983. The Indices is derived from the mortgage data of the UK's largest mortgage lender HBOS, which provides a robust and representative sample of the entire UK market. There are a number of national indices covering different categories of

**Table No.2- Comparison of the methods used to construct the seven main UK house price Indices**

Name of Indices	Data Source and Coverage	Quality adjustment method	Seasonally adjusted	Weights used	Weighting method	Measures
'Old' ODPM	SML - 5% sample of CML eligible completions	Mix adjustment	No	Rolling average of SML transactions	Expenditure	Value of average set of transacted dwellings
'New' ODPM	SML 30%-50% sample of CML eligible completions	Mix adjustment	No	Rolling average of Land Registry transactions	Expenditure	Value of average set of transacted dwellings
Land Registry	100% of sales registered in England and Wales	Simple average	No	None	Expenditure	Value of set of transacted dwellings
Halifax	Loans approved for house purchase by Halifax	Hedonic regression	Yes	1983 Halifax loan approvals	Volume	Price of 'Halifax' representative dwelling
Nation-wide	Loans approved for house purchase by Nationwide	Hedonic regression	Yes	Rolling average of SML, Land Registry and Nationwide transactions	Volume	Price of 'Nationwide' representative dwelling
Home-track	Survey of approx. 4,000 estate agents' estimated local average prices	Mix adjustment	No	England and Wales housing stock	Expenditure	Value of housing stock
Right-move	Sellers' asking prices posted on internet site	Mix adjustment	No	England and Wales housing stock	Expenditure	Value of housing stock



houses (all, new and existing) and buyers (all, first-time buyers and home-movers). These indices are adjusted to allow for seasonal variations. The most commonly used and quoted Halifax Indices is the UK seasonally adjusted indices covering all houses and all buyers. Regional indices for the 12 standard planning regions of the UK are produced on a quarterly basis.

2.3.9 The indices' calculations are 'standardized' and represent the price of a typically transacted house. The need for 'standardization' arises because no two houses are identical and may differ according to a variety of characteristics relating to the physical attributes of the houses and their locations.

2.3.10 In summary, prices are disaggregated into their constituent parts using a commonly used statistical technique called multivariate regression analysis or the hedonic approach. This allows values to be attributed to the various qualitative characteristics (type of property, region, etc.) and quantitative characteristics (age of property, number of habitable rooms, garages, bathrooms, etc.) of a property. The technique allows tracking the value of a 'typical' house over time on a like-for-like basis.

## Available Datasets

2.3.11 The Land Registry dataset contains the prices of all transacted houses in England and Wales, including those purchased without a mortgage (so called cash transactions). However, it has two disadvantages. First, only a very limited number of attributes are recorded for each house so it is unsuitable for use in a hedonic regression; it does not include house size which is one of the more important attributes that determine price. Second, it is only available quarterly and with a six weeks lag. Missing observations are then added to the dataset a further three months later; so the final dataset is not available until four and a half months after the quarter to which it refers.

2.3.12 The Council of Mortgage Lenders (CML), an organization representing the industry, compiles a sample of its member's mortgage approvals called the Survey of Mortgage Lenders (SML). However, until recently the sample has been a modest proportion (it has only increased from a 5% sample in the last couple of years) to date and it is not available until 4 weeks after the end of the month.

<sup>3</sup> The "Land Registry" is a government department that maintains a register the Land Register of the ownership of all property and land in the UK. The Land Registry must be informed of changes in ownership for them to be legally recognized, so it is able to maintain a database of all housing market transactions.



## Quality Adjustment

2.3.13 All indices other than the Land Registry use hedonic regression or mix-adjustment methods to quality adjust their data to take account of the effect of changes from one period to the next in the mix of houses transacted. The mix adjustment and hedonic regression methods for adjusting quality of the data can be similar under certain circumstances. If mix-adjustment is undertaken with the same house attributes as in a hedonic regression, both indices use the same weights, and the mix-adjusted indices is a geometric mean of the cell prices, then the two indices should give similar results.

2.3.14 The Halifax and Nationwide indices control for the effects of many more attributes, and so are less likely to be affected by changes in the mix of houses sold than the old ODPM indices; the ODPM indices may change if the number of houses in the sample with, for instance, bathrooms, or garages, or a garden, changes. The Halifax and Nationwide indices will not. The Weights used in UK House Price Indices are summarized in Table 3.

2.3.15 **Weighting** - The indices also differ in terms of their scheme of weighting, i.e. in terms of use of transaction on housing stock weights, current or base weights, and volume of standard expenditure weights as briefly discussed below.

2.3.16 **Transactions Weights** - Transactions weights - (Old ODPM, New ODPM, Land Registry, Halifax and Nationwide). Indices in this group measure either the price of a typically transacted house, or the value of a set of typically transacted houses. The Land Registry index is a special case in this group because, in a strict sense, the average price uses transactions weights from the most recent month or quarter.

2.3.17 **Housing Stock Weights** - Housing stock weights - (Hometrack and Rightmove). Indices in this group measure either the price of typical member of the housing stock, or the value of the housing stock.

2.3.18 **Base Weights** - Base weights - (Halifax and Rightmove). The weights are defined by the transactions

**Table No. 3 Weights Used in UK House Price Indices**

	Transactions weights	Stock weights
Base weights	Halifax	Rightmove
Rolling weights	Old ODPM New ODPM Nationwide Land Registry	Hometrack



or housing stock from a particular year and are never changed. For instance, the Halifax indices measure the price of a dwelling that has characteristics typical of dwellings transacted in 1983.

**2.3.19 Rolling Weights** - Rolling weights - (Old ODPM, New ODPM, Nationwide, Hometrack and Land Registry). The weights are updated periodically, usually annually, with new data on transactions or the housing stock.

**2.3.20** The Halifax 'standard house' is defined by the characteristics of the average house on which the Halifax approved a mortgage in 1983. All other indices base their weights on information from a wide range of mortgage lenders (SML transactions) or on all transactions (from the Land Registry) or the housing stock. These other weights may be more representative of the UK housing market than those based on dwellings on which mortgages were approved by the Halifax alone.

Of the seven main UK house price indices, three are volume weighted and five are expenditure weighted.

## **2.4 UNITED STATES**

**2.4.1** Since late 1970s attempts were made to construct real estate indices for the U.S. given the amount of investor interest. Indices based on a number of methods have been

developed for the U.S. real estate market. These include: hedonic-based price estimates from a small sample of traded properties; imputing prices and returns on properties being held (but not traded) by institutional investors; constructing synthetic return series by applying cap rate data to the rental income flows on institutionally owned properties; among others. The easy availability and reliability of data on the US real estate market has had a significant role in these developments. Summary of house price measures in the US is given in Box.

**2.4.2 National Council of Real Estate Investment Fiduciaries (NCREIF)**

**2.4.2.1** The National Council of Real Estate Investment Fiduciaries (NCREIF) is a not-for-profit institutional real estate investment industry association. NCREIF publishes the NCREIF Property Index (NPI) and other statistical measures of performance on a quarterly basis. The NCREIF Property Indices (NPI) has been calculated quarterly since 1978, using the appraised values of the properties in the database each quarter.

**2.4.2.2** Properties in the NPI are accounted for using market value accounting standards, not historical cost. NCREIF requires that properties included in the NPI be valued at least quarterly, either internally or



externally, using standard commercial real estate appraisal methodology. Each property must be independently appraised a minimum of once every three years. As such, the NPI is often referred to as an “appraisal based index.”

2.4.2.3 Index Methodology - The Index is set at 100 starting fourth quarter of 1977. Calculations are based on quarterly returns of individual properties before the deduction of portfolio-level management fees, but inclusive of property level management fees. Each property's return is weighted by its market value. Index values are calculated for income, capital value and total.

#### 2.4.3 Federal Housing Finance Agency (FHFA)

2.4.3.1 The FHFA estimates and publishes quarterly house price indices (HPI) for single-family detached properties using data on conventional conforming mortgage transactions obtained from the Federal Home Loan Mortgage Corporation (Freddie Mac). The house price indices published by FHFA are based on a modified version of the weighted-repeat sales (WRS) methodology proposed by Case and Shiller (1989).

2.4.3.2 The HPI is a broad measure of the movement of single-family house prices. It is a weighted, repeat-sales

index, meaning that it measures average price changes in repeat sales or refinancing on the same properties. This information is obtained by reviewing repeat mortgage transactions on single-family properties whose mortgages have been purchased or securitized by Fannie Mae or Freddie Mac since January 1975.

2.4.3.3 The HPI serves as a timely, accurate indicator of house price trends at various geographic levels. Because of the breadth of the sample, it provides more information than is available in other house price indices. It also provides housing economists with an improved analytical tool that is useful for estimating changes in the rates of mortgage defaults, prepayments and housing affordability in specific geographic areas.

2.4.3.4 The HPI includes house price figures for the nine Census Bureau divisions, for the 50 states and the District of Columbia, and for Metropolitan Statistical Areas (MSAs) and Divisions.

#### 2.4.4 The S&P/Case-Shiller Home Price Indices

2.4.4.1 The S&P/Case-Shiller Home Price Indices measures the residential housing market, tracking changes in the value of the residential real estate market in 20 metropolitan regions across the United States. These indices





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use the repeat sales pricing technique to measure housing markets. First developed by Karl Case and Robert Shiller, this methodology collects data on single-family home re-sales, capturing re-sold sale prices to form sale pairs. This indices family consists of 20 regional indices and two composite indices as aggregates of the regions.

2.4.4.2 The S&P/Case-Shiller Home Price Indices are calculated monthly and published with a two month lag. In addition, the S&P/Case-Shiller U.S. National Home Price Indices is a broader composite of single-family home price indices for the nine U.S. Census divisions and is calculated quarterly.

2.4.4.3 The S&P/Case-Shiller Home Price Indices are designed to be a reliable and consistent benchmark of housing prices in the United States. Their purpose is to measure the average change in single-family home prices in a particular geographic market. The monthly indices cover 20 major metropolitan areas, which are also aggregated to form two composites one an aggregation of 10 of the major metropolitan areas; the other including all 20. In addition, there are supplemental indices that cover 5 major condo markets. The headline indices are not seasonally adjusted or adjusted for inflation. Standard & Poor's does

publish supplemental data that includes seasonally-adjusted indices, tiered-price indices and sales pair counts. The seasonal adjustments are re-estimated every month. The indices are based on observed changes in home prices. They are designed to measure increases or decreases in the market value of residential real estate in defined regions and the overall U.S.

2.4.4.4 To be eligible to be included in the home price indices, a house must be a single-family dwelling. Condominiums and co-ops are specifically excluded. Houses included in the indices must also have two or more recorded arms-length sale transactions. New construction is excluded.

2.4.5 National Association of Realtors (NAR) Median Sales Price - The NAR median sales price is a series of dollar figures released monthly at the National and census reason levels and quarterly for more than 150 metropolitan areas. NAR reports are the observed median sales prices based on the closed sales transactions gathered from Multiple Listing Services (MLS). The information is compiled into a median house price for the nation and for the census reasons. The NAR Median Sales Price (which is not in index) tracks the price of the typical home where half of the homes sold at a higher and half sold at a lower



price in a particular month. Index does not use a repeat sales methodology but tracks existing homes' median value the value at which half of the home values in an area are worth more and half are worth less. NAR uses data obtained from Multiple Listing Services (MLSs) to generate the median sales prices. Properties that are listed with Realtors are included. Properties that are not listed with a Realtors, such as 'For-Sale-By-Owner' (FSBO) or auction properties are not included in NAR statistics.

## 2.4.6 Comparative Analysis of Various Housing Price Indices in USA

### 2.4.6.1 The Case Shiller, FHFA, and

NAR indices differs in fundamental ways. The NAR Indices does not use a repeat sales methodology but tracks existing homes' median value the value at which half of the home values in an area are worth more and half are worth less. But the median can easily be biased by new housing construction in an area. New homes for high-income people will pull the median up, while new homes for low-income people will push it down. As a result, the indices will capture changes in the median price that are related not to changes in home values but to changes in the composition of the housing stock. The FHFA Indices resembles the Case Shiller Indices in that it utilizes the repeat sales methodology; that is; it

**Box: SUMMARY OF HOUSE PRICE MEASURES IN THE US**

Measure	Methodology	Home Type	Additional Frequency	Geographies
NAR median home price	Average	Existing	Monthly	Regions: metro areas (quarterly)
Census median	Average	New	Monthly	
FHFA house price index	Repeat sales	Existing	Quarterly	Divisions, states, metro areas
FHFA purchase only index	Repeat sales	Existing	Quarterly	
S&P/Case-Shiller National Home Price Index	Repeat sales	Existing	Quarterly	20 metro areas
Census Bureau Constant Quality Index	Hedonic	New	Quarterly	Regions



tracks the value of individual homes that are resold over time. Its weakness is that it is based solely on houses whose mortgages are purchased by Fannie Mae and Freddie Mac. This prevents the indices from representing the entire housing stock of the community.

2.4.6.2 The Freddie Mac HPI for each geographic area is estimated using repeated observations of housing values for individual single-family residential properties on which at least two mortgages were originated and subsequently purchased by Freddie Mac since January 1975. The use of repeat transactions on the same physical property units helps to control for differences in the quality of the houses comprising the sample used for statistical estimation. For this reason the HPI is described as “constant quality” house price indices.

2.4.6.3 The major limitation of the repeat-sales technique is its assumptions that properties do not change over time. All properties age and depreciate, and some are renovated. To account for these changes, Case and Quigley (1991) developed a hybrid technique that

modifies the repeat-sales method to include selected property characteristics (similar to the hedonic technique) in the estimation model. However, due to the lack of data, this technique can be applied to commercial property only and with great difficulty.

## 2.5 HONG KONG

2.5.1 Property market statistics in Hong Kong are mainly compiled by the Rating and Valuation Department (R&VD), Government of Hong Kong. The R&VD publishes a comprehensive set of house price, rental, and transaction statistics for various types of private residential and non-residential premises in its Property Market Statistics, on a monthly basis.

2.5.2 The price indices are designed to measure changes in prices with quality kept constant. They are derived based on the same set of transaction data for computing the average prices, but using a more sophisticated statistical procedure. Initially, indices are developed for various categories of residential and non-residential properties. The indices measure price changes with reference to the factor of sales price divided by the rateable value of the property rather than with

<sup>4</sup> Source: Peng, Wensheng and Fan, Kelvin, 2004, *Real Estate Indicators in Hong Kong*

<sup>5</sup> Private residential properties are classified into classes A to E, with saleable area of less than 40 m<sup>2</sup>, 4069.9 m<sup>2</sup>, 7099.9 m<sup>2</sup>, 100159.9 m<sup>2</sup>, and 160 m<sup>2</sup> or above, respectively. Private office premises are divided into grades A to C, with grade A offices having the best quality in terms of, for example, finishes, layout flexibility, size of floor plates, management services, and parking facilities.

<sup>6</sup> Rates are one of indirect taxes levied on properties, which are charged at a percentage of the rateable value. The rateable values are reviewed annually so as to reflect the up-to-date information.



reference to price per square metre as in the calculation of average prices. The rateable value of a property is an annual rental value assessed by the R&VD as the basis for charging rates. In assessing the rateable value of a property, reference is made to open market rents for similar properties in the locality, with adjustments to reflect differences in size, location, facilities, standards of finish, and management. Therefore, by utilizing the rateable values in compiling the price indices, allowance is made not only for floor area but also other qualitative differences between properties.

2.5.3 A detailed methodology has been adopted by R&VD for using rateable values to adjust transaction prices for differences in quality characteristics between properties. The rateable value, which is an estimate of the annual rental value of a property at a reference date, is the basis for charging indirect taxes on properties in Hong Kong. In assessing the rateable value, reference is made to other open market rents agreed at or around the date of assessment, for similar properties in the locality, with adjustments to reflect any differences in size, location, facilities, standards of finish and management. The rateable value is reviewed annually by R&VD so as to reflect more up-to-date rental values of the properties.

2.5.4 A composite indices () for a certain type of properties such as residential properties is calculated as a weighted average of the component indices:

Where, and are the component indices and weight for property class or grade respectively.

2.5.5 The weights for residential premises are based on the proportions of the numbers of transactions of the components in the current and previous 11 months, while those for non-residential premises are based on the proportions of the total floor area of the components in respect of the current and previous 11 months. The use of twelve-month rolling transaction data for determining the weights helps smooth out the volatility due to short-term fluctuations.

## 2.6 FRANCE

2.6.1 The National Institute of Statistics and Economic Studies (INSEE), France comes out with nine indices for real estate prices at the national level, out of which seven are indices for apartments. The whole of France is now covered by quarterly hedonic housing price indices. In fact, according to European Central Bank (ECB) report only two countries, France and Finland, use hedonic regression method to estimate property prices.

<sup>7</sup> In calculating the weights, numbers of transactions are used for residential properties rather than the total floor area as for non-residential properties. This is because the variety, in terms of floor area, of residential properties is relatively small compared with that of the non-residential properties.



2.6.2 An assessment of the INSEE methodology brings out the fairly robust nature of the model. The major credit for this goes to the data collection mechanism. The notaries collect the data and they also compute the indices on the basis of the methodology developed by INSEE. The coverage is 100 percent as all housing sales have to take place in front of a notary who draws up the deed and is in charge of collecting stamp duty for the central government. In 1994 the notaries started to centralize those data. This had been done for the city of Paris since the 1980s and housing price indices was published under the name 'Notaries-INSEE'. The new indices started to be published quarterly in the summer of 2000, and the whole of France was covered at the end of 2002.

2.6.3 More than one-third of first homes in France are more than 50 years old. This leads to 75 percent of housing purchases being second hand, and, what is more important for a price indices, homes rarely change hands. Price observation is rare. The unique method of the notaries collecting information on price and attributes enables this problem to be largely sidestepped.

2.6.4 The method relies on the econometric estimation of the value of fixed baskets of apartments or houses in some 300 elementary geographic zones. The quarterly estimate is based

on all sales recorded in a given period. Each zone has its own hedonic price model. This allows creation of indices at various geographic levels.

2.6.5 In a given zone, the price indices is defined as the ratio of the estimated value of a reference stock of dwellings, a 'basket of houses', to its value at the base period of the indices. For each quarter, the value of each dwelling in the reference basket is estimated from the prices of all observed sales, using the econometric models for estimating the sales of the 'estimation period'. The process has several steps, as follows:

- Define zones (strata), where RE price trends are assumed to be homogeneous;
- Define a hedonic model of price, i.e. introduce correction coefficients for quality effects, zone by zone;
- Estimate the correction coefficients from an estimation stock of dwellings;
- Compute the value of a reference stock at the base date for each zone;
- Compute the value of this reference stock, from data on all current period sales, by zone;
- Compute the indices as the measure of the trends and changes



of the value of the reference stock between base and current date; and

- Publish indices and sub-indices by aggregation of local zone indices.

2.6.6 The first four steps are applicable only once (and revised every five years), while the others are repeated every quarter. The advantage of a using a reference stock is that it allows the model to abstract from the variations of the structure of the market. Using this model, prices can be compared both in space and over time and it gives fairly reliable estimates of price movements, at least, of residential properties having attributes close to the defined reference stock.

## 2.7 AUSTRALIA

2.7.1 In Australia, house price indices are compiled by the Australian Bureau of Statistics (ABS), the Reserve Bank of Australia, and Australian Property Monitors (APM), a private sector research company.

### 2.7.2 Australian Bureau of Statistics (ABS) house price indices (HPI) -

2.7.2.1 The HPI is a Laspeyre's indices that measure the inflation or deflation in the price of established houses over time.

2.7.2.2 The HPI in its current form was first published in December 2005, with the HPI series backdated to March

quarter 2002. The scope for the HPI is restricted to those dwellings where the primary purpose is residential (i.e. excluding commercial properties) regardless of ownership or tenure of the occupants (i.e. including government-owned properties and properties owned by private landlords).

2.7.2.3 **Coverage** - The HPI measures the rate of change in the prices of the stock of established houses, including the land component, in the 8 capital cities. Each capital city HPI is produced as a weighted average of cluster indices. The national HPI is a weighted average of the indices for the 8 capital cities. The capital city indices measure price movements over time in each city individually; they do not measure differences in price levels between cities.

2.7.2.4 **Reference date for prices** - In the Australian context, there are four significant dates related to the purchase of a residential dwelling. A general timeline of the stages of the sale of residential dwellings is - verbal agreement to purchase at a negotiated price; approval of mortgage financing; exchange of contract; and settlement of the property sale. For the purposes of measuring price changes for houses, it is desirable to select the earliest date at which the final purchase price is set. The point in time at which the price is first determined is when verbal agreement is reached. However, there is



no effective way to capture this information and it is possible for the originally agreed sale price to be renegotiated before the exchange of contracts. Approval of mortgage finance data is limited to those sales that involve mortgages. A house price indices constructed on a settlement date basis incorporates a lag in identifying the turning points in housing prices as the settlement date can occur several weeks or months after the exchange of contract. It is for these reasons that, in compiling the HPI, the date of exchange of contract is the preferred date.

**2.7.2.5 Median Price** - Ideally, the HPI would be compiled using the current and historical market prices of the entire stock of houses. In practice, market prices for any particular period are only available for those houses that are actually traded (sold/purchased) in the period. Such sales account for only a very small proportion of the total housing stock in any quarter and so it is necessary to draw inferences about the price behaviour of the whole stock from these small samples. The assumption behind this procedure is that the median sales price of the houses traded each quarter is indicative of the median price of all houses.

**2.7.2.6 Data** - The ABS approach utilizes two different data sources to compile the HPI. The first is to use the prices from the State government

authorities to compile the price indices up to the point for which a complete set of data can be obtained on an exchange date basis (i.e. to the quarter ending two quarters prior to the most recent quarter). This is referred to as the benchmark series. The second is to blend the mortgage lenders' data and early State government authority data to project the HPI for the two most recent quarters to provide a timely indicator of changes in house prices. These are referred to as the leading indicator observations.

**2.7.2.7** The ABS is receiving loan approvals data from a number of financial institutions. The data were comprehensively analyzed and compared with the benchmark. The ABS has concluded that these data when added to early transaction data provide sufficient coverage of the housing market for changes in the overall prices to be estimated reasonably accurately for the two most recent quarters in the HPI. As final benchmark data become available, they are used to replace the leading indicator observations. As a result, the most recent two quarters' estimates of the HPI are preliminary, and subject to revision.

**2.7.2.8 Strata** - The approach uses location (suburb) to define strata that group together (or 'cluster') houses that are 'similar' in terms of their price determining characteristics. Ideally,



each suburb would form its own cluster as this would maximize the homogeneity of the cluster. However, there are insufficient numbers of observations from quarter to quarter to support this methodology. The ABS has grouped similar suburbs to form clusters with sufficient ongoing observations to determine a reliable median price. ABS research showed HPI strata (or clusters of suburbs) were most effectively determined using an indicator of socio-economic characteristics, the median price, the percentage of three bedroom houses and the geographical location of the suburbs. The indicator used for the suburb socio-economic characteristics is the Socio-Economic Index for Areas (SEIFA) Indices of Advantage\ Disadvantage. This ABS produced index is a continuum of advantage to disadvantage and is available for both urban and rural areas. Low values indicate areas of disadvantage, and high values indicate areas of advantage. It takes into account variables such as the proportion of families with high incomes, people with a tertiary education, and employees in skilled occupations.

**2.6.2.9 Weights** - The weights used in the indices are the value of the housing stock in each cluster in each city. Data from the 2001 Census of Population and Housing on the number of houses in each suburb provide the starting point for the weights. A value of the

dwelling stock in each cluster was estimated by aggregating suburb counts to clusters and valuing them at March quarter 2002 'mean adjusted' median prices.

### **2.7.3 Australian Property Monitors (APM) House Price Series**

**2.7.3.1 Australian Property Monitors (APM)**, a private sector research company, publishes a composition adjusted national house price series quarterly and monthly. They produce both House and Apartment median price series. Their approach is to release a series of median house price levels for each city and they calculate the growth in prices from these level estimates.

**2.7.3.2 Data** - Similar to the ABS methods the APM approach uses the transaction data from the State government authorities to compile their HPI. The APM approach uses data from Real Estate agents from recent auctions to supplement the State government authority data for the most recent quarters. The APM series is subject to revision.

**2.7.3.3 Strata** - The RBA/APM approach groups' houses and suburbs into strata based on the variable that is most likely on an a priori basis to explain the price in any transaction, namely the long-term level of prices for the suburb where the house is located. The method involved the following steps:





- suburbs were ranked according to their median transaction prices over the 2000-2004 period;
- based on these rankings, suburbs were grouped into strata; suburbs in the five largest cities were divided into ten groups (deciles) with an approximately equal number of suburbs in each group, while houses in Canberra and apartments in Sydney and Melbourne were divided into 5 groups (quintiles);
- a median price was calculated for each stratum for each quarter, then changes in median prices from each stratum were weighted together to calculate the growth in city-wide prices.

2.6.3.4 **Weights** - Once suburbs are grouped into deciles (or quintiles), a median price is calculated for each strata for each quarter. The changes in the median prices for each stratum are then calculated and a city wide median produced by taking by a geometric mean of the strata medians (which is labeled as the 'mix-adjusted measure'). The mix-adjusted measure is then compared to the previous period's to calculate the growth in city-wide prices.

## 2.7.4 Methodology of Reserve Bank of Australia (RBA)

2.7.4.1 Reserve Bank of Australia

(RBA), Australia's Central Bank produces house and apartment median price series. This composite adjusted national house price series is on quarterly and monthly basis. Series of median house price levels for each city is released and calculate the growth in prices from these level estimates.

2.7.4.2 **Data** - Transaction data from the state government authorities are used to compile the HPI. It uses the data from real estate agents from recent auctions to supplement the state government authorities' data and this series is subject to revision.

2.7.4.3 **Strata** - In this approach suburb median price (median sale price) to define price based strata that cluster houses that are similar (details indicated in Para 2.7.3.3).

2.7.4.4 **Weights** - Suburbs are grouped into quintiles. After Quintiles (deciles) are grouped, a median price is calculated for each stratum for each quarter. The changes in the median prices for each stratum are then calculated and city wide median produced by taking by a geometric mean of the strata medians (Mix-adjusted measure). The mix-adjusted measure is then compared to the previous period's to calculate the growth in city-wide prices.

## 2.8 AUSTRIA

2.8.1 The Austrian Central



Statistical Office (ÖSTAT) calculates output price indices (compiled using the component cost method) comprising five broadly similar quarterly sub-indices for:

- Construction of residential buildings
- Other building construction work
- Construction of roads
- Bridge building
- Other civil engineering work

**2.8.2 Reference population** - Prices are collected from enterprises involved in construction activity. Enterprises supply prices for consistently-defined types of building operations on the basis of their most recent contract. If there are several contracts available for selection for a reported quarter, the contract selected for price information is roughly equivalent to a four-storey residential building with approximately 20 apartments.

**2.8.3 Geographical area covered** - The indices are weighted for 9 regions in Austria. Weights for the road and bridge construction indices also take into account the type of terrain. Each region has percentages of flat, hilly and mountainous terrain. The total area covered is Austria.

**2.8.4 Items included in the indices** - For all indices, the prices collected are prices on the basis of concluded contracts. These may not be the final

prices, but reflect the prices at the moment of observation. They have the advantage of being available relatively quickly, in contrast to invoice prices. The indices include the installation costs of water, gas and electricity, and internal fittings. Excluded are: land purchase and preparation costs, telephone installation costs, external fittings, professional fees. The prices are net of discounts, and generally do not include VAT.

**2.8.5 Sources of data** - For residential and other structural building a questionnaire is sent to the building companies who provide information on a voluntary basis. The approximate number of enterprises reporting prices each quarter for the defined individual work types of buildings is as follows:

- Construction of residential buildings 770
- Other building construction work 730

For roads the provincial construction departments and companies responsible for awarding road building contracts provide the prices to ÖSTAT. For bridges the provincial construction departments again perform this role. For other civil engineering, survey questionnaires are sent to provincial construction departments and specialist associations.

**2.8.6 Method of compilation** - The component cost method is based on



prices for representative types of construction operations. For each sub-index a list of types of construction operations is drawn up. Price indices are calculated by forming an average price from the (maximum of eight) price reports received for each individual operation in each Federal State. The 738 indices (82 types of construction operations for nine Federal States) produced in this way each quarter are combined to produce Group Indices and the Overall Indices for Austria, both through weighting the individual types of construction operations and also by means of regional weighting.

2.8.7 The types of construction operations are identified according to a detailed classification. Wherever possible the prices are collected for types of construction operations consistently-defined from period-to-period. Where a change in the detailed specification of the work is unavoidable, the change is reported on the questionnaire (with a figure on the new basis also being reported for the previous period) and taken into account by making base adjustments when calculating the current indices values.

2.8.8 **Type of indices, base year and frequency of compilation** - All indices are compiled according to the Laspeyre's formula. The reference base year for the overall indices is currently 1994, which is always the base year of

the most recently revised sub-indices. Sub-indices with other base years are, for the calculation of the overall indices, mathematically related to this year. The Austrian indices of construction prices and all sub-indices are compiled quarterly. The indices are used for deflation of national accounts and will also probably be used for the planned production indices in construction.

## 2.9 GERMANY

2.9.1 The Federal Statistical Office of Germany (Statistisches Bundesamt) and Hypoport AG, one of Germany's leading mortgage and financial services groups are calculating HPI in Germany.

2.9.2 The Federal Statistical Office of Germany (Statistisches Bundesamt)

2.9.2.1 It calculates construction price indices for selected important types of construction that fall into two broad groups:

- Construction of conventional design, and maintenance of residential building (quarterly)
- Single-family houses of prefabricated design (half-yearly)

2.9.2.2 The first indices are compiled using the component cost method and are referred to as the conventional construction price indices. The second indices were created in 1968 when the construction of prefabricated single-family houses experienced a boom and



reached a market share of 10 per cent of total house construction in the mid-1970s. These indices are comparable to a producer price indices and are referred to as standard house price indices.

**2.9.2.3 Reference population** - The reporting unit is the enterprise with activities in the building and civil engineering sectors.

**2.9.2.4 Geographic area covered** - The territorial classification by 16 Lander is used for the conventional construction price indices for data collection and processing. The total area covered is Germany after unification, i.e. the borders as of 3rd October, 1990.

**2.9.2.5 Items included in the indices** - For both indices the prices notified are market prices at the time of the award of the contract (not tender prices) excluding VAT. VAT rate changes are reintroduced in the calculation of the indices.

**2.9.2.6 Sources of data** - All the data used to compile construction price indices are obtained from surveys conducted by the regional and federal statistical offices. Conventional construction price indices involve activities in the building and civil engineering sectors. Standard house price indices include the producers of prefabricated single-family houses. A judgmental sample of reporting units is

used. All data collection is done using questionnaires sent and collected by the Regional Offices.

**2.9.2.7 Method of compilation** - The Regional Offices first calculates for each price notification, the firm's indices figure. This is the ratio, multiplied by 100, of the current price of an item of construction work category to the corresponding average price in the base year. The firm's indices figures for a collection item are then averaged and the resulting 220 Land indices figures are sent to the Federal Statistical Office. The Federal Office then calculates a federal indices figure for each survey heading (construction work categories) by weighting the Land indices figures with the construction industry turnovers in the base year. Finally, the federal indices figures are weighted by means of structure-specific weighting schemes. As prices are surveyed excluding VAT, the last stage is to increase (or decrease) the price indices by change in the tax rate. The price indices for prefabricated design houses are usually producer price indices. The producer can build a number of similar houses for subsequent sale. In this case, the producer price can differ from the purchasing price, and the methods used to calculate the indices are similar to those used for manufacturing industries.

**2.9.2.8 Type of indices, base year and**



**frequency of compilation** - The indices are calculated according to a Laspeyres' formula. Conventional construction price indices- Data are collected quarterly in February, May, August and November. Standard house price indices - Data are collected half-yearly. The prices refer to 1st April and 1st October.

### 2.9.3 HypoportAG

2.9.3.1 Hypoport AG, launched the Hypoport German House Price Index (HPX), the index aimed at regular tracking nationwide residential property price developments.

2.9.3.2 HPX is released monthly, and constituted in a similar way as measurements of building societies in the UK. It is compiled from neutral data on between 4,000 and 6,000 home sales processed monthly over Hypoport's proprietary EUROPACE platform, which accommodates a share of nearly 10% of the total German home mortgage market. This kind of home loan volume now on EUROPACE across Germany means that the data is not only widely representative of the market nationwide, but are neutral since it acts as an intermediary for brokers, mortgage providers and others who want to access the German market. The statistics have been smoothed up to take into account structural and cyclical fluctuations.

2.9.3.3 The data are taken from

residential sales amounting to around 10% of the German housing market now transacted through the EUROPACE Internet-based platform - a proprietary development fully owned by the Hypoport Group.

2.9.3.4 The index is derived on the basis of anonymised statistics which are fully representative of the nationwide German market. Monthly data are smoothed out with a 3-month lagging moving average, calculated on the basis of sales expressed in square meter terms, and are based on 100 at August 2005. HPX-new home is the index for newly-built single and double households, HPX-existing home tracks prices for existing single and double households, while HPX-apartment assesses prices for existing single apartments.

### 2.10 SWEDEN

2.10.1 The Swedish Statistical Office (SCB) calculates quarterly building price indices for new residential buildings using a hedonic price methodology. The indices are computed according to a Paasche year to year chained formula. The evaluation of prices is carried out by multiple regressions taking into account the heterogeneous impacts of quality attributes of the houses on prices. The SCB also calculates factor price indices for the construction industry.



**2.10.2 Reference population** - The survey unit is a government aided loan for new construction where the average useful floor space of dwellings is at least 45 Square metres or, where the residential primary useful floor space is equal or more than twice the total of non-residential useful floor space, plus accessory space.

**2.10.3 Types of construction covered** - The building price indices covers two categories of new residential buildings: collectively built one or two-dwelling buildings, and multi-dwelling buildings. Privately financed multi-dwelling buildings (1 per cent of the total), and new dwellings located in mainly non-residential buildings (also 1 per cent of the total) are not covered by the indices. One or two-dwelling buildings built without government aid as well as those financed by a government loan, but individually built (as opposed to collectively) are also not covered by the indices. The indices cover 40-65 per cent of one or two dwelling buildings.

**2.10.4 Items included in the indices** - The prices used to compile the building price indices correspond to the building prices prevailing at the time of construction, including costs of ground preparation, primary planning, and VAT.

**2.10.5 Sources of data** - The data used to compile the price indices are

obtained from investors and from application forms submitted to government authorities to obtain housing aid for new construction. The information relates to prices and quality characteristics on the stock of houses, as well as structural variables that influence prices. At the moment, as the reference population is limited; data collection is based on an exhaustive survey. When it exceeds 500 individuals for each type of building the SCB plans to use a stratified sample.

**2.10.6 Method of compilation** - The building price index is a hedonic indices computed on the basis of a regression analysis. The variables used are those that explain the variation in the building prices of different categories of buildings. The building prices used in the regression calculations are expressed in terms of price per square metre of primary useful floor area (dependent variable). The regression analysis is based on two sets of explanatory variables that are expressed in a similar way. The first group corresponds to estimated averages of quality characteristics that influence the price of a building, and assumes that the market prices of newly built buildings are strongly correlated with these quality characteristics. The variables correspond to weighted averages of the values of several kinds of equipment and enclosed areas of walls and roofs. The estimates are



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derived from calculations of the mortgage value of house, and are provided by the National Housing Board. The second group corresponds to structural characteristics that influence the building price, such as geographic location, type of building, the investor's category, and the size of the project.

**2.10.7 Type of index, base year and frequency of compilation** - The building price index is compiled

monthly according to a year to year chained Paasche formula. The base year is the preceding year.

**Use(s) of the index** - The index is used for deflation, national accounts, and the consumer price indices. It is also used for analysis purposes. The change in productivity and profits can be estimated by comparing the building price indices and the factor price indices.





## CHAPTER III

### SUMMARY

Country	Index	Organisation	Data source	Methodology
Canada	New Housing Price Index (NHPI)	Statistics Canada	Builders/Developers are under obligation to respond to survey for NHPI. Face to face interview as well as telephonic interviews. System on disclosure control exists.	Data collected on house price, estimated cost of land and on detailed attributes of model house. Samples are given equal weight; Amongst metropolitan areas weights are based on housing completion data; Chain-Laspeyre's formula; 1997=100. updated monthly
UK	Land Registry HPI	Land Registry	Land Registry's own data	Simple average (median) of 100 % of sales registered.
	ODPM-HPI	Office of Deputy Prime Minister	Survey of Mortgage Lenders and Council of Mortgage Lenders	Mix adjustment; measure the value of average set of transacted dwellings
	Halifax	Halifax	Loan approvals by Halifax	Hedonic regression; weights based on 1983 Halifax loan approvals; measure the price of Halifax representative dwelling; updated quarterly.
	Nation wide	Nation wide	Loan approvals by Nation wide	Hedonic regression; weights based rolling average of SML, land Registry and Nation wide transactions ; measure the price of Nation wide representative dwelling; updated quarterly.





Country	Index	Organisation	Data source	Methodology
	Home track	Home track	Survey of aprox. 4000 estates agents' average price	Mix adjustment, weights based on housing stock, measure value of housing stock.
	Right move	Right move	Sellers' asking prices posted on internet platform	Mix adjustment, weights based on housing stock, measure value of housing stock.
USA	FHFA- HPI	FHFA	Mortgage transaction from Fannie Mae and Freddie Mac.	Weighted-Repeat-Sales; updated quarterly.
	NCREIF Property Indices	NCREIF	NCREIF collects data both for individual and commercial properties and collective investment funds. NCREIF publishes the NCREIF Property Index (NPI) and other statistical measures of performance on a quarterly basis.	NCREIF Property Index is a quarterly time series composite total rate of return measure of investment performance of a very large pool of individual commercial real estate properties. NPI is often referred as an "appraisal based index."
	S&P/Case-Shiller HPI	Standard & Poor's	Deed records of residential sales transactions	Weighted-Repeat-Sales; updated quarterly.
	National Association (NAR) of Realtors- Existing home median value	NAR	Survey of over 150000 transactions of existing single family homes.	Median price is calculated on the basis of transaction covered under monthly survey.
France	National Institute of Statistics and Economic Studies (INSEE) - Indices	INSEE	Data collection and computation of index by Notaries, who draw up deeds and collect stamp duty. Data on house price and other attributes.	Hedonic regression; with fixed baskets houses in some 300 geographic zones; up dated quarterly.
Australia	Australian Bureau of Statistics (ABS)- HPI	ABS	Prices from State Government Authorities and data from mortgage lenders.	Weighted average (Median); weights based on housing stock in each cluster.
	Australian Property Monitors (APM) house price series.	APM	Transaction data from State Government Authorities.	Composition adjusted National house price (Median) series quarterly and monthly to calculate growth in prices



Country	Index	Organisation	Data source	Methodology
<b>Austria</b>	Austrian Central Statistical Office output price indices.	Austrian Central Statistical Office	Data from building companies through questionnaire.	Indices compiled according to Laspeyre's formula; updated quarterly (Basically cost of construction Indices).
<b>Germany</b>	Federal Statistic Office of Germany construction price indices.	Federal Statistic Office of Germany.	Surveys conducted by regional and federal statistical offices.	Indices compile according to Laspeyre's formula ; updated half yearly (Basically cost of construction Indices)
	Hypoport AG German house price index.	HypoportAG	Home sales data from EUROPACE internet-based platform.	Mix adjustment; updated monthly.
<b>Sweden</b>	Swedish Statistical Office (SCB) building price indices	Swedish Statistical Office (SCB)	Data obtained from investors and from application forms submitted to Government Authorities to obtained housing aid for new construction.	Hedonic price methodology according to Paasche chained formula.
<b>Hong Kong</b>	Property Market Statistics - Price Indices	Rating and Valuation Department ( R & V D ) , Government of Hong Kong.	Actual transaction prices are reviewed by the R&VD for stamp duty purposes.	Price indices are compiled in the basis of ratable values of various properties. A composite index for a certain class of properties is calculated as a weighted average of the component indices. Weights being the number of transactions during current and previous 11 months in case of residential properties; whereas the weights in case of non-residential properties are based on floor area of the components.





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## CHAPTER IV

### Properties of a Good Housing Price Index

Like any other index, a good housing price index must satisfy a number of criteria:

- Reliable data should be available easily and with least cost.
- Index must be relevant for the purpose of the users.
- Index must be easy to calculate.
- Index should be easily updated at regular intervals.
- Index should reflect the reality.
- Index should be decomposable by regions and categories.
- Index should be subject to usual statistical test.





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## CHAPTER V

### Pre-requisites/elements for a good system of data collection

5.1 The key data for compiling a house price index is a set of price observations, either actual transaction prices when a house is sold, or assessed prices according to professional opinion. With abundant price data at various time periods available for the group of properties in a particular housing market, house price indices can be constructed by using statistical techniques. However, in reality, house prices are not readily observable continuously. The price of any given property is observed only when it is sold or assessed, both of which happen at infrequent intervals. In addition new houses are always being constructed and old houses demolished. Accordingly, the population of a house we can observe is changing over time.

5.2 Transaction prices are typically available to mortgage banks, notaries, land registry offices and tax authorities. In some countries other sources of price data are used which are based on valuation of dwellings. For example, in Germany, the data

source used comprises typical values quantified by real estate experts who refer to price data of various types, including also non-transaction prices. Further, the Austrian price index makes use of offer prices, provided on an internet platform of real estate agency. Given that the transaction prices of properties are fixed in a bargaining process, the price changes of offer prices might not always properly reflect the dynamics of transaction prices.

5.3 Some of important pre-requisites for a good system of housing data collection are as under:

- Given the importance of tracking the changes in property prices, there is a need to have price indicators of good statistical quality. For the interpretation of the results it is crucial that the selected data source has adequate coverage that it covers the share of housing transaction which is considered representative of all market transaction in terms of



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geographical coverage as well as coverage of various categories of housing products from the total housing stock of the city.

- A key issue in construction of transaction based indices is the availability of data in a format suitable for analysis and transformation to variables that can be used in various index estimation procedures. Accordingly, it is desirable that the raw data be presented in a panel format with key variables which are required to be captured for construction of an index.
- A key element for the successful delivery of statistics that is fit for the purpose is to define precisely user requirements. This requires absolute clarity about the statistic, in this case, a house price index is being aimed to measure. There are many possible target real estate price indices that could be constructed. Thus, it is useful to consider alternative uses for the real estate price indices.
- The needs of users can not be met by a single house price index. Similarly, the statistical agencies should not produce multiple indices that measure the same thing. The listing of properties on the internet may well facilitate the development of high quality property price indices.
- In order to build a good system of data collection, it is necessary to compare the desired system with the currently available statistics and data sources for identifying gaps in the data provision, options for filling these data gaps in a cost effective manner from readily available sources, with due care to data coherence issues and the scope for further data integration and need for new data sources.
- Housing information system should ideally operate to ensure that key information is not missed or unnecessary information not collected. Further, the information system should be flexible, in terms of both data collection and data analysis. An Information Management Team can play an important role in overseeing the cost effective collection, analysis and updating of data. The emphasis should be on information rather than technology; IT systems should be driven by information needs, not the other way round.
- Data definitions should be consistent across the various sources to enable accurate cross-analysis. Databases should be



capable of meeting the requirements placed upon them by the Housing Information System i.e. data storage, analysis or updating.

- It is more important to have all types of property represented in the sample, rather than large samples of the same type. Stratified rather than simple random samples are often the most effective in ensuring that concentrated problems in particular types of stock are included.
- It should be ensured that the survey based information system is reliable. It requires that the scope for variation; particularly through defining the surveyor's task more precisely through careful survey briefing and management; including: clear briefing about the scope of the survey. Careful management, including spot checks during fieldwork; the use of call-back surveys to assess the potential extent of surveyor variability, are critical for a good survey based data system.
- Updating of data is a key issue; procedures need to be identified to capture data routinely to continue to inform the database.
- In order to encourage the supply of data on housing prices on voluntary basis, it is desirable that the confidentiality of the data should be maintained. One of the possible options could be to encourage the supply of anonymised transaction based housing price data. Further, the data confidentiality could also be ensured by suppressing a part of the transaction related information. For example, Statistics Canada is prohibited by law from releasing any data which would divulge information obtained under the Statistics Act that relates to any identifiable person, business or organization without prior knowledge or consent in writing of that person, business or organization. Various confidentiality rules are applied to all data that are released or published to prevent the publication or disclosure of any information deemed confidential. Besides, suitable memorandum of agreement could also be executed between the agency responsible for maintaining housing related data and the supplier of the information, by clearly spelling out the right and obligations of both the parties. Besides, the compliance toward supply of data



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may also be backed by a suitable statute, as in the case of Australia and South Africa. In South Africa, the Housing Act, 1997, inter alia provides for the establishment of a national housing data bank for the purpose of collection, compilation and analysis of data, in respect of

housing development. The Act also enables the Director General to access to existing sources of information including prohibiting or regulating the disclosure of information. Relevant extract of this Act are given in **Appendix-IV**.





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## CHAPTER VI

### RECOMMENDATIONS FOR INDIA

6.1 Based on the international experiences in collection of data for compilation of housing price indices, and the pre-requisites of a good housing information system, the following recommendation merit consideration for developing a system for collection of housing prices in India:

- Association for real estate agents/builder/developers may be associated for providing data for Housing Price Index by entering into suitable memorandum of cooperation in the matter.
- Periodic monitoring of the housing prices are possible at an aggregate level without detailed information on actual parties to the transactions if such information is passed on the price monitoring authority.
- Banks and Housing Finance Companies (HFCs) may be approached to prepare a data bank based on housing loan approvals. This could be facilitated by having a uniform housing loan application form so as to capture all attributes as required under the data template for NHB RESIDEX. Appropriate regulatory directions from RBI and NHB may be considered for making the supply of data for NHB RESIDEX obligatory for banks and HFCs.
- Computerizing the Property Registrar's Office and Land Registry Offices so that all transactions reported may be retrieved and reported easily.
- Prices may be collected from Municipality Authorities and other State Government Authorities engaged in fixing the "Circle Rate". This may be a good system for data collection and alternatively may provide a data base.
- The option of having an enabling statute needs to be considered for enforcing supply of data - for housing price index and other





housing related data for policy making - on obligatory basis by the agencies where the data is generated. There could be provision relating to confidentiality of information and disclosure control. The transaction data could be supplied by making the same anonymous so that it could be used only for research purpose without getting to know about parties to the transaction. Such statutory provisions exist in countries like Australia, Austria and South Africa.

- In order to create a better information system on the housing sector, there is need to persuade (even through appropriate regulatory mechanism) the housing sector intermediaries to maintain a data base on transactions that is available for periodic revises for the sector. This could be facilitated though a suitable system of registration or accrediting of the property dealers and by making certain

practices mandatory including maintaining a record of property transactions. Suitable formats could be devised for maintaining such records so as to capture all the attributes of housing transactions which are required for construction of housing price index.

- The stamp duty rates for registration of properties need to be rationalized so as to encourage the registration of property transaction without any evasion at their true values without resorting to under registration. Furthermore, there should be a time limit within which the property transaction should be registered on compulsory basis with suitable penal provisions to encourage compliance. Besides, there is also a need to device uniform format for maintaining property registration records, that the information required for construction of housing price index is routinely captured in the process of property registration.





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## APPENDIX-I

# NHB RESIDEX TRACKING THE PRICES OF RESIDENTIAL PROPERTIES IN INDIAN

Keeping in view the prominence of housing and real estate as a major area for creation of both physical and financial assets and its contribution in overall National wealth, a need was felt for setting up of a mechanism, which could track the movement of prices in the residential housing segment. Accordingly, National Housing Bank, at the behest of the Ministry of Finance, undertook a pilot study to examine the feasibility of preparing such an index at the National level. The pilot study covered 5 cities viz. Bangalore, Bhopal, Delhi, Kolkatta and Mumbai. Besides, a Technical Advisory Group (TAG), with Adviser, Ministry of Finance, as its Chairman and comprising of experts members from RBI, NSSO, CSO, Labour Bureau, NHB and other market players, was constituted to deal with all the issues relating to methodology, collection of data and also to guide the process of construction of an appropriate index. Based on the results of the study and recommendations of the TAG, NHB launched RESIDEX for tracking prices of residential properties in India, in July 2007.

NHB RESIDEX is a pioneering attempt by National Housing Bank to measure residential prices in India. The launch of NHB RESIDEX in India is arguably the maiden attempt by a developing country to capture the price movements in the residential properties at such a comprehensive scale. Though the residential property market in India is active, there is no organized market which estimates the demand and supply forces and tracks the price movements. The complexity of market for house property in terms of the price discovery mechanism which is an outcome of combination of factors like locality, covered area, community facilities, individual layouts etc. emerged as the major challenge in choice of an appropriate methodology for development of a representative price index.

Based on the results, it was felt that there were good reasons to believe that, in spite of the existing gaps in tracking the true prices of house transactions; it will be of great utility to put in place a meaningful and organized mechanism to track the movement of prices in the residential



housing segment by way of a suitable Index.

The index which is capturing the price movements of the residential houses in India has been named NHB RESIDEX and is being operated by NHB on a half yearly basis.

### Scope and Coverage

The primary objective of NHB RESIDEX is to track the moments in prices of residential properties, in selected cities/towns. Accordingly, to begin with it is proposed to cover only the residential properties under the index. However, at a later stage, based on the experience and depending upon the availability of data, the scope of the

index could be expanded to cover commercial properties as well.

### Prices

NHB RESIDEX is being compiled by using the actual transaction prices of residential houses inclusive of land cost but exclusive of other components of the transaction cost like registration fee, stamp duty, brokerage etc.

### Categorization of Housing Units

In order to ensure true representative character of the index, the housing units are grouped into three categories based on built up area viz. built up area less than 45 sq. mt. (500 sq. ft.) 45-90 sq. mt. (500-1000 sq. ft.) and more than 90 sq. mt. (100 sq. ft.).

### NHB RESIDEX: Salient Features

- ☛ Pilot study covered 5 cities viz. Delhi, Mumbai, Kolkata, Bangalore and Bhopal representing the various regions of the country.
- ☛ Actual transactions prices considered for the study in order to arrive at an Index which will reflect the market trends.
- ☛ 2001 was taken as the base year for the study to be comparable with the WPI and CPI. Year to year price movement during the period 2001-2005 has been captured in the study, and subsequently updated for two more years i.e. up to 2007.
- ☛ NHB RESIDEX has been expanded to cover ten more cities, viz, Ahmedabad, Faridabad, Chennai, Kochi, Hyderabad, Jaipur, Patna, Lucknow, Pune and Surat.
- ☛ Further, with 2007 as base, NHB RESIDEX has been updated up to December, 2008, with two half yearly updates (Jan - June and July - Dec) during 2008.



- ☛ At the time of last updation and expansion of coverage of NHB RESIDEX to 10 more cities, the base year has been shifted from 2001 to 2007.
- ☛ NHB RESIDEX will be up dated on half yearly basis, for the present.
- ☛ In the first phase NHB RESIDEX will be expanded to cover 35 cities having million plus populating.
- ☛ The proposal is to expand NHB RESIDEX to 63 cities which are covered under the Jawahar Lal Nehru National Urban Renewal Mission to make it a truly national index.
- ☛ Prices have been studied for various administrative zones/property tax zones constituting each city.
- ☛ The index has been constructed using the weighted average methodology with Price Relative Method (Modified Laspeyre's approach).
- ☛ Primary data on housing prices is being collected from real estate agents by commissioning the services of private consultancy/research organisations of national repute; in addition data on housing prices is also being collected from the housing finance companies and bank, which is based on housing loans contracted by these institutions.

### **Stratification to arrive at the representative basket**

In compilation of NHB RESIDEX the cities/towns have been suitably stratifies by tax/administrative zones/municipal wards or any other criteria according to availability of the data for different cities/towns. The lowest level of the stratification has been the colonies/localities.

### **Sample Size**

Based on the appropriate degree of stratification, data on housing prices is being collected from 20-30 colonies for each city/town, which are fairly

distributed across all the tax/administrative zones. The sample size of price observations, consists of 500-600 observations for each city/town, which would imply about 20-25 transactions in each colony/locality.

### **Statistical Model**

The index has been computed by using Price Relative Method (Modified Laspeyre's Approach). Under this method price relatives are calculated only once (at the basic stratified unit) and the weighted average of these price relatives leads to the index at next level and so on.



PI (Laspeyre's Standard):

$$\frac{\sum (Q_o * P_1) * 100}{\sum (Q_o * P_o)}$$

PI (Laspeyre's Modified):

$$\frac{\sum [(Q_o * P_o) * P_1 / P_o] * 100}{\sum (Q_o * P_o)}$$

Which can be re-written as.-

PI (Laspeyre's Modified):

$$\frac{\sum (W_o * P_1 / P_o) * 100}{\sum W_o}$$

### Base Year

Under the pilot study, the index for 5 cities was computed with 2001 as base. Under the last expansion and updation of NHB RESIDEX the base year has been shifted from 2001 to 2007.

### Data Sources

The TAG recommended that in the initial period, NHB should have institutional arrangements for availing services of a Government agency having requisite network, expertise and experience in the field of price collection on a regular basis. Accordingly, has been interacting with NSSO and requesting them to take up the task of data collection for NHB RESIDEX. However, in view of shortage of field investigators, NSSO has not agreed to proposed arrangement.

As an alternative, data on housing prices is being collected by utilizing the services of private consultancy/research organization of national repute. In addition information on housing prices is being collected from housing finance companies and banks, which is based on housing loans contracted by these institutions.

### Frequency of Updation

For the present NHB RESIDEX is proposed to be updated on half yearly basis that is January to June and July to December.

### Way forward

At present, NHB RESIDEX has covered 15 cities, in the first phase is it proposed to cover 35 cities having million plus population. The proposal is to expand NHB RESIDEX to 63 cities, which are covered under the Jawahar Lal Nehru National Urban Renewal Mission, to make it a truly national index, in a phased manner. It is envisaged to develop a residential property price index for select cities/towns and subsequently an all India composite index by suitably combining these city/town level indices to capture the relative temporal change in the prices of houses at different levels.



## APPENDIX-II

# GENERAL INFORMATION ABOUT PRICE INDICES

Different indices have their own strengths and weaknesses. It depends on the purpose to determine which index is appropriate. There are actually three different kinds of price indices computed. These are:

Laspeyres (Constant Quality type);

Paasche (Output Deflator); and

Fisher Ideal Index (Price Deflator)

Below is a brief description of each type of index and its appropriate use.

### **Laspeyres Price Index (Constant Quality)**

This index answers the question, "How much is the sales price today for the same quality house as in the base year?" The base year we are now using is 2005; its index value is set to 100.0. Quality includes not only the physical size and amenities of the house, but also its geographic location. A hypothetical calculation is made in which the base year kind of house is

held constant over time while its selling price is calculated in current dollars.

### **Uses of this Index**

In theory, this index may be used to determine how much of a total price increase is due to an increase in quality - changes in size, amenities, and location - and how much is due to inflation. This index keeps housing quality constant. It has been used to inflate previous years' house prices to determine housing insurance replacement costs, to update local government real estate tax abatement levels, and to update price levels in housing programs for inflation where such updates are required by law or custom. Construction contracts might have a price escalation clause tied to this index. The assumption is that inflation in existing housing or construction can be approximated by inflation in the sales prices of new one-family houses sold.

### **Weaknesses of this Index**

Its greatest strength, constant quality,



contributes to its greatest weakness - a bias towards over-stating inflation. This index does not allow for effects of substitution in housing. If some feature in a house becomes increasingly expensive, the buyer may substitute some other item. Or, the buyer may agree to a smaller house with fewer rooms so that the house can be purchased at an affordable price. This index does not allow for such adjustments. Furthermore, this index assumes that the base year percent distribution of new home sales by geographic area will not change. In reality, these proportions do change, reflecting the fact that markets are not all relatively strong or weak at the same time. This index has a problem of weighting higher priced markets at their base year levels even when new home sales proportions have significantly changed.

### **Paasche Index (Output Deflator)**

This index answers the question, "What is the difference in price in today's house in today's dollars versus the price for the same house in base year dollars?" Since "today" is defined as any time period in question, the quality of the house defined above is not held constant. It is newly calculated at each time period. A hypothetical calculation is made in which the numerator of the calculation is the current house priced in current dollars. The denominator is the current

house priced in base year dollars. In the numerator, for each time period the size, characteristics, and geographic mixture of the houses sold reflect the activity of that time period and the prices paid. Base year prices for the same characteristics are held constant in the denominator.

### **Uses of this Index**

Since we are not concerned with new home sales or under construction as an output, we do not publish this index. Our use for this index is to calculate the Fisher Ideal Index as defined below. Data users who are concerned with measuring the value of today's output or production using a constant set of dollars will find this kind of index useful. By dividing today's output or value of production by this index, one can convert or deflate back to a fixed or standard set of dollars associated with the base year. This enables the data user to determine what the real value of output is for each time period.

### **Weaknesses of this Index**

Given that buyers of new homes can satisfy their housing needs through a variety of means, preferences in housing choices can change at each time period. If, in effect, the real costs of housing are rising relative to income, the Paasche index will allow the substitution of a smaller house with fewer amenities over the larger house with more amenities in order to



increase affordability, because there is no fixed standard quality. By doing this, the Paasche index understates inflation because it allows cheaper options to replace more expensive ones. If certain housing markets become over priced, and housing sales reflect a shift to lower priced markets, a Paasche index will not factor out these changes. All things being equal, this will result in a lower calculated rate of inflation.

### **Fisher Ideal Index (Price Deflator)**

This index helps answers the question, "What is the (unbiased) value of today's homes being constructed in constant dollars?" In doing this it attempts to eliminate two kinds of problems associated with the previous two indices:

- the tendency to overstate inflation (Laspeyres); and
- the tendency to understate inflation (Paasche);

The Fisher Ideal index is the geometric average of a Laspeyres and Paasche indices for the same time period. The geometric average is calculated by multiplying the Laspeyres index by the Paasche index and then taking the square root of the result. The biases

associated with each component index are minimized by calculating the geometric average.

### **Uses of this Index**

This index can be used as a price deflator in determining the constant dollar value of today's output of houses under construction, which is included in the Gross Domestic Product. It does eliminate the problems of either understating or overstating inflation given substitutions made in the marketplace, while at the same time allowing for some change in base characteristics to reflect the variation in size, amenities and geographic location of houses. The geometric average technique has the effect of halving the yearly quality change taking place.

### **Weaknesses of the index**

This index cannot be used to precisely determine how much of a total price change is associated with inflation and how much is attributed to changing quality since there is no fixed quality associated with the base year. A further weakness of this index is its complexity. It relies on the production of the two component indices, while producing a result similar to either the Laspeyres or the Paasche indices.







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## APPENDIX-III

### HEDONIC PRICING METHOD

The objective of official price statistics is to measure what we call “pure” price changes, purged of the adulterating influence of changes in consumption patterns, types of goods and quality features. This essentially reflects the Laspeyres Principle of once defining a basket of goods and keeping it as constant as possible over a defined period of time. Indices are often used to compare changes in living costs for one year to another by comparing the average prices of a "basket of goods" between the two periods. In many countries, indices for other investment sectors have been long established. However, property sector is rather slow to come out with a reliable index. This may be due to the difficulty of grouping the similar properties in a basket, since no two properties are homogenous.

Especially, the price of an item at two separate times can only be usefully compared if the quality of the item remains constant. If this is not the case, *quality* adjustment is undertaken in order to introduce the monetary value

of an item's quality change into price observation.

Measuring property prices differs from measuring the prices of other assets, because the special characteristics of the housing market mean that both the choice of sample data and unit of analysis will have an impact on the index results:

- **Houses are heterogeneous.** No two properties are identical; they will invariably differ in location.
- **Prices are negotiable.** The price of a property is not fixed and can change throughout the transaction process. This means that we can only know a house's market value after it has been sold.
- **Property sales are infrequent.** The Bank of England estimated that during the 1990s, about 7% of the housing stock changed hands every year this means the average house is sold approximately every 14 years. As a consequence, available sales data for a certain



property are on average 7 years old and consequently of limited use.

Existing house price indexes often simply measure the average or median price of houses sold in a particular period. This approach is problematic since the mix of houses sold could change quite significantly over time. Suppose that the proportion of low quality houses sold in period  $t$  is much higher than in period  $t+1$ . The change in the average sale price from period  $t$  to  $t + 1$  will therefore overestimate the actual change in house prices (perhaps dramatically so). For a price index to be meaningful, it must compare the prices of equivalent products from one period (region) to the next. This is particularly problematic in the case of housing where no two houses are identical, and a number of years (or decades) may elapse between sales of a particular house.

One approach for dealing with this problem in a temporal context is to restrict the comparison to repeat sales, i.e., houses that are sold at least twice during the time interval covered by the data set. The repeat-sale method has become the method of choice in the real-estate industry for measuring housing market conditions. Although sophisticated, and a huge improvement on the average price

approach, this method still has weaknesses. First, it cannot be used to construct spatial price indexes since the same house cannot sell in two different locations. Second, it does not make maximum use of the available data since houses that are sold only once during the time interval of interest is omitted. Admittedly, the severity of this problem decreases as the length of the time interval increases, since this reduces the share of houses that are sold only once as a proportion of all houses sold. Third, the results for earlier periods typically need to be revised as new data become available. Fourth, there is no guarantee that a house sold in one period is equivalent to the same house sold in a later period. This is because the house may have depreciated due to wear and tear or been renovated or enlarged between sales. In other words, the repeat-sales method does not guarantee that like is compared with like. Fifth, if repeat-sale houses tend to differ from single-sale houses in the data set in some respects (for example apartments may sell more frequently than houses), and if they follow different price paths (e.g., apartment prices rise more slowly than house prices) then the index may be biased (in this case upwards).

The simple average of transaction price is the mean price of all houses



sold in a certain period of time. This method of analysis, used by HM Land Registry, is suitable for assessing the total value of turnover in the property market.

The main problem with this method is that it does not take into account differing transaction times for differently priced properties. If, for example, the number of sales of (more expensive) detached houses rises, the simple average will record an increase in property prices, although the prices of individual properties have not actually changed.

Therefore, the data must be standardized in order to neutralize the effect of variations in the sample data.

Mix Adjustment divides the property market into 'cells'. Each cell contains properties with similar characteristics in similar locations. House price data can then be allocated to the different cells in order to assess the average price of each cell, i.e. of properties with different characteristics. After the mean values have been weighted, the average cell price is the mix-adjusted price.

The revised ODPM house price index, for examples, creates as many as 10,000 different cells, providing a very detailed price analysis for different property types. This approach has the following problems:

- All property characteristics have to be taken into account to guarantee accuracy.
- Differences in weighting can have substantial effect on the outcome of the analysis.

The hedonic approach to price index construction has the potential to resolve all these issues and hence significantly improve the quality of house price indexes. The essential idea is to regress the price of a product (in our case a house) on its characteristics. The estimated parameters on the characteristics can be interpreted as shadow prices of the characteristics (or functions thereof) which can then be used to construct an imputed price for each product as a function of its characteristics. This allows price indexes to be constructed even when products cannot be matched from one period or region to the next.

### **Hedonic Techniques**

Hedonic means “relating to utility”. Literally it means: “relating to pleasure”. The term is used both by economists and by other scientists. A hedonic econometric model is one where the independent variables are relating to quality; e.g. the quality of a product that one might buy. The hedonic pricing method is most commonly applied to measure



variations in housing prices that reflect the value of various a tributes of a house.

*No two houses* are alike, due to their heterogeneity; house prices differ according to a wide variety of attributes, such as location and physical attributes. Econometric methodologies could be employed to construct a model that the relative significance of various characteristics are defined and their influence on price levels from one time to another, or between one region and another, are allowed for simultaneously. This is the concept used in the hedonic pricing model.

Instead of assuming that a house's quality remains constant over time, the hedonic statistical methodology explicitly estimates prices for the attributes that determine house quality. It can then “construct” and price a hypothetical constant-quality house, that is, one with the same attributes over time. By choosing the appropriate mix of attributes, this constant-quality house is a taken to be representative of the aggregate housingstock.

One interpretation of the services that flow from a house is that they represent the sum total of the services that flow from each of its attributes. On other words, a house's services may

represent the sum of its bedroom services, bathroom services, kitchen services, lot service, location services, etc. If so, a house's price would approximately equal the sum total of the price times the quantity of each of its attributes. This interpretation implies a straightforward statistical regression that estimates attribute prices based on the correlations between observed house prices and house attributes.

The basic premise of the hedonic pricing method is that price of a marketed good is related to its characteristics, or services it provides. In most of the cases it is used to estimate the value of environmental amenities that affect prices of marketed goods. The method is based on the assumption that people value the characteristic of a good, or the services it provides, rather than the good itself. Thus, prices will reflect the value of a set of characteristic including, environmental characteristic, that people consider important while purchasing the good.

A house can be seen as a bundle of multi-dimensional attributes that combine together to give a certain price. It is usually impossible to break up the house into its components and market them individually. If information on the prices of houses



that correspond to the attributes of the house can be obtained, it should be possible to derive the implicit market price. House price thus reflects the purchaser's valuation of the particular set of attributes of each house unit.

Once the exact mathematical relationship between the house price and the house attributes is determined, it should be possible to derive the market price of a house.

To indicate the price variations in the individual attributes from one house to another, the price measure must be segregated. The hedonic function can be derived using Multiple Regression Analysis, which enables the estimation of changes in average price from one time period to another on a standardized basis. It isolates the variations in price that are caused by changes in the attributes of houses from those which reflect other market forces, such as purely inflationary factors. The results of the regression provide information on how much a change in a property attribute would affect the price of a property.

To overcome the heterogeneity of houses, the hedonic approach to House Price Index enables a full appraisal of the effects of the housing attributes on house prices. The technique of Ordinary Least Squares allows the estimation of the relative contribution

of each of the variables, on average, to the measurement of house prices. This relative contribution is the coefficient of the variables in the regression equation is to indicate the relative importance of the variables in explaining the variation of house prices.

The term “hedonic methods” refers to the use in economic measurement of a “hedonic function,”  $h()$ ,

$$P_i = h(c_i),$$

Where  $p$  is the price of a variety (or model)  $i$  of a good and  $c_i$  is a vector of characteristics associated with the variety. The hedonic function is then used in one of several ways to adjust for differences in characteristics between varieties of the good in calculating its price index. The hedonic function is usually estimated by regression analysis.

In order to capture price variations in the individual attributes, a hedonic function derived from Multiple Regression Analysis enables the estimation of changes in average price from one time period to another. The output of the regression provides information on how much a change in a property attribute would affect the price of a property and, estimate the predictive capability of pricing model incorporating these factors.



Hedonic methods constitute a specific quality adjustment technique. The hedonic method uses regression analysis to measure the influence of product features on the sale price. Thus price changes due to qualitative changes in certain features can be distinguished mathematically and purged from the pure price change which the price index is actually called upon to measure.

Hedonic research has often led to improvements in sampling methods that have led to better samples, sample replacement strategies, or other improvements in the matched model indices. The U.S. statistical agencies have found that hedonic analysis is a useful tool, whether used in the background as a guide to application of the matched model methods, or used directly in making quality adjustments for sample items that are being replaced.

Hedonic regressions are only as good as the data and modeling efforts that go into them. If an important new characteristic has appeared on the market, but is not included in the hedonic regression equation, there is no hope of using the hedonic function to adjust for the improvement in quality. Similarly, just as matched model methods may be biased if samples are out of date or

unrepresentative, so also hedonic methods may be biased if estimated using unrepresentative samples. For both hedonic methods and more traditional methods, the statistical agencies must depend on knowledgeable staff who proactively keep track of new products and other market developments.

The effectiveness of hedonic model is critically dependent on the availability of dwelling characteristic data (at least for those characteristics that have a significant influence on price) and the estimation of the underlying hedonic model itself. The detail on house characteristics required to support the hedonic approach is generally much greater than that required for the stratification approach. Hedonic regression relies heavily on the correct specification of the functional form of the model and the set of property characteristics. The hedonic method requires the inclusion of an appropriate set of house attributes in the modeling process. Failure to account for these attributes can lead to inconsistent estimates of the implicit prices of characteristics in hedonic methods and the inefficient grouping of observations in stratification.

The hedonic pricing method is based on actual market prices. If data readily available, it can be relatively



inexpensive to apply. If data must be gathered and compiled, the cost of an application can increase substantially.

### **Advantages of the Hedonic Pricing Method:**

- The main strength of this method is that it can be used to estimate values based on actual choices.
- Property markets are relatively efficient in responding to information, so can be good indications of value.

### **Issues and Limitations:**

- The main drawback of this hedonic technique is that it requires a tremendous amount of data on house attributes, as the number of attributes that affect a house's quality are extremely large. These characteristics can be physical (e.g., number of bedrooms, land area, etc.), or locational (e.g. the distance to the city center and nearest shopping center, the local crime rate, etc.). Furthermore, the subjective nature of some of these attributes makes them difficult to determine even for a single house. Obtaining the information on the attributes for thousands of observations necessary to estimate corresponding prices is thus a substantial challenge.

- The analysis may be complicated by a number of factors. For example, the relationship between price and attributes of the property may not be linear – prices may increase at an increasing or decreasing in response to changes in the attributes. Furthermore, many of the attributes may be correlated – a problem of multicollinearity.
- The method assumes that people have the opportunity to select the combination of features they prefer, given their income. However, the housing market may be affected by outside influences, like taxes, interest rates, or other factors.
- The method is relatively complex to implement and interpret, requiring a high degree of statistical expertise.
- The results depend heavily on model specification.
- Data on a large number of attributes is required to be gathered and manipulated.
- The hedonic model of price measurement is based on the assumption that an asset's value derives from the value of its different characteristics. The price of a house will therefore depend on the value the buyer



- 
- places on both qualitative and quantitative attributes.
- Since the prices of these characteristics cannot simply be observed, hedonic regression estimates the implicit market value of a unit of each attribute by comparing sample house prices with the associated characteristics.
  - The relevance of a certain characteristic to the value of a property cannot be assessed objectively. It is often unclear how a certain attribute influences the price of a house. Virtually all the attributes of a property that may affect its value have to be taken into accounts.







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## APPENDIX-IV

### EXTRACTS FROM HOUSING ACT, 1997, OF SOUTH AFRICA

“6 National housing data bank and information system

housing development with related activities;

- (1) The Director-General must establish and maintain a national housing data bank (in this section referred to as the 'data bank') and, associated therewith, a national housing information system (in this section referred to as the 'information system').
- (2) The objects of the data bank and information system are to-
  - (a) record information for the purposes of the development, implementation and monitoring of national housing policy;
  - (b) provide reliable information for the purposes of planning for housing development;
  - (c) enable the Department to effectively monitor any aspect of the housing development process;
  - (d) provide macro-economic and other information with a view to integrating national housing policy with macroeconomic and fiscal policy and the co-ordination of
- (e) serve and promote housing development and related matters; and
- (f) collect, compile and analyse categorized data in respect of housing development, including, but not limited to, data categorized according to gender, race, age and geographical location.
- (3) For the purposes of subsection (1) the Director-General must-
  - (a) as far as possible obtain access to existing sources of information;
  - (b) co-ordinate information required for the purposes of the data bank with other official sources of information; and
  - (c) take into account the reasonable needs of provincial governments and municipalities for information regarding housing development.
- (4) For the effective performance of the duties imposed by subsection (3) the Director-General may-



- (a) require any provincial government or municipality to provide any information reasonably required for the purposes of the data bank or information system and determine the form and manner in, and time within, which such information is to be supplied;
  - (b) render to provincial governments and municipalities any assistance reasonably required for performing their duties contemplated in paragraph (a) and subsection (5);
  - (c) link the data bank or the information system or both the data bank and information system to any other data bank information system or other system within or outside the public administration;
  - (d) subject to other legislation prohibiting or regulating the disclosure of information, limit or refuse access by any person or category of persons to any information in the data bank or information system, or in any part of that bank or system-
    - (i) that was obtained from-
      - (aa) any state source, if access by any such person or category of persons to such information in or at that source is limited or prohibited;
    - (bb) any source other than a state source on the condition that such information would not be accessible to any such person or category of persons;
    - (ii) if the disclosure of such information would unfairly prejudice any person or give any person any unfair advantage over any other person;
  - (e) determine and collect, for the benefit of the Fund, fees payable for the supply of, or the granting of access to, any information or category of information in the data bank and information system; and take any steps reasonably necessary to carry out his or her duties or to achieve the objects of the data bank and information system.
- (5) Provincial governments and municipalities must-
- (a) co-operate with the Director-General in performing his or her duties and exercising his or her powers in terms of this section;
  - (b) support the objects for which the data bank and information system have been established; and
  - (c) refrain from any act which may prejudice the effective functioning of the data bank and information system.”
- or





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