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**A Cross-Country Quarterly Database of Real House Prices:
A Methodological Note***

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Abstract

We build from (mainly) publicly-available national sources a database of (nominal and real) house prices—complemented with data on private disposable income (PDI)—for 19 advanced countries at a quarterly frequency, starting in the first quarter of 1975. We select a house price index for each country that is consistent with the U.S. FHFA quarterly nationwide house price index for existing single-family houses (formerly called OFHEO house price index), and extend the country series back to 1975 with available historical data whenever necessary. Each house price index is seasonally-adjusted over the entire sample period and then rebased to 2005=100. The house price indexes are expressed in nominal terms, and also in real terms using the personal consumption expenditure (PCE) deflator of the corresponding country. PDIs are always quoted in per capita terms using working age population of the corresponding country and can be similarly expressed in real terms with the PCE deflator. We aggregate all 19 countries in our database, weighted by their purchasing power parity-adjusted GDP shares in 2005, to compute an average (nominal and real) house price series and an average (nominal and real) per capita PDI series.

JEL codes: C80, C82, R30, R31

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“Not everything that can be counted counts, and not everything that counts can be counted.”

Albert Einstein (attributed)

IPA transcription: “/nɑt ‘ɛvrɪθɪŋ ðæt khæn bi ‘kɔwntəd kɔwnts, ən nɑt ‘ɛvrɪθɪŋ ðæt khawnts khæn bi ‘kɔwntəd/”
‘ælbərt ‘aɪnstaj̩n (əˈtrɪbjətəd)

Introduction

Scholars and policymakers involved in research on housing markets appreciate the value of cross-country comparisons as well as the difficulties of working with heterogeneous international data sources. Research on panel data suggests that time series studies that do not incorporate different country experiences run the risk of deriving biased results by ignoring the information content of the cross-section. International data panels, therefore, would not only mitigate this concern but also give researchers greater variation and a richer sample of observations that can be exploited to obtain more precise parameter estimates (see, e.g., Baltagi (2008) on this point). Nonetheless, limitations on the collection of cross-country house price data (and other relevant housing market variables) have often constrained the scope of panel data analysis and the use of related econometric techniques in empirical work on housing. Moreover, these data limitations have not facilitated the theoretical work of building models—especially open-economy models—of housing either. The basic facts on house prices that theory seeks to understand are still largely based on evidence coming from a reduced country sample—primarily from the U.S. (see, e.g., Davis and Heathcote (2005) and Davis (2010)).

There already exist a number of compilations of international house price series available to researchers to fill this gap in applied work. One of the most comprehensive repositories of international house price series, publicly-available, is maintained by the Bank for International Settlements (BIS) at <http://www.bis.org/statistics/pp.htm>, and includes data from 43 advanced and emerging countries at present. House price datasets can also be obtained from other international organizations—such as the OECD (e.g., OECD(2005), Girouard *et al.* (2006), and André (2010))¹—or constructed directly from private and public national sources. Private compilations of house price series on a variety of countries are also provided in, e.g., The Economist or the Global Property Guide (GPG) websites. The Economist’s global house prices and other relevant housing information can be accessed on-line at http://www.economist.com/blogs/freeexchange/2010/10/global_house_prices, while the GPG resources can be found at <http://www.globalpropertyguide.com/investment-analysis/House-Price-Data-and-Sources>.

¹ The OECD dataset is maintained and updated, and has been used in a number of other cross-country studies upon request. The OECD cross-country dataset came about with the same intent of making heterogeneous national sources more comparable. The country data it contains is similar to ours, although there are differences that in part emerge from the fact that we restrict ourselves to use only publicly-available sources. An important resource on house price index construction and the available national sources for some OECD countries comes from the OECD-IMF Workshop on Real Estate Price Indexes, organized in Paris on 6-7 November 2006. The workshop papers can be downloaded at: http://www.oecd.org/document/47/0,3343,en_2649_33715_37582447_1_1_1_1,00.htm

However, even when data can be found for a given country, problems with time series coverage and data breaks, incomplete sources or documentation, as well as conceptual and methodological differences across sources make international comparisons difficult. The main contribution of our work is, therefore, in sorting out the available data by country, selecting the most *similar* series for the database and documenting their differences to clarify the extent to which international sources can be made comparable for empirical research purposes. We also intend to release our dataset to the public regularly by quarter, and to maintain all vintages of the country series for researchers interested in the effect of data revisions.

This note describes the real-time, quarterly database on international house prices that we have put together, which currently contains data for 19 advanced countries going back to the first quarter of 1975 on (nominal and real) house prices and private disposable income (PDI) per working-age population. The house price data can differ significantly across countries due to characteristics such as the property type that is looked at, the area covered, the property vintage, or the priced unit. Moreover, differences can also arise because of complicated procedures and diverse valuation methods applied to construct the indexes, because of data aggregation or potentially due to the treatment of seasonality by the primary source. With the aim to facilitate further research on international house prices, the database we construct is guided by the goal of minimizing the country differences arising from heterogeneity in the characteristics of the data.

We choose a representative series from multiple, publicly-available country sources after sorting out the data for all 19 countries and homogenizing it—as best as possible—in regards to concept, methodology, frequency, seasonal adjustment and breaks. Selecting closely *comparable* house price indexes and reconstructing the country series back to 1975 makes the panel more suitable for international comparisons across countries and across time. Nonetheless, due to the multiple characteristics influencing house price measures and the range of index construction methods used, some heterogeneity is inevitable.

As indicated before, the heterogeneity of the series can be the result of either differences in the object being measured or in the methodology applied to measure it. A brief description of all house price series is given here to account for the similarities and differences in the data that arise both within and across countries. We make an effort when picking the country series to take account of the measurement object and method by selecting series that are as closely aligned with the features of the FHFA quarterly nationwide house price index for existing single-family houses (formerly called OFHEO house price index) in the U.S. We make note of the aspects in which discrepancies still persist, and adjust the data along several dimensions to make the reported measures more comparable. However, we do not attempt to change the methodology used by the primary source whenever it cannot be reconciled with that of the FHFA reference series by a straightforward transformation of the aggregate data.

Finally, it is worth pointing out that we rely solely on publicly-available, primary sources in constructing this dataset in order to facilitate both the replication of the country series as well as the wider dissemination of the dataset itself. An effort is also made to reconstruct the series back to 1975 with publicly-available and primary data (whenever possible). In some instances, historical data comes upon request from national sources (as indicated in the country descriptions

below) or through secondary sources. To the best of our knowledge, the historical series that we use can also be independently recovered by the interested scholars---without further restrictions.

The rest of the note proceeds as follows. Section I provides a detailed discussion of the national data sources and describes the method we follow to re-construct a house price index series expressed in nominal and real terms for each country. We also discuss the sources of private disposable income (PDI) data and the Personal Consumption Expenditure (PCE) deflator for every country.² Section II defines the aggregation method that we use on the house price and PDI series. It also explains how the database is maintained and the quarterly updating process that we follow, after a *sufficient* number of countries in our sample report the necessary data. Future drafts of this note will contain notice of any refinements or modifications of the methodology described here as well as a detailed reference to any new series that might be added to the database. The appendix contains a brief description of the sources as well as a series of tables summarizing the key characteristics of the data by country and by series.

² Unless otherwise noted, PCE deflator and PDI data is obtained from the most recent OECD Economic Outlook database available at the time of an update. The first release is based on OECD Economic Outlook database 89.

Description of the National Data Sources³

AU - Australia

The Australian Bureau of Statistics (ABS) produces a house price index for new and existing, single-family dwellings located in the eight capital cities (Sydney, Melbourne, Brisbane, Adelaide, Perth, Canberra, Darwin and Hobart). ABS uses the concept of established houses to differentiate from projects homes (which are not yet completed). An established house may be existing or new. The index is created using the mix-adjusted method, with dwellings grouped by suburbs. The median price is calculated for each group according to the price that is first documented in a sales contract. This price is then weighted by the value of dwelling stock, determined by the most recent five-year census. The 2006 census is the most current publication. There is a recent break in the methodology of the series. Prior to 2002, ABS documented house prices according to the final price documented in a sales contract, weighted by the financial commitment (the value of the mortgages). The main purpose was tracking mortgage interest rates. The index is reported at a quarterly frequency starting in the second quarter of 1986.

To extend the data back to 1975, we splice the ABS house price index with growth rates of the Australian Treasury house price index, obtained upon request. The Treasury index measures prices for all types of dwellings, new and existing. The Treasury index is itself a compilation of indexes: From 1986 onwards the data draws from the ABS series described above. Prior to 1986, only six capital cities are included (Sydney, Melbourne, Brisbane, Adelaide, Perth, and Canberra; Darwin and Hobart are excluded). From 1978 to 1986, data comes from the Real Estate Institute of Australia and represents median house prices weighted by housing finance data. From 1960 to 1978, data comes from Bis-Shrapnel, a private consulting company that gathered price information from published auction sales. The index represents a weighted average of median prices in each capital city, with the same weights used to aggregate the 14th CPI series.

None of the house price series are seasonally-adjusted by the source. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Australian data by reporting Private Disposable Income (PDI) on a *per capita* basis, which we compute by dividing the household disposable income series by the working age population series. Both series are reported at a quarterly frequency and obtained complete from the first quarter of 1975 through the OECD Economic Outlook database. The household disposable income series from the OECD database comes seasonally-adjusted. We use the PCE deflator to express the PDI *per capita* series in real terms. Both nominal and real PDI measures are re-based to 2005=100.

³ We use the two-letter country codes defined under ISO 3166-1 (published by the International Organization for Standardization (ISO) as part of the ISO 3166 standard) to identify the countries in our database.

Information resources:

Australian data

Australian Bureau of Statistics (2006): "A guide to House Price Indexes: Australia 2006." Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006. <http://www.oecd.org/dataoecd/30/34/37845226.pdf>

Australia Bureau of Statistics

[http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/ADD9C64F4B4E7DD4CA2576890007E7B6/\\$File/64640_2009.pdf](http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/ADD9C64F4B4E7DD4CA2576890007E7B6/$File/64640_2009.pdf)

Australian Treasury

Abelson, Peter and Demi Chung (2005): "The Real Story of Housing Prices in Australia from 1970-2003." Australia Economic Review 39, pp. 265-281.

Reserve Bank of Australia

http://www.rba.gov.au/statistics/frequency/occ-paper-8.html#section_5

Acknowledgements: Alex Beams from the Australian Treasury and Peter Abelson from Sydney University.

BE - Belgium:

Directorate General of Statistics and Economic Information (DGSEI) (part of Federal Public Service (FPS) Economy), also known as Statistics Belgium, publishes a nationwide house price index for existing, single-family dwellings. Statistics Belgium gathers data from all registered sales. The aggregation of this data and construction of the index is performed by Stadim, a group of real estate analysts. The index is constructed using the mix-adjusted method.

Registered sales data is used to gather information on average price and number of existing homes at the district level. Dwellings are categorized according to type and location. Average price for each group is calculated; average prices that are unrealistic or based on less than six transactions are eliminated. The data is transformed into a Laspeyres chained price index, where districts are aggregated based on number of dwellings in the base period (the year 2005).

In 2005, the categories for dwelling type expanded. Specifically, single-family dwellings were divided into three separate categories: small, average and large. This methodological change caused a break in the series between 2004 and 2005, but affects mainly the Brussels region index and the indexes for the single-family sub-divisions. The aggregate index that we use is minimally affected. Data is reported at a quarterly frequency.

The house price series is not seasonally-adjusted by the source. We seasonally-adjust the data using the Census X-12 multiplicative method and re-base the series to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Belgium data by reporting Private Disposable Income (PDI) on a *per capita* basis, which we compute by first interpolating the annual household disposable income series to a quarterly frequency using the quadratic-match average method. The interpolated series is seasonally-adjusted using the Census X-12 multiplicative method. This series is then divided by the quarterly working-age population series. Both series are obtained through the OECD Economic Outlook database. We use the PCE deflator to express the PDI *per capita* series in real terms. Both nominal and real PDI measures are re-based to 2005=100. Since PDI *per capita* is derived using annual data on household disposable income, we rely on the OECD Outlook's annual forecast of 2011 to report quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Statistics Belgium (in French)

http://statbel.fgov.be/fr/modules/publications/statistiques/economie/ventes_de_biens_immobiliers.jsp

Stadim

<http://www.stadim.be/index.php?page=stadimindexen&hl=en>

Acknowledgements: Paul De Wael from Stadim.

CA - Canada:

The University of British Columbia (UBC) produces quarterly house price series for existing bungalows and two story executive dwellings located in ten main metropolitan areas of Canada: Victoria, Vancouver, Calgary, Edmonton, Regina, Winnipeg, Ottawa, Toronto, Montreal, Halifax. Bungalows are defined as a detached, one-story, three-bedroom dwelling with approximately 111 square meters of living space. Two story executive dwellings are defined as a four-bedroom house with approximately 186 square meters of living space. Prices for the two types of dwellings are obtained through the Royal LePage house price survey.

Prices are determined by Royal LePage real estate experts based on their opinions of fair market value according to house price data from each location. Royal LePage offers disaggregated data grouped by area and property type. The UBC uses this data to create a house price series for each metro area by averaging the prices of detached bungalows and detached two story executive houses for each area. Metro data is offered at quarterly frequency, and goes back to the first quarter of 1975 for Victoria, Vancouver, Regina, Toronto and Montreal. We compute a national house price series by aggregating the ten house price series reported by UBC using a simple unweighted mean of all cities for which we have data in a given quarter.

The house price series are not seasonally-adjusted by the source. We seasonally-adjust the aggregate data using the Census X-12 multiplicative method and then transform the series into an index with a base year in 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Canadian data by including a Private Disposable Income (PDI) series, reported in *per capita* terms. To compute the PDI *per capita* series we divide household disposable income by the working-age population. Both series are available at a quarterly frequency and obtained from the OECD Economic Outlook database. The household disposable income series from the OECD database comes seasonally-adjusted. We use the PCE deflator to report the PDI *per capita* series in real terms. Both nominal and real PDI measures are re-based to 2005=100.

Information resources:

University of British Columbia (UBC) Centre for Urban Economics and Real Estate

<http://cuer.sauder.ubc.ca/cma/index.html>

Royal LePage

<http://www.royallepage.ca/en/media/reports-surveys/survey-of-canadian-house-prices.aspx>

Acknowledgements: Prof. C. Tsuriel (Tsur) Somerville from Centre for Urban Economics and Real Estate (UBC).

CH - Switzerland:

The Swiss National Bank publishes a nationwide quarterly house price index for new and existing, single-family dwellings. The index is originally published by Wuest & Partner and constructed using the mix-adjusted method. Single family homes include homes with 4 to 6 rooms. Dwellings are categorized by size, location and age. The median price for each group is determined through nationwide real estate listings. These prices are then aggregated, weighted by the moving average (a 40-quarter window) of the dwelling stock. Data is reported at a quarterly frequency.

The composition of real estate listings used to generate median price data has changed over time. The index was revised, with retroactive effects in the fourth quarter of 2005, to expand the source database. Prior to the revision, only print media was used; after the revision, this was broadened to include four internet sites (Homegate, Immoscout24, Immoclick and Immostreet). Prior to 1996, a representative sample of real estate listings was selected to represent the overall price. Now all listings are taken into account.

The house price series is not seasonally-adjusted by the source. We seasonally-adjust the data using the Census X-12 multiplicative method and re-base the series to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Belgium data by reporting Private Disposable Income (PDI) on a *per capita* basis. We use two household disposable income series, the first comes from the OECD Economic Outlook database; it is annual and begins in 1990. The other series comes from the OECD Economic Outlook 68 database; it is annual and covers the period 1975–2002. Both series are interpolated to a quarterly frequency, using the quadratic-match average method. The interpolated series are seasonally-adjusted using the Census X-12 multiplicative method. The current household disposable income series is extended to 1975Q1 using the growth rates of the historical series. We then interpolate the working-age population annual series from the OECD Economic Outlook database to a quarterly frequency using again the quadratic-match average method. The extended household disposable income series is divided by the working-age population to create the quarterly PDI *per capita* series in nominal terms. We use the PCE deflator to express the PDI *per capita* in real terms. Both nominal and real PDI series are re-based to 2005=100. Since PDI *per capita* is derived using annual data on household disposable income and working-age population, we rely on the OECD Outlook's annual forecasts for 2011 to report quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Swiss National Bank

<http://www.snb.ch/en/iabout/stat/statpub/statmon/stats/statmon>

Wuest & Partner (in German)

http://www.wuestundpartner.com/online_services/immobilienindizes/angebotspreisindex/information/pdf/Methodenbeschrieb.pdf

DE - Germany:

The *Deutsche Bundesbank* produces an annual, nationwide house price index for existing, terraced houses. Terraced houses are defined as single-family properties with a living space of approximately 100 square meters. Only dwellings that meet comfortable living standards in medium to good locations are included. Data is obtained through BulwienGesa AG: BulwienGesa AG, in turn, draws its data from different sources: Association of German Real Estate Agents (Immobilienverband Deutschland-IVD), Chambers of Industry and Commerce, Surveyor Committees, Building and Loan Associations, Research Institutions, their own surveys, newspaper advertisements, etc. The mix-adjusted method is used to construct the index. Dwellings are categorized by type and location. Dwellings are aggregated according to construction statistics, which are taken from the 1998 micro census for data up to 2004 and the 2002 micro census for data starting in 2005. However, since we choose to focus only on terraced houses, no aggregation across property type is made. Prices from each city are weighted by population data from 2005. Data prior to 2005 is weighted using population data from 2000. The nationwide aggregate draws data from 100 cities from the former Western Germany and 25 cities from the former Eastern Germany (all of Berlin is classified as part of Eastern Germany since 1995). This index is reported at an annual frequency and begins in 1995.

To extend the data, we use two indexes produced by the *Bundesbank*. From 1990-1994, we use an annual house price index for existing, terraced houses in West Germany (including all 100 cities). This series goes back to 1990. For 1975-1989, we use an annual house price index for new terraced houses in West Germany (including only a group of 50 cities). This series goes back to 1975. However, because the designation of new and existing dwellings was not formally introduced until 1990, the inclusion of existing dwellings in this index cannot be completely ruled out. New dwellings in this West Germany series for new terraced houses are aggregated based on each dwelling's estimated construction cost. Cities are weighted according to population data, using the same vintages of population data as the aggregate series for all of Germany. We splice the annual series for all of Germany with the growth rates of the two longer series for West Germany, and then interpolate the resulting series using the quadratic-match average method to obtain a consistent quarterly series for German house prices.

The house price series are not seasonally-adjusted by the source. We seasonally-adjust the spliced and interpolated series using the Census X-12 multiplicative method and re-base the series to 2005=100. Since the primary data is released annually, the time that would elapse if we waited for the *Bundesbank* official data to come out is at least four quarters. To avoid this lag and make the public release of the data more timely, we forecast the spliced annual series for Germany one period ahead using a simple AR(2) model to add one extra yearly observation that can be jointly interpolated. The quarterly estimates obtained from interpolating the actual data with the forecast in this way will be subsequently replaced as the official annual data becomes publicly available.

We deflate this house price series using the Personal Consumption Expenditure (PCE). The PCE series for Germany is obtained from the OECD Economic Outlook database. It is reported at a quarterly frequency and begins in the first quarter of 1991. We use the growth rates of the West Germany PCE deflator, obtained from the OECD Economic Outlook database, to extend the

German PCE deflator to the first quarter of 1975. We complete the German data by reporting Private Disposable Income (PDI) on a *per capita* basis. We use the quarterly household disposable income series for Germany from the OECD Economic Outlook database. Since the series starts in the first quarter of 1991, we use the growth rates of the household disposable income series for West Germany, which is located in the OECD Economic Outlook 88 database, to extend the series to the first quarter of 1975. Both household disposable income series from the OECD come seasonally-adjusted. The series for Germany's working-age population must also be extended using the growth rates of the West Germany series. Both series are quarterly and located in the OECD Economic Outlook database. We divide the household disposable income by working-age population to create nominal PDI *per capita*. We use the PCE deflator to express the series in real terms. Both nominal and real PDI measures are rebased to 2005=100.

Information resources:

German data

Hoffman, Johannes and Andreas Lorenz (2006): "Real Estate Price Indices in Germany: Past, Present and Future." Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006. <http://www.oecd.org/dataoecd/31/20/37625451.pdf>

Deutsche Bundesbank

<http://www.bundesbank.de/index.en.php>

BulwienGesa AG

<http://www.bulwiengesa.de/>

DK - Denmark:

Statistics Denmark publishes a nationwide house price index for new and existing, single-family dwellings. The index is constructed using the sale price appraisal ratio (SPAR) method. First, the ratio of the average purchase price and the average property assessment is computed for each region. Then, the index is created by dividing the ratio of the current quarter by the ratio of the previous quarter and multiplying the outcome by the index of the previous quarter (Dutot index). The appraisal value of dwelling stock is used to weight ratios from different regions. Since we choose to focus only on single-family dwellings, no aggregation across property type is possible. An improved SPAR method was implemented in the second quarter of 1992. The quarterly series from Statistics Denmark begins in the first quarter of 1992 and is indexed to 2006=100.

The Danish Central Bank—relying on data from the Ministry of Taxation (SKAT)—constructs another quarterly house price series going back to the first quarter of 1971 to be used for its MONA quarterly macroeconomic model for Denmark. The series is indexed to 1980=100 and can be obtained from the MONA databank. SKAT also uses the SPAR method to construct a house price index, though sales data is restricted to free sales (not involving family members). This MONA house price index also measures prices for new and existing, single-family dwellings. We use the growth rates this series to extend the series from Statistics Denmark back to the first quarter of 1975.

Statistics Denmark stopped seasonally adjusting their house price index in 2009 with the introduction of an electronic land registry database. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and re-base the series to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Danish data by reporting Private Disposable Income (PDI) on a *per capita* basis. The current household disposable income series obtained from the OECD Economic Outlook database is annual and starts in 1980. We use historical household disposable income data obtained from the OECD Economic Outlook database to extend the data. The historical series is also annual, so we interpolate both series to a quarterly frequency using the quadratic-match average method. The interpolated series are seasonally-adjusted using the Census X-12 multiplicative method. Then we use the growth rates of the historical series to extend the current series to the first quarter of 1975. To report the PDI index in *per capita* terms, we take the annual working-age population series located in the OECD Economic Outlook database and interpolate this series to a quarterly frequency using the quadratic-match average method. We then divide the spliced household disposable income series by the interpolated working age population series to create a nominal PDI *per capita* series. We use the PCE deflator to report the series in real terms. Both nominal and real PDI measures are re-based to 2005=100. Since PDI *per capita* is derived using annual data on household disposable income and population, we rely on the OECD Outlook's annual forecast for 2011 to report quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Danish data

Joensen, Joen (2006): "Danish Real Estate Price Indexes and Their Principal Users." Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006.
<http://www.oecd.org/dataoecd/38/29/37660338.pdf>

Statistics Denmark

<http://www.dst.dk/HomeUK/Guide/documentation/Varedeklarationer/emnegruppe/emne.aspx?systrid=000906>

Danmarks Nationalbank

Danmarks Nationalbank (2003): "MONA - A Quarterly Model of the Danish Economy."
Danmarks Nationalbank, Information Desk, Havnegade 5, DK-1093 Copenhagen K.
[http://www.nationalbanken.dk/C1256BE9004F6416/side/CF0EF4908189F49AC1256E3C0036A030/\\$file/mona_web_UK.pdf](http://www.nationalbanken.dk/C1256BE9004F6416/side/CF0EF4908189F49AC1256E3C0036A030/$file/mona_web_UK.pdf)

Denmark Tax Authority (SKAT)

<http://www.skat.dk/SKAT.aspx?oId=1812700>

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ES - Spain:

The *Ministerio de Formento* produces a nationwide house price series for all types of existing dwellings, priced per square meter. The series is constructed using the mix-adjusted method. The average price-per-square meter is calculated using appraisal agency data, based on dwellings that have been sold in the open market and are more than two years old. Dwellings are grouped by provinces. Dwelling stock information from the latest ten-year census is used to calculate the weights: 2001 is the most recent publication of the census data. The house price series is reported at a quarterly frequency and begins in the first quarter of 1995.

To extend the data, we use two historical series: From the first quarter of 1987 to the last quarter of 1994, we use a nationwide quarterly house price series produced by the *Ministerio de Vivienda*, which measures the average price (per square meter) for all dwelling types, new and existing. From 1976 to 1986, we use the annual house price series produced by *Tecnigrama*. The *Tecnigrama* series measures average prices (per square meter) for all types of new dwellings located in Madrid. Both series are converted into Euros at the fixed conversion rate. We combine the annual *Tecnigrama* series from 1976 to 1986 with the annual four quarter average of the *Ministerio de Vivienda* series from 1987 until 2004. We use the full combined (annual) series from 1976 to 2004 to fit an AR(3) model, then backcast an annual observation for the year 1975.⁴ The *Tecnigrama* annual series backcasted to 1975 is then interpolated at quarterly frequency using the quadratic-match average method. We use the growth rates of the *Ministerio de Vivienda* series (from 1987 to 1994) and the growth rates of the interpolated *Tecnigrama* series (from 1975 to 1986) to extend the *Ministerio de Formento* series to the first quarter of 1975.

The house price series are not seasonally-adjusted by the source. We seasonally-adjust the complete series using the Census X-12 multiplicative method and then transform the series into an index with a base year 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator. To construct the PCE deflator, we use the quarterly PCE deflator obtained from the OECD National Accounts database, which starts in 1995. To extend this series we take the annual PCE deflator from the OECD Economic Outlook database, which spans from 1960 to the present, and interpolate the series to a quarterly frequency using the quadratic-match average method. We then use the resulting growth rates to extend the quarterly PCE deflator obtained from the OECD National Accounts database to 1975Q1. We complete the Spanish data by reporting Private Disposable Income (PDI) on a *per capita* basis. To compute a current household disposable income series, we take the sum of private consumption expenditure, household savings and change in equity in pension fund reserves. All these series are at an annual frequency, and obtained from the OECD Economic Outlook database. We interpolate the summed annual series using the quadratic-match average method. Because the series for the change in equity in pension fund reserves does not start until 1995, we use the annual discontinued household disposable income series from the OECD Economic Outlook 83 database. The discontinued series is also interpolated using the quadratic match average method, and the resulting growth rates are used to extend the current measure of

⁴ Backcasting is the process of extrapolating into the past the trends present in the current data. We rely on backcasting to complete missing series only when the missing data does not exceed one year and we could not find alternative sources to extend the series back to 1975.

household disposable income. We seasonally-adjust the interpolated series, using the Census X-12 multiplicative method, before splicing them together. We also interpolate the annual working-age population series obtained from the OECD Economic Outlook database, using the quadratic-match average method. We divide the spliced household disposable income series by the interpolated working-age population series to obtain a nominal PDI *per capita* series. We use the PCE deflator to express this series in real terms. Both nominal and real PDI measures are re-based to 2005=100. Since the PDI *per capita* is derived using annual data on household disposable income and population, we rely on the OECD Outlook's annual forecast for 2011 to derive the quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

A change in the quarterly PCE deflator reported in the OECD National Accounts database occurred in January 2012. This affects our calculations for the February 2012 update and further updates. The change consists of a shortening of the quarterly PCE deflator series, which now starts in 2000 instead of 1995. Therefore, we use the interpolated growth rates of the annual PCE deflator to extend the quarterly series from the first quarter of 2000 to the first quarter of 1975.

Information resources:

Spanish data

González Veiga, Ignacio (2006): “Basic Aspects of the Methodological Design of the Housing Price Index in Spain.” Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006. <http://www.oecd.org/dataoecd/42/37/37612296.pdf>

Bank of Spain

<http://www.bde.es/webbde/en/estadis/infoest/s16-nm.pdf>

Martínez Pagés, Jorge and Luis Ángel Maza (2003): “Análisis del Precio de la Vivienda en España (Analysis of House Prices in Spain).” Documento de Trabajo nº 0307, Banco de España. <http://www.bde.es/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosTrabajo/03/Fic/dt0307.pdf>

Acknowledgements: Jorge Martínez Pagés and Juan Ayuso Huertas from the Bank of Spain.

FI - Finland:

Statistics Finland publishes a nationwide house price index for existing, single-family dwellings. Price data is collected from asset transfer statements that are compiled by the National Board of Taxes. The data that is first published for a given quarter is preliminary and represents approximately two thirds of the total transactions for that period, though coverage varies by area. This data is revised with the publication of the following quarter. Prices are expressed on a per-square meter basis and quoted in euros; data prior to 1999 has been converted to Euros using the fixed conversion rate. A dwelling refers to a room or suite of rooms that is equipped with a kitchen, kitchenette or cooking area and is intended for year-round habitation. An existing dwelling refers to a dwelling that has been completed prior to one year before the examined year. A price index on new dwellings did not become available until 2005.

Statistics Finland combines hedonic and mix-adjusted methods. The mix-adjustment method cannot control for all changes in the quality of dwellings sold. Quality adjustments are achieved by grouping dwellings by similar characteristics, but adding groups causes the number of observations to decline. Hedonic regressions can be used with a broad based grouping of dwellings to control for the varying dwelling characteristics that remain. Dwellings are first grouped by type, number of rooms and location, as these characteristics are thought to be the biggest determinants of price. A hedonic regression is then used to estimate the price index of each group, with the base period (1985) used as a reference for dwelling characteristics. Each index is then weighted by the value of the dwelling stock. Data for the dwelling stock is obtained through the Population Register Centre's register of buildings and dwellings.

The time series was revised retrospectively from the beginning of 2005 to take into account the changes in municipalities that took place in 2009. Improvements in the management of registers also contributed to an increase in the number of dwelling transactions used in the statistics since 2005. The index is reported at a quarterly frequency and begins in the first quarter of 1985.

To extend the data, we use the nationwide house price index for existing apartments (flats) per square meter. This index is also produced by Statistics Finland, using the same hedonic and mix-adjusted method; however, the base year for this index is 1970. Also, all prices from 1970 to 1986 (including the index on single-family houses) are based on information from real estate agents, which lacks the classification detail that the tax statements offer. Starting in 1987, all price data is based on tax transfer statements. Prices are expressed on a per-square meter basis and quoted in Euros; data prior to 1999 has been converted to Euros using the fixed conversion rate. We splice the single-family dwelling series with the growth rates of the series for existing flats to extend the series to the first quarter of 1975.

The house price series are not seasonally-adjusted by the source. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Finnish data with data on Private Disposable Income (PDI) reported in *per capita* terms. We interpolate the annual household disposable income series from the OECD Economic Outlook database to a quarterly frequency using the quadratic-match average method. The interpolated series is seasonally-

adjusted using the Census X-12 multiplicative method. We divide this series by the quarterly working-age population series, also obtained from the OECD Economic Outlook database, to create the nominal PDI *per capita* series. We use the PCE deflator to report the PDI *per capita* in real terms. Both nominal and real PDI measures are re-based to 2005=100. Since the PDI *per capita* is derived using annual data on household disposable income, we rely on the OECD Outlook's annual forecast for 2011 to report the quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Finnish Data

Saarnio, Mikko (2006): "Housing Price Statistics at Statistics Finland." Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006.
<http://www.oecd.org/dataoecd/3/3/37583294.pdf>

Statistics Finland

http://www.stat.fi/til/ashi/2011/02/ashi_2011_02_2011-07-29_laa_001_en.html#2.Methodologicaldescription

Acknowledgements: Petri Kettunen from Statistics Finland.

FR - France:

The *Institut National de la Statistique et des Études Économiques* (INSEE) produces a nationwide house price index for all types of existing dwellings (detached houses and apartments).⁵ The index is calculated using the hedonic method, where the price of each dwelling is defined by a combination of a fixed number of characteristics, such as location and quality of the dwelling. Dwelling prices are quoted in Euros. Mix-adjustment techniques are also implemented, as dwellings are grouped in zones where prices are more homogeneous and price evolutions are roughly parallel. In each group a reference stock of dwellings is created from all dwellings sold during 1998-2001. Price data for dwellings sold within a current period is adjusted to be representative of the dwelling characteristics in the reference stock, capturing the price movements of a fixed set of dwellings regardless of whether they have been sold at a given date. Data is reported at a quarterly frequency and begins in the first quarter of 1996.

To extend the data, we use a nationwide house price index produced by the *Conseil Général de l'Environnement et du Développement Durable* (CGEDD) for existing apartments.⁶ The CGEDD series is reported at an annual frequency, and constructed using the repeat sales method prior to 1999. Under the repeat sales method used until 1999, apartments included in the index must have been sold more than once, since the method compares a dwelling's most recent (current) transaction price with its previous transaction price. Only existing apartments that were more than 5 years old at the time of the previous transaction were included. Dwelling prices are quoted in Euros, using the fixed conversion rate. After 1999, annualized values of the quarterly INSEE index are used in the CGEDD series. We interpolate the annual CGEDD series at quarterly frequency with the quadratic-match average method and use its growth rates to extend the quarterly INSEE series.

The house price series are not seasonally-adjusted by the sources. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the French data with data on Private Disposable Income (PDI) reported on a *per capita* basis. We obtain a quarterly household disposable income series that starts in 1978Q1 from the OECD Economic Outlook database. To extend this series, we use an annual household disposable income series from the OECD Economic Outlook 79 database that we interpolate to a quarterly frequency using the quadratic-match average method. The interpolated series is seasonally-adjusted using the Census X-12 multiplicative method. We divide this extended series by the quarterly working-age population taken from the OECD Economic Outlook database to obtain a nominal PDI *per capita*. We use the PCE deflator to express the series in real terms. Both nominal and real measures are re-based to 2005=100.

⁵ A single-family dwelling refers to housing intended to be occupied by a single household, and consists usually of just one dwelling unit. A detached house or dwelling refers to a house that does not share an inside wall with any other dwelling. It, therefore, excludes dwellings such as duplexes, linked houses (semi-detached) as well as all terraced houses (row houses) and most apartment blocks (where each building unit can be assigned to a single-family but the entire building can hold multiple single-family units).

⁶ CGEDD falls under the jurisdiction of the Ministry of Ecology, Sustainable Development, Transport and Housing (French: Ministère de l'Écologie, du Développement Durable, des Transports et du Logement, MEDDTL).

A change in the quarterly house price index produced by the INSEE occurred in Q3 2011. This affects our calculations for the February 2012 update and future updates. The index is now re-based to the first quarter 2010=100.

Information resources:

French data

Gouriéroux, Christian and Anne Laferrère (2006): “Managing Hedonic Housing Price Indexes: the French Experience.” Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006. <http://www.oecd.org/dataoecd/2/24/37583497.pdf>

INSEE

http://www.indices.insee.fr/bsweb/servlet/bsweb?action=BS_RECHGUIDEE&BS_IDARBO=05000000000000

Note on base change: http://www.insee.fr/fr/indicateurs/ind96/prixloge_m.pdf

CGEED

http://www.cgedd.developpement-durable.gouv.fr/rubrique.php3?id_rubrique=137

GB - United Kingdom:

The Department of Communities and Local Government produces a nationwide house price index for all types of dwellings, new and existing. Nationwide refers to the United Kingdom of Great Britain and Northern Ireland. The index is constructed using the mix-adjusted method. Dwellings are grouped based on age, location, and type of dwelling. The average price for each group is determined by completed mortgages. The groups are then weighted according to the number of transactions over the previous three years, using a Laspeyres index; sales data is gathered from the Land Registry. Weights are recalculated every year, so the index is annually chained linked.

Currently, data is collected from banks and building societies through the Regulated Mortgage Survey. Prior to 1992, survey participants only included building societies. This was extended as larger building societies converted into banks. The current index represents all completed mortgages of survey participants. Prior to 2005, participants did not report 100% of mortgage completions. A 5% representative sample was submitted until 2001. Select lenders then started reporting all completions, which were incorporated in the index starting in 2003. Since the second quarter of 2002, the quarterly index is calculated from the average of the monthly mix-adjusted series. Data is reported quarterly going back to the second quarter of 1968.

The house price series is not seasonally-adjusted by the source. We seasonally-adjust the series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the United Kingdom data by including Private Disposable Income (PDI) series reported on a *per capita* basis. We create a net household disposable income series using the gross household disposable income series from the OECD Economic Outlook database less consumption of fixed capital.⁷ We use two series for the consumption of fixed capital. The current series starts in 1980 and is reported at a quarterly frequency. It is obtained from the IMF International Financial Statistics (IFS) database. To extend the series back to 1975 we use consumption of fixed capital reported at an annual frequency obtained from the OECD annual national accounts database. We interpolate the annual series using the quadratic-match average method and use the resulting quarterly growth rates to extend the current series back to the first quarter of 1975. We seasonally-adjust the interpolated consumption of fixed capital series using the Census X-12 multiplicative method before splicing it with the current series.. We subtract the spliced consumption of fixed capital series from the gross household disposable income series to obtain net household disposable income. We divide the net household disposable income by the quarterly working-age population series, obtained from the OECD Economic Outlook database, producing a nominal PDI series in *per capita* terms. We use the PCE deflator to express the series in real terms. Both nominal and real PDI measures are indexed to 2005=100.

⁷ We use net household disposable income to construct the PDI measure for all other countries, but this is not directly available for the U.K. For that reason, we modify the gross PDI measure to exclude consumption of fixed capital and derive a more consistent net PDI series.

Information resources:

Department of Communities and Local Government

<http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/housingmarket/notesdefinitions/>

IE - Ireland:

The Department of State for Environment, Community and Local Government produces a nationwide house price series for all types of existing (second-hand) dwellings. The average price for houses and apartments is based on data supplied by mortgage lending agencies. The series is quoted in Euros, at the fixed conversion rate prior to 1999. Dwelling prices are determined from loans that have been approved by lending agencies, and not necessarily loans that have been paid. Prices reported by mortgage agencies are broken down by area. The aggregate series is constructed from an unweighted average of each area. The series is reported at a quarterly frequency going back to the first quarter of 1978 and at annual frequency going back to 1974. We interpolate the annual series for Ireland to quarterly frequency with the quadratic-match average method and use its growth rates to extend the quarterly series back to the first quarter of 1975.

The house price series are not seasonally-adjusted by the source. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and transform the series into an index with base year 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator. To construct the PCE deflator we use the current quarterly PCE deflator obtained from the OECD Economic Outlook database that begins in the first quarter of 1990. To extend the series we use the growth rates of an earlier quarterly PCE deflator series obtained from the OECD Economic Outlook 88 database. We complete the data for Ireland with data on Private Disposable Income (PDI) reported in *per capita* terms. To create the PDI series we use the annual household disposable income series from the OECD Economic Outlook database that begins in 2002. We extend this series back to 1977 using the annual household disposable income series obtained from the OECD Economic Outlook 61 database. To extend the series further back to 1975, we use two annual series obtained from Statistics Ireland—personal consumption of goods and services and personal savings. These two series are added together to create a household disposable income measure. The three annual household disposable income series are interpolated to a quarterly frequency using the quadratic-match average method. The interpolated series are seasonally-adjusted using the Census X-12 multiplicative method. We use the growth rates of the two historical series to extend the current household disposable income series back to the first quarter of 1975.

To create a population series we use the quarterly working-age population series obtained from the OECD Economic Outlook database, which begins in the first quarter of 1990. To extend this to the first quarter of 1975, we use two annual series from Statistics Ireland—population of persons aged 15 and older and populations of persons aged 65 and older. We subtract the latter series from the former to create an annual working-age population series. This series is interpolated using the quadratic-match average method. The resulting quarterly growth rates are used to extend the current working-age population series back to the first quarter of 1975. We divide the household disposable income series by the working-age population series to create a nominal PDI *per capita*. We use the PCE deflator to express the series in real terms. Both nominal and real PDI measures are re-based to 2005=100.

Information resources:

The Department of State for Environment, Community and Local Government

<http://www.environ.ie/en/Publications/StatisticsandRegularPublications/HousingStatistics/>

Acknowledgements: Brian McCann from Ireland's Central Statistics Office.

IT - Italy:

The Italian research institute *Nomisma* produces a house price series based on all types of dwellings, new and existing. Only dwellings located in 13 main metropolitan areas are included (Bari, Bologna, Cagliari, Catania, Firenze, Genova, Milano, Napoli, Padova, Palermo, Roma, Torino and Venetia). The series is semi-annual: Data is collected in May and October from a sample of real estate agencies. Dwellings are grouped according to type and location within a city. Prices for each group are reported on a per-square-meter basis and represent the average sale price. Dwelling prices are quoted in Euros. Data prior to 1999 uses the fixed conversion rate. These prices are then weighted according to the groups' location within each city. The four locations (and weights) are luxury areas (1/15), town center (2/15), between town center and outskirts (4/15), and outskirts (8/15). The 13 cities are aggregated using an unweighted average.

To obtain data prior to 1988, we gather data from the “*Annuario immobiliare*” published by the *Il Consulente Immobiliare* for the same 13 cities. *Il Consulente Immobiliare* is maintained by the Italian business newspaper *Il Sole 24 Ore*. The prices (per-square-meter) refer to new dwellings only. Dwellings are grouped by their location within the city. No aggregation is made by the *Il Consulente Immobiliare*, so we apply the *Nomisma* approach to combine the price data within each city and across cities. We select the same 13 metropolitan areas that are included in the *Nomisma* series. Since no distinction is made for dwellings located in luxury areas, we distribute the luxury area weight equally among the three remaining areas resulting in the following weight distribution: town center (7/45), between the town center and outskirts (13/45), and outskirts (25/45). We then calculate the unweighted average of the 13 cities. Data is reported in Italian lire at a bi-annual frequency from 1967 to 2001 and in Euros at annual frequency from 2002 to 2009.

We convert the averaged bi-annual series to Euros, using the irrevocable exchange rate of 1936.27 Lire per euro and interpolate the resulting series to a quarterly frequency with the quadratic-match average method. We also interpolate the semi-annual *Nomisma* series to a quarterly frequency using the quadratic-math average method. We then use the growth rates of the interpolated bi-annual *Il Consulente Immobiliare* series to extend the interpolated *Nomisma* series to the first quarter of 1975.

The house price series are not seasonally-adjusted by the sources. We seasonally-adjust the interpolated and spliced series using the Census X-12 multiplicative method and transform the series to an index with base year 2005=100. Since the primary data is released semi-annually, at least two quarters would elapse before there is sufficient information to include all 19 countries in the database. To avoid this lag and make the public release of the data more timely, we forecast the spliced semi-annual series for Italy one period ahead to add one extra semi-annual observation that can be jointly interpolated, using an AR(2) model. The quarterly estimates obtained in this way would be subsequently replaced as *Nomisma*'s semi-annual data becomes publicly available.

We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Italian data with Private Disposable Income (PDI) reported in *per capita* terms. We interpolate the annual household disposable income series from the OECD Economic Outlook database to a quarterly frequency

using the quadratic-match average method. The interpolated series is seasonally-adjusted using the Census X-12 multiplicative method. We divide this series by the quarterly working-age population series, also obtained from the OECD Economic Outlook database. We use the PCE deflator to report the nominal PDI *per capita* in real terms. Both nominal and real PDI measures are re-based to 2005=100. Since the PDI *per capita* is derived using annual data on household disposable income, we rely on the OECD Outlook's annual forecast for 2011 to report the quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Italian data

Luigi Cannari, Ivan Faiella, Roberto Sabbatini and Francesco Zollino (2006): “House Prices in Italy: the Statistics Used at the Bank of Italy.” Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006.
<http://www.oecd.org/dataoecd/2/44/37583717.pdf>

Bank of Italy

<http://www.bancaditalia.it/statistiche>

Nomisma (in Italian)

<http://www.nomisma.it/>

Il Sole 24 Ore (in Italian)

Il Consulente Immobiliare (2010): “Valori Immobiliari.” February 2010. Il Sole 24 Ore.
<http://www.immobili24.ilsole24ore.com/>

Acknowledgements: Silvio Contessi from the Federal Reserve Bank of St. Louis. Piera Perin from Il Sole 24 Ore S.p.A.

JP - Japan:

The Japan Real Estate Institute (JREI) publishes a nationwide, residential urban land price index dating back to 1955. It is based on appraisals of residential urban land, where the market value is determined as if the land was vacant. The index is based on the average price change of three appraisals made according to urban area rankings (superior, average and inferior). Residential land located in a “medium” neighborhood from each rank is appraised. Thus, mix-adjusted techniques are used in the construction of this index. Prices are reported per-square-meter in an attempt to control for changes in price that are associated with varying plot size. The index is published at a semi-annual frequency, updated at the end of March and the end of September. The index is calculated by multiplying the index of the preceding period by the average percentage change during the subsequent half a year. We interpolate the semi-annual series using the quadratic-match average method to obtain a consistent quarterly series for Japanese house prices.

The house price series is not seasonally-adjusted by the source. We seasonally-adjust the interpolated series using the Census X-12 multiplicative method and re-base the series to 2005=100. Since the primary data is released semi-annually, at least two quarters would elapse before there is sufficient information to include all 19 countries in the database. To avoid this lag and make the public release of the data more timely, we forecast the semi-annual series for Japan one period ahead to add one extra semi-annual observation that can be jointly interpolated, using an AR(3) model. The quarterly estimates obtained in this way would be subsequently replaced as JREI’s semi-annual data becomes publicly available.

We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Japanese data by including a Private Disposable Income (PDI) series, reported in *per capita* terms. To calculate the PDI *per capita* series we divide household disposable income by the working-age population. Both series are available at a quarterly frequency and obtained from the OECD Economic Outlook database. The household disposable income series from the OECD database comes seasonally-adjusted. We use the PCE deflator to report the PDI series in real terms. Both nominal and real PDI measures are re-based to 2005=100.

Information resources:

Japan Real Estate Institute

<http://www.reinet.or.jp/en/index.html>

Ministry of Land, Infrastructure, Transport and Tourism

<http://www.mlit.go.jp/toukeijouhou/chojou/stat-e.htm>

<http://tochi.mlit.go.jp/english/index.html>

Acknowledgements: Chikako Baba from the IMF and Yodo Masato from the Japanese Ministry of Land, Infrastructure, Transport and Tourism.

KR - South Korea:

The Bank of Korea publishes a nationwide house price index for all types of dwellings, new and existing, produced by the Kookmin Bank. The Kookmin Bank is a descendant of the Korean Housing Bank (KHB). The KHB was privatized after the 1997 crisis in South Korea, and it merged to become the Kookmin Bank in 2001. The mix-adjustment/stratification method is used to construct the Kookmin Bank index. Dwellings are grouped according to location and type. Three types of dwellings are identified: detached dwellings, row houses (terraced houses) and apartments. The average purchase price for each group is then determined using real estate survey data. The dwelling stock from June 2011 is used as the base weight. The Kookmin Bank data starts in January 1986 and is released monthly. We average the monthly observations (with a simple arithmetic average) to obtain quarterly observations.

In order to capture house prices prior to 1986, we splice the current Kookmin Bank house price series with a historical annual index documented by Kyung-Hwan Kim (1993). The data reported in Kim (1993) is constructed by combining three separate annual price indexes published by the KHB. The house price index for 1982-1990 is based on information provided by real estate agents, reflective of actual transactions and estimated prices. Neither the property type nor the vintage could be determined from the source. The index for 1978-1981 is based on the KHB standard construction cost, excluding land. The index for 1974-1977 is a weighted average of the total factor construction cost (including land) for single-family dwellings and apartments. The priced unit for both construction cost series could not be determined from the source. We interpolate this series at quarterly frequency using the quadratic-match average method.

We splice the Kookmin Bank series with the growth rates of the interpolated historical series from Kyung-Hwan Kim (1993). The house price series are not seasonally-adjusted by the source. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the South Korean data by including a Private Disposable Income (PDI) series, reported in *per capita* terms. To create the PDI *per capita* series we divide household disposable income by the working-age population. Both series are available at a quarterly frequency and obtained from the OECD Outlook database. The household disposable income series from the OECD database comes seasonally-adjusted. We use the PCE deflator to report the PDI series in real terms. Both nominal and real measures are re-based to 2005=100.

A change in the quarterly household disposable income series obtained from the OECD Economic Outlook database occurred in December 2011. This affects our calculations for the February 2012 update and all future updates. The series is now reported at an annual frequency. Therefore, we splice historical quarterly series from the OECD Economic Outlook 89 database with the current annual series obtained from the most recent OECD Economic Outlook database available at the time of an update. The annual series from 2011 onward is interpolated using the quadratic-match average method and seasonally adjusted using the Census X-12 method. Growth rates of the quarterly historical series are used to extend the interpolated annual series from the first quarter of 2011 to the first quarter of 1975. Since the PDI *per capita* is now derived using annual data on household disposable income, we rely on the OECD Outlook's annual forecast

for 2011 to report the quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Korean data

Kim, Kyung-Hwan (1993): "Housing Prices, Affordability and Government Policy in Korea."
Journal of Real Estate Finance and Economics 6 (1), pp. 55-72.

Kookmin Bank (in Korean)

<http://land.kbstar.com/quics?page=B002198>

Bank of Korea (Economic Statistics System database, ECOS))

http://ecos.bok.or.kr/EIndex_en.jsp

Acknowledgements: Joong-Shik Kang from the IMF.

NL - Netherlands:

Statistics Netherlands publishes a nationwide house price index for existing, single-family dwellings dating back to 1995. The index is calculated using the sales price appraisal ratio (SPAR) method. A dwelling's appraisal value is determined by tax records and this is paired with the dwelling's transaction price. The index is weighted by the value of housing stock indicated by the appraisal value in the base year (2005). The ratio of sales price to appraisal value is recorded for all dwellings sold during the base year. This serves as the denominator for the index. For all dwellings sold during a current period, a ratio of their current sales price to base year appraisal value is determined. This serves as the numerator. The sales price and appraisal value for each dwelling are first summed and then the ratio of the sums is calculated, making it a value-weighted index. The index is reported at monthly frequency, and we average it (with a simple arithmetic average) to obtain quarterly observations.

To extend the data prior to January 1995, we splice the Statistic Netherland index with the nationwide house price index produced by the Kadaster—The Dutch Land Registry. The Kadaster index measures prices for all types of existing dwellings. Since January 1992, it is constructed using the repeat sales index. Data prior to 1992 is based on a series produced by the Netherlands' Association of Real Estate Brokers and Real Estate Experts (Nederlandse Vereniging van Makelaars, NVM) and represents the median selling price of dwellings sold exclusively by NVM agents (which on average are more expensive). The Kadaster extended its repeat sales index by interpolating the NVM data with a constant factor then splicing the resulting series. The NVM-Kadster index is reported monthly, starting in January 1976. We average the full monthly index (with a simple arithmetic average) to obtain quarterly observations from the first quarter of 1976 until the present. We then fit an AR(2) model to the data, which we use to backcast observations for the four quarters of 1975. We use the growth rates implied by the backcasted estimates and the NVM-Kadaster series to extend the current series from Statistics Netherlands back to the first quarter of 1975.

The house price series are not seasonally-adjusted by the source. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Netherlands data by including Private Disposable Income (PDI) reported in *per capita* terms. We interpolate the annual household disposable income series from the OECD Economic Outlook database to a quarterly frequency using the quadratic-match average method. The interpolated series is seasonally-adjusted using the Census X-12 multiplicative method. We divide this series by the quarterly working-age population series, also obtained from the OECD Economic Outlook database. We deflate this series with the PCE deflator to obtain PDI *per capita* in real terms. Both nominal and real measures are re-based to 2005=100. Since the PDI *per capita* is derived using annual data on household disposable income, we rely on the OECD Outlook's annual forecast for 2011 to report the quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Dutch data

van der Wal, Erna, Dick ter Steege and Bert Kroese (2006): "Two Ways to Construct a House Price Index for the Netherlands: The Repeat Sales and the Sales Price Appraisal Ratio." Presented at the OECD-IMF Workshop on real estate price indexes, Paris, November 6-7, 2006.
<http://www.oecd.org/dataoecd/38/31/37660296.pdf>

Statistics Netherlands

<http://www.cbs.nl/NR/rdonlyres/A49D8542-26EC-40FD-9093-82A519247F4B/0/MethodebeschrijvingPrijsindexBestaandeKoopwoningene.pdf>

Kadaster

http://www.kadaster.nl/window.html?inhoud=/kadaster/default.html%3Finhoud%3D/kadaster/wat_doen_we/waardeindex.html

Nederlandse Vereniging van Makelaars (NVM)

http://nieuws.nvm.nl/over_nvm/english.aspx

NO - Norway:

Statistics Norway publishes a nationwide house price index for new and existing, detached houses. The index is constructed using the hedonic method with mix-adjustment techniques. Regression analysis is used to describe the relationship between a dwelling's market price and its individual characteristics. The hedonic model used by Statistics Norway includes a limited number of explanatory variables. No attempt is made to adjust for a dwellings quality or age, only dwelling size and location factor into pricing estimates. To account for this limitation, mix adjustment techniques are used. Dwellings are first divided by type and price level, and regression analysis for each group of dwellings is performed. The price (per dwelling) is estimated relative to base year characteristics. Each group is weighted by the value of the housing stock. The base year is updated in the second quarter of every year, forming an annually chain-linked index.

The weighting scheme has undergone revisions. From 1997 to 2002, the total housing stock was used to weight the index. From 1992 to 1997, the number of sales transactions was used as a weight. There have also been revisions to the sources of data. Prior to 2002, Statistics Norway obtained price data from two different sources, the Ground Property, Address and Building (GAB) Register and a questionnaire distributed directly to the contractors. The house price index is now based on data obtained through FINN.no, which gathers data from multiple real estate agencies: the Norwegian Association of Real Estate Agents (NEF), the Association of Real Estate Undertakings (EFF) and the Norwegian Federation of Cooperative Housing Associations (NBBL). This allows more transactions to be included in the calculation of the index, and a more timely release of the index.

The Statistics Norway house price index is reported at a quarterly frequency and begins in the first quarter of 1992. To extend the data, we use a house price series put together for the *Norges Bank* RIMINI model of the Norwegian economy and obtained upon request. The *Norges Bank* data is itself a compilation of four nationwide house price indexes. From 1987-2004, it corresponds to the house price index constructed by the *Norges Eidomsmeidlerforbund* (NEF) real estate agency, based on voluntary reports of real estate agents regarding sales of dwellings. From 1984-1986, the index uses data gathered by the GAB register. From 1979-1983 the series uses the price index for building costs compiled by Statistics Norway. From 1972-1978, this series is constructed using the deflator for the housing rent component of the CPI.

The house price series are quarterly, but not seasonally-adjusted by the different sources. We splice the Statistics Norway house price series using the growth rates from the *Norges Bank* series. We seasonally-adjust the spliced series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the Norwegian data by including Private Disposable Income (PDI) reported in *per capita* terms. We interpolate the annual household disposable income series from the OECD Economic Outlook database to a quarterly frequency using the quadratic-match average method. The interpolated series is seasonally-adjusted using the Census X-12 multiplicative method. We divide this series by the quarterly working-age population series, also obtained from the OECD Economic Outlook database. We use the PCE deflator to report PDI *per capita* in real terms.

Both nominal and real PDI measures are re-based to 2005=100. Since the PDI *per capita* is derived using annual data on household disposable income, we rely on the OECD Outlook's annual forecast for 2011 to report the quarterly estimates for 2011 until the official yearly data becomes available. We use the same approach in subsequent updates of the dataset.

Information resources:

Statistics Norway

http://www.ssb.no/english/subjects/08/02/30/nos_d372_en/nos_d372_en.pdf

http://www.ssb.no/vis/bpi_en/about.html

Norges Bank

<http://www.norges-bank.no/en/price-stability/historical-monetary-statistics/house-price-indices/>

RIMINI model: Brodin, Anders (1989): "Mikrokonsumfunksjonen i Rikmod." *Arbeidsnotat 1989/1*. Oslo: Norges Bank.

Acknowledgements: Oyvind Eitheim from the *Norges Bank* and Ragnar Nymoen from the University of Oslo.

NZ - New Zealand:

The Reserve Bank of New Zealand publishes a nationwide house price index for new and existing, detached houses⁸. The index is produced using data provided by Quotable Value Limited (QV), a state owned enterprise that collects all data based on territorial authorities' recorded sales prices and property valuations. The Reserve Bank of New Zealand uses this data to construct a house price index following the sales price appraisal ratio (SPAR) method.

The collective sales price of all dwellings sold during a period is divided by their collective appraisal value, which is equivalent to weighting the individual ratios by the value of dwelling stock. The current base period is the fourth quarter of 2003. The methodology for calculating the index changed in the third quarter of 2004. Prior to this date, the aggregated sales price appraisal ratio was weighted by a moving average of sales price data from previous periods. Now the weights correspond to those of the base period, the fourth quarter of 2003.

The transaction data obtained from QV is available from the 1980s onwards, but data that complies with the current standards of the Reserve Bank of New Zealand is only available since 1995. Therefore, to extend the QV series the Reserve Bank of New Zealand performs backdating estimations to produce data prior to the third quarter of 1995. The house price index is reported at a quarterly frequency.

The house price series is not seasonally-adjusted by the source. We seasonally-adjust the series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the New Zealand data by including Private Disposable Income (PDI) reported on a *per capita* basis. An annual household disposable income series is obtained through Statistics New Zealand. This series is available from 1978 to 2010. To extend the series we use historical data on household disposable income obtained from the OECD Economic Outlook 71 database. Since no data is available past 2010, we fit an AR(2) model to the current annual series and forecast the 2011 value. The historical and current series (with the forecasted 2011 observation) are interpolated using the quadratic-match average method. The interpolated series are seasonally-adjusted using the Census X-12 multiplicative method. The growth rates of the historical household disposable income series are used to extend the current series back to the first quarter of 1975. To create nominal PDI *per capita*, we divide the resulting series by the quarterly working-age population series obtained from the OECD Economic Outlook database. We use the PCE deflator to report PDI *per capita* in real terms. Both nominal and real PDI measures are re-based to 2005=100.

⁸ The Reserve Bank of New Zealand uses the term detached house to differentiate these single-family dwellings from apartments and flats.

Information resources:

Reserve Bank of New Zealand

<http://www.rbnz.govt.nz/keygraphs/Fig4.html>

Methodology on old and new house price index:

<http://www.rbnz.govt.nz/keygraphs/1697975.html>

Description of backdating estimation method:

<http://www.rbnz.govt.nz/keygraphs/1689413.html>

SE - Sweden:

Statistics Sweden publishes a nationwide house price index for new and existing, one- and two-family dwellings. This includes detached houses, terraced houses and linked buildings. The index is constructed by first grouping dwellings by similar characteristics, implementing a mix-adjustment technique. However, the main method of index construction is the sales price appraisal ratio (SPAR) method. Because the SPAR method does not control for the compositional changes of dwellings sold, mix-adjustment techniques are combined with the SPAR method. Dwellings are first grouped according to type and location, then the ratio of the average sales price and average appraisal value is computed for each group.

In Sweden, appraisal data is provided by the official real estate registry. This is used to group dwellings by assessed value and region. Appraisal data is then coupled with current transaction data, to produce a ratio of the average sale price and average appraisal value for each dwelling group. Dwelling stock is used to weight each ratio. Dwellings are re-appraised each year, which creates an annually chain-linked index (Laspeyres). An annual index is available from 1975 onwards, and a quarterly index is available beginning in the first quarter of 1986. We interpolate the annual index at quarterly frequency using the quadratic-match average method and use the resulting growth rates to extend the current quarterly series back to the first quarter of 1975.

The house price series is not seasonally-adjusted by the source. We seasonally-adjust the series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the data for Sweden by including a Private Disposable Income (PDI) series, reported in *per capita* terms. To create this series, we divide household disposable income by the working-age population. Both series are available at a quarterly frequency and obtained from the OECD Economic Outlook database. The household disposable income series from the OECD database comes seasonally-adjusted. We use the PCE deflator to report the PDI *per capita* in real terms. Both nominal and real PDI measures are re-based to 2005=100.

Information resources:

Statics Sweden

http://www.scb.se/Statistik/BO/BO0501/2011K01/BO0501_2011K01_SM_BO40SM1102.pdf

US - United States:

The Federal Housing Finance Agency (FHFA) publishes a nationwide house price index for existing, single-family dwellings (formerly called OFHEO house price index). Prices are measured with mortgage data provided by the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac)—based on conforming, conventional mortgages that are purchased or securitized. “Conforming” refers to mortgages that meet the underwriting guidelines of Fannie Mae and Freddie Mac and do not exceed the conforming loan limit set by the Federal Housing Financial Board. “Conventional” refers to mortgages that are neither insured nor guaranteed by a government entity. The index is constructed using the repeat sales method, which analyzes changes in market prices using dwellings sold more than once—meaning that the FHFA price index measures average price changes in repeat sales or refinancing on the same properties.

Dwellings sold within a sample period are pooled together, and a univariate dummy regression model is postulated to explain the price changes between the sales transactions. The FHFA weighted repeat sales method attempts to control for price changes that occur with renovation and depreciation, and also attempts to lessen the price variance associated with infrequent transactions. The FHFA series is reported quarterly going back to 1975.

The house price series is not seasonally-adjusted by the source. We seasonally-adjust the series using the Census X-12 multiplicative method and re-base it to 2005=100. We deflate this house price series using the Personal Consumption Expenditure (PCE) deflator obtained from the OECD Economic Outlook database. We complete the data for the United States by including a Private Disposable Income (PDI) series, reported in *per capita* terms. To create the PDI *per capita* series we divide household disposable income by the working-age population.⁹ Both series are available at a quarterly frequency and obtained from the OECD Outlook 89 database. The household disposable income series from the OECD database comes seasonally-adjusted. We use the PCE deflator to report the PDI in real terms. Both nominal and real measures are indexed to 2005=100.

⁹ The OECD defines working-age population as equivalent to the economically-active population; a concept proposed by the International Labor Organization (ILO). As such, working-age population comprises of “all persons of either sex above a specified age” who supply labor for production purposes (whether employed, unemployed, or seeking work for the first time). The specified aged above which population can be counted as economically active is often determined by law, and may differ across countries.

Information resources:

Federal Housing Finance Agency (FHFA)

<http://www.fhfa.gov/default.aspx?page=84>

Selection Criteria and Aggregation

The FHFA house price index series (formerly called OFHEO house price index) serves as our benchmark reference when selecting house price series for other countries. The main selection criteria (and preference) are: geographic coverage (nationwide); vintage of dwellings (existing); type of dwellings (single-family); priced unit (per dwelling); availability of data (1975 - present); and frequency (quarterly).

In instances where our preferred series is not available from 1975 onwards, growth rates from similar historical series are used to extend the time series. In cases where a quarterly frequency is not available, lower frequency series are interpolated using the quadratic-match average method, and higher frequency series are averaged (with a simple arithmetic mean). Time series backcasting is used to extend the house price indexes of Spain and the Netherlands from the first quarter of 1976 back to the first quarter of 1975. Time series forecasting is used for Italy, Germany and Japan in order to complete the quarterly dataset and avoid long lags in its public release. Forecasts are subsequently replaced with actual data from their respective national sources, as it becomes available.

Our dataset is released quarterly as soon as house price data becomes available for at least 85% of the joint GDP of the countries in our sample (measured by their 2005 GDP in purchasing power parity). Whenever some observations are missing, we compute the aggregated house price index and re-weight the available data to represent only the included countries—similarly for the aggregate PDI series. The aggregate series would be revised in subsequent quarters to incorporate the missing countries in a given quarter, as their respective data observations become available. Old vintages would be kept for researchers interested in real-time data analysis. We adopt this 85% rule as a practical compromise between completeness and timeliness for the dataset release, as we strive to offer the widest possible country coverage in a timely fashion.

Finally, we use the 2005 purchasing power-parity adjusted (annual) GDP shares of all the countries in the sample for which we have observations as constant weights to derive our aggregate nominal house price index, our aggregate real house price index, our aggregate nominal PDI and our aggregate real PDI from the country series that we have described before. All GDP weight data is obtained from the OECD Economic Outlook database.

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Appendix A: Summary of the national sources of house price data

	House price definition	Source and Time Coverage
AU - Australia	AU ^c - Weighted average of 8 capital cities, new and existing detached house price index, per dwelling AU ^h - Weighted average of 6 capital cities, new and existing dwelling price index, per dwelling	Australia Bureau of Statistics 1986Q3-present Australian Treasury 1960Q3-present
BE - Belgium	BE ^c - Nationwide existing single-family house price index, per dwelling	Statistics Belgium 1973Q1-present
CA - Canada	CA ^c - 10 metropolitan areas, “fair” price of existing detached bungalows and two story executive dwellings, per dwelling	University of British Columbia 1975Q1-present
CH - Switzerland	CH ^c - Nationwide new and existing single-family house price index, per dwelling	Swiss National Bank 1970Q1-present
DE - Germany	DE ^c - Nationwide existing terraced house price index, per dwelling DE ^{h1} - W. Germany existing terraced house price index, per dwelling DE ^{h2} - W. Germany new terraced house price index, per dwelling	Deutsche Bundesbank 1995-present (annual) Deutsche Bundesbank 1990-2010 (annual) Deutsche Bundesbank 1975-2010 (annual)
DK - Denmark	DK ^c - Nationwide new and existing single-family house price index, per dwelling DK ^h - Nationwide new and existing single-family house price index, per dwelling	Statistics Denmark 1992Q1-present Danmarks Nationalbank 1971Q1-present
ES - Spain	ES ^c - Nationwide average price of existing dwellings, per square meter ES ^{h1} - Nationwide average price of new and existing dwellings, per square meter ES ^{h2} - Madrid average price of new dwellings, per square meter	Ministerio de Fomento 1995Q1-present Ministerio de la Vivienda 1987Q1-2004Q4 Tecnigrama 1976-1986 (annual)

FI - Finland	<p>FI^c - Nationwide existing single-family house price index, per square meter</p> <p>FI^h - Nationwide existing apartment price index, per square meter</p>	<p>Statistics Finland 1985Q1-present</p> <p>Statistics Finland 1970Q1-2009Q4</p>
FR - France	<p>FR^c - Nationwide existing detached house and apartment price index, per dwelling</p> <p>FR^h - Nationwide existing apartment price index, per dwelling</p>	<p>INSEE 1996Q1-present</p> <p>CEGDD - Ministère de l'Écologie 1936-2009 (annual)</p>
GB - United Kingdom	<p>GB^c - Nationwide new and existing dwelling price index, per dwelling</p>	<p>Department of Communities and Local Government 1968Q2-present</p>
IE - Ireland	<p>IE^c - Nationwide average price of existing dwellings, per dwelling</p> <p>IE^h - Nationwide average price of existing dwellings, per dwelling</p>	<p>Department of Environment, Community and Local Government 1978Q1-present</p> <p>Department of Environment, Community and Local Government 1974-2009 (annual)</p>
IT - Italy	<p>IT^c - 13 main metropolitan area average price of new and existing dwellings, per square meter</p> <p>IT^{h1} - 13 main metropolitan area average price of new dwellings, per square meter</p> <p>IT^{h2} - 13 main metropolitan area average price of new dwellings, per square meter</p>	<p>Nomisma 1988S1-present</p> <p>Il Consulente Immobiliare 2002-2009 (annual)</p> <p>Il Consulente Immobiliare 1967-2001 (bi-annual)</p>
JP - Japan	<p>JP^c - Nationwide urban residential land price index, per square meter</p>	<p>Japan Real Estate Institute 1955S1-present</p>

KR - S. Korea	KR ^c - Nationwide new and existing dwelling price index, per dwelling KR ^h - Kyung-Hwan Kim (1993) index: - Nationwide quoted transactions and estimations of real estate agents - Nationwide standard construction costs (excluding land) - Nationwide weighted average of total factor costs for single-family house and apartment construction	Kookmin Bank 1986M1-present Korea Housing Bank 1982-1990 (annual) Korea Housing Bank 1978-1981 (annual) Korea Housing Bank 1974-1977 (annual)
NL - Netherlands	NL ^c - Nationwide existing single-family house price index, per dwelling NL ^h - Nationwide average price of existing dwellings, per dwelling	Statistics Netherlands 1995M1-present Kadaster 1976M1-2010M12
NO - Norway	NO ^c - Nationwide new and existing detached house price index, per dwelling NO ^h - Norges Bank forecasting model index: - Nationwide sales reports of Norges Eindomsmeidlerforbund real estate agents - Dwelling price based on national property register - Nationwide building cost index - Housing rent component of the Consumer Price Index	Statistics Norway 1992Q1-present Norges Eindomsmeidlerforbund 1987Q1-2003Q4 GAB Register 1984Q1-1986Q4 Statistics Norway 1979Q1-1983Q4 Statistics Norway 1972Q1-1978Q4
NZ - New Zealand	NZ ^c - Nationwide new and existing detached house price index, per dwelling	Reserve Bank of New Zealand 1962Q2-present
SE - Sweden	SE ^c - Nationwide new and existing one- and two-family house price index, per dwelling SE ^h - Nationwide new and existing one- and two-family house price index, per dwelling	Statistics Sweden 1986Q1-present Statistics Sweden 1975-2010 (annual)
US - United States	US ^c - Nationwide existing single-family house price index, per dwelling	FHFA 1975Q1-present

Note: Time series backcasting is used to extend the house price indexes of Spain and the Netherlands from the first quarter of 1976 back to the first quarter of 1975. Time series forecasting is used for Italy, Germany and Japan in order to complete the quarterly dataset and avoid long lags in its public release. Forecasts are subsequently replaced with actual data from the national sources, as it becomes available.

Appendix B.1: Summary of frequency in national sources of house price data¹⁰

	Series	Monthly	Quarterly	Annual	Other	Adjustments
AU - Australia	AU ^c		✓			
	AU ^h		✓			
BE - Belgium	BE ^c		✓			
CA - Canada	CA ^c		✓			
CH - Switzerland	CH ^c		✓			
DE - Germany	DE ^c			✓		Interpolate
	DE ^{h1}			✓		Interpolate
	DE ^{h2}			✓		Interpolate
DK - Denmark	DK ^c		✓			
	DK ^h		✓			
ES - Spain	ES ^c		✓			
	ES ^{h1}		✓			
	ES ^{h2}				✓	Interpolate
FI - Finland	FI ^c		✓			
	FI ^h		✓			

¹⁰ We interpolate the series indicated using the quadratic-match average method at quarterly frequency. None of the original series is seasonally adjusted. We seasonally-adjust them using the Census X-12 multiplicative approach, but only after splicing the current and historical series to extend the time series back to the first quarter of 1975. Then, we re-base the resulting series to 2005=100.

FR - France	FR ^c		✓		
	FR ^h			✓	Interpolate
GB - United Kingdom	GB ^c		✓		
IE - Ireland	IE ^c		✓		
	IE ^h -			✓	Interpolate
IT - Italy	IT ^c			✓	Semi-Annual Interpolate
	IT ^{h1}			✓	Interpolate
	IT ^{h2}			✓	Bi-annual Interpolate
JP - Japan	JP ^c			✓	Semi-annual Interpolate
KR - S. Korea	KR ^c	✓			Averaging
	KR ^h			✓	Interpolate
NL - Netherlands	NL ^c	✓			Averaging
	NL ^h	✓			Averaging
NO - Norway	NO ^c		✓		
	NO ^h		✓		
NZ - New Zealand	NZ ^c		✓		
SE - Sweden	SE ^c		✓		
	SE ^h		✓		
US - United States	US ^c		✓		

Appendix B.2: Summary of units in national sources of house price data

	Series	Units	Adjustments
AU - Australia	AU ^c	Index (2003/2004=100), Australian Dollar	Rebase to 2005=100
	AU ^h	Index (2004Q2-Q3=100), Australia Dollar	
BE - Belgium	BE ^c	Index (2005=100), Euro	
CA - Canada	CA ^c	Average price, Canadian Dollar	Base to 2005=100
CH - Switzerland	CH ^c	Index (1970Q1=100), Swiss Francs	Rebase to 2005=100
DE - Germany	DE ^c	Index (2005=100), Euro	
	DE ^{h1}	Index (2005=100), Euro	
	DE ^{h2}	Index (2005=100), Euro	
DK - Denmark	DK ^c	Index (2006=100), Kroner	Rebase to 2005=100
	DK ^h	Index (1980=100), Kroner	
ES - Spain	ES ^c	Average Price, Euro	Base to 2005=100
	ES ^{h1}	Average Price, Euro	
	ES ^{h2}	Average Price, Euro	
FI - Finland	FI ^c	Index (1985=100), Euro	Rebase to 2005=100
	FI ^h	Index (1970=100), Euro	
FR - France	FR ^c	Index (2010Q1=100), Euro	Rebase to 2005=100
	FR ^h	Index (2000=1), Euro	
GB - United Kingdom	GB ^c	Index (2002Q1=100), Pound	Rebase to 2005=100
IE - Ireland	IE ^c	Average Price, Euro	Base to 2005=100
	IE ^h -	Average Price, Euro	
IT - Italy	IT ^c	Average Price, Euro	Base to 2005=100
	IT ^{h1}	Average Price, Euro	
	IT ^{h2}	Average Price, Italian Lire	Convert to Euros
JP - Japan	JP ^c	Index, (2000S1=100), Yen	Rebase to 2005=100

KR - S. Korea	KR ^c KR ^h	Index, (2011 Jun=100), Won Index, (1974=100), Won	Rebase to 2005=100
NL - Netherlands	NL ^c NL ^h	Index, (2005=100), Euro Average Price, Euro	
NO - Norway	NO ^c NO ^h	Index, (2005=100), Kroner Index, (2000=100), Kroner	
NZ - New Zealand	NZ ^c	Index, (2003Q4=100), New Zealand Dollar	Rebase to 2005=100
SE - Sweden	SE ^c SE ^h	Index, (1981=100), Kronor Index, (1981=100), Kronor	Rebase to 2005=100
US - United States	US ^c	Index, (1980Q1=100), United States Dollar	Rebase to 2005=100

Appendix B.3: Summary of covered area in national sources of house price data

	Series	Nationwide coverage	Other coverage
AU - Australia	AU ^c		✓ 8 capital cities
	AU ^h		✓ 6 capital cities
BE - Belgium	BE ^c	✓	
CA - Canada	CA ^c		✓ 10 metropolitan cities
CH - Switzerland	CH ^c	✓	
DE - Germany	DE ^c	✓	
	DE ^{h1}		✓ West Germany
	DE ^{h2}		✓ West Germany
DK - Denmark	DK ^c	✓	
	DK ^h	✓	
ES - Spain	ES ^c	✓	
	ES ^{h1}	✓	
	ES ^{h2}		✓ Madrid
FI - Finland	FI ^c	✓	
	FI ^h	✓	
FR - France	FR ^c	✓	
	FR ^h	✓	
GB - United Kingdom	GB ^c	✓	

IE - Ireland	IE ^c	✓	
	IE ^h	✓	
IT - Italy	IT ^c		✓ 13 main metropolitan areas
	IT ^{h1}		✓ 13 main metropolitan areas
	IT ^{h2}		✓ 13 main metropolitan areas
JP - Japan	JP ^c	✓	
KR - S. Korea	KR ^c	✓	
	KR ^h	✓	
NL - Netherlands	NL ^c	✓	
	NL ^h	✓	
NO - Norway	NO ^c	✓	
	NO ^h	✓	
NZ - New Zealand	NZ ^c	✓	
SE - Sweden	SE ^c	✓	
	SE ^h	✓	
US - United States	US ^c	✓	

Appendix B.4: Summary of property type in national sources of house price data

	Series	Single-Family Dwellings	All Dwellings	Other/Undetermined
AU - Australia	AU ^c	✓ Detached houses		
	AU ^h		✓	
BE - Belgium	BE ^c	✓		
CA - Canada	CA ^c	✓ Detached bungalows and 2-story executive houses		
CH - Switzerland	CH ^c	✓		
DE - Germany	DE ^c	✓ Terraced houses		
	DE ^{h1}	✓ Terraced houses		
	DE ^{h2}	✓ Terraced houses		
DK - Denmark	DK ^c	✓		
	DK ^h	✓		
ES - Spain	ES ^c		✓	
	ES ^{h1}		✓	
	ES ^{h2}		✓	
FI - Finland	FI ^c	✓		
	FI ^h			✓ Old blocks of flats
FR - France	FR ^c		✓	
	FR ^h			✓ Apartments

GB - United Kingdom	GB ^c		✓	
IE - Ireland	IE ^c		✓	Houses & apartments
	IE ^h	-	✓	Houses & apartments
IT - Italy	IT ^c		✓	
	IT ^{h1}		✓	
	IT ^{h2}		✓	
JP - Japan	JP ^c			✓ Residential urban land
KR - S. Korea	KR ^c		✓	
	KR ^h			✓ Undetermined
NL - Netherlands	NL ^c	✓		
	NL ^h		✓	
NO - Norway	NO ^c	✓		Detached houses
	NO ^h		✓	
NZ - New Zealand	NZ ^c	✓		Detached houses
SE - Sweden	SE ^c			✓ 1 & 2-family dwellings
	SE ^h			✓ 1 & 2-family dwellings
US - United States	US ^c	✓		

Appendix B.5: Summary of property vintage in national sources of house price data

	Series	Existing	New	New and Existing	Other/Undetermined
AU - Australia	AU ^c			✓	
	AU ^h			✓	
BE - Belgium	BE ^c	✓			
CA - Canada	CA ^c	✓			
CH - Switzerland	CH ^c			✓	
DE - Germany	DE ^c	✓			
	DE ^{h1}	✓			
	DE ^{h2}		✓		
DK - Denmark	DK ^c		✓		
	DK ^h		✓		
ES - Spain	ES ^c	✓			
	ES ^{h1}			✓	
	ES ^{h2}		✓		
FI - Finland	FI ^c	✓			
	FI ^h	✓			
FR - France	FR ^c	✓			
	FR ^h	✓			
GB - United Kingdom	GB ^c			✓	

IE - Ireland	IE ^c	✓		
	IE ^h	✓		
IT - Italy	IT ^c			✓
	IT ^{h1}		✓	
	IT ^{h2}		✓	
JP - Japan	JP ^c			✓ Surveyed sites according to actual land use
KR - S. Korea	KR ^c			✓
	KR ^h			✓ Undetermined
NL - Netherlands	NL ^c	✓		
	NL ^h	✓		
NO - Norway	NO ^c			✓
	NO ^h			✓ Undetermined
NZ - New Zealand	NZ ^c			✓
SE - Sweden	SE ^c			✓
	SE ^h			✓
US - United States	US ^c	✓		

Appendix B.6: Summary of priced units in national sources of house price data

	Series	Per Dwelling	Per Square Meter	Other/Undetermined
AU - Australia	AU ^c	✓		
	AU ^h	✓		
BE - Belgium	BE ^c	✓		
CA - Canada	CA ^c	✓		
CH - Switzerland	CH ^c	✓		
DE - Germany	DE ^c	✓		
	DE ^{h1}	✓		
	DE ^{h2}	✓		
DK - Denmark	DK ^c	✓		
	DK ^h	✓		
ES - Spain	ES ^c		✓	
	ES ^{h1}		✓	
	ES ^{h2}		✓	
FI - Finland	FI ^c		✓	
	FI ^h		✓	
FR - France	FR ^c	✓		
	FR ^h	✓		
GB - United Kingdom	GB ^c	✓		

IE - Ireland	IE ^c	✓	
	IE ^h -	✓	
IT - Italy	IT ^c		✓
	IT ^{h1}		✓
	IT ^{h2}		✓
JP - Japan	JP ^c		✓ Residential Urban Land
KR - S. Korea	KR ^c	✓	
	KR ^h		✓ Undetermined
NL - Netherlands	NL ^c	✓	
	NL ^h	✓	
NO - Norway	NO ^c	✓	
	NO ^h		✓ Undetermined
NZ - New Zealand	NZ ^c	✓	
SE - Sweden	SE ^c	✓	
	SE ^h	✓	
US - United States	US ^c	✓	

Appendix B.7: Summary of methods applied in national sources of house price data

	Series	Repeat-Sales	Mix-Adjusted	SPAR	Other/Undetermined
AU - Australia	AU ^c		✓		
	AU ^h				✓ Weighted average of median prices
BE - Belgium	BE ^c		✓		
CA - Canada	CA ^c				✓ Average price
CH - Switzerland	CH ^c		✓		
DE - Germany	DE ^c		✓		
	DE ^{h1}		✓		
	DE ^{h2}		✓		
DK - Denmark	DK ^c			✓	
	DK ^h			✓	
ES - Spain	ES ^c		✓		
	ES ^{h1}		✓		
	ES ^{h2}				✓ Average price
FI - Finland	FI ^c		✓ With hedonic methods		
	FI ^h		✓ With hedonic methods		
FR - France	FR ^c		✓ With hedonic methods		
	FR ^h	✓			
GB - United Kingdom	GB ^c		✓		

IE - Ireland	IE ^c			✓ Unweighted average of cities
	IE ^h			✓ Unweighted average of cities
IT - Italy	IT ^c			✓ Weighted average
	IT ^{h1}			✓ Disaggr. average
	IT ^{h2}			✓ Disaggr. average
JP - Japan	JP ^c		✓	
KR - S. Korea	KR ^c		✓	
	KR ^h			✓ Undetermined
NL - Netherlands	NL ^c			✓
	NL ^h	✓ Since 1992		
NO - Norway	NO ^c		✓ With hedonic methods	
	NO ^h			✓ Undetermined
NZ - New Zealand	NZ ^c			✓
SE - Sweden	SE ^c			✓ Mix-adj & SPAR
	SE ^h			✓ Mix-adj & SPAR
US - United States	US ^c	✓		

Note:

For more information on the methods applied to the construction of house price indexes, see Eurostat's Handbook on Residential Property Prices Indexes at:

http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/methodology/owner_occupied_housing_hpi/rppi_handbook

For more information on the repeat sales method see Chapter 6 of Eurostat's Handbook on Residential Property Prices Indexes:

http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/documents/Tab/Tab/Chapter_6_Repeat_sales_methods.pdf

For more information on the mix-adjusted method see Chapter 4 of Eurostat's Handbook on Residential Property Prices Indexes:

http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/documents/Tab/Tab/Chapter_4_Stratification_or_'mix_adjustmen'_methods.pdf

For more information on the sale price appraisal ratio (SPAR) method see Chapter 7 of Eurostat's Handbook on Residential Property Prices Indexes:

http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/documents/Tab/Tab/Chapter_7_Appraisal-based_methods.pdf

For more information on the hedonic method (which can be combined with the SPAR and mix-adjustment method) see Chapter 5 of Eurostat's Handbook on Residential Property Prices Indexes:

http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/documents/Tab/Tab/Chapter_5_Hedonic_regression_methods.pdf