



## HR – Croatia

The Croatian National Bank (CNB) produces a nationwide house price index for all types of dwellings. Data on real estate transactions are obtained from *Burza Nekretnina* (Real Estate Exchange Database), an association of real estate agencies. In addition to a dwelling's (asking and received) price, *Burza Nekretnina* collects data on its location (region, county, part of city/town) and characteristics (floor area, number of rooms, date of construction, dwelling type). This data is combined to produce a hedonic house price index, controlling for varying dwelling characteristics in the price fluctuations. Part of the fluctuations in dwelling prices can be attributed to varying dwelling characteristics, so abstracting from those produces a more economically-relevant measurement of house prices.

Dwellings are first grouped according to 4 sub-regions, thought to have similar characteristics: the City of Zagreb, the Adriatic Coast, Other urban areas and Other rural areas. Regression analysis is used to strip out the dwelling's price from the contribution of the floor space, the period in which a dwelling was sold, and the dwelling's characteristics and location within a region. Housing characteristics and location are held constant over time identifying the pure price component of housing (per square-meter) with the estimated coefficients of a dummy time variable, holding characteristics and location constant over time so that changes in the composition of the traded housing sample could not be confounded with the fundamental changes in house prices. This variant of the hedonic method is known as the time dummy index.

An index is computed for each region, then weighted by that region's share of total transactions. The City of Zagreb has the most transactions (receiving a 65% percent share in the overall index), the majority of which (around 85%) are for apartments. The Adriatic Coast represents 22% of the overall index, the other urban 8% and the other rural 5%. Transactions are only for dwellings advertised by real estate agencies on *Burza Nekretnina*'s internet site.

The CNB house price index from *Burza Nekretnina* is reported at a quarterly frequency, begins in the first quarter of 1997, and is constructed with all housing units (houses and apartments, old and used) included in the database.

The source of the current house price data has changed. Starting in 2008, the series is based on the house price index developed by the Croatian Bureau of Statistics in cooperation with the CNB. The CNB index was discontinued after the second quarter of 2015. This affects the 2016 first quarter release and all subsequent updates. Another quarter of data was added to the beginning of the new series, so it now starts in the fourth quarter of 2007. This affects the 2018 third quarter release and all subsequent updates. The new series and the previous CNB series both use the hedonic method. The new HPI series is based on a much more detailed and comprehensive database. It covers all data on dwelling transactions (houses and flats/apartments) on the territory of the Republic of Croatia that are registered on the basis of the Notification Real Estate Transfer Tax in the Tax Administration of the Ministry of Finance according to pre-defined deadlines. Weights are calculated using the prices of dwellings that were bought in the last quarter of the previous year. To extend the series back to the first quarter of 1975, we use the previous CNB series back to 1997 and a longer nationwide house price series produced by Yugoslavia's Federal Bureau of Statistics/Croatian Bureau of National Statistics that measures

the average price per square meter for new dwellings. Price data for the longer historical series is based on the settled (instead of the asking) price, which is recorded for the purpose of assessing real estate transaction taxes. Only transactions conducted on the primary market (new construction) are included and out of these transactions only dwellings built by construction corporations are included. This series is reported at an annual frequency beginning in 1965, and remains to this day—although reported semi-annually since the 2000s.

The geographic coverage for this historical series prior to Croatia's independence from the former Yugoslavia corresponds with the present day boundaries for Croatia, so there is no break in coverage in this regard. House prices are quoted in Kuna—the current local currency unit of Croatia—beginning in 1993. House prices for prior periods are reported in the currency of the former Yugoslavia—Dinars in 1965, Dinars (1:100 denomination relative to 1965) from 1966 till 1989, Dinars (1:1000 denomination relative to 1989) from 1990 till 1992, and Croatian Kuna (1:1000 denomination relative to 1992) until now.

In the former Yugoslavia (including Croatia), the real estate market was quite liberal during the 1965-1990 period. After the seventies, the majority of dwellings were built for the market. The historical series from Yugoslavia's Federal Bureau of Statistics is, therefore, somewhat unique because the former Yugoslavia allowed for transactions to be determined by market forces to an extent that is not seen in other former communist countries outside of Yugoslavia where the reported house prices were largely regulated/administered prices. To be sure, Croatia's housing market nowadays is significantly different than the one that operated during the Socialist period in Yugoslavia so naturally price measurements reflect the transformation underwent which we cannot correct for.

The annual historical time series is interpolated to a quarterly frequency using the quadratic-match average method. However, due to the hyperinflation episode experienced by Yugoslavia from 1990, we interpolate the natural log of the house price index instead of the level to prevent the distortion caused by high inflation from resulting in counterfactual interpolated data (including negative observations). The subsequent quarterly growth rates are used to extend the current house price index back 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 BSTS model 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 for Croatia. To re-construct the PCE deflator, we use the quarterly PCE deflator, produced by Eurostat, that begins in the first quarter of 2000. We extend this series using the annual PCE deflator, also produced by Eurostat, which begins in 1995. This series is spliced with the annual Retail Price Index, produced by the Croatian Bureau of National Statistics. The spliced annual series is interpolated to a quarterly frequency using the quadratic-match average method. However, due to the hyperinflation episode from 1990, we interpolate the natural log of the price index to prevent the distortion from creeping in. The subsequent quarterly growth rates are used to extend the current PCE deflator back to the first quarter of 1975.

We complete the Croatian data by reporting personal disposable income (PDI) on a *per capita* basis. The Croatian Bureau of National Statistics reports the average disposable income per

household at an annual frequency beginning in 1998. To obtain a measure of total household disposable income, we estimate the number of households by dividing the consumption expenditures reported in the national accounts by the series of average consumption expenditures per household, then multiply the estimated number of households by the average disposable income per household. To extend the data back to 1975 we use net monthly earnings averaged at annual frequency from Yugoslavia's Federal Bureau of Statistics/Croatian Bureau of National Statistics.

Net earnings are compensation of employees excluding taxes and social and health insurance contributions,<sup>28</sup> which are considered the best proxy available to measure the PDI given that generally it represents the largest source of household's disposable income. During the communist years, basically household disposable income was based on salaries, interests earned in banks, renting real estates and remittances from emigrants but no stocks or bonds—we have data on net salaries only. Data are reported at an annual frequency and represent annual averages of monthly net earnings for the entire household sector. The two annual series are spliced together, and the spliced annual series is interpolated to a quarterly frequency using the quadratic-match average method. However, due to the hyperinflation episode in the early 1990s, we interpolate the natural log of the income data to prevent the effects of the distortion.

Since the primary data on PDI is released annually, at least four quarters would elapse if we waited for the Croatian Bureau of National Statistics' official data release. To avoid this lag and make the public release of the Croatian data more timely, we nowcast the spliced annual series using the BSTS model to add one extra yearly observation that can be jointly interpolated to extend the series to the current quarter. The quarterly estimates obtained using interpolated nowcasts will be subsequently replaced as the official annual data becomes publicly available.

To report the PDI series on a per capita basis, we use data on working-age population published by the United Nations - Department of Economic and Social Affairs (Population Division).<sup>29</sup> The series is produced at an annual frequency (while the OECD series that we use for reference in other countries tend to be reported quarterly). We interpolate the working-age population series to quarterly frequency using the quadratic-match average method.

The source of the current PDI has changed. This affects the PDI *per capita* series for the 2014 first quarter update and all subsequent updates. Net disposable income series for households and non-profit institutions serving households (NPISH) is collected from Eurostat. The series is annual and starts in 2002. We use the total available household income series to extend the data back to 1998 and the average monthly paid off net earnings to extend the data back to 1975.

## References:

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<sup>28</sup> To be more precise, the household's income is based on resources gained by all household members. The available household's income includes income from paid employment, income from self-employment, income from property, pensions and transfers and other receipts. All items of the total available income are presented in net amounts.

<sup>29</sup> For further details, see the information contained in the following webpage: <http://www.un.org/en/development/desa/population/publications/dataset/index.shtml>

Kunovac et al. (2008): “Use of the Hedonic Method to Calculate an Index of Real Estate Prices in Croatia.”

Nestić (2005): “Income Distribution in Croatia: What Do the Household Budget Survey Data Tells Us?”

Posedel and Vizek (2010): “The Nonlinear House Price Adjustment Process in Developed and Transition Countries.”

*Information Resources:*

Croatian Bureau of Statistics

[http://www.dzs.hr/Hrv\\_Eng/publication/2012/03-01-05\\_02\\_2012.htm](http://www.dzs.hr/Hrv_Eng/publication/2012/03-01-05_02_2012.htm)

[http://www.dzs.hr/Hrv\\_Eng/publication/2013/09-01-01\\_07\\_2013.htm](http://www.dzs.hr/Hrv_Eng/publication/2013/09-01-01_07_2013.htm)

[http://www.dzs.hr/Hrv\\_Eng/publication/2015/13-01-02\\_01\\_2015.htm](http://www.dzs.hr/Hrv_Eng/publication/2015/13-01-02_01_2015.htm)

Eurostat Data

[http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database)

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