Price index of Existing Dwellings (PED)
Method description

Contents

1. Introduction

1.1 Motivation

The Central Bureau of Statistics (CBS) calculates the Price Index for Existing Own Dwellings (PED) in response to an European obligation. Regulation 1148/2020 of the European Commission [1] stipulates that Member States must calculate a House Price Index (HPI). The regulation refers to the Technical manual on Owner-Occupied Housing (OOH) and House Price Indices [2] for the requirements that the HPI must meet. For example, the HPI must be composed of a price index for new-build own dwellings (PND) and a PED. This document describes how CBS calculates the PED.

1.2 Objective of the PED

The PED aims to evaluate price changes of all sold existing own dwellings. The dwelling is located on Dutch territory and sold to a private buyer.

1.3 Abbreviations

Abbrevation	Definition
CBS	Centraal Bureau voor de Statistiek (Statistics Netherlands)
HPI	House Price Index
OOH	Owner Occupied Housing
PED	Price index Existing own Dwellings
PND	Price index New-build own Dwellings
WOZ	Property Appraisal Act

1.4 References

1. European Commission (2020), regulation 1148/2020. Consulted via https://eur-lex.europa.eu/legal-content/NL/TXT/PDF/?uri=CELEX:32020R1148

2. European Commission (2017), Technical manual on Owner-Occupied Housing and House Price Indices. Consulted via https://ec.europa.eu/eurostat/documents/7590317/0/Technical-Manual-OOH-HPI-2017/

3. Bourassa, S. C., Hoesli, M. and Sun, J. (2006). A simple alternative house price index, *Journal of Housing Economics*, *15*, 80-97.

4. Haan, J. de, Wal, E. van der & Vries, P. de, (2008). The measurement of house prices: A review of the Sale Price Appraisal Method.

5. Wet Waardering Onroerende Zaken, last changed on 28 januari 1999, Stb 30

2. Calculation method of the PED

2.1 Sale Price Appraisal Ratio method

The calculation of the PED is based on the so-called Sale Price Appraisal Ratio (SPAR) method. Bourassa et al. (2006) [3] and De Haan et al. (2008) [4] provide a description of the SPAR method, and various countries already use it to calculate a price index for existing dwellings. The method uses matched pairs, i.e. it combines (officially) estimated transaction prices with actual transaction prices. Formula (1) reflects the SPAR method:

$$(1) \qquad I^t = \frac{\sum_{j=1}^{n_t} S_{jt} \Big/ \sum_{j=1}^{n_t} A_{jp}}{\sum_{i=1}^{n_0} S_{ip} \Big/ \sum_{i=1}^{n_0} A_{ip}} * 100 \quad ,$$

where I_t represents the price index over the period t, S_{jt} the transaction price of dwelling j in period t, A_{jp} the appraised transaction prices of dwelling j at reference moment p and n the number of transactions. Due to the fact that the transaction prices of most dwellings sold in a particular period are unknown in the base period, transaction prices are estimated by using *appraisal* data. The numerator reflects the price developments of dwellings sold in a particular month relative to the *appraisals* from the base period of these dwellings. The denominator corrects for under and overestimation of the *appraisal* compared to the actual transaction price in the reference period. Formula (1) is a *weighted* method [3]. This implies that more weight is attributed to expensive dwellings than to cheaper dwellings.

2.2 Characteristics

A big advantage of the SPAR method is the use of (nearly) all data, because the base prices of all dwellings in the base period are known. If a dwelling is sold, it is *matched* with the *appraisal* of the same dwelling and it is included in the calculation. An additional advantage is the absence of revision, i.e. historical data are not subject to change caused by the addition of new data in the next period. Moreover, the SPAR method corrects for changes in the 'quality mix'. The average quality of sold dwellings within a set may vary in each period. However, in the SPAR method the transaction price of a dwelling is *matched* to the *appraisal* of the same dwelling, thus eliminating the problem of the 'quality mix'.

As dwellings may change in quality over time due to renovations, it is imperative in the SPAR method to adjust the *appraisals* if a dwelling is renovated. If the *appraisals* are not adjusted, a quality change is reflected in the price increase, which is not the objective of the PED. Quality changes as a result of conversion carried out between the reference date and the moment of appraisal are reflected in the Dutch WOZ value used for the calculation of the PED (see section 2.3.2). However, the PED does not correct for changes in the quality of a dwelling in the period between the WOZ evaluation and the dwelling's transaction moment. This effect is assumed to be fairly limited.

Finally, transparency and simplicity are two advantages of the SPAR method.

2.3 Data

For the calculation of the PED based on the SPAR method, transaction prices as registered by the Dutch Land Registry Office are used, and for the *appraisals* the WOZ values from the most recent period are used.

2.3.1 Transaction prices

The Dutch Land Registry Office has a legal obligation to register all changes in property ownership. Once the deed of conveyance is signed at the notary, a copy of this Act is registered at the Land Registry Office and the data be included in the Land Registry transaction database. The Office also registers transaction price, address and transfer date. As from January 1993, all property ownership changes in the Netherlands are recorded in the Land Registry transaction database.

The seller of a dwelling may be a private individual or, for instance, a housing corporation; the buyer is invariably a private person. The transaction price is the outcome of the negotiation between seller and buyer. The transaction price includes the land on which the property stands, unless this land is leased. The transaction price does not include additional costs (notary, estate agent and surveyor services and transfer tax). Moveable property, like household effects, is also excluded.

The Land Registry Office divides existing own dwellings into five types and one group where the dwelling type is unknown:
1. Multi-family dwellings: apartments
2. Single-family dwellings: corner houses
3. Single-family dwellings: terraced houses
4. Single-family dwellings: semi-detached houses
5. Single-family dwellings: detached houses
6. Type of dwelling unknown

2.3.2 WOZ data

Since 1995, the Act on Property Assessment (WOZ) [5] obliges municipal authorities to assess the value of all immovable property at regular intervals. According to section 18, paragraph 1 'the value of property is based on the value of the property on the value reference date'. And, according to section 19, paragraph 1, the value is adjusted, 'if the property is changed as a result of extension, rebuilding, improvement, demolition or destruction in the year after the value reference date.' The WOZ value includes the land belonging to the property, even if the land is leased.

A requirement of the SPAR method is that *appraisals* (i.e. the WOZ values) should be representative for transaction prices, or rather: a fixed relationship between the transaction price and the WOZ value is essential. The WOZ values used to calculate the PED deviate on average from the transaction prices of property sold during the value reference data, but the average relationship between the transaction price and the WOZ value approaches the ideal value of 1. Moreover, the deviation from the average is stable for the last years (see table 1). This also counts for the years after the crisis in 2009. Because the SPAR method corrects for under and overestimation of the *appraisals* (see section 2.1) and also because outliers are not included in the calculation of the PED (see section 2.4.1), the quality of WOZ values is sufficient to calculate the PED.

Table 1: Data transaction price and WOZ value per value reference date

Reference date	Average transaction price around April[1] in thousand €	Average WOZ-value in thousand €	Average ratio of price/WOZ	Standard deviation ratio price/WOZ
1 January 1995	93,2	89,2	1,055	0,161
1 January 1999	136,8	135,5	1,010	0,125
1 January 2003	201,7	201,4	1,004	0,106
1 January 2005	216,9	217,7	0,998	0,095
1 January 2007	241,5	240,1	1,005	0,090
1 January 2008	249,9	248,6	1,003	0,086
1 January 2009	236,8	240,3	0,983	0,088
1 January 2010	235,8	239,5	0,983	0,087
1 January 2011	239,0	242,5	0,983	0,085
1 January 2012	232,2	236,2	0,982	0,084

Source: CBS and Kadaster

[1] Because the period is about 2 to 3 months between the provisional contract (the moment the price is set) and the moment the sale is registered by the Dutch Land Registry Office, the sales of the months around April are chosen. The sale price of dwellings registered in or around the month April, should represent the price level of January.

2.4   Implementation of the PED

The calculation of the PED based on the SPAR method is performed in 4 steps:

1. Determining and filtering the database
2. Stratification
3. Calculation of subseries per stratum
4. Linking and weighting of subseries

2.4.1   Step 1: Cleaning the dataset

First, the transactions are selected that are related to the target population of the PED. The PED includes all sales of current residential property in the Netherlands sold to private buyers (see figure 1). This also implies inclusion of sales by housing corporations to private buyers. Hence, the following two categories of dwellings as defined in the Act on Property Assessment, are taken into account for the calculation of the PED:

Code 10   Dwelling serving as main accommodation
Code 11   Dwelling with office space and mainly used for residential purposes

These categories refer to dwellings for single or multi-person households. Houseboats and caravans are excluded since they do not belong to the category immovable property. Newly-built dwellings and rented dwellings which are not sold to a private buyer are excluded.

Then all unreliable data are removed from the transaction database of the Land Registry Office and the WOZ files, in order to rule out negative effects on the PED. In total, six selection criteria are used

to obtain a reliable database (see figure 1). Dwellings are not included if they match one of the following characteristics:

1. type of dwelling unknown;
2. sold more than once within a month;
3. transaction price below €10,000 or above €5,000,000;
4. WOZ value unknown;
5. WOZ value below €10,000 or above €5,000,000;
6. unrealistic ratio between transaction price and WOZ value.

The last selection criterion requires further explanation. The PED calculation is based on the ratio between transaction price and WOZ value of all dwellings sold in a particular month. If there is no plausible relationship between the two entities, this may result in a huge, unrealistic price change. Such examples, which can cause bias in the PED, are rare. The introduction of a minimum value of €10,000 and a maximum value of €5,000,000 eliminates questionable transactions to a great extent.
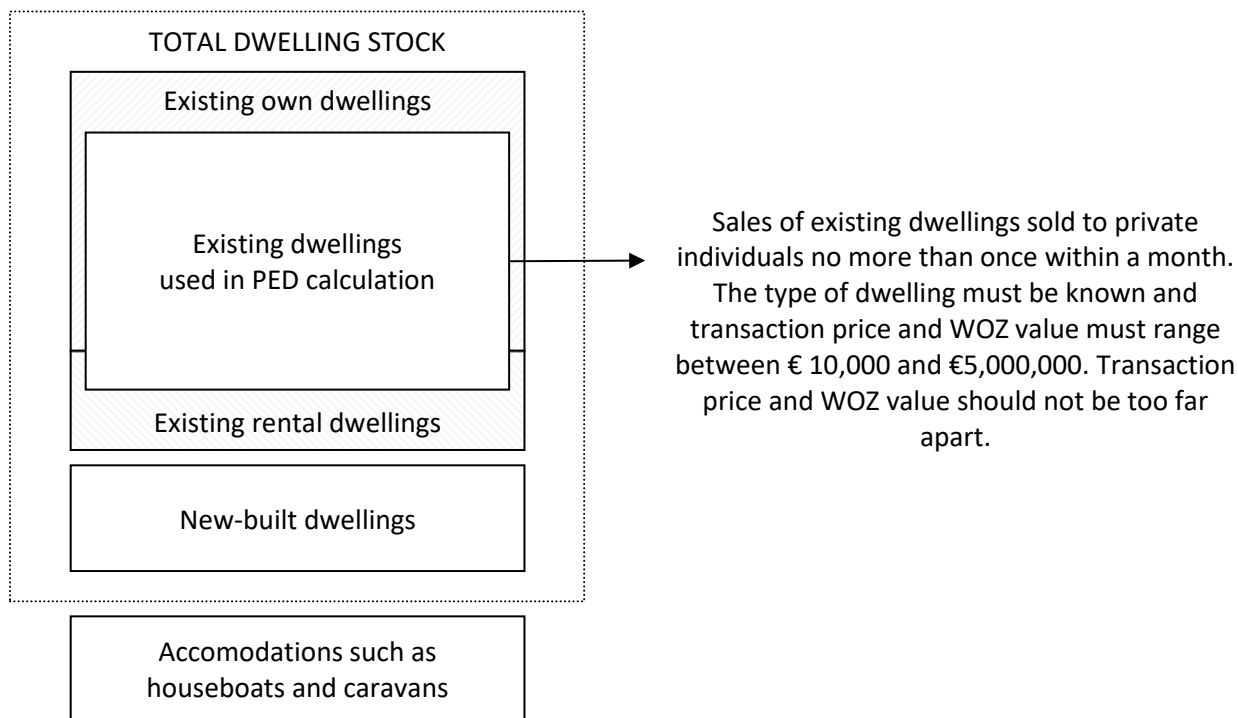
Furthermore, the transaction price – which is adjusted for price changes - is not permitted to be less than half or more than double the WOZ value used. In other words, the transaction will be removed if it satisfies equation (2) or (3)

(2)
$$\frac{S_{jt}/A_{jp}}{I_{NL}^{t-1}/I_{NL}^{p}} < 0.5$$

(3)
$$\frac{S_{jt}/A_{jp}}{I_{NL}^{t-1}/I_{NL}^{p}} > 2$$

where S_{jt} refers to the transaction price of dwelling j in period t, and A_{jp} refers to the WOZ value of dwelling i at reference date p. The quotient to the right of the slash reflects the relative change in the index for the Netherlands as a whole between the previous period and reference moment p. Dividing the ratio by this quotient causes an adjustment of the transaction price for incremental changes in the price level.

After applying all selection criteria, approximately 90 percent of all sales of existing dwellings in the Land Registry transaction database fit the requirements for calculating the PED. The most transactions are removed because of selection criteria 4 and 5. After selection criterion 1 to 5, the removed outliers (equation 2 en 3) account for less than 2 percent of the number of sales per month.

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TOTAL DWELLING STOCK

  Existing own dwellings

    Existing dwellings          ──────►   Sales of existing dwellings sold to private
    used in PED calculation                individuals no more than once within a month.
                                           The type of dwelling must be known and
                                           transaction price and WOZ value must range
  Existing rental dwellings                between € 10,000 and €5,000,000. Transaction
                                           price and WOZ value should not be too far
  New-built dwellings                      apart.

  Accomodations such as
  houseboats and caravans
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2.4.2   Step 2: Stratification

Sold dwellings used to calculate the PED are broken down by province (12) and type of dwelling (5), resulting in 60 strata. As a result the set of sold dwellings becomes more homogeneous.

2.4.3   Step 3: Subseries

The PED series begins in January 1995, because from this date on the WOZ value is available. Each new WOZ period causes a reference shift. Therefore the PED is composed of several subseries starting every new WOZ period. The current dwelling stock (see figure 1) is stable between two successive value reference dates. Dwellings which enter the current housing market in the period between two value reference dates are included after the new value reference date.

Table 2 provides an overview of the various calculated subseries and the WOZ values that were used to calculate these subseries.

Table 2: Use of WOZ values in various subseries

Period beginning	Period end	WOZ reference date
January 1995	Januari 1999	1 January 1995
January 1999	January 2003	1 January 1999
January 2003	January 2005	1 January 2003
January 2005	December 2008	1 January 2005
December 2009	December 2010	1 January 2008
December 2013	December 2015	1 January 2013
…	…	…
December Y	December Y+1	1 January Y-1

From the end of 2008, a new subset starts each year. In order to calculate these subseries WOZ data are used with reference date 1 January, dating two years back.

The different subseries are calculated separately for the different strata.

2.4.4 Step 4: Linking and weighting

Aggregated index series arise when weighted *sub*series per stratum are added. The weighting factors indicate each stratum's share relative to the total transaction value of existing own dwellings in the base period. The calculation per stratum is the sum of all transaction prices per stratum divided by the sum of all transaction prices throughout the Netherlands (see formula 4).

(4)
$$W_s = \frac{\sum_{j=1}^{n_s} S_{jp}}{\sum_{j=1}^{n_{total}} S_{jp}},$$

in which $\sum_{j=1}^{n_s} S_{jp}$ and $\sum_{j=1}^{n_{total}} S_{jp}$, are respectively, the sum of all transaction values of dwellings j in stratum s (s = 1,2…60) on 1 January of a base period and the sum of all transaction values of sold dwellings on 1 January of a base period. N.B. the weighting factors add up to 1:

$$\sum_{s=1}^{60} W_s = 1.$$

After the *sub*series of the strata, required for a particular aggregated index series, have been weighted and added up, the weighted *sub*series of the overlapping months are linked. As a result, an uninterrupted (chain) index set is created.

Finally, all index series are rescaled to the base year according to European directives. As a result international comparison of the index series is easier.

2.5 Changes as of reporting period January 2024

The PED has undergone limited methodological adjustments as of reporting year 2024. The weights for the sub-series have been adjusted following a method change imposed by Europe. The PED price index figures were also given a new base year; 2020 instead of 2015. This means that the figures are more in line with current events. In addition, this was a good opportunity to make other minor adjustments to the data, such as improving links.

2.5.1 Changed weights

The PED is an aggregate of 60 sub-series: 5 dwelling types x 12 provinces. With the change in method, the weightings of the sub-series have been adjusted. Previously, these were weighted on the basis of the sum of the WOZ values of the owner-occupied dwellings in each stratum. This has been adjusted to the sum of the transaction value of the prices of the owner-occupied dwellings in each stratum.

Changing the weightings is the result of a European obligation. The method for calculating price developments has been further harmonized within Europe. The idea behind this mandatory method of weighing is that market developments are better reflected in price developments.

2.5.2 New reference year

To ensure that the results of the index series are more in line with the recent economy, a so-called base shift is carried out once every five years. This is a usual periodic adjustment for index series for Statistics Netherlands. The PED price index will therefore have a new base year (2020). The series goes back as far as the previous one: to 1995.

2.5.3 Small changes

Minor improvements, such as improving links between data sources, were made to the data over the reporting period between 1995 and 2007. For example, the calculation of the PED value is based on the combination of the WOZ values with the actual transaction prices of existing dwellings. Each object included in the calculation must be identified as a 'price pair' in different data sources and these data must then be linked together. By adjusting the data, more links can be created, allowing a larger number of dwellings to be included in the calculation. This contributes to an even more reliable outcome.

2.5.4 Impact

The differences between the old and new results on an annual, quarterly and monthly basis are limited; it concerns numbers after the decimal point. Added up, these small changes do have a long-term effect on the index level, resulting in a maximum difference between the new and old method over the entire series of around 2 index points. The changes have no effect on the total transaction value, total transaction numbers and average transaction price.

The PED measures broadly the same concept before and after the adjustment, but differs in details, which means it measures (or aims to measure) slightly differently. The old series aimed to follow the price development of the stock more closely. Transactions were used as input for this. The new series measures the price development of sold dwellings. Here too, transactions are used as input.