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## CONSTRUCTING A NEW ADVERTISED HOUSE PRICE INDEX

Erica Maria Brincat and Michaela Ghigo<sup>1</sup>

Policy Note

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<sup>1</sup> Erica Maria Brincat is a Senior Economist in the Economic Projections and Conjunctural Analysis Department, and Michaela Ghigo is a Senior Economist in the Fiscal Affairs and Reports department of the Central Bank of Malta. The authors would like to thank Prof. Edward Scicluna, Alexander Demarco, Aaron George Grech, Rita Schembri, Ian Borg and Brian Micallef for their helpful comments. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Central Bank of Malta. Any errors are the authors' own.

Any queries or requests should be sent to [info@centralbankmalta.org](mailto:info@centralbankmalta.org).

## Abstract

The advertised house price index published by the Central Bank of Malta has a long time series – annual data starts from 1980 and quarterly data from 2000 – and is derived from listings of properties in Malta and Gozo as advertised on print media. Over time, however, the number of listings collected from the print media monitored by the Bank have declined considerably, reflecting the increasing use of social media and other online platforms. As a result, the Bank launched a project to collect advertised listings from online sources, with data collection commencing from the first quarter of 2019. This study compares the characteristics of the properties in the new dataset with those advertised on print media. Statistical techniques are used to detect outliers, which are removed using the interquartile range (IQR). Both indices exhibit similar dynamics, though there are some divergences in certain quarters, particularly towards the second half of 2021. The paper concludes with some methodological changes for the new index based on online sources to minimize the revisions with the previous series based on print media, which will be discontinued.

**JEL classification:** C10, O18, R3

**Keywords:** house prices, advertised prices, housing market, Malta.

## Table of contents

Abstract .....	2
Executive Summary .....	4
1. How do online sources improve the CBM advertised house price index? .....	5
2. How does the composition of properties in these sources compare with that in the current source? .....	8
3. How will the new data change the advertised house price index? .....	12
References .....	16
Appendix .....	17

## Executive Summary

The Central Bank of Malta (CBM) publishes on a quarterly basis an advertised house price index, which complements the official contract-based index that is produced by the National Statistics Office (NSO). The CBM advertised index has a long time series and is derived from listings of properties in Malta and Gozo as advertised on print media.

Over time however, the number of listings collected from the print media monitored by the Bank declined considerably, reflecting the increasing use of social media and other online platforms. The number of observations reached a peak of over 10,000 listings per annum in 2007 to 1,600 in 2020. Hence, the robustness of the overall advertised price index and its ability to portray reliably indicative house price dynamics in Malta, has weakened in recent years.

To address this issue, the Bank launched a project to collect advertised listings from online sources. Data collection commenced in the first quarter of 2019. In addition to the advertised price, the dataset includes several property characteristics, such as property type, the state of the property, its size and location, which can be useful for more elaborate research on property market trends. Similar to the print media database, listings are collected on a quarterly basis. Between 2019Q1 and 2021Q4, close to 60,000 valid listings were collected, before the removal of outliers. This means that an average of prices for 5,000 properties per quarter were collected, in contrast to 530 from print media.

Even though the number of listings collected using online sources are much higher than those from print media, the distribution in terms of property types is very similar. Around two-thirds of properties listed in print media and online sources are apartments, followed by maisonettes. The remaining listings consist of terraced houses and other property categories. At the same time, median and average prices using the online database on balance exceed those collected from print media. The largest discrepancy is in the 'other' category of the index, primarily driven by villas. Differences in the volatility of the indices for separate dwelling categories are also noticeable, except for apartments. In general, both indices have similar dynamics, though there are some divergences in certain quarters.

The paper concludes with some methodological changes for the new index based on online sources to minimize the revisions with the previous series based on print media, which will be discontinued. Online-sources offer the advantage of a richer dataset but can also contain a more substantial number of outliers than smaller datasets. Statistical techniques are used to detect outliers, which are removed using the interquartile range (IQR). For the proposed new index based on online adverts, the base year will change to 2015=100 from the current 2000=100, in line with publications of the NSO. Statistical break-adjustment techniques were utilised to minimize past revisions in the growth rate of the index prior to 2019. The index levels for this period were revised due to the re-basing and the application of break adjustment techniques on the new indices for 2019.

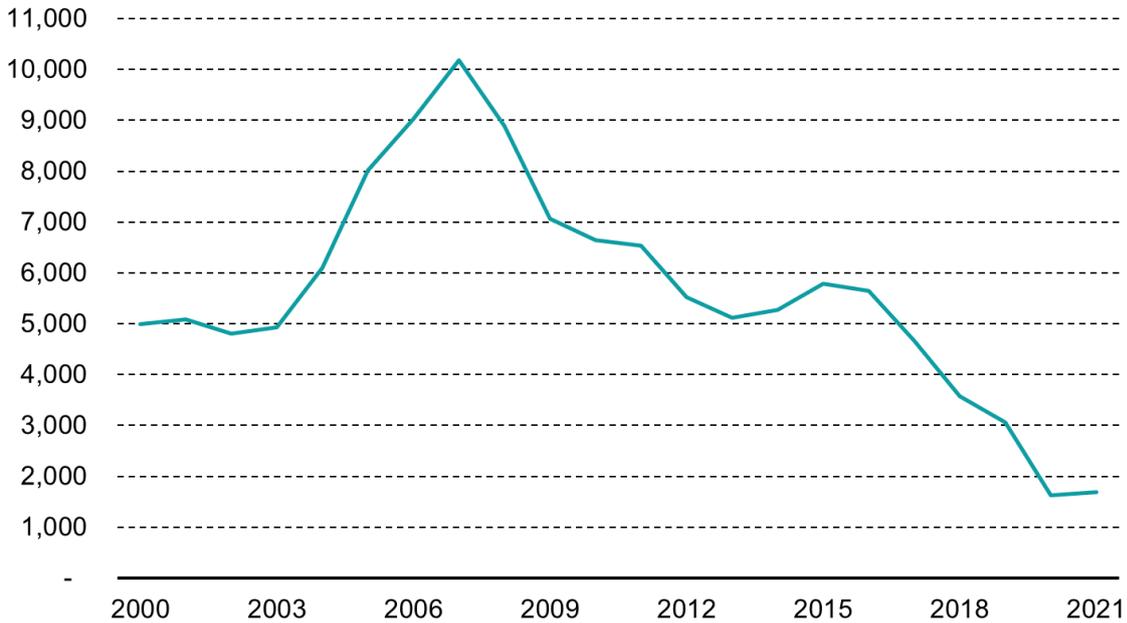
## 1. How do online sources improve the CBM advertised house price index?

The Central Bank of Malta (CBM) publishes on a quarterly basis an advertised house price index, which complements the official contract-based index that is produced by the National Statistics Office (NSO). The CBM advertised index pre-dates that produced by the NSO and has a considerably long time series - it is available in annual terms starting from 1980 and in quarterly terms from 2000. The series is derived from listings for properties in both Malta and Gozo, advertised on print media (Demarco, 1995). Following collection, the dataset is cleaned of duplicate listings and corrected for outliers.

To construct the index, weights are calculated every quarter, reflecting the variation in counts for each dwelling type as a proportion of the total number of observations. A Fischer-chained house price index is then computed based on the set of estimated weights and median price levels. Along with the overall advertised index, the CBM publishes indices for four separate property types. These include apartments, maisonettes, terraced houses, and 'other' properties. The latter is composed of villas, houses of character and town houses.

In the early 2000s, a total of around 4,900 to 6,000 observations were collected annually from print media. The number of observations reached a peak of over 10,000 data points in 2007 (see Chart 1). Over time, however, the number of listings collected from the print media monitored by the Bank declined considerably. Indeed, in 2020, the CBM was able to collect just around 1,600 valid listings from this source. This reflects the increasing use of social media and other online platforms, which offer a broad range of market opportunities for buyers and sellers alike, thus limiting the number of properties advertised on print media. Hence, the robustness of the overall advertised price index and its ability to portray realistically house price dynamics in Malta has weakened over time.

**Chart 1  
NUMBER OF PROPERTIES ADVERTISED ON PRINT  
MEDIA**



Source: Print Media; Authors' calculations.

In order to improve the robustness of the advertised house price index, the Bank launched a project to collect advertised listings from online sources. Online listings started to be collected in the first quarter of 2019. Along with information regarding the property type and the associated price levels, the dataset includes several property characteristics which can be useful for more elaborate research on property market trends.<sup>2</sup>

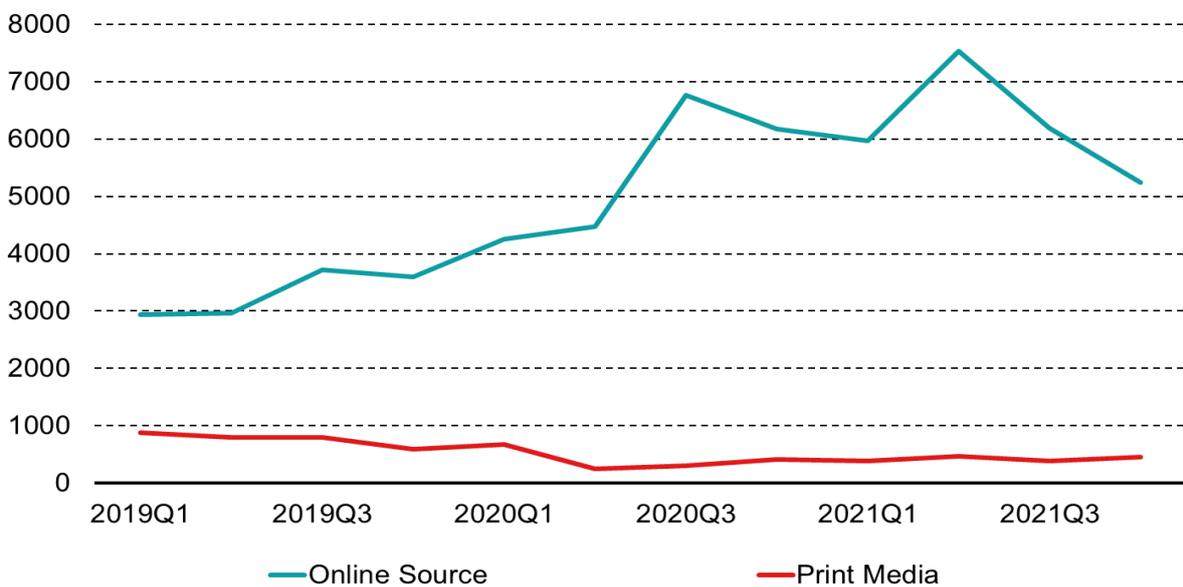
The online sourced dataset comprises of different property types along with information about the locality in which the property is set. Similar to the print media database, the online sourced dataset accounts for the state of the property (i.e., finished or shell) and other characteristics, such as the number of bedrooms, availability of a garage or pool facilities, as well as whether the property advertised is close to a seafront or enjoys some view. However, information on square meters is sparse. The property types collected include apartments shell, apartments finished, maisonettes shell, maisonettes finished, penthouses shell, penthouses finished, terraced houses, town houses, villas, and houses of character.

Listings are collected on a quarterly basis. As is the case for data retrieved from print media, the online data is cleaned of any duplicates. Between 2019Q1 and 2021Q4, close to 60,000 valid listings were collected, before the removal of outliers. This means that an average of prices for 5,000 properties per quarter were collected, in contrast to 530 from print media.

<sup>2</sup> Neither the Bank's current advertised index nor the proposed new index are hedonically adjusted.

The number of valid listings available from the online source averaged around 3,500 per quarter in 2019, as opposed to 900 per quarter using print media (see Chart 2). The number of online listings continued to increase through the second half of 2020. Subsequently, the number of counts was somewhat volatile and even decreased since 2021Q2. Nonetheless, the number of listings in online sources at the end of 2021 remained well above that in 2019 and continued to exceed by a wide margin the number of listings in the Bank's printed media source.

**Chart 2  
COMPARISON BETWEEN THE NUMBER PROPERTIES  
ADVERTISED ON PRINT MEDIA AND ONLINE SOURCE  
IN EACH QUARTER**



Source: Print Media; Online Source; Authors' calculations.

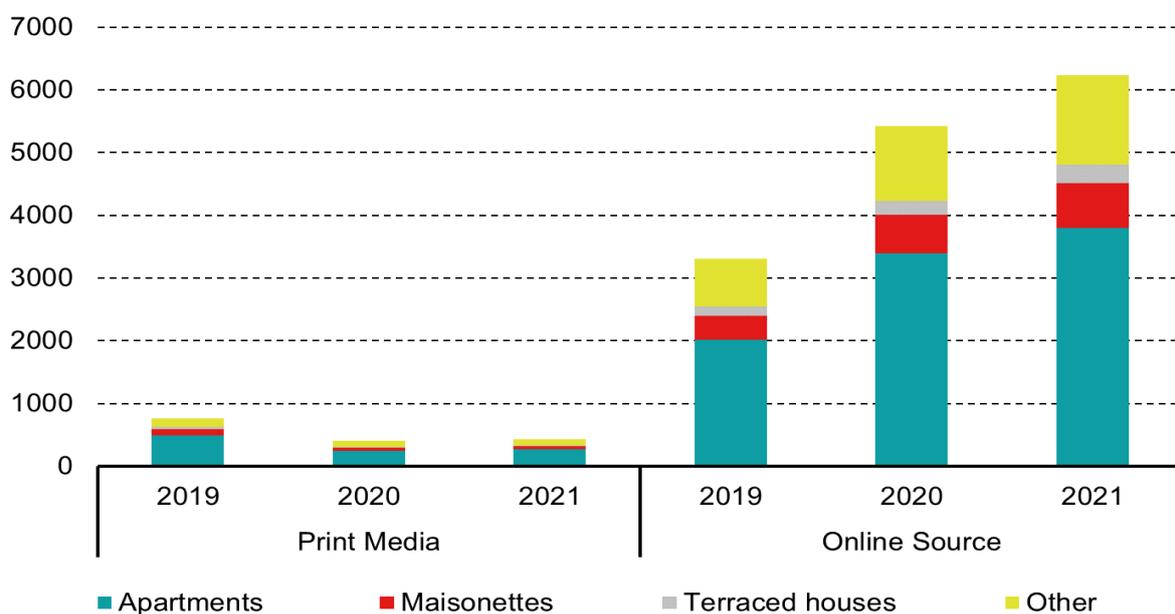
## 2. How does the composition of properties in these sources compare with that in the current source?

This section compares the composition of the two datasets, as well as their development since 2019, the first year when online data started being collected.

Chart 3 illustrates the average number of properties advertised per quarter between 2019 and 2021 according to each source and their distribution by property type. The higher number of listings in the online source becomes more evident when looking at specific property categories. For example, the online source dataset records an average of 200 and 1,100 observations per quarter for terraced houses and properties in the 'other' category, respectively. On the other hand, the print media dataset registered an average of 20 terraced houses per quarter, while the 'other' category consisted of around 110 listings over the same period.

It is notable that in contrast to print media, which shows a decline in the total number of listings between 2019 and 2021, the number of listings available in the online source has increased over this period.

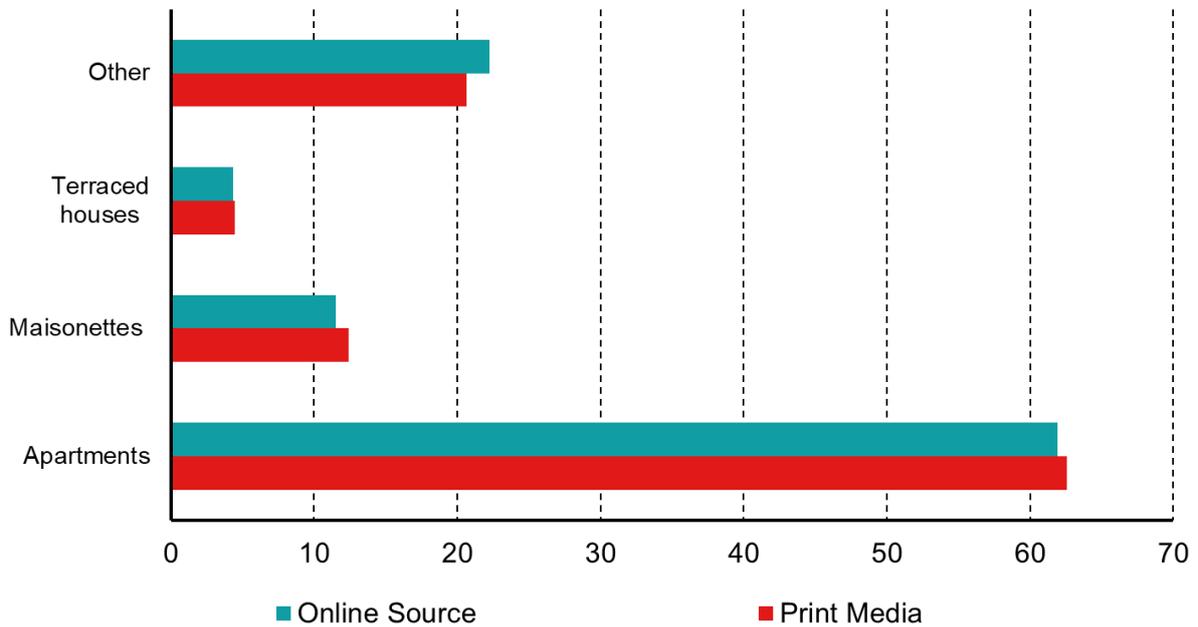
**Chart 3**  
**AVERAGE QUARTERLY COUNTS OF PROPERTY TYPES**  
**BY PERIOD OF ANALYSIS**



Source: Print Media; Online Source; Authors' calculations.

Even though the number of listings collected using online sources are much higher than those from print media, the distribution in terms of property types is very similar (see Chart 4). Around two-thirds of properties listed in print media and online sources are apartments, followed by maisonettes (12%). The remaining listings (around a fourth) consist of terraced houses and other property categories.

**Chart 4**  
**DISTRIBUTION BY PROPERTY TYPE<sup>(1)</sup>**  
*(Percentages)*

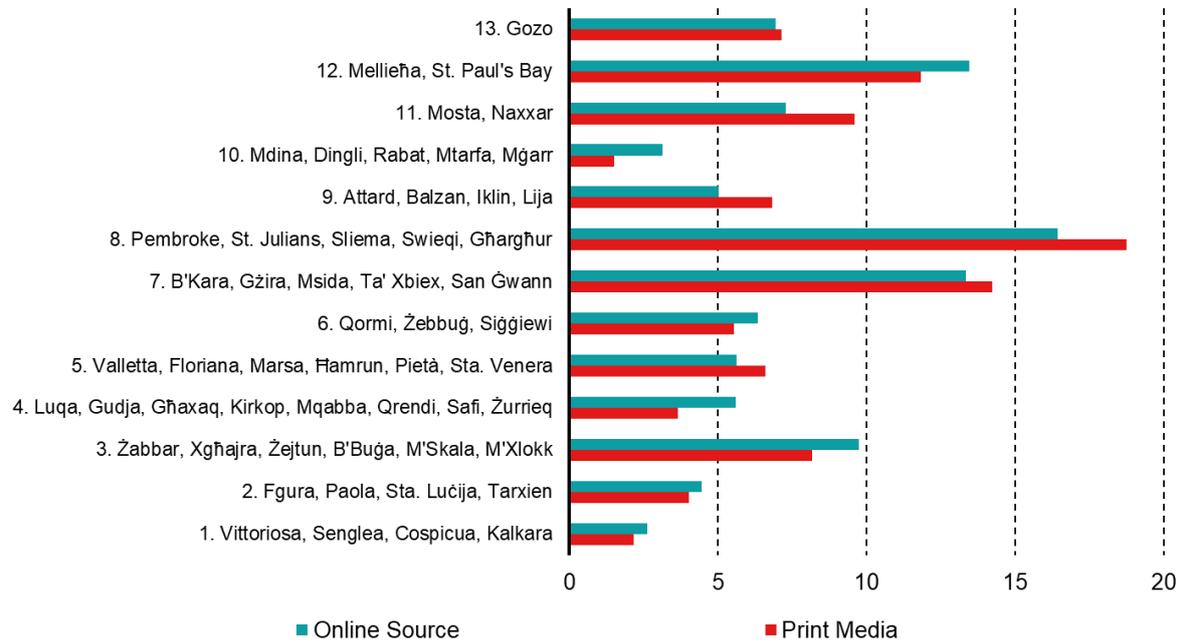


Source: Print Media; Online Source; Authors' calculations.

<sup>(1)</sup> Data shown are the proportion for each property type for the period 2019 - 2021.

Between 2019 and 2021, the highest number of listings related to properties advertised on print media were located in region 8, followed by region 7 (see Chart 5). On the other hand, the lowest number of advertised properties were located in region 10. Similarly, the largest share of dwellings advertised online were also recorded in regions 8, with minimal discrepancies between both sources. This was followed by properties advertised in regions 12 and 7. Meanwhile, the lowest number of listings for this source were located in region 1.

**Chart 5**  
**SHARE OF PROPERTIES BY REGIONS<sup>(1)</sup>**  
*(Percentages)*



Source: Central Bank of Malta.

<sup>(1)</sup>Data shown are for the period 2019 - 2021.

In view of their similar composition, both datasets yield similar weights, with a few insignificant variations (see Table 1). The 'apartments' category had an average weighting of 62.9% by the print media-based index, and a weighting of 60.7% when using the index based on the online source. Meanwhile, similar weights were observed in the maisonettes category, with 12.8% and 11.8% in the case of print media and online source, respectively. Terraced houses, which is the smallest category, also exhibited similar weights across the two sources, with 3.6% in the case of print media and 4.4% in the online source. Additionally, the 'other' category contributed 20.7% and 23.1% to the overall index, using the print media and online source, respectively.

**Table 1**  
**Average Weights (1)**

*(Percentages)*

	<b>Print media</b>	<b>Online Source</b>
<b>Apartments</b>	62.9	60.7
<b>Maisonettes</b>	12.8	11.8
<b>Terraced houses</b>	3.6	4.4
<b>Other</b>	20.7	23.1

Source: Print Media; Online Source; Authors' Calculations.

(1) Data shown are an average for the period 2019 - 2021

Table 2 shows the average and median prices per category for the two data sources for the period 2019-2021. Median and average prices using the online database on balance exceed those collected from print media. The largest discrepancy is in the 'other' category of the index, whereby properties advertised online registered an average price of €1.1 million, while equivalent properties in print media were listed for €735,000. The median price in this category also differs by a considerable margin, of €100,000. Within this category, the largest discrepancy is detected for villas.

**Table 2**  
**Average and Median Prices per Category (1)**

*(Eur thousands)*

		<b>Online Source</b>	<b>Print Media</b>
<b>Apartments</b>	Average	367	313
	Median	275	259
<b>Maisonettes</b>	Average	305	303
	Median	280	290
<b>Terraced houses</b>	Average	625	559
	Median	585	545
<b>Other</b>	Average	1,054	735
	Median	659	555

Source: Print Media; Online Source; Authors' Calculations.

(1) Data shown are for the period 2019 - 2021

### 3. How will the new data change the advertised house price index?

Online-sources offer the advantage of a richer dataset but can also contain a more substantial number of outliers than smaller datasets. This makes the detection of outliers more challenging and almost inevitably requires the use of statistical outlier detection techniques. For the purposes of the new index, outliers are detected and removed using the interquartile range (IQR).<sup>3</sup>

The IQR is the difference between the 75<sup>th</sup> percentile and the 25<sup>th</sup> percentile of the data and is thus a measure of dispersion within the data. A data point is treated as an outlier based on two criteria; (1) if it is greater than the 75<sup>th</sup> percentile added to a constant of 1.5 multiplied by the interquartile range; or (2) smaller than the 25<sup>th</sup> percentile less a constant of 1.5 multiplied by the interquartile range (Walfish, S., 2006). In this exercise, the outlier detection test in each quarter was employed on a rolling window sample of that quarter and the previous three quarters to account for volatility in the data between quarters.

Looking at the average number of observations per quarter, retrieved listings for apartments reach over 3,000 (see Table 3). This is followed by almost 600 maisonettes and 200 terraced houses per quarter. At the same time, the 'other' category accounts for another 1,100 listings per quarter.

Using the IQR outlier detection method outlined above, marginally more than 5% of apartments are removed from the dataset, followed by another 3.5% from the 'terraced houses' category. Furthermore, around 2% of observations are omitted from the maisonettes and 'other' categories.

**Table 3**  
**Average No. of Observations**<sup>(1)</sup>

	<b>No Thresholds</b> (number of units)	<b>Interquartile Range</b> (number of units)	<b>Outlier corrected dataset</b> (% of total)
<b>Apartments</b>	3,068	2,908	94.8
<b>Maisonettes</b>	571	561	98.2
<b>Terraced houses</b>	219	212	96.5
<b>Other</b>	1,127	1,105	98.1

Source: Online Source; Authors' Calculations.

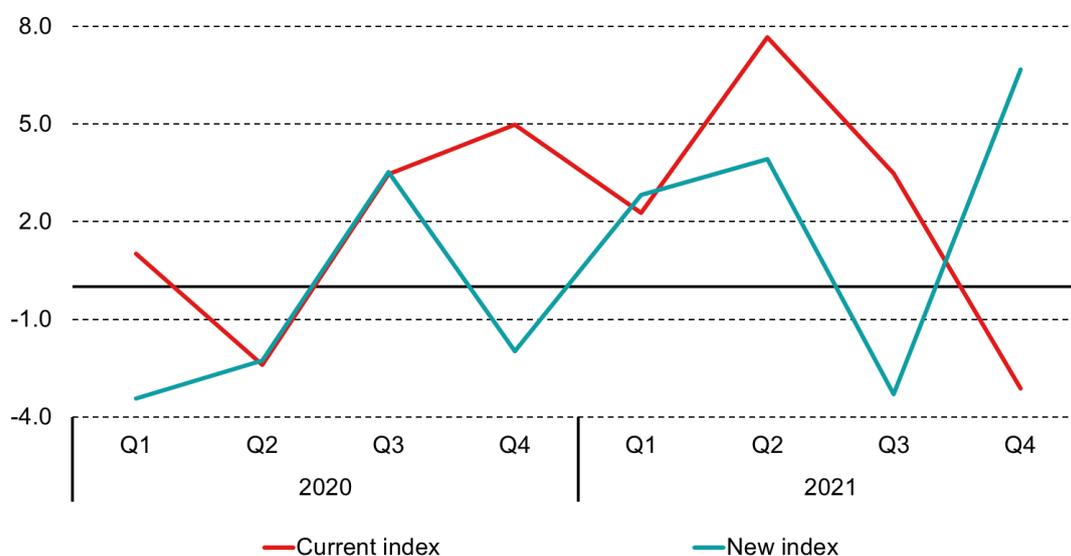
<sup>(1)</sup> Data shown are for the period 2019 - 2021

<sup>3</sup> Alternative outlier detection techniques were tested and gave similar results.

Chart 6 plots the annual percentage changes in the advertised house prices for the current index and the new index, for the period 2019Q1 to 2021Q4. In general, both indices have similar dynamics, though some divergences in certain quarters are noticeable. In particular, in the second half of 2021, the current index and the new index seem to move in opposite direction. In fact, by the end of the year, the new index registered a growth rate of 6.7%, following a contraction of 3.3% in the third quarter. By contrast, the index based on print media data fell into negative territory in the fourth quarter of the year (-3.1%), following an increase (3.5%) in the previous three-month period.

**Chart 6**  
**ANNUAL CHANGES IN THE HOUSE PRICE INDEX**

*(Annual percentage changes)*



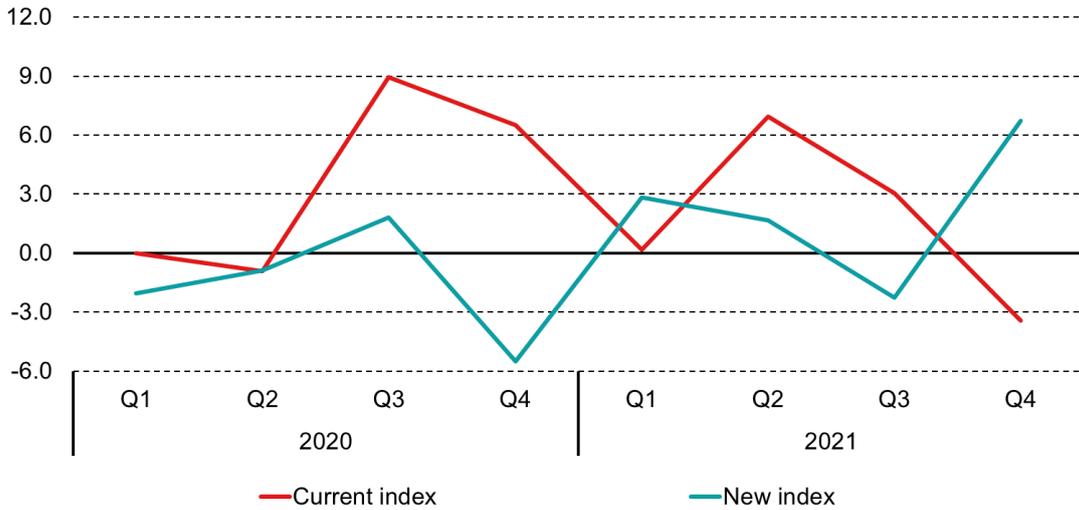
Source: Central Bank of Malta.

Looking at each of the indices for the separate dwelling categories, significant differences can be outlined in almost all property types, except for apartments (see Chart 7 and Chart 8). This is because, despite the discrepancy in volume terms between the two datasets, apartments remain well represented by the print media source, being the largest category of property types.

On the other hand, the new index is less volatile than the corresponding one derived from print media for the other property category types. Chart 7 illustrates this for maisonettes. A similar pattern can also be detected for 'terraced houses' and the 'other' category (see charts A1 and A2 in the Appendix).

**Chart 7**  
**ANNUAL CHANGES IN THE HOUSE PRICE INDEX -**  
**APARTMENTS**

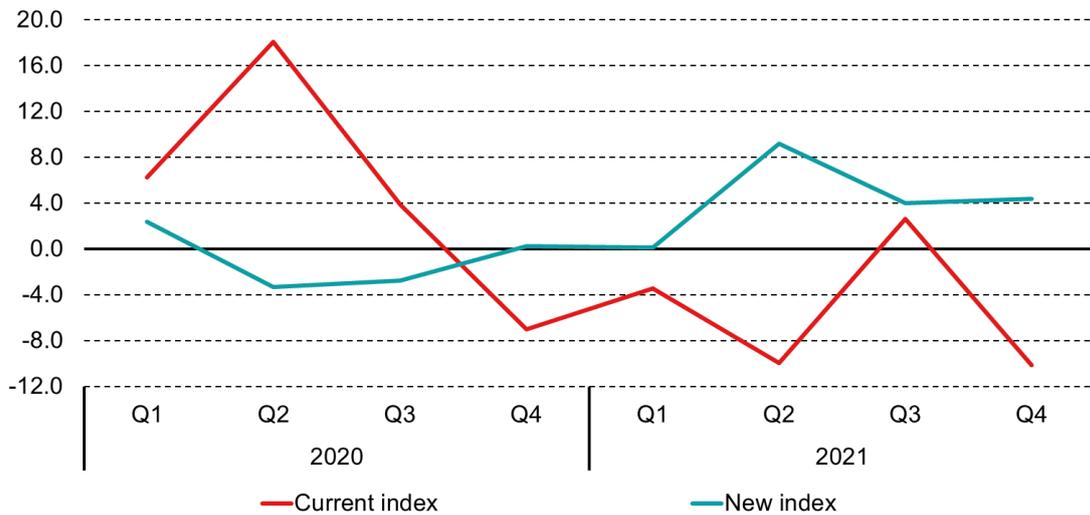
*(Annual percentage changes)*



Source: Central Bank of Malta.

**Chart 8**  
**ANNUAL CHANGES IN THE HOUSE PRICE INDEX -**  
**MAISONETTES**

*(Annual percentage changes)*



Source: Central Bank of Malta.

Chart 9 depicts the annual percentage change in the advertised house price index using the current index and the new index. In 2020, the index based on print media registered an annual growth rate of 1.7%, with growth picking up to 2.5% in 2021. The new index turned marginally negative in 2020 (-1.0%), before recovering to 2.4% in 2021, in line with that recorded for the index based on print media.

**Chart 9**  
**ANNUAL CHANGES IN THE HOUSE PRICE INDEX**  
*(Annual percentage changes)*



Source: Central Bank of Malta.

### ***Methodological changes***

In order to improve the robustness of the CBM advertised property index, the Bank is making some important changes to its methodology. These methodological changes are being implemented as from the 2019Q1 reference period onward.

The main changes are the following:

1. The Bank will stop collecting advertised listings from print media and will instead utilise an online source.
2. Outliers will be removed based on a standard interquartile range test.
3. The base year for the index will change to 2015=100 from the current 2000=100.
4. Growth rates for 2019 and later periods will thus be revised.

The full time series, i.e., from 2000Q1 will continue to be published on the Bank's website. Statistical break-adjustment techniques were utilised to minimize revisions in terms of growth rates between 2000Q1 and 2018Q4. The index levels for this period will be revised due to the rebasing of the index and the application of break adjustment techniques on the new indices for 2019.

## References

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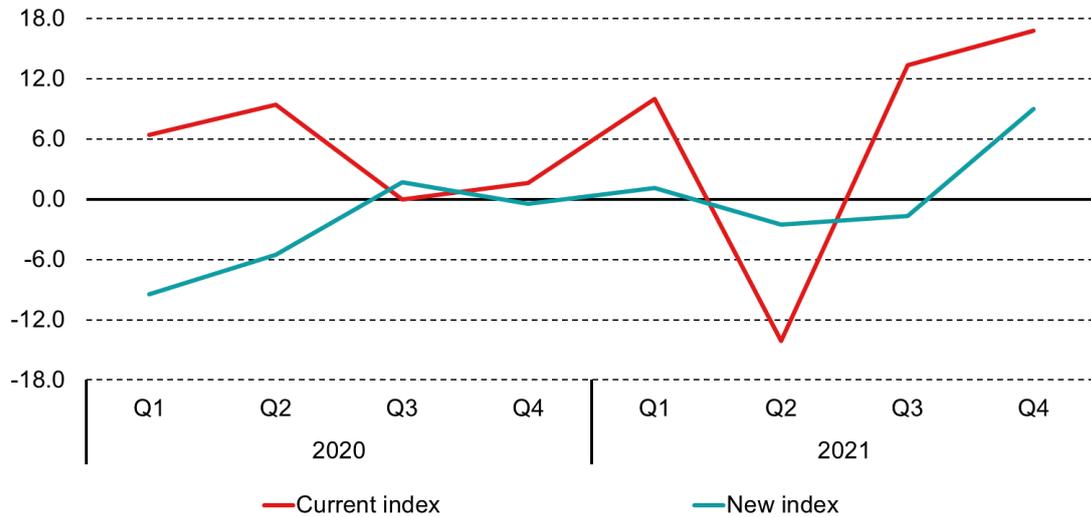
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## Appendix

**Chart A1**  
**ANNUAL CHANGES IN THE HOUSE PRICE INDEX -**  
**TERRACED HOUSES**

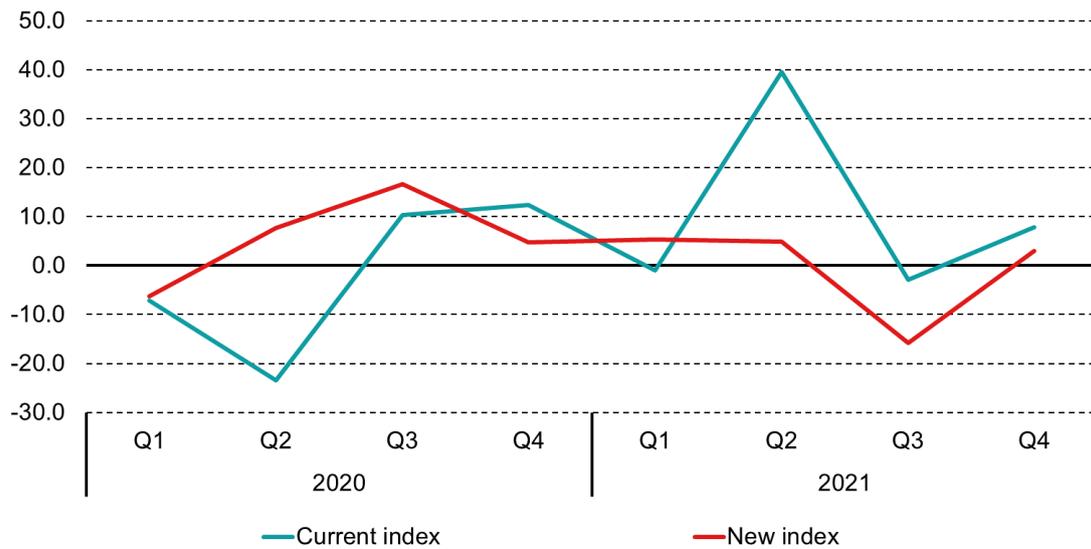
*(Annual percentage changes)*



Source: Central Bank of Malta.

**Chart A2**  
**ANNUAL CHANGES IN THE HOUSE PRICE INDEX - OTHER**

*(Annual percentage changes)*



Source: Central Bank of Malta.