TECHNICAL ASSISTANCE REPORT

UKRAINE

Report on Residential Property Price Index (RPPI) Mission (July 15–19, 2024)

SEPTEMBER 2024

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DISCLAIMER

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Acronyms

CPPI   Commercial Property Price Index

EFF   Extended Fund Facility

HPI   House Price Index

NBU   National Bank of Ukraine

NUTS   Nomenclature of Territorial Units for Statistics

RPPI   Residential Property Price Index

SSSU   State Statistical Service of Ukraine

TA   Technical Assistance

Summary of Mission Outcomes and Priority Recommendations

1.   **A technical assistance (TA) mission was conducted from July 15–19, 2024, to assist the authorities in Ukraine to develop new processes and methods for the compilation of the House Price Index (HPI).** This was the second mission of a project that commenced in April 2024. The mission worked closely with the authorities to (i) develop R scripts to clean the listings data received from an online real estate platform, (ii) implement updated methods for index compilation, and (iii) increase the capacity of the SSSU staff.

2.   **The authorities are strongly committed to making improvements to the published HPI for the Ukraine.** Reliable property price indices and other indicators of real estate markets are essential for the assessment of developments and risks in property markets and understanding the linkages between property markets and financial soundness, as well as to IMF surveillance. In addition, under the Extended Fund Facility (EFF) for Ukraine, the National Bank of Ukraine (NBU) and Ministry of Justice committed to prepare a detailed proposal to increase the transparency of the real estate market, strengthen systemic risk analysis and mitigation, and bank collateral valuations. One aspect of this proposal will include details and timelines for developing residential and commercial property price indexes.

3.   **The SSSU should support relevant staff to upskill on the R statistical package.** Specific supports should be identified to ensure staff can develop the required skills with the R statistical package e.g., online, or in-person training courses, internal support from IT or other modes for developing the relevant coding ability. During the mission, some initial R scripts were developed by the mission team and provided to the officials. However, it is crucially important that staff take ownership of this process and begin to amend and update the R scripts.

4.   **The authorities currently process and filter the online listings data from the OLX platform using MS Excel.** The SSSU requested assistance to automate this task, which normally takes two weeks to complete. R scripts were developed in conjunction with the officials. By the end of the mission, they were able to run the R scripts and export the clean data files to the network. Extensive filtering is applied to the OLX raw data files. This allows the authorities to focus on a narrow subset of the real estate market initially, while staff build experience with the methods for compiling the price indices.

5.   **The authorities should organize a meeting with OLX to expand the breadth and coverage of the quarterly file.** The SSSU should investigate whether it is possible to (i) extend the data to include houses – the current data set only includes apartments - and (ii) collect more detailed information on the location of the properties for sale. In addition, for new apartments, the SSSU should experiment with using the OLX data. The authorities currently use survey data collected by the regional offices to compile price indices for new apartments. However, the OLX data set contains potentially very useful information on new apartments.

6.   **A new stratification of the input data was developed based on the broad NUTS[1] regional classification for Ukraine.** This stratification is more useful than the previous stratification, given that the NUTS regions are also used in other statistical areas. The real estate market is split into sixteen strata; eight NUTS regions, which are further split into new and existing apartments. Experimental quality-

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[1] Nomenclature of territorial units for statistics.

adjusted hedonic indices for the strata were compiled during the mission. It is clear from the resulting indices, that the regions in the west of the country are experiencing significant price increases. In contrast, the regions most impacted by the war in the east of the country, have shown little growth or even falling prices.

7. **A compilation spreadsheet was designed in MS Excel to aggregate the price indices for the strata, using a set of expenditure weights, to a national HPI for Ukraine.** The weight information was calculated as the sum of expenditure (i.e., price in local currency) for the calendar year of 2023. The national HPI for Ukraine is showing price change of about 15 percent over the six quarters from 2023 Q1 to 2024 Q2.

TABLE 1. Priority Recommendations

Target Date	Priority Recommendation	Responsible Institution
30 Sep, 2024	Identify appropriate IT supports for staff to upskill in the R statistical package.	SSSU
30 Sep, 2024	Locate the raw data files received from OLX for each quarter from 2023 Q1.	SSSU
30 Sep, 2024	Investigate the unusual price changes for 2024 Q2 for new apartments.	SSSU
31 Dec, 2024	Implement the new R scripts for the regular processing and cleaning of the OLX data.	SSSU

8. **Further details on the priority recommendations and the related actions/milestones can be found in the action plan under Detailed Technical Assessment and Recommendations.**

Section I. Detailed Technical Assessment and Recommendations

TABLE 2. RPPI Workplan

Priority	Action/Milestone	Target Completion Date
Topic: Data sources for the RPPI		
H	Identify appropriate IT supports for staff to upskill in the R statistical package.	30 Sep, 2024
H	Locate the raw data files received from OLX for each quarter from 2023 Q1.	30 Sep, 2024
H	Investigate the unusual price changes for 2024 Q2 for new apartments.	30 Sep, 2024
H	Implement the new R scripts for the regular processing and cleaning of the OLX data.	31 Dec, 2024
M	Gather more information on apartments categorized as "construction in progress" to decide how they should be treated during the data processing.	31 Dec, 2024
M	Relax the data filtering over time to expand the coverage of the HPI.	30 Jun, 2025
H	Experiment with using the OLX data, instead of survey data, for new apartments.	30 Jun, 2025

Priority	Action/Milestone	Target Completion Date
M	Extend the data coverage to include houses.	31 Dec, 2025
M	Collect more detailed information on the location of the apartments for sale.	31 Dec, 2025
Topic: Compilation methods		
M	Implement the time-dummy hedonic (TDH) method for index calculation.	31 Mar, 2025
M	Once familiar with the TDH method, extend the method by using a rolling window.	31 Mar, 2025
M	Use Cook's Distance for outlier detection.	31 Mar, 2025
M	Use the OLX data for the expenditure weights.	31 Mar, 2025
M	Practice using the compilation spreadsheet for aggregating the stratum-level price indices.	31 Mar, 2025
M	Become familiar with the requirements under relevant EU statistical legislation.	31 Mar, 2025
Topic: Dissemination		
L	Review the revisions policy for the HPI after the conclusion of the war.	To be decided
L	Update the structure of the published HPI data after the conclusion of the war.	To be decided
L	Update the methods document after the conclusion of the war.	To be decided
L	Publish the updated HPI on the authorities' website after the conclusion of the war.	To be decided

A. INTRODUCTION

9.   A TA mission was conducted from July 15–19, 2024, to assist the authorities in Ukraine to develop new processes and methods for the compilation of their House Price Index (HPI). This mission was a continuation of work that commenced during the mission in April, 2024. Due to the ongoing war in Ukraine, the meetings were held at the Joint Vienna Institute (JVI) in Austria. Local staff at the JVI provided exceptional support with arranging the logistics for the mission. As before, there was a strong commitment from the SSSU participants to make improvements in the methods used to compile the HPI for Ukraine.

10.   This TA report should be read alongside the report for the April 2024 mission. Where possible, this report does not repeat information that has already been discussed in the previous TA report. The report outlines the progress achieved during this mission and, as appropriate, provides new or updated information.

11.   The workplan was updated at the end of the mission. This mission primarily focused on implementing the recommendations from the previous mission. This resulted in completed steps being removed from the workplan, while some additional steps were added to the workplan as required. The updated workplan is outlined in detail in Table 2. Ukraine has been under martial law since the outbreak of the war in early 2022. Despite the determination of the SSSU to continue to improve their HPI, the uncertainty over the war creates a significant risk to the workplan.

12. **Throughout the mission, there was a focus on increasing the capacity and knowledge of the authorities.** SSSU requested assistance to develop the R scripts for the processing and compilation of the available data sources. In addition, the mission provided practical training on the application of hedonic methods for the calculation of the HPI. The mission will continue to support the authorities as required while the agreed workplan is being implemented. The authorities specifically requested virtual TA before the next in-person mission.

B. DATA SOURCES

13. **The authorities currently use two data sources for the compilation of the HPI.** For new apartments, the SSSU regional offices collect data from the websites of real estate agents and property developers. For existing apartments, they use online listings from the OLX website platform (www.olx.ua). OLX have agreed to provide this data directly to the SSSU on a quarterly basis.

14. **The SSSU should support relevant staff to upskill on the R statistical package.** Specific supports should be identified to ensure staff can develop the required skills with the R statistical package e.g., online, or in-person training courses, internal support from IT or other modes for developing the relevant coding ability. During the mission, some initial R scripts were developed by the mission team and provided to staff. However, it is crucially important that staff take ownership of this process and begin to amend and update the R scripts.

15. **The authorities currently process and clean the OLX data using MS Excel.** Each quarter, this task takes about two weeks to complete. The SSSU requested assistance to automate this task. The mission worked collaboratively with the SSSU officials to develop the R scripts for this purpose. By the end of the mission, they were able to run the R scripts and export the clean data files to the network. The SSSU should implement the R scripts for the regular processing and cleaning of the OLX data. In addition, the authorities should apply the R scripts to the previous quarters. To facilitate this, they will need to locate the raw data files received from OLX for previous quarters.

16. **Extensive filtering is applied to the OLX raw data files.** Table 3 outlines the list of filters being applied to the data. This allows the SSSU to focus on a narrow subset of the real estate market initially. Over time, as more experience is acquired, some filters can be relaxed to expand the coverage of the HPI. For example, apartments in smaller towns and apartments with greater than 3 rooms can be retained in the dataset.

TABLE 3. Filters being applied to the raw data files from OLX.

No.	Filter
1	Apartments in small towns and rural areas are removed, leaving just larger cities.
2	Apartments with greater than three rooms are removed
3	Allowable floor area depending on number of rooms: - If number of rooms is 1, then floor area should be between 30 and 100 square meters. - If number of rooms is 2, then floor area should be between 40 and 180 square meters. - If number of rooms is 3, then floor area should be between 50 and 250 square meters.
4	Allowable range for price in local currency is between 200,000 and 50,000,000.
5	New apartments are removed, leaving just existing apartments

No.	Filter
6	Apartments categorized as "construction in progress" are removed.
7	Single story dwellings are removed, leaving only apartments in buildings with more than one floor
8	Observations in the middle month of the quarter are retained e.g. for Q2, May is retained and the other months are removed.

17. **The authorities use the advertised apartments for the middle month of the quarter.** For example, for Q1, February data are used, and for Q2, May data is used. There are sufficient observations on the OLX data file to support this approach. Duplicate properties are removed within a particular quarter; however, duplicates are not removed across quarters. If an apartment appears in more than quarter, the relevant price changes over that period should be reflected in the price index.

18. **Apartments categorized as "construction in progress" are filtered from the data.** On the OLX data file for 2024 Q2, there just over 10,000 existing apartments that are categorized as "construction in progress." It may be the case that these should be included with the new properties. The SSSU should gather more information on these properties to decide how they should be treated during the data processing. A related issue raised by the authorities is how to treat apartments that are transacted during the construction process or even before construction has begun. It is common in Ukraine that apartments are sold by developers based on the architect's plans. Both the mission team and the authorities will investigate this issue further. Given that the Ukraine HPI should meet the requirements of the relevant EU statistical legislation, the authorities will also consult with Eurostat to clarify the definition of new properties.

19. **List prices are almost exclusively denominated in USD.** For example, for 2024 Q2, only 1 percent of observations on the OLX platform are denominated in a currency other than USD. These foreign currency prices are converted to Ukrainian hryvnia using the prevailing daily exchange rate. The HPI is calculated using these local currency prices. Given that list prices are quoted in USD, the resulting price indices will be impacted by the movement in the exchange rate. Even if the list price in USD is unchanged, the price index can increase or decrease depending on the movement of the exchange rates.

20. **The SSSU expanded the data collection for new apartments.** Table 4 outlines the quarterly number of observations used for both new and existing apartments. During 2024 Q2, the SSSU instructed the regional offices to increase the data collection from about 900 observations per month to over 1,800. While this should have improved the coverage of new apartments across the country, some unusual price movements were evident for the latest quarter. By way of example, Appendix A examines the box plots for the log of price for new apartments in one particular NUTS region. The median price increases significantly in 2024 Q2. The SSSU should investigate in more detail the impact of the increased sample size on apartment prices in 2024 Q2.

TABLE 4. Number New and Existing Apartments per Quarter, 2023 Q1 to 2024 Q2

Quarter	New apartments	Existing apartments
2023 Q1	893	24,278
2023 Q2	926	30,070

Quarter	New apartments	Existing apartments
2023 Q3	925	33,703
2023 Q4	912	33,529
2024 Q1	923	35,556
2024 Q2	1873	31,417

21.   For new apartments, the SSSU should experiment with using the OLX data. The authorities use survey data collected by the regional offices to compile price indices for new apartments. However, the OLX data also contains information on new apartments. These are currently removed from the file during the filtering process. The SSSU should experiment with calculating price indices using the OLX data, applying similar methods to those applied to the existing apartments.

22.   The authorities should organize a meeting with OLX to expand the breadth and coverage of the quarterly file. As recommended in the previous mission, the SSSU should investigate whether it is possible to (i) extend the data to include houses – the current data set only includes apartments - and (ii) collect more detailed information on the location of the properties for sale. The former would significantly increase the coverage of the resulting HPI, and the latter would provide additional information on the location of the properties to allow more accurate quality adjustment.

Recommended Actions:

- Identify appropriate IT supports for staff to upskill in the R statistical package.
- Locate the raw data files received from OLX for each quarter from 2023 Q1.
- Investigate the unusual price changes for 2024 Q2 for new apartments.
- Implement the new R scripts for the regular processing and cleaning of the OLX data.
- Gather more information on apartments categorized as "construction in progress" to decide how they should be treated during the data processing.
- Relax the data filtering over time to expand the coverage of the HPI.
- Experiment with using the OLX data, instead of survey data, for new apartments.
- Extend the data coverage to include houses.
- Collect more detailed information on the location of the apartments for sale.

C. COMPILATION METHODS

23.   During May 2024, the SSSU published an improved HPI for reference quarter Q1 2024. The main changes implemented included: (i) a new data source for existing apartments with more detailed geographical coverage i.e. OLX data, (ii) use of list prices instead of transaction prices, and (iii) improved compilation methods for the price indices i.e. quality adjustment carried out using regression-based (hedonic) methods instead of stratified means. As noted in the previous TA report, the new method implemented by the SSSU is a non-standard approach. While the method is an improvement on the previous stratified means approach, there are more optimal hedonic methods that can be applied to the data. This mission focused on applying improved methods that more closely follow international standards.

24.   A new stratification of the input data was developed based on the broad NUTS regional classification for Ukraine. This stratification is more useful than the previous stratification, given that the

NUTS regions are also used in other statistical areas. Table 5 outlines the sixteen strata; there are eight NUTS regions (Kyiv City was separated from the remainder of the region), which are further split by new and existing apartments. This was a significant improvement to the methods given that the stratification will be used both for the compilation and dissemination of the price indices.

TABLE 5. Number of Observations per Strata for New and Existing Apartments for All Quarters, 2023 Q1 to 2024 Q2[2]

NUTS region code	Description	New apartments	Existing apartments
UA1	Poltavska Oblast, Sumska Oblast, Kharkivska Oblast, Chernihivska Oblast	935	26,844
UA3	Dnipropetrovska Oblast, Zaporizka Oblast, Kirovohradska Oblast	808	22,627
UA4	Mykolaivska Oblast, Odeska Oblast, Khersonska Oblast,	698	49,009
UA5	Vinnytska Oblast, Ternopilska Oblast, Khmelnytska Oblast	540	9,194
UA6	Kyivska Oblast, Cherkaska Oblast	818	14,515
UA63	M. Kyiv	1,050	48,595
UA7	Zakarpatska Oblast, Ivano-Frankivska Oblast, Lvivska Oblast, Chernivetska Oblast	1056	12,822
UA8	Volynska Oblast, Zhytomyrska Oblast, Rivnenska Oblast	547	4898

25.   Experimental quality-adjusted hedonic indices for the strata were compiled during the mission. Figure 1 shows RPPIs for existing apartments calculated using the hedonic (time-dummy) method. New apartments were excluded temporarily while the SSSU examined the unusual price movements for 2024 Q2. A single index was calculated for each strata for existing apartments, with the same model being applied for each. The dependent variable was the log of price (in local currency), and the independent variables were (i) floor area, (ii) number of rooms and (iii) region. There was no additional location information within Kyiv, so the region variable was excluded from the Kyiv model. The authorities will require additional assistance to refine the hedonic models used for each stratum and implement the rolling-window approach. It is clear from the resulting indices, that the regions in the west of the country are experiencing significant price increases. In contrast, the regions most impacted by the war in the east of the country, have shown little growth or even falling prices.

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[2] Data exclude the territories which are temporarily occupied by the Russian Federation and part of territories where the military actions are/were conducted.

FIGURE 1. Experimental HPIs for Existing Apartments by NUTS Region
(2023Q1=100), 2023 Q1 to 2024 Q2
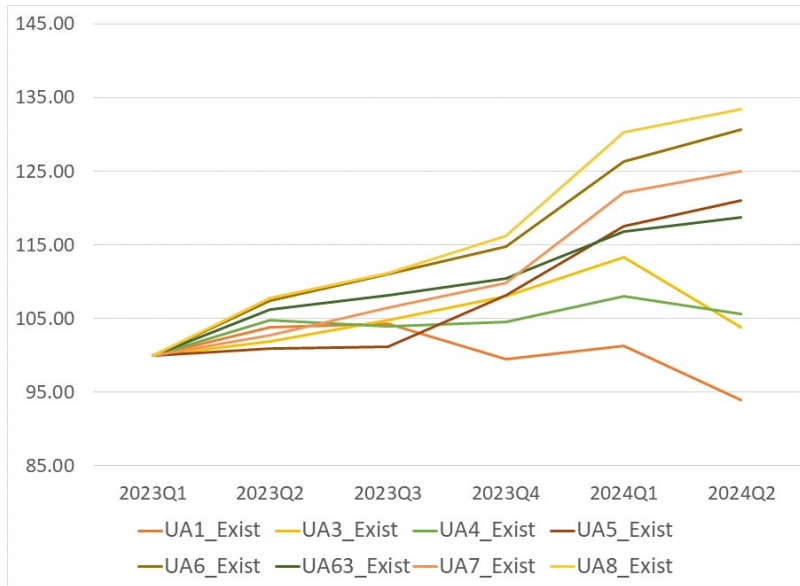
26. **A compilation spreadsheet was designed in MS Excel to aggregate the price indices for the strata, using a set of expenditure weights, to a national HPI for Ukraine.** The weight information was calculated as the sum of expenditure (i.e. price in local currency) for the calendar year of 2023. The same set of weights were applied to each of the six quarters from 2023 Q1 to 2024 Q2. Figure 2 shows the aggregated national HPI, both including and excluding the outliers. The outliers were removed at the level of the strata using a statistical method called Cook's Distance. This method was discussed in more detail in the previous TA report. The national HPI for Ukraine is showing price change of about 15 percent over the six quarters from 2023 Q1 to 2024 Q2.

FIGURE 2. Experimental National HPI for Existing Apartments (2023Q1=100),
2023 Q1 to 2024 Q2
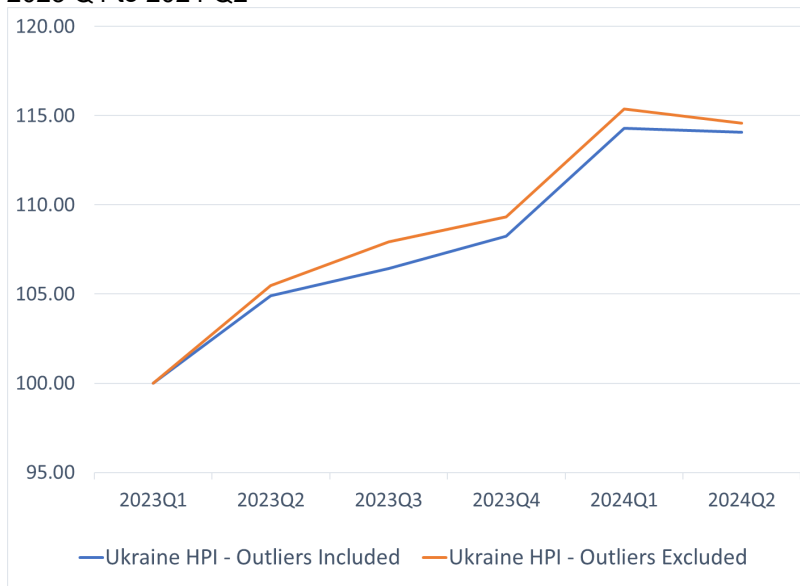
Recommended Actions:

- Implement the time-dummy hedonic (TDH) method for index calculation.
- Once familiar with the TDH method, extend the method by using a rolling window.
- Use Cook's Distance for outlier detection.
- Use the OLX data for the expenditure weights.
- Practice using the compilation spreadsheet for aggregating the stratum-level price indices.
- Become familiar with the requirements under relevant EU statistical legislation.

D. DISSEMINATION

27.   Dissemination was not discussed in detail during this mission. Therefore, the recommendations from the previous TA report continue to apply. These are outlined below. One point to note is that the SSSU are required to release methodological details of any new or updated publications as part of an annual plan of statistics. This annual plan is published in March every year. This procedural requirement should be included in the planning for any update of the HPI for Ukraine. This means that the methods document will need to be released some time in advance of the publication of the data.

Recommended Actions:

- Review the revisions policy for the HPI after the conclusion of the war.
- Update the structure of the published HPI data after the conclusion of the war.
- Update the methods document after the conclusion of the war.
- Publish the updated HPI on the authorities' website after the conclusion of the war.

E. OFFICIALS MET DURING THE MISSION

Name	Position	Organization
Nataliia Lysenko	Head of Division for Housing and Construction Price Statistics, Department for Price Statistics	SSSU
Victoriia Isaiuk	Senior Specialist of the Division for Construction and Housing Price Statistics, Department for Price Statistics	SSSU
Nadiia Profatska	Deputy Director-Head of Division for Consumer Price Statistics, Department for Price Statistic	SSSU
Hanna Buhaichuk	Deputy Head of the Division for Producer of industrial products Price Statistics, Department for Price Statistics	SSSU

Appendix. Box Plot—Price of New Properties Over Time

FIGURE 3. Box Plots by Quarter for Log of Price, New Properties in Region UA1, 2023Q1–2024Q2.