



TECHNICAL ASSISTANCE REPORT

REPUBLIC OF MOLDOVA

Report on Consumer Price Index Mission
(September 11–15, 2023)

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Acronyms and Abbreviations

COICOP	Classification of Individual Consumption by Purpose
CPI	Consumer Price Index
GTIN	Global Trade Identification Number
HBS	Household Budget Survey
IT	Information Technology
NBS	National Bureau of Statistics of the Republic of Moldova
NBM	National Bank of Moldova
NOS	Net Operating Surplus
OOH	Owner-Occupied Housing
RPPI	Residential Property Price Index
STS	State Tax Service of the Republic of Moldova
TA	Technical Assistance
VAT	Value Added Tax

Summary of Mission Outcomes and Priority Recommendations

- 1. A technical assistance (TA) mission was conducted to assist the National Bureau of Statistics of the Republic of Moldova (NBS) with introducing alternative data sources for the compilation of the consumer price index (CPI).** In addition, the mission examined the treatment of owner-occupied housing (OOH) which is currently excluded from the Moldavian CPI.
- 2. Incorporating Scanner Data will improve the quality of the CPI.** The regional, product and temporal coverages will be improved once these data are introduced. More accurate price indices can be compiled as both price and quantity information are available at the individual item level in the Scanner Data.
- 3. Scanner Data from the State Tax Service of the Republic of Moldova (STS) was investigated and found to be suitable for CPI compilation with some transformation.** The STS recently introduced an electronic sales monitoring system that records each individual receipt issued by the retailer. During the mission, a sample data set covering one week of receipts for the major retail chain operating in Moldova was examined. The data includes the appropriate outlet and product coverage and can be used to derive average prices at the level of the individual items. The NBS should formalize a memorandum of understanding with the STS in order to ensure regular transmission of these data in the future.
- 4. An Information Technology (IT) infrastructure for storing the Scanner Data and processes for transforming the data into a format ready to be used for CPI purposes should be developed.** The raw data provided by the STS is very large and requires some pre-processing. The data does not contain a formal item identifier, but only a detailed item description in free text. While the description is sufficient for manually assigning each item to the appropriate Classification of Individual Consumption by Purpose (COICOP) category, this process is labor intensive. The NBS should contact the retailers directly to request additional metadata on each item, such as a Global Trade Information Number (GTIN) or a retailer specific classification. This information would facilitate a more automated process for classifying items to COICOP.
- 5. Scanner Data should be incorporated into the published CPI by the end of 2026.** The mission developed an updated aggregation structure for the Moldavian CPI. At the lowest level of the index hierarchy, an additional distinction will be made between prices from Scanner Data and prices from field price collection. Prices from outlets not covered in Scanner Data will continue to be collected and processed according to the current methodology. Prices from Scanner Data could be processed separately using superlative price index formulas such as the preferred Fisher price index.
- 6. The CPI for housing rents can be improved by expanding the coverage.** The NBS will start collecting rents for houses located in Chisinau from the same real estate listings websites that are already used for collecting rents for apartments. The accuracy of the rent price index can be further improved by developing an explicit stratification by region and by type of dwelling. An improved rental price index can be the basis for including owner-occupied housing (OOH) in the CPI according to the imputed rentals approach. Given the small rental market in Moldova, further analysis and user consultations are needed to assess whether the imputed rentals approach is a viable option.

7. To support progress in the above work areas, the mission recommended a detailed action plan with the following priority recommendations.

TABLE 1. Priority Recommendations

Target Date	Priority Recommendation	Responsible Institution
March 2024	Establish a memorandum of understanding with the STS to secure regular access to Scanner Data	NBS
July 2024	Assign COICOP categories to the items included in the Scanner Data	NBS
September 2024	Improve higher-level aggregation in the CPI software	NBS

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

A. INTRODUCTION

8. Field price collection is the main data source for the CPI of Moldova. The basket comprises around 1,300 representative products for which prices are collected in the major cities of the country. Price collectors are using tablets for recording the prices observed in the outlets. The collected prices are then further processed in order to obtain the price indices for the required aggregates.

9. The NBS plans to modernize CPI compilation by using Scanner Data. These data typically cover all of the items sold by a retailer at all their locations and include both quantities sold and revenue received by the retailer for these items. Scanner Data provides improved product coverage as all products sold by a retailer can be included, instead of sampling only a few varieties. The regional coverage can be improved, as all outlets of a participating retailer can be included. The time coverage can be expanded, as Scanner Data covers a large part of the reference month, as opposed to only collecting a price once or twice per month. Scanner Data contains information not only on prices but also on quantities (items sold). Such detailed weighting at the individual item level makes it possible to apply weighted index formulas. In fact, each individual item can be weighted according to its economic importance, whereas currently unweighted index formulas are used to obtain an average price at the first stage of aggregation.

10. The use of Scanner Data will impact the production process. It can reduce the costs on price collection, but it makes the processing and the analysis of the data more complex. A flowchart illustrating the main steps for using Scanner Data in the Moldavian CPI is shown in Figure 1. This report discusses the different aspects of this flowchart: transmission and pre-processing (section B), classification (section C), and index compilation and data integration (section D). In addition, the mission addressed the treatment of owner-occupied housing (section E).

11. The work on Scanner Data in the CPI will be a multi-year project that will require resources at different levels. A roadmap (Table 2) was prepared that aims at introducing Scanner Data in the Moldavian CPI by January 2027. In line with this roadmap, a detailed work plan covering the period October 2023 to October 2024 can be found at the end of the report.

FIGURE 1 Scanner Data Process

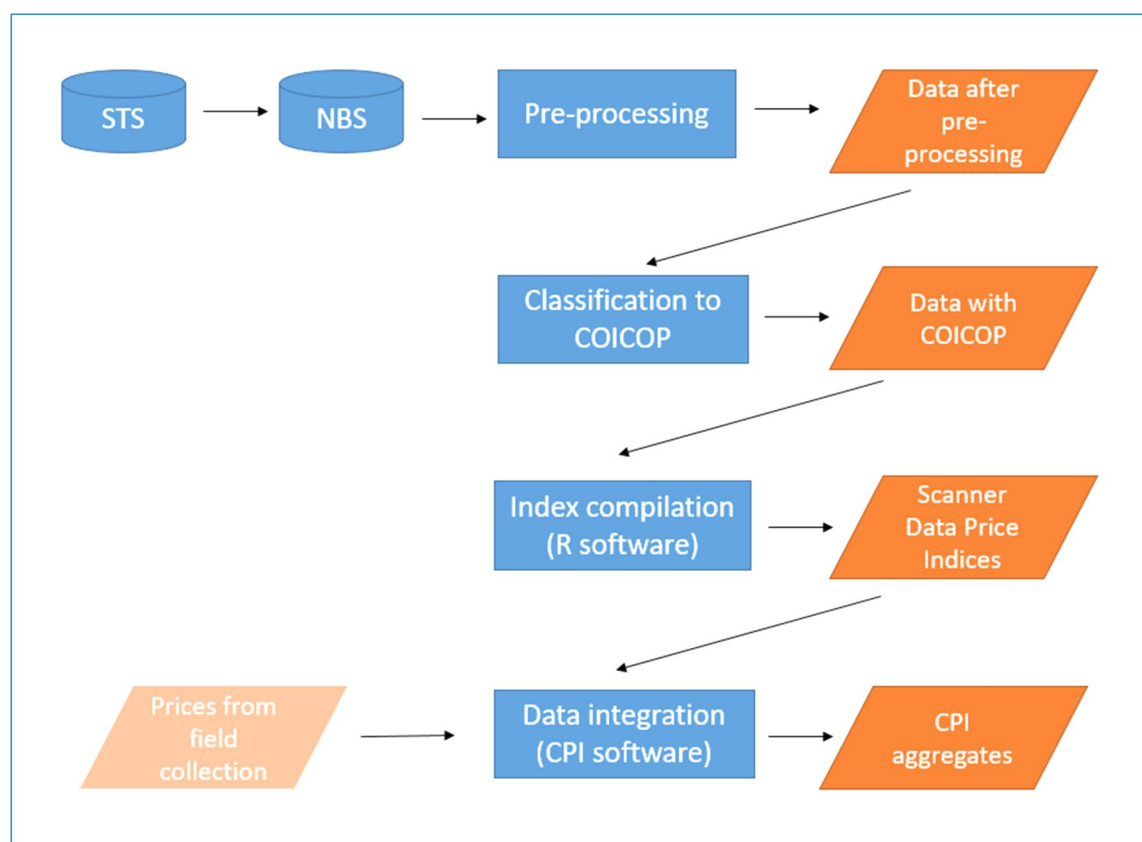


TABLE 2. Roadmap for Integrating Scanner Data in the CPI

Process	Period for developing the process
Transmission and pre-processing	2023–2024
Classification	2023–2024
Index compilation	2024–2025
Data integration	2025–2026
Finalization of the production system and publication of the Scanner Data methodology	2026
Scanner Data in the published CPI	January 2027

B. TRANSMISSION AND PRE-PROCESSING

12. Statistical agencies often negotiate the supply of Scanner Data directly with retailers. The NBS has made a market analysis to identify the most important retail chains in the country. In total, five retail chains were selected representing together more than 50 percent of total sales in the food retail sector. Some chains have good regional coverage, with outlets in the four regions (Chisinau, North, Center and South), while other chains are mainly concentrated in the capital city Chisinau. The weight in

the CPI basket of COICOP Division 01 Food and non-alcoholic beverages amounts to 35 percent in 2023. Theoretically, the Scanner Data could represent around 18 percent of the CPI basket if data from the five retailers would be used for COICOP Division 01. For practical reasons, the scope of Scanner Data could first be limited to food products of one or two retail chains, before gradually extending the scope to non-food products and to other retail chains.

13. First contacts have been initiated with the major retailers for accessing Scanner Data.

However, these requests have not been successful so far. Retailers remain reluctant to provide such sensitive and detailed data. Moreover, retailers already provide similar information to the STS and are less inclined to provide similar data twice.

14. The STS of the Republic of Moldova collects transaction data through an electronic sales monitoring system that was only introduced in July 2023. This system records the information that can be found on each individual receipt issued by the retailer for a customer. For each purchased item printed on the receipt, the system records a text string describing the item, the number of items purchased, the VAT rate applied to the item and the price. In principle, this is more granular data than typical Scanner Data that are provided by retailers and that are already aggregated up to the item level.

15. During the mission, the STS provided a test data set to the NBS. The data set covered the receipts for the two major retailers that were issued during the first six days in September 2023. The mission only examined data from the first retailer. A lot of efforts had to be made for rearranging the supplied data into a more usable format. The raw data consisted of over one million lines which each represented a specific receipt. Each receipt covers the purchase of different items. The data was transformed into a table of over five million lines which each representing the purchase of a specific item on a specific receipt.

16. The data does not contain a formal product identifier, such as a barcode or a shop internal code. While this may be a limitation of the data, it may be overcome by creating such a code from the text string. In other words, the same text string will receive the same code. The mission confirmed the technical feasibility of the approach. The validity of this approach must be further monitored in the future. In the discussions with STS, the NBS should ask whether an item identifier could be added in future updates of the electronic sales monitoring system. Another option would be to request the GTIN together with other metadata on the item directly from the retailer.

17. The data must first be aggregated up to a certain level in order to obtain an average price.

This first type of aggregation will help to significantly reduce the size of the data. Concerning temporal coverage, it is common to cover the first three weeks of the month. This would leave enough time for processing and analyzing the data at the end of the month. Moreover, the mission suggested to group together all the outlets of a retail chain in a region. Technically, let $p_{i,r}$ and $q_{i,r}$ be the price and the quantity of item i on the receipt r issued in an outlet of a retail chain in a region during the first three weeks of the month t . The following aggregates must be calculated.

$$\text{quantities}_i^t = \sum_r q_{i,r}$$

$$\text{sales}_i^t = \sum_r p_{i,r} q_{i,r}$$

An average price in month t for the item i will then be derived by dividing these two aggregates.

$$\text{price}_i^t = \frac{\text{sales}_i^t}{\text{quantities}_i^t}$$

This average price may deviate from the price observed by a price collector in a specific outlet on a specific day for the same item.

18. The mission confirmed the potential of the STS data for CPI purposes. The data contains the main variables (sales and quantities by item) that are needed for index compilation. The derived average price is conceptually correct and can be considered reliable. In terms of product coverage, the analyzed data contained around 19,000 items (both food and non-food products), which is a plausible assortment size for a retailer.

19. Following this first pilot transmission, the NBS should discuss with the STS how to best set up a regular and secure transmission protocol. The NBS should investigate whether the STS would be willing to further pre-process the data. A formal memorandum of understanding between the NBS and the STS should be developed and agreed. Such an agreement should define the contents and the characteristics of the data set (variables, scope), the rules of the data transmission (frequency of transmission, technical characteristics of the transmission), and other provisions. An agreement ensures continuity in the supplied data and helps to avoid uncoordinated changes or disruptions in the transmission of the data.

20. Given the significant size of the files, there is a need to develop an IT infrastructure for storing the STS data and transforming it into a format ready to be used for CPI purposes. The output at this stage should be a table that contains the following variables by region and item: a text string describing the item; an item code; total sales; total quantities; the price; the region where the item was sold; the date. It was possible to prepare such a table with the sample data set examined during the mission.

Recommended Actions:

- Develop a memorandum of understanding with the STS to arrange a regular and secure transmission of the data.
- Develop an IT infrastructure at the NBS for storing and pre-processing the STS data.
- Use the text string to identify an item and calculate average prices at the level of an item, retailer and region.

C. CLASSIFICATION

21. The items included in the STS files must be mapped to the classification used in the CPI. The Moldavian CPI is based on the 5-digit ECOICOP classification, which is the European variant of the internationally recommended COICOP classification. The basket of the Moldavian CPI includes an additional level (6-digit). Below this level, representative products are selected. The classification process is a crucial step as errors that are made at this stage will mean that the resulting price indices will be based on wrongly classified items. In principle, all items included in Scanner Data should be classified so that they can be further processed.

22. A decision must be made on the level at which the Scanner Data items will be mapped. The classification task becomes more challenging if the items are mapped at the lower levels in index hierarchy. At the same time, consistency should best be ensured with already existing series of the CPI. The mission recommended to map the items to the 6-digit level of the COICOP. Scanner Data items do not need to be mapped to the representative products that are classified under a 6-digit COICOP category. Representative products are only a subset (sample) of the items that fall in the corresponding 6-digit COICOP category. It may not be possible to find a suitable representative product for each Scanner Data item. Representative products are used as a tool to guide price collectors in selecting prices.

23. The mapping to COICOP should be stored in a reference table. This reference table includes at least the following variables: item description; item identifier; 6-digit COICOP code. The reference table should not have any duplicates. In principle, any item should only be mapped to a single COICOP code. In the initialization phase, all the items included in the data must be mapped at once. Once created, the reference table is augmented each month and no records should be removed. In general, the recurrent phase of monthly updates will be less resourceful than the initial phase when a large set of data must be processed at once. In practice, the following process should be implemented. For each item included in the data file in a given month, do the following:

→ If the item is already included in the reference table, then:

Do nothing

→ If the item is not included in the reference table, then:

Assign the item to a 6-digit COICOP category

Update the reference table.

24. Different methods can be used for classifying items. The most basic method would be to label the items manually. This approach can be implemented relatively easily, using for example an Excel table for entering the COICOP codes. The quality of the item description is in general sufficient to identify the corresponding COICOP code. However, manual labelling is resource intensive. Ideally, more efficient methods should be employed, if possible, and manual labelling should be seen as a method of last resort.

25. Attribute-based classification methods require an auxiliary classification under which the items are already classified. A correspondence is then made between the categories of the auxiliary classification and COICOP. It will then be possible to automatically assign a COICOP category to an item with the help of this auxiliary classification. The performance of this method depends on how well the auxiliary classification can be mapped to COICOP. It may be that this method has to be followed by another method (e.g., manual labelling) for the items that cannot be mapped to the lowest COICOP level.

26. The availability of additional metadata on each item will facilitate the classification to COICOP. The NBS should reach out to the retailers to check if they are willing to share additional characteristics of the items, such as the GTIN, a retailer specific classification or any other structured information.¹ The mission examined the web shop of the retailer which organizes its assortment according to a classification that is relatively well suited to be mapped to COICOP. Another option could

¹ For example, the availability on the weight of an item could be used to make adjustments in package sizes.

be to link the GTIN to data sources used in external trade statistics. If such item metadata are made available, the NBS could apply attribute-based classification. These additional metadata should be linked to the text descriptions as provided to the STS.

27. At a later stage, the classification process could be further optimized by using Machine Learning methods. The basic idea of these methods is to create a classifier that learns from already classified items. Once a classifier is estimated, any new incoming items can be automatically classified. A fully classified training data set must be available to design a classifier and evaluate its performance.

28. In the future, the NBS will change to the COICOP 2018. The correspondence between the COICOP 2018 and the COICOP version currently used in the Moldavian CPI is less problematic for food products which are the main scope of Scanner Data. An item that is mapped to the current COICOP version will have to be re-assigned to the relevant COICOP 2018 category.

Recommended Actions:

- Reach out to the retailers to access additional metadata of the items in view of applying attribute-based classification.
- Classify already available items to the 6-digit COICOP and put in place a regular process for updating the reference table.

D. INDEX COMPILATION AND DATA INTEGRATION

29. Scanner Data can serve as a sampling frame for selecting representative products. The process of reviewing and specifying representative products is conducted at the end of the year in order to update the basket for the following year. In addition to feedback received from price collators, Scanner Data can be consulted to identify the most popular products. This type of application will help the NBS to benefit from Scanner Data relatively quickly.

30. A price index can be compiled from the pre-processed and classified data. Ideally, with Scanner Data, we aim to use all the items (not only a sample) in the index calculation. Moreover, each item should be weighted according to its importance. There are different index formulas that can be used. For illustration purposes, the mission calculated Jevons, Laspeyres, Paasche and Fisher price indices based on a set of matched items. The Fisher price index is one of the preferred index number formulas. In the context of Scanner Data, bilateral Fisher price indices are typically embedded into a multilateral method.

31. Matching item codes will not capture pure price changes that are linked to changes in the weight of an item. The item code is based on the item description, and hence a change in the item description will lead to a different item code. In principle, if the weight of an item decreases (for example from 200g to 180g) but the price is kept unchanged, the index should record a price increase. There are different techniques to measure such price changes in Scanner Data. To apply these techniques, the “same” items with different weights must be connected together and adjustments must be made based on the weight of the item. The mission explored text string extraction techniques in order to access the weight of an item. A preferred option would be to obtain the weight directly from the retailer. More work needs to be done on this aspect.

32. The price indices compiled from Scanner Data must be integrated into the CPI. Scanner Data will not cover all purchases made by households. In order for the CPI to remain representative, price

collection in shops not covered by Scanner Data cannot be stopped. It is best to compile separate price indices with Scanner Data using an appropriate index compilation methodology. The Scanner Data price indices are combined with price indices obtained from field price collection. Currently, price indices are calculated at the level of a COICOP 6-digit category which is broken down by region. In line with this structure, the mission developed a target aggregation structure (see Table 3) to integrate Scanner Data into the Moldavian CPI. Table 3 also indicates the data source for estimating weights at a given level, and the index method that can be used to obtain an index for the next level above. This aggregation structure will only be relevant for the internal calculations at the NBS. It will not impact the dissemination of the indices that can continue to be published according to the current dissemination policy.

TABLE 3. Target Aggregation Structure

Index structure	Weights – Data source	Index method
COICOP 5-digit	HBS	Laspeyres-type
└ COICOP 6-digit	HBS	Laspeyres-type
└ Region	HBS	Laspeyres-type
└ Field price collection	Enterprise statistics (turnover)	Laspeyres-type
└ Repres. Prod.	No weights	Jevons
└ Scanner Data Retailer	Enterprise statistics (turnover)	Laspeyres-type
└ Item*Region*Retailer	Scanner data	Multilateral (Fisher)

33. Scanner Data can be progressively introduced into the CPI. Together with the annual weight update, the aggregation structure can be updated at the beginning of each year, with new retailers being added, or more products (COICOP 6-digit) being covered by Scanner Data. Whenever Scanner Data from a retailer is integrated into the CPI, the prices of that retailer will have to be removed from the index for the field price collection.

34. The CPI software should be adjusted in the future so to integrate Scanner Data. A possible architecture would be to build a separate system for processing the Scanner Data (using, for example, R software) that would eventually produce indices at the level of the retailer in a region for a specific COICOP 6-digit category. These indices could then be injected into the main CPI software which would handle the combination of the Scanner Data indices with the field price collection indices. This architecture is also illustrated in the flowchart in Figure 1.

35. The mission identified that the current CPI software has some limitations when combining the short-term (current month compared to previous month) indices from the basic level to the higher levels. The current CPI software calculates the short-term indices at the basic level (using the geometric mean index formula) and aggregates them to obtain the indices for the higher-level indices. The short-term indices are combined using the fixed weights introduced in January each year.

Technically, the weights would have to be price-updated² before combining the short-term indices. Alternatively, the short-term indices can first be chained at the basic level before being aggregated to higher levels. The NBS plans to improve the current CPI software. This will be an opportunity for also reviewing the aggregation mechanism. The mission prepared examples with the aggregation methods (see Appendix 1). This file can serve as an illustration when preparing the specifications for the IT developments.

36. The NBS is compiling and publishing average prices for a list of socially important retail products. This statistical output receives a lot of attention by users. It has to be investigated how Scanner Data can be leveraged to compile such average prices. One could select specific items from Scanner Data that meet the specification of the product and insert the “Scanner Data average price” into the calculations.

Recommended Actions:

- Use Scanner Data for reviewing the basket of representative products.
- Improve the aggregation methods in the CPI software.

E. OWNER-OCCUPIED HOUSING

37. The rental equivalence approach aims to measure the change in the price of the housing services consumed by owner-occupiers by estimating the market value of those services. In other words, it is based on estimating how much owner-occupiers would have to pay to rent their dwelling. In practice, the price indicator for the imputed rents can be sourced from the price series for rents, weighted to reflect the stock of owner-occupiers. Compared to other approaches for treating OOH, this approach can be relatively easily implemented to the extent that appropriate rent data are available. Nevertheless, the approach may be criticized because it is based on imputations. It poses some challenges if the rental market is small. An expenditure weight for imputed rentals would be available from the national accounts which values this aggregate by applying the user cost method.³ In addition, the Household Budget Survey (HBS) also asks owner-occupiers about a hypothetical rent for their dwelling.

38. Other approaches for treating OOH in a CPI also have their challenges. The acquisitions approach⁴ aims to measure the changes in prices of dwellings and of other goods and services acquired by households in their role as owner-occupiers. In practice, this approach requires monthly and timely price indices for the acquisition and construction of new dwellings. The payment approach aims to measure the changes in payments made by owner-occupiers for their dwellings, such as mortgage

² This is explained and illustrated in the following paper: Paul A. Armknecht, 2016, Fixed Basket Methods for Compiling Consumer Price Indexes, Paper presented at the UNECE meeting, Geneva, available at: https://unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.22/2016/Session_5_IMF_Fixed_Basket_Indexes.pdf.

³ See European System of Accounts ESA 2010, paragraph 3.79: “In the absence of a sufficiently large rental market, where accommodation is characteristic of owner-occupied dwellings, the user-cost method is applied for owner-occupied dwellings. Under the user-cost method, the output of dwelling services is the sum of intermediate consumption, consumption of fixed capital, other taxes less subsidies on production and net operating surplus (NOS). The NOS is measured by applying a constant real annual rate of return to the net value of the stock of owner-occupied dwellings at current prices (replacement costs).”

⁴ The quarterly OOH index compiled within the European Union is based on the acquisitions approach.

interest payments. However, this approach can be criticized because the inclusion of interest rates introduces a circular element in the CPI which is used for monetary policy purposes.

39. The CPI for Moldova includes rentals. Rents are collected for different types of apartments that are characterized by number of rooms and by vintage (new or old). Data collection is conducted at the end of each month. Rents for Chisinau are collected from popular real estate listing websites, while in the other regions, rents are observed by price collectors. Rents that are labelled in euros are transformed into local currency using the appropriate exchange rates.

40. The rental market in Moldova is small. According to the HBS, the share of owner-occupiers in Moldova is estimated to be 95 percent.⁵ The inclusion of OOH in the CPI under the rental equivalence approach is expected to increase the combined share of rentals and imputed rentals to more than 15 percent. The mission conducted an experimental simulation that included the imputed rentals by assuming the imputed rental index to be equal to the current rental index.

41. The price index for rentals can be improved by including both apartments and houses. Currently the price index only includes apartments. The mission recommended to start collecting prices for houses located in Chisinau from the real estate listing websites. The NBS also proposed to further investigate the rental markets in the regions for which data on rents are not available on these websites. The NBS agreed to collect and include rents for houses in Chisinau from next year on.

42. The internal weights of the rental price index should be reviewed to improve the accuracy of the index. Expenditure data on rents broken down by region are available from the HBS. These expenditures should be further broken down according to type of dwelling (houses and apartments). The HBS collects information from households on the type of occupancy (owner-occupier, tenant from private sector, tenant from public sector), type of dwelling, region, size of dwelling. The estimated proportions, multiplied by an appropriate average price, could be used to develop expenditure shares for a more detailed stratification of the rental price index. A weighting structure for an imputed rental index could be developed in a similar fashion.

43. There is an opportunity to automatize and expand data collection through the use of web scraping techniques. The NBS should reach out to the National Bank of Moldova (NBM) which already scrapes data from websites to compile the Residential Property Price Index (RPPI). A similar approach may be possible to collect rental data together with the characteristics of the dwellings from these websites. This would make it possible to expand the coverage and apply better techniques for quality adjustment, thereby improving price measurement.

44. The OOH inclusion according to the rental equivalence has to be further investigated. The rental market is mainly concentrated in the capital Chisinau but is very small in the other regions of the country. The majority of dwellings in Moldova are houses for which no rent data is yet collected. Given the small rental market in Moldova, further analysis and user consultations are needed in order to assess the feasibility of the imputed rentals approach.

⁵ See Results of the Household Budget Survey, Edition 2023, available at: https://statistica.gov.md/files/files/publicatii_electronice/aspecte_nivelul_trai/Publicatia_CBGC_editia_2023.pdf.

Recommended Actions:

- Expand the coverage of the rent price index and include rents for houses in the CPI.
- Start discussions with the NBM on web scraping rents from real estate listing websites.

TABLE 4. Detailed Work Plan Covering October 2023–October 2024

Priority	Action/Milestone	Target Completion Date
<i>Result: Transaction data is regularly transmitted from the STS to the NBS.</i>		
High	Establish a memorandum of understanding with the STS to secure regular access to Scanner Data.	March 2024
High	Develop an IT infrastructure at the NBS for storing and pre-processing the STS data.	March 2024
<i>Result: Scanner Data is classified to COICOP.</i>		
High	Reach out to the retailers to access metadata on the products in view of applying attribute-based classification.	January 2024
High	Classify already available items in the Scanner Data to the 6-digit COICOP.	July 2024
<i>Result: The CPI software is improved.</i>		
High	Improve the aggregation methods in the CPI software.	September 2024
<i>Result: Scanner Data is used.</i>		
Medium	Use Scanner Data for reviewing the basket of representative products.	October 2024
<i>Result: The rental price index is improved.</i>		
Medium	Update the basket and include rents for houses in the CPI.	January 2024
Medium	Start discussions with the NBM on web scraping prices from the real estate listing websites.	July 2024

F. OFFICIALS MET DURING THE MISSION

Name	Institution
Oleg Cara	Director General, NBS
Lurie Mocanu	Deputy Director General, NBS
Elizaveta Todica	Head of Consumer Price Statistics Division, NBS
Cristina Condrea	Main Advisor, NBS
Nicoleta Matcovschi	Senior Advisor, NBS
Dmitri Calincu	Head of Administrative Data Sources Service, NBS

Appendix I. Higher-Level Aggregation

We consider the following previous-month (short-term) indices obtained for the four regions for a given 6-digit COICOP category. The weights correspond to the expenditure shares included in the calculations starting with the January month.

Region	Weight	Dec	Jan	Feb	March	April
Chisinau	25		104.17	112.00	104.29	82.19
North	40		103.33	110.32	101.75	86.21
South	25		111.11	101.11	101.98	87.28
Centre	55		106.67	119.79	106.96	73.17
TOTAL	145					

In order to obtain an index at the national level (combination of the four regions), one should first chain the regional indices and then combine these chained indices using the fixed weights.

Region	Weight	Dec	Jan	Feb	March	April
Chisinau	25	100.00	100.00* $104.17/100.00=$ 104.17	104.17* $112.00/100.00=$ 116.67	116.67* $104.29/100.00=$ 121.67	121.67* $82.19/100.00=$ 100.00
North	40	100.00	103.33	114.00	116.00	100.00
South	25	100.00	111.11	112.35	114.57	100.00
Centre	55	100.00	106.67	127.78	136.67	100.00

The following long-term indices are then obtained for the national level:

- January Index = $(104.17*25+103.33*40+111.11*25+106.67*55) / 145 = 106.08$
- February Index = $(116.67*25+114.00*40+112.35*25+127.78*55) / 145 = 119.40$
- March Index = $(121.67*25+116.00*40+114.57*25+136.67*55) / 145 = 124.57$
- April Index = $(100.00*25+100.00*40+100.00*25+100.00*55) / 145 = 100.00$

There is an alternative way of obtaining the same results. One can first update the weights and then use these updated weights to combine the previous-month (short-term) indices. The table below illustrates the weight updating.

Region	Dec	Jan	Feb	March	April
Chisinau	25.00	25.00* 104.17/100= 26.04	26.04* 112.00/100.00= 29.17	29.17* 104.29/100.00= 30.42	30.42* 82.19/100.00= 25.00
North	40.00	41.33	45.60	46.40	40.00
South	25.00	27.78	28.09	28.64	25.00
Centre	55.00	58.67	70.28	75.17	55.00
Total	145.00	153.82	173.13	180.63	145.00

The following short-term indices are then obtained for the national level using the previously calculated updated weights:

- January Index = $(104.17 \times 25 + 103.33 \times 40 + 111.11 \times 25 + 106.67 \times 55) / 145.00 = 106.08$
- February Index = $(112.00 \times 26.04 + 110.32 \times 41.33 + 101.11 \times 27.78 + 119.79 \times 58.67) / 153.82 = 112.55$
- March Index = $(104.29 \times 29.17 + 101.75 \times 45.60 + 101.98 \times 28.09 + 106.96 \times 70.28) / 173.13 = 104.33$
- April Index = $(82.19 \times 30.42 + 86.21 \times 46.40 + 87.28 \times 28.64 + 73.17 \times 75.17) / 180.63 = 80.28$

As a consequence, the following long-term indices are obtained for the national level. These indices are identical to the ones obtained above:

- January Index = 106.08
- February Index = $106.08 \times 112.55 / 100.00 = 119.40$
- March Index = $104.33 \times 119.40 / 100.00 = 124.57$
- April Index = $80.28 \times 124.57 / 100.00 = 100.00$

In this example, we combined regional indices (6-digit COICOP) into the national level (6-digit COICOP). The same procedure applies for combining the 6-digit COICOP indices in order to obtain indices for the higher-level aggregates.