Central European Labour Studies Institute

www.celsi.sk

CELSI Discussion Paper No. 67

The End of Slovakia's Convergence in GDP per Capita at PPP: Role of Shortcomings in Input Data Submitted to Eurostat

December 2023

MAREK HLAVAC

The End of Slovakia's Convergence in GDP per Capita at PPP: Role of Shortcomings in Input Data Submitted to Eurostat

CELSI Discussion Paper No. 67
December 2023

Marek Hlavac

Senior Analyst, Social Policy Institute. Ministry of Labour, Social Affairs and Family of the Slovak Republic. Bratislava, Slovakia;
Research Fellow, Central European Labour Studies Institute (CELSI);

E-mail: marek.hlavac@employment.gov.sk

Central European Labour Studies Institute (CELSI)

Zvolenská 29
821 09 Bratislava
Slovak Republic

Tel/Fax: +421-2-207 357 67
E-mail: info@celsi.sk
Web: www.celsi.sk

The End of Slovakia's Convergence in GDP per Capita at PPP: Role of Shortcomings in Input Data Submitted to Eurostat

ABSTRACT

According to official statistics, Slovakia's GDP per capita at PPP has been declining compared to the EU-27 average since 2016. This unfavorable evolution is influenced by shortcomings in the input data provided to Eurostat – especially in expenditures on housing rentals and in housing stock data. Using the Eurostat-OECD methodology for calculating purchasing power parities, we estimate alternative scenarios that correct these shortcomings. Our results still suggest that Slovakia's convergence level has been stagnating since 2016. They are less optimistic than those by other Slovak institutions, and are not very sensitive to changes in assumptions about the prices of rentals.

JEL Classification: E01, E31, O47

Keywords: Slovakia; purchasing power parity; convergence; housing; imputed rent

1. Introduction

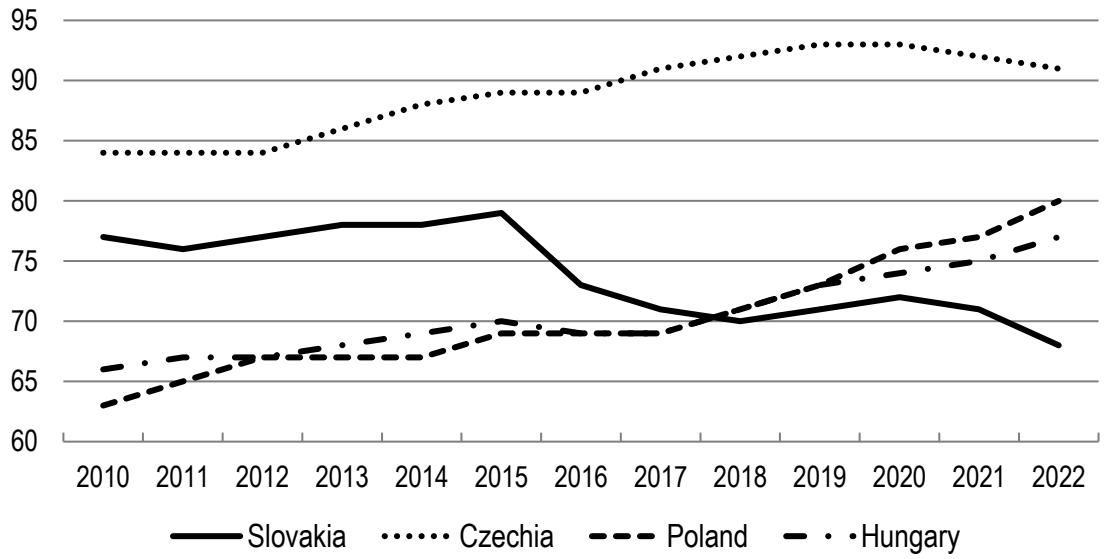
A comparison of nominal gross domestic product (GDP) per capita across EU-27 countries often does not accurately reflect differences in living standards and purchasing power, as it does not take into account differences in price levels. In international comparisons, therefore, purchasing power parities (PPP) are often used. PPPs adjust the level of GDP based on the price level of comparable goods and services in different countries, and allow for more meaningful cross-country comparisons.

In such international comparisons, Slovakia's GDP per capita at purchasing power parity (PPP) has, according to official Eurostat statistics, been declining compared to the EU-27 average since 2016. While in 2015 the country's convergence level was at 79 percent of the EU average, in 2022 it was only at 68 percent. Slovakia thus occupied, along with Greece, a shared 25th and 26th place among the 27 EU Member States – ahead only of Bulgaria (59 percent). In recent years, Slovakia's GDP per capita at PPP has plummeted to the last place among the four Visegrad Group (V4) countries – Czechia, Hungary, Poland and Slovakia – that often serve as a natural comparison group. The drop is quite notable since, as recently as 2015, Slovakia occupied second place after Czechia.

Figure 1 presents a comparison of the evolution of GDP per capita at PPP in V4 countries, expressed as a percentage of the EU-27 average, from 2010 to 2022 in Eurostat's official time series (Eurostat 2023e). A significant break occurred between 2015 and 2016, when Slovakia's GDP per capita at PPP fell by as many as 6 percentage points year-on-year (from 79 percent of the EU-27 average in 2015 to 73 percent in 2016). After this sudden decline, Slovakia continued to stagnate or even fell further behind the EU-27 average. Such evolution of Slovakia's convergence level in GDP per capita at PPP represents a significant departure from the past trend. Until 2015, Slovakia had been catching up to the EU-27 average. Lagging behind the EU average would also set the

country apart from all other V4 countries, as these have all continued converging to the EU-27 average.

Figure 1. GDP per capita at PPP as a percentage of EU-27 average in V4 countries, 2010 – 2022 (Eurostat).



Source: Eurostat 2023e

The evolution of statistics on the performance of the Slovak economy at PPP holds great importance to policy-makers, as it can have an impact on the reputation of the country, on its perception by investors, as well as on the evaluation of the country by rating agencies. Worse ratings indicate a lower creditworthiness of the Slovak Republic as a borrower, and can thus increase the costs of financing the country's public debt (Habrman, Habodászová and Šrámková 2022). Furthermore, the amount of funding from European Structural and Investment Funds (ESIF), to which Slovak regions and the country as a whole are entitled, as well as member quotas in the International Monetary Fund, also depend on Slovak statistics at PPP (ECA 2019; IMF 2021).

Since they considered the evolution of the country's per capita GDP at PPP to be suspicious and unlikely, several public institutions and private banks in Slovakia have calculated their own alternative estimates – typically taking the official statistics for 2015 as the starting point, and extrapolating from them using the growth rate of real GDP. Such alternative estimates have indicated that Slovakia's GDP per capita at PPP could instead have grown to be in excess of 80 percent of the EU-27 average by 2021, rather than the 71 percent indicated by Eurostat for the same year (Habrman, Habodászová and Šrámková 2022; Horňák and Valachyová 2022; NBS 2022, 2023; Novák et al. 2022). A number of well-regarded public and private institutions in Slovakia have thus estimated that the country's per capita GDP at PPP might be more than 12 percent higher than is indicated by official Eurostat statistics – a very sizable difference.

In this paper, we investigate the reasons for the sudden drop and continuing unfavorable trend in Slovakia's per capita GDP at PPP since 2016. We find that the evolution of the official statistics has been influenced by shortcomings in the input data that Slovakia provides to Eurostat. The most important factors are changes in the methodology for estimating expenditures on housing rentals in the national accounts after their benchmark revision in 2019, as well as a change in the reporting of the surface area of dwellings, and – before the revision – not accounting for intermediate consumption in rentals expenditures. In addition, expenditures on several other expenditure categories – especially construction and health – have also been significantly revised, and have thus contributed to the drop seen in Slovakia's official statistics.

Under the alternative assumption that Slovakia had housing rental prices equal to their highest level from among the other post-communist EU Member States, we estimate Slovakia's convergence level to be 73 percent of the EU-27 average in 2019, and only 71 percent in 2022. Such results still indicate that the Slovak economy has been stagnating

or even declining compared to the 74 percent convergence level that it would have achieved in 2016. Our estimates are not very sensitive to changes in assumptions about the prices of rentals. They would remain almost unchanged even if Slovakia were assumed to have housing rental prices equal to their lowest level from the set of post-communist EU countries.

Compared to the alternative estimates of other Slovak institutions, our results are significantly less optimistic. Our approach to estimating the evolution of per capita GDP at PPP focuses on correcting only the problematic parts of the input data. The approach based on extrapolation using the growth rate of real GDP that was typically taken by the other institutions overestimates Slovakia's GDP per capita, as it starts from a too-high initial level and reflects a production concept of GDP, rather than the more appropriate purchasing power concept (Feenstra et al. 2009).

2. Data

From Eurostat, we obtained detailed input data, which are used to calculate official purchasing power parities for economic aggregates such as GDP (henceforth "detailed PPP data"). The data contain PPPs and the corresponding nominal expenditures from the national accounts at the basic heading level – i.e., at the lowest level for which PPPs are calculated – for all 27 Member States of the European Union, covering the time period from 2010 to 2022. They include all 276 basic headings that are used to calculate PPPs for economic aggregates, and relate to the June 2023 calculation of PPPs by Eurostat (Eurostat 2023e). The level of detail is much greater than in the publicly available data on the Eurostat website. Compared to only 61 higher-level "analytical categories" (such as "Milk, cheese and eggs"), the detailed PPP data contain 276 basic headings (such as "Milk, whole, fresh", "Milk, low fat, fresh", "Milk, preserved", "Yoghurt", "Cheese and curd", "Other milk products" and "Eggs" for the same analytical category).

In addition to basic heading PPP and nominal expenditure data, Eurostat also provided us with data on the housing stock of the Visegrad Group (V4) countries – i.e., Czechia, Hungary, Poland and Slovakia. These data contain the number of flats and houses of various sizes (based on the number of rooms), their usable surface area, as well as information about their facilities (electricity, running water, indoor toilet and central heating).

As a condition for receiving access to the detailed PPP data, we have agreed to limit the level of detail at which we publish the results of our analysis. In particular, we have committed ourselves not to publish any results at a more detailed level than the 61 analytical categories which are available on the Eurostat website. Although we performed our analysis at the most detailed level of the 276 basic headings that were provided to us, we publish any results and conclusions at the less detailed level of publicly available analytical categories.

3. Methodology

Purchasing power parities (PPPs) are *de facto* exchange rates that can be used to convert different currencies into an artificial common currency. Through this conversion, PPPs equalize the currencies' purchasing power by eliminating the differences between the price levels of individual countries. Purchasing power parities can therefore be used as spatial price deflators. If we convert nominal GDP or another expenditure aggregate (e.g., household final consumption expenditure) to a common currency using PPPs, the result will only reflect differences in the volumes of goods and services purchased in the compared countries (Deaton and Heston 2010).

The methodology that Eurostat uses to calculate PPPs is described in the *Eurostat-OECD Methodological Manual on Purchasing Power Parities* (Eurostat-OECD 2012). The legal basis for the manual is Regulation 1445/2007, which establishes

common rules for the provision of basic information on Purchasing Power Parities and for their calculation and dissemination. The calculation of PPPs is a three-stage process:

(1) For each basic heading, national statistical institutes collect or estimate prices for individual goods and services in individual EU Member States. In Slovakia, this stage is carried out by the Statistical Office of the Slovak Republic.

(2) From the prices collected and submitted by the national statistical institutes, Eurostat calculates PPPs for each basic heading by taking the (typically unweighted) average of the relative prices of goods and services.

(3) Eurostat calculates PPPs for economic aggregates (such as GDP) by weighting and subsequently averaging PPPs for basic headings. These basic heading PPPs are weighted by the corresponding amounts of nominal expenditure.

Calculation of Purchasing Power Parities for Basic Headings

To calculate PPPs at the basic heading level, Eurostat first calculates two bilateral PPPs as the geometric means of the price ratios of products that are representative of base country *h* or partner country *j*. The technical terms for the resulting PPPs are the Laspeyres-type PPP and Paasche-type PPP:

$$Laspeyres_{j/h} = \left(\prod_{i=1}^{k} \frac{{}_hP_j^i}{{}_hP_h^i} \right)^{\frac{1}{k}}$$

$$Paasche_{j/h} = \left(\prod_{l=1}^{m} \frac{{}_jP_j^l}{{}_jP_h^l} \right)^{\frac{1}{m}}$$

where ${}_hP_j^i$ and ${}_hP_h^i$ in the first equation are simple arithmetic means of the prices of items *i*, which are representative of the base country *h* and were collected in countries *j*

and *h*. Similarly, in the second equation, ${}_jP_j^l$ and ${}_jP_h^l$ are simple arithmetic means of items *l*, which are representative in the partner country *j*. Letters *k* and *m* denote the number of items which are representative in the base or partner country within a particular basic heading.

The geometric mean of these two bilateral PPPs is then taken to create a single bilateral Fisher-type PPP for each country pair:

$$Fisher_{j/h} = \left(Laspeyres_{j/h} \times Paasche_{j/h}\right)^{\frac{1}{2}}$$

In the last step, the Fisher-type PPP is made transitive. Transitivity is achieved using the EKS (Èltetò-Köves-Szulc) method (Köves 1993), in which each bilateral Fisher-type PPP is replaced by the geometric mean of its own square and of all corresponding indirect Fisher-type PPPs that calculate it using a third country:

$$PPP_{j/h}^{BH} = \left(Fisher_{j/h}^2 \prod_{t \neq j,h}^{N} \frac{Fisher_{j/t}}{Fisher_{j/t}} \right)^{\frac{1}{N}}$$

where *t* denotes third countries in indirect Fisher-type PPPs, and *N* is the total number of countries. The resulting parities $PPP_{j/h}^{BH}$ are then used in the third stage to calculate PPPs for economic aggregates.

Calculation of Purchasing Power Parities for Housing Rentals

Eurostat calculates purchasing power parities for housing rentals differently from other basic headings (Eurostat-OECD 2012). Household expenditures on actual and

imputed rentals for housing are part of household final consumption expenditure in the national accounts. In the detailed PPP data, each of these two types of rentals has their own basic heading: A.04.1.0.0 for *Actual Rentals for Housing* and A.04.2.0.0 for *Imputed Rentals for Housing*.

EU-27 Member States calculate household expenditures on rentals in their national accounts according to the ESA 2010 methodology (Eurostat 2013, 2016). If possible, Member States should use the stratification method, which relies on actual rental prices that have been collected using surveys. This method is suitable if there is a sufficiently large and representative market for rental flats or houses in the country. PPPs for housing rentals are then calculated directly using the price approach.

If a market for rental flats or houses does not exist in the country, or if it is not sufficiently large or representative, Member States can apply the user cost method to estimate rental expenditures. In this method, imputed rentals equal the sum of all costs that the owners of dwellings would have to take into account when determining the amount of market rent if they were to rent out their flat or house. In this case, PPPs are calculated indirectly using the quantity approach.

In Slovakia, the user cost method was used for all dwellings – flats as well as houses – before the 2019 benchmark revision of national accounts. After the benchmark revision, however, the stratification method was introduced for flats, as it was deemed that Slovakia had a sufficiently large and representative rental market for this type of dwellings. For houses, which are rarely rented in Slovakia, the user cost method remained in use (Statistical Office of the Slovak Republic, 2021).

Stratification Method and the Price Approach

In the stratification method – which was used for flats in Slovakia after the 2019 benchmark revision – dwellings are first divided into strata according to their type, size,

quality and location. Rental prices for flats and houses in each stratum are then collected, usually through a survey. The number of dwellings in each stratum is multiplied by the average rental price in the same stratum, and the results are summed up to obtain the total household expenditure on housing rentals.

When the stratification method is used, purchasing power parities are calculated directly using the price approach, which is based on the collected rental prices. In this approach, PPPs are calculated separately for actual and imputed rentals for housing. PPPs for rentals are calculated differently from the standard procedure for calculating other basic heading PPPs, in which unweighted geometric averages are usually taken. When calculating PPPs for housing rentals, nominal expenditures on rentals are used as weights.

First, Laspeyres- and Paasche-type PPPs are calculated:

$$Laspeyres_{j/h} = \frac{1}{\sum_{i=1}^{k} w_{i,h}} \sum_{i=1}^{k} \left[\frac{P_{i,j}}{P_{i,h}} \times w_{i,h} \right]$$

$$Paasche_{j/h} = \frac{1}{Laspeyres_{h/j}}$$

where $P_{i,j}$ and $P_{i,h}$ denote average prices for rentals in stratum *i* in the partner country *j* and base country *h*, respectively. The letter $w_{i,h}$ denotes the weight of rental expenditures in stratum *i* in the base country *h*, calculated as a share of the total expenditure on actual or imputed rentals for housing. The total number of strata is denoted by the letter *k*.

Fisher-type PPPs for actual and imputed rentals are then calculated in the standard way by taking the geometric mean. Finally, these PPPs are made into the final, transitive purchasing power parities by applying the EKS method.

User Cost Method and the Quantity Approach

In the user cost method – which was used for all dwellings (flats and houses) before the 2019 benchmark revision, and for houses after – rents are calculated as the sum of all costs that the owners of dwellings would have to take into account when setting the rent if they wanted to rent out their flat or house at the market price. The resulting total should provide a realistic estimate of the expenditure on rentals. These costs include:

- Intermediate consumption, which consists mainly of spending on routine maintenance and repairs, FISIM and insurance services. FISIM stands for *Financial Intermediation Services Indirectly Measured*, and mostly represents interest payments for mortgage and construction loans.
- Consumption of fixed capital, which captures the depreciation of owned fixed assets (in this case, housing) due to normal wear and tear, as well as obsolescence.
- Net operating surplus is the nominal rate of return on the capital invested in the dwelling and in the land on which it is located.
- Other taxes (minus subsidies) on production, such as the real estate tax.

Consumption of fixed capital and net operating surplus depend, among other things, on the reproduction price of the property – i.e., the price for which it would be possible to acquire the property at the given moment.

When the user cost method is used, purchasing power parities are calculated indirectly using the quantity approach. National statistical institutes provide Eurostat with data on the total housing stock in individual Member States. These data include the number of flats and houses and their surface area (quantity data), as well as the number of flats and houses that have electricity, running water, an indoor toilet and central heating (quality data). Data are provided for all flats and houses without distinguishing whether

they are rented or owner-occupied. The following measures are calculated from these data:

- the *quantity measure* is the ratio between the usable surface areas of flats and houses per capita in countries *j* and *h*,
- the *quality measure* is the ratio between the percentages of flats and houses with the facilities listed above in countries *j* and *h*,
- the *volume measure* is the product of the quantity measure and the quality measure. The volume measure thus expresses the relative quantity of dwellings in country *j* compared to country *h*, adjusted for their quality.

The purchasing power parities between countries *j* and *h* for housing rentals are calculated indirectly. The following formula is used:

$$PPP_{j/h} = \frac{\frac{E_j}{E_h}}{V_{j/h}}$$

where E_j and E_h denote the per capita final expenditure on housing in the national currency of country *j* and *h*, respectively, while $V_{j/h}$ is the volume measure.

In the quantity approach, E_j and E_h include all final housing expenditures in a Member State. These consist of the sum of expenditures on the following four basic headings: household expenditure on actual rentals, household expenditure on imputed rentals, expenditure on housing by non-profit institutions serving households (NPISH), and general government expenditure on housing. The indirect PPPs for housing therefore refer to all housing in the Member State.

Calculation of Purchasing Power Parities for Economic Aggregates

The calculation of PPPs for economic aggregates in the third stage involves the same procedure as the calculation of basic heading PPPs in the second stage. The only difference is that the formulas used to calculate the Laspeyres- and Paasche-type PPPs differ from those used in the previous stage.

To calculate aggregate PPPs, Eurostat first calculates two bilateral PPPs for each pair of countries – a Laspeyres-type PPP and a Paasche-type PPP. Laspeyres-type PPPs are calculated by taking a weighted arithmetic mean of the ratio of basic heading PPPs in countries *j* and *h*. Nominal expenditures on individual basic headings from the national accounts of base country *h* are used as weights.

$$Laspeyres_{j/h} = \frac{1}{\sum_{i=1}^{k} w_{i,h}} \sum_{i=1}^{k} \left[\frac{PPP_{i,j}^{BH}}{PPP_{i,h}^{BH}} \times w_{i,h} \right]$$

where $PPP_{i,j}^{BH}$ a $PPP_{i,h}^{BH}$ denote the purchasing power parities for basic heading *i* in the partner country *j* and base country *h*. The letter $w_{i,h}$ denotes the weight of basic heading *i* in the base country *h*. The total number of basic headings is denoted by the letter *k*.

Paasche-type PPPs for economic aggregates are the reciprocals of Laspeyres-type PPP with the base and partner countries exchanged:

$$Paasche_{j/h} = \frac{1}{Laspeyres_{h/j}}$$

Calculating the Fisher-type PPP and ensuring the transitivity of PPP using the EKS method is done in exactly the same way for economic aggregates as it was done for basic headings:

$$Fisher_{j/h} = \left(Laspeyres_{j/h} \times Paasche_{j/h}\right)^{\frac{1}{2}}$$

$$PPP_{j/h}^{AGGR} = \left(Fisher_{j/h}^{2} \prod_{t \neq j,h}^{N} \frac{Fisher_{j/t}}{Fisher_{h/t}} \right)^{\frac{1}{N}}$$

where *t* denotes third countries in indirect Fisher-type PPPs, and *N* denotes the total number of countries.

Calculation and Interpretation of Price Level Indices

Dividing PPPs by the exchange rate between the local currency and the euro allows one to calculate the Price Level Index (PLI) at PPP in each EU country, both for basic headings and for economic aggregates such as GDP:

$$PLI_{j/h}^{BH} = \frac{PPP_{j/h}^{BH}}{\mathrm{e}_{j/h}}$$

$$PLI_{j/h}^{AGGR} = \frac{PPP_{j/h}^{AGGR}}{\mathrm{e}_{j/h}}$$

where $\mathrm{e}_{j/h}$ denotes the market exchange rate between the currencies of partner country *j* and home country *h*.

These indices make possible a direct comparison of average prices of goods and services in a country not only with the average prices in the EU-27 as a whole, represented

by a value of 100, but also across individual Member States. Price level comparisons using PLIs must, however, be interpreted with caution, as these indices are sensitive to fluctuations in the exchange rates of currencies used in their calculation.

According to simple economic theories (Cassel 1921, 1922; Dornbusch 1987), exchange rates adjust to reflect the relative price levels between countries (*purchasing power parity theory*), since arbitrage ensures that the prices of goods are the same in all countries that trade in them (*law of one price*). These theories assume that exchange rates depend only on international trade, that all goods and services are tradable, and that transaction costs (e.g., for transport, taxes or tariffs) are negligible.

In reality, however, many other factors can also have a significant impact on exchange rates, including interest rates, speculation in foreign exchange markets, or various government and central bank policies. In addition, many goods and services do not trade on international markets. Non-tradable goods and services include, for example, real estate, almost all public sector services, and most services provided by the private sector. Transaction costs also play an important role (Keynes 1923). For example, transport costs increase with the distance between the producer and the consumer. International borders create a trade barrier not only because of tariffs, but also in themselves (Engel and Rogers 1996).

As a result, PLIs are a more useful tool for comparing relative prices in countries that use a common currency. In the case of PPPs provided by Eurostat for the EU-27, these indices are more reliable for comparisons within the euro area. If at least one of the countries being compared is outside the euro area, comparisons are likely to be more reliable over a longer time horizon. In this time frame, exchange rates between currencies may be more reflective of relative price levels (Rogoff 1996). These considerations are

relevant to the interpretation of the evolution of Slovakia's PLIs relative to its neighbors, as each of the Visegrad Group countries uses a different currency.

Importantly, while currency exchange rates have an effect on PLIs, they do not affect the levels of GDP per capita at PPP. They are not necessary for the calculation of GDP at purchasing power parity, as one can simply divide nominal expenditures in the local currency by the corresponding PPP, without using exchange rates. Exchange rates therefore do not affect the convergence level to the EU-27 average in GDP per capita at PPP.

4. Consequences of the 2019 Benchmark Revision of National Accounts

In 2019, a benchmark revision of Slovakia's national accounts was performed. It led to several significant methodological changes – especially in the estimation of expenditures on housing rentals – and to the incorporation of data from updated sources. In addition to housing rentals, the benchmark revision also had a significant impact on estimates of the non-observed economy, construction production, household expenditures on energy and health, as well as on foreign trade statistics (Statistical Office of the Slovak Republic 2023).

Eurostat rules allow the retrospective revision of purchasing power parity time series for no more than three years into the past. The 2019 revision of the national accounts for Slovakia affected the official PPP statistics from 2016 onwards, but did not change them in the preceding period. As a result, there are jump changes in published values, which are largely an artifact of Eurostat's revision policy.

Post-Revision Increase in Estimated Expenditures on Housing Rentals

The benchmark revision resulted in a significant increase in the estimate of household expenditures on actual and imputed housing rentals. *Actual rentals for housing*

include cash payments for the use of the dwelling, including any garage or parking space. If the dwelling is furnished, the rent also includes payments for the use of furniture and other equipment. *Imputed rentals for housing* represent the estimated value of dwelling services used by households that live in houses and flats they own. They correspond to the estimated rentals that such households would pay for renting the same unfurnished dwelling (i.e., the *rental equivalent*), taking into account factors such as the type of dwelling, its size, quality or location. Although not an actual payment, the inclusion of imputed rentals in national accounts allows for better comparisons of the economies of countries with different shares of rented and owner-occupied housing (Commission Implementing Regulation 2022/2094). It is recorded as an expenditure that the household pays to itself for the dwelling services it consumes (Eurostat 2013, 2016).

The post-revision increase in estimates of housing rental expenditures in Slovakia stems from the following methodological changes (Statistical Office of the Slovak Republic 2021):

- Before the 2019 benchmark revision of Slovakia's national accounts, the user cost method was used to estimate expenditures on all dwellings – both flats and houses. This method estimates expenditures indirectly as the sum of all relevant costs that owners would have to consider when determining the amount of rent they could charge if they were to rent out their homes.
- After the benchmark revision, the stratification method was introduced to estimate expenditures on rentals for flats, and replaced the user cost method which had been used for these types of dwellings before the revision. This method uses a survey to collect rental prices for various types of flats, and therefore relies on actually observed prices in its calculations. The user cost method continued to be used to estimate expenditures on rentals for houses.

- The estimate of rental expenditures for both flats and houses was also adjusted based on the results of studies by Hajnovičová and Horecká (2018, 2019), which established what data sources were available for calculating the production of dwellings services, and subsequently estimated this production.

Table 1 presents expenditures on imputed and actual rentals for housing in Slovakia's national accounts before and after the 2019 benchmark revision (OECD 2019, 2023). The benchmark revision led to a doubling of estimates of imputed rentals spending and an increase in estimates of spending on actual rentals to 1.5 – 2 times their pre-revision values.

Table 1: Expenditures on rentals for housing in national accounts, millions of EUR

Imputed rentals for housing:	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
before benchmark revision	3 098	3 086	3 113	3 100	3 185	3 240	3 355	3 476
after benchmark revision	6 230	6 318	6 272	6 287	6 379	6 439	6 761	7 105
Increase (%):	**101%**	**105%**	**101%**	**103%**	**100%**	**99%**	**102%**	**104%**
	2018	**2019**	**2020**	**2021**	**2022**			
before benchmark revision	-	-	-	-	-			
after benchmark revision	7 610	8 219	8 962	9 998	11 400			

Actual rentals for housing:	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
before benchmark revision	381	402	409	388	406	406	408	424
after benchmark revision	626	658	607	626	691	773	842	813
Increase (%):	**64%**	**64%**	**48%**	**61%**	**70%**	**90%**	**107%**	**92%**
	2018	**2019**	**2020**	**2021**	**2022**			
before benchmark revision	-	-	-	-	-			
after benchmark revision	871	995	1 053	1 052	1 129			

Source: OECD 2019, 2023

Due to Eurostat's revision policy, the benchmark revision led to much higher nominal expenditures on rentals being recorded in Eurostat's PPP input data since 2016. Higher spending resulted in higher PPPs for imputed and actual rentals. These subsequently raised Slovakia's PPP for GDP, as more expensive rentals received a greater weight in the calculations. Purchasing power parities for some difficult-to-estimate basic headings are calculated indirectly using reference PPPs (Eurostat-OECD 2012). More

expensive rentals in the input data therefore also led to an increase in the prices of basic headings for which purchasing power parities are calculated indirectly using the PPPs for rentals.

Such a significant change in estimated expenditures on housing rentals in the national accounts, as well as in the PPPs calculated from these expenditures, raises the issue of whether the pre- or post-revision estimates are more accurate. Most previous analyses of the evolution of Slovakia's per capita GDP at PPP assumed that the values for years before 2016 had been reliable (Habrman, Habodászová and Šrámková 2022; Horňák and Valachyová 2022; NBS 2022; Novák et al. 2022). Contrary to the assumption in these studies, we find shortcomings in the input data used to calculate PPPs both in the pre- and post-revision years.

Non-Inclusion of Intermediate Consumption in Housing Rentals Before 2016

The nominal expenditures on housing rentals used to calculate PPP statistics in years 2010 to 2015 correspond to the expenditures reported in Slovakia's national accounts before the benchmark revision (OECD 2019). A comparison of nominal expenditures in 2010 in the pre-revision national accounts with data for the same year in the *GNI Inventory* (Statistical Office of the Slovak Republic 2016), however, strongly suggests that intermediate consumption was not included in housing rentals expenditures in the national accounts. As Table 2 shows, nominal expenditures on imputed and actual rentals for housing in the national accounts match the difference between the expenditure and intermediate consumption reported by the *GNI Inventory* almost exactly.

Table 2: Expenditures on rentals for housing in GNI Inventory and national accounts before benchmark revision

	Rentals for housing, 2010, millions of EUR	
	Imputed	**Actual**
	Source: GNI Inventory	
Production / Expenditure	4 588	537
Intermediate consumption	1 491	164
Share (%)	32,5%	30,6%
Difference	3 098	373
	Source: National accounts before benchmark revision, OECD	
Reported production / Reported expenditure	3 098	381

Source: Statistical Office of the Slovak Republic 2016, OECD 2019

Intermediate consumption for housing rentals includes expenditures on routine repairs and maintenance of the dwelling, interest payments on mortgage or construction loans, as well as insurance and some other services related to housing. In the detailed data from Eurostat, we observe a significant decrease in nominal expenditures on basic headings associated with these types of spending between 2015 (not yet affected by the benchmark revision) and 2016 (already affected). We list the relevant basic headings in in Table 3. Such a decrease, along with its size, suggests that intermediate consumption had indeed not been included in the pre-revision national accounts. At the same time, it also suggests that the error was corrected in the benchmark revision, which led to a reclassification of spending on intermediate consumption into the appropriate basic headings.

Table 3: Basic headings which included the pre-revision intermediate consumption for housing rentals

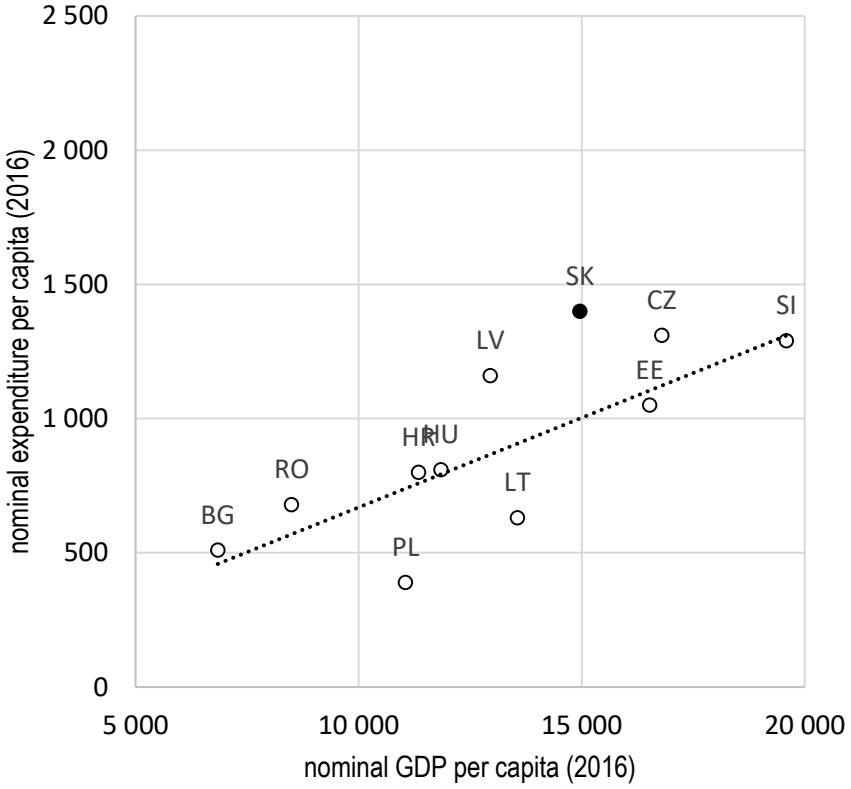
A.04.3.1.0	Materials for the maintenance and repair of the dwelling
A.04.3.2.0	Services for the maintenance and repair of the dwelling
A.04.4.4.0	Other services relating to the dwelling n.e.c.
A.12.5.2.0	Insurance connected with the dwelling
A.12.6.1.0	FISIM

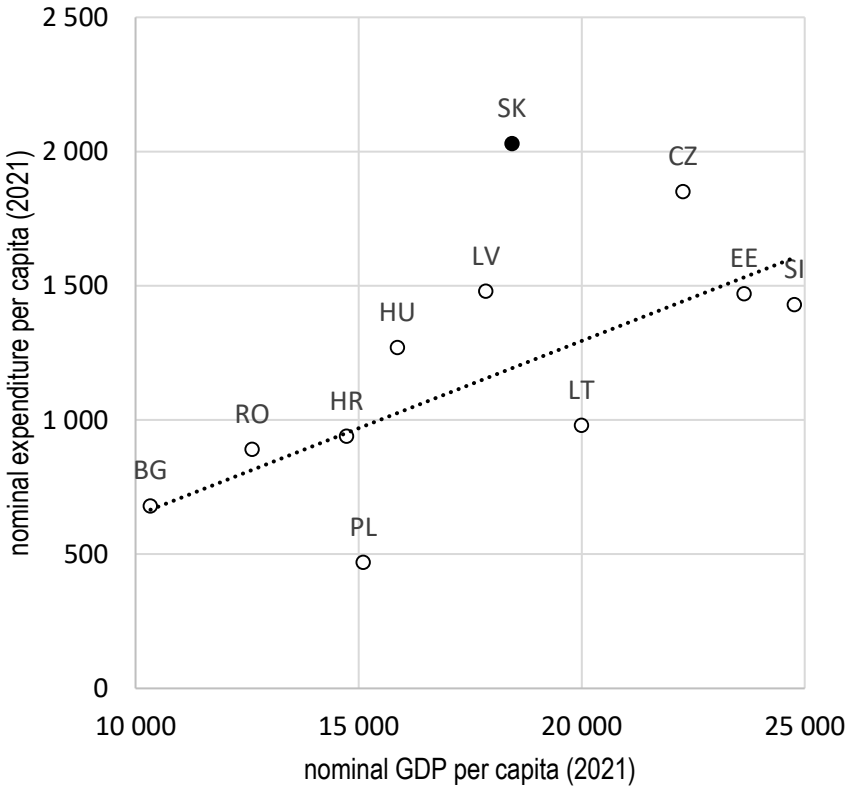
Overestimated Housing Rentals Expenditures from 2016

Figure 2 shows the relationship between nominal GDP per capita in post-communist EU Member States and nominal per capita expenditure on housing rentals (both imputed and actual) in these countries' national accounts in 2016 and 2021. In both 2016 and 2021, Slovakia had the highest per capita expenditure on rentals of all post-communist EU countries. This was also true in each year from 2016 to 2021, with the exception of two: In 2018 and 2019, the per capita expenditure on rentals was slightly higher in Czechia.

The dotted line indicates the expected per capita amount of expenditures on rentals for the corresponding level of nominal GDP per capita, estimated using a simple linear regression. In both 2016 and 2021, per capita expenditures on housing rentals in Slovakia's national accounts were significantly higher than expected given the country's nominal GDP per capita. In both years, furthermore, Slovakia shows the largest gap between per capita expenditures on rentals and their expected amount of all post-communist EU countries. As a result, one may reasonably conclude that expenditures on rentals in Slovakia's national accounts were overestimated after 2016, and thus also in the input data for PPP calculations. Without additional information, however, it is difficult to adjust these expenditures to a more realistic level.

Figure 2. Housing rentals (imputed + actual) – Expenditures per capita in post-communist EU Member States in 2016 and 2021, in EUR.





Source: Eurostat 2023e

Too-Fast Growth of Housing Rentals Expenditures from 2016

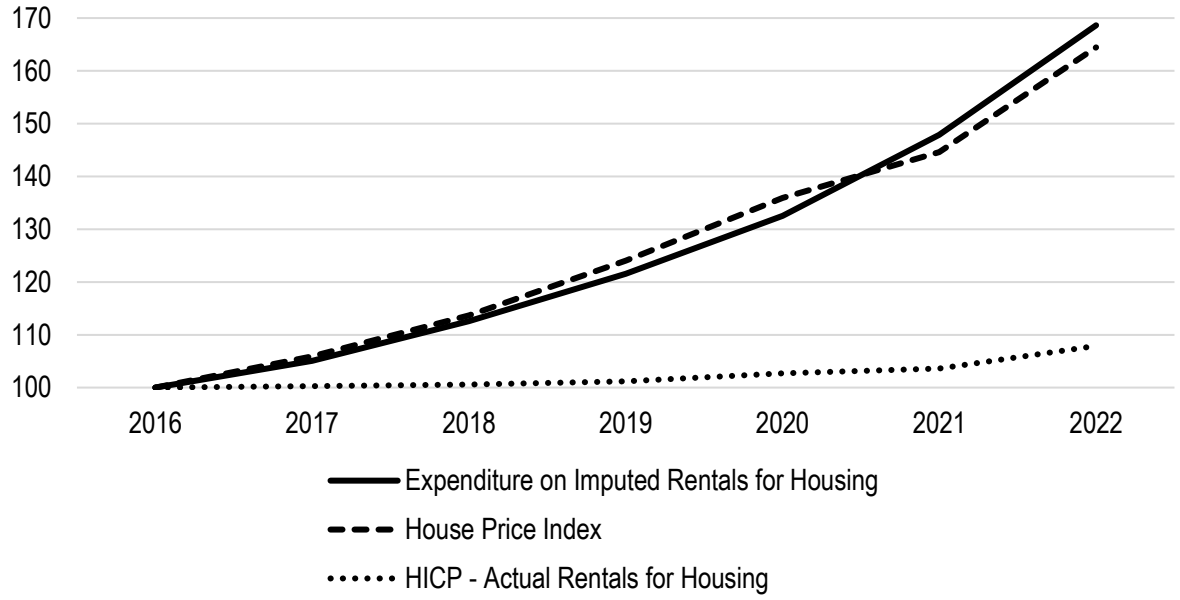
Since national statistical institutes of EU countries have limited capabilities, expenditures on rentals for housing in national accounts are usually calculated from data that were collected only for the base year (e.g., 2015). Amounts for other years are then extrapolated using the evolution of the housing stock and an appropriate price index. Eurostat's *Handbook on Price and Volume Measures in National Accounts* (Eurostat 2016) recommends the use of a consumer price index for privately rented dwellings that takes full account of changes in the quality of dwellings. It refers to the Harmonised Index of Consumer Prices (HICP) for actual rentals for housing as a "potentially useful series" (44).

Figure 3 shows the evolution of expenditures on imputed rentals for housing in Slovakia's national accounts (OECD 2023), as well as of the HICP for actual rentals (Eurostat 2023c) and of the House Price Index (HPI) (Eurostat 2023d). The HPI measures the change in market prices of all residential properties that are purchased by households (Eurostat 2017). In the figure, we can see that expenditures on imputed rentals in the national accounts are growing much faster in Slovakia than the HICP for actual rentals. These expenditures, however, exhibit a growth rate that is nearly identical to that of the HPI index of real estate acquisition prices.

According to Eurostat reports on the quality of the Harmonised Index of Consumer Prices during this period, Slovakia's HICP for actual rentals for housing only captured changes in the rental prices for flats and houses rented out by municipalities. Privately rented dwellings were not covered by this price index in Slovakia due to the lack of reliable data (Eurostat 2018). Slovakia's HICP for actual rentals for housing is therefore not suitable for extrapolating expenditures on imputed rentals in the national accounts.

Extrapolation of expenditures on imputed rentals with the House Price Index would, however, involve the use of a price index that is unsuitable for this purpose. Eurostat regards the use of acquisition prices of new dwellings in the extrapolation/deflation of national accounts as an inappropriate method that should not be used, as such prices do not relate to the rental income of the dwelling (Eurostat 2016).

Figure 3. Expenditure on Imputed Rentals for Housing; HICP for Actual Rentals for Housing; House Price Index (HPI); Slovakia in 2016 = 100.



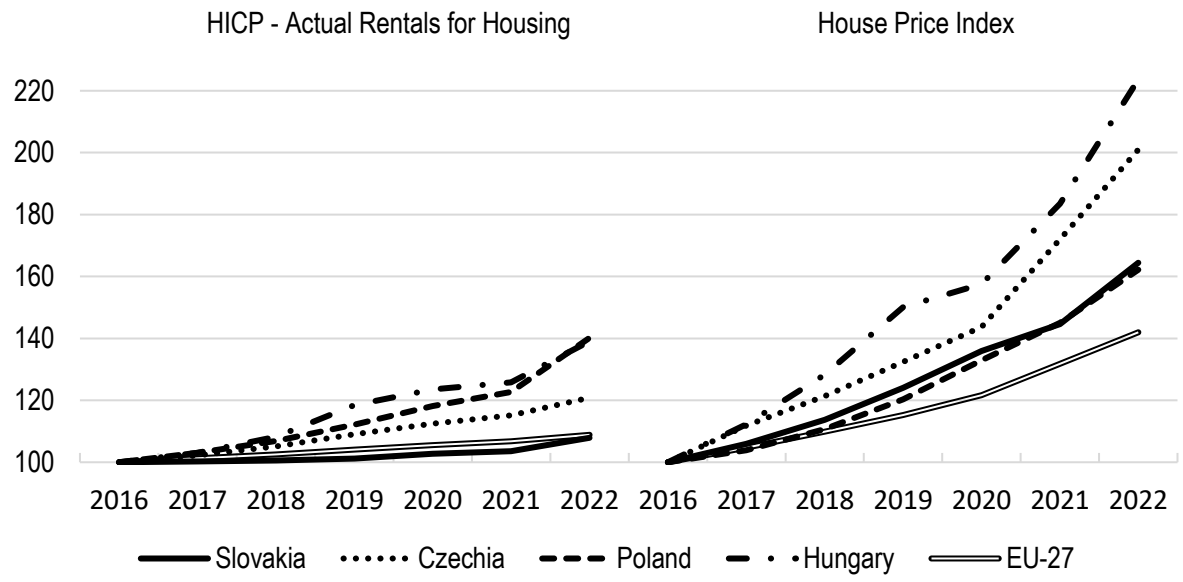
Source: Eurostat 2023c, 2023d; OECD 2023

Figure 4 compares the evolution of the HICP for actual rentals for housing and the HPI in the Visegrad Group (V4) countries since 2016 (Eurostat 2023c, 2023d). Slovakia's HICP for actual rentals clearly grew at the slowest rate among the V4 countries, and also more slowly than the same index for the EU as a whole. Given that Slovakia's HICP only captures rental prices in municipal dwellings, which are often regulated, such evolution is not surprising. A price index reflecting market rents for privately rented dwellings would likely grow at a faster rate. The House Price Index (HPI)

grew faster in Slovakia than for the EU-27 as a whole, and at a pace similar to that seen in Poland.

According to the HPI index, real estate prices in all V4 countries, as well as in the European Union as a whole, grew faster than housing rents. If real estate prices in Slovakia also grew faster than rental prices, the expenditure on imputed rentals in Slovakia – which has grown at approximately the same rate as the HPI in the country's national accounts – is overestimated in the input data for PPP calculations from 2016 onwards.

Figure 4. HICP for Actual Rentals for Housing and House Price Index (HPI); 2016 = 100.



Source: Eurostat 2023c, 2023d

Reporting of Underestimated Surface Areas of Flats and Houses from 2017

Between 2016 and 2017, there was yet another sizeable increase in the PPPs of imputed and actual rentals for housing in the detailed PPP data. This increase was significantly larger than could reasonably be expected as a result of the rapidly growing nominal expenditures on rentals.

Despite the fact that a hybrid method – the stratification method for flats and the user cost method for houses – is used to estimate expenditures on housing rentals in Slovakia's national accounts, Eurostat applies the quantity approach when calculating purchasing power parities for imputed and actual rentals in the country. Purchasing power parities for housing rentals are thus calculated by dividing the ratio of final housing expenditures by the volume measure. As a consequence, PPPs for housing rentals are directly proportional to the amount of final housing expenditures in Slovakia, but inversely proportional to the total usable surface area of flats and houses per capita in the country. The observed increase in PPPs may thus be the result of a change in the reporting of total usable surface area per capita of dwellings in Slovakia. Note that data on the usable surface area of flats and houses are provided to Eurostat by the Statistical Office of the Slovak Republic on a separate form that is submitted independently of national accounts data (Eurostat-OECD 2012).

Between 2016 and 2017, there was a significant drop – by approximately a quarter – in the surface area of dwellings reported to Eurostat by the Statistical Office of the Slovak Republic. This decline can be seen not only in the total surface area of flats and houses in Slovakia, but also for each type of dwelling separately in the data on the average area of flats and houses with different numbers of rooms. Before 2017 the surface area of dwellings per capita in Slovakia was comparable to other Visegrad Group countries. Since 2017, however, this number has been lower by a significant margin.

Table 4 contains comparisons of the total livable and usable (or floor) area of selected types of flats and houses in Slovakia in 2016 as reported in Hajnovičová and Horecká (2018). The decrease in the reported area of dwellings by about a quarter – especially as the data showed decreases in the average area of flats and houses of all sizes at the same time – suggests that there was a change from reporting the usable (or floor) surface area to reporting only the livable surface area.

Table 4: Livable and floor area of selected types of flats and houses, 2016

	Total area in Slovakia, m²		
	Livable	Floor	Share
Owner-occupied flats	38 278 759	51 814 192	73,9%
Rented municipal and state flats	2 091 170	2 947 405	70,9%
Rented flats in NPISH sector	147 178	222 350	66,2%
Cooperative flats	1 787 621	2 321 923	77,0%
Cooperative houses	35 936	48 384	74,3%

Source: Hajnovičová and Horecká 2019

Unlike the usable (or floor) area, the livable area of dwellings does not include, for example, corridors or bathrooms. However, the *Eurostat-OECD Methodological Manual on Purchasing Power Parities* requires national statistical institutes to report the *usable* surface area. Stairs, balconies, terraces, cellars and attics are not included in the usable area. However, it still includes corridors, bathrooms, toilets and the like (Eurostat-OECD 2012). As a result of the incorrect reporting of the surface area of flats and houses, the prices of rentals for housing in Slovakia have likely been overestimated by approximately a third since 2017.

Significant Revision of Expenditures on Construction and Health

The 2019 benchmark revision of Slovakia's national accounts led to a significant change not only in the reported expenditures on rentals for housing, but also on other

categories of goods and services. Due to Eurostat's revision policy, which allows retrospective revisions only three years into the past, we observe jumps in the nominal expenditures on these goods in the input data for PPP calculations between 2015 and 2016 as well.

Table 5 presents a comparison of nominal expenditures and Price Level Indices in 2015 and 2016 for analytical categories in the input data. The data for 2015 represent the original data from before the benchmark revision, whereas those for 2016 already reflect changes brought about by the revision.

Table 5: Nominal expenditures and Price Level Indices in PPP for analytical categories, 2015 and 2016

	Nominal expenditures			Nominal expenditures (% of GDP)			Price Level Index in PPP (EU-27 average = 100)		
Analytical category	2015	2016	Difference (mil. EUR)	2015	2016	Difference (pp)	2015	2016	Difference
Housing, water, electricity, gas and other fuels	10 321	13 196	2 875	12,9%	16,2%	3,3 pp	51,8	75,2	23,4
Alcoholic beverages, tobacco and narcotics	2 109	2 520	411	2,6%	3,1%	0,5 pp	76,7	77,6	0,9
Household furnishings, equipment and maintenance	2 431	2 659	228	3,0%	3,3%	0,3 pp	81,7	82,9	1,2
Clothing and footwear	1 630	1 772	142	2,0%	2,2%	0,2 pp	99,6	99,6	0,0
Restaurants and hotels	2 374	2 467	93	3,0%	3,0%	0,0 pp	75,7	75,8	0,1
Education	3 228	3 248	20	4,0%	4,0%	0,0 pp	55,9	53,3	-2,6
Communication	1 410	1 416	6	1,8%	1,7%	-0,1 pp	82,3	83,7	1,4
Food and non-alcoholic beverages	7 331	7 284	-47	9,1%	9,0%	-0,1 pp	90,1	88,0	-2,1
Transport	3 095	2 950	-145	3,9%	3,6%	-0,3 pp	74,3	77,8	3,5
Machinery and equipment	9 016	8 419	-597	11,3%	10,4%	-0,9 pp	96,4	96,4	0,0
Miscellaneous goods and services	5 398	4 632	-766	6,7%	5,7%	-1,0 pp	68,1	72,9	4,8
Health	6 312	5 301	-1 011	7,9%	6,5%	-1,4 pp	50,9	51,3	0,4
Construction	8 348	6 899	-1 449	10,4%	8,5%	-1,9 pp	70,8	68,7	-2,1
Software	-	-	-	-	-	-	93,1	95,1	2,0

Source: OECD 2019, 2023

After the revision, the most notable increase in expenditures and a dramatic increase in the Price Level Index was recorded in the analytical category *Housing, water, electricity, gas and other fuels*, primarily due to the significantly higher estimate of expenditures on housing rentals. *Alcoholic beverages, tobacco and narcotics* is another category that recorded a sizeable increase in nominal expenditures. However, the benchmark revision also led to a significant decrease in reported expenditures on construction and health, as spending on each of these two categories was more than one thousand million euros lower in the input data for PPPs calculations in the post-revision year 2016 compared to the pre-revision year 2015. These changes in reported expenditures are in line with claims by the Statistical Office of the Slovak Republic (2023), according to which the benchmark revision had the most significant impact on estimates of dwelling services, the non-observed economy (which includes narcotics), construction and household expenditures on health.

5. Estimation of Alternative Scenarios

In this section, we estimate what the evolution of Slovakia's per capita GDP at PPP would have looked like in the absence of the housing rentals-related shortcomings in the input data. This paper is among the first to estimate this evolution by adjusting the input data to Eurostat's PPP calculations for Slovakia at the detailed basic heading level. As such, it offers a surgical approach to the estimation of alternative scenarios in that only the problematic basic headings in the input data are replaced. By contrast, previous studies have typically taken a more heavy-handed approach by extrapolating using the growth rate of real GDP for the entire economy (Habrman, Habodászová and Šrámková 2022; Horňák and Valachyová 2022; NBS 2022, 2023; Novák et al. 2022), with the notable exception of Dujava and Žúdel (2023) whose approach is similar to ours.

We estimate two alternative scenarios for the evolution of Slovakia's GDP per capita at PPP between 2010 and 2022. In one scenario, labeled *SK-H*, we assume that prices of housing rentals in Slovakia are equal to the highest prices among other post-communist EU countries. In practice, this means that we replace Slovak prices of actual rentals for housing by those from Slovenia from 2010 to 2021, and from Estonia in 2022. We replace Slovak prices of imputed rentals for housing by those from Slovenia from 2010 to 2017, and from Czechia from 2018 onwards. As we saw in Figure 2, the prices of housing rentals tend to rise with a country's nominal GDP. Since Slovakia does not have the highest nominal GDP among the post-communist countries of the European Union, we may reasonably assume that the highest rental prices among this group represent an upper limit to what prices are plausible for Slovakia.

The other scenario, labeled *SK-L*, assumes that prices of rentals for housing are, on the contrary, equal to the lowest prices among other post-communist EU countries. In particular, we replace Slovak prices of actual rentals for housing by those from Poland throughout the 2010 – 2022 time period. We also replace Slovak prices of imputed rentals for housing by those from Poland from 2010 to 2013 and later from 2017 to 2022, and by those from Bulgaria from 2014 to 2016. This scenario serves as a sensitivity check that allow us to test whether different assumptions about the price of rentals significantly affect our estimates.

Since we do not possess enough information to establish whether the post-revision expenditures on health and construction are more or less plausible than their pre-revision values, the spending on these analytical categories remains unchanged in our alternative scenarios. Nevertheless, after estimating the *SK-H* and *SK-L* alternative scenarios, we also calculate the approximate impact of the revision of construction and health spending. In this way, we get an indication of how much of the sudden decrease in Slovakia's

convergence level to the EU-27 average can be explained by the significant downward revision of these analytical categories.

Note that our analysis only focuses on adjusting the input data for Slovakia, but does not make any changes to the data for other countries. While it is possible that Slovakia is not the only country whose input data may exhibit shortcomings, the estimation of alternative scenarios for other countries is beyond the scope of our analysis.

Estimation Procedure

When estimating the evolution of Slovakia's per capita GDP at PPP in our two alternative scenarios, we adjust the input expenditure and purchasing power parity data for the relevant basic headings. We proceed as follows:

(1) In the data for the pre-revision years 2010 to 2015, we adjust expenditures for the basic headings into which intermediate consumption was classified in the original detailed PPP data. We do not have sufficient information about the shares of intermediate consumption that were classified into particular basic headings. We therefore adjust the nominal expenditures on all of them so that the expenditure on each of these basic headings is, as a proportion of the total expenditure in the Slovak economy (with the exception of expenditures on rentals and the adjusted basic headings themselves), equal to its post-revision average for the period since 2016. Such an adjustment will prevent any sudden jumps in spending on the adjusted basic headings.

(2) In the data for years from 2017 onwards, which were affected by changes in the reporting of the surface area of houses and flats in Slovakia, we adjust the PPPs for imputed and actual rentals for housing in each year based on the ratio of the reported total surface area from 2017 (representing only the livable area) to the reported total surface area from of 2016 (corresponding to the usable area, in

accordance with the Eurostat methodology). We obtain the relevant surface areas from Eurostat's detailed data on the housing stock in Slovakia. This adjustment has no effect on nominal expenditures in the input data, as it refers to values that the Member States' national statistical institutes provide to Eurostat on a separate questionnaire, independently of the national accounts.

(3) In each year from 2010 to 2022, we replace the Price Level Indices (PLIs) for imputed and actual rentals. In the *SK-H* scenario, we replace them with the highest prices of rentals among other post-communist EU countries. In the *SK-L* scenario, we use the lowest prices of rentals from among the same group of Member States.

(4) We adjust the PPPs for imputed and actual rentals in the input data based on the replaced PLIs. We subsequently adjust the nominal expenditures for imputed and actual rentals so that they are in line with the total usable surface area of houses and flats in Slovakia. Please note that total nominal GDP changes in this step, as the choice of higher PLIs for housing rentals also leads to an increase in the corresponding nominal expenditures, and vice versa.

(5) The above steps yield adjusted input data, in which shortcomings related to incorrectly classified intermediate consumption in the data from 2010 to 2015, as well as changes in the reporting of the surface area of dwellings from 2017 onwards, are corrected. The expenditures on actual and imputed rentals in the adjusted data are modified to be in accordance not only with the adjusted PPPs, but also with the total usable surface area in Slovakia.

(6) Finally, we compute purchasing power parities for GDP from the adjusted input data using the Eurostat-OECD (2012) methodology. From these results, we calculate Slovakia's GDP per capita at PPP as a proportion of the EU-27 average.

Since purchasing power parity statistics reflect differences in *relative* price levels across countries, changes in the input data for Slovakia will affect the statistics of *all* other EU-27 Member States as well. Expenditures on rentals in Slovakia, however, constitute only a small part of the total EU-27 expenditures. Changes in the input data for Slovakia therefore only have a minimal impact on the statistics of other Member States. In both of our scenarios, the PPPs of other countries change by amounts that are nearly imperceptible at the level of rounding precision used in the published results. For ease of interpretation and communication of our results, we therefore present values from the publicly available official Eurostat statistics for other EU-27 countries in all comparisons.

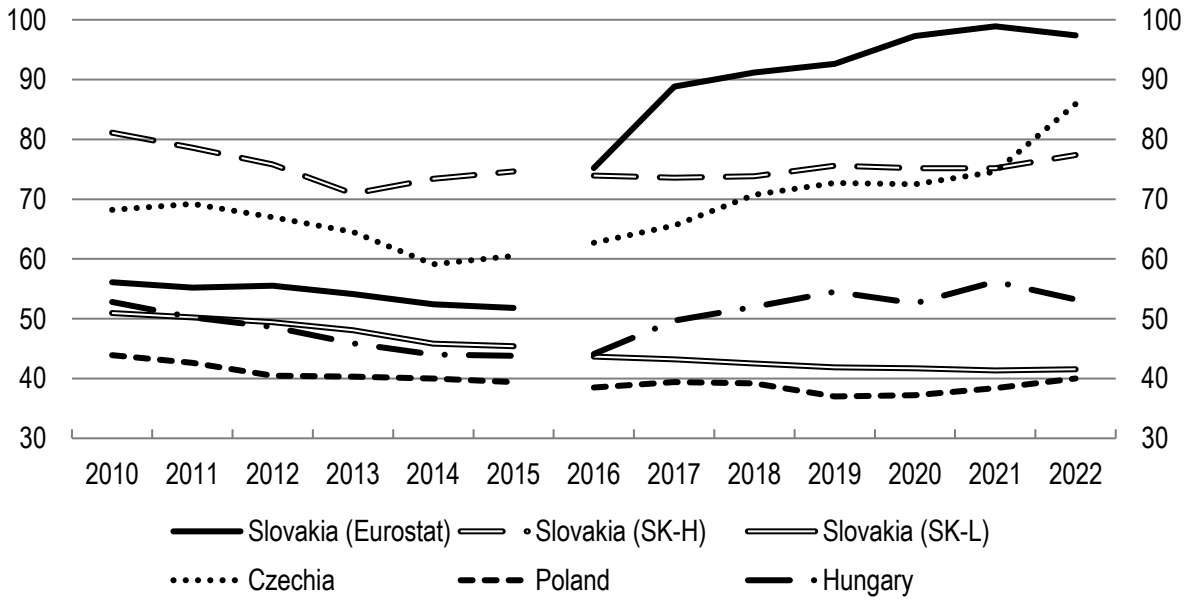
The discussion of our results is limited only to the period since 2016, as during that time Slovakia's national accounts incorporated information from updated data sources and methodological refinements associated with the benchmark revision. In the figures and tables, however, we present statistics both for the pre-revision period from 2010 to 2015 and the post-revision period from 2016 to 2022. Due to methodological differences, statistics from the period before and since 2016 are not directly comparable. For this reason, the lines shown in figures are not connected between 2015 (reflecting data from before the benchmark revision) and 2016 (after the revision).

Evolution of Price Level Indices

Eurostat requirements do not allow us to publish PLIs at the level of the basic headings *Imputed rentals for housing* and *Actual rentals for housing*. Instead, we illustrate their evolution indirectly using the publicly available analytical category *Housing, water, electricity, gas and other fuels*. The basic headings for imputed and actual rentals have a significant weight in this category, as they jointly account for slightly more than 50 percent of nominal expenditures in the adjusted data for 2016.

Figure 5 depicts our estimates of the evolution of the PLI for the *Housing, water, electricity, gas and other fuels* analytical category. In the *SK-H* alternative scenario, the price level of this analytical category was relatively stable from 2016 to 2022, at the level of approximately three quarters of the EU-27 average. The price level in Slovakia was the highest among the V4 countries until 2021, after which it was exceeded by Czechia. The price level was also relatively stable in the *SK-L* scenario, albeit at a significantly lower level. It reached only slightly more than 40 percent of the European Union average, corresponding to the second lowest housing prices among the V4 countries during the period since 2016, more expensive than only Poland.

Figure 5. Alternative scenarios – Price Level Index at PPP for Housing, water, electricity, gas and other fuels; EU-27 average = 100.

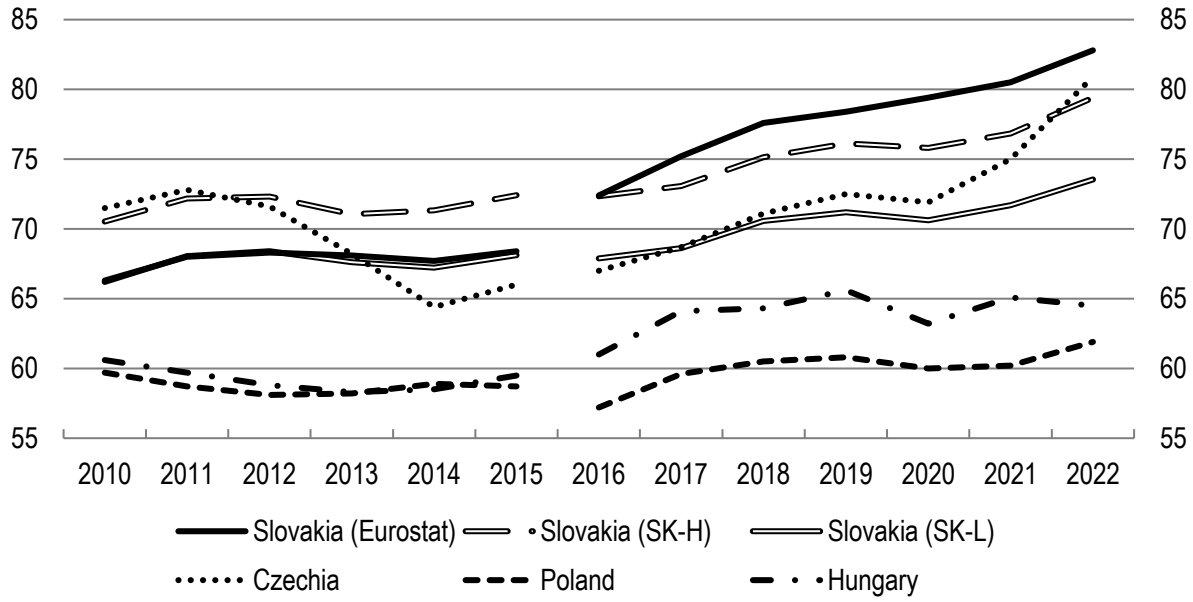


Source: Eurostat 2023e and author's estimates

Having adjusted the PLIs for imputed and actual housing rentals, we calculate the aggregate PLI for the country's GDP in each year. In the *SK-H* scenario, Slovakia's economy-wide price level in 2016 was estimated to be at 72.3% of the EU-27 average, as

shown in Figure 6. In 2019, the last year before the COVID pandemic, the price level in Slovakia reached 76.1% of the EU-27 average, and in 2022 it reached 79.4%. In the *SK-L* scenario, the price level in the Slovak economy was several percentage points lower. It was at 71.2% of the EU average in 2019, and at 73.5% in 2022.

Figure 6. Alternative scenarios – Price Level Index at PPP for GDP; EU-27 average = 100.



Source: Eurostat 2023e and author's estimates

Convergence in GDP per Capita at PPP

Despite the difference in the estimated price levels, Slovakia's GDP per capita at PPP exhibits a similar convergence level to the EU-27 average in both alternative scenarios. Our estimates are presented in Table 6 and depicted in Figure 7. In tables and figures, we round Slovakia's convergence level to one decimal place in order to be able to report the small differences between alternative scenarios *SK-H* and *SK-L*. By contrast, other countries' convergence levels are rounded to whole percentages, as that is the level of precision that Eurostat uses in the published time series (Eurostat 2023b).

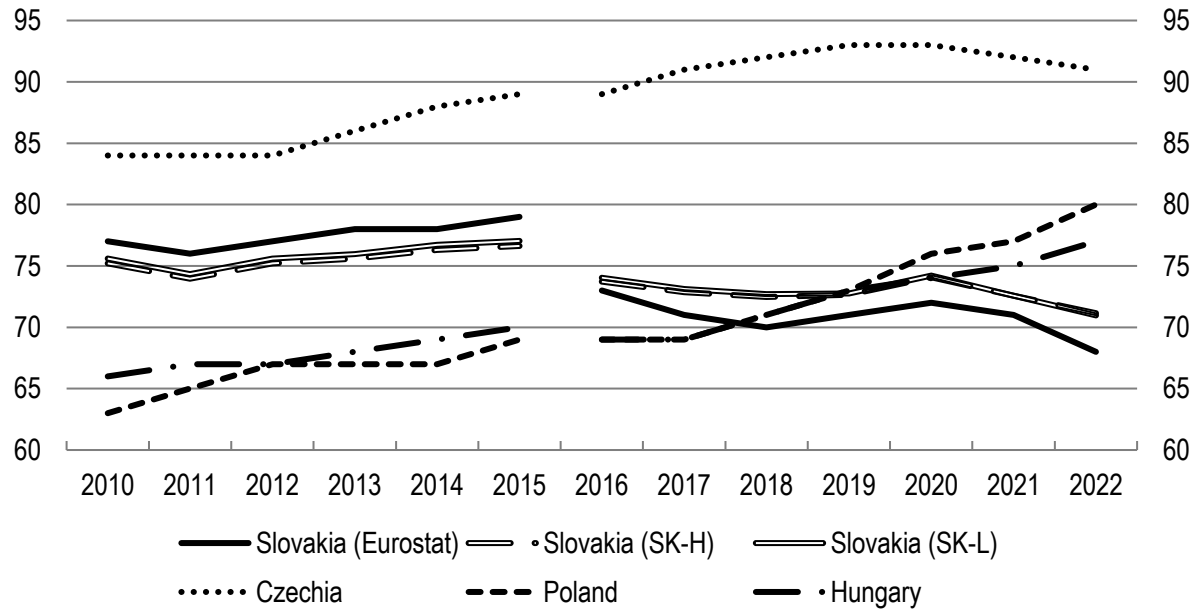
Table 6: Alternative scenarios – GDP per capita in PPP as a percentage of EU-27 average

V4 Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Slovakia													
- SK-E: Eurostat	77	76	77	78	78	79	73	71	70	71	72	71	68
- SK-H:													
most expensive rentals	**75,2**	**74,0**	**75,2**	**75,6**	**76,3**	**76,6**	**73,7**	**72,9**	**72,5**	**72,6**	**74,1**	**72,6**	**71,2**
- SK-L:													
least expensive rentals	**75,6**	**74,3**	**75,6**	**76,0**	**76,7**	**77,0**	**74,0**	**73,1**	**72,7**	**72,8**	**74,2**	**72,6**	**71,0**
Czechia	84	84	84	86	88	89	89	91	92	93	93	92	91
Poland	63	65	67	67	67	69	69	69	71	73	76	77	80
Hungary	66	67	67	68	69	70	69	69	71	73	74	75	77
EU-27 Average	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Eurostat 2023e and author's estimates

In 2016, Slovakia's convergence level was at 73.7% of the EU average in the *SK-H* scenario and at 74.0% in the *SK-L* scenario (compared to 73% in official Eurostat statistics). In the pre-pandemic year 2019, Slovakia's convergence level was at 72.6% of the EU-27 average in the *SK-H* scenario and at 72.8% in the *SK-L* scenario (compared to 71% according to Eurostat). In that year, both Poland and Hungary caught up with Slovakia in per capita GDP at PPP – a year later than in the official statistics. In 2022, Slovakia's GDP per capita at PPP was only equal to 71.2% of the EU-27 average in the *SK-H* scenario and 71.0% in the *SK-L* scenario (compared to 68% in official Eurostat statistics) – a drop of approximately three percentage points compared to 2016. This would mean a poor 25th place among the EU Member States (compared to 25th-26th place according to official statistics), just ahead of Greece (68% of the EU-27 average) and Bulgaria (59%).

Figure 7. Alternative scenarios – GDP per capita at PPP as a percentage of EU-27 average.



Source: Eurostat 2023e and author's estimates

According to our alternative estimates, GDP per capita at PPP in Slovakia as a percentage of the EU-27 average during the period from 2016 to 2022 was approximately two percentage points higher in each year than official statistics indicate. However, Slovakia still experienced stagnation, or even a decline, in per capita GDP at PPP compared to the EU average during this time period, and was caught up or even overtaken by Poland and Hungary.

Table 7: Alternative scenarios – Country ranking (2016, 2019 and 2022): GDP per capita in PPP as a percentage of EU-27 average

	EU-27 Member State	2016		EU-27 Member State	2019		EU-27 Member State	2022
1	Luxembourg	278	1	Luxembourg	251	1	Luxembourg	261
2	Ireland	177	2	Ireland	189	2	Ireland	233
3	Austria	130	3	Netherlands	127	3	Denmark	137
4	Netherlands	129	4	Denmark	126	4	Netherlands	129
5	Denmark	128	4	Austria	126	5	Austria	125
6	Germany	125	6	Germany	121	6	Belgium	120
7	Sweden	124	7	Sweden	119	6	Sweden	120
8	Belgium	120	8	Belgium	118	8	Germany	117
9	Finland	111	9	Finland	109	9	Finland	109
10	France	106	10	France	106	10	France	102
11	Italy	99	11	Malta	104	10	Malta	102
12	Malta	98	12	Italy	97	12	Italy	96
13	Spain	92	13	Czechia	93	13	Cyprus	92
14	Czechia	89	13	Cyprus	93	13	Slovenia	92
15	Cyprus	88	15	Spain	91	15	Czechia	91
CD (2	Slovenia	84	16	Slovenia	89	16	Lithuania	89
17	Portugal	78	17	Lithuania	84	17	Estonia	87
18	Estonia	77	18	Estonia	82	18	Spain	85
19	Lithuania	76	19	Portugal	79	19	Poland	80
20	**Slovakia (SK-L)**	**74,0**	**20**	**Slovakia (SK-L)**	**72,8**	20	Hungary	77
20	**Slovakia (SK-H)**	**73,7**	**20**	**Slovakia (SK-H)**	**72,6**	20	Portugal	77
20	**Slovakia (Eurostat)**	**73**	20	Hungary	73	20	Romania	77
21	Hungary	69	20	Poland	73	23	Latvia	74
21	Poland	69	**22**	**Slovakia (Eurostat)**	**71**	24	Croatia	73
23	Greece	68	23	Romania	70	**25**	**Slovakia (SK-H)**	**71,2**
24	Latvia	66	24	Latvia	69	**25**	**Slovakia (SK-L)**	**71,0**
25	Croatia	62	25	Croatia	67	**25**	**Slovakia (Eurostat)**	**68**
26	Romania	59	26	Greece	66	25	Greece	68
27	Bulgaria	49	27	Bulgaria	53	27	Bulgaria	59

Source: Eurostat 2023e and author's estimates

Shortcomings in the estimate of rental expenditures can explain around half of the sudden downward jump in the convergence level that we see in the official statistics between 2015 and 2016 – i.e., approximately 3 percentage points of the 6 percentage-point jump. If spending on construction and health had remained at the same level in 2016 as in the pre-revision data for 2015, Slovakia's convergence level to the EU-27 average in 2016 would have been around 1.6 percentage points higher than suggested by the *SK-H* scenario. Revisions to construction and health spending can thus explain nearly a further third of the total jump.

Insensitivity to Changes in Assumptions about Housing Rentals Prices

Our methodology for estimating alternative scenarios adjusts nominal expenditures based on the assumed level of rental prices, in accordance with the Eurostat-

OECD (2012) guidelines. An increase in prices also causes an increase in nominal expenditures, and these two phenomena have countervailing effects on the convergence level. As a result, our estimates of Slovakia's convergence level to the EU-27 average in GDP per capita at PPP are not very sensitive to changes in assumptions about the prices of actual and imputed rentals.

Our estimates differ from official Eurostat statistics mainly due to the correction of intermediate consumption misclassification (before 2016) and of the reported surface area of dwellings (from 2017). They depend only to a very limited extent on our assumptions about the price of rentals in Slovakia relative to other post-communist countries. In particular, Slovakia's estimated convergence levels to the EU-27 average in GDP per capita at PPP in the *SK-H* and *SK-L* alternative scenarios differ by a maximum of 0.3 percentage points in the period since 2016.

6. Comparison with Other Institutions' Estimates

Because the evolution of Slovakia's GDP per capita at PPP in official Eurostat statistics seemed unrealistic, several public institutions and private commercial banks in Slovakia have calculated their own alternative estimates.

Aside from our paper, the only other study that relies on the Eurostat-OECD (2012) methodology is *On Purchasing Parity*, a March 2023 policy brief by the Institute for Financial Policy (IFP) of the Ministry of Finance of the Slovak Republic (Dujava and Žúdel 2023). It draws attention to prices in the *Housing, water, electricity, gas and other fuels* analytical category, and acknowledges that methodological differences could have an upward influence on prices in Slovakia in components other than housing as well. If housing prices in Slovakia had been at the level of those in Czechia, this policy brief estimates that, in 2021, Slovakia's GDP per capita at PPP would have been at 72% of the EU-27 average in GDP per capita at PPP – only one percentage point less than our

estimate for the same year. The *On Purchasing Parity* policy brief, unlike most other analyses, correctly points out that Slovakia's PPP statistics since 2016 have been affected by the 2019 benchmark revision of the country's national accounts.

Other institutions' estimates generally assume that Slovakia's GDP per capita at PPP statistics were reliable before 2016, and use the growth rate of real GDP to extrapolate their evolution from that year. Estimates based on this approach tend to be significantly more optimistic than those presented in our paper:

- In its analysis *Reform Compass of the Slovak Economy* (Habrman, Habodászová and Šrámková 2022) from August 2022, the IFP notes that official Eurostat figures, which show a "sharp decline in 2016 and 2017 and subsequent stagnation" (10) for Slovakia, are "unintuitive and do not correspond to the development of real GDP in the country" (10). The analysis points to the rapid rise of the PLI for *Housing, water, electricity, gas and other fuels* after 2015, but also points to "unpredictable price developments in other categories, especially in actual collective consumption" (11). According to this study, Slovakia's GDP per capita at PPP could have been between 74% and 84% of the EU-27 average in 2020. Our analysis estimates 74% for 2020, a convergence level that corresponds to the lower bound of the study's estimate.
- Habrman (2018), an older policy brief by the IFP from January 2018, relies on calculations by the World Bank, which extrapolate from the price level at PPP in 2011 using the growth rate of real GDP. In this approach, Slovakia was at an estimated 80% of the EU-27 average in 2016 – a higher convergence level compared to official Eurostat statistics, which at the time indicated 76%. Our estimate for 2016 shows a convergence level of 74%. Habrman (2018) is based on statistics on purchasing power parities that predate the benchmark revision of

Slovakia's national accounts in 2019. Haluška and Dolinič (2018) also published a study that is based on pre-revision PPP statistics. It found that the performance of the Slovak economy had already slowed down between 2010 and 2017, mainly due to the more sluggish growth in domestic demand.

- In the document *Structural Challenges* (NBS 2022) from July 2022, the National Bank of Slovakia (NBS) points out that "the evolution of GDP per capita at purchasing power parity (PPP) has since 2015 been greatly affected by problematic estimation; however, even an analytical adjustment of the indicator, using GDP per capita at constant prices, confirms the slowdown in convergence with the EU" (11). After this analytical adjustment, the NBS estimates that Slovakia's GDP per capita at PPP in 2021 was at 81% of the EU-27 average, compared to 73% in our estimate. The NBS gives the same estimate in the analytical commentary *Slovakia 30 Years Ago and Today* (Novák et al. 2022) from December 2022.
- A more recent edition of the NBS *Structural Challenges* document (NBS 2023) from July 2023 points out that "methodological problems surround the estimation of the evolution of per capita GDP at purchasing power parity" (12). It notes, however, that analytical adjustments to the indicator based not only on the evolution of GDP per capita in constant prices, but also based on the Harmonised Index of Consumer Prices (HICP), suggest that "convergence was already slowing significantly even in the pre-pandemic period" (13). In a footnote, this document admits the possibility that "the assumption of the correctness of per capita GDP at purchasing power parity in 2015 may not necessarily be valid" (12).
- In the analysis *30 Years of Slovakia's Independence* (Horňák and Valachyová 2022) from December 2022, the commercial bank Slovenská sporiteľňa (SLSP)

recalculates the evolution of the country's GDP per capita at PPP since 2015 using the growth rate of real GDP per capita. According to the SLSP analysis, the Slovak economy reached approximately 81% of the performance of the EU-27 countries in 2021, compared to 73% in our estimate. The SLSP estimate of the convergence level matches the NBS (2022) estimate, an unsurprising result given that SLSP and the NBS used the same method to estimate the trajectory of GDP per capita at PPP.

Overestimation of Convergence Level in Other Institutions' Estimates

Studies that rely on real GDP growth rates to extrapolate from a base year (typically 2015, the last year before the sudden drop in the convergence level), such as those described earlier, use an approach that overestimates Slovakia's convergence level to the EU-27 average in GDP per capita at PPP. This problem occurs as a consequence of two facts. Firstly, the extrapolation starts from a too-high initial level of per capita GDP at PPP, due to the misclassification of intermediate consumption before the benchmark revision of Slovakia's national accounts. Secondly, GDP at purchasing power parity and real GDP do not reflect the same concept of economic performance. While GDP at PPP, as calculated using the Eurostat-OECD (2012) methodology, reflects a purchasing power concept of GDP, real GDP reflects a production concept (Feenstra et al. 2009).

GDP at PPP measures the overall purchasing power in the economy. Purchasing power in the economy can increase even when domestic production does not change. That can happen, for instance, when the prices of imported goods or services decrease, allowing a country's inhabitants to buy more with the same income. Alternatively, an increase in the prices of exported goods would lead to an increase in the inhabitants' incomes. The Eurostat-OECD (2021) methodology for calculating GDP at PPP does not take into account differences in the terms of trade (relative prices of exports and imports)

between countries. This concept of measuring the gross domestic product reflects the real incomes of inhabitants, which can increase thanks to either lower export prices or increased production in the economy. By contrast, real GDP captures the total physical volume of goods and services produced in the economy. To calculate it, it is crucial to be able to disaggregate the evolution of export and import prices from that of their physical volume. The growth rate of real GDP thus also reflects changes in the terms of trade (Feenstra, Inklaar and Timmer 2013).

If a country has favorable terms of trade – that is, if it exports goods and services at relatively high prices compared to the prices at which it imports them – its GDP at PPP (purchasing power concept) will be higher than its real GDP (production concept). The opposite will be true if the country imports relatively expensively and exports relatively cheaply. Dujava and Žúdel (2023) report that the prices of Slovak exports have long been growing more slowly than the prices of imports. The unfavorable evolution of the terms of trade means that real GDP growth in Slovakia has been faster than GDP growth in PPP terms. The use of the real GDP growth rate as a substitute deflator for extrapolation therefore overestimates the speed and level of Slovakia's convergence to the EU-27 average in GDP per capita at PPP.

7. Conclusions

The sudden drop in Slovakia's convergence level in GDP per capita at PPP between 2015 and 2016 in official Eurostat statistics, followed by a continued stagnation and even decline, was met with skepticism in the country's economic policy community. In response, several public institutions and private commercial banks have indicated that they find this statistic's evolution to be unlikely. Based on the assumption that the country's convergence level had been plausible before 2016, these institutions produced

alternative estimates of Slovakia's convergence level that typically extrapolated from a base year, such as 2015, using the growth of real GDP. Most of these estimates have indicated a more optimistic evolution of Slovakia's convergence to the EU-27 average than the official Eurostat figures.

In this paper, we have shown that the observed drop is largely due to the fact that the 2019 benchmark revision of Slovakia's national accounts only affected the official PPP statistics from 2016 onwards, due to Eurostat's policy of revising the time series no further than three years into the past. In addition, we have identified several shortcomings in the input data for PPP calculations, which are provided to Eurostat by the Statistical Office of the Slovak Republic. The most important of these involve the likely overestimation of expenditures on housing rentals in the country's national accounts after their revision, the reporting of underestimated surface areas of dwellings in Slovakia from 2017, and – before the benchmark revision – the misclassification of intermediate consumption related to dwelling services.

Using the Eurostat-OECD (2012) methodology for calculating purchasing power parities, we have estimated alternative scenarios in which we corrected these shortcomings. In sharp contrast to the relatively optimistic alternative estimates of several other Slovak institutions, we have found that Slovakia's convergence to the EU-27 average in per capita GDP at PPP would have been higher only by a couple of percentage points, and would still be stagnating.

From a methodological perspective, the fact that our alternative estimates are significantly less optimistic than those of other institutions highlights the importance of distinguishing between purchasing power and production concepts of GDP (Feenstra et al. 2009). When applying approaches that extrapolate GDP per capita at PPP using the growth rate of real GDP, researchers and policy-makers ought to be conscious of the fact

that the evolution of a country's terms of trade – the relative prices of export and imports – can bias their estimates (Dujava and Žúdel 2023).

Our findings suggest the need for improved quality control, on the part of both national statistical institutes, which collect and submit the input data, and Eurostat, which receives these data and uses them to compute PPP statistics. This need is not limited to Slovakia, as the purchasing power parity statistics of other EU Member States may also suffer from shortcomings that could raise questions about their quality or suitability for use in international comparisons.

In the case of Slovakia, caution is warranted in interpreting any of its PPP statistics until the shortcomings in the country's national accounts and housing stock data are brought fully into line with Eurostat's methodological requirements. Due to Eurostat's three-year limit on retrospective revisions of the PPP input data, another break in the time series is likely to occur after the shortcomings are corrected. We also recommend the swift implementation of the recommendations laid out in Eurostat reports on the quality of the Harmonised Index of Consumer Prices (HICP) for Slovakia. The monitoring report from February 2021 recommended that the Statistical Office of the Slovak Republic "continue investigating the data availability on dwellings rented out by private landlords" in order to improve the quality of the HICP for actual rentals for housing (Eurostat 2021, 3).

Our results open up several potentially fruitful avenues for further research or analytical work. The overestimation of expenditures on housing rentals in Slovakia's national accounts would also lead to the overestimation of the nominal GDP for the entire Slovak economy, as well as of other relevant economic aggregates, such as actual individual consumption or household final consumption expenditure. Changes in these

nominal amounts would have consequence for the dynamics of real economic growth that might be worth investigating.

In the methodology we have applied, changes in assumptions about the price of imputed or actual rentals do not have a large effect on our estimates of Slovakia's GDP per capita at PPP, or on its convergence level. They can, however, have a sizable effect on the estimated PPPs, which can serve as spatial price deflators in international comparisons of wages, incomes, social benefits or pensions in countries with different price levels. The OECD, furthermore, publishes international comparisons of wages for teachers (OECD 2022a), doctors and nurses (OECD 2022b), adjusted for price level differences using PPPs.

Since 2016, Slovakia has achieved only very unflattering results in such international comparisons. For instance, according to official Eurostat statistics, Slovakia had the lowest net household earnings at PPP of all EU Member States in 2022 (Eurostat 2023a). These results might, however, be influenced by the fact that that Eurostat deflates earnings by the PPPs for household final consumption expenditure (HFCE), an economic aggregate that includes imputed rentals. We have seen that imputed rentals are unrealistically expensive in the detailed PPP data for Slovakia, and account for a large and likely overestimated portion of household consumption. As a result, using HFCE as the deflator might underestimate household earnings in the country. In future research, it might be worthwhile to re-estimate such international comparisons using adjusted deflators. These deflators could reflect more plausible estimates or assumptions about housing rentals prices and expenditures, or might wish to exclude imputed rentals entirely due to their largely non-monetary nature (as is the case in household final monetary consumption expenditure, or HFMCE).

Acknowledgments

Matěj Bělín, Ondrej Buchel, Katarína Gajdošová, Branislav Hábel, Norbert Hoferica, Ján Komadel, Igor Liška, Simona Majdanová, Michal Tomajko, Marcela Veselková and Beáta Vitteková (all from the Social Policy Institute), Valéria Bankoová (Ministry of Investment, Regional Development and Informatization of the Slovak Republic), Štefan Domonkos (European Labour Authority), Pavel Gertler, Milan Vaňko and Roman Vrbovský (all from the National Bank of Slovakia), Ján Haluška and Janka Horecká (both from Infostat), Juraj Petráš and Laura Salomonsová (Government Office of the Slovak Republic), Daniel Dujava and Branislav Žúdel (Institute for Financial Policy), Michal Habrman (Research and Innovation Authority - VAIA) and Michal Lehuta (Všeobecná úverová banka) have contributed to the creation of this analysis with their advice, comments, useful information or occasional assistance. Our special thanks go to Alžbeta Ridzoňová, Jozef Rosík and Martin Smatana (all from the Statistical Office of the Slovak Republic) for their willingness to answer all our questions about Slovakia's national accounts, and to Lars Svennebye (Eurostat) for useful consultations regarding the implementation of the methodology for calculating purchasing power parities.

Declaration of Interest Statement

The author reports there are no competing interests to declare.

References

Cassel, Gustav. 1921. *The World's Money Problems.* New York, NY: E.P. Dutton and Co.

Cassel, Gustav. 1922. *Money and Foreign Exchange After 1914*. New York, NY: MacMillan.

Commission Implementing Regulation 2022/2094. *Commission Implementing Regulation (EU) 2022/2094 of 28 October 2022 specifying the technical items of data sets, establishing the technical formats for transmission of information and specifying the detailed arrangements and content of the quality reports on the organisation of a sample survey in the consumption domain pursuant to Regulation (EU) 2019/1700 of the European Parliament and of the Council.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R2094

Deaton, Angus, and Alan Heston. 2010. "Understanding PPPs and PPP-Based National Accounts." *American Economic Journal: Macroeconomics* 2(4): 1–35.

Dornbusch, Rudiger. 1987. "Purchasing Power Parity." In *The New Palgrave: A Dictionary of Economics*, edited by John Eatwell, Murray Milgate, and Peter Newman. New York, NY: Stockton Press.

Dujava, Daniel, and Branislav Žúdel. 2023. *On Purchasing Parity.* Bratislava, Slovakia: Institute for Financial Policy.

ECA (European Court of Auditors). 2019. *Allocation of Cohesion Policy Funding to Member States for 2021-2027: Rapid Case Review.* Luxembourg: European Court of Auditors.

Engel, Charles, and John H. Rogers. 1996. "How Wide Is the Border?" *American Economic Review* 86(5): 1112–1125.

Eurostat. 2013. *ESA 2010 – European System of Accounts*. Luxembourg: Publications Office of the European Union.

Eurostat. 2016. *Handbook on Prices and Volume Measures in National Accounts.* Luxembourg: Publications Office of the European Union.

Eurostat. 2017. *Technical Manual on Owner-Occupied Housing and House Price Indices.* https://ec.europa.eu/eurostat/documents/7590317/0/Technical-Manual-OOH-HPI-2017/

Eurostat. 2018. *HICP Compliance Monitoring Report – Slovakia.* https://ec.europa.eu/eurostat/documents/272892/272977/CM-Report-Slovakia-2017-web.pdf

Eurostat. 2021. *HICP Compliance Monitoring Follow-Up Report – Slovakia.* https://ec.europa.eu/eurostat/documents/272892/272977/CM-follow-up-report-SK-2021-web.pdf/

Eurostat. 2023a. "Annual net earnings [EARN_NT_NET]" (dataset). https://ec.europa.eu/eurostat/databrowser/product/page/earn_nt_net

Eurostat. 2023b. "GDP per capita in PPS [TEC00114]" (dataset). https://ec.europa.eu/eurostat/databrowser/view/tec00114/default/table

Eurostat. 2023c. "HICP – annual data (average index and rate of change) [PRC_HICP_AIND]" (dataset). https://ec.europa.eu/eurostat/databrowser/view/PRC_HICP_AIND/default/table

Eurostat. 2023d. "House price index (2015 = 100) – annual data [PRC_HPI_A]" (dataset). https://ec.europa.eu/eurostat/databrowser/view/prc_hpi_a/default/table

Eurostat. 2023e. "Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates [PRC_PPP_IND]" (dataset). June 2023 Calculation. https://ec.europa.eu/eurostat/databrowser/product/page/PRC_PPP_IND

Eurostat-OECD. 2012. *Eurostat-OECD Methodological Manual on Purchasing Power Parities. Eurostat Methodologies and Working Papers.* Luxembourg: Publications Office of the European Union.

Feenstra, Robert C., Alan Heston, Marcel Timmer, and Haiyan Deng. 2009. "Estimating Real Production and Expenditures Across Countries: A Proposal for Improving the Penn World Tables." *Review of Economics and Statistics* 91(1): 201–212.

Feenstra, Robert C., Robert Inklaar, and Marcel Timmer. 2013. "The Next Generation of the Penn World Table." *American Economic Review* 105(10): 3150–3182.

Habrman, Michal. 2018. *Dobiehame alebo nedobiehame ten Západ?* [Are We or Are We Not Catching up to the West?]. Bratislava, Slovakia: Institute for Financial Policy.

Habrman, Michal, Ľuba Habodászová, and Lucia Šrámková. 2022. *Reformný kompas slovenskej ekonomiky* [Reform Compass of the Slovak Economy]. Bratislava, Slovakia: Institute for Financial Policy.

Hajnovičová, Viera, and Janka Horecká. 2018. *Analýza dostupných zdrojov údajov pre výpočet produkcie bytových služieb* [Analysis of Data Source Availability for the Calculation of Dwelling Services Production]. Bratislava, Slovakia: Infostat.

Hajnovičová, Viera, and Janka Horecká. 2019. *Odhad produkcie bytových služieb* [Estimate of Dwelling Services Production]. Bratislava, Slovakia: Infostat.

Haluška, Ján, and Jaroslav Dolinič. 2018. "Makroekonomická výkonnosť slovenskej ekonomiky v rokoch 1995 – 2017" [Macroeconomic Performance of the Slovak Economy in 1995 – 2017]. *Slovenská štatistika a demografia [Slovak Statistics and Demography]* 3: 57–76.

Horňák, Matej, and Mária Valachyová. 2022. *30 rokov samostatnosti Slovenska* [30 Years of Slovakia's Independence]. Bratislava, Slovakia: Slovenská sporiteľňa.

IMF (International Monetary Fund). 2021. *Fifteenth General Review of Quotas – Quota Formula and Realigning Shares.* Washington, DC: International Monetary Fund. https://www.imf.org/en/Publications/Policy-Papers/Issues/2021/03/05/Fifteenth-General-Review-of-Quotas-Quota-Formula-and-Realigning-Shares-50149

Keynes, John Maynard. 1923. *A Tract on Monetary Reform*. London, UK: Macmillan.

Köves, Pál. 1993. "EKS Index and International Comparisons." *Hungarian Statistical Review* 77: 3–14.

NBS (National Bank of Slovakia). 2022. *Structural Challenges – 2022.* Bratislava, Slovakia: National Bank of Slovakia. https://nbs.sk/en/publications/structural-challenges/

NBS (National Bank of Slovakia). 2023. *Structural Challenges – 2023.* Bratislava, Slovakia: National Bank of Slovakia. https://nbs.sk/en/publications/structural-challenges/

Novák, Vladimír, Branislav Reľovský, Eva Štulrajterová, and Milan Vaňko. 2022. *Slovensko pred 30 rokmi a dnes [Slovakia 30 Years Ago and Today]*. Bratislava, Slovakia: National Bank of Slovakia. https://nbs.sk/slovensko-pred-30-rokmi-a-dnes/

OECD (Organisation for Economic Co-operation and Development). 2019. "Final consumption expenditure of households, 2019 Archive" (dataset). https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE5_ARCHIVE

OECD (Organisation for Economic Co-operation and Development). 2022a. *Education at a Glance 2022: OECD Indicators.* Paris, France: OECD Publishing.

https://www.oecd-ilibrary.org/education/education-at-a-glance-2022_3197152b-en

OECD (Organisation for Economic Co-operation and Development). 2022b. *OECD Health Statistics 2022 – Remuneration of Health Professionals.* Paris, France: OECD Publishing. https://www.oecd.org/health/health-data.htm

OECD (Organisation for Economic Co-operation and Development). 2023. "Final consumption expenditure of households" (dataset). https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE5

Regulation 1445/2007. *Regulation (EC) No 1445/2007 of the European Parliament and of the Council of 11 December 2007 establishing common rules for the provision of basic information on Purchasing Power Parities and for their calculation and dissemination.* https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007R1445

Rogoff, Kenneth. 1996. "The Purchasing Power Parity Puzzle." *Journal of Economic Literature* 34: 647-668.

Statistical Office of the Slovak Republic. 2016. *GNI Inventory – SK, ESA 2010.* Bratislava, Slovakia: Statistical Office of the Slovak Republic.

Statistical Office of the Slovak Republic. 2021. *GNI Inventory – SK, ESA 2010.* Bratislava, Slovakia: Statistical Office of the Slovak Republic.

Statistical Office of the Slovak Republic. 2023. *Metodické vysvetlivky – ročné účty* [Methodological Notes – Annual Accounts]. Bratislava, Slovakia: Statistical Office of the Slovak Republic. https://slovak.statistics.sk/