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METHOD OF PRICE ADJUSTMENT IN CONTRACTS FOR THE PROVISION OF TRANSPORT SERVICES

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Abstract

Public passenger transport represents a fundamental element of regional mobility, ensuring accessibility and social inclusion across all areas. Its effective and transparent financing is a key condition for maintaining the long-term stability and sustainability of the transport system. Long-term public service obligation contracts are, however, significantly influenced by fluctuations in fuel prices and labour costs, which creates uncertainty for both transport operators and public authorities. Therefore, it is necessary to establish an objective and predictable mechanism for price adjustment. The aim of this study was to design and verify a methodology for adjusting prices in PSO contracts using reliable statistical indicators published by national statistical offices. The research process consisted of five stages: analysis of existing contracts, identification of key cost components, development of an adjustment model, testing on historical data from 2016 to 2024, and evaluation of the model's accuracy. The results confirmed that the differences between calculated and actual unit costs were within ±0.01 to ±0.02 € per km, representing a deviation below 5%. Consequently, the proposed model can be considered a reliable and transparent tool for price adjustment in long-term public transport contracts.

Keywords: public passenger transport; public service obligation; price adjustment; operator costs; cost indexation

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1. Introduction

According to the authors of the article "A review of public transport economics" public transport is defined as high-capacity vehicle sharing with fixed routes and schedules – from the backbone of urban mobility in densely populated cities. The core challenge of efficiently coordinating large number of travellers sharing high-capacity vehicles remains. Public transport economics therefore aims to improve this coordination by ensuring optimal resource allocation and maximising the societal benefits of mass mobility [8]. Based on Brízdiková [4], the most important task of public passenger transport is to satisfy the transport requirements of passengers. Transport represents a secondary demand, which serves to satisfy the primary demand of customers. The demand for public transport is influenced by various factors, such as the income of the population, geographical location, car ownership, and the like. The importance of public transport in less densely populated areas was investigated by Berg and Ihliström [3], who focused on the everyday mobility of rural residents. Their findings confirm that public transport plays a crucial role in ensuring basic needs, such as commuting to work, school, or the doctor. The authors also point out that passengers often have a low degree of choice and are therefore significantly reliant on public transport. This aspect needs to be considered when securing transport services via public mass transport; it is important to ensure stable funding for transport services that also reflects changing economic conditions during the contract's duration. It is necessary to conclude a public service contract because not all services are economically profitable for the carrier, and therefore, the ordering party undertakes to pay for the demonstrable loss through the net financial effect, which is determined based on Regulation (EC) No 1370/2007 of the European Parliament and of the Council. The regulation entered into force on 03 December 2009 and sets out rules for public funding so that it does not exceed the amount of the net financial effect [7]. According to the authors of the article „Short-term forecasting of passenger demand using the theory of one-dimensional time series", the new regulation determines a commercial principle, meaning that the remuneration for services should not be calculated as a percentage of costs, but must incorporate risk. The risk arising from the operation of transport services may be borne by the operator (ordering party) or also by the carrier, according to the requirements of the public service contract [5]. To correctly determine the price, it is necessary to identify the costs that account for the largest share of the total costs, which are generally fuel costs and direct wage costs. In the case of purchasing new vehicles, depreciation costs of transport means also account for a large share of the costs [9].

A similar issue is addressed by Dydkowsky et al. [6], according to whom some factors affecting the mentioned costs cannot be influenced from the carrier's position. Such factors include, for example, taxes paid by carriers (taxes on electricity or fuel). Similarly, the amount of costs associated with fuel consumption is independent of the carrier, and therefore, it would be appropriate to burden the service ordering party with these costs. Changes in fuel prices should be compensated by the transport ordering party. Within the system of remuneration for provided services, it is necessary to introduce provisions for remuneration to increase with

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rising prices and, in justified cases, with rising costs. It is also necessary to consider the situation where vehicles with additional equipment are put into operation, e.g., air conditioning or various safety systems, which often lead to an increase in fuel or energy costs. Methods for price adjustment, especially for costs such as fuel or electricity, should be implemented in contracts due to their frequent unpredictable change. Changes in the tax burden are not such a major risk, as they usually change once a year and are known in advance. Based on the study, an increase in prices should cause an increase in the contribution to the carrier, and conversely, a decrease in costs should be accompanied by a reduction in the contribution. Furthermore, the carrier should not bear the total risk for the increase in wages and related levies, as it cannot directly influence the level of the minimum wage (this is determined by the government); an increase in the minimum wage often leads to overall wage growth in the sector, and maintaining the wage hierarchy leads to salary increases even for experienced employees. This cost item is extremely important and should therefore be included in the price adjustment formulas.

The following section contains several important definitions related to the price adjustment.

- ***Unit transport costs*** denote the average cost of providing transport services per unit of output, commonly expressed as cost per passenger–kilometre in passenger transport. This metric aggregates all relevant cost components, including direct wages, fuel, maintenance, and capital costs. Calculating unit transportation costs for buses is essential for passenger transport operators, as it supports efficient operational management, profitability, and competitive pricing. By analysing costs per passenger–kilometre, operators can evaluate key cost components such as fuel, maintenance, and direct wages. These calculations allow the total cost of a trip to be determined accurately, enabling effective budget control and optimal resource allocation [1].

- ***Direct wage costs*** refer to the labour expenses directly associated with service provision, primarily including wages and salaries paid to operational staff such as drivers, excluding indirect labour costs, administrative staff, and overhead–related expenses.

- ***Fuel costs*** represent the expenditures incurred for the energy required to operate transport vehicles, typically measured as the cost of diesel, petrol, electricity, or alternative fuels consumed during vehicle operation.

- ***Statistical indicator*** is a quantitative measure used to describe, evaluate, and compare the performance, structure, or efficiency of a system or process based on collected data.

The goal of this article is to propose and verify a generally applicable method for adjusting unit costs that change during the validity of the contract, based on an analysis of the existing situation and the requirements of legal regulations.

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2. Materials and Methods

The article deals with the analysis of the current state of the solved problem in Slovakia and selected foreign countries, with particular emphasis on price adjustment mechanisms in public passenger transport contracts. The analysis aims to identify existing legislative and contractual approaches and to assess their ability to respond to unexpected changes in carrier costs.

The first part is focused on familiarizing oneself with Regulation (EC) No 1370/2007 of the European Parliament and of the Council of 23 October 2007 on public passenger transport services by rail and by road (hereinafter referred to as the „Regulation") [7]. The Regulation deals with ensuring the provision of services of general interest and defines the conditions for concluding the Contract. Special attention is paid to the principles of transparency, proportionality, and compensation, which directly influence the economic balance of public service contracts and the rules for adjusting prices. The Regulation can be applied to national and international provision of public service in rail and road passenger transport, excluding services provided for their historical significance or tourist value.

The second part of the analysis is focused on existing public service contracts (hereinafter referred to as the „Contract") at the level of self-governing regions and cities in Slovakia and abroad. The purpose of the analysis is to determine existing solutions for price adjustment due to changes in carrier costs that cannot be foreseen (e.g., fuel costs and driver wages). The purpose of the analysis is to determine existing solutions for price adjustment due to changes in carrier costs that cannot be foreseen (e.g., fuel costs and driver wages). The analysis also aims to identify differences in contractual approaches and to reveal potential shortcomings, such as unclear adjustment rules or the absence of objective indexation mechanisms. The analysis includes 4 self-governing regions in Slovakia (Banská Bystrica Self-Governing Region, Košice Self-Governing Region, Nitra Self-Governing Region, and Trnava Self-Governing Region) and the Karlovy Vary Region in the Czech Republic. Within the research, cities in Slovakia are analyzed, specifically Galanta, Martin, Poprad, Spišská Nová Ves, Topoľčany, and Zvolen, and cities from Hungary, specifically Budapest and Miskolc. The analyzed contracts are publicly available documents published by regional and local authorities. The comparison of contracts from different regions and countries allows for the identification of common practices, as well as significant discrepancies in the methods used for price adjustment.

Based on the findings of the contractual analysis, a structured research procedure was designed to verify the suitability of a unified price adjustment approach. The research consisted of five main stages that were sequential and collectively allowed for the verification of the proposed method of price adjustment in case of cost changes in contracts for the provision of transport services.

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In the first stage, the selection and analysis of contracts from Slovakia and abroad were carried out. The second stage involved determining the main factors that have the greatest impact on the carrier's total costs. Based on the structure of operating costs, two items were identified as decisive: fuel costs and direct driver wage costs. The third stage focused on proposing a unit cost adjustment through a computational model that allows for reacting to year-on-year changes in variable costs. In the fourth stage, the model was tested on real data from the period 2016 to 2024. The last stage included comparing the calculated results with real data and evaluating the accuracy of the proposed model. Within the research, the hypothesis was verified that the proposed price adjustment model can reproduce the real values of unit costs with a maximum deviation of up to 5% of the total value. The verification of this hypothesis is essential for assessing whether the proposed model can be applied in practice as a transparent and predictable tool for long-term public service contracts.

3. Research

3.1. Regulation (EC) No 1370/2007 of the European Parliament and of the Council on public passenger transport services by rail and by road

According to Andrei [2], from the European Commission's perspective, the Regulation is of paramount importance for the organisation and financing of public bus, tram, and rail transport in the Member States. The European Commission believes that the uniform and correct application of its provisions is important from both economic and political standpoints.

The objective of the service contract is to ensure safe, efficient, and high-quality transport services for the public at a set basic fare. The Contract also takes into account the transport service needs of the territory, as well as social, environmental, and regional development factors. The ordering party concludes a contract with a regular transport carrier if these services would not be provided at all, to a sufficient extent, quality, or for a determined fare without a subsidy, while being essential for the transport service provision of the area. In the Slovak Republic, it is not possible to conclude a Contract for long-distance transport or for commercial recreational and tourist transport. The Contract must be in written form [7]. Within the Contract, the following must be clearly defined: the obligations arising from public service that the provider must meet, and the geographical areas concerned; the parameters on the basis of which any compensation payments are to be calculated must be set out in advance in an objective and transparent manner, as well as the nature and extent of any exclusive rights granted, in a way that prevents overcompensation; the method for determining the costs associated with the provision of services must also be determined. In the case of bus transport, the Contract is concluded for a maximum duration of ten years [8].

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The awarding of Contracts under the Regulation can be secured by the following methods:
- providing the public service itself,
- awarding the Contract directly without a tender to a legally distinct entity (in-house operator),
- awarding the Contract to a party other than the in-house operator.

The Contract can be awarded to a party other than the in-house operator in two ways:
- direct award to a specific service provider,
- public tender that allows the participation of all service providers [8].

According to van de Velde [13] and Rosell [11], a direct award of the Contract is only possible if the estimated average annual value of the services provided is less than €1 million, or the performance is less than 300,000 km per year. The limiting conditions can be adjusted to double, i.e., the average annual value of the services provided to €2 million and annual performance to 600,000 km per year, if the Contract is awarded to a small or medium-sized enterprise that operates no more than 23 vehicles. The shifting of the limits is due to the support of small and medium-sized regional firms.

Based on the Regulation, the compensation for public service obligations must not exceed the net financial effect, which is the sum of all positive and negative impacts resulting from fulfilling these obligations on the service provider's costs and revenues. This impact is assessed by comparing the real situation in which the public service obligations are observed with a scenario in which these obligations would not be fulfilled. The determination of the net financial effect is carried out based on the following procedure:
- calculation of costs incurred in connection with the public service obligation imposed by the competent authority and specified in the Contract or a general rule,
- deduction of any positive financial results generated by the network within the relevant public service obligation,
- addition of a reasonable profit [7].

3.2. Public Service Contracts within the Slovak Republic

Within the Slovak Republic, the respective self-governing region is responsible for suburban bus transport, and the respective city is responsible for urban transport (i.e., the self-governing region and the city are referred to as the relevant local authority). The Contract may be concluded between self-governing regions and carriers or between cities and carriers.

3.2.1. Banska Bystrica Self-Governing Region (BBSK)

In the Banská Bystrica Self-Governing Region, public passenger transport is provided by SAD Zvolen, a joint-stock company, in the period from 01/01/2024 to 31/12/2033, based on the contract dated 28/06/2022. The price of transport performance per 1 km (hereinafter

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referred to as the „Price") in the calendar year 2021 is set as the initial price for the fulfilment of the Contract at the level of €1.37 without VAT [10]. The Price of transport performance consists of several unit cost items. Within the scope of the research, unit costs for fuel and unit costs for direct wages were examined in more detail. An initial indexation is carried out at the start of operation, and subsequently, a regular indexation of the Price is performed, which means a decrease or increase based on the year–on–year change in the inflation rate, fuel costs, and the average gross wage of drivers.

Indicator of Fuel Price Change

The change in fuel costs is determined by the year–on–year change in the consumer price of diesel fuel from the data of the Statistical Office of the Slovak Republic and is calculated based on the following formula:

$$C_{Fa} = C_{Ftp} * I_{CF} \tag{1}$$

C_{Fa} – the adjusted fuel costs per 1 km of transport performance for the respective calendar year „n", €/km,
C_{Ftp} – the fuel costs per 1 km of transport performance €/km,
I_{CF} – the year–on–year change coefficient [10].

Indicator of Driver Wage Change

The indicator of driver wage change, based on the Contract in BBSK, is calculated as the weighted average of the year–on–year change in wages based on data from the Statistical Office of the Slovak Republic, as follows:

- 50% weight of the index is the average gross wage in the Slovak Republic,
- 25% weight of the index is the average gross wage in the Banská Bystrica Self–Governing Region,
- 25% weight of the index is the average gross wage in the Transport and Storage sector [11].

The formula for adjusting direct costs, including levies, is as follows:

$$PC_a = PC_{tp} * I_{PC} \tag{2}$$

P_{Ca} – the adjusted personal costs of drivers, including levies, per 1 km of transport performance for the respective calendar year „n", €/km,
P_{Ctp} – the personal costs of drivers, including levies, per 1 km of transport performance, €/km,
I_{PC} – represents the year–on–year change coefficient [10].

3.2.2. Košice Self–Governing Region (KSK)

The Košice Self–Governing Region („KSK") has concluded a Contract with the carrier eurobus, a. s., dated 25/02/2022, for the „KSK West" area. The public services under the Contract are provided in the period from 01/04/2022 to 31/03/2029. The average unit price per 1 km represents a Price of €1.5523 without VAT [10].

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Adjustment of the Price Component for Fuel Consumption

Based on the Contract, the unit fuel costs stated in the carrier's offer are valorised weekly, depending on the change in average fuel prices in the Slovak Republic for the indicator „Motor Diesel" published by the Statistical Office of the Slovak Republic. The following formula is used to calculate the valorised value:

$$F_{1i} = F_{0i} * \frac{P_F}{P_{F0}} \tag{3}$$

F_{1i} – the valorised relevant part of the price per 1 km for the i–th vehicle category for the respective week in which the service was provided,

F_{0i} – the relevant part of the price per 1 km for the i–th vehicle category stated in the carrier's offer,

P_F – the average price of diesel fuel in the SR for the week for which F_{1i} is calculated,

P_{F0} – the reference average price of diesel fuel in the SR stated in the carrier's offer.

Based on the agreement of the contracting parties, the data on the average fuel price for the indicator „Motor Diesel" is used regardless of the types of vehicles and propulsion (fuels or propulsion sources) used by the carrier [10].

Valorisation of the Price Component for Direct Wages

The unit costs for direct wages (i.e., driver wages) stated in the carrier's offer (Annex No. 7) are valorised for each respective year in which the service was provided. Within the carrier's offer, direct wage costs are divided into three components, namely:

- driver wages excluding surcharges and wage compensation (performance wage),
- wage advantages and wage compensation,
- social and health insurance of drivers (levies).

The unit costs for driver wages excluding surcharges and wage compensation are calculated based on formula (4) as follows:

$$V_{1i} = V_{0i} * \frac{a_{NMW}}{a_{NMW0}} \tag{4}$$

V_{1i} – the valorised relevant part of the price per 1 km for the i–th vehicle category for the respective calendar year in which the service was provided,

V_{0i} – the relevant part of the price per 1 km for the i–th vehicle category stated in the carrier's offer,

a_{NMW} – the average nominal monthly wage in the economy of the SR published by the Statistical Office of the SR for the calendar year preceding the respective calendar year in which the service was provided,

a_{NMW0} – the reference average nominal monthly wage in the economy of the SR stated in the carrier's offer [10].

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3.2.3. Nitra Self-Governing region (NSK)

The Nitra Self-Governing Region („NSK") has concluded a Contract with a group of suppliers: ARRIVA Nové Zámky, joint-stock company, and ARRIVA NITRA, a. s., for the period from 01/01/2016 to 31/12/2025. The cost price per 1 tariff kilometre, determined as the average price for all types of buses, is at the level of €1.35 without VAT [10].

Adjustment of Fuel Costs

The continuous and rapid evolution of fuel prices requires the updating of carrier costs during the contract duration. The contracting parties have agreed that this adjustment will take place once a year, always after the end of the calendar year, for the mutual settlement of this item. The unit cost for the fuel indicator shall be adjusted for subsequent years for each vehicle type based on the following formula:

$$U_{fu} = U_{fp} * Pi_F \tag{5}$$

U_{fu} – the unit cost for the fuel indicator, €/km (adjusted),
U_{fp} – the unit cost for the fuel indicator, €/km (original),
P_{if} – the fuel price index, % [10].

Adjustment of Driver Wage Costs

The Contract does not define a specific procedure for adjusting driver wage costs. Annex No. 3 states that the direct driver wage costs are adjusted using a price index—the consumer price index [10].

3.2.4 Trnava Self-Governing Region (TTSK)

A Contract has been concluded between the Trnava Self-Governing Region („TTSK") and the carrier ARRIVA Trnava, a. s., for the provision of public suburban transport services in the Trnava transport region, starting from 01/01/2024 [10].

Adjustment of Fuel Costs

The update of the baseline price component for fuel costs from the carrier's offer is performed once a year. The recalculation of the baseline value is carried out based on the following relationship:

$$C_{FU} = C_{F0} * \frac{P_{FU}}{P_{F0}} \tag{6}$$

C_{FU} – the updated fuel price component for the respective calendar year, €,
C_{F0} – the baseline price component stated in the carrier's offer, €,
P_{FU} – the average price of diesel or CNG in the SR for the calendar year for which the updated price component C_{FU} is calculated, €,
P_{F0} – the average price of diesel or CNG in the SR for the calendar year preceding the calendar year in which the deadline for submitting tenders in the public procurement process expired, € [10].

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Adjustment of the Price Component for Wage Costs

The baseline wage costs from the carrier's offer are updated once a year based on the following formula:

$$C_{CLU} = C_{CL0} * \left(0{,}4 * \frac{a_{NMWU}}{a_{NMW0}} + 0{,}6 * \frac{a_{MHWU}}{a_{MHW0}}\right) \quad (7)$$

C_{CLU} – the updated price component „Cost of Labour", €,

C_{CL0} – represents the relevant price component „Cost of Labour" stated in the carrier's offer, €,

a_{NMWU} – the average nominal monthly wage of an employee in the SR economy published by the Statistical Office of the SR for the calendar year for which the updated price component C_{CLU} is calculated,

a_{NMW0} – the average of the values of the average monthly nominal wage of an employee in the SR economy published by the Statistical Office of the SR for the four quarters immediately preceding the quarter in which the deadline for submitting tenders in the public procurement process expired,

$aMHWU$ – the minimum hourly wage, stipulated by the Government Regulation of the SR based on Section 2, paragraph 1 of Act No. 663/2007 Coll. on the Minimum Wage as amended, valid for the respective calendar year for which CCLU is calculated,

$aMHW0$ – the minimum hourly wage, stipulated by the Government Regulation of the SR based on Section 1, paragraph 2 of Act No. 663/2007 Coll. on the Minimum Wage as amended, valid in the calendar year preceding the calendar year in which the deadline for submitting tenders in the public procurement process expired [10].

3.2.5. City of Galanta

The Contract between the City of Galanta and the carrier SAD Dunajská Streda, a. s. is concluded for the period from 01/06/2021 to 31/05/2031. The cost price per 1 kilometre for the base year is set at €2.15 without VAT, which may be adjusted due to changes in certain costs [10].

Adjustment of Fuel Costs

In the case of this Contract, the adjustment of fuel costs is handled in a similar way as in the Contract of the Nitra Self-Governing Region. The recalculation of fuel costs is carried out based on formula (5) [10].

Adjustment of Wage Costs

Wage costs are negotiated annually by the contracting parties according to the development of the situation on the labour market [10].

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3.2.6. City of Martin

The Contract between the City of Martin and the carrier Dopravný podnik mesta Martin, s. r. o. is concluded for the performance of urban public transport for the period from 01/01/2022 to 31/12/2031. Based on the agreement of the contracting parties, the total costs incurred in connection with the obligation arising from public services represent €2.21 per 1 driven kilometre. The costs are broken down into four items, namely: the price component for fuel, the price component for labour (wages), the price component for repairs, overhead, and other costs, and the price component for depreciation [10].

Cost Adjustment During the Contract Duration

If, during the contract duration, there is an increase or decrease in costs independent of the ordering party and the carrier (e.g., fuel prices, average wages in the transport and storage sector, or overall inflation), the contracting parties shall adjust the cost per 1 driven kilometre based on the aforementioned items [10].

3.2.7. City of Poprad

A Contract has been concluded between the contracting parties, the City of Poprad and the carrier SAD Poprad, joint-stock company, for a ten-year period, starting from 01/01/2025. The unit price per 1 actually realised kilometre is €4.20 without VAT [10].

Based on the agreement between the contracting parties, the unit costs will be adjusted during the Contract duration through regular valorisation of individual unit cost items once a year (price component for fuel consumption, for direct wages, etc.) [10].

Valorisation of the Price Component for Fuel Consumption

The valorisation of unit costs for the fuel price component is calculated depending on the type of propulsion according to the carrier's offer. The formula for motor diesel is provided in the article. The unit costs are valorised based on the following relationship:

$$C_{F1i} = C_{F0i} * \frac{P_F}{P_{F_0}} \tag{8}$$

C_{F1i} – the valorised relevant part of the price per 1 km for the i-th vehicle category for the respective week in which the service was provided,

C_{F0i} – the relevant part of the price per 1 km for the i-th vehicle category stated in the carrier's offer,

P_F – the average price of diesel fuel in the SR for the week for which C_{F1i} is calculated,

P_{F0} – the reference average price of diesel fuel in the SR stated in the carrier's offer [10].

Valorisation of the Price Component for Direct Wages

Similarities with the Košice Self-Governing Region Contract were found within this part of the Contract. The unit costs for direct wages, which are stated in the carrier's offer (Annex No. 7), are valorised for each respective calendar year, based on individual components,

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which are: driver wages excluding surcharges and wage compensation (performance wage), wage advantages and wage compensation, social and health insurance of drivers (levies). The adjusted value is determined based on the following formula:

$$C_{1i} = C_{0i} * \left(0{,}5 * \frac{a_{NMW}}{a_{NMW0}} + 0{,}5 * \frac{CPI}{CPI_0}\right) \quad (9)$$

C_{1i} – the valorised relevant part of the price per 1 km for the i–th vehicle category for the respective calendar year in which the service was provided,

C_{0i} – the relevant part of the price per 1 km for the i–th vehicle category stated in the carrier's offer,

a_{NMW} – the average nominal monthly wage in the SR economy published by the Statistical Office of the SR for the calendar year preceding the respective calendar year in which the service was provided,

a_{NMW0} – the reference average nominal monthly wage in the SR economy stated in the carrier's offer,

CPI – the consumer price index compared to the base period for the indicator consumer prices total for the calendar year preceding the respective calendar year in which the service was provided,

CPI_0 – the consumer price index stated in the carrier's offer [10].

3.2.8. City of Spišská Nová Ves

Urban public transport in the City of Spišská Nová Ves is secured based on the Contract between the city and the carrier eurobus, a. s. for the period from 01/10/2024 to 30/09/2034. The unit price per 1 driven kilometre is at the level of €3.7628 without VAT. The Contract includes the calculation of changes in fuel and direct wage costs [10].

Valorisation of the Price Component for Fuel Consumption

The valorisation of unit costs for fuel from the carrier's offer is performed in a similar manner as in the case of the City of Poprad Contract. For diesel propulsion, the unit costs are recalculated based on formula (8).

Valorisation of the Price Component for Direct Wages

The unit costs for driver wages are divided into three components, similar to the Contracts of KSK and the City of Poprad, which are: driver wages excluding surcharges and wage compensation (performance wage), wage advantages and wage compensation, and social and health insurance of drivers. The adjustment of the component „driver wages excluding surcharges and wage compensation" consists of the recalculation of the performance wage, which is carried out based on formula (9).

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3.2.9. City of Topoľčany

The City of Topoľčany has concluded a concession contract with the carrier Freibus SLOVAKIA, s. r. o. for the provision of urban bus transport for the period from 01/01/2021 to 31/12/2030. The unit price per 1 driven kilometre is agreed upon at €1.6857 without VAT [10].

Cost Adjustment During the Contract Duration

In the event that, during the contract duration, there is a change compared to 01/01/2021:

- in fuel prices by more than 25%,
- in inflation, average wage, or the average wage growth index by more than 33%, the carrier shall initiate negotiations on adjusting the remuneration for fulfilling the subject of the Contract [10].

3.2.10. City of Zvolen

Urban bus transport in the City of Zvolen is provided by the carrier SAD Zvolen, a. s., based on the Contract. The carrier is obliged to fulfil public service obligations for a period of ten years, starting from 01/07/2023. The price per 1 kilometre by the carrier's vehicle without VAT is:

- for a standard bus with diesel propulsion: €1.65914,
- for a standard bus with CNG propulsion: €0.77748 [10].

Fuel Price Adjustment

When adjusting the fuel price, it is necessary to take into account the different types of fuel used in the carrier's offer. The calculation shall be carried out separately for each fuel type based on formula (10), and the result must be rounded to four decimal places.

$$P_{FU} = P_F * \frac{a_{FU}}{a_F} \tag{10}$$

P_{FU} – the updated fuel price (diesel or CNG),
P_F – the fuel price according to point 8.3[1)] of the Contract,
a_{FU} – the average price (diesel/CNG) in the SR for the month for which the updated price component PFU is calculated, published by the Statistical Office of the SR,
a_F – the average price (diesel/CNG) in the SR for the quarter preceding the quarter in which the deadline for submitting tenders in the public procurement process expired, €.

[1)] Point 8.3 of the Contract contains a table showing the structure of the baseline prices of transport services based on the carrier's offer (Annex No. 2) [10].

Adjustment of Driver Labour Costs

The adjusted price for driver labour costs is calculated based on the following formula, and the result is rounded to four decimal places:

$$P_{LCU} = P_{LC0} * \frac{a_{MNW}}{a_{MNW0}} \tag{11}$$

P_{LCU} – the updated price for driver labour costs,
P_{LC0} – the price for driver labour costs according to point 8.3 of the Contract,

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a_{MNW} – the average of the values of the average monthly nominal wage of an employee in the SR economy published by the Statistical Office of the SR for the four quarters immediately preceding the quarter for which PLCU is calculated,

a_{MNW0} – the average of the values of the average monthly nominal wage of an employee in the SR economy published by the Statistical Office of the SR for the four quarters immediately preceding the quarter in which the deadline for submitting tenders in the public procurement process expired [10].

3.3. Public Service Contracts Abroad

3.3.1. Czech Republik – Karlovy Vary Region

The Karlovy Vary Region has concluded a Contract with the carrier Cvinger bus, s. r. o., via a direct award to a small/medium-sized enterprise based on Article 5, paragraph 4 of Regulation (EC) No 1370/2007 of the European Parliament and of the Council, for the period from 01/01/2024 to 31/12/2033. The contracting parties have agreed on the adjustment (indexation) of the compensation for the given calendar year in relation to the public service obligation [10].

Indicator of Year-on-Year Change in Diesel Price

The index CD is used as the indicator of the year-on-year change in the price of diesel fuel, which is calculated based on the following formula:

$$C_D = \frac{a_{Pn-1}}{a_{P2023}} \tag{12}$$

n – represents the calendar year of the Contract duration for which indexation is performed,

a_{Pn-1} – represents the average annual consumer price of diesel fuel in the calendar year „n-1," i.e., in the calendar year immediately preceding the calendar year „n," published by the Czech Statistical Office,

a_{P2023} – represents the average annual consumer price of diesel fuel in the calendar year 2023, i.e., in the calendar year immediately preceding the first calendar year of the Contract duration (2024), published by the Czech Statistical Office [10].

Indicator of Year-on-Year Change in Average Gross Monthly Wage

The coefficient for the change in driver wages is calculated based on the formula:

$$C_{LC} = \frac{a_{NMWn-1}}{a_{NMW2023}} \tag{13}$$

n – represents the calendar year of the Contract duration for which indexation is performed,

a_{NMWn-1} – represents the average gross monthly wage of the sub-group/category of the

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CZ ISCO 83311 Bus drivers in urban public transport classification of occupations, based on the survey of the Ministry of Labour and Social Affairs of the Czech Republic for the calendar year „n–1," i.e., for the calendar year immediately preceding the calendar year „n",

$a_{NMW2023}$ – represents the average gross monthly wage of the sub-group/category of the CZ ISCO 83311 Bus drivers in urban public transport classification of occupations, based on the survey of the Ministry of Labour and Social Affairs of the Czech Republic for the entire calendar year 2023, i.e., for the entire calendar year immediately preceding the first calendar year of the Contract duration [10].

3.3.2. Hungary – City of Budapest

Transport services in the city of Budapest are secured by a Contract between BKK and BKV for fifteen years, from 01/01/2021 to 31/12/2036. Based on the Contract, an annual agreement is concluded for the following calendar year no later than December 15 of the respective calendar year. The annual agreement includes the framework schedule of public service, the monthly and summary plan of eligible costs, and the amount of the public service fee. In case the contracting parties do not agree on the conclusion of the annual agreement, a preliminary financing agreement is drawn up. The method of price adjustment due to changes in carrier costs is not included in the Contract; it is performed based on the mutual agreement of the contracting parties each year [10].

3.3.3. Hungary – City of Miskolc

The City of Miskolc has concluded a Contract with the carrier MKV (Miskolc Városi Közlekedési Zártkörűen működő Részvénytársaság) for the period from 01/06/2011 to 31/05/2026. The Contract from 2011 has been amended several times; the information is drawn from the latest version (32nd amendment) effective from 14/03/2024. The carrier provides public services in the defined geographical area based on the Contract and in accordance with the provisions of the annual agreement. The annual agreement sets out the performance schedule, performance quality, and financing conditions for the following year. The annual agreement summarizes the conditions for the provision of services, such as:

- monthly and annual plan of revenues and eligible costs, as well as a profit and loss plan for the calendar year,
- investment plan for the calendar year (specified quarterly and by sector),
- the amount of public service compensation payable for the current year, broken down by month,
- monthly and annual liquidity plan of the service provider related to its public interest activities, and others.

The basis for calculating the planned annual public service compensation is the business plan according to the Contract. Cost changes are reviewed quarterly based on quarterly reports. The ordering party is obliged to compensate only eligible costs that are not covered by revenues. The compensation may also include a reasonable profit for the carrier [10].

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3.4. Research on Cost Adjustment Based on Existing Methods

This section provides the calculation of unit costs for fuel and direct wages based on the formulas specified in the selected Contracts and real statistical data. The results are subsequently compared with the actual values negotiated between the contracting parties.

3.4.1. Nitra Self-Governing Region (NSK) – Evaluation

The Nitra Self-Governing Region has the oldest contract (from 2016) of all selected regions. It agreed with a group of suppliers (ARRIVA Nové Zámky and ARRIVA Nitra) on the baseline unit costs for 2016, broken down by vehicle size, as follows – Table 1.

Tab. 1. Baseline Unit Costs for Fuel and Direct Wages for 2016 – NSK

Item / Vehicle Category	Low-Capacity Bus LCB [€/km]	Mid-Capacity Bus MCB [€/km]	High-Capacity Bus HCB [€/km]	Total [€/km]
Fuel	0.23	0.25	0.28	0.26
Direct Wages		0.27		0.27

Source: Author based on [10]

Unit Costs for Fuel

The recalculation of unit costs for fuel is carried out for the years 2017 to 2024 based on formula (5). Price indices (P_{iF}) and adjusted unit costs for fuel are shown in Table 2, divided by vehicle category.

Tab. 2. Adjusted Unit Costs for Fuel for 2016 to 2024 – NSK

Year	P_{iF} [–]	Low-Capacity Bus LCB [€/km[	Mid-Capacity Bus MCB [€/km]	High-Capacity Bus HCB [€/km]	Total [€/km]
2017	1.0912	0.25	0.27	0.31	0.28
2018	1.0975	0.25	0.27	0.31	0.29
2019	0.9892	0.23	0.25	0.28	0.26
2020	0.8653	0.20	0.22	0.24	0.22
2021	1.1649	0.27	0.29	0.33	0.30
2022	1.3867	0.32	0.35	0.39	0.36
2023	0.9024	0.21	0.23	0.25	0.23
2024	0.9673	0.22	0.24	0.27	0.25

Source: Author based on [10]

The actual adjusted unit costs were found in the Contract amendments. Data is available for the years 2022, 2023, and 2024; previous data are not publicly accessible. Table 3 shows the actual unit costs for the years 2022–2024.

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Tab. 3. Actual Adjusted Unit Costs for Fuel for 2022–2024 – NSK

Year	Low-Capacity Bus LCB[€/km]	Mid-Capacity Bus MCB [€/km]	High-Capacity Bus HCB [€/km]	Total [€/km]
2022	0.23	0.27	0.29	0.28
2023	0.32	0.37	0.40	0.38
2024	0.29	0.33	0.36	0.34

Source: Author based on [10]

The comparison of calculated and actual values is performed using the graph in Figure 1. The bar chart shows the comparison of values for the Low-Capacity Bus (LCB), Mid-Capacity Bus (MCB), High-Capacity Bus (HCB), and the total for all categories for the years 2022 to 2024.

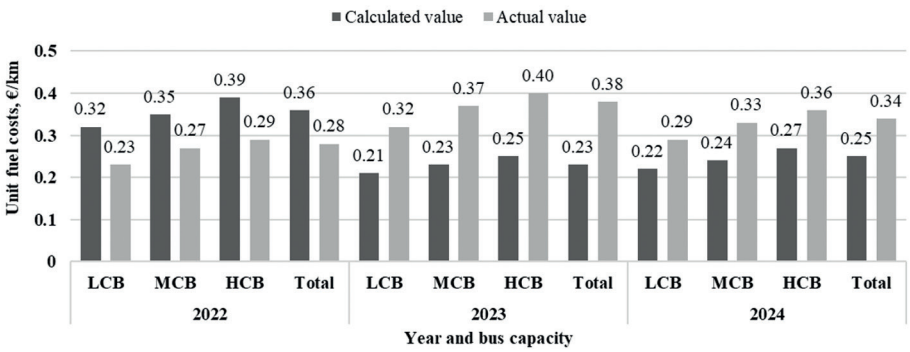

Fig. 1. Comparison of calculated and actual unit fuel costs for the years 2022–2024 in NSK

In 2022, the calculated values are higher, while for 2023 and 2024, the actual values are higher.

Unit Costs for Direct Wages

The Contract does not define an exact formula for adjusting driver wage costs. Therefore, the recalculation was carried out based on available information, namely using the consumer price index (Annex No. 3). Statistical data were used for the recalculation, based on which the year-on-year change coefficients of the consumer price index (C_{CPI}) were determined. Subsequently, the coefficient was multiplied by the original value of the unit costs for direct wages (Table 1), and the results shown in Table 4 were obtained.

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Tab. 4. Adjusted Unit Costs for Direct Wages for 2017 to 2024 – NSK

Year	Year-on-Year Change Coefficient of Consumer Price Index – C_{CPI} [-]	Adjusted unit costs for direct wages – a_{CDW} [€/km]
2017	1.0135	0.27
2018	1.0249	0.28
2019	1.0266	0.28
2020	1.0190	0.28
2021	1.0317	0.28
2022	1.1278	0.30
2023	1.1051	0.30
2024	1.0277	0.28

Source: Author based on [10]

The actual values of unit costs for direct wages were available for the years 2022 to 2024. The following graph in Figure 2 illustrates the confrontation of calculated and actual values of unit costs for direct wages for the years 2022–2024 [10].

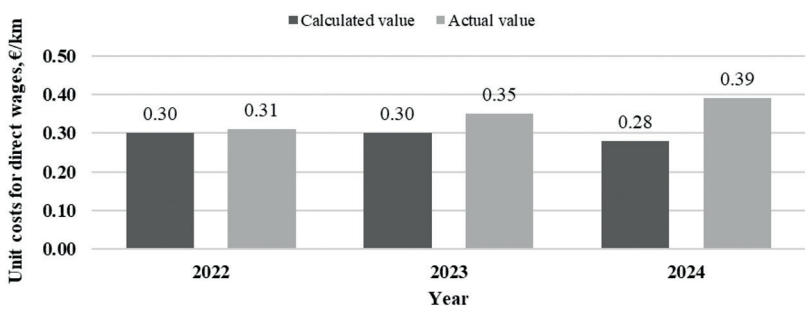

Fig. 2. Comparison of calculated and actual unit costs for direct wages for the years 2022–2024 in NSK

The smallest difference (actual unit costs higher by €0.01) was observed in 2022, and the largest difference was found for 2024, where the actual unit costs were higher by €0.11.

3.4.2. City of Zvolen – evaluation

The baseline unit costs were determined from the Contract, where the costs were broken down by item. For the purposes of the calculations, the unit costs for fuel (motor diesel and CNG) and direct wages, which are presented in Table 5 for the year 2023, were used.

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Tab. 5. Baseline Unit Costs for Fuel and Direct Wages for 2023 – Zvolen

Year	Fuel		Direct Wages	
	Motor Diesel [€/km]	CNG [€/km]	Motor Diesel [€/km]	CNG [€/km]
2023	0.33743	0.29514	0.53255	0.11478

Source: Author based on [10]

Adjustment of Fuel Costs

The unit costs for fuel were recalculated based on relationship (10). Fuel costs were calculated for each month of 2024, and subsequently, the annual average was calculated from the values. The results of the calculations are shown in Table 6.

Tab. 6. Adjusted Unit Costs for Fuel for 2024 – Zvolen

Month	Motor Diesel (MD) [€/km]	CNG [€/km]
January	0.4037	0.4006
February	0.4282	0.3974
March	0.4218	0.3977
Apríl	0.4168	0.3974
May	0.4037	0.3974
June	0.4010	0.3974
July	0.4055	0.3974
August	0.3914	0.3977
September	0.3759	0.3915
October	0.3781	0.3855
November	0.3869	0.3852
December	0.3914	0.3852
Average	**0.4004**	**0.3942**

Source: Author based on [10]

The actual adjusted values were determined from Amendment No. 1 to the Contract [10]. The results of the calculations were compared with the actual values of adjusted fuel costs using the following graph in Figure 3.

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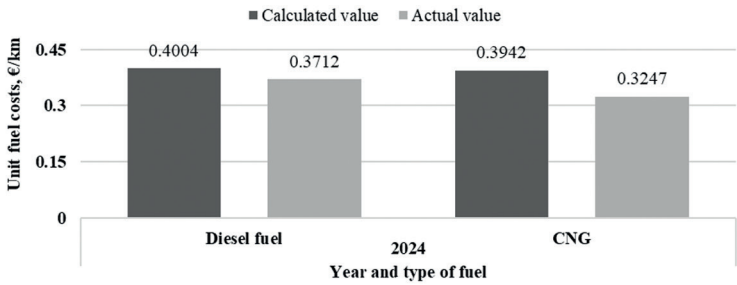

Fig. 3. Comparison of calculated and actual unit fuel costs for Zvolen in 2024

It can be inferred from the graph that the actual values are lower than the calculated values for both motor diesel and CNG. This fact may be due to the demonstrable costs proven by the carrier being lower than the calculated ones.

Adjustment of Direct Wage Costs

The unit costs for direct wages were calculated based on relationship (11). The unit costs for direct wages were calculated together for the year 2024, and the results shown in Table 7 were obtained.

Tab. 7. Adjusted Unit Costs for Direct Wages for 2024 – Zvolen

Year	Direct Wages	
	Motor Diesel [€/km]	CNG [€/km]
2024	0.64027	0.13800

Source: Author based on [10]

The actual values of adjusted unit costs for direct wages were determined from Amendment No. 1 to the Contract [10]. The comparison of calculated and actual adjusted unit costs was performed using the following graph in Figure 4.

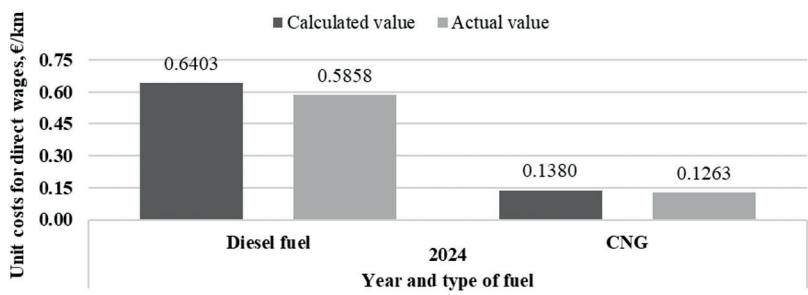

Fig. 4. Comparison of calculated and actual unit costs for direct wages for Zvolen in 2024

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Based on the graph, it is possible to identify that the actual values of unit costs, even in the case of direct wages, are lower than the calculated values for both motor diesel and CNG.

3.5. Proposal for a Uniform Method of Unit Cost Adjustment

3.5.1. Unit Costs for Fuel

Unit costs for fuel in road transport are influenced by multiple factors. The direct factors influencing

the unit costs for fuel are as follows: fuel price, vehicle fuel consumption, and vehicle performance. Other factors influencing unit fuel costs are operational and human factors, organisational and external factors, and administrative influences. Based on the mentioned factors, the formula for adjusting unit fuel costs includes the fuel price and the Consumer Price Index (CPI). In the proposal, the change in fuel price is given a greater weight (0.7) (values are entered based on the type of propulsion used, e.g., motor diesel, CNG, etc.), and the change in the Consumer Price Index relative to the base period (December 2000 = 100) is given a weight of 0.3, but this can be adjusted as needed.

$$C_{F_U} = C_{F_0} * \left(0{,}7 * \frac{P_{F_{n-1}}}{P_{F_0}} + 0{,}3 * \frac{i_{CPI_{n-1}}}{i_{CPI_{n-2}}}\right) \tag{14}$$

$C_{F\,u}$ – the adjusted unit cost for fuel, €/km,
$C_{F\,0}$ – the baseline unit cost for fuel from the carrier's offer, €/km,
$P_{F\,n\text{-}1}$ – the average fuel price in the preceding year for which the unit cost for fuel is calculated, €/l,
$P_{F\,0}$ – the average fuel price at the time of contract conclusion (average annual value), €/l,
$i_{CPI\,n\text{-}1}$ – the Consumer Price Index in the preceding year for which the unit cost for fuel is calculated,
$i_{CPI\,n\text{-}2}$ – the Consumer Price Index two years before the year for which the unit cost for fuel is calculated.

The resulting value is obtained by substituting the data from the carrier's offer and statistical data into the proposed formula (14). The carrier's offer must include the baseline fuel costs (average value of monthly values for the preceding year), which should be derived from the average consumption of the carrier's vehicles. The following statistical data from the Statistical Office of the Slovak Republic are used to calculate the adjusted unit fuel costs:

- the annual average of the Average Price of Fuel in the SR – monthly [12],
- the annual average of the Consumer Price Index (December 2000 = 100) – monthly [12].

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3.5.2. Unit Costs for Direct Wages

Unit costs for direct wages are influenced by various factors that can be divided into several groups. The most important factors include:

- Level of wages and wage entitlements: minimum wage, collective agreements, average wage in the region, shortage of drivers,
- Scope of hours worked and structure of working time: effectiveness of driver working time planning, overtime, night shifts, public holidays and weekends, driver remuneration outside of the actual driving,
- Legislative changes: changes in the Labour Code.

The proposed formula for adjusting unit direct wage costs takes into account the development of the wage level in the SR economy and the Consumer Price Index (CPI). Weights are assigned to individual items based on their directness of impact on unit costs. Both the change in the average nominal monthly wage of an employee in the SR economy and the change in the Consumer Price Index are given a weight of 0.5. The following relationship is proposed for calculating the adjusted unit costs for direct wages:

$$C_{LC_U} = n_{LC_0} * \left(0{,}5 * \frac{a_{NMW_{n-1}}}{a_{NMW_0}} + 0{,}5 * \frac{i_{CPI_{n-1}}}{i_{CPI_{n-2}}}\right) \tag{15}$$

$C_{LC\,u}$ – the adjusted unit cost for direct wages, €/km,
$n_{LC\,0}$ – the baseline unit cost for direct wages from the carrier's offer, €/km,
$a_{NMW\,n\text{-}1}$ – the average nominal monthly wage of an employee in the SR economy in the preceding year for which the unit cost for direct wages is calculated, €,
$a_{NMW\,0}$ – the average nominal monthly wage of an employee in the SR economy at the time of contract conclusion (average annual value), €,
$i_{CPI\,n\text{-}1}$ – the Consumer Price Index in the preceding year for which the unit cost for direct wages is calculated,
$i_{CPI\,n\text{-}2}$ – the Consumer Price Index two years before the year for which the unit cost for direct wages is calculated.

Costs should be adjusted based on formula (15) by substituting the data from the carrier's offer and statistical data (in Slovakia, data from the Statistical Office of the SR). The carrier's offer should include the average nominal monthly wage of an employee in the SR economy at the time of contract conclusion (e.g., for the preceding year) and the baseline unit costs for direct wages. Drivers in road transport should be remunerated based on working hours according to valid social regulations. The following statistical data from the Statistical Office of the SR are used to calculate the adjusted unit costs for direct wages:

- the annual average of the average monthly wage in the SR economy [12],
- the annual average of the Consumer Price Index (December 2000 = 100) – monthly.

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4. Discussion

The following section contains the application of the proposed method of price adjustment on a specific example, which is the recalculation of the baseline unit costs of the Nitra Self-Governing Region, due to the availability of the most data.

4.1. Unit Costs for Fuel – Application of the Proposal

The unit costs for fuel in the case of the Nitra Self-Governing Region are specified in the Contract based on vehicle capacity for three categories and a total for all vehicle types. Formula (14) was used for cost adjustment. Since the required value, such as the average fuel price at the time of Contract conclusion, is not stated in the Contract, the average value from 2015 was used for the purpose of the calculation. The average price of motor diesel for 2015: €1.135/l including VAT [12]. Average fuel prices in the calculations are used without value-added tax. Table 8 contains a comparison of the adjusted unit fuel costs based on the proposed adjustment method for the Nitra Self-Governing Region for the years 2022 to 2024 with the actually adjusted values.

Tab. 8. Comparison of Adjusted Unit Costs for Fuel Based on the Proposed Adjustment Method for 2022 to 2024 – NSK

Year	Vehicle Category	Calculated Value [€/km]	Actual Value [€/km]	Difference [€/km]
2022	Low-Capacity	0.25	0.23	0.02
	Mid-Capacity	0.27	0.27	0.00
	High-Capacity	0.30	0.29	0.01
	Total	**0.28**	**0.28**	**0.00**
2023	Low-Capacity	0.32	0.32	0.00
	Mid-Capacity	0.35	0.37	-0.02
	High-Capacity	0.39	0.40	-0.01
	Total	**0.36**	**0.38**	**-0.02**
2024	Low-Capacity	0.30	0.29	0.01
	Mid-Capacity	0.32	0.33	-0.01
	High-Capacity	0.36	0.36	0.00
	Total	**0.33**	**0.34**	**-0.01**

Source: Author based on [10], [12]

Table 8 includes the quantified differences between the calculated and actual values of unit fuel costs. A graphical representation of the comparison is shown in Figure 5.

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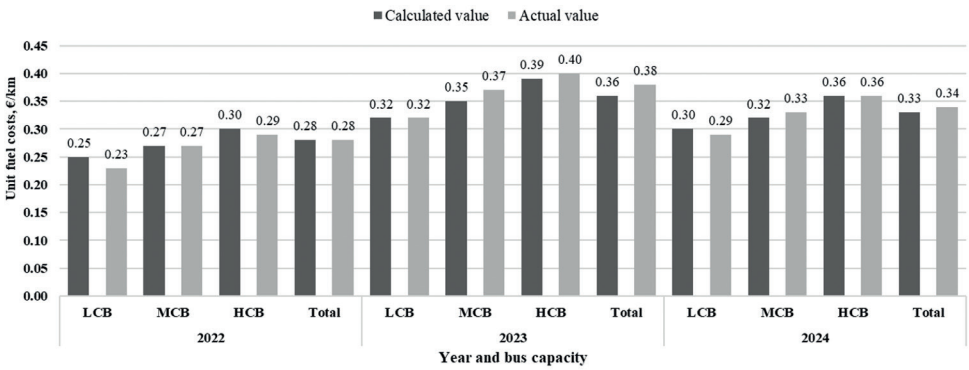

Fig. 5. Comparison of calculated and actual unit fuel costs for the years 2022–2024 according to the proposed adjustment method – NSK

Based on the comparison, differences of ±€0.01 to ±0.02 per km were found. In some cases, the calculated values are the same as the actually adjusted unit costs based on the Contract amendments. In the case of recalculation based on formula (5) from the Contract, differences were found in the range of ±€0.08 to ±€0.15 per km. In contrast, the results are more accurate based on the calculation using the proposed method.

4.2. Unit Costs for Direct Wages – Application of the Proposal

The unit costs for direct wages in the case of the Nitra Self-Governing Region are the same for all vehicle categories; for this reason, a single value for all vehicle categories is considered in the calculations. To recalculate the baseline costs based on the proposed adjustment method, it is necessary to know the average nominal monthly wage of an employee in the SR economy, but this data is not stated in the Contract; therefore, the average value for 2015 was considered in the calculations. The average monthly nominal wage of an employee in the SR economy for 2015 is €883/month [12].

Table 9 contains a comparison of the adjusted unit costs for direct wages calculated according to the proposed method with the actual values based on the Contract amendments for the Nitra Self-Governing Region for the years 2022 to 2024.

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Tab. 9. Comparison of Adjusted Unit Costs for Direct Wages Based on the Proposed Adjustment Method for 2022 to 2024 – NSK

Year	Calculated Value [€/km]	Actual Value [€/km]	Difference [€/km]
2022	0.32	0.31	0.01
2023	0.35	0.35	0.00
2024	0.37	0.39	–0.02

Source: Author based on [10]

Table 9 includes the quantified differences between the calculated and actual values of unit costs for direct wages. Figure 6 illustrates the graphical comparison of the calculated and actual values of unit costs for direct wages.

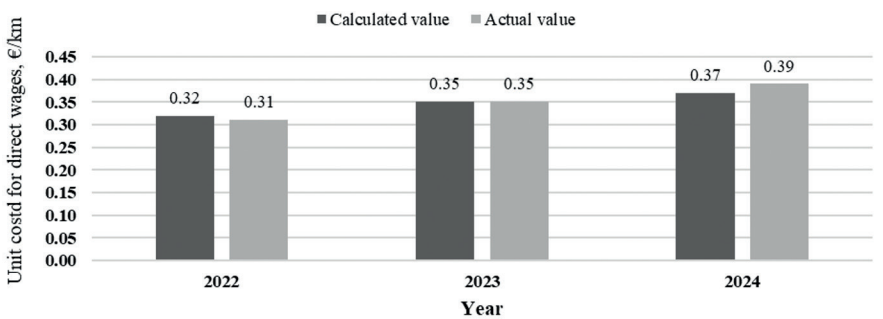

Fig. 6. Comparison of calculated and actual unit costs for direct wages for the years 2022–2024 according to the proposed adjustment method – NSK

Based on the comparison, differences of ±€0.01 to ±€0.02 per km were found, similar to the case of unit fuel costs. In 2022, the calculated costs were higher by €0.01 per km, and in 2024, the calculated values were lower by €0.02 per km. For 2023, the calculated and actual costs were identical. In the case of recalculation based on the Contract, the calculated values were lower by €0.01 to €0.11 per km than the actual ones. Using the proposed solution, the differences were minimized or completely disappeared.

The comparison of the calculated and actual values of unit costs confirmed that the proposed model is able to estimate the real development of costs. The detected deviations ranged from ±€0.01 to ±€0.02 per km, which represents a difference of less than 5% compared to the real values. Based on these results, it can be concluded that the hypothesis of a maximum deviation of up to 5% has been confirmed, and the model can be considered a reliable tool for price adjustment in public transport service contracts.

5. Conclusions

The article focused on the issue of price adjustment when costs change in public service contracts in the field of regular bus transport. The main objective of the article was to propose a uniform and transparent method for including the adjustment of costs, which change over time due to external factors (fuel prices, average wages), in a public service contract. Based on the analysis of existing public service contracts in the Slovak Republic and abroad, procedures applied to adjust unit costs for fuel and direct wages were identified. The article also included the recalculation of unit costs according to existing adjustment procedures.

Based on these calculations, a method for adjusting unit costs for fuel and direct wages was proposed. The proposed procedure was verified by application to historical data of the Nitra Self-Governing Region, which were available. The results showed that the unit costs adjusted in this way were close to the actual adjusted values in most cases. The differences were minimal (in the range of ±€0.01 to ±€0.02 per km) in the case of unit costs for fuel and direct wages. This result suggests that the proposed method of price adjustment in contracts is also suitable for practical use, providing a fair basis for price adjustment in long-term public transport service contracts. From a practical point of view, the recommendation is that a clear, universally valid method for adjusting unit costs affected by changes in input values should be included in public service contracts. When adjusting costs, it is important that the formulas support transparency and verifiability of changes; thus, official, publicly available statistical data should be used.

The proposed method of price adjustment in public transport service contracts can be extended, if necessary, to include other items that change during the contract duration, e.g., costs for repairs and maintenance, and toll costs.

6. Acknowledgement

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7. References

[1] Alrajhi J, Abdelwali H, Swilem SH, Abdelati M. An Efficient Methodology to Calculate Unit Transportation Costs: Case Studies for Trucks and Busses. International Journal of Traffic and Transportation Engineering. 2024;13(3):56–65. https://doi.org/10.5923/j.ijtte.20241303.02.

[2] Andrei AC. Public Ownership of Local Public Transport Vs. Private Competition. Popa I, Dobrin C, Ciocoiu CN. ed. Proceedings of the 10TH International Management Conference: Challenges of Modern Management (IMC 2016). 2016:81–88.

[3] Berg J, Ihlström J. The importance of public transport for mobility and everyday activities among rural residents. Social Sciences Online. 2019;8(2):58. https://doi.org/10.3390/socsci8020058.

[4] Brídziková M, Konečný V, Hammer J, Abramovic B. Demand specifics of disabled persons and persons with reduced mobility for bus transport. Case of regional bus transport in Slovakia. The Archives of Automotive Engineering – Archiwum Motoryzacji. 2020:87(1):81–95. https://doi.org/10.14669/AM.VOL87.ART7.

[5] Cyprich O, Konečný V, Kilianová K. Short-term passenger demand forecasting using univariate time series theory. Promet – Traffic and Transportation. 2013;25(6):533–541. https://doi.org/10.7307/ptt.v25i6.338.

[6] Dydkowski G, Galecka W, Urbanek A. Contracts of Transport Services Provision as a Factor of Increasing the Effectiveness of the Urban Public Transport. Lecture Notes in Networks and Systems. 2024;907:15–33. https://doi.org/10.1007/978-3-031-53181-1_2.

[7] European Union. Regulation (ES) No 1370/2007 on public passenger transport services by rail and by road and repealing Council Regulations (EEC) Nos 1191/69 and 1107/70. Official Journal of the European Union, L 315/1, 3.12.2007.

[8] Hörcher D, Tirachini A. A review of public transport economics. Economics of Transport. 2021;25:100196. https://doi.org/10.1016/j.ecotra.2021.100196.

[9] Kilianová K. Pôsobenie činiteľov na vybrané nákladové položky prímestskej autobusovej dopravy a ich štatistická závislosť. Doprava a spoje – elektronický časopis Fakulty prevádzky a ekonomiky dopravy a spojov Žilinskej univerzity v Žiline. 2012:213–217. Available from: https://tac.uniza.sk/pdfs/das/2012/01/25.pdf (accessed on 2025 Feb 01).

[10] Regional and local transport authorities in Slovakia, the Czech Republic, and Hungary. Public passenger transport service contracts. Public documents (2016–2024). Availabla from: https://pagedrop.app/p/public-passenger-transport-service-contracts/ (accessed on 2025 Jan 30).

[11] Rosell J. Urban bus contractual regimes in small- and medium-sized municipalities: Competitive tendering or negotiation?. Transport Policy. 2017;60:54–62. https://doi.org/10.1016/j.tranpol.2017.08.009.

[12] Statistical Office of the Slovak Republic. Statistical data on average fuel prices, average monthly wages, and consumer price index. Publicly available statistical data (2016–2025). Available from: https://pagedrop.app/p/1312-statistical-office-of-the-slovak-republic/ (accessed on 2025 Feb 04).

[13] Van de Velde D. A new regulation for the European public transport. Research in Transportation Economics-A Research Annual. 2008;22(1):78–84. https://doi.org/10.1016/j.retrec.2008.05.011.