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THE IMPACT OF A DEMOGRAPHIC TREND ON THE DEMAND FOR SCHEDULED BUS TRANSPORT IN THE SLOVAK REPUBLIC

Scheduled bus transport is an important and irretrievable transport system from society point of view. All age groups of population use this transport system to satisfy their own transport requirements. The performance of scheduled bus transport has markedly decreased recently. The performance level is affected not only by fare prices and incomes of population but also by the change in population structure. Population represents potential demand for scheduled bus transport services.

Key words: scheduled bus transport, demographic trend, demand, passengers, inhabitants

1. Introduction

Concrete groups of passengers have different transportation requirements in relation to demand for scheduled bus transport services. Their demand for transportation services is influenced by various factors. These factors consequently affect the possibility of substitution of the bus transport services by individual motoring. It is therefore necessary to investigate not only the total demand for scheduled bus transport but also individual demands of concrete age groups.

The paper deals only with scheduled bus transport (besides urban mass transport), because only this kind of mass transport has provided performance and revenue data in relation to concrete passenger groups in the Slovak Republic.

2. An analysis of performance and revenues of scheduled bus transport in the SR

Performance and revenues of provided transport services are a result of passenger demands for concrete transport services. Fares and incomes of population are the most influential factors that affect demands for scheduled bus transport. The impact of these factors is elaborated in detail at [4], [5] and [6]. This paper is focused on demographic development in the SR as an important factor of the demand.

In the case of fare prices and incomes changes the passengers search other possibility for transportation. It means a change in the scheduled bus transport services and their substitution by other kind of transport, often by individual motoring. Calculation of growth rates for transported passengers was based on data¹⁾ included in table 1. Figure 1 was elaborated on the basis of these data, too.

The number of passengers transported by school reduced fares decreased on the average by 8.5 % and by full fares decreased on the average by 6 % from 2000 to 2004. On the other hand the number of passengers transported by other reduced fares increased on the average by 16.1 % from 2000 to 2004. Pensioners were included into this group of passengers.

The structure of passengers transported by scheduled bus transport (thousands of passengers) according to the fares in the Slovak Republic from 2000 to 2004

Year	Number of passengers transported by		
	school reduced fares	full fares	other reduced fares
2000	107 100	309 345	9 181
2001	106 120	281 110	18 589
2002	109 244	269 600	11 829
2003	98 756	244 296	14 800
2004	75 201	240 963	16 662

Source: Elaborated on the basis of [9]

The shares of fares on revenues in scheduled bus transport in the SR in 2000 were:

- 92 % in case of full fares,
- 5 % in case of school reduced fares,
- 3 % in case of other reduced fares.

The situation changed considerably within 5 years, the shares in 2004 were:

- 84 % in case of full fares,

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¹⁾ data on costs, revenues and performance in enterprises provided scheduled bus transport services in the SR are consolidated till 2004

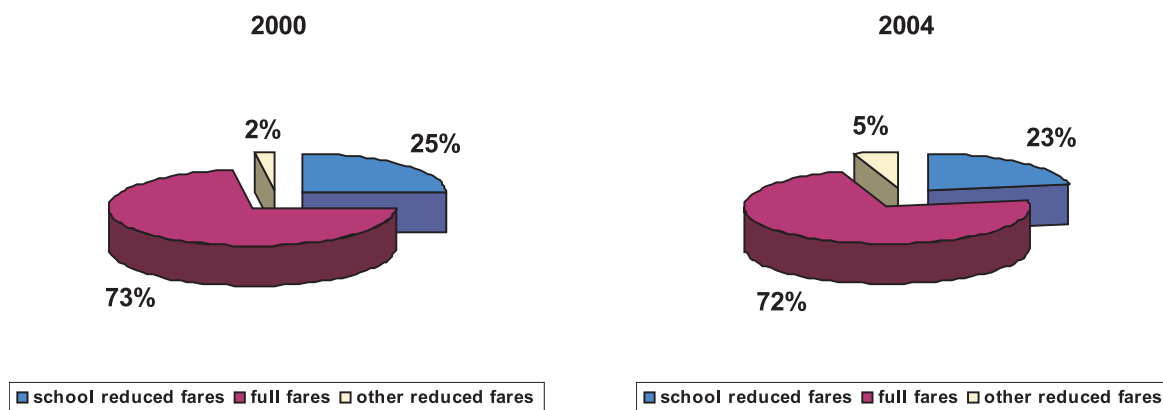


Fig. 1 Comparison of scheduled bus transport performance split by the fares in the SR in 2000 and 2004

- 10 % in case of school reduced fares,
- 6 % in case of other reduced fares.

For more details see table 2.

The structure of revenues in scheduled bus transport (thousands of SKK) according to the fares in the Slovak Republic from 2000 to 2004

Year	School reduced fares	Full fares	Other reduced fares
2000	213 772	3 789 260	105 427
2001	305 335	4 162 912	164 937
2002	288 103	4 138 212	127 698
2003	476 295	4 312 938	139 410
2004	519 489	4 160 039	277 488

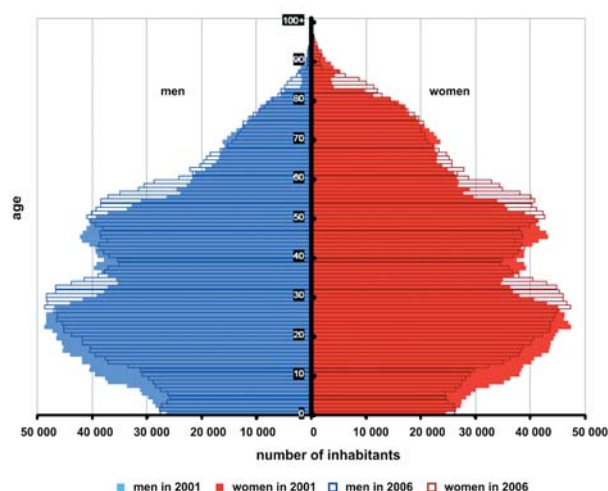
Source: Elaborated on the basis of [9]

3. A demographic trend in the Slovak Republic

Aging of population is an all-society problem not only in the Slovak Republic territory in recent years. It caused changes in potential demand of concrete population groups for scheduled bus transport. Fig. 2 depicts aging of population in the SR territory; Fig. 3 includes comparison of population split in the SR in 2000 and 2004.

The structure of transported passengers had to be synchronized with aging structure of population split realized by the Statistical Office of the SR in relation to the investigation of demand and performance of scheduled bus transport. For that purpose the following classification was realized:

- age group from 5 to 19 years - school reduced fares,
- age group from 20 to 64 years - full fares,
- age group from 65 and above - other reduced fares.



Source: The Statistical Office of the SR

Fig. 2 Population split by the age group in the SR, 2001 and 2006 (December 31)

The structure of population by the age in the SR from 2000 to 2004 (persons)

Age group (years)	2000	2001	2002	2003	2004
0 - 4	285 562	274 648	267 273	262 203	259 974
5 - 19	1 194 678	1 175 603	1 142 661	1 109 856	1 076 827
20 - 64	3 302 723	3 316 015	3 353 002	3 387 683	3 422 079
65 and above	619 584	612 685	616 225	620 311	625 942

Source: Elaborated on the basis of [7]

In relation to the structure of age groups the percentage share of pupils and students (5-19 years) decreased by 2 % in a relatively

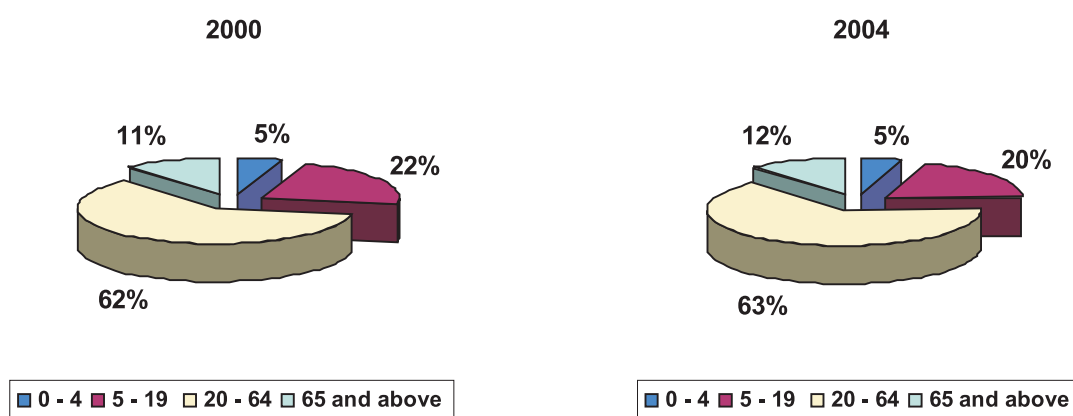


Fig. 3 Comparison of population split by the age groups in the SR in 2000 and 2004

short time period. Within the mentioned population groups the following trend was observed:

- age group from 5 to 19 years – average year to year decrease by 2.6 %,
- age group from 20 to 64 years – average year to year increase by 0.9 %,
- age group from 65 and above – average year to year increase by 0.3 %.

Prognosis of population by the age in the SR is included in table 4. A marked increase in people over 65 years old is expected in the future. The number of pupils and students will decrease to 2015. It will increase again from 2015. The age group from 5 to 19 years (pupils and students) will reach 16 % share of population, working age inhabitants (from 20 to 64 years) will reach 67 % share and pensioners will reach 12 % share of population in 2010.

The years 2020 and 2025 will be extreme and significant in relation to demography because the number of pensioners will be higher than the number of pupils and students. In 2025 the following percentage shares of population are expected:

- 16 % in case of pupils and students,
- 60 % in case of people in working age,
- 19 % in case of pensioners.

The prognosis of population by the age groups in the SR (persons)

Table 4

Age group (years)	2010	2015	2020	2025
0 - 4	275 816	291 002	284 774	260 885
5 - 19	894 853	821 665	830 320	856 514
20 - 64	3 577 152	3 583 514	3 473 333	3 356 876
65 and above	675 883	775 472	921 798	1 047 470

Source: Elaborated on the basis of [1]

4. A relationship between the demographic trend and the performance of scheduled bus transport in the SR

The demographic process determines a demand for mass passenger transport not only in the SR. Pupils and students represent the greatest potential demand for transportation because they use this kind of transport for travelling to and from school. Their potential demand for transportation is influenced by decrease in their population.

This predication is confirmed by correlation between two variables – the number of people included in the age group from 5 to 19 years and the number of passengers transported by school reduced fares from 2000 to 2004. The correlation reaches the value of minus 0.83, it means a strong negative correlation (dependence) between the investigated variables.

A decrease in pupils and students transported by bus transport is expected in the future similarly as the population of pupils and students decreases. Their habits and activities did not change. This fact will eliminate the possibility of their movement rising (number of trips) in the future. Movement of pensioners achieved a lower level in comparison to other inhabitant groups.

The formula for calculation of future demand for schedule bus transport services in the SR based on the use of average movement of pupils and students within 5 years (from 2000 to 2004):

$$FD_i = NI_i \cdot AMP_{SRF} \quad (1)$$

where: FD_i means a future demand for schedule bus transport services in the year i , (trips per year or passengers per year),

NI_i means a number of inhabitants included in the age group from 5 to 19 years for the year i ,

AMP_{SRF} means an average movement of passengers transported by scheduled bus transport, the variable reaches the value of 86.87 trips per capita and year²⁾

²⁾ the value was calculated on the basis of [9] as an average of movements of pupils and students for every year during the period from 2000 to 2004

The future demand for scheduled bus transport is calculated on the basis of application of formula (1). The number of passengers transported by school reduced fares is expected to reach 77 736 thousands of passengers in 2010 and 74 405 thousands of passengers in 2025 (in case of changelessness of pupils' and students' demand for scheduled bus transport). This calculation approach respects only a demographic trend, not e. g. changes in fare prices.

The future pupils' and students' demand for scheduled bus transport services can be estimated without respecting the demographic process, too. It can be realized through the application of an average decline rate for passenger transported by school reduced fares. In 2010 44 131 thousands of passengers and in 2025 only 11 643 thousands of passengers will be transported using the above mentioned approach. Respecting the demographic trend in the SR the average movement of pupils and students will be 43.32 trips per year and capita in 2010, it will be only 13.59 trips per year and capita in 2025. These values of movement of pupils and students in 2010 and in 2025 are unrealistic. There is a wide difference between the future movement and average movement value within 5 years (from 2000 to 2004). The future movement in comparison to the current average movement could not be so low because pupils and students travel mainly for education. The education process will not markedly change in the future.

Other approach to calculation of future pupils' and students' demand for scheduled bus transport services is based on the application of regression function that expresses the relationship between the number of passengers transported by school reduced fares and the number of persons included in the age group from 5 to 19 years (see Fig. 4).

Working age inhabitants represent the largest population group. The increase in an average wage is a significant factor affecting demand of people in working age for scheduled bus transport in comparison to the demography as another important factor. The relationship between the average monthly wages and the number of passengers transported by full fares expressed as a correlation reaches the value of minus 0.95, it means a strong negative dependence. The correlation between the number of working age inhab-

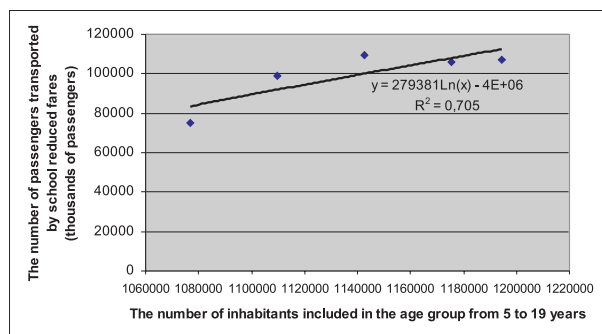


Fig. 4 Regression function of relationship between the number of passengers transported by school reduced fares and the number of inhabitants included in the age group from 5 to 19 years

itants and the number of passengers transported by full fares reaches the value of minus 0.94, it means a strong negative dependence, too. If the prognoses of demographic trend and average wage level are known, the future demand could be estimated using the regression functions (see Fig. 5). The increase in an average wages influences the decrease in a demand for scheduled bus transport and the increase in a demand for individual motoring.

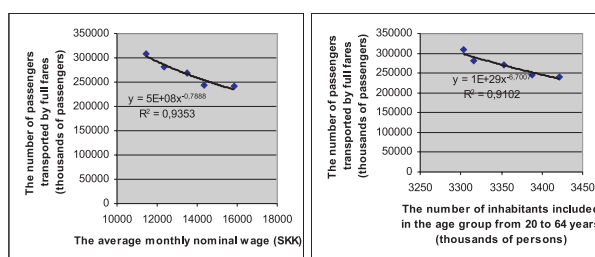


Fig. 5 Regression functions of relationship between the number of passengers transported by full fares and average monthly nominal wage (the left side of Fig. 5), and the number of inhabitants included in the age group from 20 to 64 years (the right side of Fig. 5)

The possibilities to drive or use the passenger cars are different for concrete population groups. The working age inhabitants have the greatest potential for the substitution of scheduled bus transport services using the individual motoring, followed by the pensioners. The pupils and students till the age of 18 have almost no possibilities to drive own cars (only as fellow passengers).

The working age inhabitants can own driver's licences and can use their cars. This activity is supported rising the average monthly wage in the SR in recent years. Within 7 years (from 2000 to 2006) the average monthly nominal wage increased by 8.6 % per year and the average monthly real wage increased by 9.9 % per year. Even the growth of fuel prices did not reduce the use of passenger cars in the SR till 2006 [6]. An inhabitant of the SR could buy 331 litres of gasoline (price 34.50 SKK per litre) or 366 litres of diesel (price 31.20 SKK per litre) in case of spending the average monthly wage of 11 430 SKK in 2000. In 2004 447 litres of gasoline (price 35.40 SKK per litre) or 496 litres of diesel (price 31.90 SKK per litre) could be bought in case of spending the average monthly wage of 15 825 SKK.

A lot of pensioners (over 65 years) can use their cars, too but they are limited by the level of pensions. Many of them face the health troubles that make them incapable of driving passenger cars. Their incomes are markedly lower in comparison to the incomes of working age inhabitants. 157 litres of gasoline or 194 litres of diesel could be bought in case of spending the average monthly pension of 5 412 SKK in 2000 and 199 litres of gasoline or 221 litres of diesel in case of spending the average monthly pension of 7 046 SKK in 2004 (see Fig. 6).

There is a difference between the average income of working age person and the average income of pensioner in the SR. The

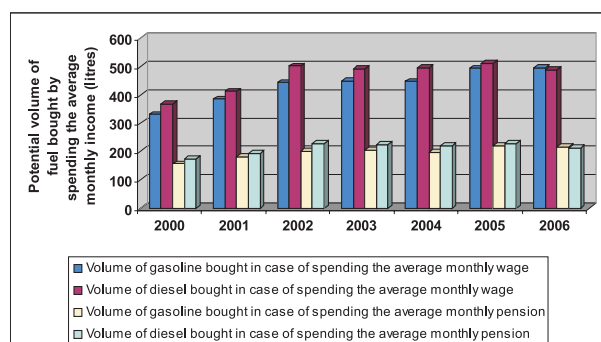


Fig. 6 Calculation of bought fuels in case of spending the average monthly income

income gaps are deeper in case of comparison between the households consisting of working age inhabitants and pensioners.

5. Conclusion

A decrease of performance of schedule bus transport is expected as a result of the aging of inhabitants and changes in the population structure.

The economy growth and increase in incomes cause the movement of working age inhabitants from using the scheduled bus transport to the individual motoring. A decrease in transported passengers is expected. It is influenced mainly by the growth of

the Slovak Republic economy (in GDP) and by the growth of motorization³⁾ in the SR. An indicator of motorization does not reach even half of the EU 25 countries' value.

The proportionality of shares of passenger groups based on the full and reduced fares changed in last years. The number of passengers transported by full fares decreased faster in comparison to another groups of passengers. This trend influences and will influence operators' revenues and benefits. It will cause the increase in required sources for financing of public interest transportation performance in the future.

For the expectation of future development in the Slovak Republic, we can define the significant risks as insufficient capacity of road infrastructure, lack of parking places in town residential areas, increase volume of exhaust emissions, higher accident rate in the field of road transport etc. The slowdown of decrease in scheduled bus transport performance could be realized through providing transport services characterized by a higher quality level (higher quality often gives rise to higher operator's costs and is followed by higher fares) or through the development of integrated transportation systems.

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References

- [1] BLEHA B., VANO B.: *Prognosis of Demographic Trend in the SR to 2025*, INFOSTAT –Demography Research Centre, Bratislava, 2007.
- [2] GNAP, J., KONECNY, V., POLIAK, M.: *Demand Elasticity of Public Transport Journal of Economics (07/2006)*; Institute of Economic Research of the Slovak Academy of Sciences and Institute for Forecasting of Slovak Academy of Sciences, Bratislava; ISSN 0013-3035 (Journal is documented in Social Sciences Citation Index, Current Contents/Social and Behavioural Sciences and in electronic version of index EconLit).
- [3] CHAJDIK, J.: *Statistics Simply*, STATIS, Bratislava 2003, ISBN 80-85659-28-X.
- [4] KONECNY, V.: *Price Elasticity of Demand for Passenger Transport in the SR*, Transport Horizons, 1/2007, ISSN 1210-0978.
- [5] KONECNY, V.: *Income Elasticity of Demand for Passenger Transport in the SR*, Transport and Communications, Electronic Journal of Faculty of Operation and Economics of Transport and Communications, University of Zilina, No.1, 2007, ISSN 1336-7676.
- [6] KONECNY, V.: *Elasticity of Demand for Passenger Transport in the SR*, Proc. of 4. Intern. Conference Road and Urban Transport and Sustainable Development 2007, EDIS University of Zilina, 2007, ISBN 978-80-8070-759-0.
- [7] *Statistical Yearbook of the SR 2006*, VEDA Bratislava, 2006.
- [8] VANO, B., JURCOVA, D., MESZAROS, J., POTANCOKOVA, M., SPROCHA, B.: *Demographic Trend in the Slovak Republic 2006*, INFOSTAT – Demography Research Centre, Bratislava, 2007.
- [9] *Statements of Costs, Revenues and Performance in Enterprises Provided Scheduled bus Transport Services*, Ministry of Transport, Posts and Telecommunications of the SR.

³⁾ the number of passenger cars per 1000 inhabitants