Extrapolation in Population Projections of the Slovak NUTS III and their Reliability with Respect to Societal Processes

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Abstract

In general, the paper deals with population forecasting. Selected extrapolation methods are used for the case of NUTS III regions in Slovakia. Main aim is to verify how reliable they can be with respect to recent demographic and socio economic processes in Slovakia after 1989 within transformation. We have presupposed linkages among demographical and socio-economical changes and curves; therefore, we have attempted to verify how fluctuation, rapid changes during last decade, and reduction of these fluctuations influence the accuracy of the models. There seems to be a strong linkage between demographic and socio-economic systems. Stability of the demographic one is higher although influenced by fluctuations of the economical ones. There is no doubt that the rapid demographic change will influence features such as retirement system in the future. It is necessary to know how populous and old will be the Slovak population and sub-national ones. The more accurate will be the results, the more suitable for economists and planners.

Keywords: *forecasts, extrapolation, reliability, accuracy, demographic change, socio-economic development*

JEL Classification: J11

Introduction

The basic aim of this paper is application of selected extrapolation models to Slovak regions at territorial NUTS III level. The goals of the paper include also verification possibilities of the models and their applicability for the future population development. Do these models really guarantee correct population forecasts? Are perhaps the cohort-component method or other methods more suitable?

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As one can assume, there is no explicit answer to the above questions. There is a complex of factors that influence the results. First of all, we can name territorial level, forecasting period's length but also recent population development features in the respective region. Concerning these aspects, we made an attempt to apply and verify (through measuring a model's accurateness) a set of selected extrapolation models. We were interested in all above mentioned facts, concerning a wider context of the period of transformation of Slovak society and economy. Prognostic approaches and accuracy of the forecasts are strongly affected by fluctuations and multiple unexpected shifts in development trajectories of (population) processes. In association with this, we should mention that accuracy represents only one of the quality attributes of a population forecast, although it the crucial one.

The transforming societies and economic systems of the former east bloc experienced huge changes in the 1990´s. These changes seem to have influenced quality and accuracy of forecasts, as well as applicability and reliability of different forecasts methods. The cohort-component method seems to be a top technique applicable for these periods in developed countries. On the other hand, some of the extrapolation models might be appropriate for short-term regional forecasts. There is no doubt that the rapid demographic change will influence features such as retirement system in future. This will be the moment when the ratio of retired people and children turns inverse (Bleha and Vaňo, 2007). It is necessary to know how populous and old will be the Slovak population and subnational ones. The more accurate will be the results, the more suitable they will be for economists and planners.

1. Methodological Basis

There is a wide range of methods used for population forecasts. If necessary input data is available, the cohort-component method is most frequently used by official institutions in the Slovak Republic. This method is preferred in developed countries.

Extrapolation methods belong to less employed methods of population projections. They are often a subject of criticism because of certain rate of inaccuracy and simplification of complexity of real situation. Their controversy is caused also by the fact that they apply development tendencies observed in the past into the future, which can be misleading in fluctuation periods. Such oscillation period is typical for contemporary processes in Slovakia including its population; in spite of that (and because of that) we have applied the selected models. On the other hand, low demands on construction of these projections, and in some cases also a good availability of necessary input data represent the great positives of the extrapolation models´ application.

All extrapolation models (working with a discrete time quantity) are based on the assumption that a chronological sequence of values P_1, P_2,...P_t showing a selected parameter of a surveyed region at equidistant time points is available for a certain historical time period. As the first parameter aligned in a sequence, number of residents of a region at each time point will be used in our study. Natural increase rate for each point in time has been selected as the second parameter. The aim of the projection is to obtain estimated values (arranged in the respectively time sequence) for a selected and clearly defined future moment. This estimation (its numerical value) will be considered as a result of the population projection and defined as a forecast.

For creation of projections by means of extrapolation methods, many extrapolation models are available, both simple and sophisticated. In our paper we focus only on three groups of the models which will be used to make population projections for the purposes of our study.

The first group of extrapolation models embraces simple growth models being less exacting. The models have been derived on the basis of trivial estimations of population growth. The elementary growth models are represented by the following models:

- *The naive model*

$$\hat{P}_{t+h} = P_t \tag{1}$$

based on a presumption that no change of population size in the region within the time span between the starting and target moments of the forecast will take place.

- *The arithmetic growth model*

$$\hat{P}_{t+h} = P_t + ah \tag{2}$$

- *The geometric growth model*

$$\hat{P}_{t+h} = P_t \cdot (1+r)^h \tag{3}$$

where parameter a denotes arithmetic mean of yearly absolute increase, r denotes arithmetic or geometric mean of relative values of increase.

The second group includes so-called trend models which are more complex in comparison with the first type of extrapolation models. The following models are included here:

- T*he constant trend model*

$$\hat{P}_{t+h} = a \tag{4}$$

where arithmetic mean of P_i $(i = 1, 2,...,t)$ denotes a simple estimation of a.

- *The linear trend model*

$$\hat{P}_{t+h} = a + b(t+h) \tag{5}$$

- *The quadratic trend model*

$$\hat{P}_{t+h} = a + b(t+h) + c(t+h)^2 \tag{6}$$

- *The exponential trend model*

$$\hat{P}_{t+h} = ab^{t+h} \tag{7}$$

- *The multiplicative trend model*

$$\hat{P}_{t+h} = a\left(t+h\right)^b \tag{8}$$

In the other models, values of parameters *a* and *b* are estimated by the least square method.

Simple comparative models represent the last group of models that will be used here. Existence of a quantitative relationship between a region's population growth dynamics and population of a selected reference area is the basic condition inevitable for creation of comparative models. Providing that the above mentioned dependence will continue in the future, we can create a population projection for any region and any time point, based on a prediction of the reference area's population size at the target point.

Three models are included in this group of models:

- *The model of constant share* (of population size)

$$\hat{P}_{t+h} = (P_t / C_t)C_{t+h} \tag{9}$$

- *The model of constant share* (of absolute increase)

$$\hat{P}_{t+h} = P_t + [(P_t - P_1)/(C_t - C_1)](C_{t+h} - C_t) \tag{10}$$

We can anticipate that the share of absolute increase values equal $P_t - P_1/C_t - C_1$ will not change.

- *The model of arithmetic growth of share* (of population size)

$$\hat{P}_{t+h} = C_{t+h}(P_t / C_t + ah) \tag{11}$$

We anticipate that the mean yearly absolute increase of rate P_i/C_i observed in the historic period (*a* parameter) will remain constant during the forecast period.

After modifications:

$$\hat{P}_{t+h} = \left[\frac{P_t}{C_t} + \frac{h}{t}\left(\frac{P_t}{C_t} - \frac{P_1}{C_1}\right)\right]C_{t+h} \tag{11.1}$$

where C_t and C_{t+h} respectively, represent the reference region's population number at time t or $t + h$, respectively.

To conclude this part, we should remark that the comparative models require an independent forecast of population size for the reference region at target point (C_{t+h}). Thus it is necessary to pay attention to the fact that there are two sources of inaccuracy in each comparative model. The first of them is an error of prediction of the variable expressing relationship between the researched region and the reference area. The second and probably less important source of inaccuracy is linked with the reference region's population projection (Smith, 1987; Smith and Sincich, 1988).

2. Application

A chronological sequence of data from 1993 to 2002 has been used here. Population numbers as well as natural increase rate values are the main indicators focusing our attention. These two indicators are dissimilar in their values, but also in their nature and diverse development from the aspect of time, which is extraordinarily important for extrapolation. We will try to explain some of the identified dissimilarities. Based on the temporal data series, forecasts of population number and natural increase values for 2003, 2005 and 2010 have been constructed. Slovakia's NUTS III units have been selected as the most suitable territorial units for regional analyses. Considerable differences in values of the researched indicators as well as in their development within the monitored time period are characteristic for this territorial division.

Population numbers of eight NUTS III regions forming the territory of the Slovak Republic reach from 550,000 to 790,000 residents, which is a relatively low range. Number of inhabitants of Slovakia and its 8 regions did not vary too much in the 1993 – 2002 period. A certain stability in overall population development was disrupted by the year 2001 (census data, underevaluation).

Population of the Slovak Republic as of 2002 numbered 5,379,161 inhabitants, thus an increase by 42,706 inhabitants (8‰) occurred after 1993. A survey of the population development at regional level shows a certain differentiation. In 1993 – 2002 period, a population growth was recorded in four regions (Trnava, Žilina, Prešov and Košice regions), while the other four regions (Bratislava, Trenčín, Nitra and Banská Bystrica) witnessed a population decrease. The highest increase rate (45‰) occurred in Prešov region. On the other hand, the most prominent decrease (25‰) was observed in Bratislava region. This spatial development is closely linked with some of the natural population movement and migration processes. Eastern and northern Slovakia keep higher fertility rates, whereas in western Slovakia population losses have been compensated by deconcentration and suburbanisation processes, typical not only for many post--communist countries, particularly at municipalities (NUTS V) and districts (NUTS VI) level. For instance, the Capital lost substantial share of its population after 1989 due that factor.

Natural increase is the second researched indicator, whose influence on population development at each territorial level is much stronger that the one of migration. The natural increase changed dramatically after 1993. From 20,549 people (3.9‰) in 1993 it dropped to 2,427 (0.45‰) in 2000. In 2001 Slovakia for the first time in its short history witnessed a natural decrease by 844 people. The tendency of natural decrease remaining still in negative numbers occurred at regional level, too, except for Prešov, Košice and Žilina regions, where we observed a descent of natural increase, although still proving slightly positive numbers.

In general, first half of previous decade was the period of the most violent changes accompanying transformation of socio-economic system. Demographic indicators reacted immediately but population inertia has retained retains until present within spatial differences. The reasons' explanation is various. Indeed, all factor which are deeply varying (age and other demographical structures, living standard, ability to adapt after 1989) influence real change and result of projections.

2.1. Projection Results

The naive model, the arithmetic growth model and the geometric growth model represent the group of simple growth models that have been based on trivial presumptions regarding growth of regional populations. The naive model (1) is the simplest one. Thus the number of inhabitants of individual regions remains at constant level from the starting point of the forecast being identical with the year 2002. The forecast generated by the naive model could be acceptable in case of a stabilised population development and projections reaching to near future only. However, it is inevitable to emphasise the role of the naive model as a certain norm to which quality of other extrapolation models for regional population projections can be compared (Bezák and Holická, 1995). The arithmetic (2) and geometric (3) growth models bring very similar forecasts with very little differences. The differences grow with time distance which is caused by the character of functions used by the models (linear function in the arithmetic growth model, exponential in the geometric one). Their elementariness comes out of the fact that they anticipate continuation of the dominant development trend (either continuing growth or descent). It is evident that the tendency observed in the recent history will continue in the future, either as a trend of population growth in four out of eight regions, or as a population decrease in the rest of the country. This assumption is true up to a point; however, the expected population dynamics will be lower, especially as for the population growth.

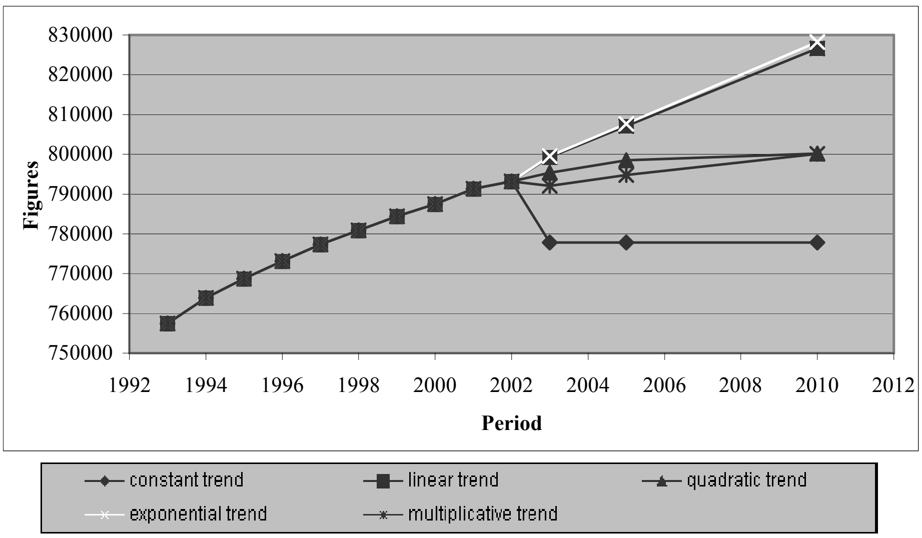
The trend models form the most numerous group of the presented models. They offer extensive variations of population figures for individual regions. The most primitive model out of the group is the constant trend model (4) which reckons on the stable population development (in much the same way as the naive model), but this time the population number is derived from arithmetic mean of its values recorded in the historical time series. Evaluating the population development in the regions of Slovakia, we have mentioned several times that the trends of either growth or decrease are quite clear in the regions. That is why it is not too correct to speak about a stable development in the immediate future.

On the other hand, we have already described the dynamics changes manifested in deceleration of population growth in 4 regions. Based on these facts, we preferably tend to accept the idea of a stabilized development in the distant future. Likewise the similarity of the forecasts constructed by the arithmetic and geometric models, certain similarities between the linear (5) and exponential (7) trend models are visible.

The trend models operate with a recent trend, prolonging it into the future in the way that is different from the other models of the same group. As an example, we can look at figures referring to Prešov.

F i g u r e 1

Number of Inhabitants Projection for Region of Prešov for Years 2003, 2005 a 2010 (trend models)



In accordance with the exponential model, a population growth reaching to 828,194 inhabitants by 2010 could be expected in Prešov region. It is evident that the linear and exponential models expect a little milder descent. The multiplicative trend model (8) brings a forecast of a mild prolongation of the existing trend into the future. For this reason, this model could bring the most probable development, at least for the regions with growing population. It is caused by the mildness of the growth dynamics projected by this model. The regions with the growing trend have been emphasized deliberately, because in case of decreasing trend, the descent forecasts would be too mild. And finally, the quadratic trend model (6) brings forecasts substantially different from the other ones. This model's results are derived from the recent data prolongation into the future copying a parabola. Due to this, the decreasing trend will continue with a progressive increase of population size. However, the main contrast between this and the other models appears in case of the regions with recent population growth. The quadratic trend model forecasts a trend of a slowdown of the growth leading gradually to a decrease, which certainly will not occur at the same moment in all of the regions.

The simple comparative models are the last ones to evaluate. For the study purposes, the territory of Slovakia has been selected as a reference area. In most cases, a region at higher hierarchical level is selected as a reference area. When projections for individual regions of a country are made, then the area of the country as a whole is the most suitable reference area. We assume that parts of a country bear some common features, thus a certain consistency of development exists here respecting the principles of bottom-up approach.

As the data source, results of the medium scenarios of Slovak population forecasts elaborated by the Statistical Office of the Slovak Republic and the Research Demographic Centre by means of the cohort-component method have been used. It is necessary to point to the discrepancies between the forecasts, especially those as to the year 2010 defined as the time horizon of our study. We have to stress that the forecast of the Statistical Office of the Slovak Republic anticipates permanent population decrease from the beginning of the surveyed period. The Research Demographic Centre forecasts population increase and a tendency of growth even for the year 2010 and gradual decline for later time horizons (Vaňo, 2002; ŠÚ SR, 2002).

The discrepancies between the two forecasts result from different input assumptions (especially the one of the future fertility development). The dissimilarities between the two growth trends led into different population numbers projected for the eight regions, and – which is even more important – into different development courses predicted by some models.

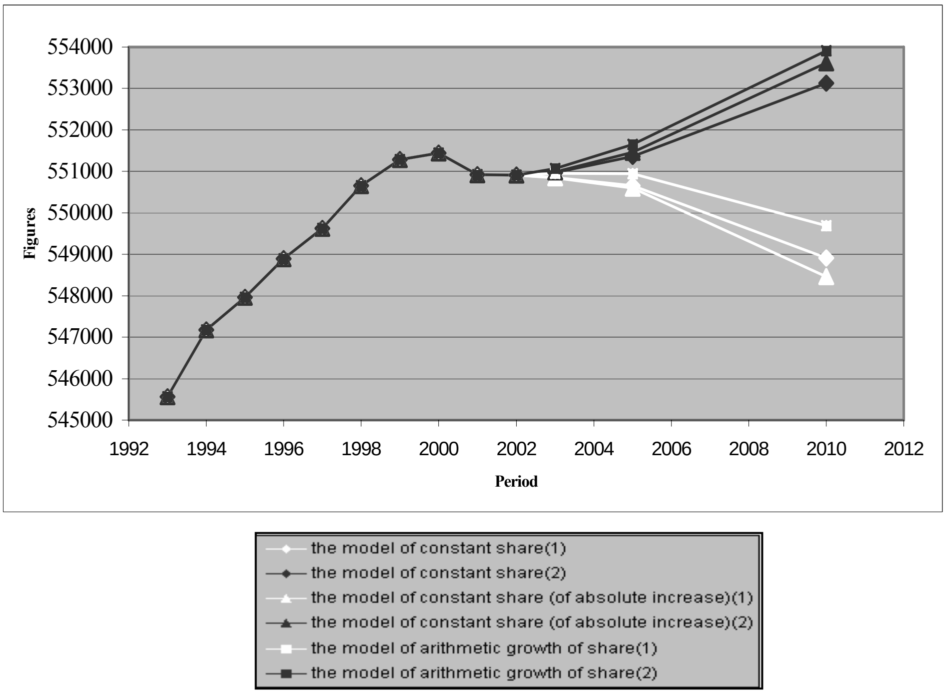
The constant share (of population number) model (9) is based on a very elementary precondition that the initial ratio between population size of a researched region and the reference area will remain constant in the future (Isard, 1960; Isserman, 1977; Krueckeberg and Silvers, 1974). This ratio is in a multiplicative relationship with the population size of the reference area. Consequently, respecting the population growth of Slovakia (as forecasted by the Statistical Office of SR as well as the Research Demographic Centre), we can expect the population growth also in individual regions of the country, whereas the general population decrease in the country (projection of the Statistical Office of SR) would bring an opposite effect in the regions. Thus the forecast of the population development generated by this model can be presented as the most prospective scenario for Trnava, Žilina, Prešov and Košice regions, partly also for Bratislava region.

As for the constant absolute increase share model (10), it is the opposite of the constant share model to a certain extent, mainly if we consider its forecasts. This was also caused by differences in expectations of the future development of Slovakia's population as predicted by the applied prognoses. In case of the regions with population growth in 1993 – 2002, we can see almost the same situation. Forecasts for the Slovak Republic as a whole made by the Research Demographic Centre predict a prolongation of growth; on the contrary the Statistical Office anticipates a population decline. However, if we focus our attention to the regions where population decline was observed in the 1993 – 2002 period, the situation is completely different and the opposite trends can be expected. The values generated by the Statistical Office indicate a population growth, while the Research Demographic Centre comes with expectations of a decline. This discrepancy results from the substance of the model operating with absolute increase values. First, it is the absolute gain observed in the researched region in recent years, second, the absolute increase of Slovakia's population in the same time period and finally, the model operates with the expected population increase values of Slovakia indicated by the forecasts. A ratio between the values of the two former population increase values must be calculated. The future trend depends on whether the values of the ratio are positive or negative. Since Slovakia as a whole has witnessed a growth, identification of recent processes in the regions is inevitable. The regions with population increase induce positive ratios, and vice versa. Consequently, the ratio is in a multiplicative relationship with the expected absolute increase values predicted for individual target points. For illustration of this we present situation in Region of Trnava.

Because of negative values of natural increase, some of the natural increase models have to be omitted.

F i g u r e 2

Number of Inhabitants Projection for Region of Trnava for Years 2003, 2005 a 2010 (simple comparative models)

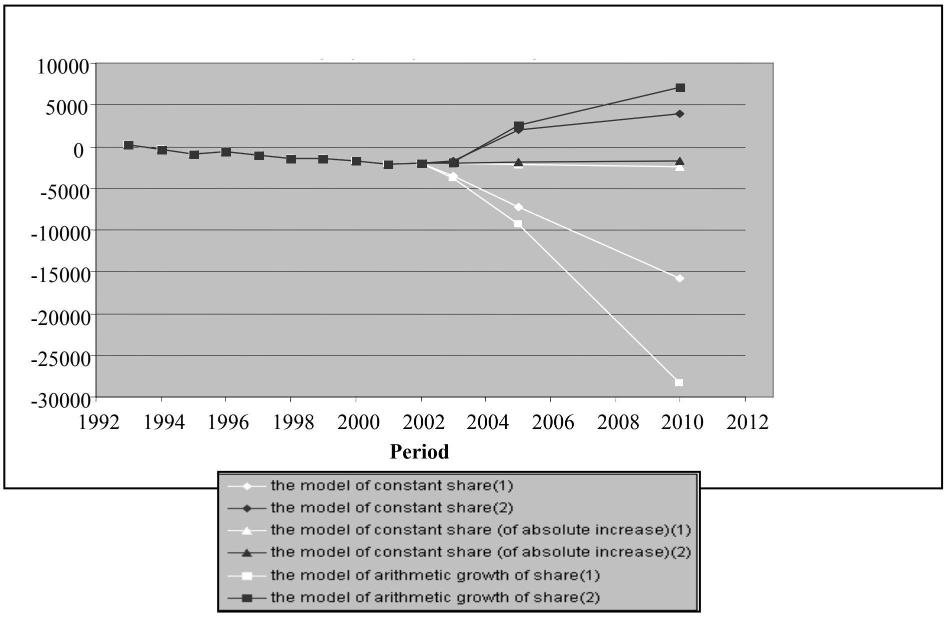


As for the trend models group, the exponential trend model (7) and the multiplicative trend model (8) must be omitted because of negative logarithms. Since the decline of natural increase values has been observed in the researched period, stabilization of population parameters must be preceded by their growth. Although such stabilization represents a theoretical vision of the future development, the preceding growth is unlikely to happen, as indicated by the recent observation. Like the arithmetic growth model belonging to the simple growth models group, the linear trend model (5) anticipates the trend of natural increase decline in the future, it differs only in dynamics of the decline, forecasting more intensive drop of natural increase, with exception of Košice region where the linear trend model forecast is milder than the one of the arithmetic growth model. Similarly, the linear growth model assumes gradual shift from natural increase to decrease in Žilina, Prešov and Košice regions. The year 2005 (Žilina region) and 2010 (the other two regions) represent the moments when clearly negative values of natural increase should be observed. The quadratic trend model (6) brings completely different values showing gradual natural increase growth in each region of Slovakia. This stems from the substance of this model prolonging the recent data into the future along a parabola. A generalized growth of the natural increase in most of the regions is unacceptable, this conception would be considered as oversimplified. The forecasted natural increase value for Bratislava region in 2010 will be several times higher than the one in the initial year 1993 (873 people in 1993; 2,846 people in 2010). In Nitra and Košice regions, unstable natural increase development in the 1993 – 2002 period brought about the fact that the decline will continue by 2010 as well, although in a milder way.

Out of the comparative models, we applied three ones which have been mentioned above. We may also see differences in expected natural increase values in the presented forecasts. The Statistical Office forecasts a continuing natural increase decline; on the contrary, the Research Demographic Centre's prognostication brings expectations of gradual growth for the studied period and, moreover, of reaching positive values of this indicator. The differences in the trends cause differences in forecasts of natural increase values, as well as in the course of expected development according to some of the models. Like most of other models, the constant share (of natural increase in this special case) model (9) prognosticates a trend of a decline for this indicator, however, only in case the Statistical Office's forecasts are considered. This tendency can be expected in the five regions of Slovakia where negative values of natural increase have been observed recently. However, for Žilina, Prešov and Košice regions, the constant share model indicates growth of natural increase. As indicated in case of the quadratic trend model, this kind of growth is less probable. For instance, in comparison to the linear trend model forecasting a natural increase decline, the absolute values generated by the constant share model are two or three times higher. On the contrary, the Research Demographic Centre's forecast shows opposite results. The constant share (of natural increase) model forecasts growth in the regions where a decline was previously indicated (Bratislava, Trnava, Trenčín, Nitra and Banská Bystrica regions) and a decline is projected for the regions where we expected some growth (Žilina, Prešov and Košice regions). This simple forecast principle can hardly be accepted again. Similarly, the decline values may be exaggerated. Perhaps only in case of Žilina region with a little slighter decline, this alternative might be acceptable. As far as Prešov and Košice regions are concerned, the natural decrease prognosticated for 2010 reaches to –5,995 and –738 people respectively. Such decline seems to be a little too intense. We can again offer a simple comparison, the linear trend model forecasts values –309 (Prešov region) and –373 people (Košice region) for the year 2010, but still positive values for 2005 in both regions. On the contrary, the constant share model anticipates negative values for both regions in 2005.

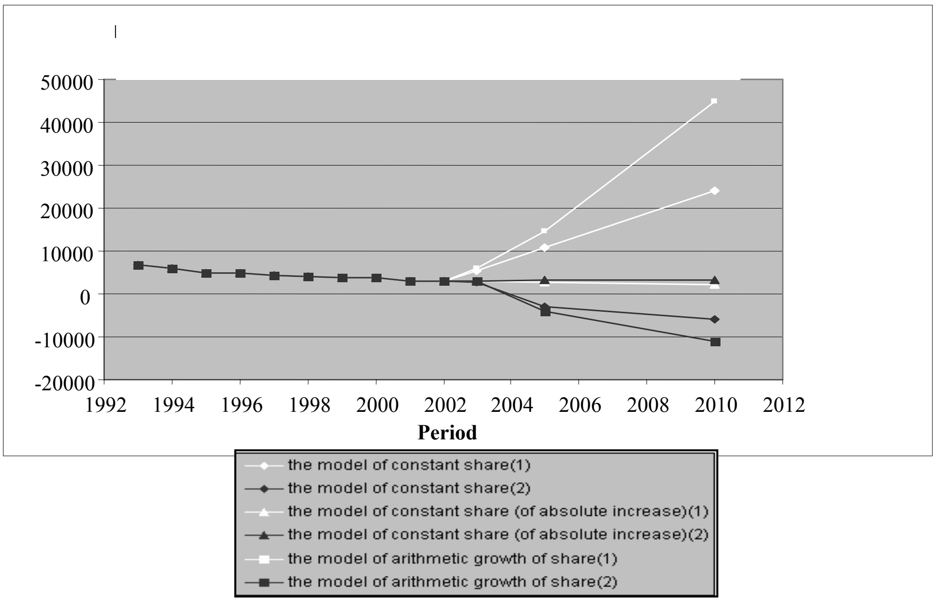
F i g u r e 3

Natural Increase Projection for Region of Nitra for Years 2003, 2005 a 2010 (simple comparative models)



F i g u r e 4

Natural Increase Projection for Region of Prešov for Years 2003, 2005 a 2010 (simple comparative models)



Almost all the characteristics that have been outlined are applied also to the arithmetic growth-of-share (of natural increase) model (11 and 11.1 respectively), though different trends may appear using values of natural increase forecasted by the Statistical Office and the Research Demographic Centre which results in formation of two opposite groups of regions. Based on this model's application for Bratislava, Trnava, Trenčín, Nitra and Banská Bystrica regions, we might observe either a decline of natural increase using the values coming from the Statistical Office or a growth using the data from the Research Demographic Centre. The exact opposite trends might be visible in the rest of the regions depending on which data source we use for the modelling. The principal differences concern dynamics of decline and growth respectively. The arithmetic growth-of-share model forecasts even more significant decline or growth than the previous model. This indicates that the forecasts generated by this model are overestimated.

2.2. Accuracy of the Models

In the previous text we gave only simple comments on the forecasts, however, in the following part more exact methods of evaluation will be presented.

The quality of population projections can be evaluated in two different ways: either by a projection model analysis or by an empirical analysis of forecasts generated by the model. The empirical evaluation is usually based on a forecast of known values arranged in time series. Afterwards, these forecasted values are compared with real empirical values. This strategy has been known as *ex post evaluation* (Keyfitz, 1972).

Perhaps the most primitive way of evaluation of a projection is comparison with reality, but on the other hand, there appears a problem stemming from the fact that projections are constructed for the distant future, thus only time will verify their quality. That is why the ex post evaluation represents a proper tool. In our attempt to compare forecasts with real values (population size and natural increase) we selected the year 2003 as the first target point. The starting point of the projection (the year 2002) represented the latest available statistical data at the time when the projections were constructed. At the end we will focus attention on a small deficiency of the selected technique, resulting from the shortness of the period (only one year) used to compare projections with real values. At very distant target time points our forecasts can either diverge from real values or even approach to them.

An elementary information on the models´ effectiveness can be obtained also by simple statistical indicators e.g. (Openshaw and Knaap, 1983; Smith 1987) such as follows:

- *Mean absolute error*

$$S_1 = \frac{1}{n}\sum_{i=1}^{n}|d_i| \tag{12}$$

- *Mean percentage error*

$$S_2 = \frac{1}{n}\sum_{i=1}^{n}\frac{|d_i|}{P_i} \, . \, 100\% \tag{13}$$

- *Mean algebraic error*

$$S_3 = \frac{1}{n}\sum_{i=1}^{n}\frac{d_i}{P_i} \, . \, 100\% \tag{14}$$

where d_i is an error of population size projection for region *i*, P_i is real population size of region *i* at the target point in time (in case of natural increase, its value in the given region will be on the denominator), *n* represents a number of regions.

Mean percentage error (S_2) represents projection errors in relative values. Considering population size of individual regions (from 550,000 to 800,000 inhabitants), the relative errors are low, reaching to less than 1 per cent. The lowest S_2 value (0.11 per cent) was detected again in case of the arithmetic growth model (working with data from the Statistical Office). On the contrary, the constant growth model showed the highest S_2 value (1.14 per cent). If we ranked the models in ascending order from the lowest error value to the highest, the order would look the same for both S_1 and S_2 values. Of the 14 models surveyed, nine showed S_2 values below 0.2 per cent. As for the other five models (all trend models), S_2 values were considerably higher.

Finally, we surveyed mean algebraic error (S_3). This statistic brings information on deviation rate of the projection, whose positive values indicate overestimated projections (on average), and conversely, negative values indicate underestimation. However, it is inevitable to see that this statistic is somewhat different from those mentioned above. If the S_3 value is equal to 0, it does not necessarily mean that the projection was perfect; it only means that on average, the projection was not deviated from the real value. S_3 value equal to 0 appeared in case of one of the comparative models, concrete the model of constant share, but with forecasted data by Statistical Office of the Slovak Republic. The mean algebraic error values calculated for the individual models (usually reaching to ‰ values) were an order of magnitude smaller than those of the mean percentage error (S_2). The highest S_3 value (0.45 per cent) has been calculated for the exponential growth model.

Forecast accuracy is not the only parameter determining the quality of forecasts, although it is crucial. Nevertheless, its importance might be reduced in case there is no concordance between estimations and results of a forecast. This can happen when a calculated population size (or other indicators such as aging index, etc.) is a result of development trajectories different from those projected by the prognosticator.

Conclusion

Are the extrapolation models able to compete with the cohort-component method, or even replace it in forecasts of the future population development? The answer to this simple and strict question (abstracting from other, more stochastic methods, micro-simulations) is: no, they are not. Population development is influenced by dynamics of multiple processes and, moreover, these processes are affected by age structure of the population. The situation might be confusing in case of forecasting of age groups and even more complicated if we intended to project indicators such as natural increase or migration balance strongly oscillating in time, which is typical for recent development in Slovakia and its regions. On the other hand, e.g. the net migration extrapolation is highly employed, but only as a partial process in the cohort-component method. Extremes in the population dynamics together with unbalanced age structure of the regions constitute unfavourable initial position for the models applied in the paper. Prognosticators incline to acceptation of a tendency of stabilization of demographic processes in Slovakia with expectation of gradual reduction of the regional differences in Slovakia. If this is a right hypothesis, does this allow us to assume that the models will be easily applicable? The answer to this question is not simple and requires other empirical analyses. Excessive fluctuations are not very helpful for the extrapolation; predominance of trend components over cyclic and random ones brings advantages. However, Slovakia is now at a breaking point, from the aspect of its development, thus many projection models might fail here. This is why recognition of the breaking-points is necessary and leads us to utilization of the cohort-component method. This does not mean that no distinct mistakes caused by the above mentioned development appeared in the cohort-component prognosis application in last decade. This highly important accuracy aspect was pointed by Keilman and Kučera (1991). On other hand, we have been able to observe increase of fertility in most of the regions in last three years. If it is a steady trend resulting of postponed childbearing as well as certain stabilization of economical situation, precondition for use of extrapolation will be given.

Spectrum of results and successfulness of the above models is very broad. Out of the models applied in our study, the comparative models seem to be the most appropriate to form a certain base for modelling and showing starting points of the future development, although only as conditioned projections rather than forecasts. We suppose that Slovak population as a reference region here plays an important role. In general, the extrapolation methods are more reliable for larger regions. On other side, if a lower hierarchical level is considered, the results might be worse due to more wide-ranging situation. Sometimes there are pragmatic reasons for extrapolation models – extrapolation is irreplaceable as a method of research of selected territories and countries when there is a shortage of necessary data, which often happens in case of less developed countries or specific population groups.

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