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METHOD OF FORECASTING BY SPATIO-TEMPORAL ANALOGIES

The author presents the arguments for applying the method of forecasting by analogies in economics and social science. There are presented ways of applying the method of spatio-temporal analogies for the two cases: when there are available time series of the lagging variable and when we lack the data about the lagging variable.

1. INTRODUCTION

In the group of analogue methods of forecasting, two of them play an important role. These are *historical analogies*, and *spatio-temporal analogies*, both supplying quantitative forecasts. The method of historical analogies allows to predict the future of one variable on the basis of the observations coming from the past of some other variables describing the same object. An example of this may be foreseeing the number of cinema spectators in a given country on the basis of the number of TV sets and videos in the same country. The most popular use of this method is analysing and forecasting economic conjuncture (Burns, Mitchell 1946; Moore 1983). The *method of spatio-temporal analogies* consists in anticipating the future of a variable describing the forecasted object on the basis of the past data about the same, as to their essence, variables, describing different objects. For instance, this method can be applied to forecast the number of computers in Poland, taking into consideration the number of computers in Belgium, France, Germany etc.

The paper is dedicated to the method of spatio-temporal analogies. Could we include this method into the set of forecasting methods? This question seems justified, for in the world-wide literature about forecasting analogue methods do not gain much attention. They are mentioned more extensively in the newest edition of the monograph *Forecasting Methods and Applications* (Makridakis, Wheelwright 1998, pp. 466–471). The authors claim there the following: "Extrapolating long-terms trends is limited by the fact that in many instances no, or little, historical information is available, much less data series going back to 1800. In such cases analogies can be used, allowing forecasters to make

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predictions based on similar situations for which past data, or accumulated experience, are available" (p. 446). Analogies are thus treated as a substitute for something better, i.e. statistical methods that cannot be applied exclusively because of too little information about the past. It is worth mentioning that the authors of the work quoted above talk about "analogies", and not about "analogue method" and in their further discussion over the industrial and computer revolution they do not apply any method.

Undoubtedly, the heart of the set of forecasting methods consists of statistical and econometric methods that have sufficient theoretical foundation and are elegant on the formal score. Their use, however, meets with many difficulties, not only in regard to the lack of data. Guessing the mechanism of the forecasted variable's changes and choosing such a method of forecasting that would faithfully render this mechanism is demanded, and then it is necessary to assume that this mechanism is constant in time. In case of social and economic phenomena completing these successfully is doubtful. Why does the birth rate in Poland have a falling tendency? Is it because, as some claim, society has become poorer, unemployment has occurred, and the feeling of safety has been lessening? Or perhaps because the system of values has altered towards ever-growing importance of personal professional career, obtaining material foundation for establishing and maintaining the family, assuring good education and favourable life-start to the offspring? If we were building a causal model for this variable, could we introduce to it variables characterizing the changes of the system of values and then assume that these variables will be influencing our birth rate in the same way in the future, as they do today? If we were building the model of systematic component of this series, could it indicate anything else than falling birth rate? We have similar problems with solving the mechanism of economic variables, because although there exist theories of these variables, they are of a general character and cannot be fully accomplished in a given time and place. So the difficulties with applying statistical and econometric methods of forecasting are rooted in our uncertainty as to the mechanism of the variables' changes and as to the stability of this mechanism, which brings about anxiety as to the accuracy of extrapolating hitherto existing regularities.

Analogue methods of forecasting do not claim basing predictions on the theory of the forecasted phenomena, and thus describing its mechanism. They are based on stating empirically the similarity of the variables behind which forecasters suspect economic, psychological or other laws working. We may accuse forecasters of little effort put in understanding the forecasted phenomena, and shake the accuracy of the assumption that similarities existing in the past will exist unchanged in the future. The first accusation may be refuted as follows. The method demands observing many variables, often in many objects, and thus the world view expands beyond a single variable and a single object, which allows to notice not only similarities, but also differences in variables' shaping. It makes us reflect upon the causes of the observed course of events, including reaching to their theories, leads to better understanding of the world and the suggestions delivered by it may serve for building causal models, explaining or forecasting models. The second complaint may be softened only partially by referring to variables' inertia.

2. CRITERIA OF SIMILARITY AND MEASURING VARIABLES' (OBJECTS') SIMILARITY

The analogue method of forecasting demands distinguishing at least two groups of variables. They consist of *leading variables* (often called leading indicators), i.e. these which undergo subsequent phases of changes in earlier time than other variables do (phases do not necessarily mean phases of changes of periodical component, they could be phases of stability, growth, or fall of growing tendency), and *lagging variables* (lagging indicators), i.e. these which undergo subsequent phases later than leading variables. The forecasts are made for lagging variables, thus they are the forecasted variables. Leading variables play the role of some kind of explaining variables.

Using many variables in forecasting, chosen not on the basis of hypotheses describing the character of their relationships, gives great importance to measuring of similarities of the variables. There exist two *criteria of similarity*: the *criterion of level* and the *criterion of shape*.

According to the *criterion of level* two variables are similar if they have ever arrived at similar states, i.e. when there is fulfilled the relation:

$$y_{t''}^{(o)} - y_{t'}^{(k)} \approx 0 \qquad t' \ll t'', \tag{1}$$

where: $y_{t''}^{(o)}$ – value of variable Y in object "0" in moment t''; $y_{t'}^{(k)}$ – value of variable Y in k-th object in moment t'.

This criterion, in short called monomial variables, may be applied only in regard to variables identical as to their essence.

According to the *criterion of shape*, two variables are similar, when they are characterized by the same dynamics, i.e. when they have similar growing tendencies, cyclical or seasonal components. This criterion may be applied both in case of monomial and multinomial variables.

For measuring the similarity of shapes we may apply various measures, and at the same time the coefficient of linear correlation and measure of the function similarity are used most often (Cieślak, Jasiński 1979). Both measures usually give comparable results, but still we can enumerate the situations when one of them may fail. The correlation coefficient is useless when two variables are characterized by trends of the same analytical form, but different parameters, and the measure of function similarity is sensitive to the "roughness" of time series and differences in their values. To get rid of these weaknesses, we should smooth the data before computing the measure's value, e.g. by means of moving average and then standardize them.

After choosing the measure of similarity, computations on time series are made. The time series have to be long enough to contain regularities of variables' shaping. The result of the computations is establishing leading variables in respect to every lagging variable, defining time intervals in which there occurs the biggest likeness (of so-called similarity intervals) and indicating forecasting models.

We will consider this task for two variables X and Y assuming that the forecast is made for the Y variable. The steps of procedure are as follows.

1. We choose relevant similarity measure d and we select its threshold value d^* in such a way that if d^* is at least attained by empirical values, then in our opinion it will prove the existence of the similarity of Y and X variables.

2. We select the interval from which the last, long enough fragment of time series of forecasted variable comes.

3. We compute the values of similarity measure of this fragment with fragments of the same length of X variable's time series, moving step by step fragment of X variable's series one period backwards. We obtain the values of similarity measure:

$$d_{-1}, d_{-2}, ..., d_{-s}. \tag{2}$$

where: d_{-p} – value of similarity measure of fragments of variables X and Y series with a shift of p time units, $p = 1, 2, ..., s$.

4. We find maximal value of similarity measure and, if there is fulfilled the relation:

$$\max d_{-p} \geq d^*, \tag{3}$$

then we consider X variable leading in respect to Y variable with p precedence. Intervals in which there appeared maximal and sufficient similarity are called similarity intervals and we mark them for variable $Y - P^{(0)}$, for variable $X - P^{(k)}$. The lengths of these intervals are equivalent.

5. We build a model connecting lagging variable with leading variable, considering obtained above p delay:

$$y_t = f(x_{t-p}). \tag{4}$$

Model (4) may take various forms. After deciding upon its form and assessing it we use it to calculate the forecasts for lagging variable. The big advantage of this model is the fact of obtaining p forecasts of lagging variable on the basis of p real values of leading variable, under the condition that we have at our disposal so many values after the interval $P^{(k)}$. It is thus desirable to search for $P^{(k)}$ interval in more distant past.

When the number of candidates for leading variables is bigger than 1, then defining the time of precedence is made separately for each variable and it occurs in the way identical to the one described above and the forecast model respects all the leading variables. In regard to each lagging variable the lines of conduct are made separately.

3. SPATIO–TEMPORAL ANALOGIES

Assumptions of forecasting and similarity of objects

In forecasting basing on spatio-temporal analogies, a time series of monomial variables describing many objects of different character are used. Sets of objects may consist of countries, regions, voivodeships, social groups, corporations manufacturing the same products, institutions providing the same services etc. Forecasting is based on the expectation that at least some of the objects from particular sets are similar in respect to at least some features. These expectations are justified, generally speaking, by people's wishes and aspirations to make discoveries and use them to improve the conditions of living, and to excel others in various aspects of life: military power, wealth, life comfort etc. But not everyone is able to make discoveries and nearly everyone wants to use them. Every one of us feels to be a member of the human family and claims that he has the right to be cured by means of the newest method, although neither he, nor his social group have contributed to discovering this method. We want to listen to modern music, use a phone, drive a good car, apply cleansers and washing powders effective and at the same time harmless for us and our environment etc. These desires are called imitation tendencies and they can be observed among rather poor people and societies, being on a lower level of civilization development. The object of their envy and imitation are wealthier people or social groups, enjoying higher prestige. Imitation tendencies are popularized and stimulated by mass media. These are the sources of consumption's similarities forcing similarities in production of goods and services.

It is worth mentioning that imitating first of all embraces consumption of goods and services of higher rank, primarily of those which can be described as luxurious. Societies usually cultivate their traditions concerning food (e.g. consuming fish, meat, potatoes, flour products, wine, vodka, or beer), habitation (type of buildings, appliances, fittings), their attitude towards nature etc., but they eagerly adopt new designs of clothes, ways of spending their free time, they buy fashionable gadgets.

Thus we may expect that the method of spatio-temporal analogies may succeed first of all in the field of forecasting consumption of higher rank goods and services, and therefore their production and in all these fields in which systems of values play important role, weakening or even destroying the effects of "objective", e.g. economic, factors.

In each set of objects, in regard to civilization, cultural or even climate differences and other factors specific for certain objects, there appear differences among the objects, therefore there also emerges the problem of finding objects similar with respect to the aim of the research. The similarity is defined in regard to the similarity of the variable. In the case of the method discussed it is possible to apply both section criteria of similarity enumerated in point 2, i.e. of level and of shape.

Applying the criterion of level similarity demands dividing objects into more and less developed. The forecast is made for the less developed object on the basis of the data about the more developed objects. It is assumed that a less developed object, since reaching the level of the variable reached in the past by the more developed object, will follow the path of its pattern object. Accepting similarity of level criterion thus means considering the fact that the phases of variable's changes are strictly connected with its values, and, in supposition, that in all the objects the variable should follow the same track and attain the same levels. Such a picture of the world is too uniformed. Experience proves that in different objects phases of growth or fall of a given variable appear at its different levels, thanks to which the objects move up or down the ladder of development.

Thus for the typology of dynamic objects that is to be used for forecasting it is not sufficient to state temporary similarity which is done by applying the criterion of level similarity. We must grasp the dynamical similarity, i.e. the similarity of trajectories of objects' position's changes. The object that has the trajectory different than other objects cannot be forecasted by analogue methods. It is such an object which has not signalized the "desire" to step into the path of development of other objects. Dividing objects into more and less developed is not a necessary condition for applying the criterion of shape similarity, though it may be helpful (compare *Metody...* 1988, p. 228). The most important task is identifying the phases of development of different objects and pointing out this phase, from which the examined object will probably start.

The criterion of shape similarity is therefore more universal than the criterion of level similarity. Sometimes it is useful to combine both criteria, which should take place when an identical level of the variable in the future in different objects is natural or desirable. Examples of this may be: probability of death at the age of x years, consuming animal protein per person, use of electricity for production of one ton of steel etc.

4. LONG ENOUGH TIME SERIES OF LAGGING VARIABLE AND LEADING VARIABLES

The procedure of forecasting in this context embraces the following steps:

1. *Preliminary list of objects* defined on the basis of objects' similarity in respect to the conditions of the shaping of the forecasted variable. For instance, climate, when we forecast the number of refrigerators, musical culture of society when we forecast production of classical music records.

2. *Measuring objects' similarity* according to the chosen criterion or both criteria combined and defining the set of similar objects.

3. *Stating partial forecast* of the forecasted variable on the basis of the data about a single object. The forecast is a fragment of the time series of a similar object following its interval of similarity, perhaps regarding the level shift.

4. Stating global forecast calculated as an average of partial forecasts, applying the weights proportional to the value of similarity measure.

5. Assessing the forecast's acceptability made by independent experts.

Detailed descriptions of the procedure described above are contained in (Cieślak 1983; *Prognozowanie...* 1997).

And this is an example of applying this method.

The forecast of the number of passenger cars used per 1000 inhabitants in Poland

In the preliminary list of objects there were included: Austria, Belgium, Czechoslovakia (the Czech Republic since 1992), Denmark, Finland, France, Great Britain, Greece, Hungary, Italy, the Netherlands, Germany (the united state since 1994), Norway, Portugal, Spain, i.e. those Western European countries, which are close to Poland in respect to culture and civilization. The time series of these countries come from the years 1970–1995. These series were not always complete, so a few lacking data were completed by means of interpolation. Political changes in the Czech Republic and Germany need introducing a provision, that if the intervals of similarity of these countries were located later so that the partial forecasts would be calculated on the basis of the data from the 90's, then these countries would not be included in these computations.

The fragment of time series for Poland used for searching similarity interval comes from the years 1987–1996. Only the criterion of shape similarity was utilized, for such a low state of the variable that has lately occurred in Poland showed up in most of the countries so long ago that they characterized some other era of motorization. As a threshold value there was accepted the value of similarity measure m = 0.9.

The analysis of the time series of the countries included in the preliminary list (Figures 1, 2, 3, 4) made us remove Denmark from the list, in respect to the breakdown of the development tendency of the variable in the years 1980–1984. We may infer that the fall of the variable's value in this period was the result of the evidence errors. The computations of the forecasts were thus made on the basis of the time series of fifteen countries.

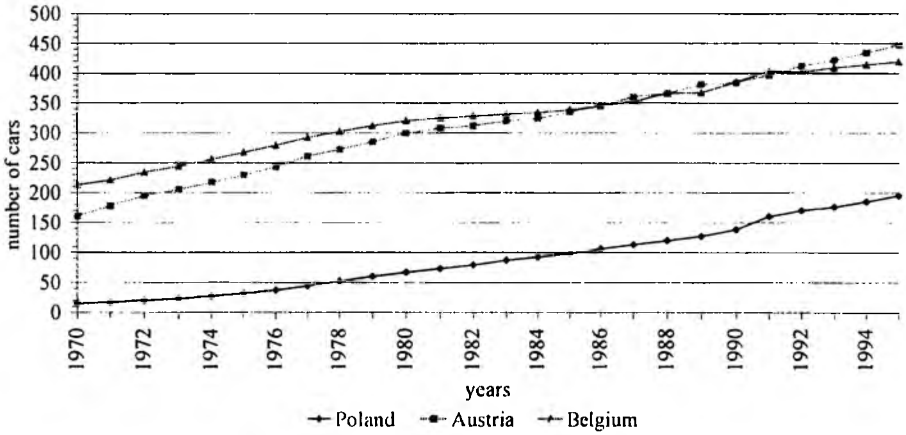

Fig. 1. The number of passenger cars per 1000 inhabitants in Poland, Austria and Belgium in the years 1970–1995
Source: own computation.

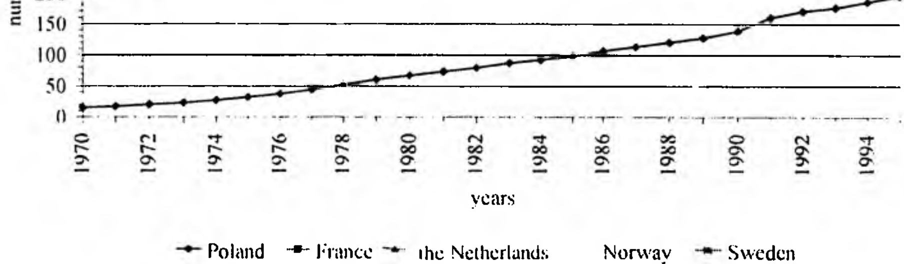

Fig. 2. The number of passenger cars per 1000 inhabitants in Poland, France, Norway, Sweden and the Netherlands in the years 1970–1995
Source: own computation.

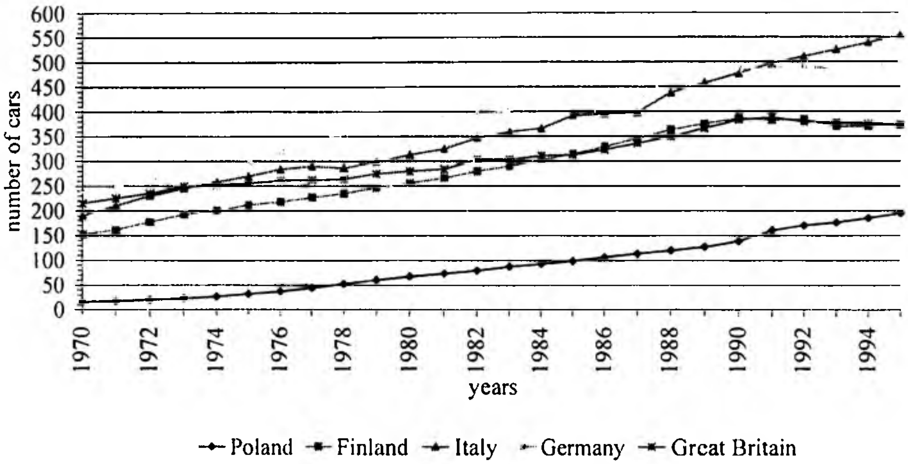

Fig. 3. The number of passenger cars per 1000 inhabitants in Poland, Finland, Italy, Great Britain and Germany in the years 1970–1995
Source: own computation.

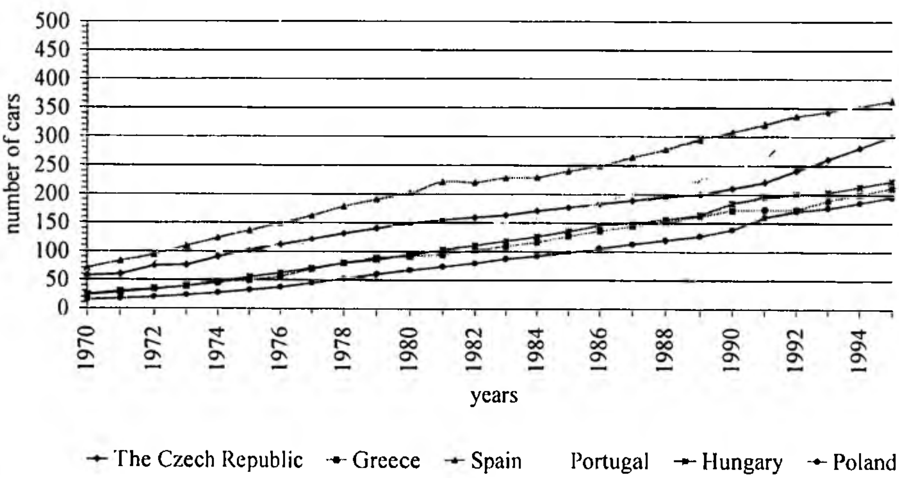

Fig. 4. The number of cars per 1000 inhabitants in Poland, the Czech Republic, Greece, Spain, Portugal and Hungary in the years 1970–1995
Source: own computation.

From Table 1 we infer that the most similar fragments of time series come most often from the years 1970–1979, which means that the dynamics of the forecasted variable in Poland in the years 1987–1996 was similar to that which occurred in the similar countries in the 70's. Only the similarity measure in Sweden was located in the years 1978–1987. In respect to the lower similarity measure than the threshold value this country was not considered in computing the forecasts. The localization of measures of similarity of the remaining countries lets us utilize all the time series.

Table 1

Intervals of similarity and values of the similarity measure of chosen countries

Country	Measures of similarity	Value of the similarity measure	Country	Measures of similarity	Value of the similarity measure
Austria	1970–1979	0.965	the Netherlands	1970–1979	0.971
Belgium	1970–1979	0.971	Hungary	1970–1979	0.950
Czechoslovakia	1970–1979	0.956	Italy	1970–1979	0.944
Finland	1970–1979	0.964	Norway	1970–1979	0.972
France	1970–1979	0.957	Portugal	1970–1979	0.928
Germany	1970–1979	0.968	Sweden	1978–1987	0.832
Great Britain	1970–1979	0.944			

Source: own computation on the basis of statistical GUS annuals from the years 1973–1997.

In Table 2 there is presented the global forecast, and in Figure 5 the global forecast and the minimum and maximum of partial forecasts. The maximal forecasts were obtained on the basis of the data about Italy, and the minimal forecasts were determined mostly on the basis of Belgium. The fact that may be considered surprising is that the minimum forecasts were not obtained on the basis of the series of Czechoslovakia, Hungary or Greece. The span between the extreme forecasts grows in time. In 1997 it was 9, and in 2006 105 cars per 1000 inhabitants, which makes respectively 4% and 35%.

Table 2

The global forecast of the number of passenger cars in Poland in the years 1997-2006

Year	Forecast	Year	Forecast
1997	218	2002	259
1998	226	2003	269
1999	234	2004	279
2000	241	2005	289
2001	249	2006	298

Source: Own computation on the basis of statistical GUS annual from the years 1973–1997.

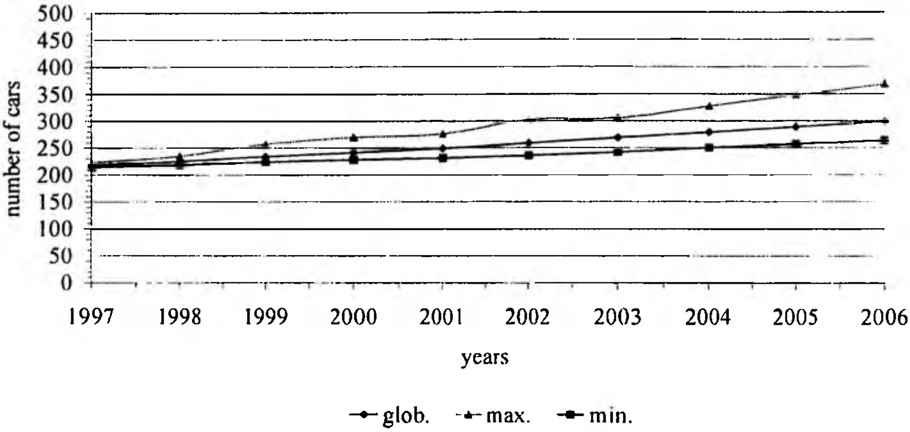

Fig. 5. The global forecast and extremal partial forecasts of the number of passenger cars in Poland in the years 1997–2006
Source: own computation.

Partial forecasts may be treated as investigative, and among them experts can select the paths of the most probability, being guided by additional, not numerical information. In the considered case the big number of the countries and comparably high similarity among them prove the reality of this forecast. However, this opinion can be weakened or strengthened by independent experts.

5. LACK OF DATA ABOUT LAGGING VARIABLE

Quite often we meet the demand of determining forecast for such a variable whose states in the examined objects has not been observed yet. The examples are: unemployment in a country where there has been observed full employment, falling ill with a new disease, the demand for a new product on a particular market. Such tasks seem to be an impossible task, but for practical reasons they are taken up. It seems that analogue methods may prove useful in such instances, but each task has to be treated and solved individually.

Here we will suggest a way of forecasting the demand for a new product (Cieślak 1998), covering the forecasts of a general demand, the forecasts of producer's sales, and monitoring of the forecasts. The two first forecasts are made in the situation where there is a lack of data about the variables forecasted. In this way of forecasting the method of spatio-temporal analogies is applied and opinions of experts used. It is assumed that the discussed forecast is necessary for a corporation which, preparing its development strategy, is considering the possibility of starting to manufacture a product that has not been manufactured before.

The demanded forecast is a kind of a long-term forecast in respect to the following reasons: the time required for deciding upon starting a new production line is usually about a few or even a dozen or so months, and in such a period the nearer and farther environment of the company may get changed; the introduction of the project itself may change the market dependencies.

Taking into consideration the forecast's characteristics, the producer does not expect an assessment of a very high degree of reliability. He realizes that it is better to get some signals about the future based on a rational procedure than to get driven only by intuition. Thus he expects a variant forecast with an indication on the chances for accomplishing particular variants.

The first stage of forecasting procedure is making a forecast (or several forecasts) of the "life curve" of a new product.

The "life curve" of a product characterizes the demand for a product from introducing it to the market up to the moment of its demand's decline. In the literature concerning marketing some examples of "life curves" of different types of products are presented, e.g. of mass and recurrent consumption, the consumption of durable utility goods, etc. These curves express some law of economy that, as is usual in economics, accomplishes in certain place and time in a specific form. Formulating the law permits us to search its completion in the case we are concerned with. In order to attain this we would recommend experts finding products which in the past satisfied the needs similar to these which are to be satisfied by the planned product, e.g. computers of different generations, music records, ballpoint pens etc.

After defining the set of similar products we outline their "life curves", attempting to get to the data from different markets, especially of those with which the producer wants to work in the future. The variable observed is the sale whose level on various markets would be different. To get rid of the level differences we standardize the data and we number anew the time variable, giving number 1 to the first period, in which the sale was begun on different markets, and the number n_i to the period in which the sale was stopped on i-th market ($i = 1, 2, ..., I$). As a result of the observation we may obtain all the similar curves (the similarity is examined by means of the measure of the functions' similarity) or the bunches of similar curves. The latter situation can be observed in Figure 6.

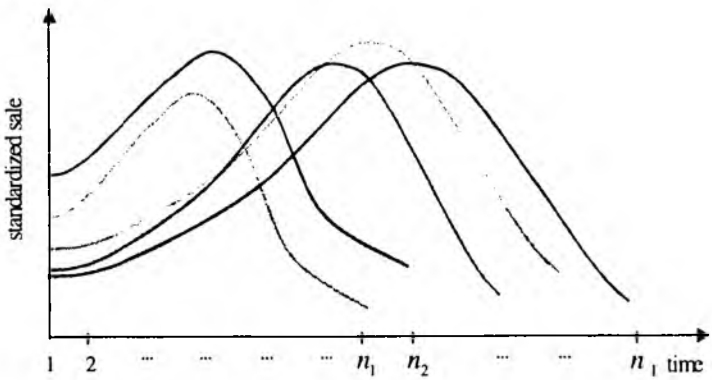

Fig. 6. Bunches of similar "life curves"
Source: own computation.

The curves of particular products may differ in respect to their shape and the length of their "life cycle". It is reckoning the shape of the "life curve" and the length of the "life cycle" of the planned product, which the discussed investigation serves. Both these pieces of information are important for the producer, because they inform him about the phases of the demand for the product and the time of this product's remaining on the market.

Experts assess the properties of the markets on which there appeared certain bunches of "life curves" and they select these bunches which characterize the markets most similar to the market of the probable sale. As a result of the analysis one bunch gets selected and then one forecast of the new product's "live curve" is made, or we can choose several bunches which means reckoning several forecasts. In the latter case the averages calculated for each bunch are the forecasts. Figure 7 presents one of such forecasts.

A "life curve" allows determining the moments important for the producer: the period of ending the product's expansion (t_2), the period of ending its durable position on the market (t_3), and the period of declining the demand for the product (t_4). The result of a subtraction $t_2 - t_1$ informs about the time of the expansion's durability, $t_3 - t_2$ about the time when the highest demand appeared, $t_4 - t_3$ about the time of a fast decline in the demand.

For analysing a "life curve" we may utilize models of spreading innovations (for example Fisher, Pry 1978; Kot et al. 1989; Pociecha, 1996). These models often take the form of a logistic function, which means that a model does not embrace the phase of the decline of demand for the product. Such a model can be useful in forecasting the demand for the product of a very high durability

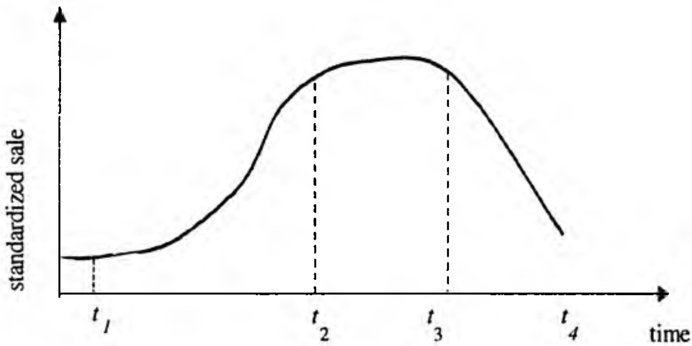

Fig. 7. The forecast of a "life curve":
t_1 – period of introducing the product on the market; t_2 – period of ending the product's expansion; t_3 – period of ending durable position on the market; t_4 – period of declining demand for the product
Source: own computation.

on the market. Two-phased models that take into consideration absorption phases and innovations' elimination phases, and also wave models that describe spatial diffusion, are more interesting (Kot et al. 1989). Using these models in the suggested procedure is by all means justified because they may form an analytical description of particular bunches of "life curves".

Next the forecasts of a general demand should be prepared. For the sake of it we must assume several things, e.g. the following:

– the sale will be held according to the shape of the "life curve" or "life curves" chosen previously,

– the initial quantity of the sale will be estimated by the experts or obtained on the basis of so-called market pre-tests, e.g in the following way:

$$y_0^* = y_{test} \cdot \frac{N}{n} \tag{5}$$

where: y_0^* – the forecast of the initial sale on the whole market; y_{test} – sale assessed on the basis of investigating the intentions for buying; N – the number of potential clients on the whole market; n – the number of potential clients on the tested market.

Other formulas used for the same reason are presented in (Dittman 1996, p. 146).

The above assumptions mean that there are expected dynamics of the demand's changes as it happened to some other products in the past and the specifics of a given market (e.g. clients' affluence, their tendency to buy new products etc.) will be revealed in the initial value of the sale.

We may suppose that at the time of preparing the strategy, a potential producer is not interested in obtaining the forecast of the demand for the whole "life cycle" of the product, but the forecast up till the moment of gaining the highest level of the demand for the product (i.e. t_2) will be sufficient for him (see Figure 8). "Life curves" in this section of time may be described analytically by means of some elementary functions the most probable by means of the exponential function:

$$y_t = e^{\alpha_0 + \alpha_1 t}. \tag{6}$$

Estimates of the parameters of this function are obtained in such a way: we treat y_0^* as α_0, and then α_1 moves directly from the selected "life curve", obtaining the forecast equation:

$$y_t^* = e^{y_0^* + \alpha_1 t}. \tag{7}$$

There may be as many of these equations as there were forecasts of "life curves" or more, when we allow a few variants of the initial sale y_0^*. The equations obtained in such a way serve to determine the variant forecasts of the general demand. Thanks to their application we acquire the "forecast field" which may also be called the "scenario funnel" (Figure 8).

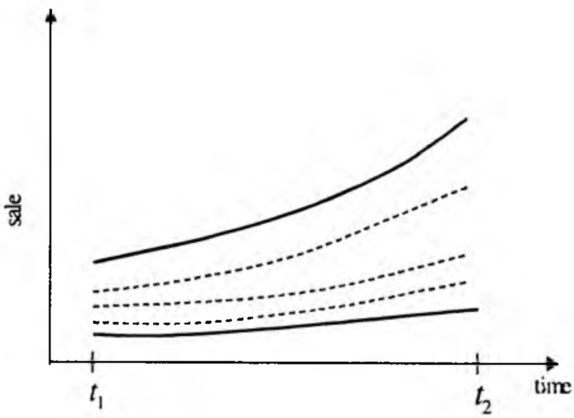

Fig. 8. Scenarios of changes of the general demand
Source: own computation.

Inside the funnel, among the optimistic and pessimistic scenarios, there are also the median scenarios of a lesser cognitive meaning. The lesser the distance between the extreme scenarios, the more reliable the forecasts are. Using methods proper for scenario analysis we choose such paths of changes that are characterized by the biggest chances of accomplishing.

After scheming the forecast of the general demand we pass on to forecasting the share in the market of this producer, who is preparing his developing strategies. If the producer is an innovator, i.e. he introduces some product on the market as the first, then the forecast of the general demand is simultaneously the forecast of his sale, therefore his share in the market in the initial period equals 100 per cent. If, on the other hand, the producer is an imitator, and he decides to introduce his product on the basis of the observations of the shaping the general demand, he should know in which phase of changes of the demand he is going to enter the market, estimate the initial value of his sales, and construct the equation of the sale in a way similar to the one presented above.

The suggested methods of determining the forecasts of the general demand and the producer's sale should be used before starting to sell the product. The opinions about the quality of these forecasts are based on assessing the credibility of the data used and the logic of the forecasting procedure. The assessments ought to be formulated by independent experts.

It is obvious that the specifics of a given market may induce some, even substantial, distortions of the regularities observed in some other place or time. Therefore the necessary element of the forecasting system of the company is the monitoring of forecasts comprising "life curves", general demand and producer's sale. Monitoring is conducted on the basis of the information coming from the market. It should allow forecasting of the turning points of the trends, preparing warning forecasts, short-term realistic forecasts and correcting the previously determined, preliminary long-term forecasts (*Prognozowanie...* 1997; Dittmann 1996; Guzik 1993). The process of forecasting in a company can be effective only when it is a continual process based on a large amount of data.

6. CONCLUSIONS

The presented reflections indicate the possibility of utilizing analogue methods for preparing the forecasts of these variables, whose future states are much more difficult to define only on the basis of their hitherto existing history and of such variables, whose history in the examined object has just begun. The method of spatio-temporal analogies could especially be widely used as it allows to deepen the knowledge about the segment of reality interesting for the investigator and to define the investigation and realistic forecasts of different horizons.

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