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RISK OF EXPERIENCING UNEPLOYMENT IN 2003 SELECTED ISSUES OF EMPIRICAL ANALYSIS

1. INTRODUCTION

The stream analysis of recourses existing on the labour market is one of the methods of identification of determinants of the labour market flexibility. From the socio-economic point of view, the stream of the outflow from unemployment to employment resource is vital. Thanks to the availability of results of the survey study, i.e. Testing Economic Activity of Population (BAEL), the observation of the volume of the stream is not so much difficult as arduous. In the subject literature, we can find results of surveys within that scope (Kucharski, Kwiatkowski 2000, pp. 167–205; Kucharski 2000). Making use of results of BAEL, which records behaviours of individuals on the labour market, we can go further and investigate intensity of the stream flow from unemployment to employment.

The paper aims at presenting quantitative estimation of chances of leaving unemployment and becoming employed on the tough national labour market. Taking into consideration the volume limitations of the paper, the author does not include a very large result material (tabular and graphical) of empirical analyses.

2. ESSENCE OF TESTING ECONOMIC ACTIVITY OF POPULATION (BAEL)

Results of quarterly Testing Economic Activity of Population in Poland 2003 are the source of numerical information used in the analysis presented.

All persons aged 15 and more, being members of drawn households, were subject to BAEL. Persons staying in collective households, i.e. workers' hostels,

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dormitories, barracks, nursing homes, etc., were excluded from the survey. The key criterion for division of population into employed, unemployed and economically inactive, from the point of view of the economic activity, is the work, i.e. the fact of being employed or searching for a job in the week surveyed.[1]

Since the fourth quarter of 1999, the method of carrying out Testing Economic Activity of Population has been changed. The observation of the chosen week in the middle month of the quarter is now replaced with the method of the continuous observation (movable week of the survey). In each of 13 weeks of the quarter, 1/13 part of the quarterly sample of households is subject to investigation. By means of this method of observation, results of the survey illustrate the situation on the labour market in the period of the whole quarter.

Economically active population includes all persons aged 15 and more, who are considered employed or unemployed according to definitions given below.

The employed person is everyone who, in the week surveyed:
• does work giving earnings or income as a hired worker, a self-employed person or a helping member of a family,
• does not do any work (for example because of a sickness, leave, company's operation stoppage, tough weather conditions, strike) but has a job.

The unemployed, according to BAEL, are persons aged 15–74, who fulfil 3 conditions simultaneously:
• are not employed in the surveyed week,
• search for jobs actively,
• are ready to take up jobs within two weeks following the investigated one.

Until May, 2004, the act of the 14th of December, 1994 concerning employment and counteracting of unemployment had been valid (uniform text, Dz. U. No. 58, pos. 514, of the 7th of March, 2003).

Economically inactive population – persons aged 15 and more, who were not classified as employed or unemployed.

3. SURVEY METHOD – LIFE TABLES (LT)

Changes of some cohort n_0 of persons being analysed at the moment $t_0 = 0$ are considered. Each of them is exposed to a change of the state called "death" in time t_i ($i=1, ..., k$). $n_1, n_2, ..., n_{k-2}, n_{k-1}$ persons live to the age of $t_1 = t_0 + \Delta t$, $t_2 = t_1 + \Delta t, ..., t_{k-2} = t_{k-3} + \Delta t, t_{k-1} = t_{k-2} + \Delta t$, respectively. This is a consequence of the object's transition from one age class to another. Differences

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[1] http://www.stat.gov.pl/dane_spol-gosp/praca_ludnosc/kwart_inf_ryn_pracy.

$n_i - n_{i+1}$ ($n_0 - n_1$, $n_1 - n_2$ and so on...) indicate the number of deceased persons in particular time ranges, i.e. (t_0, t_1), (t_1, t_2), ..., (t_{k-2}, t_{k-1}).

The analysis of the process of elements' leaving (dying out) the population is conducted by means of life tables most comfortably. Most often, it is assumed that the change in the number of survivors is a discrete process and, the life table is built for the so called stasis population. On the basis of current death rates for the surveyed period, the empirical probability of death is determined. Remaining functions of LT are estimated on the basis of obtained probability of death for the particular category (class) of the time t_i.

Let the following symbols denote:

n – number of cases (persons) subject to the survival analysis by means of numerical characteristics of LT, while $n_1 = n$,

i – number of the class range of duration of the phenomenon in LT ($i = 1, ..., k$), in which:

$x_{i,D}$ ($x_{i+1,D}$) – bottom value of the i-th (i +1-th) time range t_i,

$x_{i,G}$ – default upper value of the i-th class range of time t_i fulfilling the condition: $x_{i,G} = x_{i+1,D}$,

$h_i = x_{i,G} - x_{i,D}$ – span of the i-th time range t_i,

uc_i – number of observations (cases) censored in the i-th ($i = 1, ..., k$) time range t_i.

The life table is built on the basis of three source numerical quantities n, uc_i and z_i as well as the uniform span h_i of time ranges t_i. ($i = 1, ..., k$). The result LT contains many characteristics. From the point of view of their usefulness in the interpretation of conducted survey, the most important are:

1. $x_{i,D}$ – beginning of each of i-th time ranges t_i,

2. uc_i – number of "censored" elements, that is the number of cases which "died", i.e. changed their states (status quo) in i-th time range t_i of the described phenomenon.

The survival analysis is distinguished by an opportunity to carry out surveys by means of individual data in conditions of incomplete information. The subject[2] of its interest is duration of the phenomenon and, to be precise, the length of the period that passes from the object's transition from the current state to another one, that is the change of the object's status quo (the observation identified with the case (person) of the survey). The change of the object's state is defined as "death". In the analysed period, the object can change its status quo or not. The observation is called "censored" ("complete") if in analysed period the object does not change its state, and its term which may occur is unknown. The fact that we do not know the exact moment of the change of the object's

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[2] The survival analysis is called the duration analysis in economic applications and reliability analysis in engineering applications.

state means that we have to do with incomplete information. Then, the observation is defined as "incomplete".

Let t_i $(i = p, k, \bullet)$ denote three spells of the individual observation over a period of time, such as:

t_p – initial moment of the period of survival analysis,

t_k – final moment of the period of survival analysis,

$t_\bullet$ – moment of the change of state (status quo) of the object (individual).

Graphical form of censored observation on the time axis (t) in survival analysis is presented in Figures 1.A) and Fig. 1.B).

A) *period of survival analysis*

t_p t_k t

the term $(t_\bullet)$ of the change of an individual's state
is unknown

B) *period of survival analysis*

t_p t_k $t_\bullet$ t

the term $(t_\bullet)$ of the change of an individual's state lies out of
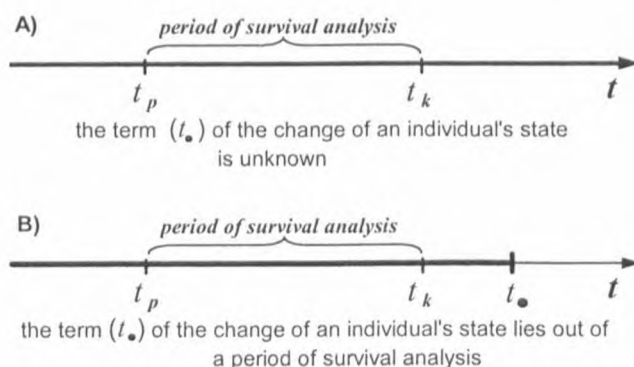a period of survival analysis

Fig. 1. Censored observation in survival analysis

It happens that the change of the object's state takes place in the period of survival analysis. The graphical form of the relapsed observation is presented in Figure 2.

period of survival analysis
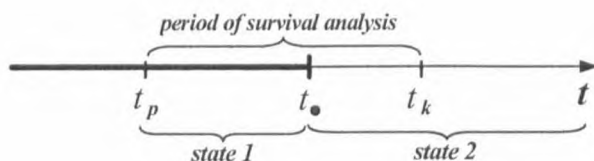
t_p $t_\bullet$ t_k t

state 1 *state 2*

Fig. 2. Relapsed observation in survival analysis

3. Cumulated proportion of survivals $S(t_i)$, that is the survival function. Assuming that survivals probabilities are independent in time ranges t_i, cumulated proportion of survivals is denoted as:

$$S(t_i) = S(t_{i-1}) \cdot pp_i \ \left(S(t = 0) = 1 \right) \tag{1}$$

where: $pp_i = 1 - pz_i$ (survivals proportion), $pz_i = \dfrac{z_i}{zz_i}$ (deaths proportion);

$z_i = n_i / uc_i = 1$ (source number of deaths which occurred in i-th time range t_i.);

$zz_i = n_i - \dfrac{uc_i}{2}$ (the number of endangered elements).

Survival function $S(t)$ illustrates the probability that the object (person) lived to the time t or, in other words, the probability that the object will live longer than to some assumed time t, that is:

$$S(t) = P\{T > t\} \tag{2}$$

where: $S(t)$ – survival function at the moment t.

This crucial and synthetic parameter of survival analysis enables to estimate the probability of object's survival in unchanged conditions and randomly chosen point of time t.

Theoretically, $S(t)$ is a smooth curve defined for every value t – see Figure 3.
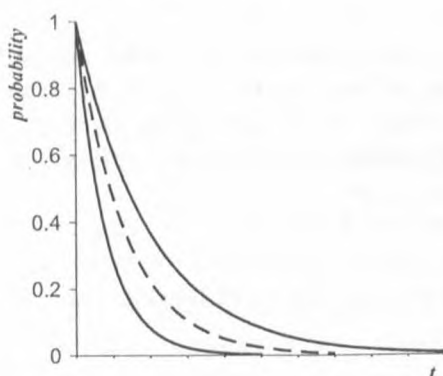

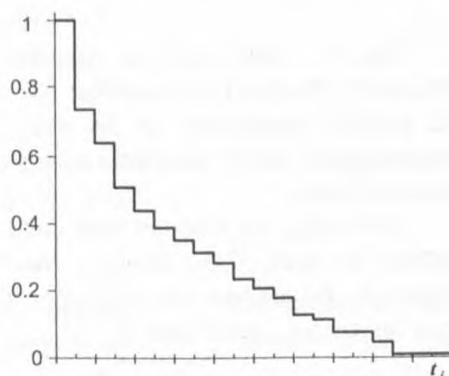Fig. 3. Theoretical survival function   Fig. 4. Empirical survival function

In practice, however, when duration of the phenomenon is finite and its measuring is classified discreetly, then the diagram of empirical survival function is not a "smooth" but a "stepped" curve – see Figure 4. Both functions are distinguished by the following property:

$$\lim S(t) = \begin{cases} 1 & for \ \ t \to 0^+ \\ 0 & for \ \ t \to \infty \end{cases} \tag{3}$$

The case $S(t = 0) = 1$ describes the starting situation of the analysis in which no one has diminished yet and therefore, the probability of an individual's

surviving the time $t = 0$ is 1. Both theoretically and practically, the opposite case $S(t = \infty) = 0$ describing a situation in which everyone has diminished from the analysis, means that the probability of an individual's surviving the time $t = \infty$ is 0 (intuitively it means that every phenomenon has its end).

4. The hazard rate $H(t_i)$ is defined as the probability of "death" at the beginning of the particular i-th time range, which i-th cases counted over a time unit t_i lived to. In particular, it is calculated as:

$$H(t_i) = \frac{pz_i}{h_i} \tag{4}$$

Theoretical hazard rate $H(t)$ illustrates a temporary potential of expected object's "death", provided that he/she lived to the moment t. It is a specific intensity measure since defined as follows:

$$H(t) = \lim_{\Delta t \to 0} \frac{P\{t \le T < t + \Delta t \mid T \ge t\}}{\Delta t} \tag{5}$$

This is a limit with Δt approaching zero, from the conditional survival probability divided by as smallest increment of time Δt as possible. It expresses the possible probability of the specific event's occurrence at the moment t, assuming that the survival time equals t. Therefore, it is not the probability in its classical sense.

Practically, for discreet time units, the hazard rate $H(t_i)$ is a broken curve defined for each of the values t_i. Since it illustrates a failure level of the phenomenon, the hazard rate generally indicates upward trend together with the time increment – see Figure 5.
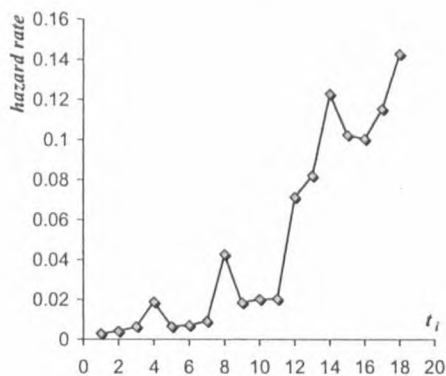

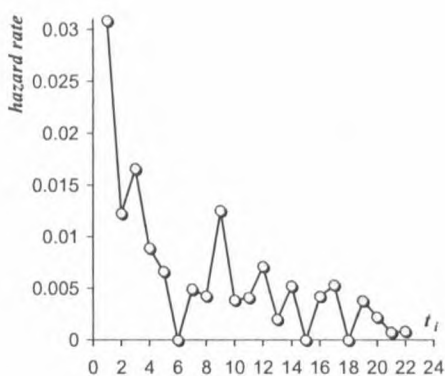Fig. 5. Empirical hazard rate   Fig. 6. Empirical hazard rate

Nevertheless, it is worth noticing that with reference to some phenomena, the empirical failure level in time may approach zero – see Figure 6. It happens so in case of unemployment analyses.

Theoretically, the hazard rate does not have a defined upper limit (see formula (5)). Its level may exceed 1.

In case of analyses of unemployment duration, the interpretation of presented research tools (LT) is completely opposite of the standard one. Perversity of the interpretation of LT characteristics results from the fact that the expected "death" of an individual is a desirable state. Consequently, in analyses of unemployment duration, it is expected that:

1. for cumulated survival function $S(t)$:

a) as small level of the cumulated survival function in the particular range of unemployment duration as possible,

b) as fast decrease rate in the surveyed period as possible,

2. for the hazard rate $H(t)$:

a) as high level of the hazard rate in the particular range of unemployment duration as possible,

b) as fast increase rate in the surveyed period.

4. DEMOGRAPHIC AND SOCIAL CHARACTERISTIC OF QUARTERLY TESTS OF BAEL, 2003

Questionnaires of ZD (conducted quarterly by the Central Statistical Office within the frames of BAEL) contain various number of observations. Their structure, from the point of view of one of the vital questions of analysed issues, is presented in Tables 1–4.[3]

In each of the tests the number of system data deficiencies is dominant. They stand for working persons excluded from the conducted empirical analysis. Whereas, the category "not applicable" includes the unemployed who stopped working before 1995.

In all tests women dominate. Regardless of sex, three out of four investigated persons are of productive age, while almost every second person is of mobile age (18–44).

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[3] All calculations and most of the forms of graphic data presentation were made by means of SPSS 12.0 PL for Windows.

In all tests married persons are most numerous. Not less numerous category "remaining of marital status" includes: divorced persons as well as widows and widower, inclusively.

Three out of five persons have basic vocational education at the most. Merely 10% of respondents have tertiary education.

Table 1. Duration of unemployment: the 1st quarter of 2003

How long have you been searching for a job?

QUARTER I	Frequency	Percent
1 month	329	.7
2 - 3 months	801	1.7
4 - 6 months	1162	2.4
7 - 12 months	1467	3.1
13 - 24 months	2002	4.2
2 years and more	1341	2.8
not applicable	117	.2
Total	7219	15.1
Missing (system)	40593	84.9
Total	47812	100.0

Table 2. Duration of unemployment: the 2nd quarter of 2003

How long have you been searching for a job?

QUARTER II	Frequency	Percent
1 month	338	.7
2 - 3 months	706	1.5
4 - 6 months	1056	2.2
7 - 12 months	1624	3.4
13 - 24 months	1895	4.0
2 years and more	1227	2.6
not applicable	143	.3
Total	6989	14.6
Missing (system)	40871	85.4
Total	47860	100.0

Table 3. Duration of unemployment: the 3rd quarter 2003

How long have you been searching for a job?

QUARTER III	Frequency	Percent
1 month	467	1.0
2 - 3 months	744	1.5
4 - 6 months	945	2.0
7 - 12 months	1483	3.1
13 - 24 months	1897	3.9
2 years and more	1272	2.6
not applicable	128	.3
Total	6936	14.3
Missing (system)	41459	85.7
Total	48395	100.0

Table 4. Duration of unemployment: the 4th quarter of 2003

How long have you been searching for a job?

QUARTER IV	Frequency	Percent
1 month	373	.8
2 - 3 months	740	1.5
4 - 6 months	1071	2.2
7 - 12 months	1334	2.8
13 - 24 months	1840	3.8
2 years and more	1391	2.9
not applicable	120	.2
Total	6869	14.2
Missing (system)	41615	85.8
Total	48484	100.0

S o u r c e: Own study on the basis of data of the Central Statistical Office.

## 5. TECHNOLOGY OF SELECTION OF OBSERVATIONS OF BAEL TESTS FOR THE CONDUCTED ANALYSIS

The survey aims at estimating the risk of experiencing long-term unemployment and chances of leaving it at the particular stages of unemployment duration depending on demo-social ontogenetic traits of individuals on the basis of empirical and individual information about unemployed as well as working persons who were out of work exactly a year before.

The number of unemployed and working persons, who were out of work a year before, was selected, in each of BAEL tests, on the basis of the following essential criteria:

Variable	Question /information content/ in BAEL, 2003
p40m	month of desisting from working
p40r	year of desisting from working
age	divided into productive and unproductive – transformed variable
p12	Did you do any work giving any profit or income (or did you helped in a family business for free during the surveyed week?
p13	Did you have any work but you did not do it temporarily during the surveyed week?
p51	Have you been searching for a job? { 1 – YES; 2 – NO, I have a job fixed and I have been waiting up to 3 months; 3 – NO, I have a job fixed and I am going to wait more than 3 months }
p55	Are you able to take up a job in the surveyed week or the following one? { 1 – YES }
p57	How long have you been searching for a job? Give the exact number of months. (time > 0)
p60	Do you have a current certificate of KIZ?
p61	What was your situation a year ago? { 2 – UNEMPLOYMENT }

Filtering complete samples in order to select unemployed individuals in the real time of the survey (at the critical moment of the observation) and a year before was carried out as follows:

Scheme 1. Technology of control groups of BAEL filtering (quarter I/2003)
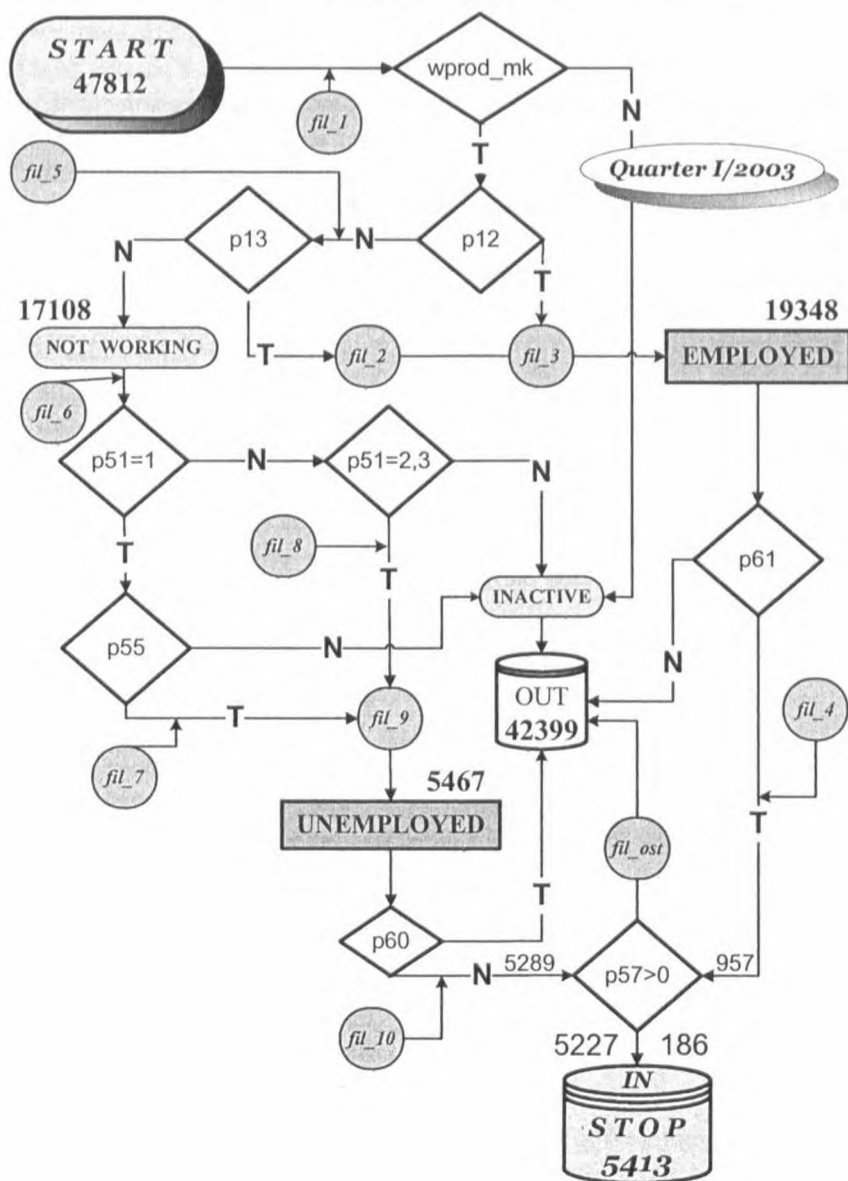
S o u r c e: Own study.

6. CHARACTERISTICS OF QUARTERLY SUB-SAMPLES OF BAEL
IN CONDUCTED ANALYSIS

The effect of the application of complex filters in each of BAEL samples, separately is presented in Table 5.

Table 5. Quantitative characteristics of samples and sub-samples of BAEL in 2003 by quarters

Quarter	Number of observation		Number of ex and present unemployed	Number of observations by the state's status	
I	47812	→	5413	186	complete
				5227	censored
II	47860	→	5143	261	complete
				4882	censored
III	48395	→	5160	284	complete
				4876	censored
IV	48484	→	5137	224	complete
				4913	censored

S o u r c e: Own study on the basis of data of the Central Statistical Office.

Over 90% reduction of all source samples of BAEL is very well noticeable. Ultimately, the number of target observations (included in an appropriate survey) is located in the range [10.6%, 11.3%] of the volume of the initial set.

Selected sub-samples are characterized by a specific structure of present and ex unemployed persons by duration of unemployment (ctb). The structure of still unemployed persons in the period of the survey by ctb is illustrated in Figures 7–10.

In each of the quarters of 2003 of BAEL sub-samples, the share of the unemployed remaining out of work for 1 month at the most was the smallest. The share of the long-term unemployed (remaining out of work longer than a year) was very high (oscillating around 50%) in all cases. Next, the share of the unemployed remaining out of work for 2, up to 3 months was the most time stable, while the share of the unemployed remaining out of work for 7, up to 12 months was the least time stable.

From the point of view of the conducted survey, however, the division of observations in terms of the status of the censored variable, i.e. into censored and complete observations, is vital. The complete observation registers the fact of finding a job by the unemployed person within the last year counting backwards since the survey was conducted. The censored observation indicates that the unemployed person did not find a job. The type structure of observations by the status of the state in the sub-samples of BAEL is presented in Table 6.
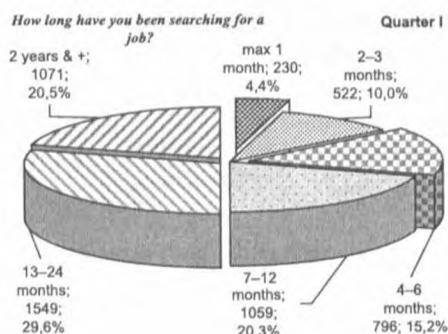
Fig. 7. Unemployed persons by duration of unemployment – quarter I, 2003
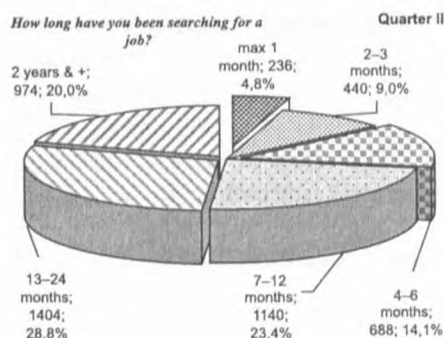

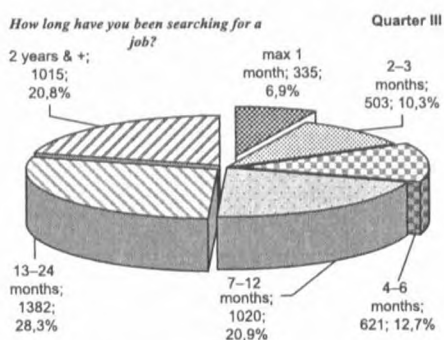Fig. 8. Unemployed persons by duration of unemployment – quarter II, 2003

Fig. 9. Unemployed persons by duration of unemployment – quarter III, 2003
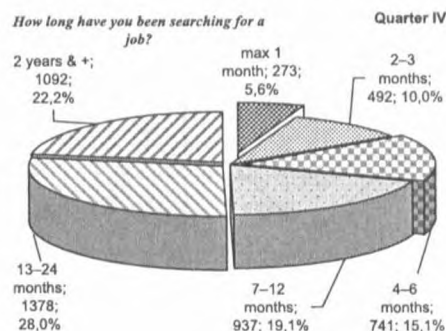

Fig. 10. Unemployed persons by duration of unemployment – quarter IV, 2003

Table 6. Status of observations by sub-samples of BAEL, 2003

Status of observations	Quarter			
	I	II	III	IV
Censored	96.56%	94.93%	94.50%	95.64%
Complete	3.44%	5.07%	5.50%	4.36%

S o u r c e: Own study.

It is easy to notice that the flow (in %) from unemployment to employment was relatively small. According to seasonal tendency of unemployment changes, most persons found jobs in the 1st and the 3rd quarters of the year. In the 4th quarter, the economy slowed down the pace of "absorbing" the unemployed. The trend remained longer and reached its unfavourable apogee in the 1st quarter of the following year. Observed mechanism of seasonalness of the flow from unemployment to employment is a simple reflection of condition-dependent

changes in the economy, which translate directly into changes in the unemployment rate in Poland. The fluctuation of trends of the most significant characteristics of unemployment in time is illustrated in Figure 11.
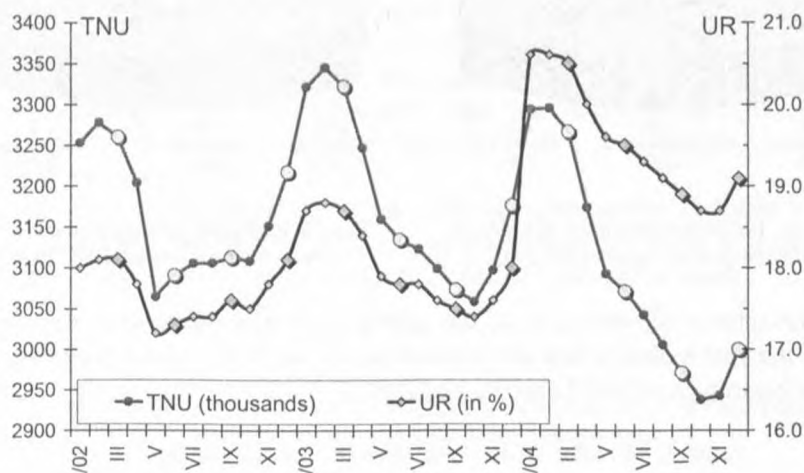

Fig. 11. Number of the unemployed in total (LBO) and the unemployment rate (SB) in Poland over the period January 2002 – December 2004

S o u r c e: Own study on the basis of data of employment agencies.

Those who leave unemployment and become the part of the employment resource differ from the unemployed by unemployment duration (ctb). Their structure by ctb in 2003 is presented in Figures 12–15.
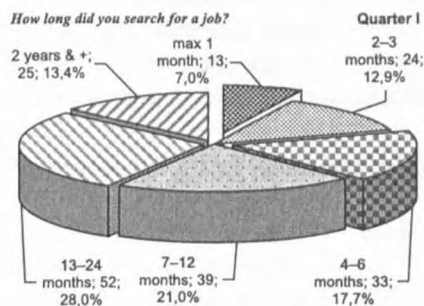

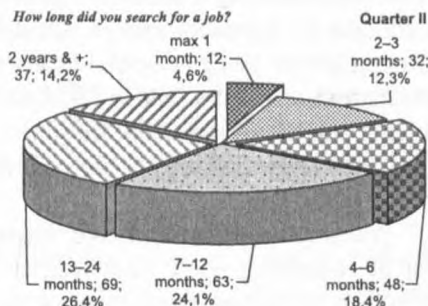**Fig. 12.** Employed persons by duration of unemployment – quarter I, 2003

Fig. 13. Employed persons by duration of unemployment – quarter II, 2003

How long did you search for a job?   Quarter III

- 2 years & +; 37; 13,0%
- max 1 month; 12; 4,2%
- 2-3 months; 33; 11,6%
- 13-24 months; 91; 32,0%
- 7-12 months; 63; 22,2%
- 4-6 months; 48; 16,9%

How long did you search for a job?   Quarter IV

- 2 years & +; 44; 19,6%
- max 1 month; 19; 8,5%
- 2-3 months; 20; 8,9%
- 13-24 months; 48; 21,4%
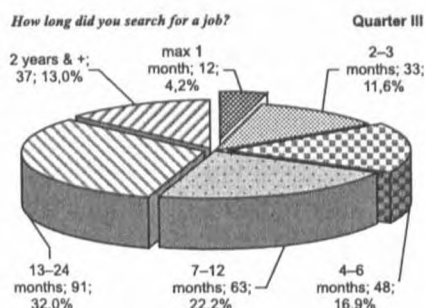- 7-12 months; 44; 19,6%
- 4-6 months; 49; 21,9%

Fig. 14. Employed persons by duration of unemployment – quarter III, 2003
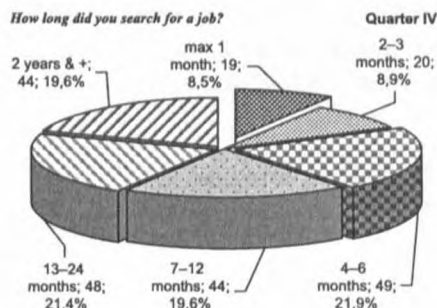
Fig. 15. Employed persons by duration of unemployment – quarter IV, 2003

Distinctness of structures of the unemployed and those who were unemployed the year before is best documented by the index of similarity of structures in all sub-samples of BAEL 2003 – see Table 7.

Table 7. Similarity of structures of present and ex unemployed by sub-samples of BAEL 2003

W_{PBZ}	Quarter			
	I	II	III	IV
Value	91.27%	91.67%	89.57%	89.71%

S o u r c e: Own study on the basis of data of the Central Statistical Office.

Selected sub-samples of BAEL disaggregated by the status of observations are distinguished by a specific structure by sex, age, marital status and the level of education of present and ex unemployed. Information about the structure of ex unemployed by demo-social characteristics is extremely interesting. From the information, it results that in 2003, the following groups were distinguished by a bigger activity in searching for jobs:

– men (significantly) at the cost of women, especially in the 3rd and the 4th quarter of the year,

– persons at the mobile age, especially in the 1st and the 4th quarter, at the cost of remaining ones. However, in the 3rd quarter, the lead reversed to the advantage of persons at the non-mobile age. Further data desaggregation by sex indicate significant lead of the activity of men in relation to women,

– married persons, especially in quarters 1 and 3. In quarters 2 and 3, the activity in searching for jobs was bigger in case of all remains (divorced persons as well as widows and widowers). Data indicate that in all quarters of 2003, bachelors and maidens were most economically inactive. Data analysis after

desaggregation by sex proves that, in case of both married persons and bachelors and maidens, more significant lead in the activity was shown by men and not women.

– persons with basic vocational education, especially in the 3rd and the 1st quarters of the year. In the 4th quarter of the year the activity of persons with tertiary education was noticeable, which affected the 1st quarter of the following year. Precise analysis of data after desaggregation by sex proves that, among persons with basic vocational education, men were more active while, among persons with secondary vocational, post secondary and tertiary education, women were more active.

The above conclusions resulting from the elementary analysis of two-dimensional frequency tables will be reflected directly in results of analyses of LT characteristics, which are the subject of the next part of the paper.

7. EVALUATION OF THE RISK OF EXPERIENCING UNEMPLOYMENT AND CHANCES OF LEAVING IT IN 2003

Introduction

The complete Life Table contains all numerical characteristics described in the part II of this paper. Taking into consideration multitude of the result material and limited volume of the paper, the presentation includes only some of the obtained results in processed version,[4] and not directly from SPSS. This professional statistical software enables us to:

1) obtain result values of limited number (up to 4) of decimal places. Such a precision of estimations of survival functions and hazard rates of surveyed aspects of unemployment is not satisfactory since empirical values of LT characteristics (and especially hazard rates) are very low and similar to each other or even identical.[5] It is due to the great sensitivity of LT parameters to sparse cases of "deaths" occurrences in relation to numerous survivals,

2) obtain single diagrams of survival and hazard functions for each of sub-samples of BAEL, separately.

Comparisons and their visualization presented below are results of author's calculations completely consistent with methodology and professional software. The great advantage of such an approach is a total arbitrariness in configuration of graphic elements according to essential random criteria.

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[4] The author used real distributions of the number of censored elements as well as the number of deaths coming from SPSS.

[5] The distributor of the SPSS PL for Windows is not able to meet the author's expectations and solve the problem of accurateness of calculations' printout.

The analysis of results of LT applications towards unemployment duration can be conducted by means of various approaches. From the point of view of the time criterion, we can distinguish two approaches, namely statistical and quasi-dynamic.

The statistical approach assumes, above all, display of data section, that is desaggregation of obtained results according to specific demo-social criteria of the unemployed in each of the sub-samples of BAEL, separately. Thanks to it, the evaluation of differences of LT parameters between ontogenetic characteristics of the unemployed in each of the quarters of 2003 is possible.

Whereas, the quasi-dynamic approach displays, above all, changes of duration of unemployment in time, according to demo-social criteria of the unemployed. Thanks to it, the evaluation of differences of LT characteristics of the same category of the unemployed in time is possible.

Table 8. Elements of LT of duration of being out of work of the unemployed by sex in quarter 1 of 2003

x_D	TOTAL, of which:		MEN		WOMEN	
	$S(t_i)$	$H(t_i)$	$S(t_i)$	$H(t_i)$	$S(t_i)$	$H(t_i)$
0	0.994044	0.001985	0.994616	0.001795	0.993386	0.002205
3	0.986577	0.002504	0.985947	0.002905	0.987284	0.002047
6	0.982160	0.001492	0.982006	0.001333	0.982337	0.001670
9	0.978833	0.001129	0.977942	0.001379	0.979811	0.000857
12	0.968102	0.003654	0.963257	0.005005	0.973221	0.002242
15	0.961886	0.002140	0.957918	0.001848	0.966130	0.002429
18	0.957515	0.001515	0.951223	0.002330	0.963988	0.000739
21	0.951637	0.002046	0.943167	0.002823	0.960170	0.001320
24	0.939950	0.004094	0.922228	0.007401	0.956967	0.001112
27	0.932042	0.002804	0.912571	0.003490	0.950587	0.002222
30	0.927915	0.001476	0.906635	0.002168	0.948018	0.000901
33	0.926322	0.000572	0.903201	0.001263	0.948018	0
36	0.914658	0.004197	0.890800	0.004577	0.936994	0.003876
39	0.909461	0.001894	0.885250	0.002077	0.932101	0.001741
42	0.909461	0	0.885250	0	0.932101	0
45	0.909461	0	0.885250	0	0.932101	0
48	0.909461	0	0.885250	0	0.932101	0
51	0.909461	0	0.885250	0	0.932101	0
54	0.909461	0	0.885250	0	0.932101	0
57	0.893074	0.006006	0.844549	0.015326	0.932101	0
60+	0.859052	0.012698	0.760094	0.033333	0.932101	0

S o u r c e: Own study on the basis of data of BAEL 2003.

Statistical (sectional) approach

For each of the quarterly sub-samples of BAEL 2003, cumulated proportions of survivals as well as hazard rates of each of the class ranges of unemployment duration defined by the user, are most important LT characteristics. In the survey, the unit of unemployment duration is a quarter (three months). Analysed data are subject to desaggregation according to the specific essential criterion. It can be continued until the number of complete observations after a division is not smaller than 30. For smaller sizes, obtained results are unreliable. This limitation causes that the empirical decomposition of data, by two criteria at the same time, is not always possible.

Some values of LT characteristics for the 1st quarter of 2003 are presented in Table 8.

The standard visualization according to characteristics of unemployment duration in Poland in quarter 1 of 2003 is presented in Figures 16–19. Figures were obtained by means of SPSS.
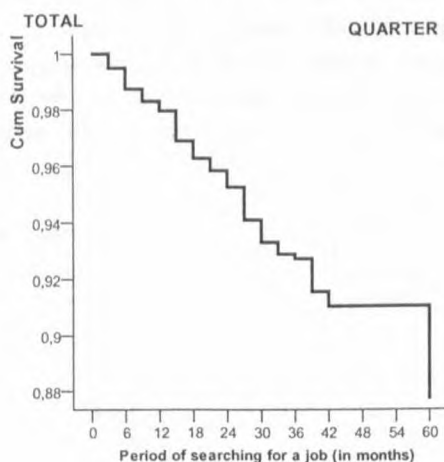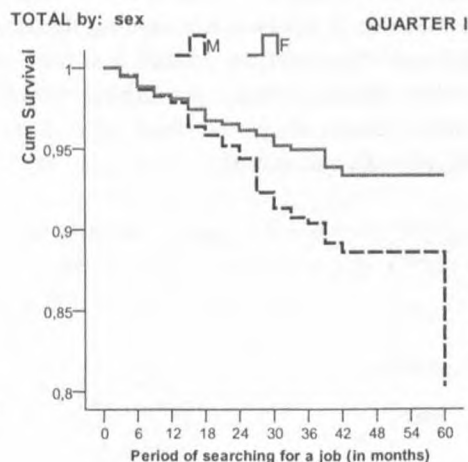

Fig. 16. $S(t_i)$ for the unemployed in TOTAL   Fig. 17. $S(t_i)$ for the unemployed by sex

S o u r c e: Own study on the basis of data of the Central Statistical Office for all Figures.

The figure of cumulated survival function illustrates the level and the rate of decrease in the process of remaining unemployed in relation to its duration. For the unemployed in total, the hypothetical probability that the unemployed would survive in resource at the moment $t=6$ (an unemployed person survived up to 6 months and has not found a job yet) was very high and amounted to 0.9816 – see Table 8. If a MAN was unemployed, the probability of his remaining in the resource was somewhat lower than WOMAN'S ($P_M = 0.982006$ against $P_K = 0.98233$). The rate of the survival function decrease by sex was different.

However, since the moment of entering unemployment, it was more favourable for men than women – see Figures 16 and 17. The biggest difference between probabilities of men and women remaining unemployed occurs after 3.5 years (42 months) of unemployment duration. After this period, survival in the unemployed recourse stabilized very high, about $P_M = 0.8852$ and $P_K = 0.9321$.

Significant and favourable leap of decrease of the probability that men would remain in unemployment resource in the 1st quarter of 2003 took place twice together with the beginning of the 15th and 27th months of remaining unemployed.

According to expectations resulting from the analysis of survival function values, levels of hazard rates (temporary potentials of hypothetical chances that the unemployed would leave the recourse, provided that he/she survived until a specific moment t_i, both in case of the unemployed IN TOTAL and by sex) were generally very low. In addition to that, it is easy to notice that they were more favourable for men than for women (exp. for $t=12$ $H_M = 0.005005$ against $H_K = 0.002242$, however for $t=6$ and $t=15$ we had to do with the opposite situation). It is worth mentioning that we should not overestimate significance of hazard rates relating to the last time range of unemployment duration, since these values contain cumulated hazard rates for all duration periods of the phenomenon above declared upper limit of the results presentation (in this case, 60 months and more).
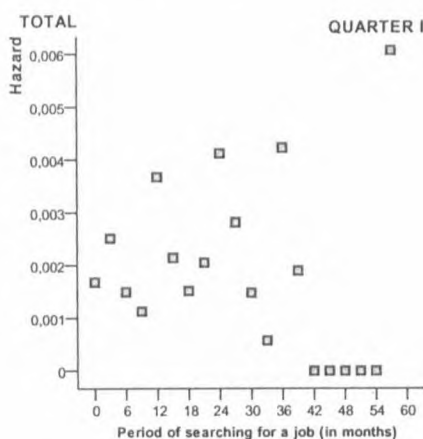

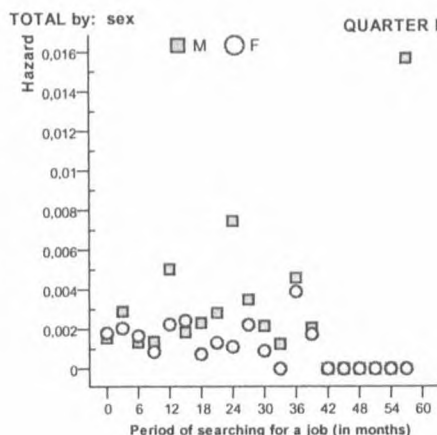**Fig. 18.** $H(t_i)$ for the unemployed IN TOTAL   **Fig. 19.** $H(t_i)$ for the unemployed IN TOTAL by sex

S o u r c e: Own study on the basis of data of the Central Statistical Office for all Figures.

Conclusion 1

Rates of probabilities that the unemployed would remain in the resource in the 1st quarter of 2003, regardless of duration of remaining in it, were very high. This unfavourable mechanism of functioning of unused, potential supply resources on the labour market is confirmed by very low levels of temporary potentials of chances of becoming employed. Maximum limit of hazard rates oscillates around a value 4/1000, and prevails – 2/1000.

Conclusion 2

The sex is a factor differentiating the level of probabilities of remaining unemployed and the level of hazard rates, that is probable chances of becoming employed in relation to unemployment duration. In the 1st quarter of 2003, men coped with finding a job far better than women.

Quasi-dynamic approach

Quasi-dynamic approach displays changes in unemployment duration according to demo-social criteria of the unemployed. Thanks to that, the evaluation of differences of LT characteristics of the same category of the unemployed in time is possible.

Cumulated survival functions of unemployment duration for the unemployed in total by quarters of 2003 are presented in Figure 20, and relating hazard rates – Figure 21. Levels and tendencies of changes of quarterly hazard rates are hard to distinguish. It is caused by values of hazard rates which are very similar or even overlapping in many points of unemployment duration.
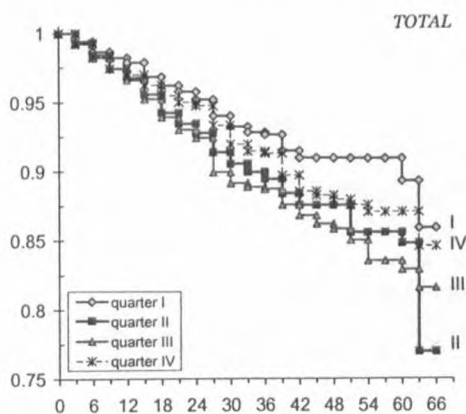

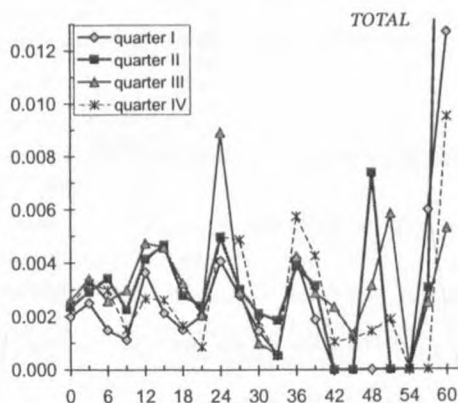**Fig. 20.** Quarterly $S(t_i)$ for the unemployed in 2003 in total

Fig. 21. Quarterly $H(t_i)$ for the unemployed in 2003 in total

S o u r c e: Own study on the basis of data of the Central Statistical Office for all Figures.

Conclusion 3

For the unemployed in total, the lowest levels of survival are noticeable in the 1st quarter and the highest – in the 3rd quarter of 2003. The favourable trend of development of survivals probabilities in unemployment in the 3rd quarter reached the 2nd quarter of 2003.

The tendency formulated in conclusion 3 is convergent with the phenomenon of seasonalness of levels of quarterly unemployment rates, which reflect the unemployment scale (LBO) indirectly. It is expressed graphically by Figures 22–24. They register levels of unemployment rates in 2003 and values of cumulated survival functions for various periods of remaining out of work at the same point of time.
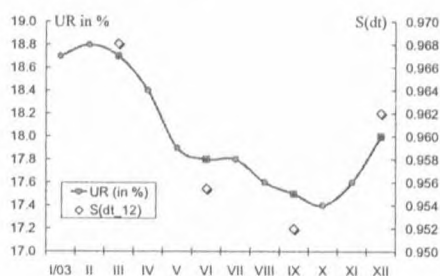
Fig. 22. Unemployment rates and $S(t_{12})$
for the unemployed in 2003 in total
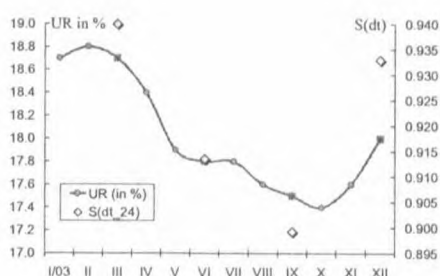
Fig. 23. Unemployment rates and $S(t_{24})$
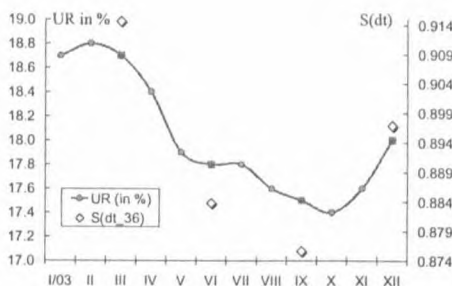for the unemployed in 2003 in total

Fig. 24. Unemployment rates and $S(t_{36})$
for unemployed persons in 2003 in total

S o u r c e: Own study on the basis of data of the Central Statistical Office for all Figures.

Conclusion 4

In general, a description of chances of finding a job was strongly unfavourable within the whole year 2003. It is expressed by very high probabilities of

remaining in the unemployed resource regardless of the quarter and duration. At the same time, they are accompanied by very low temporary potentials of probable chances of leaving the resource (see Figure 21) of the level oscillating within the range [2 – 5/1000 of unemployed].

From Figure 20, it also results that the biggest and favourable leap of survival function, especially in the 3rd quarter, can be noticed together with the beginning of 27th month of remaining unemployed.

Usually, sex is the most important criterion of division of the unemployed. The answer to the question how the unemployed of both sexes cope with the problem of unemployment at various stages of remaining unemployed in particular quarters of 2003 can be found in Figures 25 and 26.
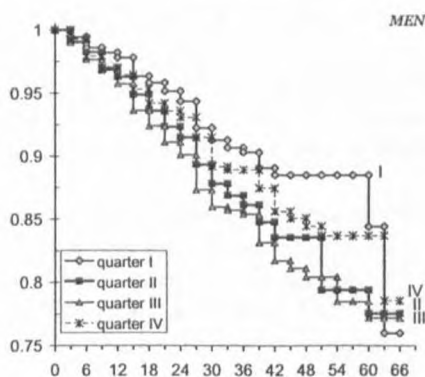

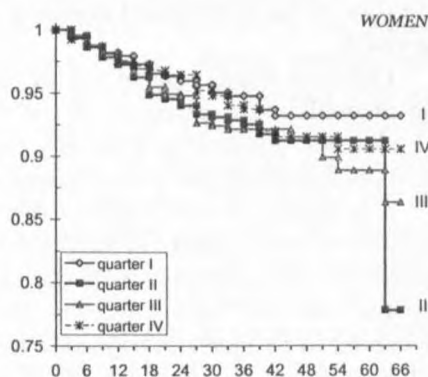**Fig. 25.** Quarterly $S(t_i)$ of unemployed men in 2003

Fig. 26. Quarterly $S(t_i)$ of unemployed women in 2003

S o u r c e: Own study on the basis of data of the Central Statistical Office for all Figures.

Conclusion 5

In the face of an identical scale of the survival function, it is easy to notice that at each of stages of remaining unemployed:

– men were leaving the unemployment resource far faster than women in each of the quarters of 2003,

– the least favourable because the highest levels of men's survivals in unemployment are noticeable in the 1st quarter of 2003 and the most favourable because the lowest – in the 3rd quarter of the same year. The beginning of the positive trend of changes in the 3rd quarter, can be observed yet in the 2nd quarter of 2003,

– the assessment of correctness of changes of probabilities of women's remaining unemployed in the particular quarters of 2003 is ambiguous. Some favourable dynamics of the process of finding jobs by women in quarters 2 and 3 was noticeable only in specific units of time of unemployment (18–39 months).

8. FINAL REMARKS

From cognitive point of view, results of conducted analyses of unemployment duration orientated towards estimation of chances of leaving the unemployment resource on the national labour market seem to be interesting.

New approach assuming investigation of streams regulating levels of resources existing on the labour market is based on the simplest trend of survival analysis, i.e. Life Tables (LT) with their numerical characteristics. Thanks to their innovative attitude towards the problem of unemployment, the measurement of intensity of the most important flows of the labour market, i.e. UNEMPLOYMENT → EMPLOYMENT was objectified. Comparability of the intensity of the investigated stream in time is a very important advantage of this approach.

Obtained estimations of risk of remaining unemployed and chances of leaving unemployment recourse in particular quarters of 2003 by unemployment duration and ontogenetic demo-social properties of unemployed authorizes us to draw the following practical conclusions:

– In general, levels of probabilities that the unemployed would remain in the resource in every quarter of 2003 were very high, regardless of their ontogenetic properties and unemployment duration. In the period of the best economic situation on the labour market, the probability of remaining unemployed amounted to as much as 0.82, and temporary biggest chance of leaving unemployment resource ran at a level of merely 0.009 (9/1000 for the unemployed having remained in the resource for at least 24 months). Generally, these chances oscillated around the level of 0.004 and in the 1st quarter of 2003 they were even lower and oscillated around the value 0.002,

– Sex, age, marital status and education level are factors differentiating levels of probabilities of remaining unemployed as well as levels of probable chances of becoming employed in relation to unemployment duration,

– In each of the quarters of 2003, men coped with finding jobs far better than women although, in the period of the best economic situation on the labour market, the probability of men's remaining unemployed amounted to merely 0.77, while in case of women – 0.88. Temporary best chances of men's leaving unemployment resource ran merely at the level of 0.01 (10/1000 for the unemployed having remained in the recourse for at least 24 months). Generally, these chances oscillated around the level of 0.005, and in the 1st quarter of 2003 they were the lowest and oscillated around the value 0.002. In the period of the best economic situation on the labour market, among unemployed women, temporary best chance of women's leaving unemployment resource ran merely at the level of 0.007 (7/1000 for the unemployed having remained in the resource for at least 24 months). In general, these chances oscillated around the level of 0.003, and in the 1st quarter of 2003 they were the lowest and oscillated around 0.001,

– In general, in each of the quarters of 2003, persons at mobile age coped with finding jobs better than persons at non-mobile age. Only in the 1st quarter of 2003, persons at non-mobile age, in some units of unemployment duration, coped with the problem somewhat better. In the period of the best economic situation on the labour market, the probability that persons at non-mobile age would remain unemployed amounted to merely 0.82, while among persons at non-mobile age – 0.86. Temporary highest chance of finding jobs by persons at mobile age ran merely at the level of 0.01 (10/1000 for the unemployed having remained in the resource for at least 24 months). Generally, these chances oscillated around the level of 0.003, and in the 1st quarter of 2003 they were the lowest and oscillated around 0.002,

– In the category of the mobile age, men took the lead in positive trends of becoming employed. In the period of the best economic situation on the labour market, the probability that men at mobile age would remain unemployed amounted to 0.77, while among women at this age – 0.88. Temporary biggest chance that men would leave unemployment resource ran merely at the level of 0.01 (10/1000 for the unemployed having remained in the recourse for at least 24 months). In general, these chances oscillated around the level of 0.004, and in the 1st quarter of 2003 they were the lowest and oscillated around 0.002. Among unemployed women at the mobile age in the period of the best economic situation on the labour market, temporary best chance of finding a job ran, similarly to men, at the level of 0.01 (10/1000 for the unemployed having remained in the resource for at least 24 months). However, in general, these chances oscillated around the level of 0.003, and in the 1st quarter of 2003 they were the lowest and oscillated around 0.002.

– Among the unemployed at non-mobile age in the period of the best economic situation on the labour market, temporary best chance of becoming employed ran merely at the level of 0.005 (5/1000 for the unemployed having remained in the resource for at least 24 months). Generally, these chances oscillated around the level of 0.003, and in the 1st quarter of 2003 they were the lowest and oscillated around 0.001,

– Bachelors and maidens as well as married persons coped with finding jobs similarly and with ups and downs in each of the quarters of 2003. Both categories of the unemployed competed successfully within this scope with unemployed divorced persons as well as widows and widowers. In the period of the best economic conditions on the labour market, the probability of bachelors' and maidens' remaining unemployed amounted to merely 0.84, while among married persons – 0.86. Temporary highest chance that bachelors and maidens would become employed ran merely at the level of 0.011 (11/1000 for the unemployed having remained in the resource for at least 24 months). Generally, these chances oscillated around the level of 0.004, and in the 1st quarter of 2003 they were the lowest and oscillated around 0.002.

– Among bachelors and maidens it is not easy to indicate the sex which took the lead in the process of finding a job. Only in the 4th quarter of 2003, women were far worse than men in the competition.

– Among married unemployed persons in the period of the best economic conditions on the labour market, temporary best chance of finding a job ran merely at the level of 0.009 (9/1000 for the unemployed having remained in the resource for at least 24 months). In general, these chances oscillated around the level of 0.003, and in the 1st quarter of 2003 they were the lowest and oscillated around the value less than 0.002. The image of significant men's superiority over women of this category is very clear. In each of the quarters of 2003, married men coped with finding jobs undoubtedly better than married women. Desaggregation of the unemployed of the particular marital status by sex reveals that, taking into consideration rivalry for a job, men always distanced women in that respect. Married men and women differed significantly. Curiously enough, we had to do with atypical shape of levels of cumulated survival functions of married women in the particular quarters of the year. As opposed to married men, seasonal improvement in economic conditions on the labour market in 2003 was of no importance for married women. Equally bad they coped with finding jobs in the 3rd quarter as well as in remaining ones. Within this range of the unemployed, the fact that both bachelors and maidens were not most effective as for the problem of finding jobs in the best economic situation of the labour market is very interesting. They stressed their struggle for finding jobs significantly in the 2nd quarter of 2003,

– In each of the quarters of 2003, persons with tertiary education were best at finding jobs. In the period of the best economic situation on the labour market, probability that persons with tertiary education would remain unemployed amounted to merely 0.86. In that period, the unemployed of remaining education categories competed with each other effectively. This is the reason why explicit identification of the education level most discredited on the labour market is practically impossible. Temporary best chance that persons with tertiary educa- tion would leave the unemployment resource in that period ran merely at the level of 0.012 (13/1000 for the unemployed having remained in the resource for at least 12 months). In general, these chances oscillated around the level of 0.007, and in the 1st quarter of 2003 they were the lowest and oscillated around 0.004. The unemployed with tertiary education were additionally distinguished by particularly dynamic and constant leaving the resource in the 4th quarter of 2003. Persons with basic vocational education coped with the problem of unemployment relatively well. In the period of the best economic situation on the labour market, probability that persons with basic vocational education would remain unemployed amounted to even 0.81. Temporary best chance that persons with basic vocational education would become employed, ran merely at the level of 0.008 (8/1000 for the unemployed having remained in the resource

for at least 24 months). Generally, these chances oscillated around the level of 0.005, but in the 1st quarter of 2003 they were the lowest and oscillated around 0.002.

A very important complement to the surveys presented above is one of the trends of survival analysis, that is modelling unemployment duration using the method defined as non-parametric regression of Cox (Malarska, Szymczak 2004). Taking into consideration its realization, it is well-known that sex, age and marital status correlated with the level of education of the unemployed are statistically significant determinants of duration of remaining in unemployment resource. The information seems to confirm the justness of conclusions following from analyses of unemployment duration conducted by means of LT characteristics.

REFERENCES

K u c h a r s k i L., K w i a t k o w s k i E. (2000), *Przepływ siły roboczej między zatrudnieniem, bezrobociem i biernością zawodową*, [in:] E. K r y ń s k a (red.), *Mobilność zasobów pracy. Analiza i metody symulacji*, Instytut Pracy i Spraw Socjalnych, Warszawa, pp. 167–205.
K u c h a r s k i L. (2002), *Przepływ siły roboczej w Polsce w latach dziewięćdziesiątych*, Wydawnictwo Katedry Ekonomii Uniwersytetu Łódzkiego, Łódź.
M a l a r s k a A., S z y m c z a k Z. (2004), *Selected Hazard Models in Application to Analyses of Unemployment* [in.:] W. S t a r z y ń s k a, M. M. G r z e l a k (red.), *Toward a New Europe. Methodological and Comparative Approach*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź, pp. 63–78.
S t a n i s z A. (2000), *Przystępny kurs statystyki z wykorzystaniem programu STATISTICA PL na przykładach z medycyny*, t. II, Wydawnictwo StatSoft Polska Sp. z o.o., Kraków.

Anna Malarska

RYZYKO POZOSTAWANIA W BEZROBOCIU. ANALIZA EMPIRYCZNA NA PODSTAWIE BAEL ZA 2003 ROK

Analiza przeżycia należy do niestandardowych narzędzi analiz statystycznych. Najprostszym jej nurtem są tablice trwania życia (LT).

W artykule przedstawiono wyniki zastosowań TTZ do analiz bezrobocia w Polsce w 2003 r. Znane z literatury przedmiotu analizy empiryczne, bazujące na indywidualnych danych o bezrobociu pochodzących z wyników badań aktywności ekonomicznej ludności (BAEL), opisują wielkość strumieni (przepływów) między zasobami rynku pracy. Prezentowane opracowanie jest dalszym krokiem analiz strumieniowych między zasobami bezrobocia i zatrudnienia.

Nowatorskie podejście badawcze polega na ilościowej ocenie szans i nadziei na wychodzenie ze stanu braku aktywności zawodowej (bezrobocia) do stanu czynności zawodowej (zatrudnienia) na trudnym, krajowym rynku pracy. Dostępny materiał statystyczny umożliwił stratyfikację problemu według tak ważnych determinant demograficzno-społecznych, jak płeć, wiek, stan cywilny i poziom wykształcenia bezrobotnych. Dzięki analizom porównawczym we wszystkich kwartałach 2003 r. Czytelnik ma możliwie wszechstronny obraz zmian szans wychodzenia z bezrobocia według wymienionych cech osób bezrobotnych w czasie w Polsce w 2003 r.