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Statistical modeling of the concepts of work and happiness

Abstract

This paper explores the concepts of work and happiness. The aim of the study is to analyze social indicators, identify factors that affect life satisfaction in general, and patterns between working conditions and happiness of employees. The research was based on the results of sociological surveys of Ukrainians regarding the satisfaction of their needs. In particular, it investigates how work affects a person's happiness and identifies the basic needs of which the respondents lack.

Keywords: happiness, work, satisfaction, probability, monitoring surveys

Statystyczne modelowanie pojęć pracy i szczęścia

Abstrakt

Ten artykuł bada pojęcia pracy i szczęścia. Celem badania jest analiza wskaźników społecznych, identyfikacja czynników wpływających na ogólne zadowolenie z życia oraz wzorców między warunkami pracy a szczęściem pracowników.

Słowa kluczowe: szczęście, praca, satysfakcja, prawdopodobieństwo, badania monitoringowe

JEL: C15

Introduction

Happiness is a sociological concept and plays an important role in assessing society in understanding the needs of the population. Happiness is measured by indices. The European study of the concept of "happiness" is based on indices of well-being and transformation. Material and spiritual blogs of the population depend on the mood of society. Happiness is important for efficient investment of resources, development of technologies and development models.

Famous scientist Golovakha draws attention to the fact that the happiest in Europe are the northern states - for example, Denmark or Norway. According to him, this is due to the fact that in these countries people have more opportunities to succeed. This year, the international

happiness index World Happiness Report took Ukraine 132nd place, while in 2013 the country was 87th.

According to the State Statistics Service, in 2019 there were about 18 million people in Ukraine, of which 16.5 million were employed. Employed people make up the bulk of the population and are important human resources for the country's economy.

The dependence of work efficiency on the well-being of the employee is very important for employers - the results of the study confirm the popular theory of greater productivity of happier workers. This, in turn, gives impetus to the monitoring of mood and satisfaction in teams and, in the future, leads to the transformation of work environments in the direction of comfort, which is an important criterion when considering vacancies in the labor market.

Study of the concept of happiness

Based on the national annual monitoring surveys of 1994-2020 asked the question «How satisfied you are with life in general?» and obtained the following results

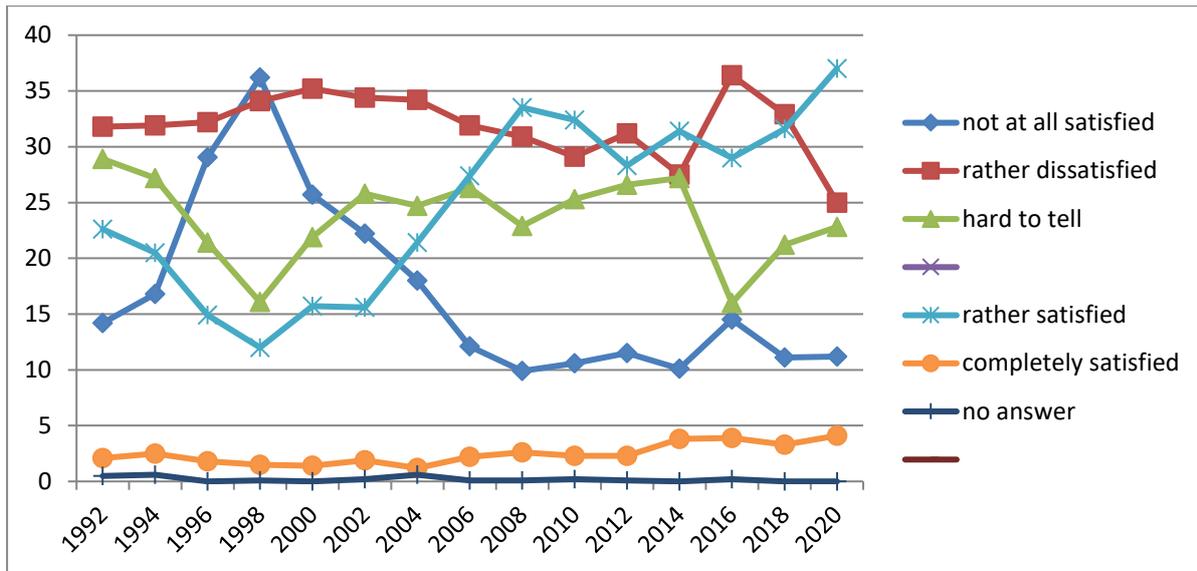
Table 1. How satisfied you are with life in general?

	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020
not at all satisfied	14,2	16,8	29,1	36,2	25,7	22,2	18	12,1	9,9	10,6	11,5	10,1	14,5	11,1	11,2
rather dissatisfied	31,8	31,9	32,2	34,1	35,2	34,4	34,2	31,9	30,9	29,1	31,2	27,5	36,4	32,9	25
hard to tell	28,9	27,2	21,4	16,1	21,9	25,8	24,7	26,3	22,9	25,3	26,6	27,2	16	21,2	22,8
rather satisfied	22,6	20,5	14,9	12	15,7	15,6	21,4	27,4	33,5	32,4	28,3	31,4	29	31,6	37
completely satisfied	2,1	2,5	1,8	1,5	1,4	1,9	1,2	2,2	2,6	2,3	2,3	3,8	3,9	3,3	4,1
no answer	0,5	0,6	0	0,1	0	0,2	0,6	0,1	0,1	0,2	0,1	0	0,2	0	0

Source: Results of national annual monitoring surveys.

There is a sharp decline in respondents' satisfaction rates in 2000 compared to 1998. however, the answers "rather satisfied" over the years became more.

These answers are shown in the graph 1.



Graph 1. How satisfied you are with life in general?

Source: Own development based on a sociological survey on life satisfaction.

Consider the following problem. Consider human satisfaction as a random variable that takes the value $\{-2, -1, 0, 1, 2\}$. Each year presented in the table, this random variable has a different distribution. Assume, that each year the surrounding situation took a certain form, which affected the distribution of satisfaction. Then the data given in the table are conditional probabilities at acquisition by a surrounding situation of a certain form.

Denoting the acquisition by a random variable of values $\{-2, -1, 0, 1, 2\}$ through the events A_i , and through G_j - a complete group of events describing the situation in the country in the year. Then, using the formula of total probability, calculate the usual probability of acquiring a random variable values $\{-2, -1, 0, 1, 2\}$

$$P(A_i) = \sum_j P(A_i|G_j)P(G_j)$$

Assume that the years were favorable or unfavorable, then $P(G_j)$ –are the probabilities of the occurrence of a favorable or unfavorable year during the observations in the formula of the total probability will act as weights.

Next, expand the tables of answers to the question «Which of the following do you lack?» a total of 13 tables were selected, all containing answers from 1996 to 2020.

After calculations, it was found that the average value for the answer «enough» increased in the period from 2014-2020 compared to the average value of the available data 1996-2014, and the corresponding average values for the answers «not enough» on the contrary decreased.

Consider the correlation between the lines "Not enough", "Hard to say", "Enough" of general life satisfaction to identify the most important issues.

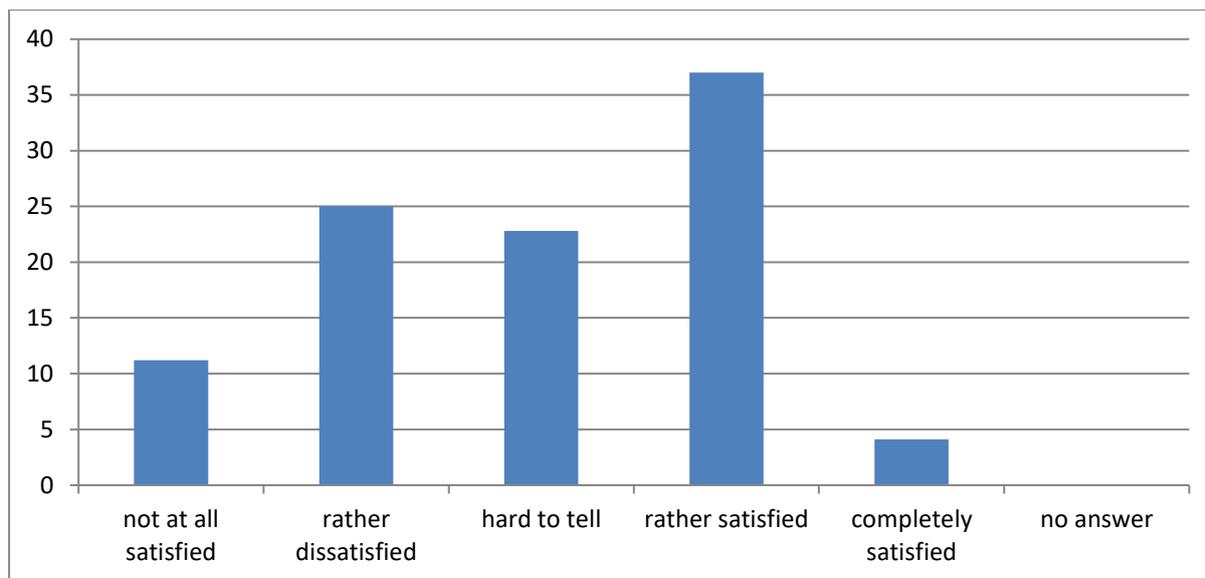
Table 2. The most important issues for life satisfaction

	Not enough	Hard to say	Enough	Mean	Variance
Health	0,68823705	0,25725324	0,77652222	0,574	0,81336
Suitable work	0,7380575	0,22455777	0,83071267	0,59778	0,9279
Necessary clothes	0,89494399	0,12223335	0,94067844	0,65262	1,27483
Medical care is needed	0,79788985	0,41015496	0,90762668	0,70522	1,1313
Necessary furniture	0,79627479	0,16036211	0,91078046	0,62247	1,10182
Legal aid	0,35677859	0,23903211	0,84233916	0,47938	0,66415
Possibility of a full vacation	0,8395685	0,58725317	0,92981974	0,78555	1,29722
Possibility of additional earnings	0,65279537	0,44071843	0,81011987	0,63454	0,87402
Opportunity to buy the necessary products	0,89455064	0,61871482	0,92995814	0,81441	1,38459
Full leisure	0,83244807	0,5918254	0,94864956	0,79097	1,31752
Work hard	0,84743522	0,40024256	0,89245335	0,71338	1,16591
Eat according to your tastes	0,93967832	0,49654688	0,97432474	0,80352	1,43322

Source: Own development.

The values of the dependence of the answers for each of the questions with the general level of life satisfaction in that year are expected to be strongly correlated. The ability to eat according to one's tastes has a particularly strong effect on overall life satisfaction, and very strong connections are observed in matters of necessity - if people do not have something they need - they cannot be truly satisfied, and, on the other hand, if a person has everything necessary - she says she is satisfied. The issues of suitable work, additional earnings, and full-time work, like others, have a strong correlation, but it should be understood that without work it is quite difficult to meet all other needs. To confirm this, look at the following table. The question was «What do you think people are most afraid of now?». People could choose several answers, so for each year the amount in the column is different, which slightly distorts the results of the observation.

Next, consider the answers to the questions only for the last year and present them as discrete random variables that acquire several values.



Graph 2. How satisfied you are with life in general in this year?

Source: Own development.

In this case, the answers can be given certain numerical values, for example from -1, -0.5, 0, 0.5, 1, the option did not answer this year is 0, and rejecting the percent of people, who did not answer and those who are not interested in the question, and dividing the remaining data by their sum - we get the probability.

Also, people were asked during the survey what they lacked to meet their needs. The answers can be «Not enough», «hard to say», or «Enough». Then, each of these answers is matched by the number -1, 0, 1, so the moments of these random variables are calculated.

Then, with this choice of numerical equivalents to the answers, the expectations of the answers will indicate the overall result «Enough or not», the variance for all questions is about 0.7, and the asymmetry of these random variables will mean the probability of higher – «not enough» or «hard to say». Capacitive asymmetry will correspond to the case, when the probability of the answer is «enough» is higher, and the proximity of the asymmetry coefficient to 0 indicates the symmetry of the distribution of the random variable.

Regarding the obtained probabilities, a hypothesis is put forward - the distribution of answers has probabilities 0.36, 0.24, 0.4 and volume - 1802 people.

Then

$$D(F) = \sum_{j=1}^3 \frac{n}{p_j} (\hat{p}_j - p_j)^2,$$

where \hat{p}_j – the corresponding probabilities from the table, and the value of the criterion χ^2 is equals 5.99, which is much smaller than the calculated values, so the hypothesis of a distribution

with the same probability is rejected. This can be explained by the large sample size, because at such large numbers the empirical frequency approaches the theoretical probability.

Let P_{ei} - the probability of an answer «enough», P_{ni} - «not enough», P_{hi} - «hard to tell», where h - is the number of questions. Provided that the answers are distributed equally and independently, the probability that the respondent will answer «enough» exactly k questions is determined by the formula

$$P_e^k (1 - P_e)^{21-k}$$

But in the case of different probabilities, different combinations of answers must be considered, to which the person will answer "enough".

Using the combinatorial formula, count how many ways, answer «enough» k times for 21 questions

$$C_{21}^k = \frac{21!}{k! (21 - k)!}$$

Next, we denote by B - a disordered set consisting of k different numbers from 1 to 21, and the very set of numbers $\{1...21\}$ is denoted as A .

It is obvious that the number of possible variants to collect B is described by the formula C_{21}^k , because B is a k -element subset of the set A .

Then the probability that the respondent will answer «enough» to k questions is calculated by the formula:

$$\sum_{i=1}^{C_{21}^k} \left(\prod_{j \in B_i} P_{Bj} \times \prod_{l \in A/B_i} (1 - P_{Bl}) \right)$$

After performing the appropriate calculations, the following probabilities are obtained in the table 3.

Table 3. Probability of answer «Enough»

Number	Enough
0	1.3378247278205485e-05
1	0.00021015765532223925
2	0.0015456292300292272
3	0.007089602590453171
4	0.022781392464700602
5	0.05458745254131207
6	0.10132715907104799
7	0.1493802461412054
8	0.17784609870587906
9	0.17289677918009433
10	0.1381961296071565
11	0.09112565286773706
12	0.0495827133184823
13	0.02219816174178102
14	0.008125648529306667
15	0.002406559763376372
16	0.0005674949290157033
17	0.0001040060129244188
18	1.4272251107723795e-05
19	1.3791114628317486e-06
20	8.364600733664827e-08
21	2.3943366892825885e-09

Source: Own development.

Mathematical expectation of the number of answers «Enough» is equal 8.45 an variance – 4,8. Similarly, calculate the probability of the answer «not enough» and «hard to tell».

Conclusions

The obtained probabilities indicate the connection between work and life satisfaction in general. Happy employees are much more efficient at work. Therefore, it is important for employers to take this factor into account.

Ukraine will leave what is in a state of transformation. Listening to the European course of development - it is very important to change the labor market and work teams. One of the most important indicators of these changes is the increase in the salary platform and living standards. Due to the fact that the level of employment of the platform of employees strongly depends on the efficiency of the enterprise, for the effective management of both the work plan and the staff that comes to the fore.

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