

**UNIVERSITY OF MISKOLC
FACULTY OF ECONOMICS**

BEATRIX VARGA

**DEMOGRAPHIC PROCESSES OF HUNGARY IN THE NEXUS
OF DISTINCT ECONOMIC AND SOCIAL FACTORS**

PH.D. DISSERTATION THEORIES

**MISKOLC
2007**

**UNIVERSITY OF MISKOLC
FACULTY OF ECONOMICS**

BEATRIX VARGA

**DEMOGRAPHIC PROCESSES OF HUNGARY IN THE NEXUS
OF DISTINCT ECONOMIC AND SOCIAL FACTORS**

PH.D. DISSERTATION THEORIES

NAME OF DOCTORAL SCHOOL:

**“ENTERPRISE THEORY AND PRACTICE”
DOCTORAL SCHOOL**

HEAD OF DOCTORAL SCHOOL:

Prof. Nagy, Aladár
Professor of Economics

ACADEMIC TUTOR:

Prof. Besenyei, Lajos
Professor of Economics

**MISKOLC
2007**

CONTENTS

1. Review of the research topic	1
2. Research background and methodology	3
3. New and novel observations of the research	5
3.1. Thesis on the economic explanation of fertility	5
3.2. Theses concerning the economic and social factors influencing fertility	10
3.3. Theses concerning the differences in mortality	15
4. Possible applications of the research results	23
Publications of the author related to the dissertation/thesis	25

„Felix qui potuit rerum cognoscere causas”

Vergilius

(Merry is the one who is able to get to know the reasons)

1. REVIEW OF THE RESEARCH TOPIC

Timeliness and aim of the research

„Economic phenomena (production, consumption, saving, investment, etc.) are inducted by the population and they aim to fulfil the needs of the population as well... In each phase of the economic processes, both in their starting point (production) and in their end point (consumption) population or its distinct layers are involved, as labour force, or consumers; their extent composition and dynamics affect the economy”¹.

Hungary has been facing the fact of its population shrinking and ageing for several years. These tendencies cause serious difficulties. Some of the most important problems are the following:

- The structure of the population changes, a shift in the direction of unproductive age groups can be experienced which makes the financing the pension system becomes a major challenge,
- We have to expect a drastic increase in the burdens of health insurance, because of the changes in the structure of the population (the share of the elderly people who more often make demand on more expensive types of health services increases),
- The share of younger, more creative people, who possess a more up-to-date knowledge decreases threatening the competitiveness of the country, society's flexibility and ability to adapt to changes decreases. In economic sense, ageing is even more dynamic, as the depreciation of knowledge becomes ever faster,
- Burdens of the middle aged persons increase dramatically, as they should be caring for their children who enter the labour market at a higher age these days, and of their elderly parents who live a longer life than the generations before them as well, while they should be saving more for their own elder age,
- Consumption structure of the society is transforming, needs for services are changing,
- Migration pressure makes us count on severe safety problems and costs.

Of course, demographic phenomena are influenced by the economic and social circumstances as well. The level of economic development works through

¹ Valkovics Emil in Klinger András (főszerk.): Demográfia p. 519.. KSH 1996

social, cultural and health filters. All these relationships can be introduced by using a model which shows the interactions of three sub-systems, demographic, economic and sociological factors side by side.

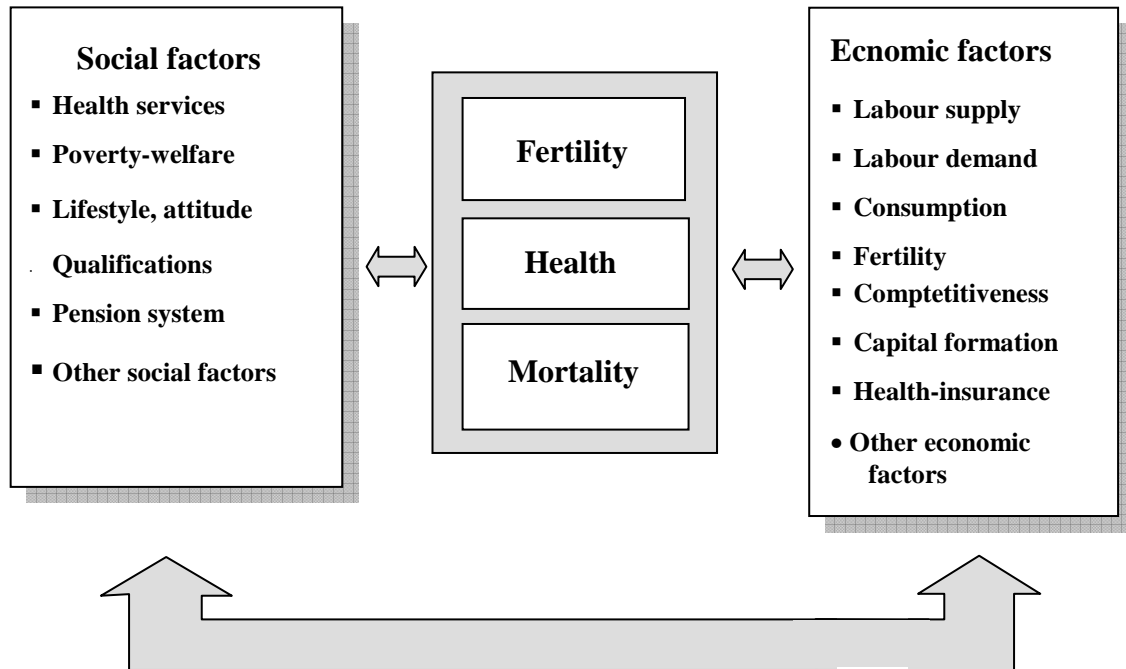


Figure 1
The model of demographic, social and economic processes

Several examples show that if economic policy competence was matched with a common will of the society, economic crises can be overcome in few years, even though in difficult ones, but in order to sense, recognise and change unfavourable tendencies in demographic process even a life-time is not enough in several cases.

In order to become able to influence unfavourable demographic tendencies, we have to get to know the reasons and mechanisms behind them. We can only get a picture of the need for government involvement and the obstacles and risks of a possible intervention only this way.

The aim of the research is to introduce the Hungarian demographic tendencies and the economic and social factors influencing them, followed by mapping the nexus of economic and demographic development behind them.

2. RESEARCH BACKGROUND AND METHODOLOGY

An important premise of this research was a study conducted by the research group of the University of Miskolc for the Prime Ministry called „An overview of the economic and social situation of Borsod-Abaúj-Zemplén County”, in which I was the author of the chapter dealing with demographic questions.

The first phase of my PhD research was to overview to the relevant international (mainly in English and German languages) and Hungarian literature. As a first step I analyse the most well-known world models, because these deal with the most important, complex and global challenges, threatening the Earth, which determining the future of the mankind, focusing on the demographic processes. The results of the World Models showed the difficult social problems can only be solved in system approach as social, economic and demographic processes can not be considered isolated, but they are involved in complex relationships. Results published by other authors concerning the subject of my research are summarized in the first part of my PhD thesis. During my review of the literature the main emphasis was put on those researches, which – in my opinion – mostly affected the cognition of demographic processes or aimed to discover the relationship between demographic and economic factors.

In my research I made an overview of the long run trends of fertility and mortality and by using descriptive statistical methods I analysed the temporal and territorial differences in these variables. I chose 1876 as a starting date for my analysis, as the data necessary for the research stood at my disposal from this date on, from official sources. The focus of the analysis is Hungary, but of course not isolated, but compared with other - mainly European – countries' time series.

Age is a defining variable from both fertility's and mortality's point of view, that is the reason why I analysed the processes according to age-cohorts. Economic transition and actual social policy measures are not of the same concern to distinct layers of the society, so where I found major differences, I conducted the analysis according to layer as well.

In order to map the relations among factors I used the methods of correlation, regression and variance analysis by using cross-section NUTS III and NUTS IV. regional data. In my research I included the extent of urbanisation, the structure of employment, the level of income, the economic development of the region, the qualification level of the population, the social situation of the region and the development of the infrastructure as explaining variables.

My calculations were based on the data published by the KSH (Central Statistics Office of Hungary) in 2001, on the Regional statistics yearbooks and the

database of Demographic Yearbook, and the indicators which can be found on the WebPages www.nepinfo.hu and <http://epp.eurostat.ec.eu.int>.

For mathematic calculations and graphical figures I used the Windows based, SPSS 14.0 statistics and Microsoft Excel software packages.

For determining the optimal regression model at multiple-variables regressions I used the Stepwise method.

3. NEW AND NOVEL OBSERVATIONS OF THE RESEARCH

In connection with factors influencing fertility and mortality I made the following new and novel statements during my research.

3.1. Thesis on the economic explanation of fertility

Each of the important economic theories concerns the questions demographic development and its influence on the economy. The basic thought of restrictive population theories is to stabilise the number of inhabitants in a region concerning the given availability of economic resources. The best known theory of the restrictive school of thought is the one of Malthus, who saw the solution of crisis situations in a constraint to population growth, and the direct means to achieve this he thought would be famines, epidemics and wars.

According to Ricardo's theory the growth of population leads to cultivation of worse quality land, so decreasing returns to scale appear on the field of agriculture as well. That is the reason why wages have to be decreased in order to maintain economic development and slow the increase of the population if the population growth is faster than economic growth.

As opposed to this Smith's opinion was that the welfare of a nation is influenced by the division of labour and the extent of the market. He thought that the way of labour division depends on the scale of the population, and its increase stimulates economic growth. According to the neoclassical growth theory long run economic growth can be explained by the development of technology used and the pace of increase in the economically active population.

Leibenstein² said that families consider the advantages and disadvantages of having the „n.“ child. The child means consumption utility (a source of joy for the parents), income utility (he/she will contribute the household's income by its work) and a so called safety utility (for the parents' elder age). This theory is supported by the fact that the Bismarckian social policy³ regulations' introduction brought about a drop in fertility, as pensions meant that elderly age welfare was not to be secured by bringing up children any more. Leibenstein stated that besides the above mentioned utilities, child bearing also has costs which can be divided to two groups: direct (raising and subsistence costs) and indirect (a lost utility of parents because of the raising of children).

² Robinson, Warren C.(1997): The economic theory of fertility over three decades in: Population Studies, No.1/1997 63-74. old.

³Dickmann, Nicola (2003): Demographischer Wandel – Geburtenraten im Internationalen Vergleich in: IW-Trends Nr. 1/2003 45-56. old

Members of the Chicago School⁴ used different mathematical models to describe the context of bearing a given number of children in a family. They thought that not only the number, but the quality of the children matter. The negative relationship between the scale of investment in the child's "quality" and the number of children can explain the drop in fertility accompanied by the increase of income.

The "theory of income flow between generations" by Caldwell⁵ states that the behaviour concerning fertility is rational in each society, and at any level of development. This theory considers children to be investment goods. The drop in fertility is explained by a change in the family system. While production was pursued in family circle, it is rational to bear more children. But, if newer generations get employed in the labour market, after an ever longer and more expensive training; direct motivation to maintain a high number of children in the family seizes. This process is reinforced by the evolution of social welfare systems to care for the elderly.

In my opinion, contemporary Hungarian women's fertility can best be explained and understood by the help of the neoclassical economic theory. According to the scientists of this school of thought value is the subjective opinion of consumers which expresses the need for a given type of commodity to meet his/her needs. Consumers tend to substitute commodities for each-other, and prefer to have more types of goods at the same time to specialized consumption. A one-sided increase in the consumption of a commodity will improve the feeling of utility by less and less.

Families make their decisions to bear children based on traditions and their judgement on values, their embracement's are rational and consistent, and they aim happiness and wish to maximize their satisfaction. The way parents choose children or consumption goods can also be explained by the theory of marginal utility. The scarcity of income and the prices of goods are determining factors when making the decisions concerning the number of children. The most important factors of utility accompanying child bearing are the following:

- Joys of being parents,
- Safety utility (for elderly age)
- Social income (transfers),
- The lost burdens and cost of contraception.

The most important factors of costs accompanying child bearing are as follows:

- Lost income because of child bearing,
- Obstacles to private life coming from child bearing.

⁴ It is sometimes called New-household economics, the best known representative of this school is Gary S. Becker.

⁵ John C. Caldwell's theory in Hungarian language can be found in Andorka Rudolf (1987): Number of children in the developed countries. Gondolat Kiadó Budapest (52.-53. old.)

*The statements of neoclassical economists and the characteristics of
Hungarian fertility today⁶*

Table 1

<i>Economic question</i>	<i>Neoclassical thought</i>	<i>Characteristics for fertility</i>
Basis of economic phenomena	The individual's subjective relation to his/her own needs which are thought to be given.	The number of children is usually the subject of a conscious, individual, family decision. Efficient techniques of contraception stand at disposal.
Driving forces of economic processes	Isolated individuals aim to improve their own, subjective satisfaction to a maximum level.	Children are a social type of commodities, which embodies utilities (joys), and costs as well.
Characteristics of economic behaviour	It is founded by nature-given, rationality based psychological factors.	Families make their decisions rationally, freely on the number of children and the time of having them.
Scale of economic actions	It is a subjective value determined by individual taste and preferences.	The change in fertility is in connection with the spread of individualism and the vindication of own interests.
Way of measurement	Based on the marginality principle.	Parents ponder before having each child. As the number of children increases, neither costs nor utilities mean the same.
Factors of economic dynamics	Idealised automatic return to (demand and supply led) equilibrium.	In order to secure self-production, each women should have 2,1 children.

As the costs and social transfers of child bearing change with the different layers of society, distinct layers are characterised by different forms of behaviour concerning fertility.

In case a family facing deep poverty and unemployment bearing an additional child means that the disposable income of the family – thanks to the social transfers – will increase from I_0 to I_1 , and as the costs of bearing a higher parity child are smaller than that of his/her older brothers/sisters, price ratios change as well. In this case point **A** does not represent the “optimal combination of commodities” any more, but point **B**. In this case, the situation of the family

⁶ The first two columns of the table are originated by Nagy Aladár (1997): The basics of Interpretive Economics (Miskolci Egyetemi Kiadó) p 19, the third column is my own complementation

improves as the basket of “commodities” represents a higher level of utility from this point on. (Figure 2)

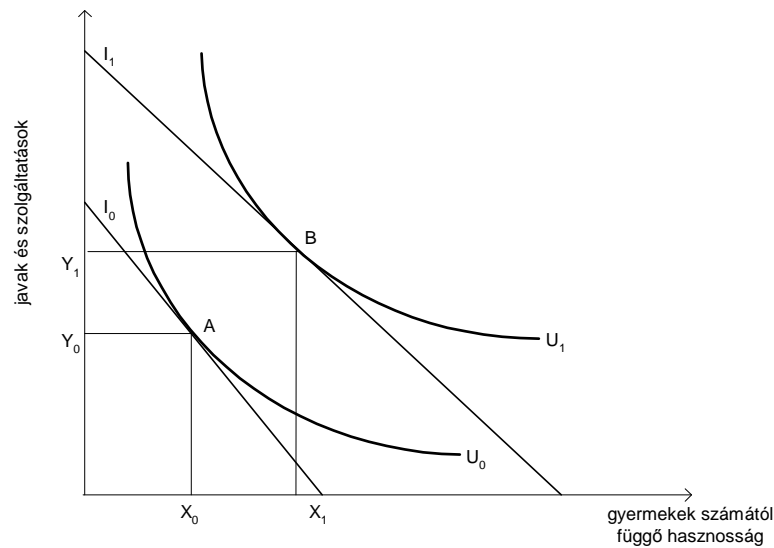


Figure 2

The graphical schedule of marginal utility theory in case of families living in deep poverty bearing children⁷

In case of an average earner, economically active family, the arriving of a new family member (as social transfer do not compensate for the lost income of the mother) the disposable income of the family will drop from I_0 to I_1 . We can conclude that the economic situation of the family declines, as the optimal combination of commodities represented by point **B** can be found on a lower level indifference curve, representing a lower level of utility. The question drops from these facts: in which case would the situation of the family not decay? In Hicks' theory the real income of the family would not change if they were able to stay on the same indifference curve⁸. This point would be represented as **C** on the schedule, if the drop in the income of the family would not be higher than $I_0 - I'$, so, if social policy would decrease the burdens of having children by giving a compensation $I' - I_1$, and in this case the number of children would even be higher in point C than in case of point B. (See figure 3)

⁷ The figure contains a certain type of abstraction, as showing baskets of consumption commodities considers all the goods and services to be homogenous and perfectly dividable.

⁸ Kopányi Mihály (1993): Mikroökonómia (Aula) p 72.

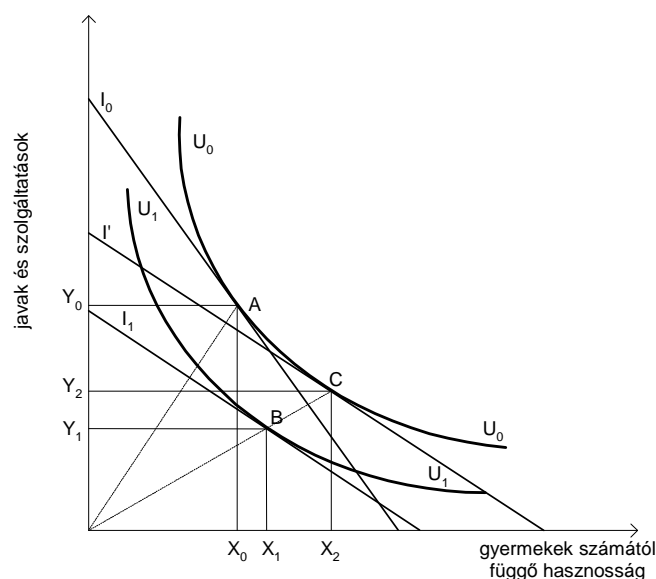


Figure 3

The graphical schedule of marginal utility theory in case of families with average income bearing children⁹

These arguments are confirmed by the results of correlation calculations as well, as in the poorer counties, fertility of younger age groups are higher than average, while in the higher income regions income level improves the fertility of age groups over thirty years. By this time the need for carriers are fulfilled and the economic resources needed to maintain the family can be earned by the husband alone as well temporarily, so the need for joys of parenthood can come to the foreground at this age.

Linear correlation coefficients and critical significance levels for income levels and age-specific fertility ratios in counties (2003)

Table 2

Age groups	Average earning (as the basis of PIT)		Average PIT	
	r	p	r	p
15-19	-0,676	0,001	-0,593	0,006
20-24	-0,832	0,000	-0,787	0,000
25-29	-0,542	0,014	-0,609	0,004
30-34	0,621	0,003	0,711	0,000
35-39	0,481	0,032	0,613	0,004
40-49	0,033	0,891	0,153	0,521

⁹ The figure contains a certain level of abstraction as this way of showing baskets of commodities concerns all types of commodities are homogenous and perfectly dividable.

T1a: Costs of child-bearing and the scale of social transfers and its marginal utility change with the different layers of society; that is why they are characterised by different fertility behaviour.

T1b: In case of those layers of the society, where the state does not take over a proper share of costs and burdens of having children, fertility lags behind the reproductive level because decisions concerning the number of children are made rationally.

3.2. Theses concerning the economic and social factors influencing fertility

Representatives of the demographic transition theory, living after World War II.¹⁰, saw the reasons for the decrease of fertility in social and cultural development, which they thought to be related to economic development. Andorka Rudolf also concluded that industrialization, urbanisation and the increase of qualification levels and women's economic activity explains the drop in fertility partially. As earlier researches were not analysing the effects of distinct factors in different age-groups, and age is a significant variable which determines fertility and causes its heterogeneity I considered this to be an important part of my study.

3.2.1. The relationship between fertility and the level of urbanisation

As a first step I analysed whether we can consider the statement that the fact of living in a village has some type of influence on fertility to be true. Several earlier studies^{11,12} showed that the process of urbanisation leads to a decrease in fertility.

The correlation coefficients between the aggregate fertility rate of counties and their rate of population living in towns in 2003 is $r=-0,415$ ($p=0,069$). In 1960 Andorka Rudolf calculated $r=-0,78$ correlation coefficient for the same relationship in his study. So we can conclude that as compared to the 1960s, the effect of the type of settlement decreased. When drawing the consequences we can not forget that the township of many of our settlements is rather new, that is the reason why most of their inhabitants grew up amongst circumstances and norms characteristic for villages. The other thing to remember is that differences between the behaviour of inhabitants of towns or villages are not so sharp today as they used to be in the 1950s and 1960s.

¹⁰ Bogue, Donald J. (1969) Principles of Demography (New York) John Wiley & Sons

¹¹ Andorka Rudolf (1967): A magyar népesség termékenységének alakulását befolyásoló gazdasági és társadalmi tényezők Demográfia X. évf.. 1. sz. pp 87-102.

¹² Klinger András (1995): A demográfiai kutatások ötven éve 1945-1995 in: Demográfia, XXXVIII. évf. 4. sz. (pp 253-274.)

When examining by separate age-groups the tendency of having more children at a younger age in villages and having them at a later age in town becomes clear.

Linear correlation coefficients in counties between the age-specific fertility rates and urbanisation ratios, and critical significance levels, (2003)

Table 3

Age groups of women	Share of population living in towns		Average number of inhabitants in the settlement	
	r	p	r	p
15-19	-0,458	0,042	-0,330	0,155
20-24	-0,574	0,008	-0,570	0,009
25-29	-0,563	0,010	-0,695	0,001
30-34	+0,663	0,001	+0,569	0,009
35-39	+0,582	0,007	+0,603	0,005
40-49	+0,312	0,180	+0,232	0,325

T2a: Concerning fertility behaviour, inhabitants of smaller settlements tend to follow the East-European demographic patterns to have children at a younger age (which characterised the whole Hungarian population earlier) while in accordance with Western-European pattern women delay having their first children to an older age.

3.2.2. Relationship between the level of education and fertility

The level of education (qualification) also influences the behaviour of founding families and having children. The longer time one spends in education, the later he/she will enter the labour market and the later one can secure the financial background for having children. This tendency necessarily decreases the fertility of women attending education. At the same time, higher qualification brings about better chances at the labour market and a higher level income to be achieved. This can explain the reason why the fertility rate of women with higher qualification has increased in the past years and more of these graduated women give birth to their third child after the age of 35 years than those having finished only secondary education. Moreover, the share of women with three children is almost as high in the group of graduated women, than among those having finished only vocational school.¹³ According to the data of the 1996 microcensus those couples had the least children who finished secondary education, while the highest number of children can be met where parents had

¹³ Kamarás Ferenc: (2002) Családtervek és gyermekszám preferenciák az „Életünk fordulópontjai” c. vizsgálat tükrében Demográfia XLV. évf. 4. sz. pp 379-405.

not even finished elementary school. International researches¹⁴ had shown similar results even decades ago. In the 1960s European fertility surveys also showed this U pattern.¹⁵

Our hypothesis is that the level of education influences mainly the timing of having children, and it is not true that having finished higher level of education is matched by a smaller fertility rate.

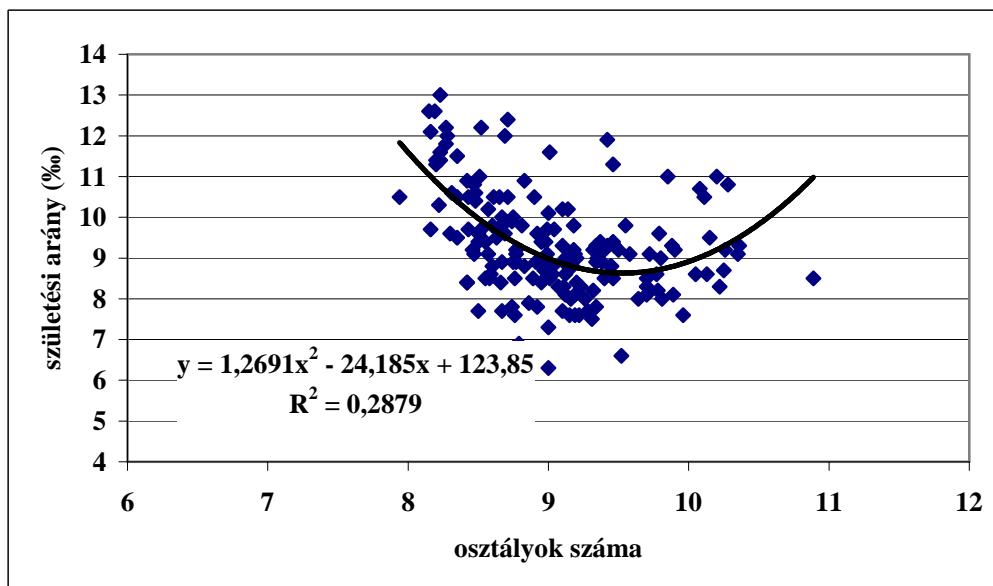


Figure 4
Live birth index and its relationship with the number of classes finished, in NUTS IV. regions (2003)

Results of the regression showed that the earlier studies which stated that the stochastic relationship between fertility and education level is not a negative linear but a quadratic one. The level of education mainly influences the timing of founding a family.

Linear correlation coefficients of age-specific fertility rates and the number of classes finished in counties (2003)

Table 4

Age groups of women	Linear correlation coefficients	p-values
15-19	-0,658	0,002
20-24	-0,865	0,000
25-29	-0,688	0,001
30-34	+0,746	0,000
35-39	+0,671	0,001
40-49	+0,207	0,380

¹⁴ Martin, Steven, P. (2000): Diverging fertility of U.S. women who defer childbearing past age 30. Demography, 4/2000 pp 523-533.

¹⁵ Andorka Rudolf (1987): Gyermekszám a fejlett országokban Gondolat Kiadó Budapest (pp 120.)

T2b: The negative relationship between the counties' inhabitants fertility rates and their educational level can only be confirmed in case of the age-groups under 30 years, in case of those age-groups above thirty years of age fertility shows a significant positive relationship with the level of qualification.

3.2.3. The relationship among fertility and the development of the area

Even though the most important indicator of a territory's level of development is GDP, the welfare of the inhabitants depends on other factors as well, for example on the employment and unemployment situation in the region.

At the beginning of the 1990s the appearance of unemployment was followed by a drastic fall in fertility in the transition countries. At the beginning of my research this fact made me think that fertility must be in a negative relationship with unemployment, as opposed to those opinions according to which there are a lot of women who have children in order to flee from unemployment, so we are to meet a higher level of fertility at regions with a higher level of unemployment. Based on my correlation calculations I can conclude that in case of the Hungarian sub-regions a middle-strong, significantly positive relationship exists between fertility and both unemployment rate ($r=+0,454$, $p=0,000$), and the share of permanent unemployment ($r=+0,473$, $p=0,000$).

Linear correlation coefficients between the indicators of economic development and age-specific fertility ratios in counties, and critical significance levels (2003)

Table 5

<i>Age groups</i>	<i>Per capita GDP</i>		<i>Unemployment rate</i>		<i>Number of tax payers for a thousand inhabitants</i>	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
15-19	-0,629	0,003	0,826	0,000	-0,865	0,000
20-24	-0,822	0,000	0,866	0,000	-0,838	0,000
25-29	-0,660	0,002	0,398	0,082	-0,377	0,101
30-34	0,651	0,002	-0,620	0,004	0,304	0,192
35-39	0,549	0,012	-0,440	0,052	0,128	0,591
40-49	0,093	0,697	-0,09	0,706	-0,202	0,394

Based on these results one can conclude that the counties with a higher level of economic development, where per capita GDP is higher than average and the number of tax payers for a thousand inhabitants is higher and unemployment is lower, the fertility of age groups above 30 years is over the average, while in the less developed regions the fertility of age groups under 30 years is higher than average.

3.2.4. The relationship between fertility rate and the share of gipsy population

The living conditions of the gipsy population and their demographic characteristics show major differences from those of the Hungarian average. The age structure of gipsy population is significantly younger, which can be explained by an above average fertility and a shorter than average life-expectancy.

The share of gipsy population and the number of life birth for a thousand inhabitants are in a strong, positive relationship based on the year 2001' census. Partial correlation coefficient's value is $r=0,687$ ($p=0,000$). We can see that this indicator also shows a different relation and a different intensity with the distinct age groups' fertility rates.

Linear correlation coefficients of the share of gipsy population and the age-specific fertility rate and critical significance levels (2001)

Table 6

Age groups	r	p-value
15-19	+0,942	0,000
20-24	+0,792	0,000
25-29	+0,339	0,143
30-34	-0,495	0,027
35-39	-0,315	0,176
40-49	-0,008	0,974

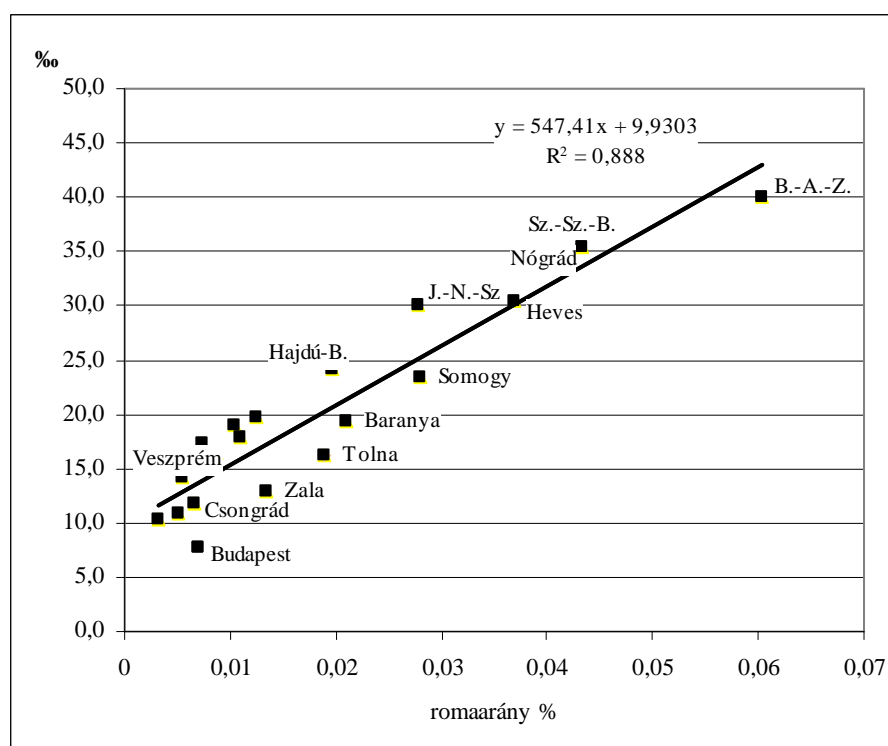


Figure 5: regression function of the fertility of the age group 15-19 and the share of gipsy population

T2c: Fertility rates of the population under 20 years and the share of gipsy population in a county show an almost functional positive relationship. The share of gipsy population only has a positive affect on the fertility of age groups younger than 25 years.

T2d: the analysed explaining variables (the level of urbanisation, unemployment, per capita GDP, income situation of the inhabitants of a region, educational levels and the share of gipsy population) are in a differently directed and differently intensive relationship with the fertility of the population.

3.3. Theses concerning the mortality of the population

In order to be able to step up against the high mortality of Hungary we have to map the factors influencing it and the way these factors work, and their priority ranks. To accomplish this task we need to compare the mortality data of Hungary with that of other countries. .

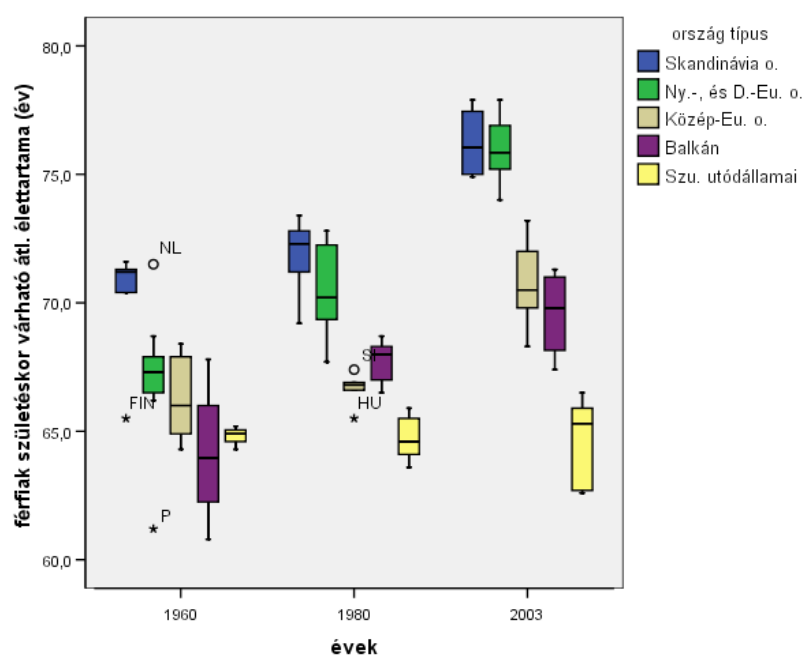


Figure 6: Box plot schedules of men's average life expectancy at birth in European countries

In the second half of the 20th century life expectancy at birth increased in all European countries, but the pace of change was different. The pace of growth was independent of the political-social systems of the distinct countries until the 1960s. Until the end of that decade Scandinavian countries could have been the most proud of their mortality indicators (except for France). But in countries which started from a worse situation (for example Austria, Finland, Germany, Portugal, and the countries of the socialist block) the decrease of mortality was

higher. The different pace of improvement resulted in a decrease in mortality differences among European countries for the 1960s. At this time though, improvement stopped and the mortality of men in socialist countries began to rise in some age-groups.

As living standards in the market economies of Central- and South-Europe continued to improve dynamically, they managed to catch up with the Scandinavian countries by the end of the 20th century. As opposed to this, socialist countries lagged behind the indicators of market economies. (See figure 6)

T3a: By the beginning of the 21st century, the differences between the North-Eastern and South-Western parts of Europe met at the end of the 20th century disappeared, and two other borderlines appeared instead of it on the mortality map of the continent, one on the western borders of the ex-socialist countries and one on the border of these countries with the ex-soviet countries.

At the end of the 1960 a so called epidemiologic crisis was started in Hungary. The crisis mainly touched on the life-expectancy of the age groups between 30 and 60 years olds.

Life-chances of the middle-aged persons were worse in 1993: in this year the chances of those men between 45 and 60 years olds were worse than in the years of the Great Depression. Life-chances of middle-aged men began to decrease by a dynamic increase in living standards and economic growth, reminding on the indicators on the third world's countries.

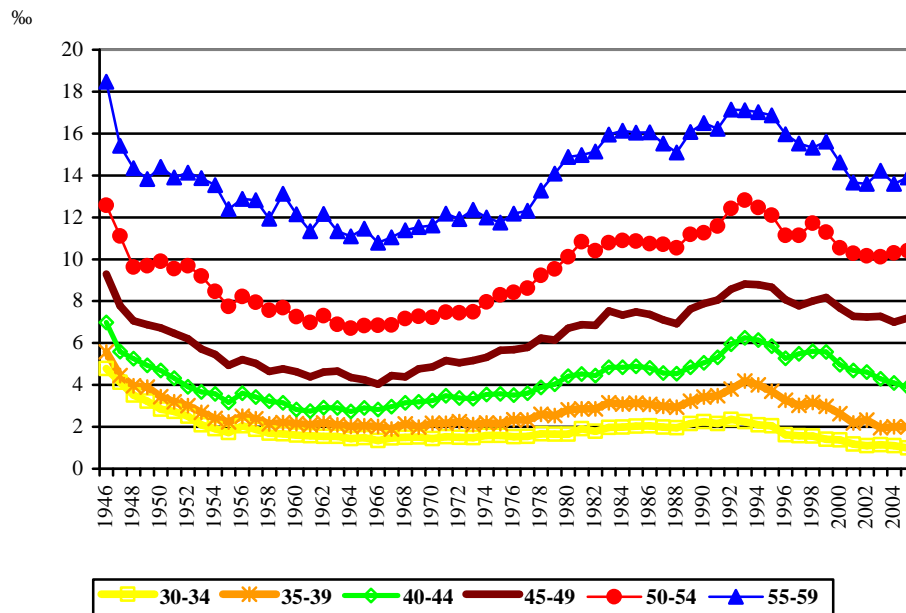


Figure 7: age-specific mortality rates of 30-60 years olds in Hungary¹⁶

¹⁶ The figure is an own work, the source of the data was: Demográfiai évkönyv 2005 CD Történet statisztikai idősorok, 1865-2005 alkönyvtár

A further characteristic of epidemiological development is that the mortality of young elderly (60-69 years olds) was permanently stagnant and the mortality of the oldest was decreasing continuously.

The changes experienced in the field of mortality did not affect the members of the two genders to the same extent. Until the school age there can hardly be found any difference in the mortality rates of the two genders. But above 10 years of age, the mortality of boys becomes higher. In the age group of 10-14 years this gap is permanently around 50%, while in the age group of 15-19 it almost reaches 100%.

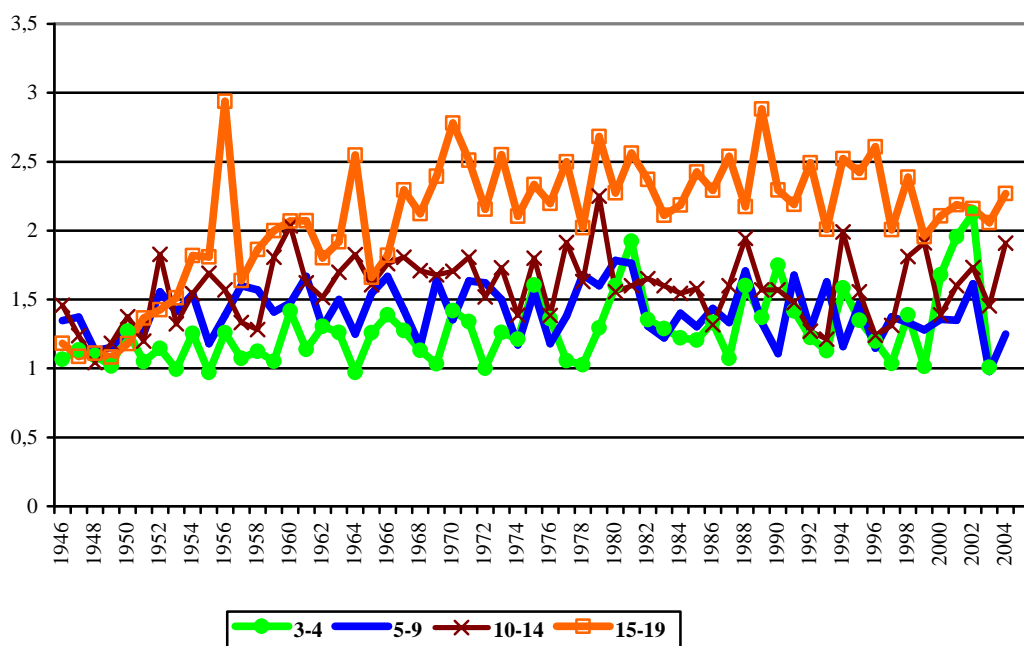


Figure 8: the age specific mortality rates of men in the age groups of 3-19 years old as a function of time in Hungary

In the age group of 20-30 years old mortality rate of men is about three fold of the women's today. In this age-group ore than 60% of deaths are caused by external reasons (in men's case almost 70%). As we know, transportation and other accidents just like suicides happen more often in the case of men.

The age-group of 30-40 years olds shows a relatively slower pace of growth and fluctuations also lag behind that of the population in their twenties, but even in this age group, mortality of men increased to 2.5 fold of women's. In men's case external reasons are also the most common cause of mortality, but with the increase of age their weight drops to around 30%. With the rise of age, the share of vascular and digestive systems' illnesses increases among death causes. In this age group of women the modus of death causes is cancer instead of external reasons.

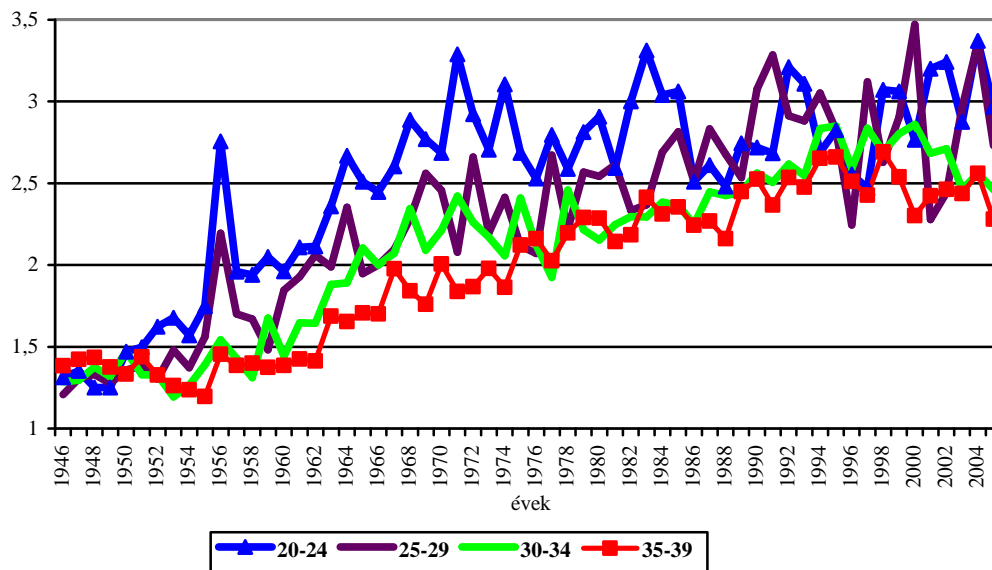


Figure 9: The ratios of age specific mortality rates of women and men in the age-group of 20-39 years olds in Hungary

In the age-groups of the middle-aged persons the mortality gap of men was very similar during the years passed. The gap between men's and women's mortality rates was the smallest at the end of the 1950s. The scissor representing the difference between the two genders mortality rates began to open in case of the 55-59 years olds first.

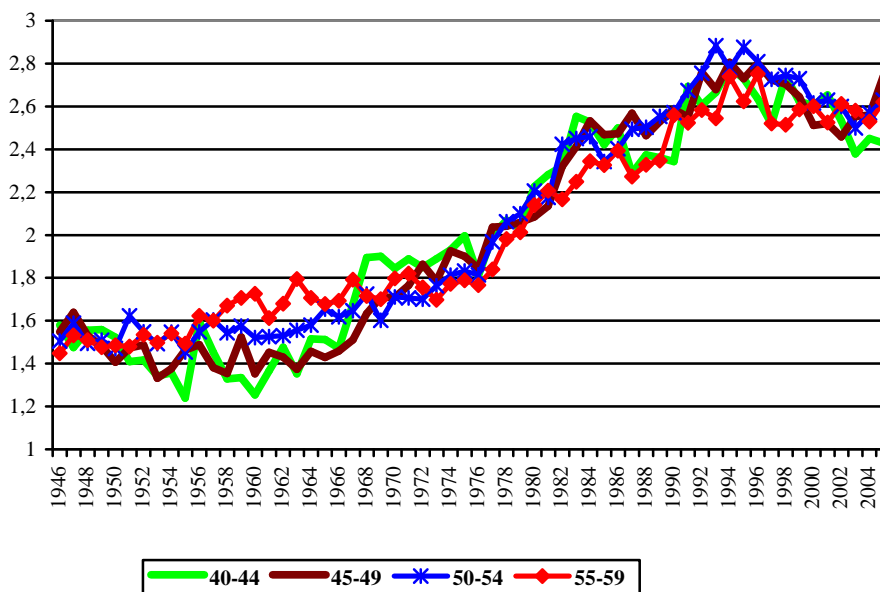


Figure 10: The ratios of age-specific mortality rates of men and women in Hungary, as a function of time

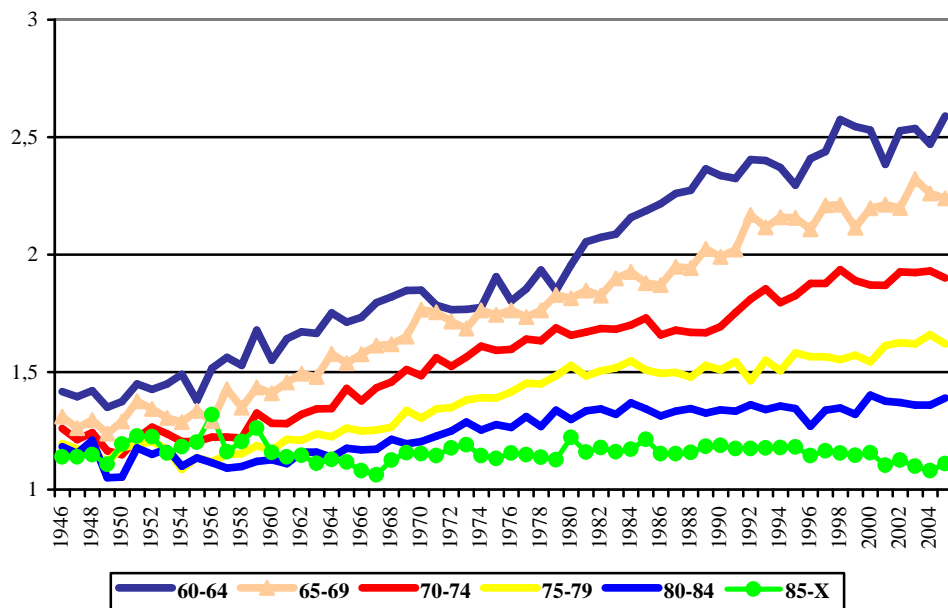


Figure 11: The ratios of age-specific mortality rates of men and women in the age groups above 60 years in Hungary, as a function of time

Men reacted to the new types of diseases with an about a decade longer delay so only in 1990s could the growth rate of the gap between men's and women's mortality decrease, followed by a fall back of the difference. Men pursue habits that harm their health more often than women (smoking or drinking alcohol). It is astonishing to think about that this worsening of men's health status happen parallel to ever broader usage of medicine's new inventions. Any girls being born today can expect to 8 years longer than their boy fellows.

The gap between men's and women's mortality rates can be shown by the facts that any girls being born in the less-developed sub-regions which are in the worse situation can expect to live longer than boys being born in the most developed sub-regions today.

T3b: As opposed to our starting hypothesis that mortality decreases with economic development, the mortality of middle aged men increased dramatically between 1964 and 1993 in Hungary.

T3c: The difference between men's and women's mortality has formed very differently in distinct age-groups.

The indicators showing the tightness of the relationship confirm the hypothesis formulated earlier that life expectance of women at birth are less responsive to external factors.

Linear correlation coefficients showing the strength of the relationships between men's and women's average life expectancy at birth in sub-regions (2003)

Table 7

Influencing factors	Value of linear correlation coefficients	
	men	women
Average number of classes finished at education	+0,732	+0,442
Number of taxpayers for one thousand inhabitants	+0,705	+0,521
Average income tax (PIT) base (Ft)	+0,654	+0,424
Average amount of income tax paid (PIT - Ft/person)	+0,644	+0,394
Share of public health service identity card holders	-0,596	-0,391
Share of unemployed persons (%)	-0,580	-0,433
Share of temporarily unemployed persons (%)	-0,571	-0,465
Share of flats with sewage (%)	+0,541	+0,320
Share of flats with drainage (%)	+0,482	+0,246
Share of the population living in towns (%)	+0,476	+0,234
Share of inhabitants living in settlements with over 120 persons/km ² (%)*	+0,401	+0,133
Share of the employees working in agriculture and forestry (%)*	-0,306	-0,152
Share of gipsy population (%)	-0,440	-0,378

*not significant explaining variable in women's case

Result of the correlation calculations confirm the hypothesis according to which differences among sub-regions' mortality rates can be explained by the average level of education, social and economic differences. Improvement of life expectancy can rather be characteristic for more developed sub-regions, while the territories who were losers of the social and economic transition process can be regarded lagging behind in this respect as well. The less developed status, the higher level of unemployment, the higher number of settlements with less inhabitants and the lower level of the population's average qualification is matched with a higher rate of mortality.

As age is the most important of the factors that cause heterogeneity in mortality, I took a closer look at the characteristics of distinct age-groups mortalities and their causes as well.

In Hungary – as in all countries with developed health culture – the majority of the inhabitants die a high age. Since 2002 less than 1% of all deaths can be attributed to the age group 0-19 year's olds. Mortality of the population under 20 years of age correlates mostly with the indicators showing the economic development of region. The relationship can be regarded as middle-strong or weak.

So, differences in the mortality of the sub-regions can mostly be determined the sub-regions level of average qualification, social and economic differences. But, in case of women, the value of each linear correlation coefficient shows a weaker relationship than in men's case. First of all, in men's case we can see that the smaller the settlement is the man lives in, the shorter life he can expect. Women's mortality is not significantly influenced by the sub-region's employment structure, and men's case we can only find a weak relationship too. Among all the factors included in the research, men's life expectancy at birth is mostly determined by the level of qualification, while for women's mortality the

sub-region's economic potential is most influential factor. The very same factors determine the baby's mortality as well. Pearson's linear correlation coefficients show that with the rise of age the relationship between the mortality rates of age-groups and the influencing factors becomes ever stronger.

Strength of the relationships between the mortality for 10 000 in an age-group and the distinct determining factors in sub-regions

Table 8

Influencing factors	Value of linear correlation coefficients		
	0-19 Years olds	20-39 Years olds	40-59 Years olds
Average number of classes finished at education	-0,366	-0,572	-0,700
Number of taxpayers for one thousand inhabitants	-0,462	-0,523	-0,694
Average income tax (PIT) base (Ft)	-0,345	-0,565	-0,640
Average amount of income tax paid (PIT - Ft/person)	-0,294	-0,558	-0,614
Share of flats with sewage (%)	-0,259	-0,484	-0,560
Share of flats with drainage (%)	-0,377	-0,433	-0,448
Share of the population living in towns (%)	-0,245	-0,354	-0,440
Share of inhabitants living in settlements with over 120 persons/km ² (%)*	-0,113*	-0,456	-0,409
Share of unemployed persons (%)	+0,409	+0,442	+0,534
Share of public health service identity card holders	+0,401	+0,509	+0,527
Share of temporarily unemployed persons (%)	+0,447	+0,414	+0,523

**not significant explaining variable

Regression model of women's mortality

The SPSS software included only one explaining variable in the model in women's case, namely the number of tax payers for a thousand inhabitants (X_1), which factor determines in 26,4% the variance of women's life expectancy at birth among sub-regions.

The regression equation is: $y = 71,758 + 0,012x_1$

On the basis of these results we can concluded that the main cause of difference among sub-regions in women's mortality lays in the differences in the level of economic development. Of course, this is only true in tendency, as we can see that the explaining force of the regression model is not too strong.

Regression model of men's mortality

In men's case three explaining variables were included in the model:

- X_1 : the average number of school classes finished ($R^2=0,540$) (VIF=2,53)
- X_2 : the share of flats attached to the sewage and drainage systems ($R^2=0,578$) (VIF=1,257)
- X_3 : share of inhabitants living in settlements with over 120 persons/km² ($R^2=0,605$) (VIF=2,162)

The regression function's equation is:

$$y = 42,413 + 2,346x_1 + 0,041x_2 - 0,013x_3$$

These three most important factors explain the life expectancy of men in sub-region in 60,5%. In men's case not the factors indicating the level of economic development are the most important ones, but three different indicators, and two of these are related to the characteristics of the settlements (the share of flats attached to the sewage and drainage systems and the share of inhabitants living in settlements with over 120 persons/km²), while one refers to the qualifications of men.

T3c: the gap between men's and women's life expectancy at birth are differently influenced by distinct economic and social factors. Men's life expectancy at birth is rather determined qualification levels while women's by the economic potential of the sub-region they live in.

4. POSSIBLE APPLICATIONS OF THE RESEARCH FINDINGS

The most important result of the research has already been published in order to enhance other researches concerning similar subjects, Further use of the results can be found at the university education, in working out family transfer and planning economic policy actions, as I see.

I have been using the experiences I had gained during my research for many years in my teaching activity at the University of Miskolc. Results concerning fertility and mortality have mostly been used in the subject demography which is taught both at the Faculty of Economics and the Faculty of Health, while the knowledge I gained on the relationship between demographic and economic processes are used in the subject Economic Statistics at the Faculty of Economics and in the subject Social Statistics at the Faculty of Law. As part of the teaching material development these research results were published on the Internet.

As the costs and burdens of bearing children are worn by the families while the economic utility of these next generations are enjoyed by the whole society, these facts should be considered when formulating the system of family transfers. The results of this dissertation can provide data for decision makers of rural development, economic policies and healthcare as well.

THE PUBLICATIONS OF THE AUTHOR IN CONNECTION WITH THE DISSERTATION

List of publications:

A halál előtti egyenlőtlenség alakulása Magyarországon

in: VI. Magyar (Jubileumi) Jövőkutatási Konferencia Győr Konferenciakötet 2. (2007) 105-115. old.

Baby-Boom, Baby-Bust (Gründe und Folgen für die unterschiedliche Entwicklung der Geburtenrate in den EU-15 und in den Beitrittsländern)

in: ME Gazdaságtudományi Kar VI. Nemzetközi Konferencia Konferenciakötet II. Miskolc –Lillafüred 2007 377-385 old.

Birth and fertility rates in Hungary in the 20th century

in: Business Studies Volume 3, Number 1 (2005) p. 113-122

A magyarországi termékenységi mozgalom területi különbségei

in: Gazdaságtudományi Közlemények, 4. kötet 1. szám (2005) 51-63 old.

Demográfiai kihívások (társszerzőkkel) Nemzeti Kutatási Fejlesztési Programok (Pályázatszám: 5/128/2001) kutatásjelentés (2003)

Demográfiai folyamatok Észak-Magyarországon

in: Borsod-Abaúj-Zemplén megye gazdasági-társadalmi helyzetének áttekintése A Miniszterelnöki Hivatal megbízásából Kutatásjelentés (2002) p. 31-65

Statisztika elemzések alapjai Miskolc, (2007) (társszerzők: Domán Csaba, Szilágyi Roland)

Historical overview of the development of decision preparation method

in: MicroCad kiadvány Section P: Management (2001) 159-164. old.

Döntéstámogató módszerek komplex alkalmazása egy konkrét vállalatnál

in: Doktoranduszok Fóruma Gazdaságtudományi Kar Szekciókiadványa Miskolc, 2000, 100-104. old.

Döntéselőkészítés a mikrogazdaságban

in: Doktoranduszok Fóruma Gazdaságtudományi Kar Szekciókiadványa Miskolc, 1998, p.100-104

Döntéselőkészítési módszerek alkalmazása a mikrogazdaságban különös tekintettel a statisztikai módszerek alkalmazási lehetőségeire.

OTKA kutatás (1997-2000) Nyilvántartási szám: F 023217

Döntés előkészítést támogató előrejelzési módszerek alkalmazhatóságának vizsgálata

1999 PhD. hallgatók Tudományos Konferenciája

Conference lectures

Der Tod macht keinen Unterschied. Oder doch? XXVIII. OTDK Közgazdaságtudományi Szekció Doktorandusz Konferencia Miskolc, 2007. április 25-27.

A halál előtti egyenlőtlenség alakulása Magyarországon

VI. Magyar (Jubileumi) Jövőkutatási Konferencia Győr, 2006. október 6-7.

Demográfiai és társadalmi tényezők kölcsönhatásai

Tudásalapú Társadalom Tudásteremtés – Tudástranszfer Értékrendváltás V. Nemzetközi Konferencia Miskolc-Lillafüred 2005. május 11-12.

A kistérségek társadalmának és gazdaságának néhány jellemzője

Magyar Közigazgatási Intézet IDEA Konferencia Budapest 2005

Borsod-Abaúj-Zemplén megye gazdasági helyzetének és demográfiai folyamatainak összefüggései

Válasz Úton Nemzetközi Konferencia Magyar Tudományos Akadémia Budapest 2003. szeptember 25-26.

Demográfiai és egyéb társadalmi folyamatok közötti kölcsönhatások

5/128/2001. NKFP Zárókonferencia Központi Statisztikai Hivatal Népeségtudományi Kutatóintézete Budapest 2004

Russian Export Blend kőolaj a statisztika tükrében MOL Szakmai Tudományos Konferencia Siófok (1997)

Educational materials

Indexszámítás (2004)

Főátlagok összehasonlítása standardizálás segítségével (2005)

Kétváltozós korreláció- és regresszió számítás (2006)

