MORTALITY CRISIS IN TRANSITIONAL ECONOMIES: THE CASE OF UKRAINE.

by

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Abstract

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Using a panel data approach, this paper is investigating the mortality crisis in the transitional economies and estimating the losses for Ukraine. On the basis of cross-section data of 24 transitional countries for 12 years, we found out that some determinants of life expectancy that are considered to be important in the literature on the subject are not that influencing for transitional economies (like malnutrition, rising poverty etc.) while some factors are of extreme importance and have both negative (economic changes, social stresses, adverse change in life styles) and positive (higher education enrollment, health system functioning) effects. Our empirical model proves to be quite successful in predicting the real mortality trends for transitional countries. To control for the effect of the Chernobyl disaster in some countries of the former Soviet Union, we are enhancing the investigation by including the proxy for radioactive pollution into model and obtaining even better predictive power. Policy implementations and recommendations of how to overcome the crisis can be found in the conclusive part.

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Thanks to everybody, without your help this work would probably be non-existent.

Chapter 1

INTRODUCTION

The future of the country is in the hands of its people. Both economic growth and development are greatly dependent on their health, skills and energies. But who are these people? Are they young or old? Healthy and long-lived, or not? In the future, will countries come up with more productive population? Or will they have to devote increasing resources to taking care of their old people?

All these questions are of extreme importance not only from the theoretical point of view, but for the practical policy implementations as well. According to Bloom and Canning (2001), an understanding of the local demography is of enormous importance for policy-makers, and can be used in three main ways. First, it is a predictive tool of enormous power, providing a powerful 'crystal ball' through which to view future trends. Second, through demographic change a country has a chance to set out on the path of rapid growth on the basis of beneficial conditions for development. Finally, demography offers a prediction about the possible challenges of the future. In general, "demography is the story of people, and in the modern economy, more than ever before, it is the quality, commitment, and enthusiasm of a country's people that determines whether it thrives[1]".

The mortality crisis in the transitional economies of the early 90's attracted a considerable attention, and this question is even more intriguing as despite of extensive research on this subject, the results are still being discussed

[1] David E. Bloom, David Canning, Kinga Huzarski, David Levy, A. K. Nandakumar, and Jaypee Sevilla "Demographic Transition and Economic Opportunity: The case of Jordan", 2001

and ambiguous. The European Health Report 2002 (EHR 2002) presented by the World Health Organization (WHO) points to major inequalities between and within countries in the level of health in the European Region. "Most striking is the widening gap in life expectancy and healthy life expectancy between western and eastern European countries, with a particularly marked decline in the NIS[2]". But pointing out many possible reasons for such a situation, they still admit that there is no final verdict on this case, and it is an interesting subject for possible future investigation.

Even more important - while investigating this matter, I found out that the number of papers dedicated to this subject is really impressive for Russia[3] and CCEE countries while there are virtually no papers on the Ukrainian case. Usually researchers are just assuming that as the patterns of mortality in Ukraine are similar to those of Russian and NIS in general, and so they can be probably explained by the same factors. For example, in the one of the central and most often citied book on the demographic shocks in transitional economies - Cornia, Pannicia (2000). *The Mortality Crisis in Transitional Economies*– authors are investigating the Ukrainian case in close connection with Russian and Belarusian ones, and their conclusions are naturally basically the same for all the countries. Basing on this paper, in his thesis on mortality crisis in Russia (on the

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[2] The **NIS** are defined here (as well as in the EHR 2002) as the 15 countries that became independent after the dissolution of the USSR, including the three Baltic countries (Estonia, Latvia and Lithuania). The **CCEE** comprise 12 countries of the formerly centrally planned economies of Central and Eastern Europe that were not part of the USSR. Wherever the grouping Western Europe is used, it includes the 15 members of the **EU** and the developed market economies outside the EU.

[3] Just to mention some of them:
Andreev E. (1999), Bennett, N.G., Bloom, D.E., Ivanov S.F. (1998), Chen, L.C., Wittgenstein, F., McKeon, E. (1996), Cockerham, W.C. (1997), Gavrilova N.S., Evdokushkina G.N., Ermakov, S.P., Gavrilov L.A. (1997), Gavrilova, N.S., Semyonova, V.G., Evdokushkina G.N., Gavrilov, L.A. (2000), Leon, D.A., Chenet, L., Shkolnikov, V.M., Zakharov, S., Shapiro, J., Rakhmanova, G., Vassin, S., McKee, M. (1997), Semenova V.G., Gavrilova N.S., Varavikova Ye.A., Gavrilov L.A., Yevdokushkina G.N. (2000a), Zohoori, N., Henderson, L., Gleiter, K., Popkin, B. (1999).

international panel data), Kassian (2002) concludes that social stresses, health system deterioration, economic decline, and alcohol consumption together provide the best statistical fit for explaining the patterns of mortality crisis.

On the one hand, we must agree that some of these factors may be of great importance for Ukrainian case, and the authors really have a reason for placing all NIS countries in one group. But on the other hand, if i.e. we look at the patterns of alcohol consumption in Belarus, Ukraine and Russia, it is quite obvious that in the case of Ukraine it won't play such an important role in determination of life expectancy (see Figure 1).

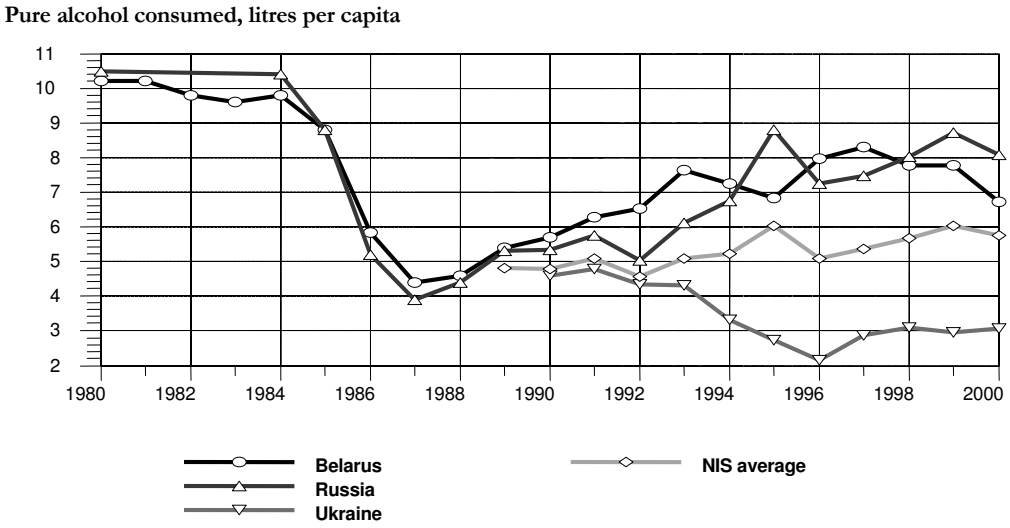
Now, if according to Zakharov (1997), the hypothesis of 'catching-up' effect (will be described in details later) due to anti-alcohol campaign in the Soviet Union, can explain from 20 to 45 percent of changes in life expectancy for Russia, and Kassian (2002) states that this numbers are even underestimated, in the case of Ukraine they are not likely to play such an important role.

Also, in Ukraine we are expecting much less influence of stress factors on life expectancy (due to an economic crisis) as the financial crisis of 1998 was much less severe here than in Russia. However, such factors as the environment and especially ionizing radiation are likely to be much more influential in our case (due to Chernobyl disaster).

Summing up, this paper will be dedicated to investigating the mortality crisis in Ukraine in connection with other transitional countries, but we will try to concentrate our attention on the specific factors that are characterizing this particular country. The fundamental ideas already developed in the literature are to be tested empirically on the basis of the data for the last decade, and the author is planning to determine the factors that are similar for all transitional countries and specifically for Ukraine.

Figure 1

Alcohol consumption in selected NIS countries, 1980 - 2000



Source: HFA Database, January 2002, WHO, http://www.who.dk

This paper will consist of several parts.

In the next chapter we are to describe why the question of demography and especially changes in population reproduction and mortality are of great importance for economists and the country in general.

The third chapter is a literature review of the papers already written on this subject and general patterns found for all the transitional countries. The overview of the factors influencing the health and life expectancy of population with special concentration on the current situation in Ukraine is included there as well.

In the fourth chapter the data overview will be presented and the reliability of sources discussed.

Next chapter will be dedicated to empirical investigation on the basis of econometric model. The results are to be analyzed and possibly criticized.

In the conclusive chapter we will describe the results obtained, discuss policy implementations, and point out possibilities for future investigations.

Chapter 2

THE INFLUENCE OF POPULATION GROWTH ON ECONOMIC DEVELOPMENT

Population growth is popularly believed to have a deleterious and destructive effect on a country's prospect. The school of '*population pessimism*' is usually mentioned in the connection with the work of Thomas Malthus at the end of 18th century. The main belief was that the population will unavoidably grow due to an inborn human desire to procreate, but at the same time the supply of land, capital and knowledge would remain fixed or would increase at much slower speed. As a result, countries would tend towards their maximum feasible population, with "the vast majority of population unable to rise above subsistence level" (Malthus, 1798).

This gloomy prediction is not a completely bizarre view of human progress. It probably fit the fourteenth to the eighteens century economic situation well. As it is mentioned in Ray (1998), blips in productivity, such as those in agriculture, increased the carrying capacity of the planet, but population did rise to fill the gap. But this theory can be certainly criticized on the basis of the question: do human beings react to economic progress by spontaneously having more children? Modern experience suggests just the opposite.

On the other extreme, '*population optimists*' argue that population growth encourages economic growth, and Boserup (1981) points out those three mechanisms involved in the process. First, rapid population growth and increasing population density tends to stimulate technological innovation and institutional change due to a variety of reasons. Second, larger populations are likely to enjoy substantial economies on scale. Third, larger populations most

probably to have a larger number of '*geniuses*', exceptional individuals with great transforming impact on country's prospect[4] (Bloom et al, 2001). Mokyr (1990) in his book on economics of innovations also mentions life expectancy as one of the factors influencing the desire of individuals to innovate: after all what are the incentives to invest in innovation if you won't be able to see the fruits?

According to Kelley (1988),"recent work has done little to advance the case put by either pessimists or optimists". Instead, a school of '*population neutralism*' has appeared. Empirical modeling proves that with all other factors controlled (*ceteris paribus*) the rate of population growth appears to have no significant effect on a country's economic prospects (both statistically and economically). As a result, "population studies have tended to fall into a state of salutary neglect among many developing country governments and international development agencies, with serious consideration of demographic factors becoming less evident in the economic development literature"[5].

However, the recent empirical research in this field employ more sophisticated models of economic growth that reveals a more complex and important relationship. These new models basically assume that every society has a ceiling on the level of per capita income it can attain, which is determined by many different characteristics such as its human capital, geography, public policies and natural resources. The next assumption of the model is that every country is generally out of equilibrium with respect to its attainable level of income, but is always tending toward reaching of that point. According to this framework, if there were two countries with the same starting level of income and they are

[4] Actually, this point is quite arguable as, after all, genius is "1% of inspiration and 99% of perspiration", according to Edison, which basically means that every genius needs appropriate environment to progress.

[5] National Academy of Sciences, 1986, *Population Growth and Economic Development: Policy Questions*, Washington, D.C.: National Academy Press.

compared, the country with the higher potential reachable income would grow in more rapid pace. Analogously, if two countries with the same potential reachable income levels were compared, the country with the lower income at the starting point would grow more quickly. According to this model, assuming that all countries had the same underlying parameters the per capita income in each of them would converge toward the same point (Barro, 1991)

I mentioned this model as one of the important features of it is flexibility, and so it is possible to test alternative hypothesizes about the determinants of economic growth (and, actually, sometimes one can only wonder if there are some limits in imagination of the economists). Bloom and Sachs (1998) used **life expectancy** among the other factors determining the steady-state level of per capita income. This study, as well as the number of other studies, has uniformly shown that initial life expectancy has a "positive, sizable, statistically significant and independent influence" on the speed of subsequent economic growth. Indeed, "about a quarter of Africa's slow rate of economic growth (relative to East Asia) may be due to the low level of life expectancy there" (Sachs, Warner, 1995). In general, the relation between GDP per capita and life expectancy for poor countries is very evident, however at the lower end of the GDP range, the relationship seems to be quite steep. But, actually, these results seem to be quite questionable in a sense that the number of exceptions from the rules is quite large, and there are poor countries with good health as well as rich countries with poor one.

Recently Wilkinson (1996) tried to clarify the complex relationship among these factors, and according to his paper the correlation between GDP and life expectancy mainly works through the impact of GDP on the incomes of the poor and public expenditures. From this analysis two important policy implementations follow. The main idea is that mortality can be reduced by:

a) "Growth-mediated" processes meaning faster economic growth with the strong employment component and concentration on the enhanced economic prosperity and social security;

b) "Support-mediated" processes meaning development of social programmes of education and health care support.

"Resources are therefore needed to develop "resource-led", low-cost, labour-intensive activities such as education and health care. Giving priority to these resources is a key requirement for development" (EHR 2002).

Also it is important to point out that empirical research demonstrates the important and substantial influence of age structure on the growth of per capita income, and meaning that age structure changes following the demographic transformation create possibilities for large fluctuations in the rate of economic growth. This effect exists even when one accounts for possible reverse causality effect between population change and income growth (Bloom, Canning, Malaney, 2000).

These new models allow us to challenge more then two decades of habitual wisdom on the neutral and insignificant effects of population changes on economic growth. "They (models) allow for countries to escape from a poverty trap of low life expectancy, poor health, inadequate education and low growth, and enter a virtuous growth spiral with good health, high life expectancy and low fertility feeding high growth" (Becker et al, 1990).

In general, modern theories suggest that health is not only the main component of welfare (to mention, the index of human development is partly based on heath parameters), but also it is closely related to the problems of medical and retired insurance.

In the case of transitional economies the question of the influence of life expectancy and mortality rates on economic growth is of even more interest as, first of all, the demographical transition has already finished at most of them during the Soviet Union period, and so it is quite painful from the social and political point of view to observe the substantial decrease in life expectancy and increase in mortality rates. In Ukraine, for example, this situation gave reasons to some politicians to speculate on the idea of 'dying nation' and 'undeclared war' to obtain cheap popularity. And the most unpleasant fact is that this threat is not completely meaningless. According to the last available data, the population of Ukraine has decreased from approximately 52 million in 1991 to 48 million people in 2002 (47.2 million according to the latest available data – April 2003). And so it is the task of great importance to specify the factors that determine such a situation not only from the economic point of view but also from the point of national security, as we have not observed any positive trends for the last 12 years. Also, it is proven that policy implementations based on the right facts are able to influence the demographical trends, and so it is important to look for the right solutions.

There were attempts to evaluate macroeconomic effect of the Russian mortality crisis. For example, in Bloom and Malaney (1998), the authors obtained the result that only a small fraction of productive crisis can be explained by worsening health situation (less then 3%, to be exact), and it is mainly explained by the losses in human capital with increased mortality. So the results are ambiguous, to say the least.

I would like to point out that calculation of the losses due to a demographic shock is beyond the scope of this paper, but it can be viewed as an interesting subject for future investigation with the use of complicated econometric techniques (like calibration).

One more interesting point is that recently a group of Russian demographist argued about the importance of long-trend changes in life expectancy and mortality of working population. Popov (2001) i.e. is pointing out that it is not the reduction in population to be afraid of and taken care of, but the changes in age structure that matters. So the main problem is not growth in mortality rates but sharp reduction in fertility. This point of view is, with no doubt, interesting and challenges traditional theories but is not widely accepted yet.

For our research this conclusion basically means that in short-run the cause-effect relation is one-way, so that it is economical environment that affects life-expectancy and not vice versa (as for age-structure to change the time period of at least several decades is required). So in the short run there is no causality problem meaning that, if not stated otherwise, we assume the absence of substantial influence of life expectancy on economic situation. This assumption allows us to control for the whole cohort of potential problems (like endogeniety problem, for example) with the strength and direction of influences in econometric analysis, and as we are working with one decade only, it seems to be quite defensible.

Chapter 3

MORTALITY CRISIS AND ITS EXPLANATIONS

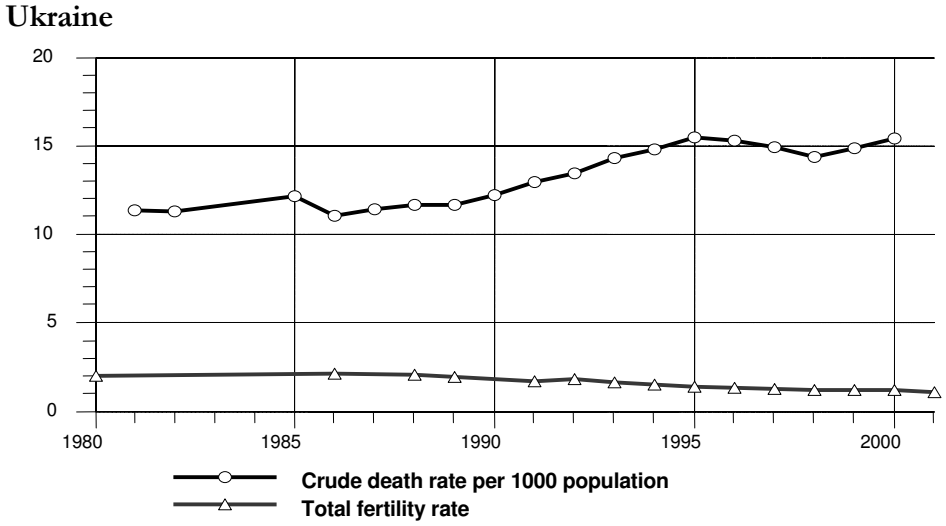
"Demographic shocks convey the idea of a sudden change in those factors, external or exogenous to the demographic system that affects mortality, fertility and migration" (Bacci, 2000). Among the external disturbances that affect the normal functioning of the demographic system one can mention famines and epidemics, wars and displacement of people. Malthus renamed them "*repressive checks*" and determined them to be endogenous to the system as they can be viewed as inescapable consequences of unsustainable and uncontrollable population growth. Traditional demographic shocks are usually characterized by sudden increases in mortality, decreases in fertility, an explosion in mobility and family break downs. The aftershock, however, is mainly determined by changes that counter the initial results. In other words, a steady or semi-steady state is not reached and populations work to recover the point of equilibrium.

In the case of Ukraine all the indications of classical demographic shock are present. On the *Figure 2* the overall situation with mortality and fertility is present, and in the *Table* one can find the indicators of net external migration and divorce rates.

Mortality crises of different intensity are not something new for the former socialist countries of the region. It is enough to mention the population losses during the World War I and October Revolution, the famines of 1921 and 1927, the forced famine ('holodomor') in Ukraine and Southern Russia during the period of forced collectivization in 1933-1934, the World War II. The population losses during the first half of the century in Ukraine are estimated to be from 20 to 30 million people, and this is only direct losses. The indirect losses are hard to

Figure 2

Crude death and fertility rates for Ukraine, 1980 – 2000



Year	Net external migration (thousands of people)	General divorce rate (per 100 families)
1989	-108,9	39,6
1990	-139,3	39,9
1991	-180,4	40,7
1992	288,1	56,5
1993	49,6	51,2
1994	-143,2	52
1995	-94,8	45,9
1996	-131,2	62,8
1997	-74,5	54,6
1998	-93,6	57,9
1999	-44,8	51
2000	-46,6	71,9

Source: HFA Database, January 2002, WHO, http://www.who.dk
TransMONEE Database, 2002, UNECE, http://www.unece.org/ead

estimate, but they would be approximately twice as high. It might be hard to believe but today's population of Ukraine is only 10 million higher then before 1914. And we must take into account that fertility rates in the country were one of the highest in Europe before 1970's (partly due to social programs and partly due to the prohibition of abortions).

The recent surge in mortality, according to Cornia and Paniccia (2000), shares few analogies with these historical precedents. First, it has occurred during peacetime and it has not been accompanied by outbreaks of deaths by exhaustion, starvation, and infection (at least at the countries of the Eastern Europe). Second, with its keen mortality gradients, the transition mortality crisis differs a lot from the gradual but long-lasting patterns of 1970's -1980's. Third, the recent wave in death rates happened in the period initially described by general expectations of betterment of living standards. Actually, as for the last point, I cannot completely agree with the authors as actually no one was expecting immediate improvement after the start of reforms, and even if some illusions were present at the first stages, they were quickly and mercilessly obliterated by sharp inflation and unemployment processes.

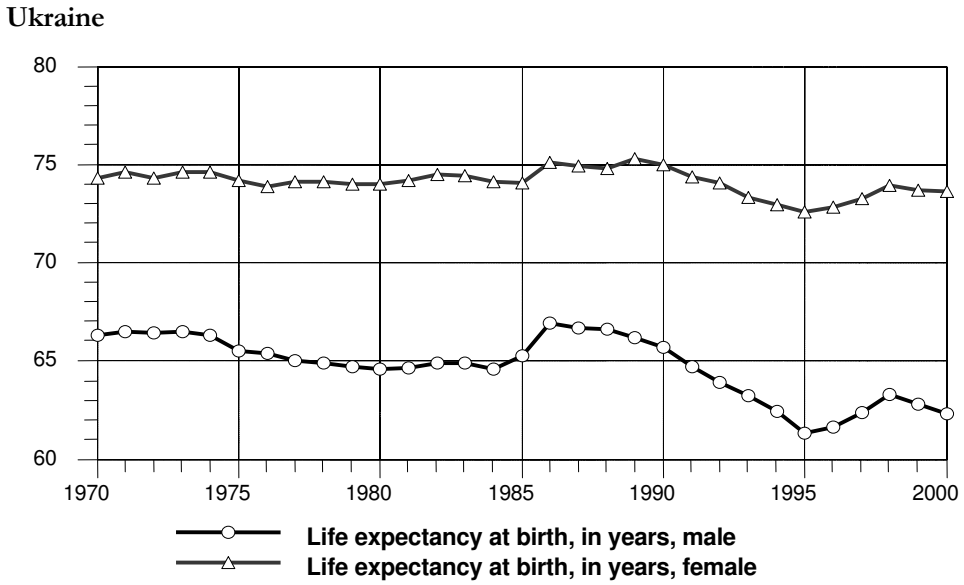
Mortality patterns differ in the countries of the region. The tenseness of the situation of changes in Ukraine can be represented by the following figure (*Figure 3*).

In general, the trend in life expectancy in Ukraine is similar to that in most other NIS. The substantial improvement in this indicator in 1985-1986 was then replaced by a downward trend, and by 1992 it had returned to the level seen before the start of the anti-alcohol campaign. Average life expectancy then continued to fall until 1995. It increased between 1996 and 1998, but then fell again slightly in 1999-2000. In 2000, a decline to 67.9 years was registered, and it is substantially lower than in EU countries. The changes were especially severe

for males, and much less impressive for female population. In the period 1986-2000, the difference in life expectancy between men and women increased from 8.1 to 10.9 years. On the basis of this figure, Ukraine is in the leading group of countries in WHO's European Region.

Figure 3

Life expectancy at birth for male and female population in Ukraine, 1970 - 2000

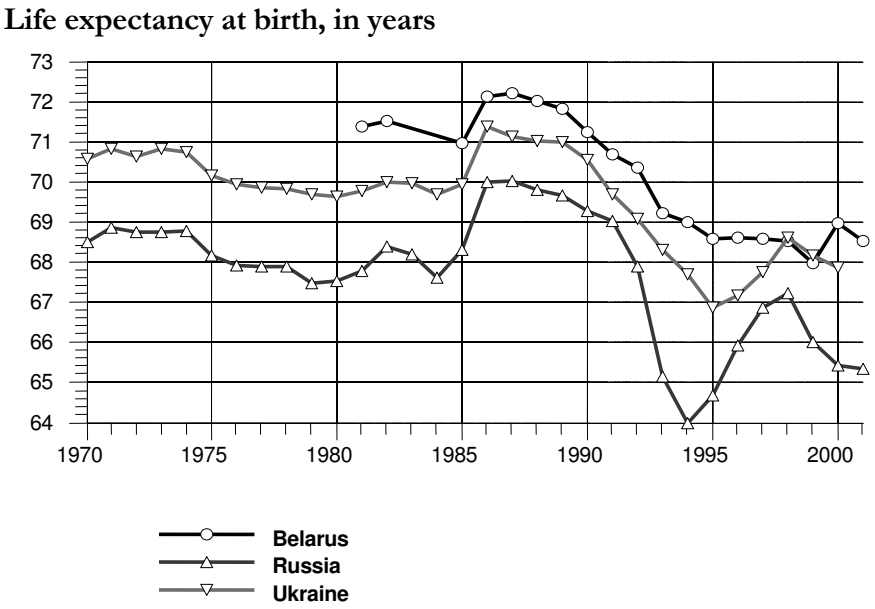


Source: HFA Database, January 2002, WHO, http://www.who.dk

The next figure (*Figure 4*) represents comparative statistics on this indicator on Ukraine in comparison with its neighbors. As one can see from it, the numbers in Ukraine were pretty close to average NIS levels.

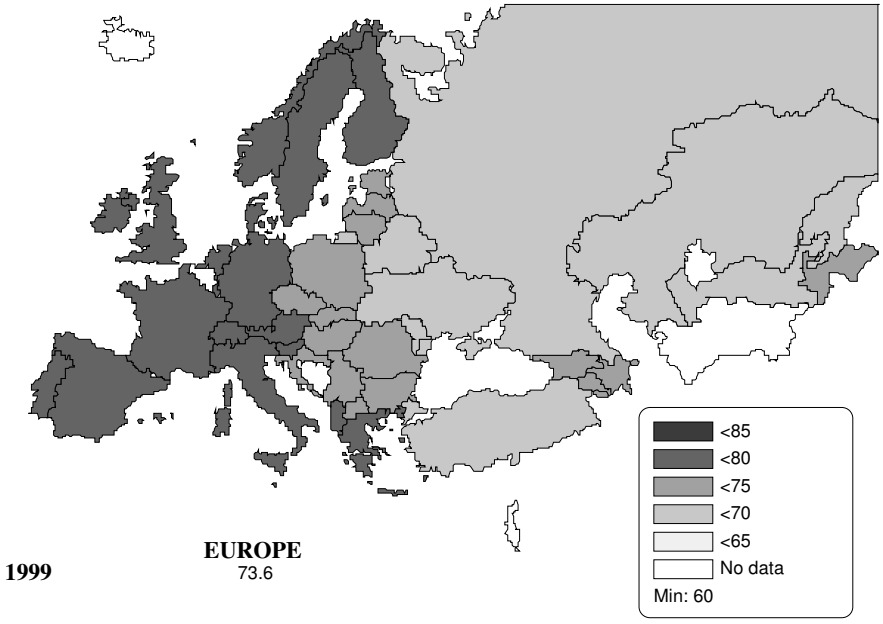
Figure 4

Life expectancy at birth for the whole population in selected NIS countries, 1970 -2000



Source: HFA Database, January 2002, WHO, http://www.who.dk

060101 +Life expectancy at birth, in years



Source: HFA Database, January 2002, WHO, http://www.who.dk

In the past decade, Ukraine has been experiencing an adverse demographic situation. Since 1991, the death rate has exceeded the birth rate. In 1999, the natural population loss rate reached a level of -7.1 per 1000 that basically means one of the highest rates of natural population loss in the European region.

These statistics is even more impressive if to take into account the fact that all the Western European countries have enjoyed a continuous and impressive increase in life expectancy – the average gain between was 6.4 years at birth.

So what are the factors that determine a general demographic situation in the country and, to be more specific, what are the major determinants of health and life expectancy? This question is of extreme importance but it is not enough just to know what they are. One needs to evaluate the strength and direction of influence to be able to propose some policy recommendations. And this is exactly the goal of this paper.

The traditional list of determinants of health includes such factors as lifestyles, environment, genetic and individual factors as well as availability and effectiveness of health services in the country. According to WHO's terminology, these factors can be separated into four main groups which are:

I) Socioeconomic determinants.

II) Lifestyles.

III) Physical environment.

IV) Health system development.

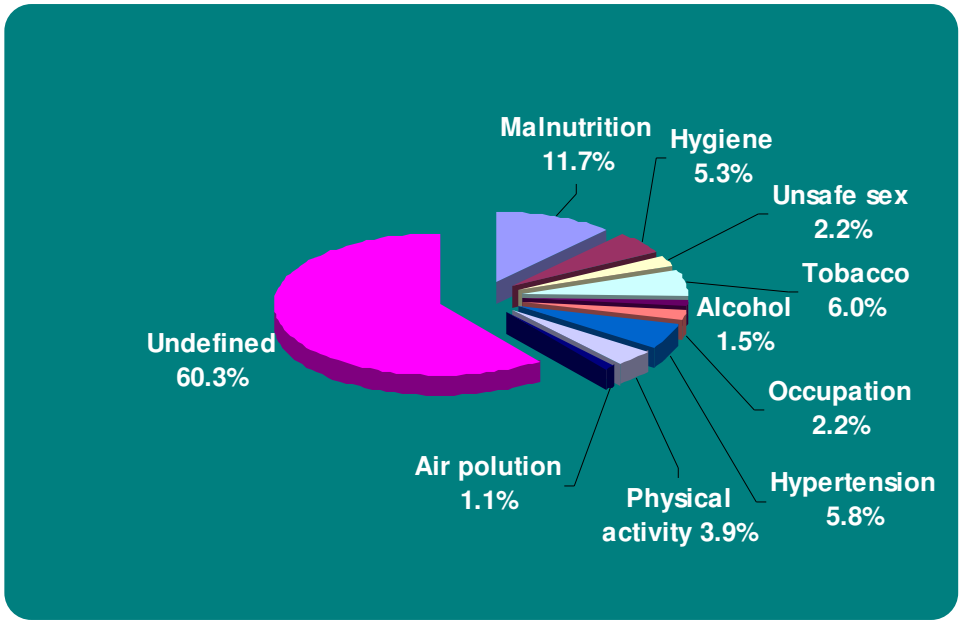
Let's have a look at each of these factors and analyze the overall situation with them in the NIS region and Ukraine.

I. **Socioeconomic determinants**.

The importance of this group have increased tremendously for the last decade, and the main reason of it, as it is easy to guess, in a tremendous increase in the gap among the countries of the European region. This group is characterized by concentration on the determinants that affect health at the population level as a whole. As it is stressed in the EHR 2002, individual lifestyles and risk factors as well as development of health system (and universal access to effective health services is one of the characterizing factors of the each society that is struggling to be considered developed) can explain only a portion of variations in the disease occurrence, for example. From the *Figure 5* it is clearly seen that more then a half burden of deaths in the region remains unexplained by the known major risk factors.

Figure 5

Major mortality risk factors in the European region, 2000



Source: European Health Report 2002, WHO, http://www.who.dk (redrawn)

Among the sub-groups of socioeconomic determinants the most important are poverty, psychosocial factors, unemployment and education.

Poverty

"Poverty and ill health form a vicious circle, poverty being both a major determinant of poor health and a potential consequence of it" (EHR 2002). Lower life expectancy, poor reproductive health, high infant mortality, unhealthy lifestyles, tobacco, alcohol and drug consumption, risk of contracting infectious diseases as well as prevalence of noncommunicable ones, depression, suicide, violence and antisocial behavior – this is the short list of problems usually associated with poverty.

There is literally no society not affected by poverty but the difference quite substantial depending on whether we measure it in absolute or relative terms. Actually, the most widely spread indicator is the one used in *The Human Development Report* namely Gini index.

Gini index measures the extent to which the distribution of income (or consumption) among individuals or, more often, households within a country deviates from a perfectly equal distribution, and its number is in the interval from 0 to 1 where 0 represents perfect equality, and 1 – perfect inequality.

It is important to mention that there is no such thing as uniformly recognized socially optimal Gini index as social inequality may have positive as well as negative influence on the economy in the static and dynamic framework. To mention, there are schools in the history of economics that believed in total equality as in something that every society must struggle for, thus representing very interesting concept of social utility curve in which social utility can't be higher then the utility of the least satisfied of its members (egalitarian utility curve). On the other hand, it is theoretically and practically proven that perfect equality tends to destroy incentives to maximize working efforts and innovate,

and so might be very dangerous from the dynamic point of view. The message is that, as always, there is a trade-off between choosing more or less equative society structure, and the optimal value is most probably lying somewhere in between of extreme values.

Table 1

Gini coefficients statistic in transitional economies, 2000

Country	2000
Czech Republic	0,23
Slovakia	0,26
Poland	0,35
Hungary	0,26
Slovenia	0,25
Croatia	0,35*
FYR Macedonia	0,35
FR Yugoslavia	0,37
Bulgaria	0,33
Romania	0,31
Estonia	0,39
Latvia	0,33
Lithuania	0,36
Belarus	0,25
Moldova	0,44
Russia	0,37*
Ukraine	**0,36**
Azerbaijan	0,30
Georgia	0,50*
Kyrgyzstan	0,41*
Tajikistan	0,47

As we can clearly see from this table the values of Gini index vary substantially among the countries of the region, and differ from comparatively low levels as in Czech Republic and Slovakia to high ones as in Russia, Ukraine with extreme measures in Moldova and Georgia.
These values are pretty comparable to the Western European ones (for comparison, in Denmark Gini coefficient is calculated to be equal to 0.25 while in the United Kingdom – 0.36), but still in general in NIS all of them extremely high, and if to look at the trend it is the changes in numbers that were really dramatic. In Ukraine, for example, the value has changed from 0.22 in 1989 to 0.36 in 2000.

* the latest available data from 1998
Source: TransMONEE Database, 2002, UNECE, http://www.unece.org/ead

Also I would like to mention that there are some other proxies used to measure poverty in the society. For example, as a very good proxy one can use the criminal situation in the country, and it is proven that correlation between these two numbers is very significant (according to some researches on the developing economies of the Latin America and Africa).

One more important point: while the *absolute poverty* defined as "poverty that does not allow people to afford a minimum consumption basket of US$2.15 per day" (EHR 2002 from the World bank) is estimated to influence only 2% of the region, the *relative poverty* defined as existing when "people's economic resources do not allow them a minimum acceptable way of life in the society in which they live, e.g. an income below 60% of the median" (the same source) can affect about 50% of the people in some European Countries.

Psychosocial factors

Stress and increasing social pressure are uniformly recognized as key factors determining the problems with alcoholic psychosis, suicides, accidents, as well as with heart attacks, hypertensions and cirrhosis of the liver. Even visual inspection of the data is enough to understand the importance of these factors in the transitional economies. Accelerated social and economic transition left deep scars on the demographic situation and its influence is likely to matter even in distant future.

According to EHR 2002, these factors are likely to play an important role in the regions of Europe in the nearest future, and it is one of the clue tasks of the governments to provide accurate and intelligent social policies to make sure that this influence will be largely positive rather then negative.

Unfortunately, there are no universal measures of the undergoing transformation, and so we have to use proxies to see the influence. One of the possible proxies can be the changes in GDP per capita in the country, inflation and dummies for financial crises. We will concentrate on this matter while creating the specific model in later chapters.

Employment

There is an evident connection between the grade of employment and mortality and morbidity (EHR 2002). Even when controlling for such factors as level of education and tenure of housing, this relationship is very evident.

Although the mechanism through which unemployment affect health and wellbeing is complex and difficult to observe, there is little or no doubt that being unemployed a person have higher risk of psychological and mental problems such as stress and mental disorder. On the macro level unemployment is likely to lead to abnormal inter-person's (inside families, in particular) relations and social collusions, thus leading, for example, to increased number of divorces.

Frey et al. (2002) analyzed the influence of unemployment on happiness, and in comparison with other factors this one was especially influencing and severe. The important part that it is not only personal employment that matter (on average one point of increase in unemployment - in 1 to 4 scale - leads to 0.33 points decrease in happiness) but general unemployment as well has a negative effect (but less substantial, of course). As the level of happiness is closely associated with health (especially mental one), this study can be used to prove the link.

Table 2

Unemployment rates in transitional economies, 2000

Country	2000
Czech Republic	9,0
Slovakia	19,2
Poland	14,0
Hungary	8,7
Slovenia	12,2
Croatia	21,1
FR Yugoslavia	26,4
Albania	16,8
Bulgaria	18,1
Romania	10,5
Estonia	5,3

Judging from this table, one can think that the level of unemployment in the NIS countries is not really something to worry about. But, unfortunately, the situation is far from ideal.

First of all, in the table it is annual official level of unemployment that is shown but the shadow level of unemployment is what matters in the region. According to some estimations (and author's personal experience) the unofficial numbers are at

Latvia	8,5	least 5 times higher. The main reason for it is, first, that many people are officially considered to be employed on the enterprises that are not working starting from 1992. Due to the absence of functional bankruptcy procedure these enterprises are still considered to exist but naturally they are not producing anything. Second, the absence of well organized and financed labor market policies makes is useless to register in them. So mainly people just avoid wasting their time and nerves. Also, during the Soviet period any expectations of something useful from the official sources were devastated, and so most of the population just prefers to have as less as possible businesses with local governments.
Lithuania	11,5	
Belarus	2,1	
Moldova	2,1	
Russia	1,4	
Ukraine	**4,2**	
Armenia	11,7	
Azerbaijan	1,2	
Georgia	5,9	

Source: TransMONEE Database, 2002, UNECE, http://www.unece.org/ead

Overall it means that for our paper we will have to use the data on unemployment counted on the basis of technologies different from official ones, and this question will be discussed in modeling chapter.

One more important point is that psychological influence of unemployment might be much more severe in the NIS countries as officially there was no unemployment in the Soviet Union[6], and so the changes in this pattern were new for many people and considered to be personal catastrophe when occurred. There is virtually no experience in dealing with this problem.

Education

All the empirical investigations suggest education to be very important determinant of health, and this influence is very similar to the income one. The

[6] Of course, this statement was rather of political nature then economical, and there always were hidden unemployment and 'hoarding' effects present, but what is important here is the fact that one could always be sure that he will find job – or rather job will find him – if needed.

influence is complex one and on the one hand can be explained by better access to well paid job and opportunities on the labor market while on the other hand just by better knowledge of sources of morbidity and the ways to care of oneself (like medicines, for example).

Also, as for transitional economies, the level of education seems to be one of the most influencing factors, and its importance only increased since the changes have started. The recent studies for Russia showed that the gap in life expectancy for the best and least educated persons have increased from 1.63 in 1989 to 1.89 years in 1993 (Shkolnikov, 1998).

For our study it basically means that some proxies measuring the level of education in the country must be included in the model. In the ideal there must be two different models for more and less educated people, and then the influence of education must be measured on the basis of the difference among them controlling for other variables. But such research can only be made on the basis of micro data that is, unfortunately, unavailable to us. So the best idea in this case will be to include some other proxy for education (like the number of people with higher education) and calculate its influence on macro level (or, to be more precise, the influence of its changes)

Gender

Gender influences health in two main ways. First and foremost, there is a clear difference in the patterns of diseases for men and women accompanied by varying types of behavior in seeking health care and getting responses from service providers. This biological basis is strengthened accordingly by socio-economic factors that determine its magnitude. Gender inequalities are likely to contribute to additional risk of ill health, according to western sources.

It is important to mention that the author's opinion on the latter point is a bit different from the one accepted lately. As for me, this factor can be very

influential in the modern Western societies but it is not likely to be that important in more traditional and less feminized societies of the former Soviet Union. Its influence is likely to increase with time flow but nowadays it is not that important. To confirm this idea one needs, again, information on the micro data and it can be viewed as an interesting topic for sociological survey.

Anyway, on the biological level it is widely accepted that women live longer then man, but they are more vulnerable to depression and morbidity due double pressure at home and work (and in the former Soviet Union due to intensive usage of labor resources more then 90% of women worked). Men on the other hand are suffering from higher rates of accidents both on the work and outside it. Actually, the substantial part of increased mortality among men can be explained by higher accident rates after the start of transition.

In this paper we are planning to use women gender group as control one to check our results obtained at the men's group. After controlling for some factors (like accident rates), the result obtained hopefully must be robust for both groups.

II. **Lifestyles**.

Among the factors influencing overall health situation, lifestyles together with socio-economic determinants are mainly responsible for the burden of, so called, unavoidable diseases such as heart attacks or cancer, for example, meaning that they can't be directly influenced by the development of health system (at least at the current stage of development). This part will be dedicated to sub-factors of lifestyle influencing morbidity and mortality.

Nutrition

The influence of nutrition and the burden of diseases due to malnutrition are usually underestimated. There are some reasons of such a situation, and the main one is that the causes of the most diseases are usually hard to identify and malnutrition tends to be the last one mentioned. But still its influence is uniformly accepted in the literature.

Among the problems due to malnutrition it is worth to mention the increased infant death rates due to stunting and wasting[7], overweight and obesity, iodine and iron deficiency, and cholesterol over concentration. All this factors naturally have negative influence of health and life expectancy.

Obesity, for example, is estimated to reduce life expectancy by 8-10 years (!). And it is difficult and expensive to cure. Also it tends to increase the risk of diabetes and cardiovascular diseases – about 80% of the prevalence of diabetes can be attributed to obesity.

For transitional economies nutrition factors are mostly influencing health due to under consumption of fruits and vegetables thus increasing the risk of chronic diseases. Also, due to substantial decrease in population welfare the consumption has switched from meat and fruits to less expensive and local grown products like potato or buckwheat. But such a diet is generally not considered to be unhealthy in the world practice.

As for nutrition, there are several important factors that make it hard to make any conclusions on its influence on health even on micro data. First of all, there is no such thing as uniformly accepted 'healthy' diet. The optimal food consumption is very dependant upon such factors, for example, as race of the individual and climate. The race, in particular, is determining the need in optimal

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[7] *Stunting* – a height for age that is less than two standard deviations below the reference

Wasting – a weight for height that is less then two standard deviation below the reference

(EHR 2002, from the US National Centre for Health Statistics)

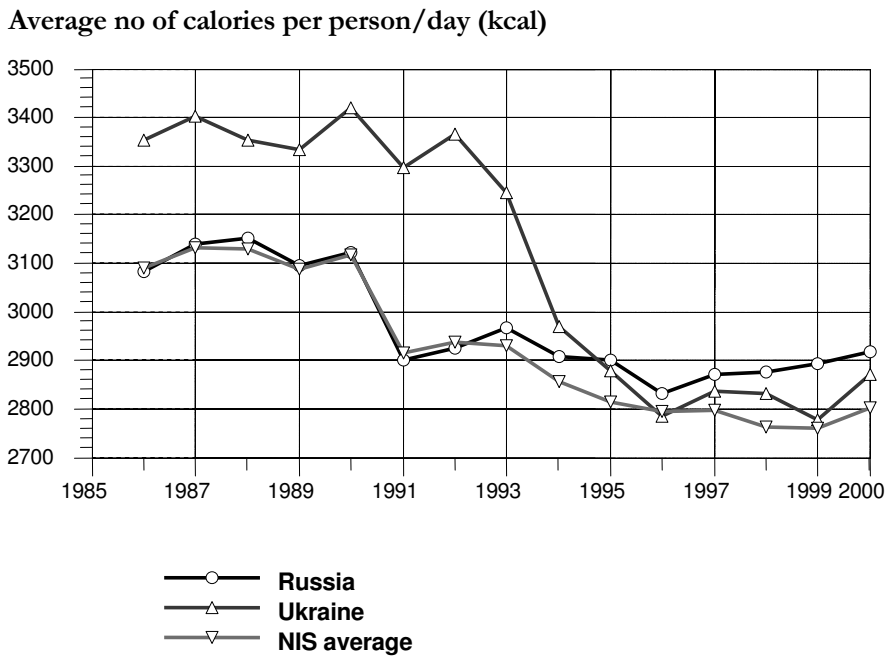
ratio of proteins, carbohydrates and fats in the food, while climate is determining the energy needed. Individual differences, such as metabolism, for example, are of importance as well. Second, the switch from the consumption of more expensive to less expensive food doesn't necessary mean it has become worse for health. Even more, in many cases such a switch can be even for better! So the question of nutrition influence is a complicated one and can be a subject of special research.

But: some trends in the transitional economies can be viewed as very negative and so we can include them in our model and investigate its influence. In particular, it is the consumption of fruits and vegetables, and number of calories consumed. On the figure below the situation is represented.

As it can be seen, the calories consumption for Ukraine is somewhat lower then in Russia, for example. The same can be said as for consumption of fruit, meat and fish during the period of 1994-1997 and 1998-1999. The volatility can be probably explained by economic crises. Also, from the data of surveys of the population we can conclude that the obesity seems to be a problem in the country as well (but not to the same extent as in more developed countries, fortunately).

Figure 6

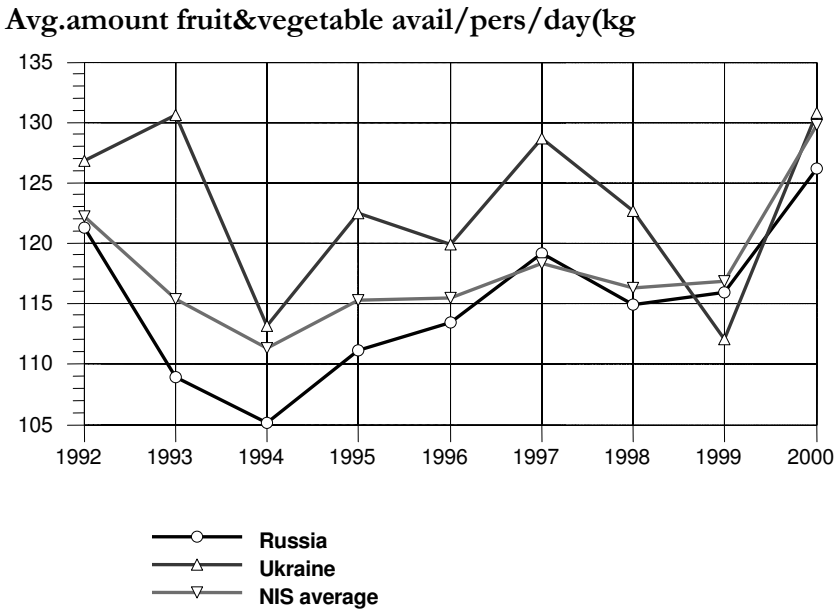
Average number of calories per person/day in selected NIS countries, 1985 -2000



Source: HFA Database, January 2002, WHO, http://www.who.dk

Figure 7

Average number of fruits and vegetables consumed per person/year in selected NIS countries, 1992 - 2000



Source: HFA Database, January 2002, WHO, http://www.who.dk

Physical activity

According to recent researches (and common sense, I would say) those physically inactive middle-aged and elderly people have much higher risks of contracting a variety of noncommunicable diseases. "It has been estimated that eliminating physical inactivity would result in 15–39% less coronary heart disease, 33% less stroke, 12% less hypertension, 12–35% less diabetes, 22–33% less colon cancer, 5–12% less breast cancer and 18% less osteoporotic fractures" (EHR 2002).

Quite fascinating, but recent experience proves that it is not only regular aerobic exercises that matter but even average everyday physical activity

influences the chances a lot. However, if to look at time figures, we can see that as the time spend on during leisure physical activities tends to increase, the amount of miles, for example, cycled or walked to work is decreasing stably. This fact proves that despite of the people exercising more, the physical activity decreases – a kind of paradox.

Unfortunately, the data on physical activity is only available (and only partly) for some countries of the EU, and even there it is far from ideal. The main reason is high cost of monitoring and checking. Such a data is simply unavailable for NIS countries, and even when we tried to use some proxies on it – like the number of stadiums per population or the number of people with sportive degree (Master of Sports, for example) – these attempts proves to be either unavailable, or unsuccessful (for example, the number of stadiums in big cities is quite substantial when in the many villages they are simply absent – but it doesn't necessary mean that the level of physical activity is higher in cities, even more, the experience shows vice versa). So this factor will not be included in our model.

Tobacco consumption

The consumption of tobacco and diseases related to it always was a problem in the countries of the former Soviet Union, and the situation even worsens during the last decade. The roots of the problem lie mainly in the absence of social propagandistic programs to fight smoking and the absence of negative associations in the people's mind. After the transformation has started, the market was immediately occupied with foreign investors who evaluated it as potentially extremely profitable. The massive advertising program and the whole variety of brands led to increase in consumption. To mention, the propaganda of smoking in Ukraine, for example, was forbidden from TV screens only after 5 years of transition passed. And it is still allowed on the big-boards, for example. Officially it is forbidden to sell tobacco to those younger then 18 years, but as the

market is pretty profitable, it is quite easy to buy tobacco from 'half-official' sources (like retail sellers on the streets).

As a result, among 1.2 million of yearly deaths attributable to tobacco consumption in the European region, about 700,000 occurs in the CCEE and NIS (EUROHIS survey data). In Ukraine smoking prevalence is estimated to be about 53.2% (72.9% among men and 42.1% among women) (Highlights on Health in Ukraine, 2000). These figures are among the highest in the region.

The prevalence of smoking is highly dependant on gender, age, employment, and education. "Smoking appears to be a major factor for the difference in risk of premature death between non-manual and manual workers" (EHR 2002, p.79).

The influence of smoking can be directly observed from the figures of mortality from lung, trachea and bronchus cancer. In our research we are going to use the number of cigarettes smoked as the factor influencing mortality situation. Although, it is important to mention that in Ukraine the problem of smuggling, bootlegging and near-border purchases is of extreme importance due to limitations introduced and high profitability of the market, and together with the extensions of new forms of tobacco use, it is likely to create substantial underestimation of general tobacco consumption. This matter challenges us to use the data carefully, and as actually the data from official sources is simply unavailable, we are going to use approximate data from the sources in Philip Morris Company that are making corrections for this factor[8].

Alcohol consumption

Alcohol seems to be a major influential factor for many countries of the region but, fortunately, for Ukraine this problem is much less sharp then for

[8] Unfortunately, the source of the data demanded to stay anonymous.

many other countries. Actually, Ukraine is one of the countries with low alcohol consumption, and the patterns were already demonstrated on *Graph 1*. According to the official data consumption is approximately equal to 2 liters of pure alcohol a year per person, but actually this numbers are very likely to be underestimated, and bootlegging (especially in the villages) is the main reason. The actual numbers, according to EUROHIS estimations, lies pretty close to 3.7 liters, but in our research the absolute numbers is not something that influence the result a lot but rather the changes in consumption. So the official data is very likely to be appropriate proxy for the process description.

However, despite of the low consumption, the 'catching-up' hypothesis (explained in details later) still may be influential in Ukraine as it is in other NIS countries, and one of the tasks of this paper is to investigate if it is.

Alcohol can influence death rates in many ways. In the region as a whole between 40% to 60% of the injuries are estimated to be the result of alcohol consumption (alcohol intoxication as one of the important factors, for example). The burden of diseases related to alcohol is estimated to be about 9%, and, to mention some of them, it is increasing the risks of liver cirrhosis, raised blood pressure, larynx, and heart diseases greatly. At the same time, alcohol is directly and indirectly responsible in many cases of violence and assaults, criminal behavior (including homicide) and suicide. According to EHR 2002, "the welfare, health service, insurance, enforcement and penal costs associated with drinking, and the costs resulting from loss of production, accrue to a total societal cost of 1–3% of GDP"(p.85).

As a result many countries of the region are moving to stricter position and enforce alcohol consumption control as well as more prohibitive law system and higher taxes. Still the pressure from producers and commercial marketing greatly slows the process as well as collective unwillingness to recognize the seriousness of the problem.

Illegal drugs

Illegal drugs are responsible for both medical and social problems. Drug addicts are extremely difficult and expensive to cure and they can be a serious problem to society as on the later stages their behavior becomes completely uncontrollable and dangerous. Unfortunately after the period of transition has started all the countries of the NIS region have reported significant increase in the numbers of drug addicts. These statistics is especially worrying as HIV infection and AIDS mostly affect drug abusers in these countries.

Also, in the CCEE and NIS countries the drugs used are usually of much lower quality and, as a result, are even more dangerous for abusers' health. The number of drug-related deaths has increased mainly due to heroin overdose but also due to poor quality of street drugs because of its usage in combination with some extremely toxic substances (such as strychnine, for example).

One of the possible proxies to measure the changes in drug consumption is the number of deaths due to overdose, or the number of patients in drug treatment centers. Unfortunately, this measure proves to be misleading in some countries of the Western Europe as it showed downward trends lately but other sources that drug consumption actually still growing. At the absence of better indicator, this one will be used in our model, and thus we are assuming that increased number of drug users will increase the number of deaths due to overdose, *ceteris paribus*.

III. **Physical environment**

Ecology and environmental factors always influenced the health of population of any country (for example, skyrocketing of tuberculosis in Great Britain after the Industrial Revolution has started – XVIII century) but only lately

their impact became critical. Among the reasons of that one can mention that modern pollutions tend to be international, and so there are literally no borders for sulfur dioxide or sea pollutions. The most tragic example in the region was the impact of Chernobyl's malfunction on the NIS countries (Ukraine, Belarus and Baltic countries as well as on Scandinavian countries), or 'acid rains' in the Western Europe. As a result, the study of the complex ecological mechanism and its effects on population is in the centre of current papers.

Air quality

The effects of air quality on health range from mild changes in respiratory system to severe malfunctions of lungs, skin illnesses and even mortality. EHR states that according to some studies a long-term exposure is associated with 1.5-2 years of reduction in life expectancy. In the Europe alone the overall burden associated with PM_{10} pollutions exceeds 100 000 years of life annually. Tobacco consumption is considered to be one of the main indoor air pollutants.

In Ukraine, as well as in many other countries of the region, the concentration of air pollutants has decreased significantly for the last decade. There are two main sources of this. First of all, the fall in industrial production and thus amount of pollutants discharged in the atmosphere, and, secondly, the decrease in pollutants from auto transport due to introduction of modern standards for cars and general decrease in car's usage because of comparative increase in gasoline prices. According to Highlights on Health in Ukraine, 2000, "since 1990 there has been two-fold reduction in emissions from stationary sources, and a four-fold drop in those from mobile sources". But still about one third of population of the country lives in the conditions of severe air pollution, especially in the main industrial centers like Donetsk, Kyiv and Kharkiv.

Nevertheless, the impact of this reduction is expected to be positive, and basing on the data we are planning to find it.

Food safety

Food safety is the matter of extreme importance for transitional economies, as after the market liberalization has started on the first stages it looked more like market anarchy. Poverty and instability led to the absence of government control for the quality of food sold, and thus especially during the first periods we could observe the skyrocketing of food borne diseases and even mortality both from microorganisms-caused diseases and chemicals poisonings. It is important to mention that due to extreme industrial pollution in some parts of the country and unwise usage of mineral stimulators of growth, pesticides and veterinary drugs, the problems with chemical poisoning were severe in the region even before the transition has started but the government seems to lose control of situation only after the mass changes in the system.

Nowadays one can observe a noticing improvement in the situation due to introduction of all-around control for food quality on large markets and introduction of import quotas for countries that proved to be especially dangerous from the point of view of food safety (like quotas on meat import from Great Britain, or veto on chicken meat from the USA), but still there are difficulties with controlling of unorganized street markets ('styhiyni rinki'), and every year in summer the number of deaths of food poisoning is substantial.

In our model we are going to check the influence of food safety on the basis of data on food borne diseases available from the HFA Database, but this influence is not likely to be very substantial.

Water

The low quality of water and sanitation system may lead to uncontrolled gastrointestinal morbidity and mortality especially among old-aged and youth population groups. In the transitional countries this problem is hard to solve as,

for example, in Ukraine 50-60% of sanitation and water systems are more then 70 years old and in some cases their amortization has expired 40-50 years ago (this problem is especially important for southern regions of the country where water scarcity is a problem as well), but to reinstall them local government would need more money then 2 yearly budgets of the region.

Also, according to the reports of government water agency, up to 28% of the samples of water taken from pipes and other water supplies do not meet hygiene standards both in bacteriological and chemical indicators. The basin of river Dnieper is extremely polluted with sewage waters, and in the same time it is the main water source for more then 30 million people.

As a result we observe summer epidemics of hepatitis A, diarrhea, and legionellosis as well as such long-forgotten and dangerous disease as cholera – 3 epidemics from the start of transition already. Unfortunately, the author haven't found any direct way to include this factor in the model as there is no centralized data on water and sanitation system quality across the countries. One of the possible ways out would be to control for the mortality causes related to water pollution, but unfortunately this data, fist of all, is not available for all the countries and, secondly, logically seems to be pretty unreliable proxy. Thus this factor won't be included in our framework.

Housing

Poor living conditions can be a major problem for many countries of the region. According to EHR 2002, "the quality of housing seems to play a decisive role in the health status of the residents" (p.98). In the CCEE and NIS countries more then 60% of housing stock consists of panel block buildings built between 1960 and 1980 years, so called '*hrushovki*', and the quality of these houses is so low that already became legendary. The main goal when building them was to

economize resources and to sustain the deficit on the market, and as a result in some of them living and surviving became synonymous.

The situation starts to improve lately but, unfortunately, at least several decades and substantial economic improvements are needed to observe some positive trends. The combination of increasing poverty, lack of governance and coordination, together with high private ownership rates stand on the way of improvement of the matter.

In the HFA Database the only data which can be theoretically used to measure this factor, namely the number of people per 10 square meters of apartment, is available only for some CES countries and only for the last 5 or 6 years. Thus the author found it hard to include this variable in the model.

Work conditions

Contrary to the fact that the influence of work related diseases is increasingly recognized by the states and governments of the region, there are still few policies in fighting this problem. Unfortunately the impact in this case is extremely hard to assess, and there is no uniform list of occupational diseases as well as legal basis.

At the same time, according to the European Agency for Safety and Health at Work, the losses from work-related illnesses range from 2.6 to 3.8% of GNP (EHR 2002). But because of the differences in calculation methods, comparison between different countries is impossible to make.

In Ukraine one could observe the increasing trend in the mortality due to work injuries, especially in mining industry. The safety conditions have worsened a lot and at the same time the coal mining in Ukraine requires more and more complicated methodologies. As for diseases, the largest category is the diseases of respiratory system (about 50%) due to work conditions in metallurgy.

It is important to notice that the level of occupational morbidity in Ukraine is much lower then in developed economies but it can be explained by their insufficient identification and significant delay in diagnosis. In general, the data on occupational morbidity in the transitional economies is mentioned as one of the most unreliable in the whole data sample and is advised not to be used in researches.

Radioactive pollution

Leukaemia, thyroid cancer, and psychosocial effects are the most noticing results of radioactive pollution from accidents on nuclear plants and testing of nuclear weapons.

Ukraine is one of the countries with a high level of natural radiation due to Chernobyl accident of 1986 and following territory pollution with radon 222, caesium 137 and strontium 90. According to Ukrainian Health Report 2000, the mean individual dose of radiation amounts to 3.8 mSv/year while natural level must be close to 1mSv/year. The total collective dose of radiation received by the population for the last 10 years after the accident is estimated to be about 50,000 Sv. The most influenced group is children who were under 1 year old in 1986.

In the next 10 years this generation will be the one responsible for population reproduction, and thus a substantial number of inborn anomalies and connected with the mortality rates is expected. It might worsen the situation that is already far from ideal, and influence life expectancy in a very negative way. Unfortunately, there is not much state can do to improve the situation as such illnesses are unavoidable, and only improvement of health care could help a bit.

In our model we implicitly assume that radioactive pollution is one of the most important determinants explaining substantial increase in the number of new cases of cancer in the country for the last 15 years, and thus we will use it as proxy for radioactive pollution.

IV. **Health care system.**

In *The World Health Report 2000* health systems are defined as "comprising all organizations, institutions and resources that are devoted to producing health actions. A health action is defined as any effort, whether in personal health care, public health services or through intersectoral initiatives, whose primary goal is to improve the health" (EHR 2002).

There are three social goals to which health system contributes, namely:

a) to improve population health (level and distribution);
b) to improve responsiveness to the legitimate expectations of population;
c) to ensure fairness in financial contributions to health (EHR 2002).

Despite of the fact that the principles and practice of public health are pretty similar in all the countries of the European region, the achieved results differ a lot across them. One of the main reasons is that health systems function in a very different way, and so concentration on these differences is required to analyze the overall situation. It is uniformly recognized that the analysis of input parameters and organizational features is not enough.

In the case of transitional economies we could observe the substantial changes in the functioning of health care systems as a result of economic, social and political reforms, but unfortunately in many countries these changes were inconsistent and fragmentary. Sometimes the general impression is like governments don't really know what to do.

The most influencing factor in the transitional economies is the general decrease in macroeconomic indicators thus leading to insufficient funding. As a result the countries' spending on health system might officially stay at the same level as before while the real input of resources is decreased substantially. As a

result all the indicators of health system functioning fall as well as the general satisfaction of the population (at least, it is true if we look on the data for the number of beds or financing).

In Ukraine current expenditures on health system are about 3.6% of GDP, but these payments can't even satisfy the needs of hospitals not talking of other social programs. In most cases patients have to pay for drugs by themselves, and together with general poverty rise in the country it creates severe problems for the system. Also it is worth mentioning that official wages in the health care system are still at the level of $25-30 and considered to be the lowest in the country. At the same time wage arrears are very substantial in the hospitals. As a result medical personal is surviving buy collecting 'not-mandatory' donations from the patients, or, to be straightforward, – bribes. The level of your satisfaction with curative program is dependant upon how much money you can pay to doctor.

All these problems together give us basis to talk of catastrophical situation in the country's health system, and consider it as the main one of the main factors on life expectancy changes.

Although, it is important to note that some other proxies for health system efficiency are showing positive trends, and thus the question remains open – so are we observing lower or higher efficiency?

More detailed description of how we are going to measure the effectiveness of health systems and logic behind it will be given in the model description part.

Despite of the growing number of papers on the subject in Russia, there is no universally recognized answer as for the causes. Also, contrary to Russian situation, the problem of mortality wasn't paid as much attention to as in other post-Soviet republics.

As the trends are very similar in the Russian and Ukrainian cases, we will have a look at the theories already developed in the literature.

It is widely recognized that mortality jump in Russia is in some way correlated with changes in the economical and political systems, price liberalization and general uncertainty in future. Attempts to identify cause-and-effect relations have led to the creation of several alternative hypotheses, and hot discussions among the economists. Some of the papers (like Kassian [2002]) are abstracting from the beginning from this hypothesis but later on the basis of facts still find close relation among mortality and the economic situation. Still the strength of influence is questionable. The most problematic issue is that many of the hypotheses that differ greatly on the first sight are, in fact, complementary rather then competitive.

Ideally, research of this kind must be done on the basis of micro- and individual data but due to the substantial costs and complications in collecting this data, we have to work on highly aggregated data samples.

For Russia the most widely accepted reasons of changes could be divided in several groups of complimentary or competitive hypotheses.

Shkolnikov and Cornia (2000, pp. 272-77) have explained the crisis under five different headlines:

(1) *The collapse of the health system.*

This collapse is uniformly recognized and can be seen even from the visual data examination. In fact, there are several measures (indexes) of the health system development according to WHO's classification but all of them showed substantial negative trend from the beginning of the transition

period. This trend, however, seems to be unable to clarify the increased incidence of cardiovascular attacks and violent and accidental deaths.

(2) *Rising psychosocial stress.*

In these transitional societies (namely Russian, Belarusian and Ukrainian ones), the traditions of collectivism and mutual aid are still strong, and their roots can be found long before communism transformation has started. We could argue that the strength of influence in them might differ a bit (severe Russian climate, for example, made peasants to cultivate the land as the part of large communities – 'obshina' – while moderate Ukrainian climate and fertile soils leaded to more egocentristic and egoistic society structure), but still during the Soviet period many of the old traditions have been changed. Thus unemployment, job insecurity, family instability, personal insecurity, marginalization, and changes in social hierarchies - all factors of psychological stress and instability - have progressed and, in the opinion of the authors, have contributed to the rise in mortality. "Stress and mortality rises were less marked among women, the youth, people in stable employment, married people and people with higher education" (p. 277). Note that alcohol consumption in this setup is closely related to stress.

Also, this point is well motivated in Ziglio (2002) who proves that increased mortality in the transitional countries was mainly fuelled by a massive increase in the psychological stress induced by anticipation of high employment turnover and unemployment in general, family erosion and social stratification.

(3) *The weakening of the state.*

Well observed through the skyrocketing of injury and homicide rates, it was mainly caused by annihilation of the legal system and the disorder that immediately followed. It is not surprising though that its influence was the most substantial in the first years of transition. The authors also specially

stress the inability of the Russian government to recognize the influence of the problem and work on adequate policies to ease it.

(4) *Adverse change in lifestyles.*

The most important of which is smoking and, of course, alcohol consumption. The latter closely related to the impressive increment in violent deaths as well as to a wide range of other causes of death.

(5) *Rising poverty.*

"Poverty rates soared from 10 percent in 1991 to 30 to 40 percent in 1993-94, increasing malnutrition and under nutrition". However, the authors themselves agree that the impact must have been reduced, judging by the relatively insignificant increase in poverty-related diseases such as infectious, parasitic, and respiratory disease.

From the very beginning the authors mention that contrary to the widespread opinion the mortality changes in 90's are not a continuation of past trends – mortality rates have diverged considerably from the long-term trends.

They are dividing the countries on four main groups on the basis of mortality patterns dynamic:

I. A modest and temporary rise in mortality followed by a rapid decline (Czech Republic, Slovakia, Poland and former GDR)

According to them common important trends are still present even after taking into account some important country specific factors. All of the countries went through the period of "less acute and lasting recessions, a limited surge in income inequality and an extensive introduction of labor market programmes". In addition to it, the public expenditures on health in all of them actually increased while the alcohol consumption remained pretty stable. "Family instability, distress migration, and personal insecurity have also been less pervasive, and none of them experienced

the massive withdrawal of the state in the field of law and order and social security" (p.7).

II. A moderate increase in mortality which stabilized at a higher than pre-transition level (Bulgaria and Romania)
III. A large and accelerating increase in mortality starting to be reversed in 1995-6 (Russia and Baltic countries)
IV. A delayed but not yet stabilized surge in mortality (Moldova, Ukraine and Belarus)

It is important to mention that this classification is quite relative and current situation proves this. Starting from 1998 the illusive reversal in Russia has ended and a new crisis phase has begun.

Among other explanations, the ecological situation and a 'catching-up' effect are often mentioned. The latter one needs to be explained in more details.

The '*catching-up*' hypothesis was first proposed by Avdeev et al (1996). The main idea is that substantial part of the crisis can be explained by lower mortality in 80's that was observed due to artificial decrease in alcoholics' death rates thanks to Gorbachov's anti-alcohol campaign. The current jump can be viewed as compensation effect for those years, or, in more details, those who survived in 80's were just dying up in 90's to compensate the trend volatility.

To understand the theoretical background of this model, one must be familiar with '*cohort effects'* hypothesis. The concept of cohort effects was originally used by Casseli et al (1987) who showed in his paper that the harsh conditions experienced during the World Wars, famines and revolutions greatly affected the health status of children, adolescents, and combatants. So the recent crisis in Russia and Ukraine is nothing more then the delayed consequence of those demographic catastrophes. Unfortunately, the initial research in this area wasn't very successful in proving it. To be exact, some evidence for Ukrainian

population was found but they are obviously insufficient to make serious conclusions.

Blum et al. (1997) [as it is mentioned in Cornia and Paniccia (2000)] analyzed the mortality patterns in Russia and proved that 3-years cohort born during the period 1942-44 experienced an increase of 16% in the risk of dying between of ages 40 and 50 years. The same conclusion can be made for cohort of 1931-1933 years. But again, these data is insufficient to support the conclusion that cohort effects explain much of the surge in deceases over 1992-94.

As for the anti-alcohol campaign influence, the authors of the idea have developed an elegant model of two heterogeneous population groups with different death rates. In words, if to assume the absence of restrictions on alcohol consumption, the shares of two populations would remain constant. But after the program was launched, the share of alcoholics increased due to lower mortality rates among them. But when the artificial barriers were removed many of them have succumbed which causes the rebound in death rates and higher rates then under the steady-state. After few years the return to steady state is to be expected.

In more formal way (Kassian, 2002):

Let us define (α) as the share of people who are born non-alcoholics.
($1- \alpha$) is then the share of people of the second type (alcoholics).
These shares can change with age as the probability to die is higher for the second type.
Let $\mu_1(x)$ – the risk of dying for the people of the first type where x is age. So the probability of reaching age φ can be represented by:

$$L_1(\varphi) = e^{\int_0^{\varphi} - \mu_1(x)d(x)]}$$

Let the risk of mortality for second type people to be represented by $[\mu_1(x) + \mu_2(x)]$, where $\mu_2(x)$ is the additional probability of dying because of alcohol consumption.

$$L_2(\varphi) = e^{\int_0^{\varphi} \{-\mu_1(x) - \mu_2(x)\}d(x)]}$$

The general function for the whole population will be:

$$L(\varphi) = \alpha * e^{\int_0^{\varphi} -\mu_1(x)d(x)]} + (1-\alpha) * e^{\int_0^{\varphi} \{-\mu_1(x) - \mu_2(x)\}d(x)}$$

As soon as the consumption of alcohol is limited, the risk of dying for both groups becomes equal to $\mu_1(x)$ so there is no lagging negative effect from previous alcohol consumption.

Now assuming that the limitations were introduced at the moment of time φ_0 and cancelled at the moment of time φ_1. So the function for the whole population at any moment of time $\varphi > \varphi_1$ can be represented as

$$L(\varphi) = \alpha * e^{\int_0^{\varphi_0} -\mu 1(x)d(x)} + (1-\alpha) * e\, I^{\int_0^{\varphi_0} \{-\mu 1(x) - \mu 2(x)\}d(x) + \int_{\varphi_0}^{\varphi_1} -\mu 1(x)d(x) + \int_{\varphi_1}^{\varphi} \{-\mu 1(x) - \mu 2(x)\}d(x)]} =$$

$$= \alpha * e^{\int_0^{\varphi} -\mu 1(x)d(x)} + (1-\alpha) * e^{\int_0^{\varphi} \{-\mu 1(x) - \mu 2(x)\}d(x)} * \lambda$$

where $\lambda = e^{\int_{\varphi_0}^{\varphi_1} \mu 2(x)d(x)}$ -- the measure of population heterogeneity and the strength of introduced limitations.

Let's define also $L_A(\varphi) \equiv L_1(\varphi)$ and $L_B(\varphi) \equiv L_1(\varphi)^* L_2(\varphi)$ as functions of survival for both types in the absence of reforms. Then the previous survival function for the whole population can be rewritten in more compact way:

$$L(\varphi) = \alpha^* L_1(\varphi) + (1- \alpha)^* L_1(\varphi)^* L_2(\varphi) = \alpha^* L_A(\varphi) + (1- \alpha)^* L_B(\varphi)$$

The effect of limitations on the probability of dying is then equal to:

$$\frac{d\mu}{d\lambda} = \frac{d}{d\lambda}\frac{L'(\varphi)}{L(\varphi)} = \frac{d}{d\varphi}\frac{d}{d\lambda}\ln L = -\frac{d}{d\varphi}\left(\frac{[1-\alpha]L_B}{\alpha L_A + [1-\alpha]L_B\lambda}\right) = \frac{\alpha[1-\alpha](L'_A L_B - L'_A L'_B)}{L^2}$$

$$\Downarrow$$

$$\frac{d\mu}{d\lambda} = \frac{\alpha[1-\alpha]L_A L_B \mu_2}{L^2} \succ 0$$

So, the risk of dying is an increasing function as to λ, and so the risk is higher after the limitations are removed then in the case of absence of limitations. Also, it is clear that the number of people of the second type is an increasing function of λ.

This model has been tested on the basis of Russian data, and the authors have proved that it can explain up to 45% of changes in life expectancy for Russia. In different sources the magnitude varies but, in general, the influence is estimated to be from 20 to 50%. This factor is of extreme importance for Russia, and it alone can explain why Russian life expectancy was lowered that much comparing to other countries of the region. In Ukraine the influence of this factor is expected to be a way lower.

As for other factors, most researches do not view them as deterministic ones, but still the influence of ecological situation, for example, might play an important role. We will try to test this hypothesis in this paper firstly for the

whole sample of transitional countries, and then on the countries which we are expecting to be most affected.

Now we are moving to the data description part in which we will describe and partly analyze the data used in this research.

Chapter 4

DATA DESCRIPTION

Due to the importance of exact numbers in this case, we use the most reliable data. For example, the data on life expectancy and crude mortality rates are almost ideally registered all over the world and if to exclude the countries with unstable migration patterns or war situation, this data is highly reliable. Another data, like GDP per capita or inflation rates, can be double checked from different sources, and so the reliability is pretty high as well[9].

Several huge but publicly available databases were mainly used. First of all, the databases of the World Health Organization like "Health for All" (HFA) and Mortality database with different socio- and economic indicators. The interesting feature of these databases is the fact that, first of all, the data on Asian countries is present which gives the possibility for researchers to work using panel data approach (the sample size of this data base is pretty close to population as a whole). And it was already successfully done by Kassian (2002) in his paper on panel data analysis the results of which will be used in later analysis.

Unfortunately, some data from HFA is not very reliable or simply absent, like the data on per capita GDP for some countries of the former SU (which is clearly overestimated) or data on unemployment or divorce rates. So time after time we had to use other external sources of information like TransMONEE database from the UNICEF with more reliable data especially for macroeconomic indicators. Also, when the data was unavailable from international open sources, we had to obtain it from the domestic ones like the

[9] As for GDP or inflation rates, we always trusted more to independent sources, meaning the international ones like UNO or World Bank.

Ministry of Health statistical yearbooks or Derzhkomstat (State Committee of Statistics).

In some cases it was simply impossible to obtain information from the official sources (in all the cases it will be mentioned with the specific row), so, for example, in the case of tobacco consumption in Ukraine we had to obtain the data from the source in Philip Morris company, and this data is presumably inaccurate.

One more important question that was asked in many Western researches is if the quality of the NIS countries data is substantially high to make serious conclusions based on it. Fortunately for us, most of the authors who worked with NIS mortality data admitted that recent mortality fluctuations are not artificial and population estimates and death counts are accurate enough to ensure correct statistical analysis (Notzon et al., 1998; Leon et al., 1997; Bennett et al., 1998; Andreev, 1999). Wasserman and Varnik (1998) conducted a study of the reliability of statistics on violent death and suicide in the republics of the former USSR. They concluded that mortality data were reliable for Russia, Ukraine, and Belarus[10].

Also, in their study of mortality patterns in Russian Federation Bobak at all (2002) conclude that: "Our results confirm that the high mortality rates among Russian men are genuine, rather than an artifact of poor quality vital data, and they support the anecdotal (?) notion that the Russian Federation is "a country of widows". As the main idea of that paper is usage on indirect and untraditional techniques in estimations, thus hopefully obtaining unexpected results, we can be 100% sure that their results are not biased to approving of the traditional views.

The general conclusion is that the data can be trusted, and thus our research is not likely to suffer the traditional former Soviet Union data problems.

[10] Gavrilova N.S. et al. "Mortality Crisis in Russia: New Health Threats"

Chapter 5

EMPIRICAL PART

In this chapter we will try to analyze the influence of all the factors we described in the previous parts on the life expectancy in transitional economies using panel data approach. After the general model is built and estimated, we will analyze how good it is in predicting mortality patterns for Ukraine and conclude on weak and strong points.

In the Excel file attached to the thesis one can find the data used while creating the model. Several important comments as to the data:

- We had to exclude some transitional countries from the research – namely the former Yugoslavia, Macedonia and Bosnia-Herzegovina. The reasons for such decision were, firstly, these countries went through the period of civil war and thus their life expectancy measures are likely to be influenced by skyrocketing violence and homicide factors. As a result mortality trends in them are not representing the general trend and are likely to play the role of outliers in the model, and our task is to understand and track the factors common for all the transitional countries. Secondly, the data for these countries is extremely unreliable and gappy.
- As we were trying to use the whole sample of the transitional countries we found out that in many of them, especially on the early stages of transition, the data collection procedures were far from ideal and thus some data points are missing. This problem is very typical for the former Soviet Union countries at the period of 1989-1991 but there were some missing points even on the data of the countries considered to be successful – like Czech Republic or Poland on the later stages. In the cases when it was possible we

were using external data sources (meaning sources different from HFA and TransMonee Databases and World Development Indicators 2001) like World Bank yearbooks or web-sites of the Health Ministries of the corresponding countries but unfortunately in some cases the data from different sources was accounted on the basis of different methodologies and in some cases it was simply non-existent. The typical example is Gini coefficients – they were not estimated in the countries of the former Soviet Union before 1994 and thus we couldn't include them in the model.

In the cases when the data point was not available but it was very obvious from the trend in what direction index or rate moved we were extrapolating the results from the previous and next periods to this data point (this decision was, in fact, approved by the members of the faculty)[11]. This methodology seems to be quite arguable and ambiguous but, unfortunately, when dealing with such a large sample of countries each affected by its own external shocks and problems it proved to be the most reliable method. Using "Keep it as simple as possible but not simpler" statement we thus implicitly assume that in the cases of extrapolated data there were no substantial deviations from the trend. This fact can be viewed as the most substantial caveat of the model but virtually all the researchers working with transitional economies experienced data problems, and thus this paper was not likely to be an exception.

In the table data points obtained from the external data sources are highlighted in <green>, data considered to be highly unreliable is highlighted in <yellow>, extrapolated data is highlighted in <blue>, and unavailable data is highlighted in <red>. Fortunately for us, all the missing data points together do not exceed 5% of the total data available thus giving us the reasons to state the reliability of the data set.

[11] The methodology used – on the basis of general trend we were predicting the missing data point and then adding to it some random error term on the basis on normal distribution.

- We were trying to use relative measurements in most cases (like ratios or indices) as the countries are very different in terms of population and economy. It helped a lot on later stages when explaining the results obtained.
- In many cases several available measurements of the same phenomena were used. The reason again is highly unreliable data, and thus several proxies had to be used to make sure that the general trend is represented correctly and is not simply a result of statistical mistakes and mis-measurements. Also, I had recounted the unemployment ratio by myself on the basis of the latest data on the number of unemployed in transitional countries for all the years to make sure that the data from TransMonee and HFA databases represents the trend correctly.

The object of research and dependent variable will be life expectancy in the country at the age of 1 year. Actually the data for life expectancy for new borne children was available as well but we will exclude the first year from our regression as it is advised in Kassian (2002) and Cornia and Pannicia (2000). It was done because of several reasons, namely, first, the standards of measuring life expectancy of new borne children differed a lot from country to country, and still some former Asian Soviet Republics are estimating it on the basis of old criteria. It makes the comparison between countries hardly meaningful and can create biases of measurement in estimators. Second, the factors influencing infant and adult mortality differs a lot, and infant mortality is hardly connected to the period of transition. The only possible link here is health system devastation but still as we are interested in general picture we don't need to concentrate on infant mortality.

To control the results for robustness and make sure that our finding won't be a kind of econometrical artifact or extensive use of data mining techniques, we will split the population on two gender groups – male and female. Male

population will be used as the experimental group and on its basis we will create the first variant of the model. Female population will be used as the control group and on it basis we will check our findings. It is important to mention that the author is in no way expecting to get the same results for these two groups as it is proven in the medical literature that average woman, for example, is biologically less vulnerable to stresses, and so the influence of social shocks are less likely to affect women. The key idea is to check on the variables that theoretically influence both groups in the same direction but with possible different magnitude. To finalize our research, the findings will be checked on the basis of the population as a whole.

The basic specification of the model can be represented in the form:

$$y_{it} = \alpha_i + \beta' * x_{it} + \gamma' * y_{it} + \varphi' * z_{it} + \mu' * w_{it} + \varepsilon_{it}$$

where y_{it} is dependent variable of interest (life expectancy of the appropriate group in our case); α_i is specific cross section unit representing individual effect but constant over time; x_{it}, y_{it}, z_{it} and w_{it} are vectors of explanatory variables, or, to be more specific, vectors of socioeconomic determinants, lifestyles, physical environment and health system; β', γ', φ' and μ' are vectors of estimated slope coefficients; and ε_{it} is an error term which varies across time periods and individuals.

The estimation of the model was done in several stages by including different combinations of the factors that measure appropriate influence and confirming or rejecting the hypothesis of their influence on the life expectancy. The estimating process proved the strength of the theory as the author was pleasantly surprised to find out that all the factors that were expected to influence the dependent variable of interest were not only of correct sign but also

statistically and economically significant. Actually in each case when it was possible to use several proxies as the matter of measurement of appropriate factor, the results proved to be robust. As an example of such robustness we can use SDR of alcohol related causes, SDR of chronic liver diseases & cirrhosis and alcohol consumption; SDR of tobacco consumption related causes and number of cigarettes consumed. Not to overload the text with estimation outputs, EViews tables will be presented in the appendix, but as the data is available anyone who might be interested in the subject can reproduce them. In the *Table 3* we are presenting the results of the regression for male population.

Table 3

Estimation output

Dependent Variable: LIFE_EX_M? Method: GLS (Variance Components) Included observations: 12 Number of cross-sections: 24 Total panel observations: 288			
Variable	**Coefficient**	**Std. error**	**Probability**
C	71.79506	0.67717	0.00000
HIGHER	0.04649	0.00991	0.00000
R_WAGE	0.01083	0.00398	0.00690
R_GDP	0.00802	0.00572	0.16170
DIVORCE_R	-0.02674	0.00765	0.00060
SDR_AL_M	-0.00881	0.00084	0.00000
SDR_SM_M	-0.00598	0.00067	0.00000
SDR_APP_M	-0.48454	0.24022	0.04460
+ Random effects (see Appendix)			
R-squared : 0.9125 Adjusted R-squared : 0.9104		Sum squared residuals : 238.74	
F-test for common intercept p-value: 0.0000* (test statistics = 12.8118)			
Hausmann test : 0.9989**			

* See Excel file for calculations

** See EViews program

As one can see from the table all the coefficients are statistically significant as well as have expected signs (the situation with p-value for GDP and the reasons for leaving it in the model will be discussed later). For example, increase in real wage or real GDP (proxies for socioeconomic determinants) leads

to higher life expectancy, but increase in alcohol or tobacco consumption decreases the numbers

.

Several important notes as for estimation procedures. First of all, before estimation we should check if there are reasons to run the regression with common intercept or the countries are very different in the factors influencing population patterns and thus fixed or random panel data estimation should be used. The main reason of such differences is the factors that cannot be included in the model due to their unavailability or simply impossibility to measure. Of course, theoretically we should expect for substantial differences and thus rejection of the common intercept hypothesis, but we must check it in a more formal way. The most widely used methodology is F-test for common intercepts. The null hypothesis of the test is that the efficient estimator can be obtained by using pooled least squares. If this hypothesis is rejected, one should proceed with panel data estimation to obtain unbiased estimators[12].

The value obtained is then checked on the basis of F-distribution with the degrees of freedom equal to [Number of linear constraints; Number of observations – Number of regression parameters including intercept].

From the table one can clearly see that the hypothesis of common intercept is rejected with extremely high probability measure and thus we can state that we should work with panel data approach as theory predicts.

The second step is to check whether random or fixed effects should be used in estimation procedure. The key difference between these two estimation procedures is the nature of group specific effects, or more formally we must

[12] The calculation were done using the following formula:

$$\textbf{F-stat}. = \frac{(SSR_{restricted}/SSR_{unrestricted} -1)*(N_{observation} - N_{coefficients\ unrestr.})}{(N_{coefficients\ unrestr.} - N_{coefficients\ restr})}$$

decide whether α_i's are representing N fixed unknown parameters or they are drawn from the population of randomly distributed intercepts (on the basis of standard normal distribution) and thus can be treated as a part of an error term. According to Kennedy (2002), the random effects estimation is proved to be superior to fixed effects one as, first of all, by excluding the number of dummies used in fixed effects estimation we are saving degrees of freedom and, secondly, 'the transformation used in random effects estimation does not wipe out explanatory variables that are time-irrelevant'. But, unfortunately, random effects modeling cannot be used in the case when composite error is correlated with explanatory variables as in this case the possibility of substantial biases emerges. The formal way to check what procedure should be used is Hausmann test. The random effects can be used only in the case when null hypothesis of this test is accepted (see Greene (2000) for details).

Unfortunately EViews software – even the final available version - does not have built in procedure of Hausmann testing so especially to conduct the test the program was written (available in EViews file under 'Hausmann' label). The testing procedure showed on the very high level of probability that random effects must be used in our model, and thus the final output presented is done on the basis of random effects estimation.

Now commenting on the final results obtained. Socioeconomic determinants in our case are represented by real wage and real GDP factors that represent the influence of economic shocks on the life expectancy of the individual. As one can see from the table real wage seems to be statistically significant even at 1% value, and thus we can state that at least partly the mortality crisis in transitional economies was provoked by decrease in real wages and economic shocks. Also, as, unfortunately, the data on Gini coefficients was unavailable, the data on real wages can be theoretically viewed as the proxy for earnings inequalities in the country. To check this hypothesis, one can look at the

trends of both of these data sets, and on the basis of data points available one can clearly see that the trends are pretty similar. So, basically, real wage rate also represents poverty in our model. The coefficient can be interpreted as one percent decrease in real wage leads to 0.01 losses (in years) in life expectancy.

The real GDP change is also statistically significant, but, of course, not to the extent of real wage. According to Kennedy (lecture notes – 2003, 2001), 10% level of significance can be viewed only as traditional one but while working with very heterogeneous data with many different countries involved one can accept the hypothesis on the higher levels of uncertainty (up to 20%) – 16% seems to be acceptable in our case (also later on, in the final model we will see how the significance of GDP has changed). As I don't want to exclude theoretically significant factor from the model, I am assuming that GDP is influencing and will check it later on the basis of the control group. Also, according to practical econometrical approach, one should always be careful while excluding the variables that were expected to be significant according to the theory in use – even 40% value is considered to be acceptable in such cases.

The sign of the coefficient is positive as it was predicted by the theory and the value can be interpreted as one percent decrease in GDP leads to the loss of 0.008 years in life expectancy. The magnitude of GDP variable influence seems to be less then real wage one, and the author was actually expecting for such a result as real wage is something that even common agent is observing in everyday life. Thus the stress associated with the losses in wage must be more influencing then the stress associated with the general economic situation in the country.

Divorce rates can be viewed as one more proxy of social stress which is not directly connected with money and wealth. In our regression they can be viewed as proxy representing the general shock associated with political and social changes in inter-personal and business relationships. The sign is negative and the value can be interpreted as one point increase in divorce rates (and they are

measured as the number of divorces per hundred marriages – see *Variable description* part for details) – proxy for cultural shock - decrease the life expectancy by 0.03 years.

As for higher education enrolment, it is statistically significant and confirms the hypothesis that with the increase in desire of population to achieve higher education, the life expectancy is increasing due to the bunch of reasons like better knowledge of the factors influencing personal health, higher flexibility on the job market and, in general, less vulnerability to shocks as they become more predictable for an educated agent. And again, it can be interpreted as one percent increase in higher education enrolment leads to 0.04 years increase in life expectancy. One important comment: the significance of this coefficient was confirmed on each and every model the author tried thus giving him the reasons to state that its significance is not a kind of statistical artifact. Bottom line – the number of educated people in the country matters and decreases the risks significantly.

The most disappointing finding of the model was that unemployment rate was found to be insignificant in influencing the mortality patterns in transitional economies. The most probable explanation of this phenomenon is the fact that, as it was already stated in the theoretical part, the data on unemployment rates in transitional countries is extremely unreliable. Actually one of the problems is the difference in measuring the rates of unemployment among countries, thus a person considered to be unemployed in Czech Republic is not considered to be unemployed in Ukraine, for example. This difference was especially substantial on the first stages of transition, but even nowadays the problem still exists. One of the possible solutions could be the usage of the unemployment rates calculated on the basis of LFS concept which is standardized all over the world. But for most of the countries these numbers were calculated for the first time in 1996 thus making it impossible to use them for observing long-term trend. Also, it is important to mention that the problem of 'shadow'

unemployment when most of the workers are considered to be working on the non-functional enterprises is likely to create substantial downward bias in unemployment rate numbers. The author tried to avoid this problem by using different measurements for unemployment rate like employment ratio, and using the data from several sources (even self recalculating of the rates) but this methodology proved to be inefficient. Thus, *ceteris paribus*, we assume that there is no noticeable link among unemployment rates changes and mortality crisis in transitional economies. On the bright side, as we already mentioned, unemployment rate might be implicitly included in other socioeconomic determinants like real GDP or divorce rates.

Another important caveat of the model is that GDP measured in PPP$ appeared to be insignificant when included in place of changes in real GDP while the changes in real GDP are significant. But, actually, the data on GDP in PPP$ terms is also considered to be highly unreliable, and it is not only mentioned in the notes to the data in HFA Database but also can be seen by inspecting the date. For example, the data on PPP$ GDP for Russia shows that there was a substantial growth in the period of financial crisis of 1998 which is highly improbable. One of the reasons might be the fact that in some transitional countries statistical data can still be influenced by politicians in a way they think will be more convenient for their career. That's why real GDP growth in our case is considered to be more reliable measure.

As for possible other factors describing the general transitional cultural shock, homicide rate and general crime rate does not prove to be a good proxy for this process as well as abortion rates. In some cases they are simply insignificant, and in others they have wrong sign thus making them unusable in the model. For example, no matter what specification has been chosen the homicide rate appeared to have positive sign thus implying that increase in homicide rates leads to increase in life expectancy. Clearly this is unacceptable and thus we make conclusion that these variables cannot serve as a good proxy.

One more possible good proxy for such shocks is suicide rates for male population. The whole EViews output of the regression when divorce rates are replaced with suicide rates is presented in the Appendix (but here we represent the general results).

Table 4

Estimation output

Dependent Variable: LIFE_EX_M? Method: GLS (Variance Components) Included observations: 12 Number of cross-sections: 24 Total panel observations: 288			
Variable	**Coefficient**	**Std. error**	**Probability**
C	71.85661	0.661718	0.0000
HIGHER	0.041913	0.009127	0.0000
R_WAGE	0.009861	0.003879	0.0116
R_GDP	0.007688	0.005566	0.1683
SUICIDE_M	-0.044938	0.008404	0.0000
SDR_AL_M	-0.007356	0.000885	0.0000
SDR_SM_M	-0.005702	0.000654	0.0000
SDR_APP_M	-0.401704	0.230186	0.0821
+ Random effects (see Appendix)			
R-squared : 0.9177 Adjusted R-squared : 0.9156		Sum squared residuals : 208.0336	
F-test for common intercept p-value: 0.0000* (test statistics = 12.8967)			
Hausmann test : 0.9795**			

If you compare the numbers for both regressions, you can see that the results have not changed a lot after including a new proxy for the same phenomena. Not only all the coefficients kept the same sign and significant but even the absolute values of them have not changed noticeably. This finding is very important and proves that our results are robust and represent the pattern correctly.

The last point about socioeconomic determinants. In the first versions of the model inflation was included as well, and it proved to be significant on 10% level and had an expected negative sign with a very small absolute value – logically expected as inflation rates in some countries exceeded 10000% a year – but later on we decided to exclude it from the model for a number of reasons. The first reason was the fact that inflation rates varied a lot - and I mean a lot –

across countries. So it seems to be logically flawed to estimate in the same regression Czech Republic with very moderate inflation rates and Ukraine with 8000% a year. The second reason is the origin of the other factors. The wage and GDP changes were measured in real terms and thus as for me there was no sense in including such a relative factor as inflation that was already accounted in measuring both GDP and wage. The third reason – we have already included two proxies to measure economic shock in the model so it is not really necessary to include one more. The last but not the least – the results lost a lot in robustness after including inflation. So considering all of these reasons we decided not to include inflation rates in our framework.

Now moving on to other groups of factors. It is important to underline that none of environmental variables appeared to be influential for the regression that included all the transitional countries. Neither sulfur dioxide emissions nor food borne diseases are significant. And so we can conclude that mortality crisis was not directly, at least, linked to ecological factors. Actually, this group of determinants might influence life expectancy in a very long run but for such a short period as one decade is we were not really expecting to have large and noticeable influence.

The question about the influence of radioactive pollution of the territory indirectly measured in as a number of new cancer incidences each year – this was the only proxy available, unfortunately, as radioactive pollution is not something that is easy to measure and that countries report about eagerly – is much more complicated, actually. The author was not expecting that this factor will be influential for all the transitional economies as a whole but rather for the countries that were mostly affected by it either because of Chernobyl disaster – Ukraine, Belarus, Moldova and partly Russia – or because of substantial nuclear weapons and nuclear stations potential and problems associated with them – Russia and partly Ukraine. So a special pool was created to check for the

influence of this factor on these countries. The general results of regression are represented below for male population but the results actually hold no matter what group is investigated.

Table 5

Estimation output

Dependent Variable: CH_LIFE_M? Method: Pooled Least Squares Included observations: 12 Number of cross-sections: 4 Total panel observations: 48			
Variable	**Coefficient**	**Std. Error**	**Probability**
CANCER_M	-0.057428	0.012993	0.0001
+ Fixed effects			
_13—C	83.22007		
_14—C	74.50266		
_15—C	78.29381		
_16—C	82.96642		
R-squared : 0.5473 Sum squared residuals : 87.5794 Adjusted R-squared : 0.5052			
F-test for common intercept p-value: 0.0000* (test statistics = 15.1817)			
Hausmann test : 0.0004**			

As we can see from this table, the factor of radiation appeared to be strongly statistically significant for this group of countries. It has an expected negative sign, meaning that it is negatively influencing life expectancy. The results for female group and the population on the whole are presented in the Appendix, and as one can see the results are pretty the same for all the groups. Unfortunately this variable cannot be included in the general model on the basis of its insignificance for the whole sample, and at the same time we can't build the regression based on only these 4 countries as we suffer of the loss of generality in this case. So we will use this variable on the last stage while accounting for the general losses in the years of life expectancy as the one that explain partly the unexplained losses for Ukraine on the basis of general model.

Now moving to lifestyle factors. First let's discuss the variables describing the changes in nutrition. Their influence was found to be insignificant. And it is actually something that the author was expecting for as an insider. The number of

calories consumed might have decreased a bit in the countries of the former Soviet Union but this decrease in no way leads to problems with starvation or under consumption. Even more, as the market principles were introduced, they led to substantial increase in variability of the products available and absence of deficits so common in the planned economy. And looking on the data of fruit and vegetable consumption clearly proves this point. A slight decrease in this factor was observed only at the very first stages of transition but later on the increase was very noticeable. So, concluding, the mortality crisis in transitional economies was in no way linked to problems with food consumption or starvation, and it is actually one more point against the myth that was so popular in the Western countries at the beginning of the 90's.

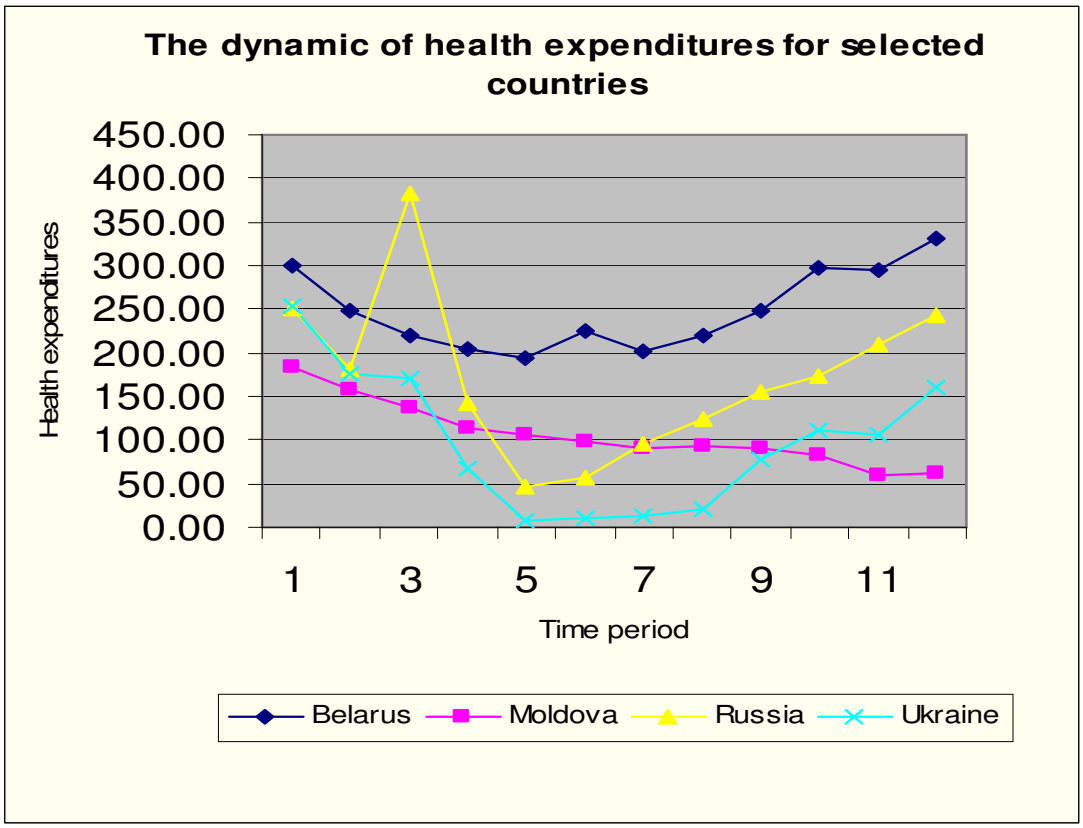
One more important finding of the paper is the fact that alcohol and tobacco consumption are the key determinants of the mortality crisis in transitional economies. These coefficients are significant and clearly show that the increase in SDR rates related to alcohol and tobacco consumption together can explain substantial part of change in life expectancy for our sample. In general, 1 point increase in SDR causes related to alcohol consumption decreases life expectancy by 0.009 years and in SDR related to tobacco consumption to decrease by 0.006 years. To check the results for robustness we tried to rerun the same model but now changing SDR from alcohol related causes to SDR from chronic liver diseases and cirrhosis. The results proved to be robust in a sense that neither signs nor significance of the coefficients have changed substantially. As for trying the numbers of cigarettes and pure alcohol consumed on their place in regression, they are found to be much less significant but as it was already mentioned in the theoretical part, the measuring of these values differs a lot in different countries and does not take into account home-brewed alcohol and home-grown tobacco. And especially in the rural areas of the countries of the former Soviet Union these numbers are huge. Furthermore, we don't have the data on cigarettes and alcohol consumption separately for male and female

groups and the influence for them is likely to differ. Thus we conclude that SDR is a more reliable measure in our case as it allows us to take into account implicitly the abovementioned numbers.

The drug consumption increase measured as the number of first admission to drug treating centers proved to be insignificant and it can be partly explained by its pretty low values, and partly by unreliability of the data (this data is considered to be highly unreliable even for the countries considered to be successful and having very well organized statistics in all the other cases).

The last group of determinants, the health system functioning, could be measured (on the basis of data available) using three different proxies – the data on expenditures on health system in PPP$, number of hospital beds per 100000, and SDR rates from appendicitis.

Figure 8



Source: HFA Database, January 2002, WHO, http://www.who.dk

On the *Figure 8* one can see the dynamic of health expenditures for selected countries of the former Soviet Union for the period from 1989 to 2000. As it is obvious from the graph, according to official data health expenditures in all these countries except Moldova were increasing, almost returning or even sometimes exceeding the numbers before the start of transition. Unfortunately, this data is, to say the least, inaccurate. The main problem of the health systems in the former Soviet Union is that financing is decreasing each year, and now even if officially one does not have to pay for your treatment and drugs, actually no money are given to hospitals to finance these expenses. According to the latest data, the average wage arrears to the workers in health system exceed their wage for 5 months (UkrNews website, April 2003). And it is even more impressive because the average wage of the doctor is about 230 hryvnas (40 dollars) a month. So the author suspects that the upward bias in this data is pretty similar to GDP in PPP$ data as it was already discussed above. Just as the matter of academic interest, this data pool was included in the regression, and, of course, found to be highly insignificant. Bottom line – data on health expenditures cannot serve as a good proxy for describing health system functioning in transitional countries.

As for using data on the number of hospital beds, this data is highly reliable but, unfortunately, the changes in this variable are only representing the quantitative changes, and tell us nothing of the quality of services. It is a stylized fact that in the former socialist countries the quality of medical services was below average compared to the world standards, and now we are observing the decrease in the number of beds accompanied by increase in quality of services. So the usage of this data set seems pretty illogical as well.

As a result we are left with the data on SDR from appendicitis. The logic behind this variable is the fact that under ideally working health system literally no one should die from appendicitis, and it is a widely used proxy in this kind of

researches actually (see, for example, Kassian(2002), Cornia and Pannicia(2000) and Andreev(2001)). After including this variable in our model we were pleased to find that it is significant and has expected sign. The result can be interpreted as one point increase in SDR rates from appendicitis - representing the health system functioning – decreases male life expectancy by 0.48 years.

Summarizing the findings for male population I would like to mention that all the factors that were expected to have some influence on life expectancy according to theoretical framework and papers already written on this subject are included in our analysis. We have a nice statistical fit to data (which is expressed in high values of R-squared) and predictive power.

Now to check our findings we are using the same model for female population (control group) to check if our findings are acceptable for this pool. In the *Table 6* the results are represented.

Table 6

Estimation output

Dependent Variable: LIFE_EX_F? Method: GLS (Variance Components) Included observations: 12 Number of cross-sections: 24 Total panel observations: 288			
Variable	**Coefficient**	**Std. error**	**Probability**
C	77.76407	0.502235	0.0000
HIGHER	0.043367	0.006526	0.0000
R_WAGE	0.012369	0.001642	0.0000
SUICIDE_F	-0.086590	0.030015	0.0042
SDR_CIR_F	-0.055692	0.007844	0.0000
SDR_SM_F	-0.006685	0.000660	0.0000
SDR_APP_F	-0.991259	0.269641	0.0003
+ Random effects (see Appendix)			
R-squared : 0.9304 Adjusted R-squared : 0.9289		Sum squared residuals : 97.1772	
F-test for common intercept p-value: 0.0000* (test statistics = 36.8475)			
Hausmann test : 0.4249**			

The author is glad to announce that the only factor that appeared to be insignificant for female population is change in real GDP. All the other determinants are significant and have expected signs but, of course, different absolute values as it was expected. As for real GDP changes one could notice from the previous regression that even for male population it was not highly significant but still the difference on one factor is not something that make the model unusable or wrong. The best tactics in this situation is to use the model for the population as a whole and check the results, and this is exactly what is done in the *Table 7*.

Table 7

Estimation output

Dependent Variable: LIFE_EX_ALL? Method: GLS (Variance Components) Included observations: 12 Number of cross-sections: 24 Total panel observations: 288			
Variable	**Coefficient**	**Std. error**	**Probability**
C	74.69635	0.599813	0.0000
HIGHER	0.040862	0.007827	0.0000
R_WAGE	0.009280	0.004667	0.0477
R_GDP	0.010442	0.003286	0.0017
SUICIDE_ALL	-0.063309	0.013091	0.0000
SDR_AL_ALL	-0.007502	0.001149	0.0000
SDR_SM_ALL	-0.006862	0.000728	0.0000
SDR_APP_ALL	-0.918500	0.309538	0.0033
+ Random effects (see Appendix)			
R-squared : 0.9148 Adjusted R-squared : 0.9127		Sum squared residuals : 141.0418	
F-test for common intercept p-value: 0.0000* (test statistics = 18.9013)			
Hausmann test : 0.9994**			

Analyzing the final regression we can conclude that all the factors that are true for two previous groups hold as well for population as a whole as well. Using the numbers obtained we can estimate the total loss of years of the life expectancy for Ukraine in 2000 compared to 1989. The results are presented in the following table.

Table 8

The losses of life expectancy in 2000 compared to 1989 (predicted)

	Change in the factor	Estimated years loss (gain)
Higher education enrolment	10,30	0,4208
Real wage growth	-51,10	-0,4742
Real GDP growth	-64,30	-0,6714
Suicide rates (social shock)	7,26	-0,4596
SDR from alcohol	45,08	-0,3381
SDR from tobacco	182,29	-1,2508
SDR from appendicitis (health system)	-0,43	0,3949
Total years loss (estimated)		-2,37
Real years loss		-3,23
Predictive power (I)		73,64%
Total years loss including radioactive pollution variable (estimated)		3.32
Predictive power (II)		97.3%

The total estimated year's loss is equal to 2.37 years while the real change in 2000 compared to 1989 was about 3.23. So we can conclude that our model is doing very well in predicting the real life situation, and thus the factors included are all relevant and significant. Although we observe some downward basis, it can be explained by the factors that are possibly significant for the process but are not be included in the framework because of some objective reason, or simply the factors specific for Ukraine but not for other transitional countries. Radioactive pollution is a nice example, as we found out earlier that it is quite influential for some countries of the former Soviet Union. As it has a negative sign we could expect that including it for Ukraine would reduce the bias substantially. Actually, when including this influence on the basis of regression

based on this factor alone we get the total estimated losses equal to approximately 3.32, and thus the prediction power is now close to 100%, but, unfortunately such a technique can only be used only as the 'rule of thumb' but not for exact predictions.

Now we are moving to the concluding part where we will analyze the magnitude of each factor and possible policy recommendations.

Chapter 6

CONCLUSIONS

First of all, as it is clearly seen from the *Table 8*, the adverse change in lifestyles played an extremely important role in the mortality crisis for Ukraine. The increase in alcohol and tobacco consumption together can explain about 1.6 years of total loss in life expectancy which is more then 50%. For Ukraine it basically means that the campaign to prohibit an advertising of alcohol and tobacco through the media is much more important then most of us think it is. It is not a secret that both cigarette and alcohol producers spend huge budgets on advertising, and as it is proven in Khomenko (2003), the competition among tobacco companies, for example, does not lead to increase in price but rather to growing quantity of cigarettes sold. Thus a situation is even more weird as in the world as a whole the consumption of both alcohol and tobacco is decreasing every year. And this year Russia, for example, was graded as the country with the highest tobacco consumption in the world. The question is: "Why should Ukraine together with other transitional countries become the main source of profits for tobacco and alcohol producers paying with thousands of lives for it each year?"

The most often discussed argument is the fact that Ukrainian government is collecting huge tax sums from alcohol and tobacco producers each year, and thus the prohibition of advertising will lead to substantial decrease in budget inflows. Unfortunately, this is exactly the case when the country cares only of static situation and is not looking forward into future. In the Constitution human

life is stated to be the most important social values for the state but, unfortunately, it is not something we observe in practice.

So my results support the proposal to forbid the advertising of tobacco and alcohol completely, and increase the punishments for ignoring these rules (as nowadays one can still observe the hidden advertising of alcohol on TV). The taxes for alcohol and tobacco consumption both from producers (direct taxing) and consumers (indirect taxing) should be increased to the break point when the consumption is likely to decrease. Even if it is likely to decrease budget inflows, this is the price we have to pay for the health of the nation.

The second point of extreme importance is the influence of economic and social shocks on life expectancy. Unfortunately, the economic situation is not something that is easy to control so its influence can hardly be negated but the least the government should do is to soften this negative shock. The most often used methodology includes social programs to help the least protected groups of population like youth and pensioners, active labor market policies, propaganda. As a matter of fact one can only observe extensive use of the last point in Ukraine (and as a result its lost it efficiency a way too long ago). Contrary to more successful Western transitional countries, the attempts to introduce active labor market policies in Ukraine were not too successful, to say the least. The same point is true as for social programs. And again, the main reason beeing the lack of financing, and exactly as in the previous case we are saving cents now to lose dollars in the nearest future.

One of the surprising findings of this paper is the fact that the collapse of the health system is not a factor that played an important role in the mortality crisis in Ukraine. Even more, on the basis of the model we can state that the influence would be negative if we observeed the decrease in efficiency, but in fact it was positive! So, basically, one should ask him/herself if gossips and general

impression are really that reliable. According to the data, no matter what proxy for the health care system functioning is used, we are not observing the decrease in efficiency, and if to take widely used proxy on the deaths from appendicitis that we used in our model as well, we are observing an improvement in the efficiency. Actually, the health care system functioning can be an interesting subject for more detailed research, but in our paper we conclude that in Ukraine we are observing not a decline but improvement, and, as a result, it partly compensated the losses. As for explanation of this phenomenon we can assume that now when the system is functioning, even unofficially, on the basis of market laws, it is much more effective than it was.

The role of higher education on the mortality crisis in transition is found to be very important as well. As a matter of fact, it looks like the population behaves very rationally in this case and answered to the economical crisis with desire to increase their skills with the help of higher education, and as a result it saved a lot of lives. The only point that is worth commenting here is that the increased demand for higher education should not lead to decrease in its quality as it often happens in some regions of the country, as we are risking to lose what we found.

Our last point will be dedicated to the influence of Chernobyl disaster on some NIS countries. As we saw from the model, it is definitely negative and influencing as one could expect from the very beginning. It alone can explain more the 20% of the total losses. But the most disappointing fact is that this influence is likely to increase during the next ten years. The problem is that the generation most affected by the accident (namely those of us who were born in 1984-1986) is entering the fertility age in the next 10 years. So we should expect for high infant mortality and lower fertility rates in general. This, unsurprisingly,

can only worsen the general situation, and this is one more reason why policy recommendations as for lifestyles should be implemented.

In general, the subject of this paper is not only of extreme importance for Ukraine but is also promising from a scientific point of view. And it is still waiting for researchers to come.

Variables list

Variable name	Short description	EViews coding
Life expectancy at the age 1	A widely used measure of the general level of mortality, this is the theoretical number of years a newborn will live if the age-specific mortality rates in the year of birth are taken as constant. It represents for a given year the sum of the mortality rates for all ages combined.	
- population		Life_ex_all
- male		Life_ex_m
- female		Life_ex_f
Distribution of income, Gini coefficient	The "Gini" is a measure of the degree of inequality in the distribution of earnings and income. It is equal to "0" in the case of total earnings/income equality (everyone receives the same earnings/income) and to "1" in the case of total inequality (one person receives all the earnings/income). In this table it is interpolated from group data for monthly earnings, with bonuses, for full-time employees as reported by employers.	Inc_gini
Distribution of earnings, Gini coefficient		Earn_gini
Real average wage growth	A proxy for the quantity of goods and services a money wage can buy, the real wage represents the money wage adjusted for inflation. Index – 1989 serves as the base year (100).	R_wage
Homicide rate index	Homicides per hundred thousand of population.	Homicide
Real GDP growth	GDP is the most widely used concept of national income defined in the System of National Accounts. It represents the total final output of goods and services produced by an economy during a given period regardless of the allocation to domestic and foreign claims. It is calculated without making deductions for depreciation. Index – 1989 serves as the base year (100).	R_gdp
Annual inflation rate	Annual average percent change in consumer prices.	Inflation
Employment ratio	IRC estimates based on the total number of employed. Differs from employment rate, which takes into consideration only the labor force.	Employ
Annual registered unemployment rate	Registered data reflect national rules and conditions and frequently differ from unemployment rates derived from labor force surveys conducted on the basis of ILO definitions.	Unempl

Unemployment rate based on LFS concept	LFS: labor force survey. According to the ILO methodology, this category comprises all persons above a specific age who, during a specified brief time-reference period, have been without work (that is, not in paid employment or self-employment), are available for work, and are seeking work (that is, have taken specific steps in the specified period to seek paid employment or self-employment). This concept differs from registered unemployment, which refers to the segment of the labor force registered at labor offices as unemployed.	NOT included due to very limited data sample
Registered unemployed	Registered data reflect national rules and conditions and frequently differ from unemployment rates derived from labor force surveys conducted on the basis of ILO definitions. Annual average, thousands	
- population		R_unempl_all
- male		R_unempl_m
- female		R_unempl_f
Public expenditures on education/ GDP ratio	Public expenditures represent current and capital expenditures on education by local, regional and national governments, including municipalities. Household contributions are normally excluded (in %).	Exp_edu
Higher education enrolment	RC estimates based on the number of students in post-secondary non-tertiary (ISCED 4) and the first stage of tertiary education (ISCED 5). Advanced degree-granting tertiary education (ISCED 6) is often excluded. Post-secondary non-tertiary education (ISCED 4): offers more advanced programmes than those offered at ISCED 3. It is aimed at broadening the knowledge of participants who have already completed a programme at level 3. It does not lead to a university degree or a recognized equivalent qualification. The first stage of tertiary education (ISCED5): offers tertiary programmes with a more advanced educational content than that offered at levels 3 and 4. Entry requires successful completion of ISCED level 3A or 3B or a similar qualification at ISCED level 4. It provides a non-doctorate-related university degree or a recognized equivalent qualification. Gross rates, percent of population aged 19-24.	Higher
Real GDP in PPP$ per capita	GDP expressed in purchasing power parity is adjusted to the relative domestic purchasing power of the domestic currency as compared to the US dollar,	PPP_gdp

	rather then using the official exchange rate. Multipliers (PPP's) are estimated periodically, using the cost of the standard basket of goods.	
Registered total crime rate	Crime data cover reported and registered crime only. Crime rates are subject to national legislation, which varies widely within the region. This hinders comparisons among countries and years. Crimes per hundred thousand of population.	Crime_rate
SDR, suicide and self-inflicted injuries (0-64) per 100000	SDR is the age-standardized death rate calculated using the direct method, i.e. represents what the crude death rate would have been if the population had the same age distribution as the standard European population. Suicide SDR is used as proxy for social stresses in this framework.	
- population		Suicide_all
- male		Suicide_m
- female		Suicide_f
Number of divorces	In thousands.	Divorce
Number of abortions	In thousands.	Abortion
General divorce rate	Divorces per hundred marriages.	Divorce_r
Abortion rate per population	Abortions per thousand women aged 15-49	Abortion_r
Average number of calories per person/day	Total amount of food available for consumption when converted into kilocalories. Food availability is calculated using the official statistics on food production, imports, exports and stocks.	Calorie
Average number of fruits and vegetables consumed per person/year	Average number of fruits and vegetables available per person, per year in kg.	Fruit
Number of cigarettes consumed per person a year	Total number of cigarettes sold/consumed in the country as calculated from official national statistics on production, import and export.	Cigar
Pure alcohol consumed per person a year	Estimated amount of pure ethanol in spirits, wine, beer and other alcoholic drinks consumed per capita in the country during the calendar year, as calculated from official statistics on production, import and export, taking into account stocks and home production whenever possible. Conversion factors used to estimate the amount of pure alcohol in beer is	Alcohol

	4.5% and in wine – 14% of alcohol. In litres.	
First admission to drug treatment centre	Number of persons during the calendar year which were admitted for the first time in their life for treatment related to drug abuse.	Drug
SDR, alcohol related causes, per 100000	The mortality from combined, selected causes of death which are known from literature to be related to alcohol consumption. It has to be pointed out that it is relatively rough indicator and it is NOT the estimate of alcohol-attributable mortality, which is more complex and difficult to calculate. This simple pooling of alcohol related deaths (irrespective of what is the actual proportion of deaths due to alcohol in each cause) can help to better rank countries by alcohol related mortality and can be used to better track trends in deaths associated with alcohol than using separate causes.	
- population		Sdr_al_all
- male		Sdr_al_m
- female		Sdr_al_f
SDR smoking related	The mortality from combined, selected causes of death which are known from literature to be related to tobacco consumption. It has to be pointed out that it is relatively rough indicator and it is NOT the estimate of tobacco-attributable mortality, which is more complex and difficult to calculate. This simple pooling of tobacco related deaths (irrespective of what is the actual proportion of deaths due to tobacco in each cause) can help to better rank countries by tobacco related mortality and can be used to better track trends in deaths associated with tobacco than using separate causes.	
- population		Sdr_sm_all
- male		Sdr_sm_m
- female		Sdr_sm_f
SDR, chronic liver diseases & cirrhosis	All ages per 100000.	
- population		Sdr_cir_all
- male		Sdr_cir_m
- female		Sdr_cir_f
Sulphur dioxide emissions, pg per capita per year	Self-explaining.	Sulfur
Microbiological food borne diseases	Per 100000.	Food_dis
Cancer incidence per 100000	Number of patients with newly diagnosed cancer during given calendar year. Usually data sources are national cancer registers or the existing routine	
- population		Cancer_all

- male	reporting system of health establishments. In the latter case, data are expected to be less accurate than register data.	Cancer_m
- female		Cancer_f
Total health expenditures, in PPP$ per capita	Whenever possible, the OECD definition of total expenditures on health is applied. It includes: household health expenses, including goods and services purchased at the consumer's own initiative and the cost-sharing part of publicly financed or supplied care; government supplied health services including those in schools, prisons and armed forces and special public health programmes such as vaccination; investment in clinics and laboratories etc.; administration costs; research and development, excluding outlays by pharmaceutical firms. In the case of the most central and eastern European countries the following had to be included: direct state budget allocated to the health sector; state subsidies to the mandatory health insurance system; mandatory health insurance contributions by employees and employers; direct health expenditure of employers for running industrial facilities; direct health expenditures of ministries and governmental agencies; charity health expenditures; foreign assistance; outstanding debt at the end of the year; private health insurance and direct private health charges. It is important to ensure that funding from the general budget revenues and health insurance contributions do not overlap. Expenditure expressed in 'international dollars'. The purchasing power parity is adjusted to the relative domestic purchasing power of the national currency as compared to the US dollar, rather then using the official exchange rate. Multipliers (PPP's) are estimated periodically using the cost of the standard basket of goods.	PPP_health
SDR, appendicitis, all ages per 100000	SDR is the age-standardized death rate calculated using the direct method, i.e. represents what the crude death rate would have been if the population had the same age distribution as the standard European population. SDR from appendicitis is often used as the measure of health system effectiveness with ideal working system no one should die of appendicitis.	
- population		Sdr_app_all
- male		Sdr_app_m
- female		Sdr_app_f
Hospital beds per	A hospital bed is a regularly maintained and staffed	Bed

100000	bed for the accommodation and full time care of a succession of inpatients and is situated in wards or areas of the hospital where continuous medical care for inpatients is provided. It is a measure of hospital capacity. Beds in all hospitals should be included. Hospital beds exclude: cots for neonates, day beds, provisional and temporary beds, beds in storerooms, beds for special purposes or belonging to special health devices, e.g. dialysis, delivery (but not post delivery beds in maternity hospitals) etc.	
Also, there are some additional variables included to test author's hypothesis like:		
Life expectancy at the age of 1 year for countries affected by Chernobyl disaster	Similar to the general life expectancy pool but created specially to test the hypothesis of influence of Chernobyl disaster on the countries of the former Soviet Union – namely Ukraine, Russia, Belarus and Moldova.	Ch_life_all Ch_life_m Ch_life_f
Self-counted unemployment rate	Similar to the general unemployment rate pool but self-counted to check at least to some degree the reliability of the data (on the basis of the number of unemployed and mid year population – see Excel file for details).	Self_unempl
Hausmann, Hausmann_m and Hausmann_f text files include the procedures of Hausmann testing for fixed or random effects in panel data programmed by author and can be reran in the command line – the results can be checked in the matrices. Test for common vs. different intercepts is done in Excel file in the Tests sheet.		
Number—C stands for intercept of the country. So, basically, 16—C means that intercept for Ukraine in the regression is equal to the shown number. The countries are numbered as:		

1	**Czech Republic**
2	**Slovakia**
3	**Poland**
4	**Hungary**
5	**Slovenia**
6	**Croatia**
7	**Albania**
8	**Bulgaria**
9	**Romania**
10	**Estonia**
11	**Latvia**
12	**Lithuania**
13	**Belarus**

14	**Moldova**
15	**Russia**
16	**Ukraine**
17	**Armenia**
18	**Azerbaijan**
19	**Georgia**
20	**Kazakhstan**
21	**Kyrgyzstan**
22	**Tajikistan**
23	**Turkmenistan**
24	**Uzbekistan**

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World Development Indicators 2001

APPENDIX A

EViews outputs (selected regressions)

I. Life expectancy for male population – divorce rates are used as proxy for social stresses

Dependent Variable: LIFE_EX_M?
Method: GLS (Variance Components)
Date: 05/19/03 Time: 12:49
Sample: 1989 2000
Included observations: 12
Number of cross-sections used: 24
Total panel (balanced) observations: 288

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	71.79506	0.677171	106.0220	0.0000
HIGHER?	0.046491	0.009907	4.692798	0.0000
R_WAGE?	0.010830	0.003980	2.720861	0.0069
R_GDP?	0.008023	0.005718	1.403109	0.1617
DIVORCE_R?	-0.026740	0.007651	-3.495035	0.0006
SDR_AL_M?	-0.008810	0.000838	-10.50926	0.0000
SDR_SM_M?	-0.005977	0.000667	-8.963583	0.0000
SDR_APP_M?	-0.484543	0.240223	-2.017053	0.0446
Random Effects				
_01--C	1.789365			
_02--C	0.135384			
_03--C	-1.744324			
_04--C	0.185326			
_05--C	0.513598			
_06--C	-0.099058			
_07--C	1.350915			
_08--C	-0.388571			
_09--C	-0.001679			
_10--C	-0.195710			
_11--C	-0.734082			
_12--C	0.308538			
_13--C	-0.556819			
_14--C	0.604637			
_15--C	-0.251781			
_16--C	-0.675419			
_17--C	2.475240			
_18--C	0.244013			
_19--C	0.597205			

_20--C	-1.011224		
_21--C	-1.272502		
_22--C	-0.591052		
_23--C	-1.057473		
_24--C	0.375472		
GLS Transformed Regression			
R-squared	0.912546	Mean dependent var	66.29767
Adjusted R-squared	0.910359	S.D. dependent var	3.084139
S.E. of regression	0.923393	Sum squared resid	238.7433
Durbin-Watson stat	0.672705		
Unweighted Statistics including Random Effects			
R-squared	0.919643	Mean dependent var	66.29767
Adjusted R-squared	0.917634	S.D. dependent var	3.084139
S.E. of regression	0.885132	Sum squared resid	219.3685
Durbin-Watson stat	0.732119		

II. Life expectancy for male population – suicide rates are used as proxy for social stresses

Dependent Variable: LIFE_EX_M?
Method: GLS (Variance Components)
Date: 05/19/03 Time: 12:52
Sample: 1989 2000
Included observations: 12
Number of cross-sections used: 24
Total panel (balanced) observations: 288

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	71.85661	0.661718	108.5910	0.0000
HIGHER?	0.041913	0.009127	4.592020	0.0000
R_WAGE?	0.009861	0.003879	2.541869	0.0116
R_GDP?	0.007688	0.005566	1.381348	0.1683
SUICIDE_M?	-0.044938	0.008404	-5.347271	0.0000
SDR_AL_M?	-0.007356	0.000885	-8.311764	0.0000
SDR_SM_M?	-0.005702	0.000654	-8.717234	0.0000
SDR_APP_M?	-0.401704	0.230186	-1.745129	0.0821
Random Effects				
_01--C	1.236705			
_02--C	0.061073			
_03--C	-1.426245			
_04--C	0.442011			

_05--C	1.441467
_06--C	0.251601
_07--C	1.147515
_08--C	-0.510825
_09--C	-0.221355
_10--C	-0.359560
_11--C	-0.527584
_12--C	1.420239
_13--C	-0.234102
_14--C	0.237610
_15--C	-0.136798
_16--C	-0.727782
_17--C	1.977423
_18--C	-0.390290
_19--C	0.196113
_20--C	-0.575685
_21--C	-1.243835
_22--C	-0.940354
_23--C	-1.400109
_24--C	0.282767

GLS Transformed Regression			
R-squared	0.917701	Mean dependent var	66.29767
Adjusted R-squared	0.915643	S.D. dependent var	3.084139
S.E. of regression	0.895764	Sum squared resid	224.6699
Durbin-Watson stat	0.718611		

Unweighted Statistics including Random Effects			
R-squared	0.923795	Mean dependent var	66.29767
Adjusted R-squared	0.921890	S.D. dependent var	3.084139
S.E. of regression	0.861961	Sum squared resid	208.0336
Durbin-Watson stat	0.776078		

III. Life expectancy for male population – SDR, liver and cirrhosis is used on the place of SDR, alcohol related causes

Dependent Variable: LIFE_EX_M?
Method: GLS (Variance Components)
Date: 05/19/03 Time: 12:55
Sample: 1989 2000
Included observations: 12
Number of cross-sections used: 24
Total panel (balanced) observations: 288

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	72.36914	0.772427	93.69062	0.0000
HIGHER?	0.051594	0.010002	5.158445	0.0000
R_WAGE?	0.008513	0.004253	2.001688	0.0463
R_GDP?	0.008458	0.006118	1.382513	0.1679
SUICIDE_M?	-0.075277	0.008458	-8.899714	0.0000
SDR_CIR_M?	-0.020958	0.006032	-3.474245	0.0006
SDR_SM_M?	-0.006654	0.000707	-9.409164	0.0000
SDR_APP_M?	-0.329863	0.251103	-1.313656	0.1900
Random Effects				
_01--C	1.253864			
_02--C	0.327613			
_03--C	-2.119504			
_04--C	1.514390			
_05--C	1.856263			
_06--C	0.391893			
_07--C	0.502115			
_08--C	-0.835834			
_09--C	-0.290582			
_10--C	-0.633809			
_11--C	-0.779125			
_12--C	1.595699			
_13--C	-0.164098			
_14--C	1.485183			
_15--C	-1.221681			
_16--C	-0.632280			
_17--C	1.790374			
_18--C	-0.271980			
_19--C	0.283460			
_20--C	-0.977890			
_21--C	-1.094210			
_22--C	-1.410562			
_23--C	-1.272910			
_24--C	0.703613			
GLS Transformed Regression				
R-squared	0.902923	Mean dependent var	66.29767	
Adjusted R-squared	0.900496	S.D. dependent var	3.084139	
S.E. of regression	0.972867	Sum squared resid	265.0117	
Durbin-Watson stat	0.982642			
Unweighted Statistics including Random Effects				
R-squared	0.910924	Mean dependent var	66.29767	
Adjusted R-squared	0.908697	S.D. dependent var	3.084139	
S.E. of regression	0.931917	Sum squared resid	243.1715	
Durbin-Watson stat	1.070897			

IV. Life expectancy for female population

Dependent Variable: LIFE_EX_F?
Method: GLS (Variance Components)
Date: 05/16/03 Time: 16:40
Sample: 1989 2000
Included observations: 12
Number of cross-sections used: 24
Total panel (balanced) observations: 288

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	77.76407	0.502235	154.8361	0.0000
HIGHER?	0.043367	0.006526	6.644787	0.0000
R_WAGE?	0.012369	0.001642	7.532673	0.0000
SUICIDE_F?	-0.086590	0.030015	-2.884874	0.0042
SDR_CIR_F?	-0.055692	0.007844	-7.100132	0.0000
SDR_SM_F?	-0.006685	0.000660	-10.12497	0.0000
SDR_APP_F?	-0.991259	0.269641	-3.676215	0.0003
Random Effects				
_01--C	0.318871			
_02--C	0.238036			
_03--C	-1.438792			
_04--C	0.524677			
_05--C	1.370715			
_06--C	0.234689			
_07--C	1.207396			
_08--C	-1.516393			
_09--C	-0.277204			
_10--C	-0.288983			
_11--C	-0.369241			
_12--C	1.172565			
_13--C	-0.484202			
_14--C	2.420733			
_15--C	-0.988752			
_16--C	-0.868002			
_17--C	1.393254			
_18--C	1.122085			
_19--C	0.752331			
_20--C	-1.018709			
_21--C	-0.832729			
_22--C	-1.686774			
_23--C	-1.304247			
_24--C	0.318676			
GLS Transformed Regression				

R-squared	0.930470	Mean dependent var	74.61052
Adjusted R-squared	0.928986	S.D. dependent var	2.206768
S.E. of regression	0.588070	Sum squared resid	97.17721
Durbin-Watson stat	0.828585		

Unweighted Statistics including Random Effects			
R-squared	0.935683	Mean dependent var	74.61052
Adjusted R-squared	0.934310	S.D. dependent var	2.206768
S.E. of regression	0.565596	Sum squared resid	89.89146
Durbin-Watson stat	0.895742		

V. Life expectancy for population as a whole

Dependent Variable: LIFE_EX_ALL?
Method: GLS (Variance Components)
Date: 05/16/03 Time: 16:45
Sample: 1989 2000
Included observations: 12
Number of cross-sections used: 24
Total panel (balanced) observations: 288

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	74.69635	0.599813	124.5327	0.0000
HIGHER?	0.040862	0.007827	5.220769	0.0000
R_GDP?	0.009280	0.004667	1.988645	0.0477
R_WAGE?	0.010442	0.003286	3.177722	0.0017
SUICIDE_ALL?	-0.063309	0.013091	-4.835924	0.0000
SDR_AL_ALL?	-0.007502	0.001149	-6.528932	0.0000
SDR_SM_ALL?	-0.006862	0.000728	-9.428074	0.0000
SDR_APP_ALL?	-0.918500	0.309538	-2.967325	0.0033
Random Effects				
_01--C	0.932305			
_02--C	-0.010332			
_03--C	-1.410740			
_04--C	0.188248			
_05--C	1.301161			
_06--C	0.169067			
_07--C	1.005474			
_08--C	-0.868868			
_09--C	-0.546606			
_10--C	0.071118			
_11--C	0.059350			
_12--C	1.903350			
_13--C	0.033116			
_14--C	0.055584			

_15--C	-0.012815		
_16--C	-0.359322		
_17--C	1.905653		
_18--C	0.047754		
_19--C	0.623928		
_20--C	-0.577595		
_21--C	-1.208908		
_22--C	-1.491484		
_23--C	-1.648699		
_24--C	-0.160739		
GLS Transformed Regression			
R-squared	0.914835	Mean dependent var	70.45823
Adjusted R-squared	0.912706	S.D. dependent var	2.499889
S.E. of regression	0.738605	Sum squared resid	152.7503
Durbin-Watson stat	0.782031		
Unweighted Statistics including Random Effects			
R-squared	0.921363	Mean dependent var	70.45823
Adjusted R-squared	0.919398	S.D. dependent var	2.499889
S.E. of regression	0.709733	Sum squared resid	141.0418
Durbin-Watson stat	0.846951		

VI. The influence of radioactive pollution on life expectancy for selected countries (for male, female and whole population)

Dependent Variable: CH_LIFE_M?
Method: Pooled Least Squares
Date: 05/16/03 Time: 10:08
Sample: 1989 2000
Included observations: 12
Total panel observations 48
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CANCER_M?	-0.057428	0.012993	-4.419914	0.0001
Fixed Effects				
_13--C	83.22007			
_14--C	74.50266			
_15--C	78.29381			
_16--C	82.96642			
R-squared	0.547314	Mean dependent var		63.12750
Adjusted R-squared	0.505204	S.D. dependent var		2.028867

S.E. of regression	1.427141	Sum squared resid	87.57941
Log likelihood	-30.54404	Durbin-Watson stat	0.516748

Dependent Variable: CH_LIFE_F?
Method: Pooled Least Squares
Date: 05/16/03 Time: 09:52
Sample: 1989 2000
Included observations: 12
Total panel observations 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CANCER_F?	-0.024668	0.006990	-3.528973	0.0009
Fixed Effects				
_13--C	81.24373			
_14--C	75.31585			
_15--C	79.70827			
_16--C	80.58918			
R-squared	0.737865	Mean dependent var		73.16021
Adjusted R-squared	0.713480	S.D. dependent var		1.476378
S.E. of regression	0.790269	Sum squared resid		26.85456
Log likelihood	0.175910	Durbin-Watson stat		0.577496

Dependent Variable: CH_LIFE_ALL?
Method: Pooled Least Squares
Date: 05/16/03 Time: 20:19
Sample: 1989 2000
Included observations: 12
Number of cross-sections used: 4
Total panel (balanced) observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CANCER_ALL?	-0.046591	0.011322	-4.115181	0.0002
Fixed Effects				
_13--C	83.29916			
_14--C	75.75693			
_15--C	80.17655			
_16--C	82.97831			
R-squared	0.495888	Mean dependent var		68.15833
Adjusted R-squared	0.448993	S.D. dependent var		1.602660
S.E. of regression	1.189652	Sum squared resid		60.85669
Log likelihood	-73.80475	F-statistic		10.57461
Durbin-Watson stat	0.566509	Prob(F-statistic)		0.000005