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# The Poor Health Status of the Hungarians; Comparative Macro-Analysis of the Likely Explanatory Factors on Hungarian and Austrian Data, 1960-2004

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# The Poor Health Status of the Hungarians; Comparative Macro-Analysis of the Likely Explanatory Factors on Hungarian and Austrian Data, 1960-2004

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## Abstract

In Hungary, the health status of working age men is extremely bad in comparison with both the developed market economies and the neighboring transition countries. The study based on data between 1960 and 2004 investigates the health status of population in Hungary and Austria by health-production functions on macro level and makes comparisons. The rationale for comparison of these very countries is the territorial closeness and the mutual long past. The mortality rate of working age population (15-60 years old) is considered the proxy variable for the health status. According to this indicator the health status in the two countries was at the same level in 1960's, but they started to diverge at the beginning in the 1970's. As explanatory variables for the mortality rate of the working age population the following variables are taken into account: the indicators of the life style (consumption of alcohol, smoking, the extra work in the „second" and „hidden economy"), the long- term economic development (the development of the GDP per capita), health-care resources (the relative share of physicians) and the situation in the labor market (unemployment rate). The estimations of the health production functions turn out approximating well real world developments in both countries.

Keywords: health status, health production function, mortality, Hungary, Austria

JEL: I12

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# A magyarországi rossz egészségi állapot lehetséges magyarázó tényezői: összehasonlító makroelemzés magyar és osztrák adatok alapján, 1960-2004

Lackó Mária

## Összefoglaló

Magyarországon a dolgozó korú férfiak egészségi állapota kirívóan rossz mind a fejlett piacgazdaságokkal, mind pedig a környező átalakuló országokkal való összehasonlításban. A tanulmány Magyarország és Ausztria lakosainak egészségi állapotát „egészségtermelési függvények" segítségével makroszinten vizsgálja és összehasonlítja az 1960-2004-es időszak adatai alapján. A két ország összehasonlításának létjogosultságát a területi közelség és a közös régmúlt adják. Az egészségi állapot proxyjának a munkaképes korú felnőttek (15–60 év) halálozási rátáját tekintjük. Ez alapján az egészségi állapot a két országban az 1960-as években még azonos szinten állt, ám az 1970-es évek elejétől nagymértékben elszakadt egymástól. A munkaképes korú felnőttek halálozási rátájának magyarázó tényezőiként az életmódot jellemző mutatókat (alkohol- és dohányfogyasztás, többletmunka a „második", illetve a „rejtett" gazdaságban), a gazdaság hosszú távú fejlődését (az egy főre jutó GDP alakulása), az egészségügyben rendelkezésre álló forrásokat (orvosok relatív aránya) és a munkaerőpiac állapotát jellemző mutatót (munkanélküliség) vesszük figyelembe. Az egészségtermelési függvények regressziós becslése segítségével mindkét ország esetében sikerül jól közelíteni a valóságban lezajló folyamatokat.

Tárgyszavak: egészségi állapot, egészségtermelési függvény, mortalitás, Magyarország, Ausztria

JEL kódok: I12

Köszönetnyilvánítás: A tanulmány a „Foglalkoztatottság, egészségi állapot és szubjektív jóllét" című OTKA kutatás(K 76867) keretében készült.

## 1. MACRO-LEVEL STUDIES OF POPULATION HEALTH IN HUNGARY IN THE CONTEXT OF INTERNATIONAL DATA

Hablicsek (1995) discusses long-term and comparative international analyses of Hungarian mortality and fertility indicators, placing special emphasis on a comparison with Austria. The author establishes that the *first Demographic Transition*[1] in Hungary started during the last third of the 19th century and ended in the 1960s, and was characterised by clear stages in the pattern of mortality. During the first phase (up to 1920), the declining trend in mortality was due to the drastic drop in infant mortality. Between 1921 and 1939, the dominant factor was the decrease in mortality rate among older children. Finally, Hungary experienced its steepest fall in mortality over the period from 1945 to 1960, which was characterised by an overall decrease affecting almost all age groups.

Comparing the processes observed in Hungary to those observed in Austria, Hablicsek points out that while during the first stages of the *demographic transition*, life expectancy was substantially higher in Austria, by the end of the transition period the gap between the two countries had diminished: "Life expectancy at birth among Hungarian men, which had been 10 years lower than the corresponding Austrian figure at the beginning of the transition, had reached the Austrian level by the early 1960s, and female life expectancy at birth had closely approached the level observed in the neighbouring country. At a later stage – starting with the second half of the 1970s – the gap began to widen in favour of the Austrian values, and currently a 5 to 10 year difference can be observed (once again)." (p. 409)

Hablicsek argues that the post-1965 increase in mortality rate among working-age men should be attributed to special circumstances and should not be seen as a feature of the *first Demographic Transition*. The author's reasoning is as follows: "There are a number of theories attempting to account for the deceleration or reversal of the decrease in mortality rates in Hungary. However, if we compare Hungary with more highly developed European countries having far lower death rates, it becomes quite clear that none of these hypotheses provides an adequate explanation: there are counterexamples for every one of them (be it "the battle of the sexes," substances hazardous to health, life-style or

[1] "During the 19th and 20th centuries there was a turn in the demographic profile of the world, which first affected the countries now classed as developed, and at a later point, the countries of the developing world. The high birth and death rates typical of earlier periods dropped to low levels in a – from a historical perspective – short period of time. This process is termed the first Demographic Transition." (Hablicsek, 1995: 396.)

environmental factors). As if men and women living in Hungary "simply" died earlier than those living under equivalent conditions in other countries." (p. 410)

Bobak and Marmot (1996) reported that a Medline[2] search identified 1262 papers on mortality in Eastern Europe since 1983. These papers all described the problem that there was a sharp divide in mortality between Eastern and Western Europe. According these two authors, in the explanation of the divide the quality of medical care, environment pollution and socioeconomic forces have to be taken into account. They also suggest that the socioeconomic effects might be mediated by lifestyle (smoking, exercise), diet, alcohol and possibly psychosocial stress.

Mesle and Villan (2002) emphasize two main differences lying behind the divergence in mortality between the western and eastern countries emerging from the 1960's until 1995. The first is the unhealthy behaviour in the East, and the second is that Eastern countries did not participate in the cardiovascular revolution that enabled the West to make new advances in the progress of life expectancy.

The Health Production Function approach a widely used method in the literature attempts to characterise population health (life expectancy or mortality rate[3]) as a combined function of health care resources, lifestyle and socio-economic factors. There is a broad consensus in the pertinent literature as to the set of macro-level factors involved:

1. Health care resources: This may be quantified in terms of finances (health care spending) or in terms of physical units (e.g., number of doctors).
2. Lifestyle factors: Alcohol and tobacco consumption, eating habits and lifestyle proxies (fat and sugar consumption, calories, fruit and vegetables, relaxation and exercise).
3. Socio-economic factors: income per capita, education and environmental pollution.

While the above are the most commonly included factors, some researchers may also look at poverty, urbanisation, income distribution, unemployment, dominant religion and employment status as explanatory variables.

A comprehensive study was carried out by the Joumard et al. (2008) based on panel regressions for 23 OECD countries for the period between 1981 and 2003. As the study is not only a fairly typical example of the Health Production Function approach but also allows a longitudinal as well as a cross-sectional comparative analysis of population health

[2] Medline is the US. National Library of Medicine's premier bibliographic database.
[3] The term "health production function" in fact may be misleading since the dependent variable or its increase or decrease refers to the absence of health, e.g., to mortality rate and its changes over time.

in Hungary, it will be discussed in some detail below. The study uses the following variables in defining the macro-level production function of health:

$$Y_{it}=a_i+b \times HCR_{it}+c \times SMOK_{it}+d \times DRINK_{it}+e \times DIET_{it} + f \times AIRPOL_{it} + g \times EDU_{it} + h \times GDP_{it} + error_{it}$$

Where i refers to the country, t refers to the year

$Y_{it}$: life expectancy at birth for the total population

$HCR_{it}$ : health care resources *per capita*, either measured in monetary terms (total spending including long-term care at GDP PPP exchange rates and constant prices) or in physical terms (*e.g.* health practitioners).

$SMOK_{it}$ : tobacco consumption in grams *per capita*.

$DRINK_{it}$ : alcohol consumption in liters *per capita*.

$DIET_{it}$ : consumption of fruits and vegetables *per capita* in kgs.

$AIRPOL_{it}$: emissions of nitrogen oxide (NOx) *per capita* in kgs.

$EDU_{it}$: share of the population (aged 25 to 64) with at least upper secondary education.

$GDP_{it}$: GDP *per capita*.

The authors note that there are a number of unavoidable simplistic assumptions underlying their panel estimation and the model is also subject to some problems of interpretation.

1. Although the close association between health and education is well established in the literature, the direction of causation is subject to debate, as the effect may operate either way:

1.a Better health may facilitate greater investment in education since healthier people can invest more time and energy into learning. As they live longer, they are more highly motivated to educate themselves expecting greater income returns to education over their lifetimes.

1.b On the other hand, higher educational attainment results in better health since better educated people use health care services more efficiently, it is easier for them to make sense of medical procedures and they use more modern medication. Education also affects health through lifestyle factors (alcohol and tobacco consumption). Since the above model, however, also includes these lifestyle factors as individual variables, they do not interfere with the effects of education on health outcomes.

2. The macro-level analysis of international data reveals a far stronger relationship between population health and GDP per capita than between health and education. A higher GDP per capita has an impact on health outcomes because, in addition to

factors individually included in the model (education, health care resources), it also allows the consumption of goods and services (food, housing, transport) contributing to the maintenance of good health. Further factors of this sort may include better working conditions: in wealthier countries, a higher proportion of workers are employed in service sector jobs, which are less detrimental to health than are work activities in, for instance, manufacturing or construction. Just as for education, the direction of causation is also highly controversial for the level of income. Some researchers argue that a higher income is a consequence of better health. This may be the case at the micro-level (Cutler, 2005, Kiuila és Mieszkovszki, 2007): healthy people have more time and energy for education and work; they work more efficiently and earn more. At the macro-level, however, income is far more likely to be the cause and health the consequence, at least as far as developed countries are concerned. The panel model provides evidence that GDP per capita is one of the strongest explanatory variables for health outcomes. This pattern does not change if the percentage of service sector workers is substituted for GDP per capita. This observation sheds light on the question of causal direction since it reveals that the health effects of GDP are primarily manifested through the better working conditions characterising the service sector.

3. The effects of lifestyle factors: the authors treat current lifestyle as a proxy for previous habits, i.e., no time lag is incorporated in the function. This decision had to be made as there was an insufficient number of observations to carry out the estimation with time lag. It means, however, that the effects of lifestyle are underestimated. (The authors attempt to correct for the distortion by introducing a lag in GDP but the results remain unaffected.)

4. Endogeneity and collinearity among exogenous variables: GDP per capita and health care spending per capita are highly correlated (colleanarity), and health care spending may be affected by population health (endogeneity). There is a similar problem with education. The variables of environmental pollution and lifestyle are not subject to this objection.

5. The authors include country fixed effects in their panel estimation. These fixed effects, together with the residuals, stand for unexplained differences in health status; as the authors claim, they reflect cross-country variation in health care efficiency rather than measurement errors, omitted variables or other factors. (This assumption is concordant with the Production Function approach, in which the total factor productivity is a residual factor.) The justification given by the authors for this assumption is that the unexplained portion of health status is not correlated with variables excluded from the model, such as inequality indicators (Gini coefficients), obesity or population density. (Correlation with a number of other variables, e.g.,

health and safety regulations, working and housing conditions and poverty, could not be tested because no data was available.)

The results of the panel regression reveal that in terms of the country-specific effect, i.e., the unexplained determinant of life expectancy as an indicator of health, which is assumed by the authors to reflect health care efficiency, Hungary is in one of the worst positions among the countries under analysis and for the period under analysis. Hungary's performance is shown to be substantially poorer than other former communist countries', namely the Czech Republic and Poland. The country-specific effect is also strikingly poor for the United States.

While this paper focuses on changes over time in the health status of the Hungarian population, a comparison will also be made with a neighbouring country, Austria, sharing certain historical and cultural attributes with Hungary.

Table 1 displays the results of the production function calculations in Joumard et al. (2008) for Austria and Hungary in 2003.

*Table 1*

**Contribution of the main explanatory variables to cross-country differences in life expectancy at birth, Differences between countries and the OECD average for each variable expressed in years, 2003**

| | Hungary | Austria |
|---|---|---|
| Life expectancy | -5.6 | 0.8 |
| Health care recources | -2 | 1 |
| Education | 0.1 | 0.2 |
| Smoking | 0 | 0 |
| Alcohol consumption | -0.3 | -0.2 |
| Diet | 0 | 0 |
| Air polution | 0.5 | 0.1 |
| GDP per capita | -0.8 | 0.3 |
| Country effect | -3.1 | -0.7 |

Source: Joumard et al. (2008), 25. p.

The top row of the table reveals that compared to the OECD average, life expectancy was 5.6 years lower in Hungary and 0.8 years higher in Austria. The remaining rows of the table show the differences between the two countries for each explanatory factor as estimated by the health production function. [4] Among the determinants of life expectancy Austria shows the most substantial advantage in terms of health care spending and health care efficiency (which is derived from the country-specific effects) and these are followed by the impact of economic development. Compared to these three, the country differences between the effects of the remaining factors (the variables capturing lifestyle and education) appear to be negligible.

The health production function outlined above can not provide a satisfactory explanation for the observation that Hungary lags far behind other countries in terms of population health (life expectancy). The model from an econometric point of view highly sophisticated, but it appears not to correspond to real life. It is difficult to believe that variation in lifestyle and education has virtually the same effect on life expectancy in Hungary as in Austria while health care in Hungary happens to be managed not only with lower efficiency than in Austria, but with the lowest efficiency among all OECD countries. The sample covers, among others, the Czech Republic and Poland, and these former communist countries are estimated to have substantially more "efficient" health care systems (i.e., less negative country-specific effects) than Hungary. This is a similarly surprising result.[5]

[4] In Joumard et al. (2008) the components of the regression function are compared to the OECD average regression function for each individual country. Only the Hungarian and the Austrian values are shown here.

[5] A comprehensive critique of Joumard et al (2008) appears in Frech III (2009), where the assumptions leading to the strikingly low value for health care efficiency in the US are scrutinised. The suggestion that Hungary has one of the most inefficient health care systems has also triggered a debate in Hungary. See Vitrai et al. (2009) and Bondár (2010).

## 2. HEALTH DIFFERENCES BETWEEN HUNGARY AND AUSTRIA – FACTS AND EXPLANATIONS

In what follows, the mortality rate among working-age adults will be taken as a proxy for health status, which is defined as the probability of death between 15 and 60 years of age per 1000 individuals. This is in fact the probability in a given year of a 15 year old person dying before the age of 60 (definition given in World Development Indicators).

It is repeatedly pointed out in the literature, especially in studies concerned with health in Hungary (see Kopp 2007, 2008), that in the 1960s and early 1970s the mortality rate was lower among the Hungarian than among the Austrian adult male population and adult women had similar mortality rates in the two countries. This can be clearly seen in Figures 1 and 2 displaying the mortality rates of working-age men and women between 1960 and 2004 in the two countries.

*Figure 1*

**Mortality rate of the working age men in Hungary and Austria, 1960-2005, per 1000 capita**

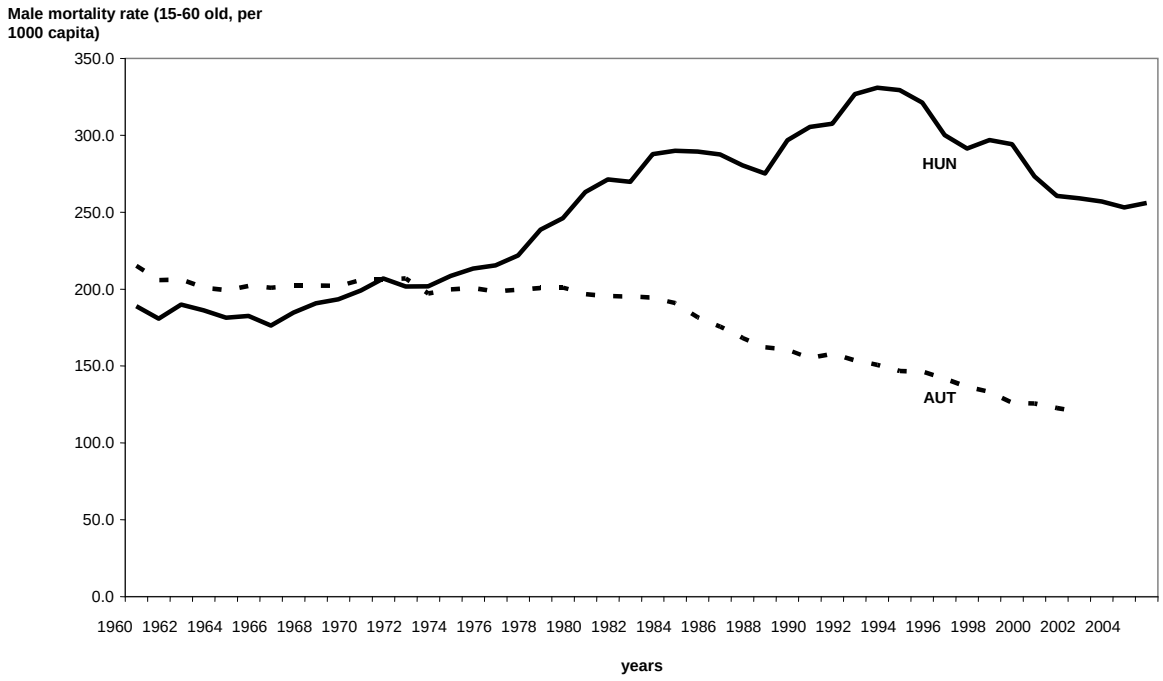
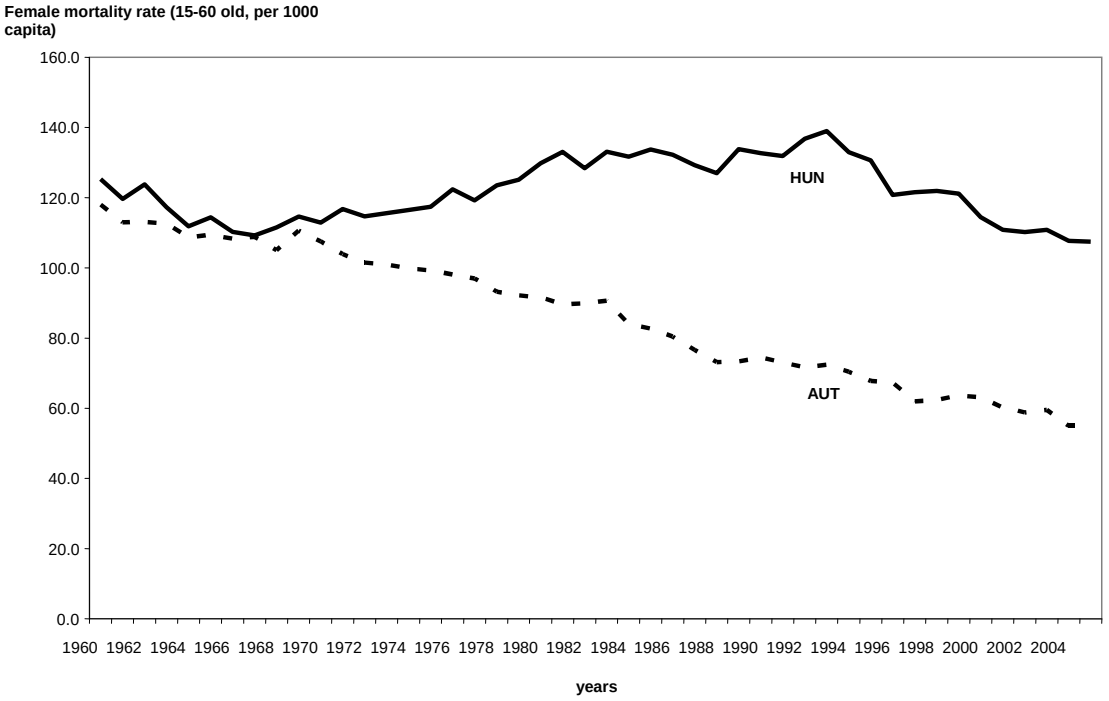


*Figure 2*

**Mortality rate of the working age women in Hungary and Austria, 1960-2005, per 1000 capita**




We can also see that following the initial period of similarity, the death rate curves of the two countries begin to diverge rapidly over time. While in Austria the stagnation (for men) and the slight downward slope (for women) characterising the 1960s is followed by a pronounced fall, Hungary displays a movement in the opposite direction: Hungarian male mortality rate sharply rises from the late 1960s through to 1993, at which point it finally starts declining, in 2004 still remaining well above the initial Austrian value. Looking at the female population, we once again find a substantial difference between the two countries. While the death rate among Austrian women halved over the period under analysis, on the whole the Hungarian rate appears to be stagnating rather than descending.

As confirmed by the literature, there is no doubt that an analysis of smoking and alcohol consumption habits is crucial for our understanding of the causes of early death in Hungary and for cross-country comparisons.

It is shown by Ádány (2007) that the Hungarian standardised mortality ratio among 25-64 year olds is 3.1 times higher than the EU average for cardiovascular diseases both in men and women; 2.2 and 1.6 times higher for malignant neoplasm-related deaths in, respectively, men and women; 5.5 (men) and 4.4 (women) times higher for deaths related to the digestive system (mostly to alcohol consumption); and 2.2 (men) and 1.7 (women) times higher for deaths caused by external factors (suicide, homicide). In their comparison

of the causes of death in Czechoslovakia, Poland and Hungary, Chenet et al. (1996) also cite alcohol and tobacco consumption as an explanatory factor for early deaths among Hungarian men.

A series of *micro-analyses* by Kopp et al (2007, 2008) suggest that the rapid rise in the adult male mortality rate starting in the early 1970s in Hungary cannot be blamed on the factors usually held responsible for cardiovascular diseases (fatty foods, smoking, excessive alcohol intake or obesity), nor can it be explained by inadequate access to medical assistance. Kopp et al (2007, 2008) emphatically argue that the dominant determinants of the rapid rise in adult male mortality rate in Hungary are *chronic stress* and elevated levels of certain psychosocial factors. Based on their data, most of which was collected during the period following the system change, the authors come to the conclusion that the major predictors of early death among men are low educational attainment, low subjective social status, low personal and family income, job insecurity, unskilled labour, depression, anomie and the absence of marital support. These remain statistically significant explanatory factors when their effects are corrected for indicators capturing lifestyle variables (smoking, alcohol consumption and obesity). Of the above factors, Kopp et al (2008) see chronic stress (represented by the depression indicator) as some sort of invisible hand playing a critical role in premature mortality among men. In her earlier work, Kopp (2006, 2007) also highlights the second economy and voluntary weekend overtime as important explanatory factors in early death of a cardiovascular origin.

Although the book by Kopp (Kopp, 2008) discusses the issue of behaviours people adopt in an effort to relieve the effects of high and chronic stress, the volume as a whole does not suggest that alcohol consumption and smoking, as health damaging habits combating stress, may be major determinants of the relatively high mortality rate among adult men in Hungary. Also, there is no indication in the volume that excessive work load (the second economy and later the hidden economy) may be a significant factor.

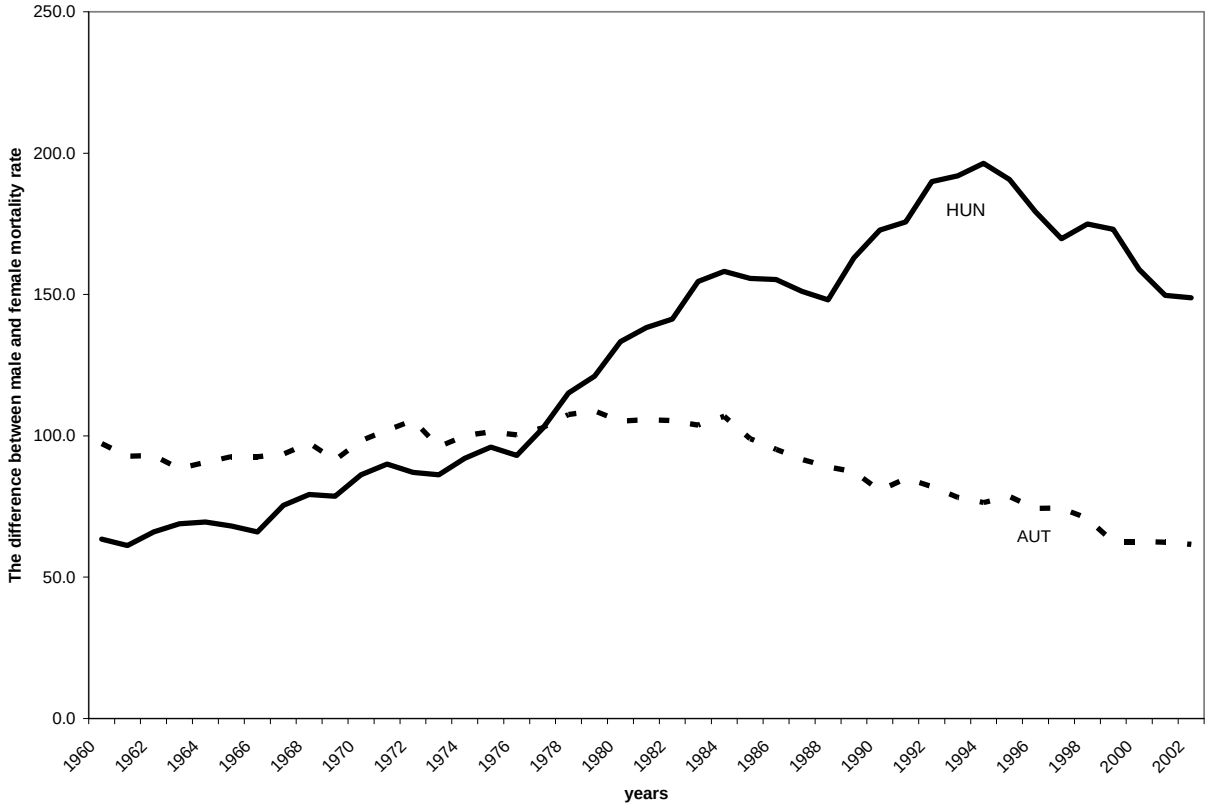
Although for Hungary no extensive micro-data is available on the relationship between chronic stress and lifestyle, such analyses have been carried out for other countries and their results may have relevance for this country. Cockerham et al. (2006) look at the relationships between psychological distress, gender, and health-related lifestyle habits in Belarus, Russia and Ukraine.[6] The motivation for the research was a previously observed drastic increase in morbidity and early mortality in these countries and the development of a wide gap between adult male and female population health. This phenomenon is

[6] In the introduction to her volume, Kopp (2008) mentions that the declining health status among the middle-aged population of Hungary shows more similarity to the Ukrainian and the Russian health patterns than to the Czech, Slovakian or Polish conditions.

sometimes termed the Central and Eastern European Health Paradox since two populations living under the same social and political conditions are characterised by substantially divergent morbidity and mortality figures. This pattern is also observed in Hungary for the period of 1960-2004 (Figure 3), with the gender gap growing especially wide after 1968, at the exact same time when the Hungarian figures depart from the corresponding Austrian ones.

*Figure 3*

**The difference between the male and female mortality rate in Hungary and Austria, 1960-2004**




Cockerham et al. (2006) note that psychological distress is often cited as the primary cause of early mortality (Leon and Shkolnikov, 1998, Shkolnikov, Cornia, Leon and Meslé, 1998, Siegrist, 2000) but there is no sufficient evidence shedding light on the precise mechanisms involved. Given very little information on the past, the authors focus on current conditions in their detailed analysis of the association between stress and health-related lifestyle in certain former Soviet republics. The analysis covers Belarus, Kazakhstan, Russia and Ukraine; the data was collected in November 2001 in the form of face-to-face interviews resulting in a database of 10,406 interviews in total.

The results reveal that the female populations of these countries experience considerably more psychological distress than do the male populations, and this pattern corresponds to that observed in most other countries (Desjarlais et. al. 1995). Higher levels of stress, however, do not provoke increased alcohol consumption among women, although heavier smoking appears to be a typical response among them. The most important conclusion of the analysis is that what is considered to be socially acceptable behaviour varies between the genders. In the post-Soviet societies drinking are an acceptable behaviour for men but not for women. The social role assigned to women, caring for their family, etc., keeps them from heavy drinking. This interpretation is confirmed by the qualitative interviews, which reveal that women give priority to the needs of the family over their own needs. Even women with paid jobs do the housework and care for the children themselves.

The study reveals that while stress is unrelated to alcohol consumption among women, it tends to be accompanied by frequent drinking among men; although it shows no relationship with regular vodka consumption (spirit consumption is a special, prominently harmful subclass of alcohol consumption). The results also suggest that regular drinking enhances the feeling of well-being. Evidence for this assumption is provided by in-depth interviews recorded in Moscow, during which several men claimed to feel more optimistic about life when drinking. This may explain why Bobak et al. (1999) find that in Russia alcohol consumption is fairly evenly distributed across the male population displaying no association with financial deprivation, economic and political changes or subjective financial position. The authors argue that at the time of the communist regime drinking became a habit among men and this behaviour conformed to the normative social influence of the time.[7] In Imperial Russia, heavy alcohol consumption had been limited to holidays. During the Soviet era, heavy drinking became normal throughout the year. The main reasons for the change are the elimination of religious barriers in combination with the immediate availability of cheep vodka and the black market sale of smuggled brandy. These facts lead the authors to believe that this characteristic lifestyle is a consequence of

[7] Józan (2002) has a similar view on Hungarian alcoholism: "In Hungary alcoholism has always been a problem but the kind of heavy drinking still haunting the nation emerged in the 1950s and 60s: partly 'imported' from Soviet Russia and partly following from the conditions inherently related to communist industrialisation and to the nature of the Hungarian version of the Soviet-type communist society. Excessive daily alcohol consumption became the social norm among the uneducated, unskilled workers recruited mostly from agriculture to labour on the large construction sites of the 1950s. Workdays were spent under the influence of alcohol, weary men drank themselves to oblivion with beer and malt at weekends spent away from the family (when Saturday was a workday) and on the long journeys on the shuttle trains while playing cards. They did not risk their jobs by being drunk; alcohol abuse was treated with permissiveness by the aggressively downward levelling society intent on curbing all achievement. Thus, the first generation of Hungarian unskilled labourers moved from Lenin- and Stalin-borough straight to the alcoholic's paradise. Down below, at the depths of society, this is the genesis of the particular alcoholism that has been a heavy burden on the entire society right up till the present day." ( p. 437)

normative influence rather than psychological distress and that regular drinking among men essentially follows from that. This conclusion is consistent with Van Gundy's (2005) results showing that in Moscow alcohol consumption habits are primarily related to gender role orientation and drinking norms.

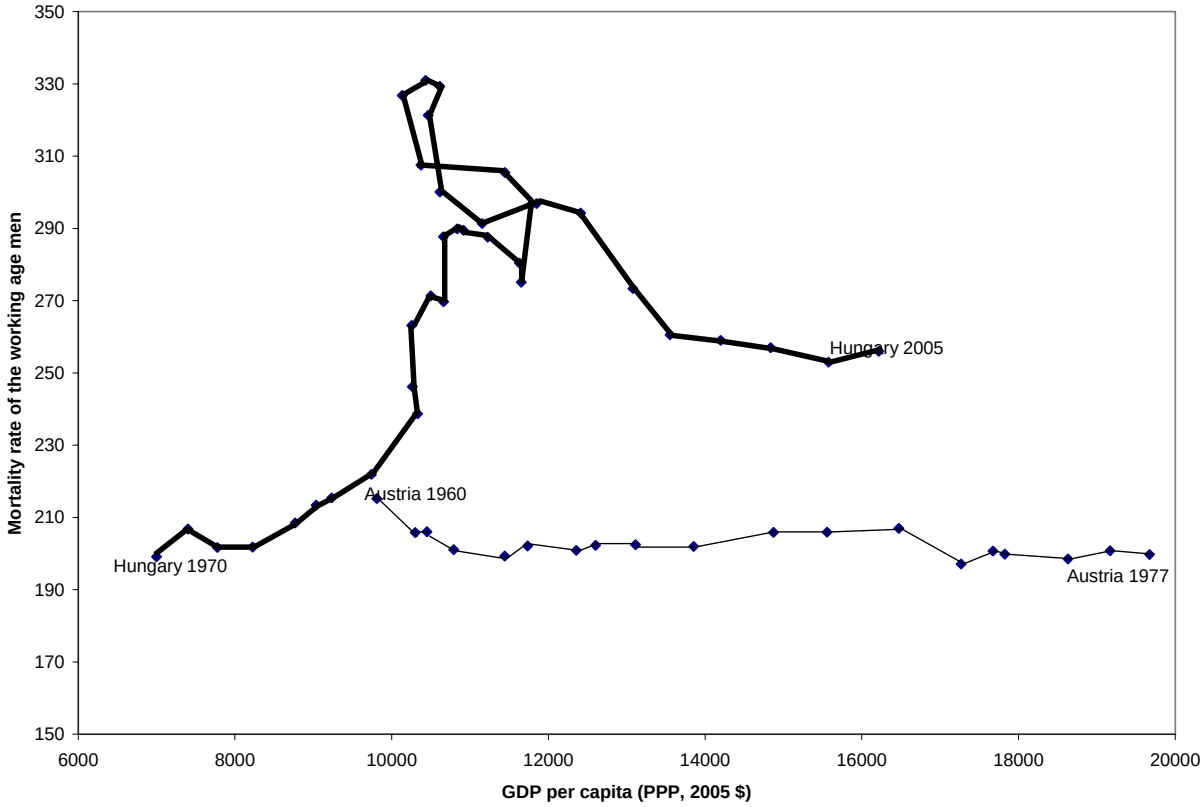
As was mentioned before, insightful microanalyses have been carried out on the association between mortality and stress in Hungary (Kopp, 2007, 2008). However, the direct relationship between stress and behavioural patterns detrimental to health has not been explored in a comprehensive micro-level analysis. The extent, patterns and health effects of alcohol use in Hungary have been discussed by Elekes (2000), Elekes and Paksi (2001), Józan (2003) and Gábor and Kiss (2006). It is a common misconception that the strikingly poor health of the Roma population living in Hungary is a result of excessive alcohol consumption. Kósa et al. (2007) provide evidence that the factors that can be held responsible for the poor health status among the Roma, which is even worse than is typical of the low-income population in general, are list of other causes, such as heavy smoking, inadequate nutrition (insufficient vegetable and fruit intake), limited access to medical care and, within that, extreme discrimination, rather than excessive alcohol intake.

Józan (2002) mainly emphasises the contribution of lifestyle to the increase in early mortality among men in Hungary. The author finds four risk factors (alcohol, smoking, fat-rich diet and lack of exercise) as the causes of this phenomenon observed over the period from 1965 to 1993. He notes that expert opinion is divided as to the role of stress: some believe that stress damages the immune system and thus indirectly causes ill health or death, while others object that there is insufficient evidence for this claim, even in the case of cardiovascular diseases.

Józan (2002) argues that the increased incidence of early death among working-age men "is not a Hungarian phenomenon, not even specific to Central and Eastern European societies. It started West of the River Elbe; in Austria, for instance, in the 1950s, although it did not persist for so long over there and did not have such tragic consequences as in Hungary." (Józan, 2002, p. 434) This can be clearly seen in Figure 4 – which displays the mortality rates among working-age men in Hungary and in Austria as a function of GDP per capita – although for Austria appropriate data are only available from 1960. Between 1960 and 1977 Austrians have a lower mortality rate than Hungarian men but the curve is essentially stable despite the growth of the economy. In Hungary, when reaching approximately the same economic indicator value 18 years later, in 1978, the mortality rate among men enters a steep upward slope, and the decline observed from 1993 still leaves it at a substantially higher level than the value recorded for Austria at a similar level of development.

*Figure 4*

**The level of development and mortality rate of working age men in Hungary and Austria (per 1000 capita)**




Józan's (2002) explanation for this phenomenon is that following World War II the years of need gave way to years of relative plenty, which especially uneducated people failed to use judiciously, i.e., they embarked on self-damaging consumption. The fact that in Austria (and most Western countries) this behaviour was less excessive and less persistent can be attributed to the openness and performance oriented nature of the market economies emerging after the War.[8] In Hungary and other Eastern European countries, the new epidemic could not be contained: "The traditional diet and for a long time the 'have a full stomach for once" syndrome, the alcoholism of the 'peace camp,' the lack of health conscious behaviour and the indulgent, abuse-tolerating ethos... are society-specific attributes." (Józan, 2002, p. 436)

[8] "A performance-oriented society is not conducive to non-health conscious behaviour: people must hold up under competitive conditions. An open society dispenses with bureaucratic control and quickly absorbs new information, including information concerning modern risk factors and health-conscious behaviour in general." (Józan, 2002, p. 437)

Analysing the mortality crisis observed in East Germany at the time of the system change, Riphahn and Zimmermann (1998) discuss the complex relationships between stress, lifestyle and mortality. The East German mortality crisis is fairly mild compared to the Hungarian situation. In terms of life expectancy, the gap between East Germany and West Germany started growing considerably later than the gap between Hungary and Austria or West Germany. The former gap is also much smaller than the latter. Table 2 displays life expectancy at birth in East Germany, West Germany, Austria and Hungary for the period from 1969 to 1995 based on the above study and on our calculations.

*Table 2*

**Life expectancy at birth in West- and East-Germany, and in Austria and Hungary between 1969 and 1995**

| Year | West germany | | East Germany | | W-E | Austria | | Hungary | | A-H |
|---|---|---|---|---|---|---|---|---|---|---|
| | Men | Women | Men | Women | Men | Men | Women | Men | Women | Men |
| 1969/71 | 67.3 | 73.6 | 68.1 | 73.3 | -0.8 | 66.5 | 73.5 | 66.6 | 72.0 | -0.1 |
| 1975/77 | 68.6 | 75.2 | 68.8 | 74.4 | -0.2 | 68.1 | 75.1 | 66.5 | 72.4 | 1.6 |
| 1980/82 | 70.2 | 76.9 | 69.0 | 74.8 | 1.2 | 69.2 | 76.4 | 65.7 | 72.9 | 3.5 |
| 1985/87 | 71.8 | 78.4 | 69.8 | 75.8 | 2 | 70.9 | 77.6 | 65.1 | 73.1 | 5.8 |
| 1988/90 | 72.6 | 79.0 | 70.0 | 76.2 | 2.6 | 72.0 | 78.6 | 65.8 | 73.9 | 6.2 |
| 1991/93 | 73.1 | 79.5 | 69.9 | 72.2 | 3.2 | 72.5 | 79.1 | 64.9 | 73.7 | 7.6 |
| 1993/95 | 73.5 | 79.8 | 70.7 | 78.2 | 2.8 | 73.1 | 79.6 | 64.6 | 73.9 | 8.5 |

Source: Riphnahn and Zimmermann (1998) and own calculations.

Table 2 clearly shows that a crisis similar to the East German mortality crisis defined by the lag – of 3.2 years – in life expectancy compared to its Western neighbour was experienced by the Hungarian population considerably earlier, in the early 1980s, relative to Austria. The gap between Hungary and its Western neighbour had trebled by 1993-95: at this stage life expectancy among men in Hungary was 8.5 years lower than life expectancy among their Austrian peers, while the corresponding gap between East and West Germans was only 2.8 years.

Riphahn and Zimmermann's analysis reveals that during the period from 1989 to 1991 the greatest increase in the absolute rate of mortality in East Germany was observed among middle-aged men. Looking at the relative changes in mortality, the greatest increase was experienced by young adult men. Seeking an explanation for this pattern, the authors come to the conclusion that the most plausible explanatory model is a psychosocial stress model. This type of model claims that exposure to stress has an impact on individuals' health. The transition from a state socialist to a market economy brought about drastic social, political and economic changes, which could have been a source of stress for individuals daily experiencing the changes. An analysis of the age and

geographical region-specific trends in the causes of mortality provides the following insights:

1. Following the unification, the incidence of alcohol-related deaths increased in East Germany and it continues to display a rising trend.
2. The main causes of increased mortality are cardiovascular diseases.
3. The increase in the incidence of fatal traffic accidents (which is also related to increased alcohol use) is an important transient phenomenon mostly responsible for deaths among young men.

A multivariate statistical analysis based on German Socioeconomic Panel data confirms the hypothesis that stress and insecurity have an effect on health outcomes: individual health satisfaction shows a strong negative correlation with financial insecurity both among men and women, although the effect is stronger for men. The effect is especially strong among middle-aged men and remains robust for both the employed and the unemployed sub-samples. The authors further find that health satisfaction declines over time and various individual-level attributes have surprisingly little effect on it.

The literature focusing on Austria shows a strong interest in analyzing the causes of the gap between male and female mortality rates. Among Western scholars, this gap, which is also present in the West, is not considered an East-European paradox. It is usually attributed to the different life styles and educational attainment, different sensitivity to the same social and employment status in the two genders present in many societies.

Schwartz (2006) analyzed cause-specific mortality differentials by education in Austria and found large educational disparities in alcohol-associated mortality, with increasing disparities between 1981 and 1991. According Schwartz et al (2008) in Austria it is not only educational attainment, but also employment status what matter in the development of alcohol problems: in 2001/2002, low skilled inactive men were 18 times more likely to die due to alcohol-related causes than high skilled economically active men.

## 3. HEALTH PRODUCTION FUNCTIONS FOR HUNGARY AND AUSTRIA DURING THE PERIOD FROM 1968 TO 2004

This section discusses the results of a macro-level health production function based on Hungarian and Austrian data. The dependent variable of the function is the mortality rates mentioned above and its explanatory variables are *lifestyle indicators* (alcohol and tobacco consumption and overwork), *long-term economic growth, health care resources* (relative number of doctors) and *labour market indicators* (unemployment).

### 3.1. ALCOHOL CONSUMPTION

In Hungary alcohol consumption per capita steeply increased from 8 litres in 1960 to 15 litres in 1986, and has slowly declined since (to 13-14 litres). In Austria, the equivalent indicator was substantially higher in the 1960s (its value increased from 11 to 16 litres) than in Hungary but a steadily declining trend has been observed since the early 1970s (from 16 to 11 litres).

Alcohol consumption is of course characterised not only by the average amount of alcoholic beverage consumed in a country but also by the type of alcohol consumed. (This became apparent in the analysis of the former Soviet republics discussed above.) Thus there are two measures to consider: first, the amount of distilled beverage consumed, since this type of alcohol is well known to be the most harmful to health; and second, the amount of non-registered alcohol consumed in a given country. Medical sources report that the latter is beyond control and the poor quality of unregistered alcohol makes it far more damaging to health than is typical of registered alcohol (Szűcs et al., 2005).

The registered consumption of distilled beverages shows very different patterns in the two countries. After the 1970s 2 or 3 times more of this type of alcohol was consumed in Hungary (6.5 litres) than in Austria (2 litres) even though in the 1960s consumption had been higher in Austria than in Hungary (3 litres). Taking into consideration that non-registered alcohol use amounts to 31% of registered consumption in Hungary but only to around 10% in Austria, the post-1970s gap is even wider. (The extent of non-registered alcohol use is discussed in Popova, Rhem, Patra and Zatonski, 2007.)

A cursory glance at the sudden rise in mortality observed after the system change in Hungary may suggest that the system change itself, the peaceful change that still came as a shock bringing rising unemployment and early retirement or disability pension on a mass scale, should carry all the blame. In what follows, it will be shown that this aspect of the system change may indeed have played a role but older, health damaging lifestyle habits must have had at least the same, if not more, contribution. Figure 5 displays mortality rates among the total Hungarian population over time broken down to causes of death.

*Figure 5*

**The development of mortality rates of the total Hungarian population over time broken down to causes of death (1960=1)**

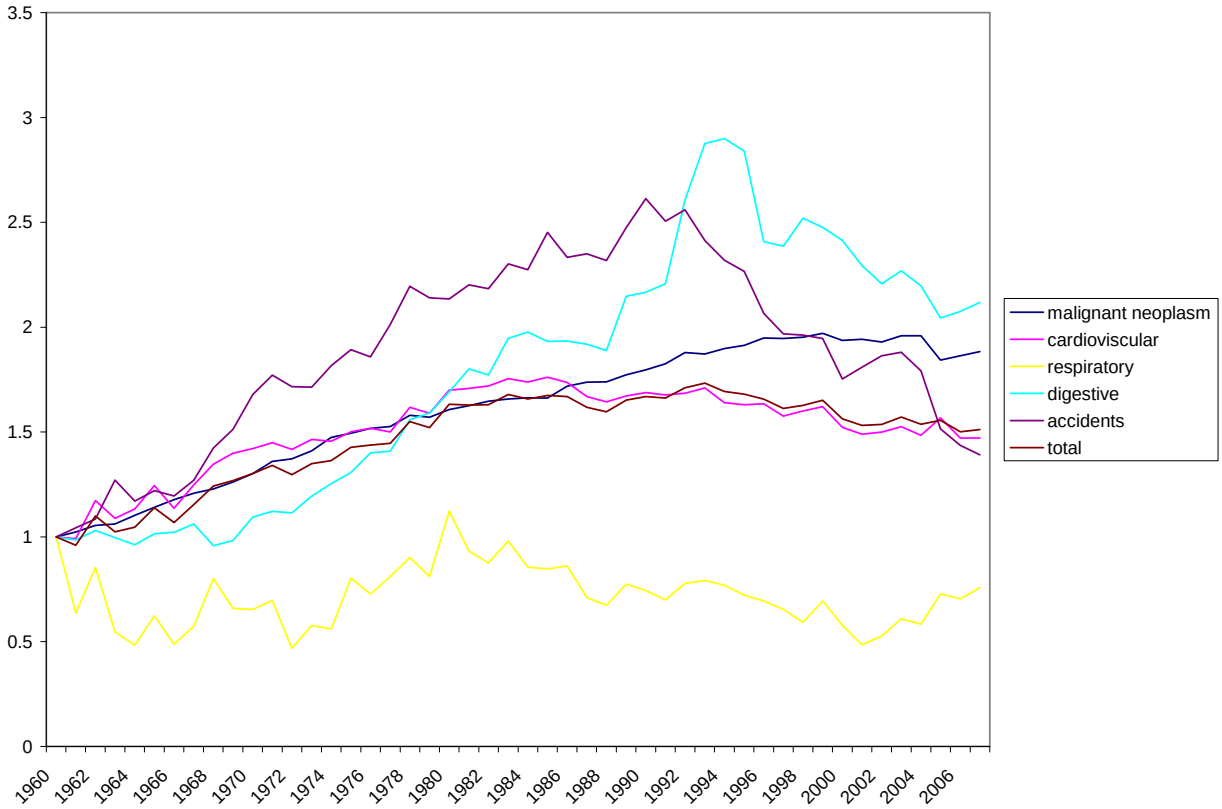



Figure 5 reveals that around the time of the system change, the steepest increase in mortality occurs for digestive system related deaths starting in 1987 and becoming even steeper in 1989. The curve enters a downward slope after 1992 but does not reach the "initial" 1989 value until 2000. As was mentioned before in connection with Ádány's (2007) work, in an international context digestive system related deaths were prominently

frequent in Hungary compared to the EU average. This cause is undoubtedly closely associated with alcohol consumption.[9]

There are two channels through which alcohol use and increased mortality may have been associated following the system change. One possibility is that the health damaging effects of (registered) alcohol consumption and especially of distilled beverage consumption had been accumulating for some time. The other trigger may have been the shock of the system change (alcohol used to relieve tension) and the increased freedom of producing and drinking non-registered distilled beverages.

All this therefore suggests that – contrary to the assumptions of the OECD (2008) report – *simultaneous relations* of indicators of alcohol consumption and mortality are unsuitable for a realistic analysis of the relationship between the two phenomena. The health damaging effects of heavy alcohol use develop over a period of several years. This claim is supported by empirical evidence reported in the international literature and also corroborated by simple correlation analyses. While the mortality rate among Hungarian working-age men is only weakly correlated with simultaneous alcohol consumption per capita (giving a correlation coefficient of 0.31), the association with alcohol consumption figures of previous years is considerably stronger. The correlation coefficients listed below show the strength of the correlation between the current mortality rate among working-age population and alcohol consumption lagged, respectively, by 1, 2 ... 8 years.

*Table 3*

**Correlations between the current mortality rate among working-age men and women and the lagged alcohol consumption**

| Lag in years | Men | Women |
|---|---|---|
| 0 | 0.28 | 0.51 |
| 1 | 0.47 | 0.59 |
| 2 | 0.60 | 0.64 |
| 3 | 0.70 | 0.69 |
| 4 | 0.78 | 0.71 |
| 5 | 0.83 | 0.71 |
| 6 | 0.87 | 0.65 |
| 7 | 0.90 | 0.62 |
| 8 | 0.92 | 0.58 |

[9] It should be noted that Figure 5 shows the mortality rate among the total population. It is also worth noting that the contribution of the individual causes of death cannot be read from the figure. The probabilities of the causes for 2007 are the following: cardiovascular 0.55, malignant neoplasm 0.27, digestive 0.07, respiratory 0.057, accidents 0.04.

## 3. 2. SMOKING

We now turn to the analysis of the other major manifestation of health-damaging behaviour: smoking. During the period under analysis, tobacco use was higher in Hungary (2,900 grams per person aged over 15) than in Austria (2,500 grams per person). Tobacco consumption began to decline in the mid-eighties, at almost exactly the same time in the two countries. During the post-system change years the decline was steeper in Hungary than in Austria during the same period. The explanation for this difference is uncertain but, given that the above data only shows registered use, it is possible that once the borders had been opened, informal and illegal tobacco trading and consumption increased, and the increase was more pronounced in Hungary than in Austria. (Data on tobacco use in Austria after 1993 is unfortunately unavailable.)

## 3.3. HIDDEN ECONOMY, OVERWORK

In addition to alcohol and tobacco consumption, the size and embeddedness of the hidden (or, in communist Hungary, the so-called second) economy also constitutes a significant lifestyle difference between Hungary and Austria. The share of the hidden economy is estimated to be persistently low in Austria (Schneider, 2000). It is estimated to be worth 1.16 per cent of the official GDP for 1965 and 9.12 per cent for 1998. There are estimates for certain periods in Hungary as well (see Lackó, 2000), but no extended time series is available; moreover for measuring the hidden economy methods used for Hungary were different from that of the Austrian estimation. Schneider (2004) puts the share of the hidden economy in Hungary at around 25% of the official GDP for 1998, which is two and a half times greater than the corresponding Austrian figure. In Hungary "one of the basic tenets of the sociological studies of the 1970s and 80s was that families tried to procure extra income through the extensive exploitation of human resources – at the expense of relaxation and leisure activities – and this excessive physical and mental effort had a substantial adverse effect on population health" (Lehman and Polónyi, 1998, p. 306).[10]

[10] The most comrehensive analyses of the second economy in communist Hungary are provided by Galasi and Gábor R. (1981), Galasi and Szirácz ki (1985) and Gábor R. (1989), while the post-system change transformation of the second economy is discussed by Sík (1992, 1996). Éva Orosz's (1994) study specifically focuses on the health damaging effects of the extra hours of work performed in the second economy of Hungary.

Kopp (2007) agrees that in Hungary the "New Economic Mechanism" of 1968 led to the emergence of a second and third economy opening the way for people to take up a second and third job in addition to their main employment. This was mostly typical of men having relatively low status, low educational attainment and low income. Kopp (2007) argues that especially the cardiovascular mortality rate among men was affected by this heavy extra workload. Józan (1986) and Klinger (1987) show that the widest gap between the mortality rates among blue-collar vs. white-collar workers in the 1980s was observed for cirrhosis of the liver, suicide and lung cancer, which reflected blue-collar workers behavioural response to contemporary social conditions.

The second and third economies continued to operate during the post-system change period but with the pronounced increase in unemployment many workers lost their first, and main, job (Sík, 1992). This may have shifted health status in either direction. On the one hand, it may have improved health if the lost job had involved a health hazard but, on the other hand, it may have damaged health if the stress suffered as a result of the loss of the job was relieved by increased alcohol consumption or if the workload in the jobs inherited from the pre-system change second and third economies further increased.

Overwork could also have been a consequence of the leap in the inflation rate coinciding with the sudden surge in unemployment. In Hungary the Consumer Price Index had started rising as early as the 1970s and 80s, which, together with the distorted structure of the pricing system (shortage and high price of homes, cars and household appliances in contrast with the comparatively low prices of food, alcoholic beverages and tobacco products), forced people into overwork. In his study on the economic position of Hungarian households, Sík (1992) shows that consumption reduction, compensation for lost income by self-performing jobs around the home and extra employment are "natural" – i.e., the foremost and widespread – behavioural responses to inflation. In Hungary the stress induced by overwork was alleviated relatively "inexpensively" through alcohol use and smoking. That is, overwork together with "inexpensive access" to health damaging behaviour could have played a major role in the decline of population health from 1968 onwards.[11]

[11] There is disagreement in the literature over the question of whether the relatively low price of harmful recreational substances (alcohol, tobacco, etc.) leads to increased consumption and thus to health damage. Treismann (2008) and Mihályi (2009) contend that the relatively low price of alcoholic beverages and cigarettes plays a major role in health decline, which is reflected in the increasing mortality rates. Denisova (2009), in contrast, comes to the opposite conclusion based on data displaying a weak *positive* association between the relative price of alcoholic beverages (vodka) and the risk of mortality. The explanation offered by the author for this surprising finding is that a higher official vodka price is accompanied by increased informal market activity and it is the ghastly, health damaging quality of vodka obtained in the informal market that raises the mortality rate.

Since no extended time series is available on the extent of the extra workload of working in the second or hidden economy, as a rough approximation the changes relative to the Consumer Price Index of 1960 will be taken as a proxy for this phenomenon. This rough approximation is justified not only by Sík's (1992) microanalyses of Hungarian data but also by the international literature on the hidden economy: see Fishlow and Friedman (1994), Madzaveric and Mikulic (1999), Campos (2000) and Madzarevic-Sujster (2002).

### 3. 4. LEVEL OF DEVELOPMENT AND HEALTH CARE SPENDING

According to the theory and international empirical evidences we expect a negative correlation between long-term economic growth and mortality rate. This pattern can be clearly seen in Austria but the picture emerging for Hungary is far from being so straightforward. Up until the mid eighties the growth rate of GDP per capita relative to its level in 1960 runs in parallel with the adult male mortality curve, at which point the two curves depart from each other showing a clearly negative relationship.

Unfortunately no long-term time series data are available on health care spending for Hungary. Our analysis must therefore rely on a natural indicator, the number of doctors per 1000 people. Looking at the relative numbers of doctors, the ratio was lower in Austria than in Hungary for a long time (from the starting point of the analysis in 1960 until 2000).

### 3. 5. UNEMPLOYMENT

The association between health and unemployment has been under professional scrutiny in the literature for several decades. The cause-and-effect relationship between health and unemployment is far from being unequivocal. On the one hand, unemployment as a source of stress and the termination of personal social relationships may lead to increased alcohol consumption and, in turn, to adverse health outcomes. On the other hand, unemployment may be accompanied by an improvement in health if the jobs that need to go are effectively hazardous to health. The relationship will also have a positive sign if the workers affected by the lay-offs have suffered from ill health. Researchers looking at developed market economies seem to be reaching a consensus that unemployment has a stronger (negative) effect on health than ill health has on unemployment rates (Jin, Shah and Svoboda, 1995).

In Hungary, as well as in other Eastern European countries, unemployment was a new phenomenon after the system change, and there can be little doubt that the shock it produced had an adverse effect on population health. We have also seen, however, that at the time of the system change the mortality rate among working-age Hungarian adults (especially among men) was already exceptionally high, which means that the route from health decline to unemployment is also a plausible option. The two effects have the same sign, however: a higher unemployment rate is associated with poorer health.

## 4. HEALTH PRODUCTION FUNCTIONS

In Section 4 we went into some detail concerning all of the explanatory variables required for a health production function intended to characterise mortality rates in Hungary and in Austria. The direct effects of income inequality and education cannot be taken into account as we lack long-term time series data on these variables. However, the indirect effects of income inequality and education can be captured through lifestyle factors (alcohol and tobacco consumption and overwork) and labour market status (unemployment).[12]

The health production function computed for the present study therefore departs in a number of ways from the OECD's (2008) previously discussed panel estimation function covering the OECD countries:

1. The dependent variable is not life expectancy for the total population but the mortality rate among the 15-60 year-old population.
2. The direct impact of education cannot be assessed due to lack of data.
3. Diet as a lifestyle factor is not included as an independent variable. Eating habits are instead expected to be reflected in the lifestyle variables of alcohol and tobacco consumption on the assumption that heavy drinking and smoking tend to be coupled with a disregard for health-conscious eating behaviour.

[12] At the micro-level, the association between educational attainment and health is explored by Tahin, Jeges and Lampek (1997, 2000) using Hungarian data. The authors' analysis provides strong evidence for Ross and Wu's (1995) model claiming that the effect of educational attainment on health outcomes is mainly indirect, mediated by factors such as working and economic conditions, psycho-social resources and lifestyle. In their study of the effects of gender, age, educational attainment and economic activity on mortality rates, Bakacs et al. (2008) analyse regional Hungarian data from the first few years of the 21st century. The results reveal strong effects for each of these factors in isolation and also for their interactions. An analysis of British data by Clark and Roger (2008), however, challenges the hypothesis that education in itself has a strong impact on health outcomes in developed countries with a high share of educated people. Pokas and Soukiazis's (2010) health production functions are corrected for endogeneity in economic development, education and health status and their results show a positive health effect of education among women only.

4. The environmental factor captured in the OECD study through nitrogen oxide emission per capita is not included in the current model due to lack of data.

5. Given some features specific to Hungary and other East European countries, our model incorporates increases in the Consumer Price Index characteristic of the communist regime and, especially, of the transition period. A CPI increase is taken to be a proxy for the second economy of the communist era and the hidden economy of the transitional period. Everyday experiences and sociological surveys converge in that a substantial share of the population compensated for the adverse effects of the rise in consumer prices by working more. Consumer price increase is added to the model from 1960 onwards and it is defined relative to the CPI in 1960 (1960 = 100), which is meant to capture the intuition that the effects of overwork cumulate over time, and this bears upon health outcomes. It should be noted that overwork is not the only channel through which the proxy for the hidden economy affects health: consumption of the "classic" product of the hidden economy (non-registered alcohol) also has its contribution. As was mentioned before, non-registered alcohol use is estimated to amount to about 30% of registered alcohol consumption in Hungary in the early 1990s.

6. Experiences of Hungary also suggest that the health damaging effects of alcohol cannot be accurately derived from the current indicator value of alcohol use, since the effect is not immediate but accumulates over long periods of time. For this reason, the value of alcohol consumption is calculated by averaging the values of the 8 years preceding the measurement time of the dependent variable (mortality rate).[13]

7. The effects of unemployment, for an individual one of the most significant negative consequences of the system change, are taken into account.

The Health Production Function is therefore defined as follows:

$$\ln M_t = a + b \times \ln ALK_{t9} + c \times \ln DOH_t + d \times \ln GDP_t + e \times \ln ORV_t + f \times \ln INL60_t + g \times MN_t + hiba_t$$

where $b>0$, $c>0$, $d<0$, $e<0$, $f>0$, $g>0$.

$t=1968,\ldots\ldots\ldots 2004,$

$M_t$: mortality rate per 1000 adult (male and female population aging between 15 and 60 years)*

$ALK_{t9}$: moving average of pure alcohol consumption per capita in liter (lagged by 8 years)**

$DOH_t$: tobacco consumption per capita in grams (among population older than 15 years)**

$GDP_t$ : GDP per capita, PPP constant 2005 dollar*

[13] The cumulation of lagged values may also be justified for smoking but this effect was found not to be statistically significant. We should presumably go further back in time but our time series does not allow a more extended analysis.

$ORV_t$: the number of doctors per 1000 capita**

$INL60_t$: the changes of the consumer prices, 1960=100*

$MN_t$: unemployment rate*

Sources: * World Development Indicators, 2008

** OECD Health Data, 2009

The function was first estimated using the data for Hungary. With the exception of unemployment rate, the variables were converted to a natural logarithmic scale (ln). The function was estimated using the Prais-Winsten regression, which relies on the generalised least squares estimation while assuming that the errors follow a first-order autoregressive process. Although the explanatory variables cannot be broken down to genders, health production functions will also be estimated separately for men and women. Let us first look at the mortality rate among the total 15-60 year-old population.

*Table 4*

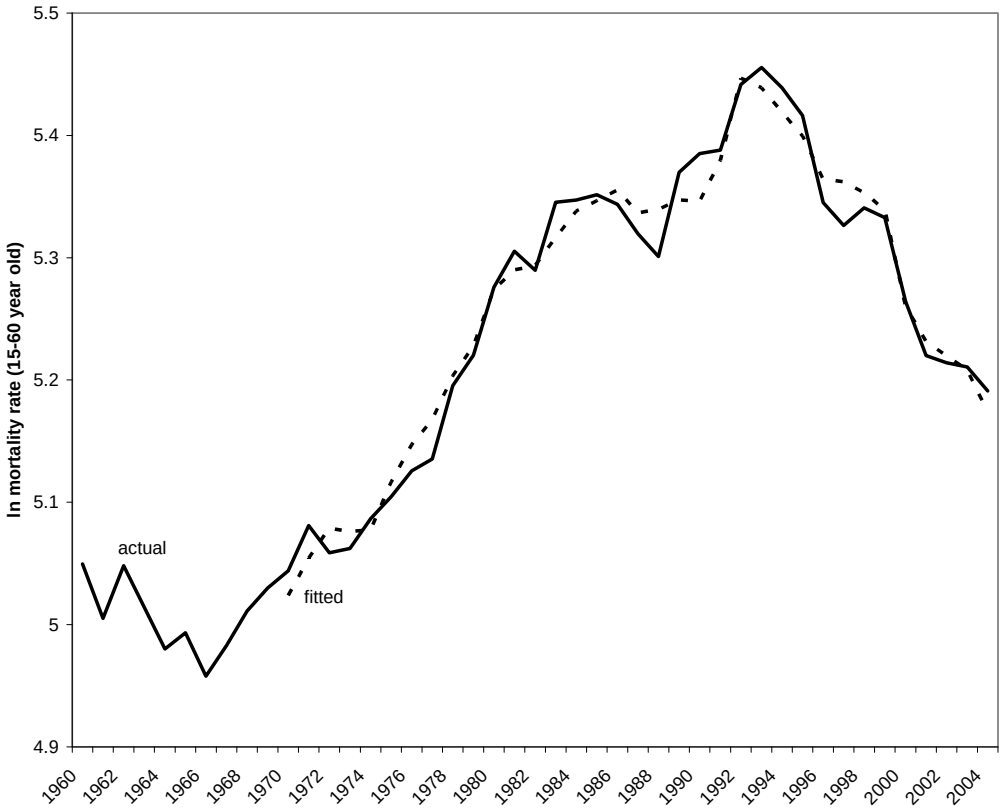
**Regression results for the mortality rate among the total 15-60 year-old population in Hungary**

| | [1a] | [1b] | [2a] | [2b] | [3a] | [3b] |
|---|---|---|---|---|---|---|
| Dependent v. lnMORT | Coefficient | Stand. C. | Coefficient | Stand. C. | Coefficient | Stand. C. |
| lnALK | | | | | 0.1 | 0.12 |
| | | | | | [0.57] | |
| lnALK9 | 1.01** | 0.89 | | | | |
| | [14.77] | | | | | |
| lnSPIRIT9 | | | 0.49** | 0.98 | | |
| | | | [18.13] | | | |
| lnDOH | 0.35** | 0.46 | 0.44** | 0.57 | 0.38** | 0.49 |
| | [4.46] | | [6.4] | | [3.90] | |
| lnGDP | -0.39** | -0.55 | -0.44** | -0.62 | -0.08 | -0.11 |
| | [-5.96] | | [ -8.1] | | [-0.88] | |
| lnORV | -0.08 | -0.11 | -0.23* | -0.32 | 0.17 | 0.23 |
| | [-0.58] | | [-1.9] | | [0.52] | |
| lnINFL60 | 0.09** | 0.8 | 0.14** | 1.31 | 0.04 | 0.38 |
| | [4.66] | | [8.1] | | [0.88] | |
| MN | 0.01** | 0.26 | 0.01** | 0.26 | 0.012** | 0.32 |
| | [4.07] | | [4.9] | | [4.32] | |
| konstans | 3.1** | | 4.48** | | 2.29** | |
| | [4.54] | | [8.1] | | [2.18] | |
| rho | 0.34 | | | | 0.97 | |
| DW original | 1.34 | | 1.71 | | 0.71 | |
| DW transformed | 1.74 | | | | 1.51 | |
| Number of observations | 35 | | 35 | | 35 | |
| $R^2$ | 0.994 | | 0.98 | | 0.98 | |
| RMSE | 0.0195 | | 0.019 | | 0.0283 | |
| Method | AR(1)* | | OLS | | AR(1) | |
| * Prais-Winsten AR(1) | | | | | | |
| RESET test | | | 0.13 | | | |

In Table 4 the parameters of the explanatory variables of the regression function show the expected signs (positive or negative), and the relative number of doctors is a statistically significant explanatory variable in one case (Column 2a). The parameters shown in Column 1a reveal that, *ceteris paribus*, mortality rate is increased by alcohol consumption over the previous 8 years, smoking, extra work (and/or non-registered alcohol and tobacco consumption) related to the second and hidden economies as measured by CPI increases and unemployment, while it decreases with economic growth (GDP per capita). The standardised coefficients (Columns 1b, 2b and 3b) indicate the weights of the individual explanatory variables. The figures reveal that the two most important explanatory variables for the mortality of 15-60 year-olds are cumulative lagged alcohol consumption and overwork as represented by relative CPI. Further non-negligible results are the mortality increasing effect of smoking and the mortality reducing effect of standard of living as represented by GDP per capita. The fit of the regression function is shown in Figure 6.

*Figure 6*

**Natural logarithm of the actual mortality rate for working age population and the fitted values by function (1a) for Hungary**

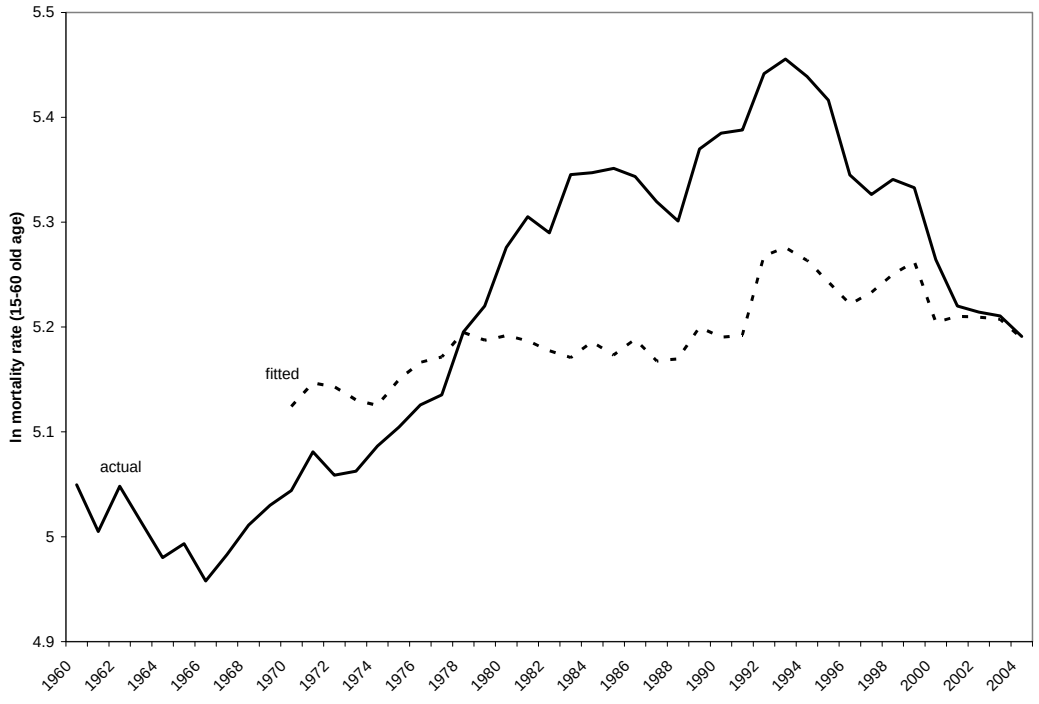


Column (2a) shows the results of the regression function where the ALC9 variable is replaced by the SPIRIT9 variable, i.e., an indicator of distilled beverage consumption is substituted for the general indicator of alcohol consumption (covering all types of alcohol). This function also has a good fit, the error value remains 0.019. Compared to the previous model, the mortality increasing effect of smoking is slightly higher in this function, and the same observation can be made for the cumulative increase in CPI. At the same time, the relative number of doctors has a statistically significant beneficial effect of reducing death rate among the adult Hungarian population. (This function was estimated using OLS regression, as the rho parameter of autoregressivity proved to be very small in the Prais-Winsten estimation.) A Ramsey RESET test confirms that the function is well specified and the DW value is within the desired range.

Column (3a) displays the results of a health production function in which lagged alcohol consumption is replaced by non-lagged or simultaneous alcohol use, which is the indicator used by the OECD (2008) panel regression discussed above. The results support our conjecture that this assumption introduces significant distortion into the model: to what extent mortality is underestimated by this function can be clearly seen in Figure 7.

*Figure 7*

**Natural logarithm of the actual mortality rate for working age population and the fitted values by function (3a) for Hungary**



The underestimation of mortality rate due to this assumption is equivalent to an overestimation of life expectancy. This may be the reason for the exceptionally high absolute value and negative sign assigned to the country-specific effect by the OECD (2008) health production function, where life expectancy is the dependent variable. We are therefore convinced that the strikingly poor efficiency of the Hungarian health care system suggested by the OECD study is simply a consequence of misspecification: if the OECD function took into account the adverse effects of alcohol consumption starting with the relatively distant past, the "efficiency indicators" would turn out to be quite different.

Table 5 displays the Hungarian results of the health production functions by gender. Although the explanatory variables cannot be split by gender, the results remain instructive.

*Table 5*

**Regression results for the mortality rate among the 15-60 year-old men and women in Hungary**

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | [1a] | [1b] | [2a] | [2b] | [3a] | [3b] | [3a] | [3b] |
| Dependent v. lnMORT | Coefficient | Stand. C. | Coefficient | Stand. C. | Coefficient | Stand. C. | Coefficient | Stand. C. |
| lnALK9 | 1.21** | 0.8 | | | 0.60** | 1.08 | | |
| | [13.99] | | | | [11.7] | | | |
| lnSPIRIT9 | | | 0.57** | 0.86 | | | 0.29** | 1.18 |
| | | | [14.39] | | | | [14.61] | |
| lnDOH | 0.37** | 0.36 | 0.47** | 0.46 | 0.31** | 0.83 | 0.37** | 0.99 |
| | [4.15] | | [5.75] | | [4.21] | | [5.50] | |
| lnGDP | -0.45** | -0.47 | -0.49 | -0.52 | -0.25** | -0.73 | -0.27** | -0.79 |
| | [-5.53] | | [-6.10] | | [-5.12] | | [-6.72] | |
| lnORV | -0.13 | -0.13 | -0.2 | -0.21 | 0.01 | 0.02 | -0.09 | -0.25 |
| | [-0.75] | | [-1.28] | | [0.07] | | [-0.98] | |
| lnINFL60 | 0.12** | 0.82 | 0.17** | 1.2 | 0.018 | 0.33 | 0.05** | 0.97 |
| | [4.88] | | [7.32] | | [1.20] | | [3.68] | |
| MN | 0.01** | 0.2 | 0.01** | 0.21 | 0.01** | 0.49 | 0.01** | 0.51 |
| | [3.70] | | [3.44] | | [4.11] | | [5.84] | |
| constant | 3.17** | | 4.68** | | 3.07** | | 3.75** | |
| | [4.07] | | [6.03] | | [4.44] | | [6.42] | |
| rho | 0.4 | | 0.3 | | | | -0.21 | |
| DW original | 1.25 | | 1.53 | | 1.87 | | 2.34 | |
| DW transformed | 1.63 | | 1.75 | | | | 1.98 | |
| Number of observations | 35 | | 35 | | 35 | | 35 | |
| $R^2$ | 0.994 | | 0.992 | | 0.96 | | 0.996 | |
| RMSE | 0.023 | | 0.022 | | 0.016 | | 0.015 | |
| Method | AR(1) | | AR(1) | | OLS | | AR(1) | |

1. The effect of alcohol or distilled beverage consumption is twice as strong for men as it is for women.

2. The effect of smoking is roughly the same for the two populations.

3. The relative number of doctors does not have a statistically significant effect on mortality rate for either men or women.

4. There is no difference between the genders in terms of the impact of unemployment.

5. The most interesting difference emerges in the adverse health effect of cumulative CPI increase as a proxy for overwork. Overwork has an especially strong effect on male morbidity and, thus, on the mortality rate among men, substantially stronger than for women. This result is undoubtedly related to the fact that men were considerably more likely to participate in the second economy and in the post-system change hidden economy; as a rule, they have the task of securing the extra income needed by the family.

Tables 6 display the results of the health production functions for Austria, i.e., the estimations of mortality rates among working-age men and women.

*Table 6*

**Regression results for the mortality rate among the 15-60 year-old men and women in Austria**

| | Men | | | | | | | Women | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Dependent v. lnMORT | [1] | [2] | [3] | [4] | [4b] | [5] | [6] | [7] | [8] | [8b] |
| lnALK | -0.12 | 0 | | | | | | | | |
| | [-1.42] | [0.00] | | | | | | | | |
| lnALK9 | | | 0.46** | 0.51** | 0.33 | | | 0.42** | 0.39** | 0.14 |
| | | | [3.11] | [3.79] | | | | [2.52] | [2.11] | |
| lnSPIRIT9 | | | | | | 0.05 | 0.09 | | | |
| | | | | | | [0.47 | [0.78] | | | |
| lnDOH | 0.44** | 0.41** | 0.46** | 0.46** | 0.27 | 0.47** | 0.47** | 0.17 | 0.02 | 0.01 |
| | [3.77] | [2.52] | [2.89] | [3.67] | | [2.18] | [2.51] | [0.83] | [0.18] | |
| lnGDP | -0.17 | -0.07 | -0.47** | -0.36** | -0.63 | -0.28* | -0.09 | -0.30** | -0.51** | -0.84 |
| | [-1.19] | [-0.78] | [-3.19] | [-3.22] | | [-1.80] | [-0.93] | [-2.00] | [-3.80] | |
| lnORV | -0.35** | -0.48** | -0.01 | -0.05 | -0.08 | -0.32* | -0.39** | -0.03 | -0.14 | -0.2 |
| | [-4.43] | [-3.41] | [-0.05] | [-0.27] | | [-1.67] | [-2.01] | [-0.15] | [-0.75] | |
| lnINFL60 | 0.017 | | 0.08 | | | 0.11 | | -0.13 | | |
| | [0.20] | | [0.79] | | | [1.11] | | [-1.56] | | |
| MN | | 0.022* | | 0.019** | 0.18 | | 0.21* | | 0.005 | 0.02 |
| | | [1.63] | | [2.19] | | | [1.99] | | [0.43] | |
| constant | 3.84** | 2.87** | 4.58** | 3.10** | | 3.78** | 2.51** | 5.80** | 8.47** | |
| | [5.20] | [2.81] | [3.10] | [5.07] | | [2.00] | [2.10] | [4.54] | [11.27] | |
| rho | 0.39 | 0.22 | 0.23 | | | 0.29 | 0.19 | 0.33 | 0.24 | |
| DW original | 1.52 | 1.62 | 1.75 | 1.83 | | 1.52 | 1.66 | 1.5 | 1.63 | |
| DW transformed | 2.02 | 1.97 | 2.02 | | | 1.98 | 1.94 | 1.75 | 1.89 | |
| Number of observations | 34 | 25 | 26 | 25 | | 26 | 25 | 26 | 25 | |
| $R^2$ | 0.997 | 0.993 | 0.995 | 0.975 | | 0.994 | 0.992 | 0.995 | 0.994 | |
| RMSE | 0.002 | 0.021 | 0.0197 | 0.0191 | | 0.022 | 0.021 | 0.0239 | 0.0023 | |
| Method | AR(1) | AR(1) | AR(1) | OLS | | AR(1) | AR(1) | AR(1) | AR(1) | |
| Prais-Winsten AR(1) | | | | | | | | | | |
| [4b] [8b] standard. coef. | | | | | | | | | | |

For Austrian men, the factors increasing mortality are the 8-year alcohol consumption, smoking and unemployment, while the standard of living has the opposite effect. For Austrian women, neither smoking nor unemployment has a significant impact and the effect of cumulative alcohol consumption is smaller than it is for men. These macro-effects observed for Austria are in accord with the results of analyses based on micro-data (population interviews) (Österreichische Gesundheitsbefragung 2006/2007).

The results of the Austrian models can be compared to their Hungarian counterparts. As in the case of the Austrian data there is a strong positive correlation between unemployment rate and the values of CPI increase relative to 1960, the two variables are added to the health production function separately.

1. Mortality rates among adult Austrian men and women are less strongly affected by current and past alcohol consumption. The coefficient of the impact of alcohol consumption on Hungarian male mortality is almost three times that of the Austrian value. The association between mortality and alcohol is weaker for Austrian women than either for Austrian men or for Hungarian women.
2. Tobacco consumption has a slightly stronger effect on mortality among Austrian than among Hungarian men but the effect fails to reach significance for Austrian women.
3. For Austria, the relative number of doctors is not significant for the functions including all alcohol use but produces a significant negative coefficient in the models taking distilled beverage consumption into account.
4. CPI increase, which is taken to be a proxy for overwork in the hidden economy, has no significant impact on mortality rates either among men or women in Austria. In Hungary, by contrast, this is a major explanatory variable, especially for men.
5. Unemployment rate does not appear to increase mortality among Austrian women but it does have a significant adverse effect for men. In Hungary, the effect is statistically significant not only for men but also for women.
6. Simultaneous alcohol consumption fails to show a significant effect on mortality rates among Austrian men just as it does in the Hungarian analysis. This finding casts doubt on the correctness of the assumption used by the OECD (2008) panel regression not only for Hungary, but for all the countries in the sample: simultaneous alcohol consumption is not a good proxy variable for past alcohol consumption habits.

Figures 8 and 9 compare the actual and the estimated mortality rate curves for working-age men and women in Austria (based on Functions [4] and [8]).

*Figure 8*

**Natural logarithm of the actual mortality rate for working age men and the fitted values by function (4) for Austria**

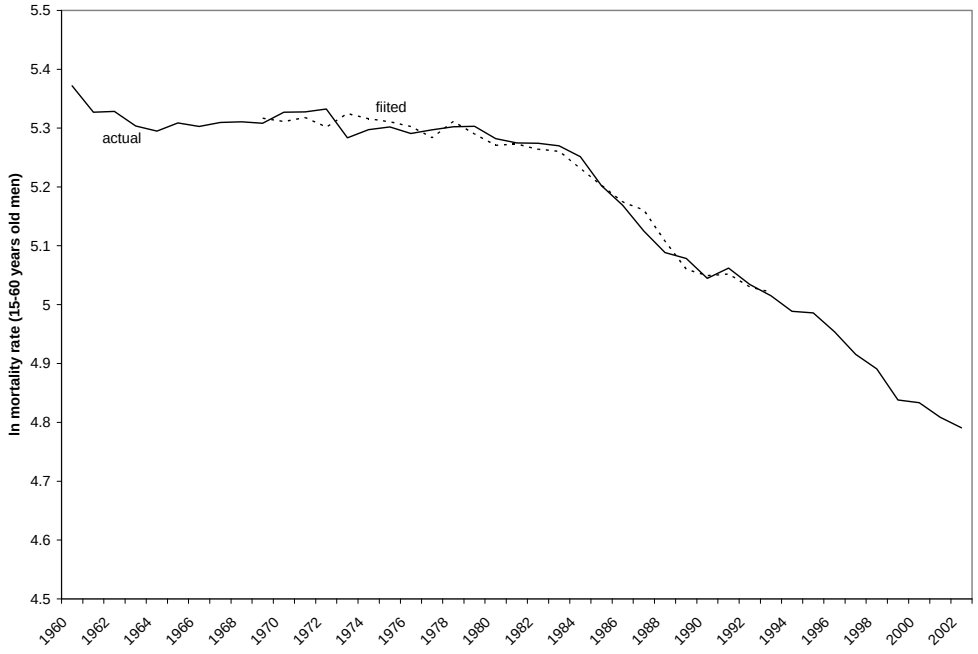
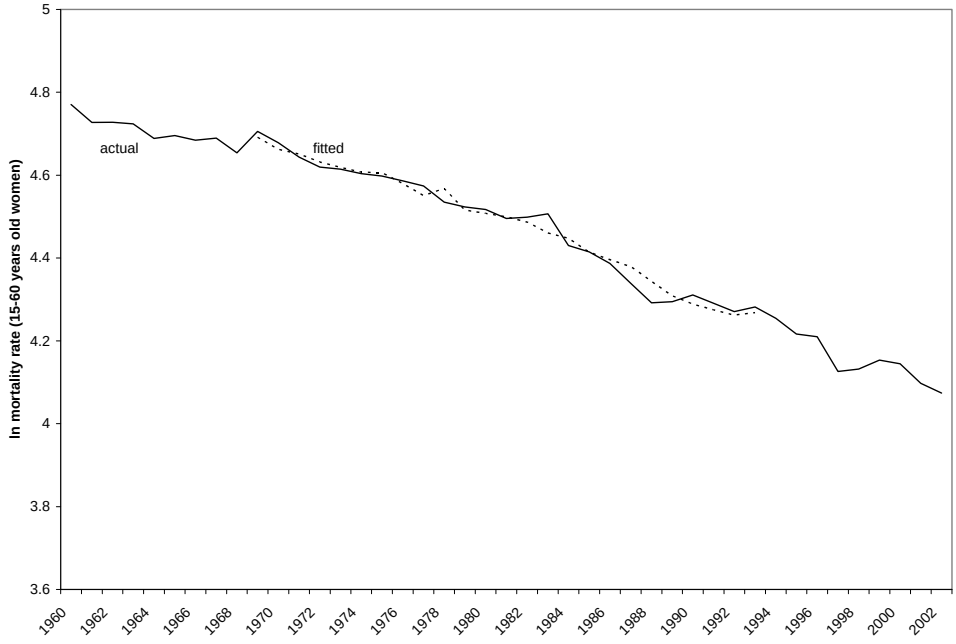



*Figure 9*

**Natural logarithm of the actual mortality rate for working age women and the fitted values by function (8) for Austria**



## 5. SUMMARY

In Hungary the health status of working-age men is strikingly poor in comparison with both highly developed market economies and the neighbouring countries.

The present study used Health Production Functions relying on data from the period between 1960 and 2004 to explore population health in Hungary and Austria at the macro-level and to compare the two countries. The justification for the comparison of the two countries is their geographical proximity and their shared distant past. The mortality rate among the working-age (15-60 year-old) adult population was taken as a proxy for health status. This indicator places the two countries at the same level in the 1960s but the two curves show substantial divergence from the early 1970s onwards. The following variables were considered as explanatory factors for the mortality rate of working-age adults: lifestyle indicators (alcohol and tobacco consumption and extra work in the "second" or the "hidden" economy), standard of living (GDP per capita), health care resources (the relative number of doctors) and a labour market indicator (unemployment). The health production function regression models offer a close approximation to the processes that took place in real life for both of the countries.

The results reveal that the exceptionally poor health status characterising the adult male population of Hungary and its steep decline observed from the late 1960s onwards can primarily be explained by lifestyle factors: high levels of prolonged alcohol consumption, especially distilled beverage consumption, heavy smoking and widespread self-exploitative excess work (in the second and, later, the hidden economy). Following the system change, up until 1993 the extensive hidden economy together with rapidly growing unemployment played a major role in the further deterioration of health among men. These two factors override the potential health improving effects of the past 25 years' gradually declining trends in (registered) alcohol consumption and smoking. Although from 1993 some improvement can be observed, in 2004 the probability of a 15 year-old young men not living to be 60 is still twice as high in Hungary as it is in Austria. At the macro-level, our models do not show adverse health effects for distilled alcohol consumption or overwork in Austria, since these lifestyle-related behaviours are far less widespread in that country and the higher level of economic development also plays a role in the health advantage of the Austrian population.

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