Exploring the conditions for a mortality crisis: Bringing context back into the debate

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Abstract

This study engages with the debate over the mortality crises in the former Soviet Union and Central and Eastern Europe by 1) considering at length and as complementary to each other the two most prominent explanations for the post-communist mortality crisis, stress and alcohol consumption; 2) emphasizing the importance of context by exploiting systematic similarities and differences across the region. Differential mortality trajectories reveal three country groups that cluster both spatially and in terms of economic transition experiences. The first group are the countries furthest west in which mortality rates increased minimally after the transition began. The second group experienced a severe increase in mortality rates in the early 1990s, but recovered previous levels within a few years. These countries are located peripherally to Russia and its nearest neighbours. The final group consists of countries that experienced two mortality increases or in which mortality levels had not recovered to pre-transition levels well into the 21st century. Cross-sectional time-series data analyses of men's and women's age and cause-specific death rates reveal that the clustering of these countries and their mortality trajectories can be partially explained by the economic context, which is argued to be linked to stress and alcohol consumption. Above and beyond many basic differences in the country groups that are held constant—including geographically and historically shared cultural, lifestyle and social characteristics—poor economic conditions account for a remarkably consistent share of excess age-specific and cause-specific deaths.

Key words: mortality, alcohol consumption, stress, post-communist, health behaviour, economic context

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I. Introduction

Much research on the mortality crises during market reform in the post-socialist region fall along two separate lines of investigation. The two explanations revolve around the contribution of stress and alcohol consumption to increased mortality. Scholarly interpretations of research findings tend to either emphasize the consequences of economic instability for health or attribute the mortality crisis to lifestyle choices and the remnants of Soviet cultural norms. This paper explores the extent to which the two main explanations of stress and alcohol consumption can be integrated and considered together rather than as disparate explanations, providing a more comprehensive explanation of the mortality crisis.

I approach this challenge by first highlighting shortcomings in the literature and emphasizing the areas of research in which a convergence of the two explanations has furthered the debate. Second, I consider meaningful empirical differences in mortality rates during the transition from communism as well as demonstrate the way in which these differences appear related to the economic context. I identify three groups of countries in which similar mortality profiles emerge; geographical clusters are evident and a general worsening of health occurs moving eastward. Statistical analysis is then used to confirm systematic differences among these three regions as well as identify contextual factors that may account for the differences. Focusing particularly on causes of death that may be alcohol-related, this paper contributes to the current debate by comprehensively taking stock of the interpretations given to various empirical findings and explicitly assessing how they may fit together. Moreover, this analysis focuses equally on men and women, in contrast to the great majority of research, and discusses results and interpretations in light of differences and similarities that emerge for men and women. Before addressing the literature, I first sketch the history of the debate over the post-communist mortality crisis to highlight a temporal shift in interpretations of evidence and discuss why this shift may have taken place and why a reframing of the debate is necessary.

At risk of over-simplification, two interpretations of the mortality crisis have dominated the literature at different times. The first interpretation, with a focus on context and structural dynamics, was prominent after the mortality crisis began until the early 2000s: In 1998, Shkolnikov, Cornia, Leon and Meslé published a research summary in which “psychological stress caused by the shock of an abrupt and severe economic transition is likely to have played a major role mediated by the adverse health effects of excessive alcohol consumption” (p. 1995). Six years later, Shkolnikov, Andreev, Leon, McKee, Meslé and Vallin (2004) summarized the current state of the literature and argued that alcohol consumption was a key element in the mortality crisis and that psychological stress was a factor that originated before the transition and was created in the communist environment. Their conclusions regarding the role of stress originating from economic transition were inconclusive, suggesting that there was not enough direct evidence to link stress to increased death. In regards to stress being an indirect factor leading to alcohol consumption, they cast doubt on research that has attempted to link these two elements for reasons of endogeneity; the individual-level relationship between alcohol consumption and economic circumstances can operate in both directions. Therefore, if one were to assess the state of the debate through this seminal article, health behaviour and excessive alcohol consumption is the leading cause of the mortality crisis and this harmful alcohol

consumption during the crisis was attributed to poor health lifestyles and stress rooted in the previous Soviet society.

This summary of the current status of the debate presents the two explanations as competing rather than complementary. However, the latter explanation may simply have taken precedence due to reservations based on the lack of tools and data to assess the validity of the economic argument with methodological rigor. Bobak and Marmot (2009) attribute the difficulty in substantiating the social contributions to the mortality crisis to problems with measurement and confounding factors. Moreover, a lack of rich data covering multiple years has eroded the possibility of establishing psychosocial stress as a causal mechanism. Therefore, the economic context explanation lies somewhat in ambiguity in published literature, while evidence of harmful alcohol consumption in the region has mounted. Particularly, several methodological innovations in the debate—in which the scope of investigation has been narrowed to smaller geographical areas and research designs often include case controls—have made it possible to more directly test the role of alcohol consumption (e.g., the Izhevsk Family Study: Tomkins *et al.,* 2006; the Novosibirsk study: Malyutina *et al.,* 2002; and the Udmurt Republic study: Shkolnikov *et al.,* 2004b).

However, without continued investigation into societal variation, these micro-level analyses limit findings to the individual level, thus obscuring contextual contributions. An important analytic distinction exists between finding the unemployed to be more prone to death than the employed due to excessive alcohol consumption and the finding that alcohol-related mortality increases when unemployment increases. I argue that this difference matters, particularly given the vital role this research can play in policy-making. Indeed, policy recommendations from the World Bank's Human Development Report (2005), "Dying Too Young: Addressing Premature Mortality and Ill Health Due to Non-Communicable Diseases and Injuries in the Russian Federation", advocate increased effort on the part of the Russian government to change the lifestyle behaviours of Russians. Specifically, they encourage control of alcohol and tobacco, changes in diet and promotion of physical activity, along with interventions for preventing road traffic injuries. While these positive recommendations are a response to prominent scholarly research, they may overlook other important contributors to increased mortality: the reaction of individuals to a highly unstable economic environment, including increased stress and alcohol consumption. The aim of this paper is to explore whether contextual conditions add an important interpretative lens that is missing from current research.

II. Mortality research

Research specifically on the mortality crises in the formerly socialist states undertaken in the 1990s generally agreed that smoking, environmental causes, poor nutrition, deterioration of the health care system, and cohort effects were, at best, only partial explanations of increased mortality rates in the post-communist region (e.g., Leon & Shkolnikov, 1998; Cornia & Paniccià, 2000; Notzon *et al.*, 1998). By now, many of these early explanations have been discarded[1] and the two explanations on stress and

[1] Specifically, Shkolnikov *et al.* (1998), Cornia and Paniccià (2000), Shkolnikov *et al.* (2004) and Stillman (2006) offer detailed guides to this research and highlight the hypotheses that have passed empirical examination.

alcohol occupy the mainstream debate. Bobak and Marmot (2009) describe these two explanations as representing the biomedical and social dimensions of mortality. First, I give an overview of alcohol-related research, followed by an overview of stress-related research.

The contribution of alcohol consumption to increased mortality in the post-socialist context has been presented in a number of studies. Alcohol consumption has been linked to mortality through alcohol poisoning, accidental death, homicide and suicide, as well as cardiovascular death (Chenet *et al.*, 1998; Leon *et al.*, 2007; Pridemore, 2004; Stickley *et al.*, 2007; Shkolnikov *et al.*, 2004b; Mäkinen, 2000). Although alcohol consumption fell to levels lower than found in Europe in the predominantly Muslim Central Asian Republics and Azerbaijan (TransMonee data), and these countries also experienced a mortality crisis, recent research found that ethnic Russians carried the burden of mortality increases in Kyrgyzstan (Guillot *et al.*, 2006), as well as in Estonia (Leinsalu, 2006). Therefore, there seems to be no reason to doubt the importance of alcohol consumption to the mortality crisis, even when looking across the range of countries.

Moreover, Shkolnikov *et al.* (2001) found that alcohol consumption was a likely explanation for the difference between 1994 and 1998 life expectancy rates in Russia. Using sibling data, Bobak *et al.* (2003) demonstrate that mortality was higher among men and women who binge drink once a week or once a month, respectively. Shkolnikov *et al.* (2002) found the unemployed to be more prone to death due to excessive alcohol consumption, which was linked to cardiovascular disease.

On the other hand, stress, which has been defined as being relational and situational, occurs "when person/environment transactions lead the individual to perceive a discrepancy—whether real or not—between the demands of the situation and resources of the person's biological, psychological or social systems" (Serafino, 1994 in Shapiro, 1995). Stress has also been defined and operationalized as an effort-reward imbalance (Bobak *et al.*, 2000). Marmot and Bobak (2000) offer an analysis of the psychosocial and biological mechanisms at work in the crisis and argue that psychosocial factors existing before and after the transition play an important role in the mortality crisis.

The evidence for stress reviewed in the 2004 report by Shkolnikov et al. excluded macro-data analyses. However, an empirical verification of the "acute psychosocial stress hypothesis", conducted by Cornia (2000), demonstrates the important relationship between psychosocial stress and crude death rates for 13 countries. Cornia (1998, 2000) analyzed 12 macro-regions and 72 *oblasts* in Russia, finding similar results: "that the main cause of excess mortality lies in the acute stress connected with the unexpected increase in unemployment and turnover, and to the weak policy responses to this problem" (2000, p. 74). Covering only the early years of transition, Brainerd (1998) finds evidence of a negative relationship between successful economic reforms and death rates. Stuckler *et al.* (2009) find that rapid and mass privatization, which is argued to increase stress due to unemployment and an unstable labour market, is related to mortality rates across the post-communist region as well. Bobak *et al.* (2007) find that even when controlling for individual-level socioeconomic characteristics, economic performance at the societal level impacted health across 13 formerly communist countries.

Other important research that supports stress as a potential contributor to the mortality crisis is Kristenson and Kucinskiene's (2002) study linking the physiological reaction of a cortisol response to high levels of psychosocial stress. Using an exploratory factor analysis, Gavrilova, Semyonova and Evdokushkina (2002) found that during three mortality shifts in Russia—the incline after 1991, the decline after 1994 and the second incline after 1998—three factors explained the increases in mortality: 1) stress; 2) increasing TB, drug dependence, and sexually transmitted diseases; and 3) factors related to selective mortality (e.g., asthma and diabetes). Pietilä and Rytkönen (2008) conducted interviews with St. Petersburg residents and found that stress ranked as one of the most often referred to sources of poor health.

The literature suggests, therefore, that alcohol consumption and stress are both related to increases in mortality. McKee (2005) describes how particularly rapid changes can be damaging to health and cites not only the case of the former Soviet bloc but other incidences in which populations resorted specifically to alcohol consumption during times of rapid change. But little has been written directly about how alcohol consumption and stress may have worked together in the crisis. Indeed, Siegrist (2000) pointed out that there was relatively little cross-fertilization of research on the two explanations. A few cases in which both are explicitly addressed together do exist. Brainerd and Cutler (2005) found that both alcohol consumption and stress were important to mortality changes through cross-country as well as Russian survey data analysis. Focusing on the regions of Russia, Andreeva (2006) found that the hypotheses of stress versus alcohol consumption were both correct in that they acted together to increase deaths due to suicide and homicide. Jukkala *et al.* (2008) found that men who experienced substantial economic strain were twice as likely to binge drink. Redmond and Spooner (2009) argue that the social context mattered to alcohol and drug related deaths among young adults in the former Soviet Republics. Bringing health systems into the discussion as well, Grigoriev et al. (2010) offer a complex description of contributing factors to mortality rates in Belarus, Lithuania and Russia.

The area of ambiguity in the debate lies in the interpretation given to harmful alcohol consumption in the region. Even as research on the relationship between alcohol consumption and mortality continues to emerge, why alcohol consumption behaviour changed to the degree that it produced a mortality crisis still remains under-studied. A perspective that integrates the findings on stress might argue that alcohol consumption is operating as an intermediary mechanism between the stress induced by economic crisis and mortality.

However, another perspective has arisen in the debate. Within the health behaviour literature, the two explanations have been explicitly separated and an alternative interpretation of harmful alcohol consumption has been proposed. Cockerham (1999) developed a theoretical framework in which culpability for elevated mortality fell on health lifestyles. In his 1999 study of increased mortality in seven post-communist countries, he argues that the most important social determinant behind lower life expectancy is the health lifestyle chosen in these societies. These health lifestyles—primarily harmful alcohol consumption—are argued to have been fostered under communism, particularly through the values, propensities and behaviours encouraged under the old regime.

This perspective focuses explicitly on the cultural transmission of values and behaviour from the communist era on behaviour during the post transition period. Culture, from this perspective, is perceived as generating long-term predispositions toward certain behaviours, which is plausible. Yet the fact that a critical juncture in mortality rates, or alcohol consumption behaviour, exists indicates that an explanation must include a component that is dynamic. The inherited lifestyle explanation, therefore, may be useful to understand why alcohol consumption plays a key role in deaths, but falls short of explaining a sudden and dramatic increase in deaths; an explanation for the mortality crisis requires an impetus for the sudden and dramatic increase. Furthermore, the explanation should be in alignment with two critical junctures in mortality trajectories for those countries that experienced the most intense increases: after the initial collapse of the economy and after the economic crisis of 1998.

The possibility that harmful alcohol consumption might be related to stress has been dismissed in this strand of literature. For example, Cockerham has explicitly analyzed determinants of high alcohol consumption (2000) and whether psychological distress increased poor health behaviour (Cockerham *et al.*, 2006). Although men in the lowest economic strata were not the heaviest drinkers, drinking frequency decreased with rising income. The impact of psychological distress was more strongly related to the frequency of drinking than the amount. This is interpreted as evidence that distress is not as important a factor as lifestyles since the authors consider the amount drunk, regardless of how often, as the most important outcome. In addition, they find that Russian women rate themselves as more stressed than men, but men's health behaviour is worse than women's. This is argued to undermine the validity of the stress hypothesis.

Although this deduction may be logical, the relationship between stress and lethal alcohol consumption is likely mediated by other factors, some of which the authors mention. The possibilities for variation between men and women, and indeed all people, along the causal chain are many. For example, men and women may equally encounter stressful circumstances, but the perception of stress may vary, and women may actually feel stress more intensely, be aware of or at least be more willing to admit to high stress levels. Women may also have a different set of coping mechanisms on which they rely or may have the benefit of stronger social support. More room for variation still exists since stress and coping behaviour may be physiologically experienced differently by men and women. For example, it is widely known that women survive longer than men, even though they live more years in poor health (McKee, 2005). These three points of possible deviation along the causal pathway suggest that dismissing stress as an important factor on the grounds of gender difference is insufficient. Moreover, they overlook the remarkable increase in women's mortality rates that occurred at the same time as men's.

Although empirical evidence on gendered differences in the causal chain described is scarce, Watson (1995) theoretically outlines how gender mattered during the transition from communism in a way that might explain greater increases in deaths for men. Specifically, the different value placed on core social roles for men and women in post-communist societies leaves men particularly vulnerable to adaptive breakdown in the face of economic and labour market disruption. Gender differences highlight

the need for further research on many areas of the causal pathway leading from context to poor health.

In summary, there is great scope for research that explicitly addresses how stress and alcohol consumption may have interacted during the transition from communism. Moreover, including contextual variation in analyses of mortality is important to understanding variations in death rates. Therefore, macro-data analysis of contextual and mortality variation may augment the debate over the mortality crisis, particularly if both major explanations are taken into consideration.

III. Descriptive evidence

This section presents descriptive information about the intensity and duration of mortality crises across the post-communist region. The countries covered in this analysis are all the countries of the former Soviet Union (including the Central Asian Republics, the Caucasus, Belarus, Moldova, Russia and Ukraine) and Central and Eastern Europe. Not included in the analysis are the former East Germany, Albania, Turkmenistan and the countries of the former Yugoslavia due to missing or incomparable data. I use WHO's European Health for All aggregated and standardized death rates, as well as UNICEF's TransMonee data.

Creating a comprehensive picture of mortality trajectories in the region from 1990 to 2003, three main mortality patterns emerge according to 1) the extent of increase in mortality rates, 2) when the changes occurred, and 3) if/when pre-transition rates were again achieved. On the basis of these divergences in slopes, three transition types can be identified. The three types are displayed below according to standardized death rates (SDR).

Transition Type 1 (Figure 1) includes countries where mortality increases were minimal (an increase of less than 200 deaths per 100,000) after the transition and increases generally occurred only for a very short time period (1-2 years). This group is also characterized with mortality rates that have decreased below pre-transition levels (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia). The variation within this group is mostly related to the timing of the mortality increases; Romania's and Bulgaria's mortality peaks occurred in 1996 and 1997, respectively, rather than in the first few years of transition. Transition Type 2 (Figure 2) includes countries in which mortality increased more dramatically (from over 100-400 extra deaths per 100,000) in 1991 or 1992 and for a longer period of time (elevated rates lasting around 5 years). However, mortality rates reversed and consistently decreased below pre-transition levels, or very near, in this group (Armenia, Azerbaijan, Estonia, Georgia, Latvia, Lithuania, Tajikistan and Uzbekistan).

Transition Type 3 (Figure 3) countries experienced the most severe crisis, in which mortality increased dramatically (200-450 extra deaths per 100,000 from 1991 levels), but either the first mortality crisis was followed by a second crisis or rates simply never recovered to levels anywhere near pre-transition levels by 2003 (Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia and Ukraine). This group of countries shares an additional characteristic that was not part of the selection criteria: the mortality rates before the transition occurred in these countries were remarkably

unstable. All Type 3 countries show a decline in mortality rates from 1980-1982, followed by a minor increase until 1985. In 1985, Gorbachev's anti-alcohol campaign was initiated, resulting in a decrease in deaths in 1986, followed by stability or a slow increase again until 1990. Although none of these fluctuations resemble the dramatic increases during the 1990s, it is worth noting they existed in such a uniform manner across this country group. Other countries of the Soviet Union that fall into Type 2 also show fluctuations in mortality rates before 1990; however, not uniformly. The Baltic States all reflect this pattern, but the Caucasus, as well as Tajikistan and Uzbekistan do not.

Figures 1-3 about here

In some cases, the countries fell into groups that may have been expected, such as in the case of Transition Type 1 countries; however, in other cases the grouping of countries may seem unlikely. For example, when thinking about country characteristics in general, the Baltic States may seem misplaced in a group with some Central Asian Republics and the Caucasus. However, the Baltic States do not fit into Transition Type 1 because no countries in Transition Type 1 experienced the scope of increase in mortality rates that was evident in the Baltic States. In fact, Estonia and Latvia stand out among Transition Type 2 countries as having some of the highest death rates of all during the early years of transition (Estonia had 1380 deaths per 100000 in 1994 and Latvia had 1500). Only Tajikistan increased to those levels at 1450 deaths per 100000. Lithuania experienced 1220 deaths per 100000, which falls among the range of other Transition Type 2 countries (Armenia had 1200 in 1993, and in 1994 Azerbaijan had 1150, Georgia had 1150 and Uzbekistan had 1290). For these reasons, Lithuania and the other Baltic States were categorized as Transition Type 2.

The majority of countries did not experience a mortality crisis within the populations usually afflicted by economic crises. We would expect to see increases in the mortality of the elderly if the most vulnerable populations were impacted. Likewise, we would expect to see dramatic increases in maternal and infant mortality rates. Although official data across the entire post-communist region report improvements in infant mortality rates during even the worse years of economic crisis, Aleshina and Redmond (2005) found strong evidence that infant mortality was under-reported, particularly in the Commonwealth of Independent States (CIS). Other research found a discrepancy among official statistics and locally-produced research on infant and maternal mortality rates, particularly in the Central Asian Republics (CAR) and Caucasus, which were likely due to disintegrating health care systems in the CAR (European Observatory on Health Care Systems 2002; Veneema 2000). Looking at the mortality rates of the populations that should have been the most robust, however, we see very large increases in mortality during the 1990s. Figure 4 reveals mortality trajectories according to each Transition Type and by specific age groups for both men and women. Due to the overwhelming increase in male mortality rates, female mortality rates are often overlooked, although they significantly increased as well in some countries. In fact, without any decline over the decades of communism—in contrast to male life expectancy in some areas of the Soviet Union—female life expectancy declined in Russia from 74.5 years in 1989 to 71.1 years in 1994, yielding a non-negligible decline in life expectancy of 3.4 years.

Because there is great variation between the death rates of males and females, as well

as death rates by age, the scales for each age group and sex within Figure 4 are different. The consistency of differences among the Transition Types in mortality trajectories by age group and sex is worth noting. Transition Type 1 countries show a consistent and gradual, slightly downward slope for men and women of all age groups. Type 2 countries show an increase in death rates for men and women of all age groups only in the first half of the 1990s, which was followed by a trajectory that caught up to or intersected the trajectory of Type 1. The only exceptions to this later improvement were death rates of the 25-39 years old age group, particularly females, in which the decline in death rates did not lead to improvements beyond initial death rates. Type 3 countries show some levelling of rates in the mid-1990s, but a second increase for men and women of all age groups that began in 1998, except for women older than 60. Despite the heavy focus on middle-aged men in research, there is evidence that what impacted working-aged men's health and longevity also appears to have impacted women and men of other age groups similarly from a temporal perspective. These similar trends according to timing point to the possible importance of contextual conditions.

The most important increases in mortality—in regards to an age group's contribution to total increases in mortality rates—occurred for men and women between the ages of 40-59. However, if we look at relative increases from 1989 to the year mortality first peaked, a few differences emerge. Whereas Type 2 men aged 40-59 experienced a 31% increase and Type 3 a 61% increase, Type 2 men aged 25-39 experienced a 83% increase and Type 3 a 79% increase. Therefore, death rates of men aged 25-39 deviated more from their 1990 level in both Type 2 and 3 countries than men aged 40-59. The same finding applies to women aged 25-39 of Type 2 and 3 countries. So although it is true that the most excess deaths in this time period were in the 40-59 year old age group, the 25-39 age group is just as important to study.

Figure 4 about here.

To observe how the countries cluster in the Transition Typology geographically, Figure 5 presents the three types in a map. Furthest west are the countries of Type 1. The majority of the geographical area considered belongs to Type 3, which includes Russia and some of the states closest to it. Type 2 countries form clusters that are peripherally located to Russia. These clusters are the Baltic States, the Caucasus and the Central Asian Republics that are furthest south. This interesting configuration hints at various possible factors for the observed differences such as the importance of relationships with Russia, the EU or other geographical regions (e.g., the Middle East). Although investigation of international relations as well as geopolitical and cultural similarities is beyond the scope of this paper, systematic similarities and differences across these country groups in economic performance during the transition from communism are important to observe.

Figure 5 about here.

I now explore contextual indicators to see whether consistent patterns emerge across the economic contexts of the three different Transition Types as well. Significant differences in these factors according to the typology will both confirm the saliency of the typology and give a first indication of important covariates to consider. Figures 6 to 9 display Transition Type averages, weighted by population size, for selected economic

indicators over the course of market reform. First, for visual comparison, I first present life expectancy at birth[2] for males according to Transition Type, then GDP growth, real average wages and inflation.

As expected, differences among the means of the three groups are consistently noticeable across time. Life expectancy at birth for males (Figure 6) shows a divergence particularly after 1992 and a convergence for Transition Type 1 and Transition Type 2 beginning in 1995. This convergence was never fully complete since life expectancy in Transition Type 2 countries began to increase at more or less the same rate as Transition Type 1 countries following 1997. The Transition Type averages in Figure 7 show that all countries experienced a decline in GDP growth in the first years of transition, but the Transition Type 1 countries began to recover by 1992. This divergence continued until 1995/1996 at which time Transition Type 2 and 3 countries began to recover and their average GDP growth paralleled that of Transition Type 1 countries. By 1998, countries in the Transition Type 2 group pulled ahead of Transition Type 3 countries in GDP growth and performed slightly better than Type 3 countries for the remainder of years shown here. Average real wages (Figure 8) depict a similar picture in which the initial unanimous decline in real wages diverged in 1992 by recovery for Transition Type 1 countries. Although the decline in real wages was more dramatic for Transition Type 2 than Type 3 countries, these declines ceased two years earlier and the significant variation in real wage levels according to the three types lessened over the early 2000s. Finally, inflation averages (Figure 9) by Transition Type show extreme increases for both Transition Type 2 and 3 countries, of which Type 2 reached the greatest heights in the early 1990s, but almost complete recovery occurred for all types by 1996.The second panel in Figure 9 presents inflation from 1997-2005 on a different scale to observe variation at lower increases. Transition Type 1 began these years with very high inflation because of Bulgaria's peak of hyperinflation in this year. Following the 1998 economic crisis in Russia, the Transition Type 3 inflation average increased dramatically as well.

Figures 6-9 about here.

In summary, the CEE countries of Transition Type 1 outperform both Types 2 and 3 in terms of lower inflation and higher wage and GDP growth. This is what we would expect to see if a better economic context was important to maintain stable mortality rates. Therefore, at first glance, a link exists between poor economic performance and increased mortality rates.

IV. Regression analyses: Data, method and results

Because meaningful differences appear to exist among the Transition Types, I conduct a statistical analysis to confirm these differences, as well as indicate whether the link between death rates and economic context is plausible. I use cross-sectional time-series data constructed from aggregate level indicators taken from the WHO's European Health for All database, UNICEF's TransMonee database, the IMF's World

[2] Using life expectancy at birth as a measure is not without limitations in this context since there is evidence of under-reporting of infant births and deaths in countries belonging both to Types 2 and 3 (Aleshina & Redmond, 2006). Nevertheless, the differences among the groups according to adult mortality rates, which should be less biased by under-reporting of death, mirror the differences in life expectancy among the groups.

Economic Outlook 2000 and 2003, and the ILO. The sample of this analysis includes as many of the post-communist states considered in the descriptive analyses as the data allows, for the period of 1990-2003. This includes Armenia, Azerbaijan, Bulgaria, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Lithuania, Poland, Moldova, Romania, Russia, Slovakia, Slovenia, Tajikistan, Ukraine and Uzbekistan.

If stress originating in economic instability is an important factor, those who are responsible for supporting the household and dependents should have experienced more stress from the transition than those who are retired and no longer participate in the labour force or directly provide for dependents. Therefore, being able to separate working-age adults from those who are of retirement age is important. If factors related to being in the labour market were important, we should see a relationship emerge that is particularly strong between economic indicators and working-aged adults. Therefore, step one of the analysis is to assess the impact of economic indicators on different age groups (25-39, 40-59, and 60 + per 100,000), which will highlight the nature of these relationships. Step two is to restrict the dependent variable to the causes of death that have been particularly linked to alcohol consumption in the literature: deaths due to circulatory diseases, external causes (including accidents and homicide) and suicide. Only men and women below the age of 65 are included in these analyses to narrow the focus to premature deaths during the life course stage in which labour market involvement can be assumed and, hence, a stress and alcohol consumption link would be more likely. This section is aimed at explicitly connecting economic conditions to harmful alcohol consumption, even though these causes of death may also be unrelated to alcohol consumption.

This strategy and analysis cannot directly assess long-term causes of health decline in the region. So, although long-term exposure to unhealthy lifestyles or effort-reward imbalances during the Soviet era may contribute to mortality, this analysis is only able to capture changes in death rates that are immediately related to contextual elements. Therefore, results are limited to demonstrating whether turbulent economic transition is related to increasing mortality rates. Given the critical juncture in mortality rates early in the transition experience, short-term causes are worth investigating. A benefit of studying a range of countries that share a similar history or legacy is that certain permanent characteristics are held constant. By analyzing the post-communist countries together and across time, since the beginning of the 1990s, the Soviet inheritance in Type 2 and Type 3 countries are taken as fixed effects and any systematic variation according to contextual elements may be considered net of the original propensity for destructive lifestyles that the Soviet regime may have fostered.

Although it is not possible to directly assess the quality of data for each of the 19 countries, some discussion is necessary to point out the areas in which more caution is needed than others when considering the estimates. The all-cause mortality rates of narrow age groups were taken from UNICEF's TransMonee database, whereas the WHO's European Health for All database provided the cause of death statistics for those 65 and younger. These statistics were given to UNICEF and the WHO by official statistical departments within each country; hence, there may be variation in the quality of the data. In general, there is no strong suspicion of data quality for official death counts of the countries that comprise Transition Type 1 (those of Central and Eastern Europe). Likewise, there does not appear to be cause for concern

in the Baltic States. However, it has already been pointed out that, at least for infant mortality, the official statistics may underestimate the number of deaths in other former Soviet Republics (Rechel, Shapo & McKee 2005). In regards to Russia, which is the country that has been most evaluated, the actual death counts have been established as acceptable (Andreev et al., 1995; Leon et al., 1997; Notzon et al., 1998). Higher variability in regards to infant mortality rates is one important reason why adult mortality, rather than life expectancy at birth, is a more reliable indicator. It may still be that some countries have underestimated adult mortality as well, the poorer countries in particular. Taking Kyrgyzstan as an example, however, some evidence exists that adult mortality patterns observed there are not artefacts of the data (Guillot 2007). Many countries that might fall under suspicion are those in which mortality increases were quite high, which means any bias of underestimated adult mortality may be less problematic since the difference is related only to the extent of the higher rates.

As is the case across all contexts, cause of death statistics are less reliable. In particular, Gavrilova et al. (2008) found that external causes of death are underestimated in Russia due to an increase in ill-defined causes of death. The extent to which the data quality assessment for Russia can be extended to all other CIS countries is unknown. Mathers et al. (2005) assessed the global status of cause of death statistics and identified the Baltic States, Hungary, Moldova, Romania, Slovakia and Slovenia as having high quality statistics, whereas Armenia, Poland and Tajikistan joined other countries such as Greece and Portugal in having low quality data for causes of death and all the remaining countries in this analysis joined countries such as Belgium and Sweden in having medium quality statistics. The analyses based on specific cause of death statistics, therefore, are more prone to measurement error and must be considered with more caution.

Analyses of age-specific and cause-specific deaths rates are implemented using a stepwise regression; first, only a dummy that captures whether the country belongs to Transition Type 1, 2 or 3 is entered into the model to see the straightforward impact of this division. The descriptive evidence suggests that belonging to Type 2 and 3 increases mortality for all death rates relative to Type 1 countries; moreover, Type 3 membership should increase mortality more than Type 2. This step merely confirms statistically significant differences in mortality trajectories across the region and sets the stage to see whether economic indicators can explain the differences among the three groups. Hence, the second model introduces economic variables, described below, to assess how they modify the impact of membership to Type 2 and 3. Moreover, the economic variables should impact each respective mortality rate according to the direction of economic improvement. If stress-inducing factors are represented by the economic indicators and stress matters to the death rates studied, the coefficient for the Transition Type should become statistically insignificant or reduce in magnitude.

All independent variables are lagged by one year, as the change in contextual conditions should precede the increase in mortality. This time lag adjustment ensures a uni-directional relationship between economic performance and mortality. Endogeneity ought not to be an issue in this analysis in any case; Kontorovich (2001) tested the endogeneity hypothesis in regards to mortality and concluded that the

increase in mortality was not the cause of the economic recession.

IV.1 Independent variables

The independent variables that are included in the models to capture the economic context are (log)inflation, employment growth, wage growth, GDP and the transition Type to which a country belongs. Employment growth measures yearly changes in the number of people employed. The choice to use employment growth instead of unemployment rates was due to availability and to measurement problems in unemployment data. Unemployment statistics are offered only sporadically, only for some countries and usually for registered unemployment. This is problematic as registered unemployment may not capture all unemployment since people are less likely to register themselves as unemployed once unemployment benefits expire, generally between 6-12 months (Barr, 2001). The relationship between unemployment and mortality at the micro-level has been established for a diverse range of countries (see Blazek and Dzúrová, 2000 for Czech Republic; Cornia, 2000 for Russia; Krumins and Usackis, 2000 for Latvia; Riphan and Zimmerman, 2000 for the former GDR; Abdala, Geldstein & Mychaszula, 2000 for Argentina). The impact of decreased wages and increased inflation may amplify stress related to economic survival. This includes the difficulty of purchasing needs due to inflation. Current values of the price index have also been argued to measure "worsening expectations about future living standards" (Cornia and Paniccià, 1998, p. 236).

The measure of employment growth, as well as real average wage growth, is an index based on the value of 100 at the base year. Real average wage growth represents the value of wages and proxies for the quantity of goods and services the wage can buy. GDP (PPP) per capita is often used as an important control variable, but in this model it is theoretically important as well because it captures the impact of relative changes in the greater economic context as it is transformed to an indicator of the difference between the current and previous year's GDP.

This list of independent variables is sparse; there are two main reasons for this restricted focus. First, the aim of this research is to specifically assess whether a link between changing economic conditions and mortality rates exists and whether these conditions can explain a consistent share of deaths across the groups identified. Deteriorating economic conditions, including increased economic instability, is argued to be the main driver of increased psychosocial stress, which leads to poor health and health behaviour. The latter point leads to the second reason for parsimony; these changes in behaviour will logically be reflected in the social context. Family breakdown and increased crime, for example, may indeed be related to higher death rates but they are also likely related to the economic context. To avoid introducing indicators into the model that may be influenced by the main explanatory variables, only the variables that represent the economic situation are included in this analysis. This decision does not imply that other factors are not considered important to death rates in these contexts.

IV.2 Model

Durbin's M-test indicated that there is autocorrelation in my dependent variables; evidence of autocorrelation in mortality rates is to be expected since we would expect

a country's rate in year *t* to be somewhat related to the rate in year *t-1*. Not correcting for autocorrelation can lead to incorrect inferences regarding the significance of the parameters; in the presence of autocorrelation, the variance of estimators is under-estimated, t-statistics will be inflated and variables that are not statistically significant will appear to be so. To remedy this, I fit the cross-sectional time-series regression models according to a first-order autoregressive disturbance term (using the command xtregar in Stata, which refers to fixed or random effect linear models that have an AR(1) disturbance). Autoregressive models regress the current value against a prior value in the series. Moreover, this specification, which implements methods derived from Baltagi and Wu (1999), can accommodate unbalanced panels in which observations are unequally spaced over time due to missing observations. To assess whether random or fixed effects better fit the data, the Hausman specification test was employed and indicated that the assumptions underlying the random-effects model were satisfied. Cross-sectional time-series methods control for unobserved individual effects in the data and the random effects model assumes that the unobservables are not correlated with the explanatory variables. One advantage of using a random effects model is that it allows for time-constant variables, which means that the model can accommodate static dummy variables for Transition Types. The random-effects model also deals with small *t* better, which is important because this sample includes only 13 years and 19 countries. The model, therefore, is a cross-sectional time-series linear model (Stata uses a generalized least squares estimator for random-effects AR(1) models). The model can be formally written as:

$y_{it} = a + Bx_{it} + u_i + e_{it}$, in which the u_i are independent of the x_{it}, and where

$e_{it} = rho * e_{i,\ t-1} + z_{it}$, in which $|rho| < 1$ and z_{it} is independent and identically distributed.

IV.3 Results

In the results of models using age-specific mortality as the dependent variable (Tables 1 and 2), membership in Transition Type 3 rather than Type 1 proved to be highly statistically significant and had a large impact. This impact was much greater for men's mortality than women's, except for mortality rates of the population over the age of 60, which was more or less similar. Belonging to Transition Type 2 rather than Type 1 proved to generally increase mortality rates as well, although this coefficient was not statistically significant for men or women aged 40-59. The impact was negative, however, for both women and men aged 60 years or more and was only statistically significant for men. The finding that belonging to Type 3 rather than Type 2 approximately doubles—or more—the average number of deaths per year, in relation to Type 1, for all age groups, sexes and causes of death is strong evidence that consistently different mortality profiles characterize these three country groups. Moreover, the countries that have not returned to pre-transition death rates, Type 3, had dramatically higher mortality on average each year.

The second model, in which all the economic indicators were introduced, yielded results in which the impact of Transition Type was attenuated but remained statistically significant in the cases in which it had been significant in the first model. For men 25-39 years old, the coefficient for belonging to Transition Type 3 reduced from 312 more deaths per 100,000 to 282 on average; for men 40-59 the change was from 582 to 525 deaths and for men over 60 the change was from 8 to 7 deaths. For

women, the corresponding differences are the following: 25-39 years old: 81 to 74 deaths; 40-59 years old: 203 to 189 deaths; over 60 years old: 7 to 6 deaths. The reduction in deaths for Transition Type 2 countries, when statistically significant, was from 127 to 90 deaths for the 25-39 year old men and from 39 to 28 deaths for the 25-39 year old women.

In regards to the specific effect of the economic indicators, differences emerged across age groups and sex. Inflation increased death rates across all age groups for men and had the largest impact for men in the 40-59 year old age group. This was the only statistically significant coefficient in the results for men 25-39 years old. All other results for men in the 40-59 and 60 years or older age groups were statistically significant, at least at the 10% level, and many were highly significant (1% level of confidence). Moreover, all indicators impacted mortality rates in the expected directions: increases in GDP per capita, employment growth and wage growth all decreased mortality. The greatest of these impacts was for men 40-59.

The results for women's age-specific mortality indicate that mortality across all age groups decreased when GDP increased and the largest impact was for women aged 40-59. Likewise, wage growth decreased mortality, but these results were not statistically significant for women aged 40-59 although they were in the expected direction. Inflation increased mortality and the effect was greatest for women aged 40-59, but not statistically significant for women aged 25-39. The effect of employment growth on mortality was negative for women aged 40-59 and over 60, but these results were not statistically significant.

Tables 1 and 2 about here.

In Tables 3 and 4, the regression results of mortality rates by cause of death are reported. As in the previous models, membership to Transition Type 3 in general showed higher mortality rates, relative to Type 1 than Type 2 membership for men and women. However, the effect of the Transition Type dummies was not statistically significant for deaths due to suicide for men or women. Moreover, only the coefficients for Type 3 membership were statistically significant for external causes of death for men and women. In other words, the Transition Typology appears to meaningfully differentiate among these countries for deaths due to circulatory diseases, partly for external causes of death but not for deaths due to suicide. Where membership in the Transition Types did matter, introducing economic indicators in the second model again minimized the effect of Transition Type.

For men, all economic indicators had a statistically significant effect on deaths due to circulatory diseases and these relationships were in the expected direction. Inflation increased deaths due to external causes as well, but this was the only statistically significant economic effect in the model for external causes of death. Both GDP growth and wage growth decreased deaths due to suicide for men.

The results for women's cause-specific mortality models are similar. While wage growth decreased circulatory-related deaths, inflation increased them. Inflation had a lesser but statistically significant effect on external causes of death, but in this model GDP growth also decreased deaths. For deaths due to suicide, both GDP and wage

growth decreased women's suicide rates, whereas employment growth increased suicide rates. This finding is unexpected and is highly statistically significant.

Table 3 and 4 about here.

Finally, sensitivity analyses were conducted to ensure the robustness of these results. First, because some processes of claiming independence entailed serious conflict during the early years of transition, I removed Azerbaijan, Georgia and Tajikistan from the analyses in which the death rate may have been inflated because of conflict within the borders. Specifically, the models for male mortality between the ages of 25 and 39 by all causes of death as well as male mortality below the age of 65 by external causes were re-estimated without the three countries. Results for these models remained robust. Second, I estimated the models using simple pooled cross-sectional time-series OLS models and clustered the observations for each country to account for non-independence; there were no major changes in the estimates.

V. Discussion and Conclusions

Regression analyses were implemented and confirmed the distinctiveness of the Transition Types in general, however some variation emerged. The overall impact of belonging to Type 2 was less consistent than Type 3 and seemed particularly ambiguous for men and women 40-59 and 60 years or older. One notable exception in which the Transition Typology did not matter to mortality rates was deaths by suicide of men and women. The second step of the regression analyses established that economic conditions do indeed explain some of the variation in mortality trajectories. The extent to which economic indicators decreased the impact of transition type membership was remarkably consistent over the age-specific and cause-specific death rates. For Transition Type 3 countries, the coefficient reduction in model two consistently hovered around 10% when they were statistically significant. In contrast, when the coefficients were significant for belonging to Transition Type 2 countries before and after including economic indicators, there was a reduction in the effect of around 27% for men and women and for circulatory-related causes of death. Table 5 summarizes these reductions. This finding indicates that death rates in Transition Type 2 countries were either more responsive to the economic context than Transition Type 3 countries or that their health profile is more similar to the reference category's to begin with. Particularly, the Baltic States might be expected to have a more similar mortality profile to the countries of Central and Eastern Europe; therefore, absorbing the impact of economic crisis would reduce the difference between Type 1 and Type 2 countries more than it would the difference between Type 1 and Type 3 countries. Moreover, the consistency of reduction within the types seems to indicate that the economic context has a similar impact on men's and women's mortality rates and on the causes of death that are highlighted here.

Table 5 about here.

Another important finding of the regression analyses is that certain economic indicators are related to death rates and these relationships confirm that worsening economic conditions increase mortality. GDP and inflation had the most consistent effects, but wage and employment growth also impacted certain age and cause-specific mortality rates, particularly those for men. The relationship between the

economic context and mortality rates was expected, but it is worth noting that these relationships emerge even after adjusting the model for dummy variables that capture the basic geographical division of Central and Eastern Europe versus those countries that are even further east of Europe, as well as the division of former satellite states and the republics of the former Soviet Union. These clusters represent many basic differences that are held constant, including cultural, lifestyle and social characteristics that are developed and influenced by EU involvement; basic levels of economic development; great differences in the extent that inequality has increased; and variation in governments' commitment to social support. Overall, the results of these analyses confirm the hypothesis that there were specific economic conditions under which mortality increased. The fact that the influence of economic forces were strongest for the age group and sex (40-59 year old males) that drove the mortality crisis in the region particularly lend credibility to the explanatory power of contextual conditions.

In summary, this research offers evidence that contextual conditions, those related to the economy in particular, ought to remain in the debate over increased mortality rates in the post-communist region. By finding that factors describing the economic context were significantly related to three types of death that are linked to alcohol consumption in the literature, this study also provides evidence that poor economic conditions may be related to destructive alcohol consumption. While poor health behaviours are undoubtedly a result of myriad factors, a health behaviour explanation may be integrated into the discussion on increased mortality as a complementary explanation to the stress brought about by rapid economic reforms, poorly developed markets and economic instability. Further research that assesses how worsening economic conditions influence health behaviour, as well as the reverse relationship, would add much to our understanding of how these two explanations work together. Research that takes into account the ordering of events before death—for example, changes in economic status and alcohol consumption before death—is another research design that would greatly contribute to the debate. Beyond the findings of this study, differences among death rates persisted across countries. Not only is further research required to better understand *how* the economic context influences health behaviours and mortality, but so is a better understanding of other contextual factors not addressed in this paper. For example, Redmond and Spooner (2009) point out the potentially important role of strong kinship and community support networks. Besides possibly shedding light on between-country differences, this is also one possible path toward understanding within-country differences between men and women, which remains mostly ignored in the current debate.

One unexpected finding is that women appear to commit suicide more after years of employment growth. By plotting the leverages of all observations against their squared residuals to see which countries are driving the female suicide results, I find two outlying countries: Lithuania and Estonia. Removing these countries from the sample renders the coefficient for employment growth statistically insignificant and half its previous size. Moreover, inflation then picks up significance and shows the expected positive relationship. The fact that the unexpected result was due to the Baltic States is not altogether surprising given their unusually high suicide rates, particularly in Lithuania, currently and historically. Suicide rates in Lithuania showed great volatility throughout the 1990s and remained high even after those for Latvia and Estonia returned to a lower level in the late 1990s. What we know about this high

suicide persistence is that it largely occurs in rural areas (Gailiene, 1999; Jasilionis, 2003) and that this high prevalence may be historically related to the changes in rural life that were brought about by forced collectivization during the 1950s (Gailiene, 1999). However, exactly why the relationship between employment growth and suicide appears at all and only for women remains an area of speculation. It may be that there is a unique cultural component to suicide occurrences in these countries that is not related to the economic context, but somehow is correlated with some of its elements. Additionally, Lithuania has taken a path that could be called a "re-traditionalisation" of gender roles in which women are once again expected to primarily be mothers and wives after decades of high labour force participation (Juozeliunienė & Kanopiene, 1995). This retrogression, which became more salient as economic recovery picked up speed, may be contributing to changes in women's demographic profile.[3]

Two limitations need to be explicitly acknowledged in this study. First, the results of these analyses are only as accurate as the data on which they are based. Quality issues have already been discussed in this paper. Although more caution was recommended towards the cause-specific mortality models, the consistency in the magnitude of reductions across the Transition Types for the death count and cause of death models is somewhat reassuring. Finally, little was said in this paper about the shortcomings associated with macro-level research, as they are well-established in the literature. In short, using aggregate data to analyze relationships lends itself to the ecological fallacy; the correlation observed at the macro-level may not exist, or may even be the opposite, at the individual-level. This bias occurs because it is more difficult to correctly specify a model at the aggregate level than at the individual-level and omitting potentially important variables may generate a spurious relationship. Certain techniques have been proposed to reduce the bias that may appear in aggregate models: for example, using time-series data that allows for time lags as well as how changes in the variables are related to each other (Norström 1989). This study implemented a time lag as well as addressed autocorrelation, which should lessen, although not avoid completely, the risk of spurious relationships. While this study does not address the heterogeneity that likely exists at the individual-level, it does take into account the heterogeneity of countries that exists within the groups while estimating the impact of group membership. In conclusion, although methodological shortcomings of aggregate data analysis give reason for cautious analysis and interpretation, this type of analysis allows us to gain insight into the variation among countries and groups as well as over time. Beyond what can be observed at the individual-level, valuable information about the relationship between economic change and mortality, as well as economic change and health behaviour, resides at the macro-level.

[3] Many thanks to Domantas Jasilionis for his ideas on this relationship.

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Figures

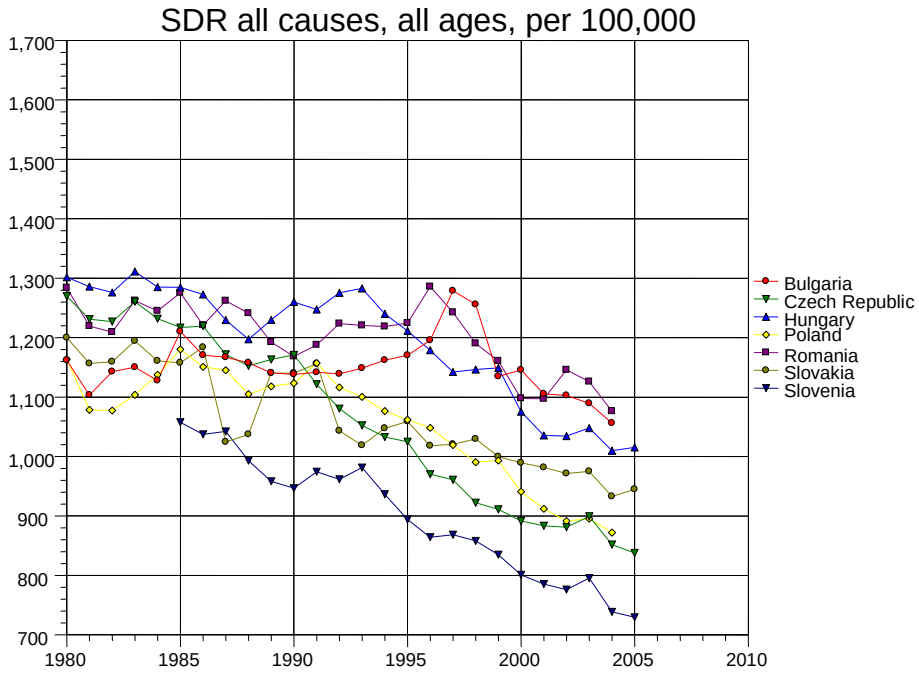


Figure 1 Transition Type 1 standardized death rates
Notes: Y-Axis represents SDR per 100,000, X-Axis represents the year for which the data was taken.
Source: WHO-HFA database.

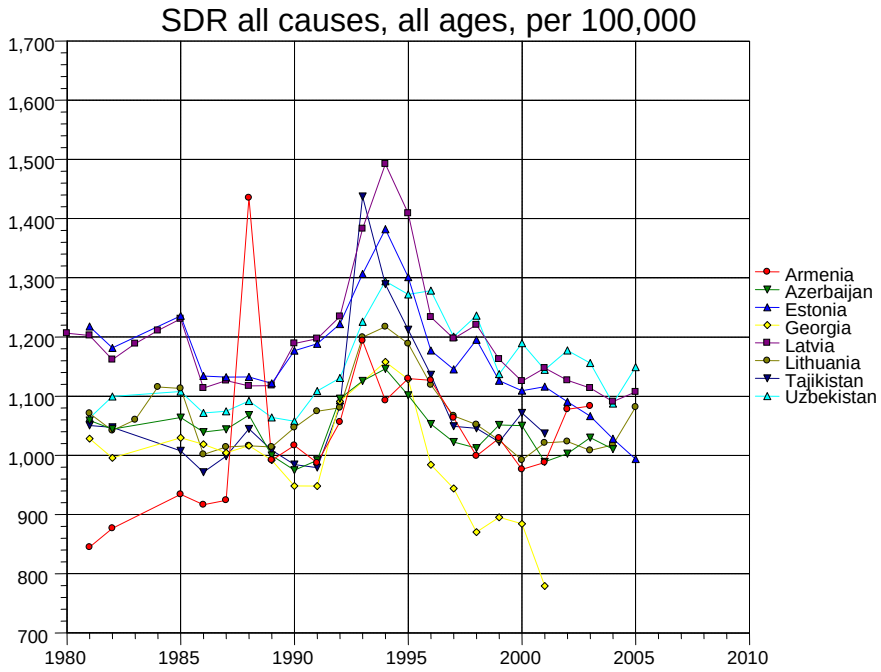


Figure 2 Transition Type 2 standardized death rates
Notes: Y-Axis represents SDR per 100,000, X-Axis represents the year for which the data was taken.
Source: WHO-HFA database.

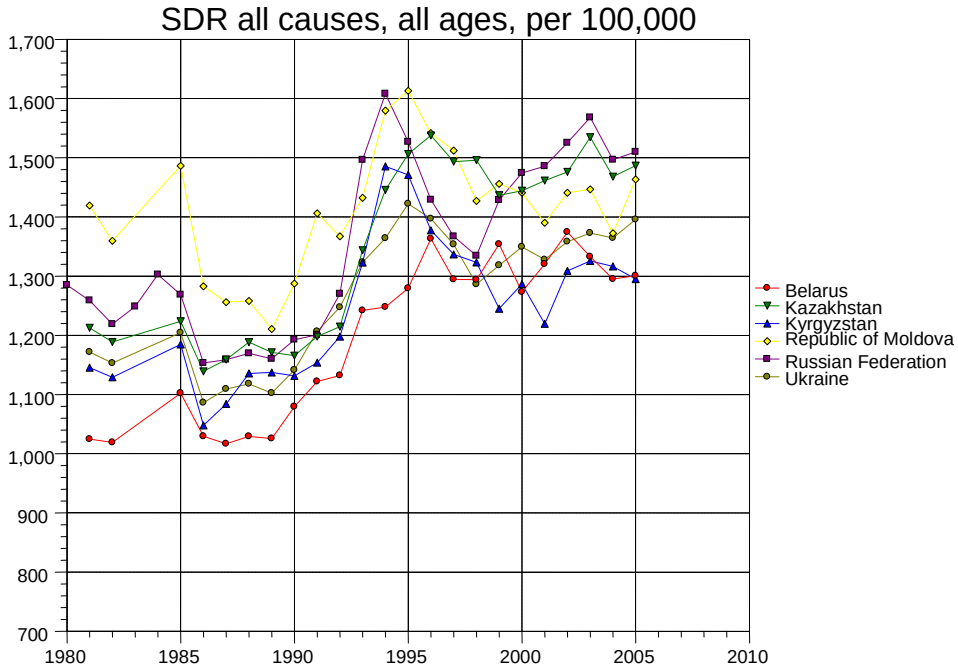


Figure 3 Transition Type 3 standardized death rates
Notes: Y-Axis represents SDR per 100,000, X-Axis represents the year for which the data was taken.
Source: WHO-HFA database.

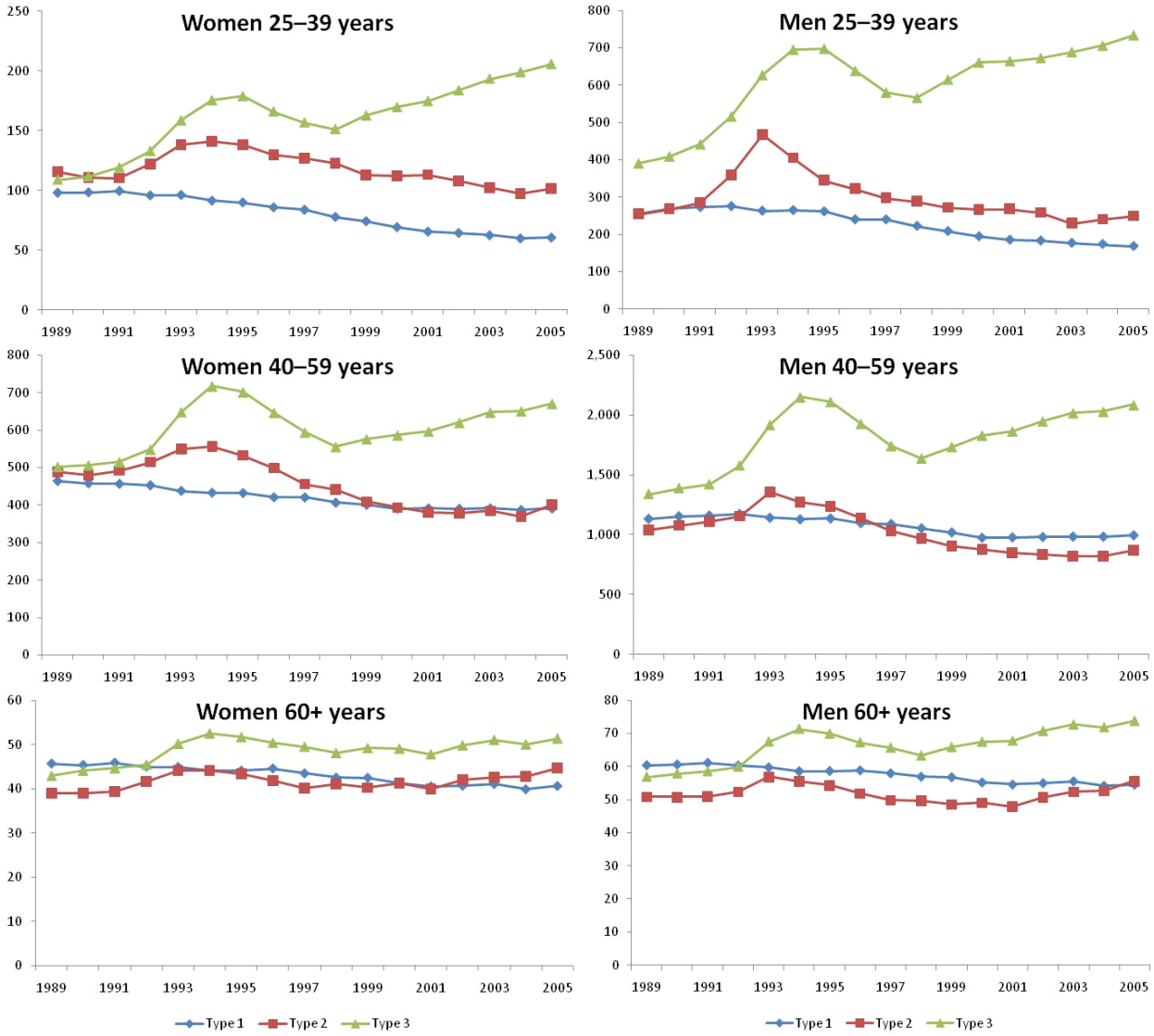
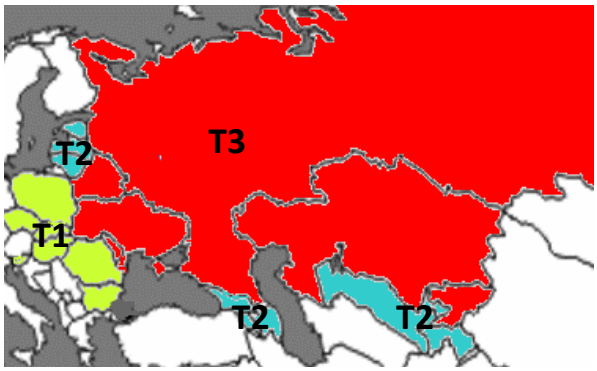


Figure 4 Average deaths per 100,000 by age group, according to each Transition Type, weighted by population size
Notes: Transition Type 1 includes Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia. Transition Type 2 includes Armenia, Azerbaijan, Estonia, Georgia, Latvia, Lithuania, Tajikistan and Uzbekistan. Type 3 includes Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, and Ukraine.



T1: Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia
T2: Armenia, Azerbaijan, Estonia, Georgia, Latvia, Lithuania, Tajikistan, and Uzbekistan
T3: Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, and Ukraine

Figure 5 Geographical clustering of the Transition Typology

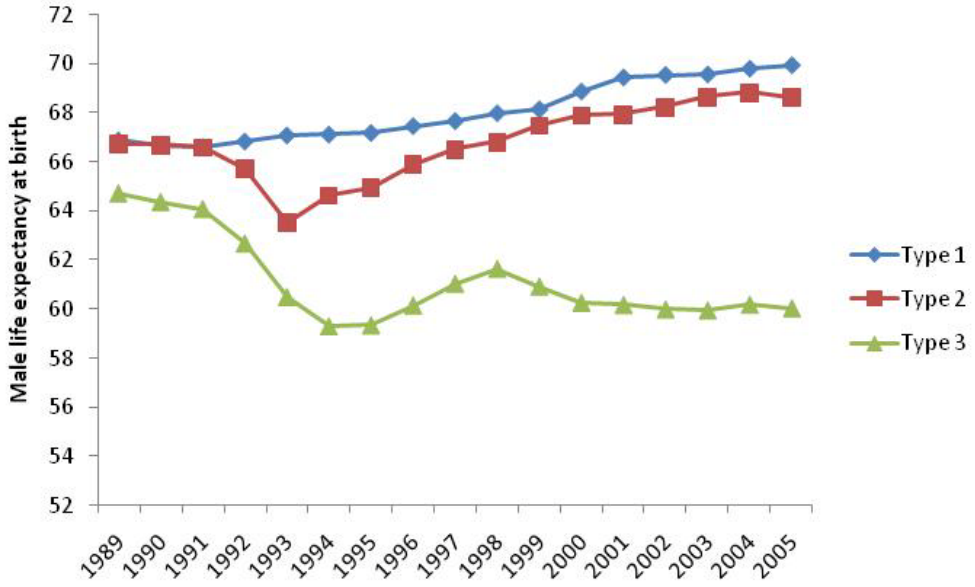


Figure 6 Life expectancy at birth for males, according to Transition Type, weighted by population size

Note: Author's calculations based on UNICEF's TransMonee data. Countries**:** Transition Type 1—Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia. Transition Type 2—Armenia, Azerbaijan, Estonia, Georgia, Latvia, Lithuania, Tajikistan, and Uzbekistan. Transition Type 3—Belarus, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, and Ukraine. Data sources: TransMonee Database

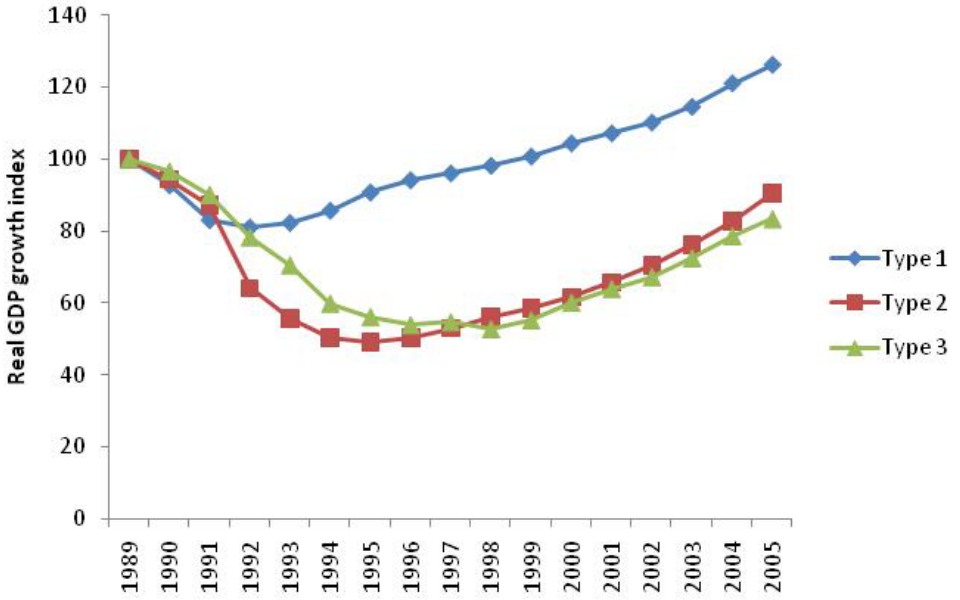


Figure 7 GDP growth, according to Transition Type, weighted by population size
Note: Author's calculations based on UNICEF's TransMonee data.

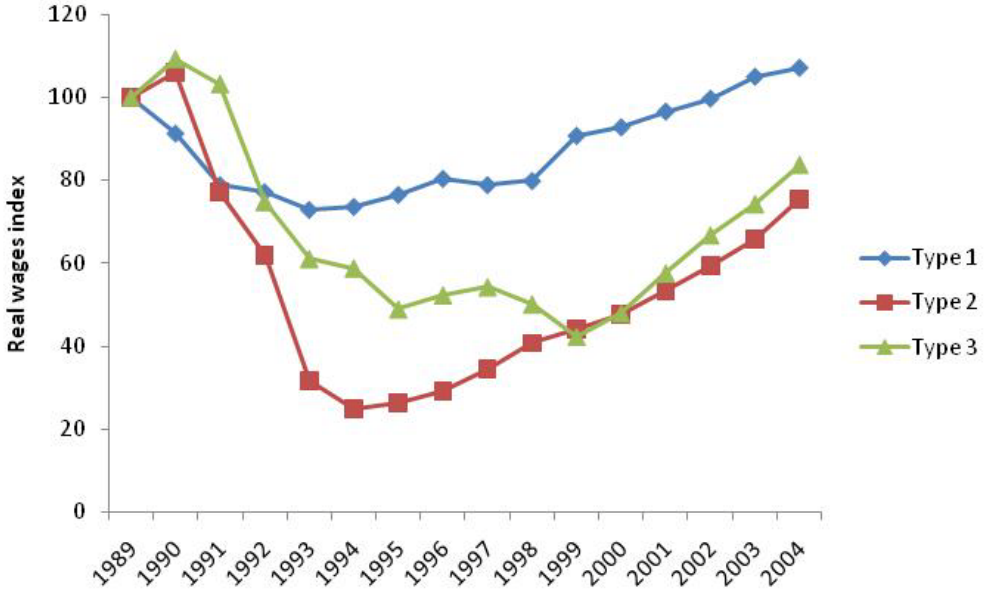


Figure 8 Real wages, according to Transition Type, weighted by population size
Note: Author's calculations based on UNICEF's TransMonee data.

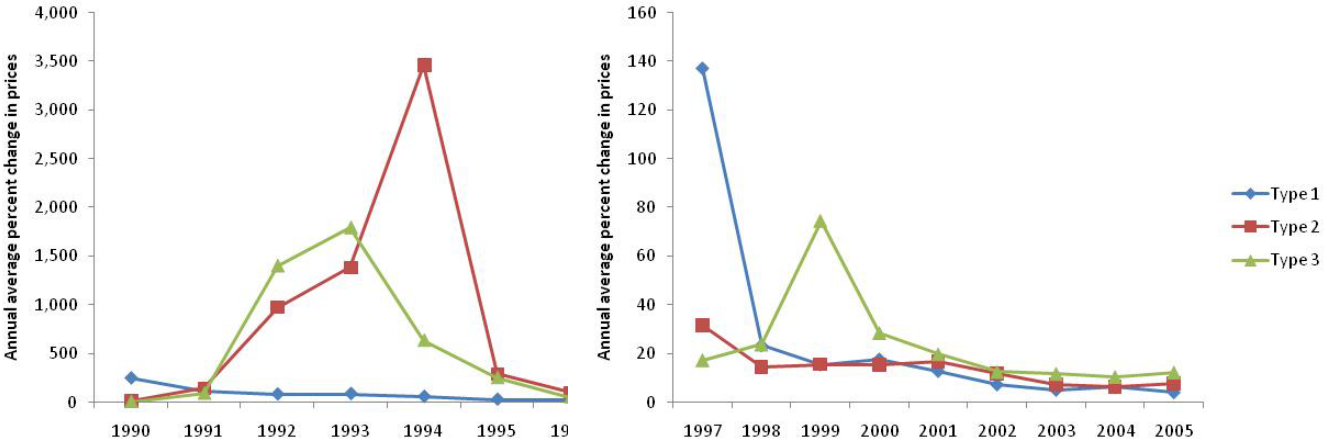


Figure 9 Inflation, according to Transition Type, weighted by population size
Note: Author's calculations based on UNICEF's TransMonee data.

Tables

Table 1 Regression results of men's age-specific mortality rates

Cross-sectional Time-series analysis with Random Effects and AR(1) Disturbances

Men						
	25-39		40-59		60+	
Transition Type 2	127.063***	90.922**	68.038	3.614	-4.802*	-5.820**
	(45.68)	(44.93)	(135.17)	(122.12)	(2.48)	(2.25)
Transition Type 3	311.900***	282.399***	581.75***	525.025***	8.111***	7.204***
	(49.74)	(47.34)	(147.56)	(130.95)	(2.71)	(2.39)
D.GDP per capita		-.008		-.025**		-.001**
		(.00)		(.01)		(.000)
(log)inflation		10.000***		32.665***		.387**
		(3.58)		(7.24)		(.16)
employment growth		.205		-3.272*		-.104**
		(.91)		(1.94)		(.04)
wage growth		-.517		-1.139*		-.027*
		(.32)		(.66)		(.015)
constant		209.138***		1311.74***		67.614***
		(77.42)		(174.43)		(3.75)
number of obs	188	188	188	188	188	188
number of groups	19	19	19	19	19	19
prob>chi2	.0000	.0000	.0005	.0000	.0000	.0000
rho_ar	.385	.282	.676	.545	.676	.691

Notes: Significance levels indicated by *=p<0.10, **=p< 0.05, ***=p<0.01. Transition Type 1 (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia) is the reference category for the Transition Type 2 (Armenia, Azerbaijan, Estonia, Georgia, Lithuania, Tajikistan, Uzbekistan) and Type 3 (Kazakhstan, Kyrgyzstan, Moldova, Russia, Ukraine) coefficients.

Table 2 Regression results of women's age-specific mortality rates

Cross-sectional Time-series analysis with Random Effects and AR(1) Disturbances

Women						
	25-39		40-59		60+	
Transition Type 2	39.143***	28.485**	51.383	32.957	-.992	-2.250
	(12.89)	(12.24)	(34.84)	(34.56)	(1.62)	(1.60)
Transition Type 3	81.42***	74.27***	203.018***	188.785***	6.912***	5.951***
	(14.07)	(13.11)	(37.92)	(36.90)	(1.76)	(1.69)
D.GDP per capita		-.002*		-.007**		-.001**
		(.001)		(.003)		(.000)
(log)inflation		1.123		8.644***		.292**
		(.74)		(2.255)		(.12)
employment growth		.023		-.365		-.027
		(.20)		(.62)		(.03)
wage growth		-.248***		-.308		-.024**
		(.07)		(.20)		(.01)
constant		93.927***		441.653***		46.585***
		(18.22)		(55.54)		(2.70)
number of obs	187	187	188	188	188	188
number of groups	19	19	19	19	19	19
prob>chi2	.0000	.0000	.0000	.0000	.0000	.0000
rho_ar	.708	.687	.819	.758	.668	.611

Notes: Significance levels indicated by *=p<0.10, **=p< 0.05, ***=p<0.01. Transition Type 1 (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia) is the reference category for the Transition Type 2 (Armenia, Azerbaijan, Estonia, Georgia, Lithuania, Tajikistan, Uzbekistan) and Type 3 (Kazakhstan, Kyrgyzstan, Moldova, Russia, Ukraine) coefficients.

Table 3 Regression results of men's cause-specific mortality rates

Cross-sectional Time-series analysis with Random Effects and AR(1) Disturbances

Men, less than 65 years old						
	circulatory		external		suicide	
Transition Type 2	49.629**	35.617	48.227	36.764	-3.800	-6.868
	(24.03)	(22.84)	(33.06)	(31.19)	(10.10)	(9.09)
Transition Type 3	121.404***	111.067***	142.748***	129.506***	15.395	13.33
	(26.27)	(24.59)	(36.11)	(33.20)	(11.07)	(9.92)
D.GDP per capita		-.003*		-.005		-.001***
		(.002)		(.004)		(.000)
(log)inflation		5.111***		7.860***		.158
		(1.22)		(2.08)		(.21)
employment growth		-.814**		-.320		-.057
		(.35)		(.55)		(.06)
wage growth		-.403***		-.042		-.082***
		(.11)		(.19)		(.02)
constant		280.393***		105.593**		38.651***
		(32.09)		(47.92)		(8.10)
number of obs	189	189	189	189	189	189
number of groups	19	19	19	19	19	19
prob>chi2	.0001	.0000	.0013	.0000	.3578	.0000
rho_ar	.794	.748	.378	.250	.713	.692

Notes: Significance levels indicated by *=p<0.10, **=p< 0.05, ***=p<0.01. Transition Type 1 (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia) is the reference category for the Transition Type 2 (Armenia, Azerbaijan, Estonia, Georgia, Lithuania, Tajikistan, Uzbekistan) and Type 3 (Kazakhstan, Kyrgyzstan, Moldova, Russia, Ukraine) coefficients.

Table 4 Regression results of women's cause-specific mortality rates

Cross-sectional Time-series analysis with Random Effects and AR(1) Disturbances

Women, less than 65 years old						
	circulatory		external		suicide	
Transition Type 2	36.762***	28.220**	6.734	3.243	-1.62	-2.317
	(12.12)	(10.89)	(6.65)	(6.46)	(1.73)	(1.52)
Transition Type 3	64.890***	59.425***	31.919***	28.886***	.999	.524
	(13.26)	(11.78)	(7.27)	(6.98)	(1.90)	(1.65)
D.GDP per capita		-.001		-.002***		-.0002*
		(.00)		(.001)		(.000)
(log)inflation		2.086***		.804***		.073
		(.49)		(.30)		(.05)
employment growth		-.119		.015		.040***
		(.14)		(.08)		(.01)
wage growth		-.211***				-.009*
		(.05)		-.045 (.03)		(.004)
constant		91.875***		23.61***		3.222**
		(13.60)		(7.88)		(1.57)
number of obs	189	189	189	189	189	189
number of groups	19	19	19	19	19	19
prob>chi2	.0000	.0000	.0001	.0000	.5655	.0011
rho_ar	.799	.728	.602	.479	.658	.522

Notes: Significance levels indicated by *=p<0.10, **=p< 0.05, ***=p<0.01. Transition Type 1 (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia) is the reference category for the Transition Type 2 (Armenia, Azerbaijan, Estonia, Georgia, Lithuania, Tajikistan, Uzbekistan) and Type 3 (Kazakhstan, Kyrgyzstan, Moldova, Russia, Ukraine) coefficients.

Table 5 Summary results: The magnitude of reductions in the impact of Transition Type membership when adjusting for economic indicators

	Transition Type 2	Transition Type 3
Men		
25-39	-28%	-10%
40-59	ns	-10%
60 +	n/a	-12%
Circ. causes	ls	-8%
Ext. causes	ns	-9%
Suicide	ns	ns
Women		
25-39	-29%	-9%
40-59	ns	-7%
60 +	ns	-14%
Circ. causes	-24%	-9%
Ext. causes	ns	-9%
Suicide	ns	ns

Note: Calculations based on regression results presented in Tables 3.1 to 3.4. “ns” indicates that both the coefficients in models 1 and 2 were not significant. “ls” indicates that the statistically significant coefficient in model 1 lost significance in model 2. “n/a” indicates the coefficients are not applicable to this summary table because the impact increased in model 2 rather than decreased.