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Mikael Svensson
mikael.svensson@esi.oru.se
Department of Economics
Örebro University, Sweden

Abstract: This paper explores the relationship between the regional unemployment rate and total and cause-specific mortality in Sweden during 1976-2005. Overall mortality is unrelated to changes in the unemployment rate, while the biggest cause of death (heart disease) decreases when the unemployment rate decreases. At the same time other accidents, including job-related accidents, increase when the unemployment rate decreases. Swedish evidence provides no support for the US research findings that short-term increases in the unemployment rate are bad for your health in general.

Keywords: Determinants of Health; Mortality; Unemployment

JEL codes: E32, I12

I. Introduction

In a series of papers in the 1970s Brenner (1971; 1975; 1979) used time-series evidence and found that there was a fluctuation in the trend of decreasing mortality rates that could be explained by changes in the business cycle. He found that there was an even larger decrease in mortality rates during economic upturns. However, other authors' argued that Brenner had some flaws in his analysis. Correcting for these flaws, a time-series approach by McAvinchey (1988) reached an opposite conclusion to Brenner.

More recently, there has been a growing series of papers that have studied the relationship between short-term changes in the unemployment rate and total and cause-specific mortality, using mostly panel-data techniques. In the panel data approach different economic developments in each region are compared to changes in mortality rates in the same region. Hence, the effect of business cycles on the mortality rate is measured by exploring within-unit changes compared to other within-unit changes, an approach that in many cases is beneficial in attempts to control for omitted variable bias. It began with an important paper by Ruhm (2000) who used state level data in the US and found that mortality actually increased in economic upturns (pro-cyclical relationship). In a follow-up Ruhm (2003) used individual level data and confirmed the finding of the aggregate state-level study that good times make you sick (or make you die). Other authors have followed and using regional data the same pro-cyclical relationship has been documented for most causes of death in Germany (Neumayer, 2004), Spain (Tapia Granados, 2005) and France (Buchmueller *et al.*, 2007). In a more recent paper Ruhm (2006) looked specifically at mortality in acute myocardial infarction (heart attacks), which is one of the main causes of death, and found that a one percentage point decrease in the unemployment rate increased heart attack mortality by 1.3%.

The pro-cyclical relationship has also been documented using cross-country data from 23 OECD countries (Gerdtham and Ruhm, 2006).

These pro-cyclical trends were also found in recent time-series applications by Tapia Granados (2004) using Swedish data for the period 1800 to 1998 (even though he found that the effect faded over the last 50 years). In another paper Granados (2005), using time-series techniques again, found a pro-cyclical pattern on US data for the period 1900 to 1996. Most papers in the literature use the unemployment rate as the only proxy for the business cycle, but Granados (2005) argued that it cannot for certain be assumed to be true that the unemployment rate is the best proxy for the business cycle. Hence, he tested three other proxies for the business cycle, but found the same qualitative results as using the unemployment rate.

There are two exceptions to the consensus that is beginning to emerge from the literature cited above, but they also differ in some respects, making them difficult to directly compare with the pro-cyclical findings. One paper by Gerdtham and Johannesson (2005), using individual level data from Sweden, studied whether national business cycle indicators were related to the probability of death. In many cases they found no such relationship, but for males they found a counter-cyclical relationship for four business cycle indicators.[1] In a recent paper Svensson (2007) uses the same statistical approach as the papers that report a pro-cyclical relationship, but finds that there is no pro-cyclical relationship between incidence, mortality and lethality in heart attacks and the business cycle in Swedish regions. Instead, a counter-cyclical relationship is found for individuals of prime-working age, i.e. between 20 and 49. There are also contrasting results regarding the association between the unemployment rate and some cause-specific mortality rates. As an example, in contrast to his overall findings, Ruhm (2000) found that suicides increased when the unemployment rate

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[1] The unemployment rate was not one of these indicators, but was rather insignificant in all estimations.

increased. However, a paper by Andrés Rodriguez (2005) specifically looking at determinants of suicide rates does not show a statistically significant effect in the full model.

The goal of this analysis is to further explore the relationship between mortality and the unemployment rate in Sweden, extending previous analyses to a longer time period (1976-2005) and focusing on ten specific causes of death. The two Swedish studies finding contradicting results in the literature are not directly comparable to the studies documenting a pro-cyclical relationship. Gerdtham and Johannesson (2005) use business cycles that are national in scope and focus on initial surveys taking place from 1980 to 1986. Svensson (2007) uses the same regional fixed approach as Ruhm (2000; 2003), Neumayer (2004) and Gerdtham and Ruhm (2006), but instead concentrates on a more detailed study of heart attacks only.

The research field exploring links between health and economic conditions, lifestyles and socioeconomic status, is an important one with major public health interests. As an example, Thornton (2002) showed that lifestyles and socioeconomic status are far more important determinants of public health in the US compared to more medical care utilization. Hence, health care policy should not only be about medical care provision.

The specific analysis in this paper is also important for at least three main public policy reasons. (1) To be used in a broader societal perspective on changes in the unemployment rate. Unemployment has direct financial effects, but also has indirect effects on e.g. property crime rates (Edmark, 2005). The latter type of effects, which could include health effects, are important to analyze so that public policy on, e.g. labour market issues may take all the relevant effects into consideration. (2) If it is found that mortality, or some cause-specific mortality, is closely associated with the business cycle, this can serve as an instrument in public health and health care planning, e.g. increasing resources for heart diseases in economic upturns or adjusting road safety regulations to different traffic demands etc. (3) To

serve as an element of knowledge for potential public health information, e.g. increased/decreased risk of heart disease related to the business cycle, and, as mentioned above, as a possible input in a broader health care policy.

The analysis in this paper reveals that no robust relationship can be found between total, age or gender-specific mortality and the business cycle. The ten specific causes of death indicate that this is reasonable, considering that the effects are different for different causes. Two robust results are found in the cause-specific analysis. Primarily *Other Accidents*, including job-related fatalities, significantly increase in economic upturns, while *Heart Disease* mortality, the most common cause of death in Sweden as well as in many other developed countries, tends to decrease in economic upturns.

The rest of the paper is structured as follows. Section two provides a brief background to the expected mechanism between mortality and the business cycle. The third section describes the data and the methods used in the empirical analysis, which is conducted in the fourth section. The last section concludes the paper with a discussion.

II. Mechanisms through which the business cycle may affect mortality

There are several mechanisms through which the economy may affect the mortality rate and some of them are listed below.

Stress: In good times unemployment decreases and this may imply less psychosocial stress due to less economic insecurity (Fenwick and Tausig, 1994). However, stress may also increase in good times for the average individual if overtime becomes more frequent and job-stress increases. Hence, stress might increase in bad times for some and in good times for others. It is generally known that stress is a risk factor, especially for cardiovascular

diseases/mortality (Black and Garbutt, 2002; Brenner and Mooney, 1983; Elisaf, 2001; Fenwick and Tausig, 1994; Krantz and McCeney, 2002; Pickering *et al.*, 2003).

Unhealthy behavior: Using a large individual level dataset over a period of 11 years in the US has helped to show that binge drinking increases in recessions (Dee, 2001). The same result is found using regional data for Finland (Johansson *et al.*, 2006). By contrast, Ruhm (2005) and Ruhm and Black (2002) have shown that binge drinking and smoking increase during economic upturns. Ruhm and Black (2002) argue that this is mainly due to heavy drinkers consuming less in recessions and not movements into and out of drinking in general. They maintain that this is to some extent an income effect leading to less drinking in short-term economic downturns when unemployment increases. That behavior such as binge drinking is important for mortality rates even in the short-run was documented as early as during WWII when alcohol-related mortality decreased quickly when alcohol consumption decreased, see e.g. Johansson *et al.* (2006) and Ruhm and Black (2002).

Health investments: Longer working hours in short-term economic upturns could make it more costly for individuals to invest in health enhancing exercises and to eat healthier food, which might be more time-intensive in preparation (Chou *et al.*, 2004; Ruhm and Black, 2002). However, once again there is some conflicting evidence; it has been found that better economic conditions produce a decrease in BMI in Finland (Böckerman *et al.*, 2006). There is also an indication that economic upturns, and the longer working hours that result from them, lead to lower investments in sleep time (Biddle and Hamermesh, 1990), which in turn is linked to higher levels of stress and increases in psychological illness (Sparks *et al.*, 1997).

Further, in good economic times it is also possible that traffic intensity increases and hence the risk of traffic-related mortality. The same link could be argued to potentially exist between job-related fatalities and the business cycle. In good economic times there is more

work done, and potentially at a faster pace, so job-related accidents, also with fatal outcomes, might increase.

Given that the evidence above indicates that there are several mechanisms linking the business cycle and mortality, and they might move in opposite directions, it becomes an empirical issue to determine which effects dominate, if any. Finally, it should be noted that the effects described above primarily concern the health effects of short-term economic upturns or downturns. In the long-term economic growth and innovation are major causes of increased health and longevity. The difference compared to the short-term impact is that long-term growth is the result of technological improvements that are not associated with more intensive use of labor and health inputs. As an example it has been estimated that 50 to 70 percent of the increased survival in cardiovascular disease between 1984 and 1999 may be explained by improved medical technology (Cutler *et al.*, 2006). Topel and Murphy estimate that the economic value of e.g. medical research, possibly due to long-term economic growth, is enormous. An example, the value of reduced heart disease mortality in the US was worth around $1.5 trillion per year over the period 1970 to 1990.

III. Data and Method

To estimate the short-term impact of business cycle fluctuations on mortality, I use aggregate data for all 21 Swedish regions, all of which are also independent providers of health care. Data covers these 21 regions between 1976 and 2005, giving a balanced sample of 21 cross section units followed for 30 years and a total number of 630 observations. The main dependent variable of interest is the natural log of the mortality rate per 100,000 individuals in each region. In addition to exploring the mortality for males and females and for different age categories, I will also look at ten cause-specific mortality rates, for (ischemic) heart disease,

suicides, homicides, traffic accidents, influenza, cancer, two different alcohol-related mortality rates, falling accidents and finally "other accidents", including many types of job-related fatalities. The full model to estimate in the paper is:

$$\ln y_{jt} = \alpha_t + u_{jt}\delta + \mathbf{x}_{jt}\beta + R_j + R_j \cdot T + e_{jt} ,$$ (1)

where y_{jt} is the mortality rate in region j at time t, and α_t is a year-specific effect and R_j is the regional-specific intercept. $R_j \cdot T$ is a regional specific time trend. The business cycle proxy is u, which is the regional unemployment rate from Statistics Sweden (SCB, 2005). The unemployment rate is measured as the unemployed as a share of the labor force. In contrast to most other developed countries, Sweden does not count students actively looking as unemployed. Using the unemployment rate as a business cycle proxy is most common in the literature (Gerdtham and Ruhm, 2006; Neumayer, 2004; Ruhm, 2006). Finally in equation (1) $\mathbf{x}$ is a vector of other covariates and e_{jt} is the error term.

Within-region changes in the variables are calculated in the fixed-effects panel data model and these are then compared region-wise to estimate the particular impact of the business cycle fluctuations on mortality. The main benefit of the fixed-effects model as described in equation (1) is that it can control for omitted variable bias in a way that a cross-section or time-series model is not capable of doing. In equation (1) R_j controls for factors that differ among regions (such as lifestyles), but do not change over time, and α_t controls for factors that change over time in the same way in all regions, such as improved medical technology or new and more efficient pharmaceuticals. $R_j \cdot T$ controls for changes over time, but allows these changes to be different, and/or occur at different times, e.g. if new medical technology is introduced earlier in some regions.

Finally in this section descriptive statistics of the variables and their sources are found in Table 1.

[Insert Table 1 here]

The mean mortality per 100,000 individuals is 1,125 over the full time period. There was a decrease in the mortality during the time period 1976 to 2005. In 1976 the mortality was 1,101 per 100,000, which decreased to 1,060 per 100,000 in 2005. The mortality rate also varied significantly between the regions; in 2005 the mortality rate was 815 per 100,000 in the region of Uppsala, close to the capital region of Stockholm, compared to 1,263 per 100,000 in the rural and northern region of Västernorrland. The unemployment rate, on a national level, increased during the time period from 1.6% in 1976 to 6% in 2005. This time period is also of particular interest to study, since it also contains a time period with unusually large business cycle swings, e.g. from 1990 to 1996 the unemployment rate increased from approximately 1.6% to 8%. Figure 1 below shows the unemployment rate over the time period 1976 to 2005, as well as cause-specific mortality in heart disease and cancer, with data from 1976 to 1996.

[Insert Figure 1 here]

Other covariates included are the shares of the young and elderly, which are assumed to have negative and positive impacts on mortality respectively. This is included to control for different age-structures in the region, considering that the dependent variable is not age-adjusted.[2] Migration may be potentially important in these type of studies (Ruhm, 2006) since regions that have a more positive business cycle impact may attract more individuals in pursuit of better employment opportunities that might be e.g. healthier than the average. The share of foreigners in each region may be important due to evidence of health gradients

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[2] I have experimented with different types of age controls, and the results in section four are robust for other uses of age controls as well.

(Banks *et al.*, 2006) even though they tend to be lower in Sweden compared to other countries

(Gerdtham and Sundberg, 1998; van Doorslaer *et al.*, 1997).

IV. Results

Before studying cause-specific mortality rates, Table 2 below begins by showing the results of

exploring the business cycle effect on total, male and female mortality rates.

[Insert Table 2 here]

The results when using three different specifications are shown. The first specification

includes year dummies and the unemployment rate as independent variables. The second

specification adds the other covariates, and the third specification estimates the full equation

(1), including regional specific time trends as well. Generally, no robust relationship can be

found. In the more simplistic specifications there are some indications that female mortality

decreases when the economy weakens (a higher unemployment rate is related to a decrease in

the mortality rate). But this is not significant in the full model. The age-variables behave as

expected; an increasing share of young individuals decreases mortality, while an increasing

share of elderly increases mortality. Somewhat surprisingly, a higher share of non-Swedish

born individuals is associated with a decrease in mortality in some specifications, albeit not

significant in the full model. As was discussed in section two, there are some mechanisms

likely to increase mortality, and some likely to decrease mortality, in good times. Hence, the

non-robust and weak relationships in Table 2 are not particularly surprising. Considering the

weak results, I move on to age- and cause-specific mortality.

[Insert Table 3 here]

Regarding age-specific mortality the results in Table 3 tell a similar story to the one in Table 2, and hence reveal no significant overall effect. Looking at cause-specific mortality, most causes show no significant correlation with respect to the unemployment rate. One of the main causes of death, cancer, is probably not likely to be affected by short-term changes in the business cycle. However, a non-significant effect on *Traffic Accidents* is perhaps more surprising. The non-significant effect on *Suicides* might intuitively be surprising, but is consistent with recent evidence based on European data (Andrés Rodriguez, 2005).

There are two major exceptions to the non-significant results regarding *Heart Disease* and *Other Accidents*. The results relating to *Heart Disease* are of major importance since this is the cause-specific category with most deaths. Considering that it is a semi-log model, the coefficients should be interpreted as that the exponent of the coefficient is the percentage increase in mortality from a one percentage point increase in the unemployment rate. In the full model, as in equation (1), this implies that a one percentage point higher unemployment rate increases ischemic heart disease mortality by approximately 1%. *Other Accidents* picks up different types of accidents, but they tend to be of the job-related sort. Hence, the pro-cyclical result, a decrease in *Other Accidents* mortality when the unemployment rate decreases, is quite intuitive. The coefficient of the full model indicates that a one percentage point increase in the unemployment rate decreases *Other Accidents* mortality by 13.9%.

For *Heart Disease* and *Other Accidents* I also perform some dynamic analysis, in which I use the average unemployment rate in each region 3 years prior to the year of interest regarding mortality. I also check for the very short-term impact in this model by calculating the deviation in the employment rate in year t compared to the average employment rate in year t-1 to t-3. This is similar to the approach to dynamic analysis in Ruhm (2006), an argument for which is that changes in the business cycle will affect health in many respects

and not only in the short-run. Further, there is a correlation between the unemployment rate in year t and the unemployment rate in the preceding years, which means that the analysis in Table 2 might pick up some of the medium-term trends.

[Insert Table 4 here]

The results in Table 4 indicate that there is an impact of the average unemployment rate 3 years prior to the current year, and in addition to the short-term impact. The coefficients imply that a one percentage point higher unemployment rate during the last 3 years increases mortality in *Heart Disease* and decreases mortality in *Other Accidents* with approximately 2.7% and 11.3% respectively. Regarding the short-term impact the coefficients imply that a one percentage point increase in the unemployment rate during a given year, compared to the average unemployment rate during the last 3 years, increases mortality in *Heart Disease* by 1.7% and decreases mortality in *Other Accidents* by 9.2%.

V. Discussion and Conclusions

This paper, using the same methods as Ruhm (2000), Neumayer (2004), Gerdtham and Ruhm (2006), finds approximately the same results with Swedish data as Gerdtham and Johannesson (2005) who used a different approach, namely a non-existent overall relationship between the unemployment rate and mortality, and a counter-cyclical result for heart disease.[3] It also points in the same direction as the results in Svensson (2007), who found that a one percentage point increase in the unemployment rate increases heart attack mortality by 7.8%. This paper contradicts the results on Swedish data by Granados (2004), but he used times-series data for almost 200 years, and the pro-cyclical effect faded after WWII. The non-

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[3] This was found for men in Gerdtham and Johannesson (2005) for some of the business cycle indicators.

significant overall effect is explained by the fact that of ten cause-specific mortality rates, the unemployment rate indicate a pro-cyclical relationship in some cases, and in other cases a counter-cyclical relationship. Two causes of death tend to be statistically significantly related to the unemployment rate. As mentioned above, the most common cause of death (ischemic heart disease), indicates a counter-cyclical relationship and other accidents, which includes job-related fatalities, indicate a pro-cyclical relationship. The dynamic analysis also indicates that it is both a very short-term impact and a short/medium-term relationship.

Hence, the results in the paper indicate that the pro-cyclical results based on US, German and Spanish data cannot be taken to be universally true in other settings. A counter-cyclical result has also been documented regarding alcohol-related mortality in Sweden's neighbour Finland (Johansson *et al.*, 2006). The same has been found regarding general health in Finland, where BMI increases during economic downturns (Böckerman *et al.*, 2006). Other possible explanations for the contrasting results in Sweden might be that large parts of Sweden have a very low population density, and e.g. the strong effects of increased traffic fatalities due to economic upturns as documented in the US (Granados, 2005; Ruhm, 2000), cannot be seen to be significant for Sweden in this paper. There are simply no congestion effects, with increased accidents, on most roads in Sweden in economic upturns. However, this cannot explain the opposite and significant effect on *Heart Disease* found in this paper. A potential explanation can be found in the paper by Gerdtham and Ruhm (2006), who find that the pro-cyclical effect on OECD countries is weaker in countries with extensive social welfare systems and more rigid labor markets. Compared to the US, Sweden certainly has more of a social welfare system and rigid labor markets. However, the same results as found in the US have also been documented in Germany and France (Buchmueller *et al.*, 2007; Neumayer, 2004), which are also countries with rigid labor markets and "social-democratic"

welfare systems. Exactly why the results differ in the Nordic countries (Sweden, and evidence of it in Finland as well) needs further research.

Considering the magnitude of the results, a one percentage point lower unemployment rate decreases *Heart Disease* mortality by approximately 1% and increases *Other Accidents* by 13.9%.[4] An economic estimate of the effect may be obtained by monetizing this in terms of the number of fatalities and using the value of a statistical life year (VSLY), or the value of a statistical life (VSL) (Mishan, 1971; Schelling, 1968; Thédié and Abraham, 1961).[5] In frequencies the mean annual national number of deaths in (ischemic) heart disease between 1976 and 1996 was 28,705 (SCB, 2006a). A decrease of 1% corresponds to 287 reduced deaths. Monetizing 287 reduced deaths using a recent US estimate of VSLY of $100,000 (Viscusi and Aldy, 2003), as a lower bound estimate, puts this at $28.7 million. Using a recent estimate of Swedish VSL (Hultkrantz *et al.*, 2006) puts this at a higher bound of $832 million.[6] Regarding *Other Accidents* there was an average of 843 annual fatalities between 1976 and 1996 (SCB, 2006b). A one percentage point lower unemployment rate increases this by 13.9%, which corresponds to circa 117 increased fatalities, with a monetized value of $11.7 million and $340 million using VSLY and VSL estimates, respectively.

These are of course very crude estimates, but are meant as indications of the relevant economic values related to changes in health status. They also indicate, as stated in the

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[4] The magnitude of Heart Disease mortality is different from the results in Svensson (2007), but that study only focused on acute myocardial infarction (heart attacks), whereas in this paper heart disease refers to all cardiovascular-related mortality. Svensson (2007) was also based on a different time period and only on individuals aged 20-49.

[5] If one life-year is assumed to be saved, VSLY is the appropriate estimate, which can be thought of as the willingness to pay to increase longevity by one year. If many life-years are saved, VSL, or something in between VSLY and VSL is the appropriate estimate. These estimates (VSL) can be considered as the willingness to pay to prevent one (unidentified) fatality. Hence, in a situation where e.g. 10 unidentified fatalities can be prevented, the total monetized value is the value per prevented fatality multiplied by 10.

[6] This should only be interpreted as a very crude indication of how one may go about monetizing the effects, something that has not been discussed previously in the literature on business cycles and mortality rates. The VSL estimate from Hultkrantz et al. (2006) is translated to US dollars only using the exchange rate (not PPP-adjusted). An effect of equal magnitude of reduced deaths in the US would render higher monetized effects, given the higher income in the US compared to Sweden (VSL is assumed to increase with income). It should also be noted that an assumption is that transferring values from the transport sector is OK (the VSL estimate is from the preventing fatalities in the transport sector, which may not necessarily be the same as preventing fatalities from heart disease).

introduction, how a broader societal concept of unemployment may be calculated. With unemployment comes not only financial loss, but an increase in heart-related mortality and other effects as well, such as increased property crime rates (Edmark, 2005). This is important for public policy to take into consideration when evaluating the labour market and labour market policy.

It is also sometimes argued that national accounts should be extended to include environmental values that might be destroyed in economic production, e.g. called green national accounts, or that a total economic wealth of nations should include estimates of natural capital, see e.g. The World Bank (2006). However, taking such steps would logically also have to lead to including monetized health effects of long-term growth. As in the results reported here, or as e.g. Cutler et al. (2006) have shown, longevity is related to investments in medical care that has tremendous value in itself. This implies that we underestimate the true value of long-term economic growth, and monetized health improvements included in national accounts would indicate even larger growth rates than those reported in regular national accounts.

Reiterating further the policy relevance discussed in the introduction, the results can be summarized by saying that an increase in the unemployment rate may be regarded as being related to an increase in health care demand for heart-related problems. Hence, if budget issues are a concern in recessions, the results here indicate that it is important not to cut back on health care related to heart diseases; rather the opposite, to plan for higher demand in weaker economic times. Further, in good economic times it will be beneficial to improve job-related safety, or to increase monitoring of newly employed workers, who have less experience and might be a reason for some of the increase in job-related fatalities in economic upturns (Breslin and Smith, 2006).

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Tables

Table 1: Descriptive statistics

Variable name	Description	Mean	Std. Dev.
Mortality	Mortality per 100,000 individuals	1125.10	120.52
Male mortality	Male mortality per 100,000 men	1184.80	144.00
Female mortality	Female mortality per 100,000 females	1065.53	121.94
Heart Disease	Ischemic heart disease mortality per 100,000	360.08	70.83097
Suicides	Suicide mortality per 100,000	17.82	4.01
Homicides	Homicide mortality per 100,000	1.11	0.77
Traffic Accidents	Traffic accident mortality per 100,000	10.23	3.70
Influenza	Influenza mortality per 100,000	3.15	3.56
Cancer	Cancer mortality per 100,000	241.94	22.01
Alcohol	Alcohol psychosis & addiction mortality per 100,000	3.48	2.59
Alcohol 2	Alcohol poisoning mortality per 100,000	1.67	1.47
Falling Accidents	Falling accidents mortality per 100,000	15.17	5.23
Other Accidents	Other accidents mortality per 100,000	9.81	3.22
Unemployment	Unemployment in %	4.41	2.48
Foreign	Share of non-Swedish citizens in each region (%)	3.94	1.92
Migration	Net migration as share of population (%)	0.15	0.35
Young	Share of population aged 0 to 20	26.58	1.47
Old	Share of population aged 65+	17.74	1.73

Notes: All data are from Statistics Sweden (SCB, 2005, , 2006c, , 2006a). Number of observations are 630 for all variables except cause-specific mortality rates where the observations number 441. Data on mortality rates are mean values among the regions and not weighted for population, which mean that the figures do not necessarily correspond to national data (which are in fact lower).

Table 2: Business cycle effects on incidence and mortality: panel data fixed effects estimations

Dep. Var.	*Total mortality*			*Male mortality*			*Female mortality*		
Unemployment	3.86E-04	0.003[*]	-7.51E-04	-0.003	-0.003	0.002	-0.006[*]	-0.005[*]	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Foreign	-	-0.001	-0.004	-	-0.023[***]	0.001	-	-0.021[***]	-0.008
		(0.003)	(0.005)		(0.004)	(0.005)		(0.005)	(0.006)
Young	-	-0.004	-0.002	-	-0.017[**]	-0.008	-	-0.009	-0.010
		(0.004)	(0.005)		(0.006)	(0.007)		(0.006)	(0.007)
Old	-	0.038[***]	0.018[***]	-	0.011[***]	3.99E-04	-	0.003	0.010
		(0.004)	(0.005)		(0.005)	(0.006)		(0.005)	(0.007)
Migration	-	0.006	0.002	-	0.008	-0.006	-	0.010	-0.002
		(0.005)	(0.005)		(0.007)	(0.007)		(0.008)	(0.007)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region specific time trend	No	No	Yes	No	No	Yes	No	No	Yes
N	630	630	630	630	630	630	630	630	630
R^2	0.34	0.59	0.69	0.57	0.60	0.76	0.71	0.73	0.82

Notes: Two-tailed tests significance levels: *** 0.01, ** 0.05, * 0.10, based on robust std. errors.
Estimations are based on equation (1) with region fixed effects and year dummies, and also including regional specific time trends in one model.

Table 3: Business cycle effects on age subgroups and cause-specific mortality: panel data fixed effects estimations

Dep. Variable:	Unemployment coefficient	Unemployment coefficient	Unemployment coefficient
Mortality Age 20-49	0.002	-0.007	-0.003
Mortality Age 50-64	0.006	0.002	0.004
Mortality Age 65+	0.004	-1.64E-04	-8.01E-04
Heart Disease	0.018***	0.010*	0.010**
Suicides	0.025	0.024	0.027
Homicides	-0.501	-0.481	-0.722
Traffic Accidents	0.001	-0.029	-0.031
Influenza	-0.312	-0.287	-0.246
Cancer	0.003	-0.002	-0.003
Alcohol	0.030	-0.108	-0.117
Alcohol 2	0.557	0.102	0.012
Falling Accidents	-0.020	-0.015	-0.030
Other Accidents	-0.084***	-0.120***	-0.130***
Fixed Effects	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Region Specific Time Trend	No	Yes	Yes
Other covariates	No	No	Yes

Notes: Two-tailed tests significance levels: *** 0.01, ** 0.05, * 0.10, based on robust std. errors. Other covariates refer to those used in Table 2 except for the age-specific mortality regressions which do not use the variables *Old* and *Young* as covariates. For cause-specific mortality the panel data covers all regions for years 1976-1996, which implies 441 observations.

Table 4: Dynamic Effects

| Dep. variable	3-year prior unemployment rate	Short-term impact
Heart Disease	0.027***	0.017**
Other Accidents	-0.107**	-0.088**

Notes: Two-tailed tests significance levels: *** 0.01, ** 0.05, * 0.10, based on robust std. errors. Other covariates included in the model, but not shown here. The 3-year prior unemployment rate refers to the average unemployment rate in year t-3 to t-1 where t is the survey year. Short-term impact refers to the deviation of the unemployment rate during the survey year compared to the average for the 3-year priors to the survey year.

Figures

Figure 1: Heart Disease and Cancer Mortality per 100,000 & Unemployment Rate in Sweden
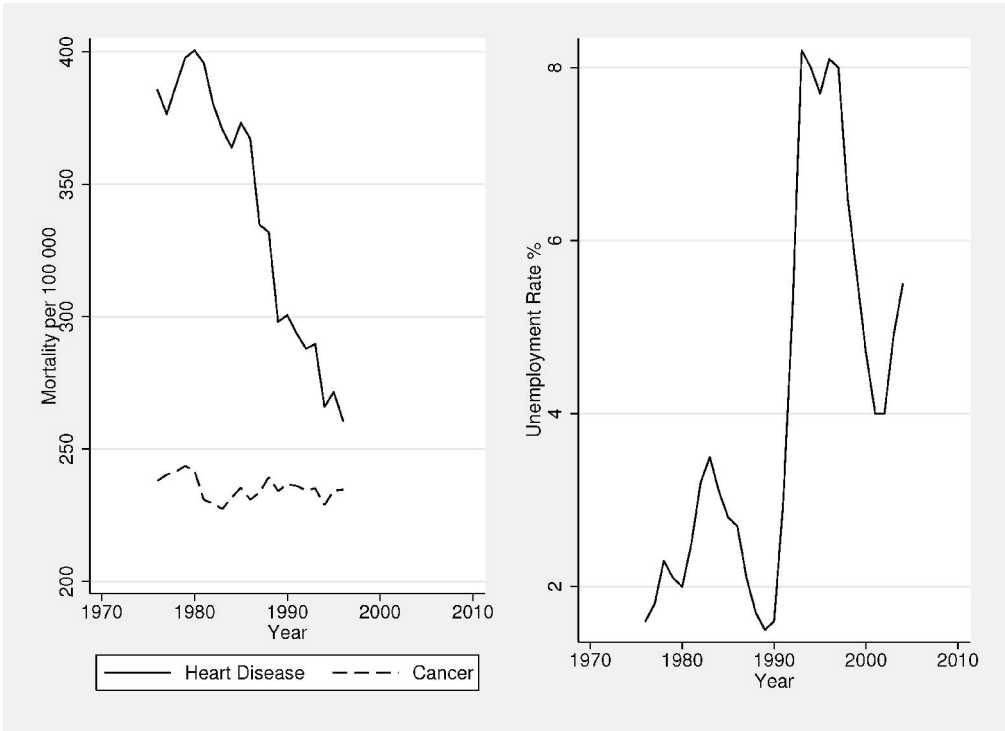
Heart Disease and Cancer Mortality per 100,000 & Unemployment Rate in Sweden
139x101mm (600 x 600 DPI)