Unemployment and Mortality in France, 1982-2002

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Abstract

This study uses aggregate panel data on 96 French *départements* for the period from 1982 to 2002 to investigate the relationship between macroeconomic conditions and mortality. We estimate linear regression models with local area and time fixed effects. The main finding is that higher local unemployment rates are associated with significant reductions in mortality. The sign and magnitude of the effects are quite consistent with several recent studies using data from other countries. Models of mortality by source indicate that the negative relationship between unemployment and mortality is strongest for deaths due to cardiovascular disease and accidents.

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1. Introduction

There is considerable interest among social science researchers and policy makers in the relationship between macroeconomic fluctuations and population health. Research in this area goes back to Brenner's seminal work on admissions to mental hospitals in New York State (Brenner, 1973a). This and other studies based on time series data for one geographical unit, found a negative relationship between unemployment (used as the main indicator of the business cycle) and health: Economic downturns were found to lead to deterioration in various health indicators, such as higher rates of admission in psychiatric hospitals (Brenner, 1973a, Marshall and Funch, 1979), higher cardiovascular mortality (Bunn, 1979, Brenner and Mooney, 1982), higher infant mortality (Brenner, 1973b) and overall mortality (Brenner, 1979). Important exceptions among this early literature are two studies by Eyer (1977a, 1977b) that find that mortality increases during good economic times.

The basic conceptual model used to explain these patterns derives from the social epidemiology tradition and posits that the disruption of social expectations or anticipation generates stress and is therefore detrimental for health, either directly or through an increased prevalence of health damaging behaviors such as drinking or smoking. One prediction of such a model (which builds upon the concept of anomy (Durkheim 1930)) is that upturns as well as downturns should be detrimental for health. However, empirical models in this tradition have only tested for a linear relationship between the unemployment rate and measures of health, and have concluded that downturns are worse than upturns.

While widely cited, these studies have been criticized on methodological grounds.[1] More recent studies using an alternative research design come to quite different conclusions. The first study in this new stream of literature is by Ruhm (2000) who applies panel data techniques to aggregate data on US states to estimate the effect of unemployment on mortality. He finds strong evidence that mortality *declines* during economic downturns. This result holds for overall mortality as well as for specific causes of death, such as heart disease, accidents (vehicles and others), homicides, and, to a lesser extent, pneumonia and infant mortality. Deaths from cancer are not related to the unemployment rate. Suicide is the one cause of death that varies counter-cyclically.

Additional research by Ruhm and others points to several causal pathways that may explain this result. Increases in economic activity may have direct effects on health. Longer working hours may result in an increase in workplace accidents and injuries as well as increased stress (Caruso et al. 2004; Yang et al. 2006). Studies based on the European survey on working conditions show that controlling for type of employment, full time workers report worse health outcomes than part time workers (Benach et al, 2004; Benavides et al, 2000).

Increases in working hours may indirectly affect health through a reduction in leisure, which in turn leads to a less healthy lifestyle. Using individual-level data, Ruhm (2000, 2005b) finds that economic downturns are associated with more exercise, healthier diets, and reductions in smoking and obesity. Other studies find that heavy alcohol consumption and deaths due to drunk driving vary pro-cyclically (Evans and Graham

[1] See, for example, Gravelle et al. (1981), Wagstaff (1985), Laporte (2004), and Ruhm (2005).

1988; Wagenaar and Streff 1989; Ruhm 1995; Dee 2001; Ruhm and Black 2002; Dehejia and Lleras-Muney 2004).

Non-workers may also be affected. For example, the increase in pollution associated with higher levels of industrial production has been shown to lead to higher rates of infant mortality (Chay and Greenstone 2003). And economic expansions will mean greater traffic congestion. Several studies find a negative relationship between the unemployment rate and motor vehicle fatalities (Wagenaar 1984; Page 2001; Cohen and Dehejia 2004; Grabowski and Morrissey 2004, 2006).

Nearly all of these studies are based on data from the US. Because the US is so different from other industrialized countries in terms of its health care system and labor market institutions, the question of whether these results are relevant for other countries is an important topic for research. Two recent studies apply the same panel data models to aggregate data from Germany (Neumayer 2004) and Spain (Tapia-Granados 2005). The results of both studies are generally consistent with the findings from the US. Similarly, Gerdtham and Ruhm (2002) find a negative relationship between unemployment and mortality using country level panel data from the OECD.[2]

We extend this literature by investigating the relationship between local area unemployment rates and mortality in France. There are several reasons why France is an interesting case to study. First, relative to the US, French workers benefit from greater employment protection and regulation of working conditions. International comparisons rate labor market conditions in France as being significantly more “worker friendly” than in the US (Nickell 1997; Chor and Freeman 2005). In 1996, the average French worker

[2] Bockerman et al (2006) analyze the relationship between regional macroeconomic conditions and body mass index (BMI) in Finland. Contrary to the studies from the US, they find that BMI falls when the economy improves. They do not analyze the effect of the unemployment rate on mortality.

worked 1650 hours per year compared to 1940 for the average American worker (Nickell, 1997). Second, during the period we study (1982-2002), unemployment was approximately 40% higher in France than in the US. Long term (more than a year) unemployment represented almost half of total unemployment in France versus less than 10% in the US (Nickell, 1997). Because of differences in regulations and societal values concerning work and lifestyle, economic booms may not produce the same levels of stress and increases in unhealthy behaviors in France as in the US. At the same time, the case of France could be one of pathological unemployment, where downturns could bring more anomy, offsetting the positive effect of shorter hours on health.[3]

One methodological difference between this study and others in the literature is that we analyze a much smaller geographic unit of observation. Specifically, we measure mortality and unemployment at the level of the *département*, compact geographic areas that are much smaller in both land area and population than US states or German *Länder* (Neumayer 2004) and slightly smaller than Spanish provinces (Tapia-Granados 2005). One advantage of a more localized analysis is that there is less within-unit heterogeneity in economic conditions and other factors affecting health than with geographic areas as large as US states.

Despite the significant institutional differences between the two countries, our results for France are quite similar to previous research on the US. We find a negative relationship between unemployment and mortality. The next section describes our data

[3] The relationship between the unemployment rate and health outcomes may be different in time of extreme economic crisis. Analyzing time series data from the former soviet Republics, McKee and Suhrcke, (2005) find that decreases in GDP per capita are associated with increases in mortality. Similarly, Cutler et al. (2002) find that recent economic crises in Mexico led to increases in mortality and Brainerd (2001) finds that downturns are associated with increases in suicide in the former Soviet Union.

in more detail and outlines our econometric specification. Results are presented in Section 3 and concluding remarks are in the fourth and final section.

2. Data and Methods

2.1. Data Sources

In France, the fundamental administrative and political jurisdiction is the *département*. Created in 1790, France's *départements* are governed by an elected assembly (*conseil général*), with responsibility for secondary education, local transportation networks, social assistance and health care.[4] Importantly for our study, the national unemployment program is administered by *départements*. Individuals who enroll must do so at the local branch of the *département* where they live. As a result, the total number of enrolled individuals searching for a job (through the state employment service) in every *département* is known for each quarter.[5] There are currently 96 *départements* in 'metropolitan France'[6], with an average land area of 5,666 square kilometers (three and half times the median land area of US counties) and an average 2003 population of 525,000.[7] In 2000, the average level of GDP per capita was €24,000

[4] To put this in rough perspective relative to the US, *départements* are more important as units of government than US counties, but less important than US states.

[5] For details on how unemployment statistics are calculated in France, see Hachid and Vallon (2005).

[6] Since 1790, there have been few changes in *département* boundaries. The last change was in 1982 (the first year of our data) when the island of Corsica was divided into two *départements*. Today, France is composed of continental France (94 *départements*), Corsica (2 *départements*), and overseas (4 *départements* and several territories). In this study, we use the 96 ones belonging to continental France and Corsica, sometimes referred to as metropolitan France (*France métropolitaine*). We exclude from our analysis overseas *départements* located in the Caribbean (Martinique and Guadeloupe), South America (Guyane) and the Indian Ocean (la Réunion).

[7] In terms of land area, departments range in size from 100 square kilometers (Paris) to 10,000 square kilometers (Gironde). The range in population is from 75,000 (Lozère) to 2,574,000 (Nord). As another point of comparison, the 50 Spanish provinces analyzed by Tapia-Granados (2005) range in population from 100,000 to 5 million.

(approximately $30,000), with a minimum of €15,500 (Creuse) and a maximum of €67,500 (Paris).

Our analysis is based on *département* level data for the 21 year period from 1982 to 2002. As noted, an advantage of using a smaller geographic area than prior studies is that there should be less within-area heterogeneity in economic conditions. The main drawback is a lack of precision in the measurement of cause-specific or age-specific death rates. It is also possible that mortality rates measured at a small local area are affected by migration—e.g. older individuals may go back to rural, isolated areas where they originated from a few months or years before dying.[8] The evidence from French census and vital statistics data suggest that two regions—Ile de France and Alsace—"lose" approximately 3% of their annual deaths. For other areas, however, this does not appear to be an issue (Baccaïni 2001). Even to the extent that this type of migration occurs, there is little reason to expect it to be correlated with short-term changes in local unemployment rates.

Population-weighted summary statistics are presented in Table 1. Total gross mortality (i.e. not age-adjusted) is somewhat higher than in Ruhm's (2000) sample of US states (934 per 100,000 versus 880 per 100,000), due to an older population: 14.5% of the population in the average French *département* is 65 or older compared to 11.5% in the average US state. Within each of the three age categories reported, the mortality rate is lower in the average French *département* than in US states. National data for France show a gradual, but steady decline in mortality rates, from roughly 1000 per 100,000 in 1982 to 907 in 2002 (Figure 1).

[8] Because population mobility is lower in France than in the U.S., inter-*département* mobility in France is similar to inter-State mobility in the US, with a yearly ratio around 1.5% (for France, Baccaïni, 2001; for the US, Schachter, Franklin and Perry, 2003).

In addition to analyze the effect of unemployment on total mortality, we estimate regression models of mortality by cause and by age group. The disaggregation by cause of death is based on ICD-9 codes, following as closely as possible the breakdowns used in previous studies (Ruhm 2000; Neumayer 2004; Gerdtham and Ruhm 2002). As in the US (Ruhm 2000, 2005) and other OECD countries (Gerdtham and Ruhm 2002), cardiovascular disease is the most important cause of death. France stands out from other developed countries for having a high suicide rate. Nationally, the rates are 26.6 per 100,000 for males and 9.1 for females in 2001, versus 17.6 and 4.1 in the US (in 2001), 10.8 and 3.1 in the UK (in 2002).[9] In our data, the mean *département* level suicide rate for the whole period is 20.1 suicides per 100,000.

Data on unemployment were collected from INSEE *Département de l'Action Régionale*. We calculate annual rates by taking a straight average of four quarterly rates for each year. During this period, the national unemployment rate ranged from roughly 8% to just over 12% (Figure 1). There was more cross-sectional variation among *départements*. In 1982, the local unemployment rate ranged from 4.5% to 11.7%; in 2002 the range was between 5.2% and 14.9%.

To give a fuller sense of how unemployment and mortality varies over this period and to foreshadow the econometric analysis, Figure 2 plots de-trended values of both variables normalized by their respective standard deviations. At both the start and the end of the two decade period, unemployment is relatively low and mortality is relatively high. In the early to mid-1990s, the reverse is true. The years with the lowest relative unemployment rates (1982-83 and 2000-02) coincide with higher than average relative

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[9] For more details, see http://www.who.int/mental_health/prevention/suicide_rates/en/. This higher suicide rate in France was already reported in Durkheim for the 1880-90s.

mortality rates. The five year period with the highest national unemployment rate was 1993 to 1998. In four of these five years, the mortality rate was below trend.

2.2. Econometric Specification

Our regression model specifies measures of mortality as a function of the unemployment rate, average income and fixed area and year effects:

$$(1) \qquad LnM_{i,t} = \alpha + \beta UR_{i,t} + \gamma INCOME_{i,t} + \delta_i + \theta_t + \varepsilon_{i,t}.$$

In our main specification, the dependent variable is the natural log of the (unstandardized) mortality rate in *département i* in year *t*. We also report models where the dependent variable is the number of deaths per 100,000 persons.[10] The unemployment rate (*UR*) and the average income in the department (*INCOME*) are also measured annually at the level of the *département*. The model includes *département* fixed effects (δ_i) that account for longstanding differences across geographic areas. Indicator variables for each year (θ_t) account in a flexible way for national trends in mortality. In some specifications, we replace the year dummies with the national unemployment rate.

Data on mortality and unemployment are available for each *département* for all 21 years, giving us a total sample of 2016 observations. Data on income are based on tax

[10] A third alternative is a grouped logit model which specifies the dependent variable as ln(*M*/1-*M*), where M is the raw mortality rate. This specification yields the same qualitative results as the two that we report.

returns from *Direction Générale des Impôts* (DGI) and are available from 1990 only.[11] We report models estimated on the full sample that exclude income as well as models for the years 1990 to 2002 that include the income variable. In all models reported, each observation is weighted by the square root of its population.

With this specification, the effect of unemployment is identified by within-*département* variation. Therefore, it is important that macroeconomic fluctuations vary across these geographic areas. Ruhm (2000) shows that this condition is easily met in his panel of US states: for most states the correlation of the state unemployment rate and the national rate is low, and over time the ranking of states in terms of unemployment changes considerably. Consistent with the general perception that the French economy is less dynamic than the US economy, there is less independence across areas in our data. The squared correlation between the departmental and the national unemployment ratio is above .9 in 18 *départements* (versus 3 states in Ruhm (2000)), and below .5 in 17 *départements* (versus 20 states). The "between" *département* variance represents 71% of total variance. Six of the 10 *départements* with the highest unemployment rate in 1982 were also in the top 10 in 2002. There is more variation at the other end of the distribution: only 3 of the 10 *départements* with the lowest unemployment rates in 1982 were also among the lowest in 2002.

[11] This is average taxable income per tax household. A tax household is similar to a household except that newly formed or dissolved households account for 3 tax households for a given year (this is a source of underestimation of the true household income but there is no reason to suspect it to differ across jurisdictions or over time).

3. Results

3.1. Total Mortality Results

Table 2 reports regression results for our baseline models, in which the dependent variable is the log of the total mortality rate (panel A) and the mortality rate per 100,000 population (panel B). Standard specification tests (Breusch and Pagan's LM test and a Hausman test) indicate significant *département*-specific intercepts and reject a random effects specification. Therefore, all models that we report include *département* fixed effects. The first column includes only these fixed effects and the local unemployment rate. Column 2 adds year dummies. This is our preferred model because it accounts for general time trends in a flexible fashion. An alternative way to control for national trends is to replace the year dummies with the national unemployment rate (column 3). Results in these first three columns pertain to the full sample of 21 years, and therefore do not control for income. The average income variable is added in columns 4 and 5 and the sample size is reduced accordingly.

Consistent with the previous literature, the results indicate that total mortality tends to be pro-cyclical in France. In all 10 models presented in Table 2, the coefficient on the unemployment rate is negative and statistically significant at the .05 level or better. In the full sample, when the dependent variable is the natural log of the mortality rate and the model includes year dummies, the estimated coefficient on the unemployment rate is -0.0075 (t-statistic = - 3.09). The magnitude of this effect is slightly smaller than what Neumayer (2004) finds for Germany (-0.011) and slightly larger than Ruhm's (2000) results for the US (-0.005) and what Tapia-Granados (2005) finds for Spain (-0.003). When the dependent variable is the mortality rate (not logged), a one point increase in the unemployment rate is estimated to decrease mortality by 6 deaths per 100,000 persons (t-statistic = -3.10), which is comparable in magnitude to Ruhm's estimate from a similar model (-4.6).

Adding average income as a covariate in the model with year dummies (column 4) has little effect on the unemployment rate coefficient. Income has a negative and statistically significant effect on mortality, which is consistent with what Gerdtham and Ruhm's (2002) find for OECD countries and with some of Neumayer's (2004) results on German Länder, but contrary to what Ruhm's (2000) results for US states and Tapia Granados' (2005) results for Spanish Provinces. The results in column 4 of Panel A imply that a one percent increase in average income (€127 per year) would decrease mortality by 1 per 100,000 or 0.1%.

In columns 3 and 5 we replace the year dummies with the national unemployment rate. The coefficient on the national unemployment rate is positive and statistically significant. This differs from Ruhm's results for the US, but is consistent with what Tapia-Granados finds for Spain.

3.2. Sensitivity Tests using Alternative Samples

To test the sensitivity of our results, Table 3 reports the results using alternative sample inclusion criteria. For the sake of brevity, we only report results from the model that includes year dummies and excludes average income. For ease of comparison, the first row restates the results from Table 2. In column 1 the dependent variable is the natural log of the mortality rate and in column 2 it is the number of deaths per 100,000 persons.

As noted, one important way that our analysis differs from previous studies is that we use a much finer geographic unit of analysis. Some of the *départements* are quite small—the smallest has an average population (over the 21 year period) of 73,000; the 25th percentile is 285,000. To test whether our results are sensitive to pooling areas of different sizes, we split the sample in half according to the average population over the entire period. These results are reported in rows 2 (for *départements* with populations below the median) and row 3 (above the median). Interestingly, the coefficient estimates for the larger *départements* are quite close to what Ruhm finds for U.S. states. The results for the smaller *départements* indicate an even stronger negative effect of unemployment on mortality.

Another concern with this type of analysis is that the results may be affected by migration across areas. In particular, the migration of younger, healthier persons in response to economic opportunities may induce a positive correlation between mortality and the local unemployment rate. One way to test for this type of an effect is to compare *départements* that gained population during the period of our analysis (of which there are 76) with those that declined in population (20). *Départements* in the latter category were smaller at the start of the period, with an average 1982 population of 394,325 compared to 611,164 for the 76 that grew. They also had an older population (16% of the population aged 65 or older in 1982, compared to 13%) and a higher baseline mortality rate (11.5 per 100,000 vs. 9.7). However, these differences in age distribution and mortality remained fairly constant over the period and the unemployment rates for these two groups were quite similar over the entire period. Therefore, it is not surprising that when we exclude the 20 *départements* that lost population, the results (row 4) are not significantly different than the results for the full sample.

In the next 3 rows we cut the data by year, estimating models for three (overlapping) 10 year periods. The results are more sensitive to this change. When we use data from the first decade (1982 to 1991), the coefficient on the unemployment rate is not significantly different from zero. The effect is significant for the middle 10 years. In the ln(mortality) model, the coefficient is -0.005 (t-statistic = - 3.05). When the dependent variable is the number of deaths per 100,000 persons, the coefficient is -3.65 (t-statistic = -2.51). The coefficients for the ten years from 1993 to 2002 have a similar magnitude, but are estimated with slightly less precision.

It is worth noting important changes in the institutions governing the labor market took place in France in 1986-88. Prior to these changes, hiring and firing was subject to stricter regulations, which were administered by local authorities (the *Préfecture* at the *département*'s level); fixed term contracts were the exception rather than the rule and labor turn over was low. The reforms of the 1980s reduced the government's role and made the French labor market much more flexible (Givord and Maurin, 2001). This might explain why the impact of the business cycle on mortality is more important in recent years, suggesting the influence of societal institutions on the relationship between macroeconomic conditions and health.

3.3. Cause-Specific Mortality

Results for cause-specific mortality are reported in Table 4, which is organized in the same manner as Table 2. Consistent with prior studies (Ruhm 2000, 2006; Gerdtham and Ruhm 2002; Neumayer 2004; Tapia-Granados 2005) we find a negative effect of the unemployment rate on deaths from cardiovascular disease in our models controlling for the time trend. The models with year dummies (columns 2 and 4) imply that a one point decrease in the unemployment rate will raise deaths from cardiovascular disease by roughly one percent. The estimated coefficient on the unemployment rate is more negative in the models that use the national unemployment rate in place of the year dummies.

The results for motor vehicle fatalities are especially interesting in light of recent political developments in France. For years, France has had one of the highest rates of traffic fatalities in Europe. After being elected to a second term in 2002, President Jacques Chirac announced road safety as one of his three main policy objectives and the government instituted a number of new policies. Recent data suggests that the various efforts to improve safety have been effective: between 2001 and 2005, traffic mortalities in France fell by 36% (from 7720 to 4990).[12] A slowdown in the French economy may have also contributed to this trend. Our results suggest that between 6 and 19 percent of the decline in motor vehicle fatalities was due to an increase in the unemployment rate from 8.7% to 9.9% over this period. Between April 2005 and April 2006, unemployment fell by roughly half a percentage point and traffic fatalities increased by 6%. This pattern is also consistent with our results.

Mortality from other accidents, a category that includes but is not limited to accidents at the workplace, also decreases when unemployment rises. In contrast, the *département* level unemployment rate is not significantly related to the number of deaths

[12] Mortality figures are from France's Transportation Ministry. See the *Observatoire National Interministériel de la Securité Routière.*

from liver disease and estimates are inconsistent in the case of the number of deaths from cancer. Similarly, we find no clear relationship between the local area unemployment rate and suicide. In column 3 (the model that includes the national unemployment rate, excluding average income) the coefficient on the unemployment rate is negative and statistically significant at the .10 level. However, in all other models reported the coefficient is not significantly different from zero. When we specify the dependent variable in levels (results not shown), the unemployment coefficient is generally insignificant, though for one model it is positive with a p-value of .085.

3.4. Age-Specific Mortality

Table 5 presents results for age-specific mortality rates for three groups of adults: those between the ages of 20 and 44, 45 to 64, and 65 and older. The results for the two working age cohorts are sensitive to the inclusion or exclusion of the average income variable. For the youngest age group, when we don't control for average income, the coefficient on the local unemployment rate is not statistically different from zero. However, when we add income as a control, the unemployment rate has a large negative effect. The results for the middle age group show a similar, if less pronounced pattern. For both of these cohorts, the results for models in which the dependent variable is the mortality rate per 100,000 persons (not reported) are qualitatively similar.

We find a significant and negative effect of unemployment on the mortality of the elderly (65 and over). Such a result may seem surprising, since most of the elderly are out of the labor force in France, but the only two previous studies detailing the impact of the business cycle on age-specific mortality controlling for income (Ruhm 2000 and

Neumayer 2004) also find a significant impact of the business cycle on the mortality of the elderly. One plausible explanation for this result is that economic upturns lead to increased vehicle use and therefore pollution, which has an impact on all, including non-working individuals (Medina et al, 2004). Another possible pathway may be related to the fact that a strong economy raises the opportunity cost of informal care, leaving the elderly without care and more vulnerable. The 2003 heat wave in France provided a stark illustration of how vulnerable elderly individuals in France are to environmental factors and to care provided by family members. That summer, record temperatures resulted in an elevated mortality rate among elderly living the community, but not among those living in nursing homes (Ledrans 2006).

4. Conclusions

This study adds to the growing literature on the effect of macroeconomic conditions and health. A main motivation for our work is that the relationship between these variables may depend in important ways on the institutional context. It is plausible that the effect of economic cycles on mortality may be quite different in a country like the US, with its highly competitive labor markets and fast-paced culture than in Europe, where the labor market is more rigid and regulated and different notions concerning quality of life seem to prevail. In other words, just because many Americans respond to economic expansions by working too hard, eating even more fast food than usual and exposing themselves to greater risk of accidents on the road and at work, does not mean that the same should be true of the French.

Despite the cultural and institutional details, our results for France line up quite closely with the results of prior studies using data from the US and other countries. We find robust evidence that total mortality varies pro-cyclically, increasing when the economy is strong and decreasing when it slackens. Results for source-specific mortality rates suggest that the total mortality results are driven in large part by the effect of economic conditions on mortality from heart conditions and motor vehicle accidents. The result for cardiovascular disease is consistent with the hypothesis that heart conditions are sensitive to employment-related stress and overwork as well as, perhaps, the effect of increased economic activity on environmental factors, such as air quality. The results for accidents are consistent with the well known positive effect of economic activity on road congestion and traffic accidents. Our finding of a negative effect of local area unemployment rates on the mortality of elderly individuals underscores the fact that pollution and road congestion induced by increased economic activity are externalities that affect workers and non-workers alike. Our results for older adults are also consistent with the fact that a strong economy raises the opportunity cost of informal care provided to elderly parents.

In summary, when it comes to the relationship between macroeconomic conditions and mortality, we find no evidence of an *exception française.*

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Table 1. Summary Statistics

	Mean	Standard Deviation
Death rates per 100,000 population		
All causes	933.7	173.1
All causes by age:		
20 to 44 year olds	136.3	22.2
45 to 64 year olds	676.0	141.8
65 years and older	5022.7	576.0
By cause of death:		
Malignant neoplasms	272.6	83.7
Major cardiovascular diseases	302.3	84.0
Pneumonia and influenza	24.2	8.5
Chronic liver disease and cirrhosis of the liver	18.3	6.6
Motor vehicle accidents	15.6	5.7
Other accidents, adverse effects	2.0	3.1
Suicides	20.1	7.1
Unemployment Rate	10.3	2.7
Average yearly household income in €	12682	2144

Notes: The sample size is 2016 observations (96 *départements* x 21 years) for all variables except average household income, which is available for the years 1990 to 2002 only. Means are weighted by the population.

Table 2. The Effect of Unemployment on Total Mortality, 1982 to 2002

	(1)	(2)	(3)	(4)	(5)
A. Dependent Variable: ln(mortality rate)					
Département -level unemployment rate	-0.0087	-0.0075	-0.0138	-0.0080	-0.0052
	(0.0013)	(0.0024)	(0.0038)	(0.0027)	(0.0030)
National unemployment rate			0.0075		0.0058
			(0.0039)		(0.0031)
Average household income (€000)				-0.0232	-0.0063
				(0.0138)	(0.0031)
B. Dependent Variable: mortality per 100,000					
Département -level unemployment rate	-7.922	-6.016	-11.906	-6.6938	-4.0839
	(1.058)	(1.940)	(3.230)	(2.3019)	(2.4449)
National unemployment rate			5.778		4.8744
			(3.353)		(2.6283)
Average income (€000)				-19.2219	-4.7363
				(10.7883)	(2.6190)
Year fixed effects	No	Yes	No	Yes	No
Sample size	2016	2016	2016	1152	1152

Notes: Observations are weighted by the square root of the population. Each model includes a full set of *département* fixed effects. Robust standard errors are in parentheses.

Table 3. Total Mortality Results for Different Subsamples

	Nat. Log of Mortality Rate	Mortality per 100,000
1. Full sample (N = 2016)	-0.0075	-6.016
	(0.0024)	(1.940)
2. Population less than median (N=1008)	-0.0085	-6.252
	(0.0033)	(2.642)
3. Population greater than median (N = 1008)	-0.0044	-4.932
	(0.0021)	(2.273)
4. Population grew 1982 to 2002 (N = 1596)	-0.0065	-5.081
	(0.0027)	(2.165)
5. 1982 to 1991 (N = 960)	0.0007	-0.311
	(0.0030)	(2.948)
6. 1986 to 1995 (N = 960)	-0.0048	-3.653
	(0.0016)	(1.453)
7. 1992 to 2002 (N = 960)	-0.0039	-3.668
	(0.0027)	(2.333)

Notes: Observations are weighted by the square root of the population. Each model includes a full set of *département* and year fixed effects. Robust standard errors are in parentheses.

Table 4. Mortality Results by Cause of Death

	(1)	(2)	(3)	(4)	(5)
Cardiovascular Disease:					
Département-level unemployment rate	0.0029	-0.0103	-0.0393	-0.0147	-0.0205
	(0.0049)	(0.0031)	(0.0135)	(0.0031)	(0.0059)
National unemployment rate			0.0613		0.0531
			(0.0142)		(0.0062)
Average household income (€000)				-0.0297	-0.1068
				(0.0180)	(0.0041)
Cancer:					
Département-level unemployment rate	-0.0486	-0.0109	0.0142	-0.0074	0.0075
	(0.0060)	(0.0030)	(0.0141)	(0.0032)	(0.0064)
National unemployment rate			-0.0910		-0.0902
			(0.0145)		(0.0061)
Average household income (€000)				-0.0191	0.1685
				(0.0131)	(0.0096)
Liver Disease:					
Département-level unemployment rate	-0.0336	0.0030	-0.0372	-0.0056	0.0020
	(0.0049)	(0.0052)	(0.0168)	(0.0087)	(0.0094)
National unemployment rate			0.0052		0.0017
			(0.0181)		(0.0098)
Average household income (€000)				-0.0772	-0.0556
				(0.0209)	(0.0052)
Motor Accidents:					
Département-level unemployment rate	-0.0459	-0.0200	-0.0545	-0.0161	-0.0263
	(0.0050)	(0.0062)	(0.0161)	(0.0090)	(0.0089)
National unemployment rate			0.0125		-0.0094
			(0.0172)		(0.0094)
Average household income (€000)				-0.0127	-0.1003
				(0.0207)	(0.0062)
Other Accidents:					
Département-level unemployment rate	-0.0975	-0.0249	-0.0841	-0.0302	-0.0605
	(0.0151)	(0.0041)	(0.0343)	(0.0099)	(0.0204)
National unemployment rate			-0.2633		0.2510
			(0.0361)		(0.0213)
Average household income (€000)				-0.0018	-0.4267
				(0.0233)	(0.0189)

Table continues

Table 4, continued

	(1)	(2)	(3)	(4)	(5)
Suicide:					
Département-level unemployment rate	-0.0000	-0.0047	-0.0214	-0.0038	-0.0171
	(0.0056)	(0.0089)	(0.0117)	(0.0107)	(0.0123)
National unemployment rate			0.0310		0.0213
			(0.0112)		(0.0128)
Average household income (€000)				-0.0132	-0.0554
				(0.0246)	(0.0062)
Year fixed effects	No	Yes	No	Yes	No

Notes: The dependent variable is the natural log of the cause-specific mortality rate. In columns 1-3 the sample size is 2016 observations (96 *départements* x 21 years). In columns 4 and 5 the sample size is 1152 (96 *départements* x 12 years). Observations are weighted by the square root of the population. Each model includes a full set of *département* fixed effects.

Table 5. Age-Specific Mortality Results

	(1)	(2)	(3)	(4)	(5)
A. 20 to 44 year olds					
Département-level unemployment rate	0.0016 (0.0021)	0.0070 (0.0047)	-0.0046 (0.0067)	-0.0120 (0.0083)	-0.0219 (0.0101)
National unemployment rate			0.0091 (0.0076)		0.0187 (0.0110)
Average household income (€000)				-0.0618 (0.0324)	-0.0791 (0.0064)
B. 45 to 64 year olds					
Département-level unemployment rate	-0.0259 (0.0036)	0.0012 (0.0032)	-0.0284 (0.0120)	- 0.0041 (0.0034)	-0.0141 (0.0045)
National unemployment rate			0.0036 (0.0125)		-0.0052 (0.0046)
Average household income (€000)				-0.0240 (0.0072)	-0.0709 (0.0030)
C. 65 and older					
Département-level unemployment rate	-0.0145 (0.0028)	-0.0006 (0.0024)	-0.0217 (0.0094)	-0.0049 (0.0021)	-0.0097 (0.0031)
National unemployment rate			0.0104 (0.0097)		0.0031 (0.0032)
Average household income (€000)				-0.0102 (0.0066)	-0.0425 (0.0019)
Year fixed effects	No	Yes	No	Yes	No
Sample size	2016	2016	2016	1152	1152

Notes: The dependent variable is the log of the mortality rate for each age category. Observations are weighted by the square root of the population. Each model includes a full set of *département* fixed effects.

Figure 1.
Unemployment and Mortality: National Data for France, 1982 to 2002

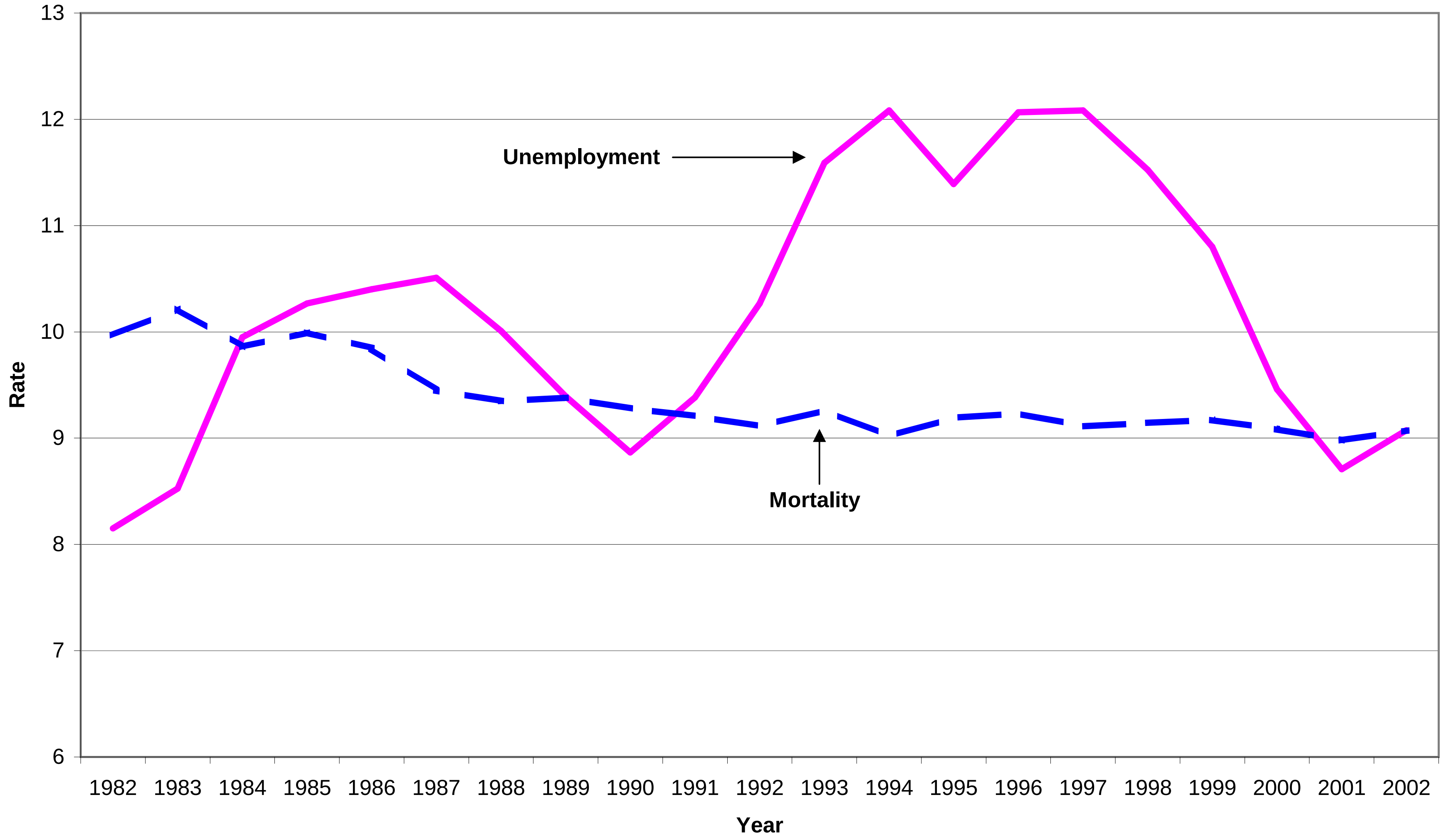

Figure 2
Mortality and Unemployment in France, 1982-2002
(Detrended and Normalized)