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Suicide in Ireland: The Influence of Alcohol and Unemployment

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Abstract: We model the behaviour of the Irish suicide rate over the period 1968-2009 using the unemployment rate and the level of alcohol consumption as the principal explanatory variables. We find that alcohol consumption is a significant influence on the suicide rate among younger males. Its influence on the female suicide rate is not well-established, although there is some evidence that it plays a role in the 15-24 age group. The unemployment rate is also a significant influence on the male suicide rate in the younger age groups but evidence of its influence on the female suicide rate is lacking. The behaviour of suicide rates among males aged 55 and over and females aged 25 and over is unaccounted for by our model. The findings suggest that higher alcohol consumption played a significant role in the very rapid increase in suicide mortality among young Irish males between the late 1980s and the end of the century. In the early twenty first century a combination of falling alcohol consumption and low unemployment led to a marked reduction in suicide rates. The recent rise in suicide rates may be attributed to the sharp rise in unemployment, especially among males, but it has been moderated by the continuing fall in alcohol consumption. Finally, we discuss some policy implications of our findings.

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Io non averei creduto
Che morte tanta n'avesse disfatta

Dante, *Inferno*, Canto III

I INTRODUCTION

Although still low compared with those of several northern and eastern European countries, by the late 1990s the Irish suicide rate was more than twice the level recorded in the 1960s. The rate among males aged 25-34 had risen more than four-fold. Suicide rates fell between the beginning of the century and 2007 but they are now rising again.

There have been many claims that the recent increase is due to the recession. In this vein Kelly (2009) warned that "… Ireland is at the start of an enormous, unplanned social experiment on how rising unemployment affects crime, domestic violence, drug abuse, suicide, and a litany of other social pathologies".

There is international evidence that the loss of income and social capital associated with recessions leads to higher suicide rates (see Helliwell, 2004, for a survey of the economic literature). Relevant evidence for Ireland is the finding by Corcoran and Arensman (2010) that over the period 1996-2006 the risk of suicide was much greater among the unemployed than among the employed, retired and home-makers. They suggest that because unemployment is now rising "… the recent period of stable Irish suicide rates may be over and that Irish suicide may increase again as in previous times of recession". It has also been shown that Irish people who become unemployed report reduced life-evaluations, even after controlling for their lower income and they adapt to their situation very little over time (Brereton *et al.*, 2008), while Madden (2009) found that the fall in unemployment over the period 1994-2000 contributed to a reduction in the level of mental stress.

However, the evidence of the link between suicide and unemployment rates over time is not as strong as the evidence based on cross section data. For example, Corcoran and Arensman (2010) also report that "… unemployment was a stronger factor where it was rare (2001-06) than in the period of decreasing unemployment (1996-2000)". The increased relative risk of suicide in a shrinking pool of unemployed people could reflect adverse selection as those with the poorest mental health remain unemployed in a buoyant labour market or it could be the case that the stigma attached to unemployment increases as its prevalence falls. Lucey *et al.* (2005) included the unemployment rate among the explanatory variables in their study of suicide trends in Ireland over the period 1968-2000 and concluded that there

was no significant association between it and the suicide rate. In their study of the Finnish economic boom and bust over the years 1985-95, Hintikka *et al*. (1999) found that completed suicides, having risen during the boom, fell during the 1990-95 recession. On the other hand, in a panel study of the impact of the business cycle on specific causes of death in the states of the United States over the period 1972-91, Ruhm (2000) found that the total death rate and eight out of ten cause-specific death rates fell during recessions, but that suicide behaved counter-cyclically, rising during recessions and falling during booms. He concluded that while worsening economic conditions may improve physical well-being – due to reduced alcohol consumption among other factors – they have negative effects on some aspects of mental health, including the propensity to commit suicide. Finally, a recent EU cross-country analysis spanning the period 1970-2007 found that increases in unemployment were associated with higher suicide rates among those aged under 65 years (Stuckler *et al.*, 2009).

A role for alcohol in Irish suicides has been claimed in many reports (see National Office of Suicide Prevention, 2001; Walsh, 2008). Some direct evidence is provided by Bedford *et al.* (2006) who in a sample of coroners' reports on suicide deaths in three Irish counties in 2000 and 2001 found high blood alcohol concentrations in young males. Different methodologies have been used to ascertain the number of suicides "due to" or "attributable to" drinking. For example, Martin *et al.* (2010) assigned "alcohol-attributable fractions" drawn from the international literature to the Irish population classified by drinking patterns and concluded that over the years 2000-04, 37 per cent of male and 25 per cent of female suicides were attributable to alcohol. In their survey of the European evidence Anderson and Baumberg (2006, p. 207) estimated that on average one in six suicides was alcohol-related, although the ratio was higher among young males.

We would expect to find a link between the national levels of alcohol consumption and suicide mortality over time if, as hypothesised by Lederman (1956), increased average alcohol consumption in a population leads to an increase in the incidence of heavy and harmful drinking. There is some Irish survey evidence to support this hypothesis. Between 2002 and 2007, when average alcohol consumption per adult fell by 21 per cent, the self-reported incidence of weekly "binge drinking" among drinkers fell from 45 per cent to 28 per cent (Morgan *et al*, 2009, Figure 2). International studies of the link between aggregate alcohol consumption and suicide also support the Lederman hypothesis. In a study of the United States over the period 1934-87, Caces and Hartford (1998) found that when the unemployment rate was included in the model, per capita alcohol consumption was significantly related to the suicide rate, especially among young males. Hintikka *et al.*

(1999) report that alcohol consumption was the only significant socio-economic influence on the Finish male suicide rate between 1985 and 1995. Ramstedt (2001) found that international differences in average alcohol consumption were more closely correlated with suicide rates in so-called "dry" (mainly Northern European) cultures than in "wet" (mainly Mediterranean) countries where alcohol is more regularly consumed. His results for Ireland over the period 1950-95 were not conclusive.

Previous Irish studies of the role of alcohol in society have not explored the link between the level of drinking and the suicide rate over time (see Walsh, 1980; Conniffe and McCoy, 1993; Mongan *et al.*, 2009). However, Lucey *et al.* (2005) report no significant association between expenditure on alcohol and the suicide rate over the period 1968-2000.

Thus, there is a lack of firm empirical evidence to support the widely-held belief that the Irish suicide rate is influenced by fluctuations in the unemployment rate and trends in alcohol consumption. The purpose of the present study is to investigate the association between these variables using the time series evidence from 1968 to 2009.

II DATA

Details of deaths by cause are published in the *Annual Reports of Vital Statistics* (Central Statistics Office, 2009, and earlier years; Central Statistics Office, 2007 and earlier years). The classification system used is the World Health Organisation's International Classification of Diseases, Injuries and Causes of Death (ICD). A narrow measure of suicide mortality would include only deaths classified as "suicides and intentional self-harm" (Codes E950-959). However, since the adoption in Ireland of the Eighth Revision of the ICD in 1968 the new category of "deaths undetermined whether accidentally or purposefully inflicted" (Codes E980-989) needs to be considered in the context of suicidal behaviour. This category was subsequently relabelled "deaths due to events of undetermined intent", which we refer to as UDs. These deaths are generally believed to include a high proportion of suicides that are not so classified due to the absence of conclusive evidence of intent.[1]

Following the introduction of the category in 1968, the number of deaths classified as UDs exceeded the number classified as suicides and the combined total doubled. This supports the widespread belief that Irish suicide rates had been significantly underreported in earlier years (McCarthy and Walsh, 1966).

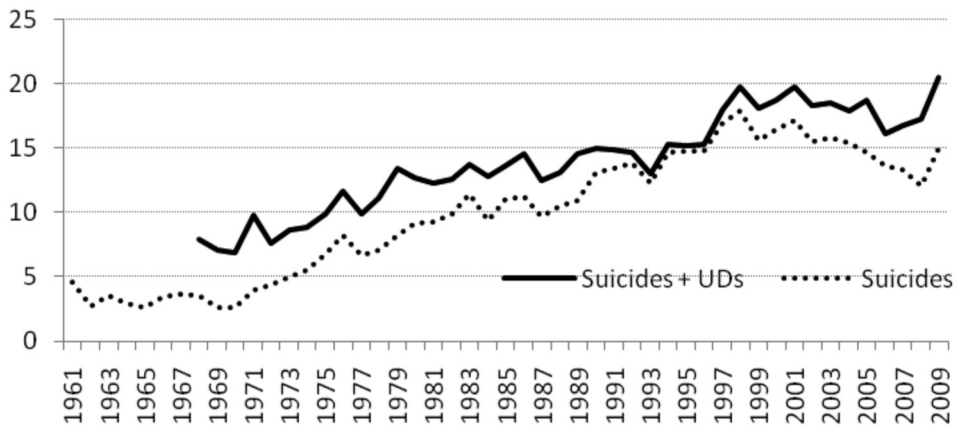
[1] The classification of inquested deaths is strongly influenced by the opinion of a member of the Garda Síochána as to the intent of the deceased (see National Suicide Research Foundation, 2007).

However, in the mid-1990s the number of UDs fell to almost zero, perhaps because of the decriminalisation of suicide in 1993. This fall proved to be temporary and the number of UDs recorded began to rise again in the late 1990s and is now running at over a quarter of the combined total of suicides and UDs. In the 65 and over age groups UDs account for over half the combined total of suicides and UDs. Over the period 1968-2009 there is a significant negative correlation between the suicide rate excluding UDs and the UD rate ($r = -0.42$, $p < 0.01$), which supports the belief that the two categories are substitutes.

Attention should be called to recent increase in the number of deaths due to poisoning recorded as UDs and "accidental". These deaths are concentrated among younger males, as is the case for suicides. Since the late 1990s, UDs due to poisoning have risen steeply and now exceed those due to drowning. The number of accidental deaths due to poisoning rose from about 50 a year in the late 1990s to over 300 in recent years, while the number of suicides due to poising fell by 50 per cent. There is a significant negative correlation between the combined total of UDs and accidents due to poisoning, on the one hand, and suicides due to poisoning, on the other ($r = -0.57$, $p < 0.01$). These trends point to an increase in the under-reporting or misclassification of suicides due to poisoning in recent years.

We calculated age-specific suicide rates for males and females in seven age groups from 15-24 years to 75 and over.[2] Figure 1 shows the suicide rate per

Figure 1: *Suicide Mortality*
Rates Per 1,000,000 Population Aged 15 and Over



[2] Annual population estimates by age group are available from the Central Statistics Office's Main Data Dissemination Service. We have ignored the small number of deaths among children under the age of 15 classified as suicides.

100,000 population aged 15 and over for the period 1961-2009 and the suicide plus UD rate for 1968-2009. For the remainder of this study we concentrated on the annual numbers of suicide inclusive of UDs in the belief that it is likely to be a more consistent series than the number of suicides exclusive of UDs. Our sample period is, therefore, limited to the years following the introduction of the UD classification in 1968.

In Table 1 we provide summary statistics for the main series used in the study, distinguishing between the first and second halves of the period 1968-2009. Male suicide rates have been consistently higher than the female rates in all age groups. The pattern across age groups has, however, changed. In the first half of the period, 1968-1987, suicide was predominantly a phenomenon of middle age, with the highest male rates among those aged 55-64 and the highest female rates among those aged 45 to 64. In the second half of the period, however, the phenomenon of suicide became much more closely associated with males aged 15-34, among whom the rate more than doubled. The rate also doubled among females aged 15-24, but the highest female rates remained in the 45 to 64 age groups. Figure 2 highlights the rise in the suicide rates among young people by showing the three-year moving average of male and female rates in the age group 15-24. This is the only age group in which the male and female rates are so highly correlated. The contrasting behaviour of suicide rates by demographic group over time brings out the importance of studying age-specific rates rather than a single age-standardised rate for each gender. The phenomenon that merits most attention is the sharp upward trend in suicide rates for males between 15 and 54 and females aged 15-24 since the late 1980s.

Irish suicide rates in many demographic groups are relatively high by international standards but the number of suicides recorded in most age groups in any year is generally low. There was only a handful of instances (mainly among young males in the early years of this century) where more than 100 suicides a year were recorded in an age group. Fewer than 10 suicides a year were recorded in a sizeable minority of age groups. UDs now account for over half of the combined total of suicides and UDs in the 65 and over age groups.

Unemployment rates by age and sex are not available before 1988, so we had to use the aggregate unemployment rate for both sexes and all ages for these years. For the period 1988-2009 separate male and female unemployment rates for five age groups from 15-24 to 55-64 were calculated from the results of the *Labour Force Survey* and *Quarterly National Household Survey.*[3] In marked contrast with the varying trend of the suicide

[3] These are available online from the Central Statistics Office's Main Data Dissemination Services http://www.cso.ie/px/pxeirestat/database/eirestat/eirestat.asp.

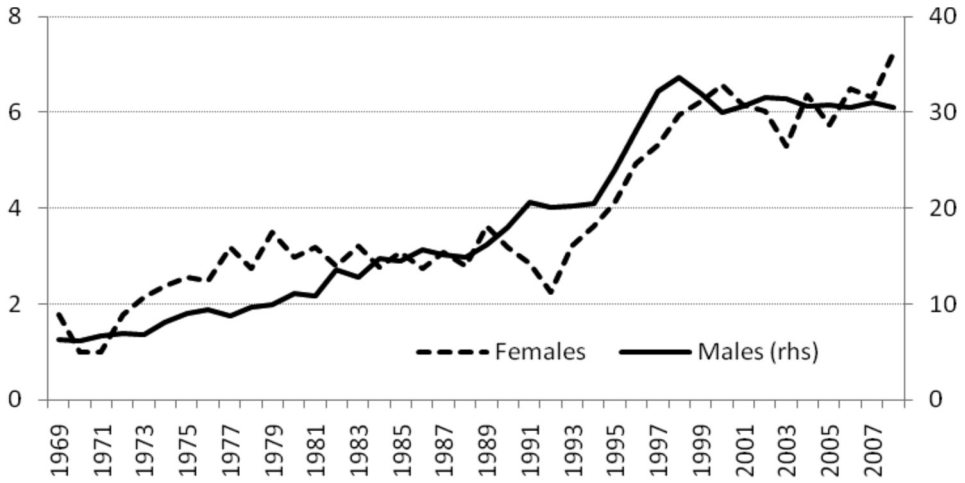
Table 1: *Summary Information on Variables Used in the Study*

Variable		*Mean*		*Standard Deviation*	
Suicide (including UD) Rate/ 1,000,000 population		*1968-1987*	*1988-2009*	*1968-1987*	*1988-2009*
Males	15-24	10.1	26.8	3.8	6.5
	25-34	15.8	32.3	5.0	6.0
	35-44	16.5	28.0	4.5	6.0
	45-54	17.4	25.8	5.4	5.4
	55-64	21.2	25.7	5.9	4.0
	65-74	18.6	18.6	7.6	4.6
	75 +	11.8	13.8	5.0	5.1
Females	15-24	2.5	5.1	1.1	2.0
	25-34	5.0	6.0	1.9	1.5
	35-44	7.2	7.2	2.2	1.7
	45-54	9.3	9.3	2.7	1.6
	55-64	10.8	9.0	3.7	1.9
	65-74	7.2	6.9	2.7	4.1
	75 +	3.4	4.4	2.7	1.7
Unemployment rate (%)					
Males	All ages	9.0	9.5	4.0	4.6
	15-24		16.4	7.7	
	25-34		9.8		4.9
	35-44		8.1		3.4
	45-54		8.5		3.5
	55-64		5.7		2.8
Females	All ages	9.0	9.1	4.0	5.1
	15-24		13.5		5.8
	25-34		8.0		4.3
	35-44		8.8		5.9
	45-54		7.5		4.7
	55-64		4.9		3.2
Alcohol consumption (litres/person aged 15 and over)		8.9	12.3	1.0	1.5

Note: Age-specific unemployment rates not available before 1988.

rates by demographic group, all but one of the 45 correlations between the 10 age- and sex-specific unemployment rates were significant ($p < 0.05$). In 2008 and 2009, however, the increase in the unemployment rates among young males was steeper than that in other demographic groups. The summary data in Table 1 show that unemployment rates among younger adults of both sexes were higher and more variable than those among the older population.

Figure 2: *Suicide (Including UD) Rates – Males and Females Aged 15-24 (Three-year Moving Averages)*



Alcohol consumption since 1986 was calculated from Revenue Commissioners' data (Revenue Commissioners, 2010, and earlier years). For the years before 1986 data from Walsh (1987) were used. It should be borne in mind that these figures do not include cross-border alcohol purchases, smuggled quantities, or the consumption of alcohol by Irish tourists abroad, but they do include consumption by tourists visiting Ireland. As there are no continuous time series for alcohol consumption by age and sex, the series used throughout is average consumption per person aged 15 and over.

III MODELLING THE IRISH SUICIDE RATE

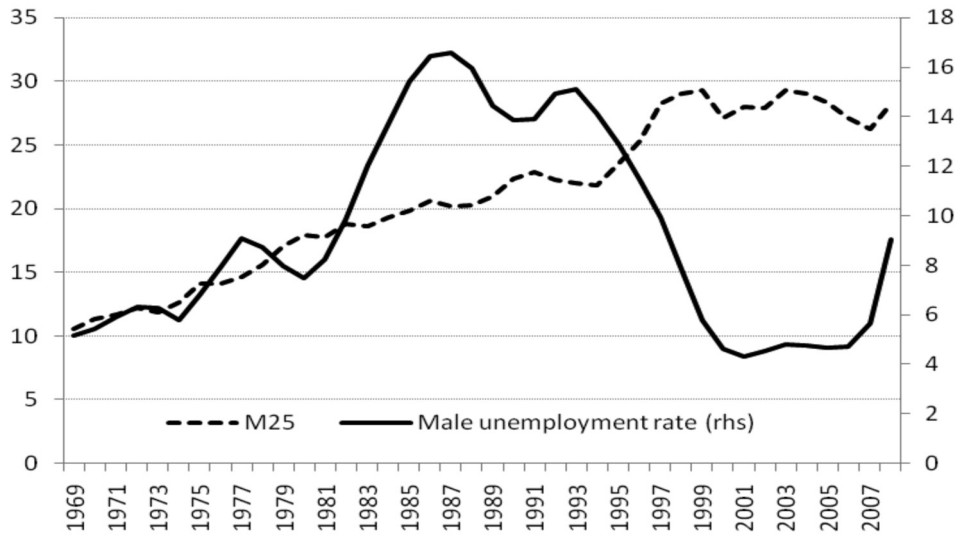
The list of variables that have been included in empirical studies of suicide rates is long. For example, Rodríguez Andrés (2005) included real GDP and its growth rate, a measure of income inequality (the Gini coefficient), the unemployment rate, the total fertility rate, female labour force participation, alcohol consumption, and the divorce rate in a panel study of suicide rates in 15 European countries between 1970 and 1998. In addition to some of these variables, in their study of the Irish suicide rate Lucey *et al.* (2005) include the marriage rate, the indictable crime rate, and the proportion of births outside marriage. The justification for including many of these variables is ad hoc and no a priori expectations regarding their effects are given. Moreover, many of them – the Gini coefficient, the fertility rate, the divorce rate, the marriage rate, and labour force participation rates, for example – change only slowly

over time. This lack of variation, together with the presence of common long-run trends, increases the problem of multicollinearity and makes it difficult to establish the separate effects of individual variables with a relatively short time series for one country. This problem may be mitigated by exploiting inter-country or inter-state variation in a panel study.

Taking a different approach, economists have used a Becker-type theoretical framework to analyse the effects of the allocation of time within households on suicide rates among young people. Cutler *et al.* (2000) posit that the growing proportion of the young population living with a lone parent has contributed to the rise of adolescent suicide rates, but Mathur and Freedman (2002) conclude that the favourable effect of the higher incomes that follow from increased labour force participation more than offsets the negative effect of lost parental time.

In the present study we have concentrated on exploring the influence of unemployment and alcohol on suicide because these are the two socio-economic variables that have the strongest theoretical support for inclusion in a model of suicide and have received the most widespread attention in ecological studies. We have cited several studies that show links between unemployment and alcohol and suicide at the micro level. These variables also seem very relevant to the demographic groups which recorded the largest increases in suicide rates since the 1980s – men aged 15 to 54 and women aged 15 to 24.

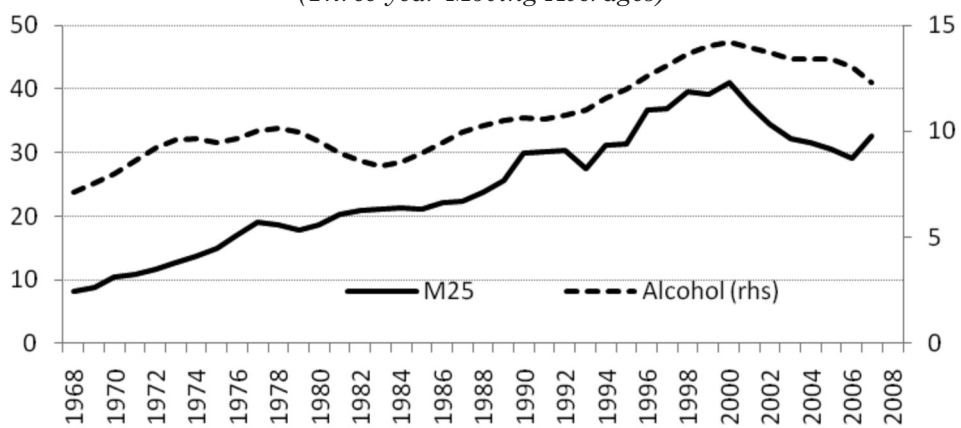
Figure 3: *Male Suicide (Including UD) and Unemployment Rates (Three-year Moving Averages)*



A visual inspection of the time series for suicide, unemployment, and alcohol is instructive. Figure 3 displays the male unemployment rate together with the suicide rate for males aged 25-34. We may see some tendency for the two variables to move together in the early years of the sample period. However, as the unemployment rate soared during the first half of the 1980s the increase in the suicide rate was modest and after 1992 the suicide rate continued to rise even as the unemployment rate fell steeply. This would suggest that while unemployment may account for some of the cyclical fluctuations in the suicide rate, it does not account for the long-term trends.

Alcohol consumption, on the other hand, displayed a strong upward trend from the late 1960s to the end of the century, punctuated by only brief downturns. Consumption peaked in 2001, at 14.3 litres per adult, more than double the level recorded in the late 1960s. However, there has been a sustained decline in consumption since the turn of the century, the first recorded in over forty years. Figure 4 brings out the similarity of the trends in alcohol consumption and the suicide rate among males aged 25-34, particularly during the 1990s.

Figure 4: *Suicide (Including UD) Rate Among Males Aged 25-34 and Alcohol Consumption (Three-year Moving Averages)*



We propose to analyse the relationship between the time series for suicide rates, unemployment rates, and alcohol consumption using standard regression techniques. Care has to be exercised in applying these techniques to the type of data under consideration. The classical properties of Ordinary Least Squares (OLS) estimators depend on the assumption that the series are stationary stochastic processes. Running regression on non-stationary series, such as $I(1)$ variables containing unit roots, can give rise to misleading values

of test statistics (t-ratios and R^2s) and lead us to conclude that meaningful relationships exist among variables that are in fact unrelated. The principal time series used in this study (the suicide rates and unemployment rates, but not the alcohol variable) are bounded between 0 and 100. This implies that although they may appear to be $I(1)$ locally their variances cannot tend to infinity over time as does the variance of an $I(1)$ variable. The widely-used Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979) tests the null hypothesis that the process is unit root nonstationary or $I(1)$ against the alternative that it is a stationary $I(0)$ process. The power of the ADF test is notoriously low, which can lead to the non-rejection of the null (unit root) hypothesis when it is in fact false. For these reasons we have used the KPSS test to test whether the series are stationary against the alternative hypothesis that they are nonstationary (Kwiatkowski *et al.*, 1992).

In Table 2 we report the KPSS test statistic for the variables used in the study. The critical values were obtained from Pesaran and Pesaran (2009). The statistics in Panel A test whether the series are level stationary and those in Panel B test whether they are stationary around a deterministic trend. The hypothesis of level stationarity is rejected for male suicide rates in the age groups 15-24, 25-34, 35-44, and female suicide rates in the age groups 15-24 and 35-34, and also for the level of alcohol consumption. However, all the reported values in Panel B are below the 95 per cent critical value and we may therefore accept the hypothesis that all the series are trend stationary at this probability level.

As these tests suggest that the key explanatory variables are trend stationary as distinct from level stationary we include a linear trend in our regressions. This has the added advantage of reducing the risk of omitted variables bias as many of the variables other than alcohol and unemployment that might be proposed as influences on the suicide rate (the rate of marital breakdown, the level of income inequality, and the incidence of violent crime and so on) are trended.

Finally, the question of parameter instability needs to be addressed. It could be argued that "the past is a different country" and that many social phenomena in Ireland, including the very low recorded suicide rate, were influenced by different factors than those that came into play in the 1980s and during the "Celtic Tiger" era. In regard to suicide, these considerations are reinforced by the changes in public attitudes that led to decriminalisation in 1993. A further consideration is the non-availability of age-specific unemployment rates before 1988. We therefore tested for the stability of our models between two sub-periods 1968-87 and 1988-2009 using the Chow tests for predictive failure and stability of the regression coefficients. Where these tests indicated a structural break between the two sub-periods a dummy

Table 2: *KPSS Stationarity Test*
42 Observations 1968-2009, Window Length = 12

Panel A
Including an Intercept but not a Trend
95 Per Cent Critical Value Computed by Stochastic Simulation = 0.38761

Variable	*M15*	*M25*	*M35*	*M45*	*M55*	*M65*	*M75*
Test statistic	0.428*	0.425*	0.426*	0.456*	0.321	0.158	0.322
Variable	*F15*	*F25*	*F35*	*F45*	*F55*	*F65*	*F75*
Test statistic	0.438*	0.461*	0.174	0.189	0.124	0.132	0.367
Variable	*AL*	*UM*	*UF*				
Test statistic	0.416*	0.123	0.130				

Panel B
Including an Intercept and a Linear Trend
95 Per Cent Critical Value Computed by Stochastic Simulation = 0.17228

Variable	*M15*	*M25*	*M35*	*M45*	*M55*	*M65*	*M75*
Test statistic	0.107	0.133	0.116	0.105	0.131	0.100	0.139
Variable	*F15*	*F25*	*F35*	*F45*	*F55*	*F65*	*F75*
Test statistic	0.129	0.122	0.112	0.112	0.111	0.132	0.148
Variable	*AL*	*UM*	*UF*				
Test statistic	0.096	0.122	0.1217				

* test statistic > critical value.
Variables:
M15, M25, M35, M45, M55, M65, M75 and *F15, F25, F35, F45, F55, F65, F75* = Male and female suicide (including UD) rates per 100,000 population, 10-year age groups.
AL = alcohol consumption per person aged 15 and over (litres).
UM = male unemployment rate (%) *UF* = female unemployment rate (%).

variable *D88* (= 0 up to 1988 and 1 thereafter) was included to allow both slopes and intercepts to vary between the two sub-periods.

IV RESULTS

Regression results for the whole period 1968-2009 are presented in Table 3. We have not included the unemployment rate in the equations for the population aged 65 and over as it relates primarily to the population aged 15-64. Where the Durbin-Watson statistic indicated that the null hypothesis of no autocorrelation in the residuals from the OLS estimates could not be rejected at the 95 per cent confidence level an AR(1) error regression model was estimated.

Our model explains male suicide rates better than female rates and rates in the younger age groups better than those in the older age groups. For males,

Table 3: *Regression Results, 1968-2009*
Dependent Variable = Suicide (Including UD) Rate Per 100,000 Population
Absolute Values of t-ratios in Parentheses

Demographic Group and Estimation Technique	*Intercept*	*D88*	*Trend*	*UR*	*UR*D88*	*AL*	*AL*D88*	$\bar{R}^2$	*Durbin-Watson Statistic*
Males 15-24	9.387	–68.886	0.479	0.108	0.854	–0.591	5.664	0.92	2.13
OLS	(1.5)	(2.8)*	(3.8)**	(0.5)	(1.5)	(0.9)	(3.3)**		
Males 25-34	–5.178	–118.808	0.192	0.646	2.014	1.480	8.713	0.90	1.96
OLS	(0.7)	(4.2)***	(1.4)	(2.5)*	(3.1)**	(1.9)	(4.5)***		
Males 35-44	9.055	–85.049	0.368	0.034	1.685	0.359	5.846	0.69	2.05
AR errors	(1.2)	(2.4)*	(2.2)*	(1.1)	(2.1)*	(0.4)	(2.6)*		
Males 45-54	6.660		0.294	–0.085		0.899		0.60	1.86
OLS	(0.8)		(2.1)*	(0.4)		(1.0)			
Males 55-64	12.080	10.100	0.934	1.141	–0.987	–0.256	0.191	0.54	1.96
AR errors	(1.4)	(0.3)	(0.5)	(3.4)**	(1.3)	(0.3)	(0.1)		
Males 65-74	30.636		0.382			–1.897		0.09	2.08
OLS	(4.4)***		(2.5)*			(2.1)*			
Males 75 and	8.491		0.015			0.376		0.00	2.08
over OLS	(1.4)		(0.1)			(0.5)			
Females 15-24	2.199		0.131	–0.117		–0.007		0.68	1.89
AR errors	(1.4)		(4.7)***	(3.1)**		(0.0)			
Females 25-34	3.632		0.021	–0.026		0.161		0.12	1.94
AR errors	(1.6)		(0.5)	(0.5)		(0.6)			
Females 35-44	1.525	28.039	–0.055	0.145	–0.612	0.881	–1.961	0.11	1.85
AR errors	(0.3)	(1.2)	(0.4)	(0.6)	(1.0)	(1.5)	(1.4)		
Females 45-54	1.185	1.828	0.090	0.190	–0.129	0.889	–0.461	0.25	2.02
AR errors	(0.3)	(0.1)	(0.8)	(1.2)	(0.3)	(2.3)*	(0.5)		
Females 55-64	1.498	10.031	0.122	0.132	–0.134	0.757	–1.268	0.11	1.85
AR errors	(0.2)	(0.3)	(0.6)	(0.4)	(0.2)	(1.0)	(0.7)		
Females 65-74	–3.651	22.403	0.129			1.070	–2.369	0.11	2.04
AR errors	(0.6)	(2.9)*	(1.4)			(1.6)	(3.1)**		
Females 75 and	–4.926	9.891	–0.009			0.947	–0.974	0.03	1.99
over OLS	(1.1)	(1.6)	(0.1)			(1.8)	(1.6)		

*p < .05 **p < .01 ***p <.001.

D88 = 0 pre-1988, 1 thereafter.
UR = Unemployment rate (per cent).
AL = Alcohol consumption per person aged 15 and over.
OLS = Ordinary Least Squares.
AR errors = Exact ML estimates of AR(1) model.

the goodness of fit is relatively high in the age groups from 15-24 to 55-64 but is very low for the 65-74 and 75 and over age groups. There were significant positive trends in the 15-24, 45-54, and 65-74 age groups. The coefficient on the unemployment rate is positive and significant in the 25-34 and 55-64 age groups. In the 25-34 age group the slope shifts upwards after 1987, from 0.646 to 2.660 (this slope is statistically significant[4], $t = 3.8$, $p < 0.01$). Alcohol consumption becomes a significant influence after 1987 in the age groups 15-24 and 25-34 with slopes 5.073 ($t = 2.8$, $p < 0.05$) and 10.193 ($t = 2.4$, $p < 0.05$). The slope of 6.205 on the alcohol variable in the 35-44 age group for the period after 1987 is not significant ($t = 0.97$, $p > 0.05$).

For females, the results were generally much less significant than for males. In the age group 15-25 there was a significant positive trend and the unemployment rate was also significant although the coefficient was much lower than that for males aged 25-24 or 55-64. The alcohol coefficient was significant in the 45-54 age group, but it was very small compared with that recorded in the younger male age groups. There is a significant post-1987 shift in the alcohol coefficient for the 65-74 age group, but the slope of 1.034 for the later period is not significant ($t = 1.3$, $p > 0.05$)

The evidence of a structural break in the late 1980s, as well as the increased level of multicollinearity associated with the estimation of slope and intercept dummies point to the desirability of re-estimating these equations for the second sub-period, 1988-2009. This allows us to take advantage of the availability of age-specific unemployment rates since 1988. When applied to the series for the period 1988-2009, the KPSS test for stationarity indicated that none of the test statistics exceeded the critical value when an intercept but no trend was included, leading us to accept the hypothesis that the variables are level stationary. We nonetheless explored the sensitivity of the results to the inclusion of a trend. The results are presented in Table 4.

The coefficient estimates presented in Table 4 are broadly consistent with those for the period 1988-2009 that may be derived from the results in Table 3. Looking first at the results for males, we note that the trend variable is not statistically significant in any of the five age groups. We have therefore concentrated on the equations that exclude it. These reveal statistically significant evidence that higher alcohol consumption leads to higher suicide rates in the first four age groups. The evidence is also that higher unemployment is associated with higher suicide rates in the 25-34 and 35-44 age groups. The highly significant and large coefficients of the unemployment and alcohol variables for males aged 25-34 are particularly striking. The

[4] This test relates to the sum of the two coefficients and is approximate because it assumes their estimates are independent.

evidence of the role of unemployment in the 55-64 age group reported in Table 3 is not found in these results.

The results for females are much weaker. There are two age groups where significant results were obtained. Among females aged 15-24 there is a significant albeit slight positive trend but neither the unemployment rate nor the alcohol variable is significant. When the trend and unemployment variables are deleted, we obtain a significant positive coefficient on the alcohol variable but the R^2 falls to 0.31. On balance it is not possible to conclude with any certainty that alcohol was a factor in the rise in female suicide rates in this age group since 1988. The only significant results obtained for females were in the 35-44 age group and these are anomalous, with significant negative coefficients for trend, unemployment, and alcohol. When the trend is omitted, neither the unemployment nor the alcohol variable is significant.

The availability of more detailed labour force data for the years after 1987 allows us to explore whether the employment rate (that is, the proportion of a population group that is employed) would perform better than the

Table 4: *Regression Results, 1988-2009*
Dependent Variable = Suicide (Including UD) Rate Per 100,000 Population
Absolute Values of t-ratios in Parentheses

Demographic Group and Estimation Technique	*Intercept*	*Trend*	*Unemployment Rate*	*Alcohol Consumption*	$\bar{R}^2$	*Durbin-Watson Statistic*
Males 15-24	–32.125	0.333	0.315	4.075	0.72	1.87
AR errors	(1.1)	(1.5)	(1.0)	(2.0)		
OLS	–58.892		0.553	6.255	0.70	1.84
	(2.5)*		(2.0)	(4.0)**		
Males 25-34	–124.527	–0.221	2.396	11.089	0.67	2.02
AR errors	(4.9)***	(1.5)	(4.9)***	(6.3)***		
OLS	–109.099		2.213	9.772	0.66	2.21
	(4.1)**		(4.3)***	(5.6)***		
Males 35-44	–46.229	–0.335	1.460	5.413	0.36	2.34
OLS	(1.8)	(1.0)	(2.3)*	(2.6)*		
OLS	–24.712		1.006	3.641	0.36	2.17
	(1.7)		(2.4)*	(3.7)**		
Males 45-54	–12.622	0.212	0.436	2.630	0.38	2.05
OLS	(0.5)	(1.0)	(0.7)	(1.5)		
OLS	–22.641		0.558	3.563	0.38	1.92
	(1.0)		(0.9)	(2.5)*		
Males 55-64	–19.087	0.181	1.887	2.616	0.00	2.00
AR errors	(0.5)	(0.6)	(1.3)	(1.0)		
	–13.181		1.539	2.472	0.00	1.94
AR errors	(0.3)		(1.2)	(0.9)		

Table 4: *Regression Results, 1988-2009 (Contd.)*
Dependent Variable = Suicide (Including UD) Rate Per 100,000 Population
Absolute Values of t-ratios in Parentheses

Demographic Group and Estimation Technique	*Intercept*	*Trend*	*Unemployment Rate*	*Alcohol Consumption*	$\bar{R}^2$	*Durbin-Watson Statistic*
Females 15-24	4.870	0.175	–0.0887	–0.050	0.51	1.99
AR errors	(0.6)	(3.0)**	(0.6)	(0.1)		
OLS	9.958		–0.247	0.122	0.34	1.81
	(0.9)		(1.3)	(0.9)		
Females 25-34	19.723	–0.018	–0.378	–0.853	0.03	2.11
OLS	(1.2)	(0.2)	(0.9)	(0.9)		
OLS	17.801		–0.321	–0.751	0.08	2.11
	(2.0)		(1.6)	(1.3)		
Females 35-44	58.617	–0.524	–1.265	–2.787	0.35	1.62
OLS	(3.5)**	(3.0)**	(3.3)**	(2.8)*		
OLS	13.854		–0.202	0.395	0.07	1.6
	(1.4)		(1.2)	(0.6)	9	
Females 45-54	0.354	0.009	–0.011	0.377	0.00	2.13
OLS	(0.7)	(0.1)	(0.0)	(0.5)		
OLS	5.209		–0.029	0.352	0.00	2.14
	(0.6)		(0.2)	(0.6)		
Females 55-64	27.533	–0.210	–0.794	–0.998	0.00	1.99
OLS	(1.7)	(1.2)	(1.2)	(1.1)		
OLS	13.956		–0.136	–0.348	0.00	1.81
	(1.3)		(0.4)	(0.5)		

*p < .05 **p < .01 ***p <.001.

UR = Male Female age-specific unemployment rates (per cent).

AL = Alcohol consumption per person aged 15 and over.

OLS = Ordinary Least Squares.

AR errors = Exact ML estimates of AR(1) model.

unemployment rate (that is, the proportion of the labour force that is unemployed).[5] The coefficient on the employment rate was negative and significant in all those cases where the unemployment rate was positive and significant but in no demographic group did its use provide a better fit.

We used our results to illustrate the impact of changes in alcohol consumption and the unemployment rate on the number of suicides a year among younger males. Alcohol consumption increased from 10 litres per adult in 1988 to over 14 litres in 2002, while age-specific unemployment rates have

[5] The reasoning is that the employment rate captures variations in various forms of disguised unemployment, such as the number of discouraged workers, better than the unemployment rate.

Table 5: *Estimates of Ceteris Paribus Impact of Changes in Alcohol Consumption and Unemployment Rates on the Annual Number of Suicides (Based on Parameters in Table 4)*

	Increase in Alcohol Consumption from 10 to 14 Litres Per Person Aged 15 and Over	*Rise in Age-specific Unemployment Rates Recorded Between 2007 and 2009*
Males 15-24	80	–
Males 25-34	130	85
Males 35-44	39	38
Males 45-54	31	–

recently more than doubled. Table 5 presents estimates of the impact of these changes on male suicide rates based on the parameter estimates in Table 4. The impact of the rise in alcohol consumption is dramatic, especially in the two youngest age groups, while the greatest impact of higher unemployment is on the 25-34 year age group.

These simulations confirm the impression conveyed by an inspection of the data that the combination of high or rising unemployment and increasing alcohol consumption was an important factor in the rapid increase in the suicide rate among younger males after 1988. They imply that the fall in suicide rates in the early twenty-first century may be accounted for by the low unemployment rate and the decline in alcohol consumption over these years. Finally, the return to a rising trend in suicides since 2007 may be attributed to the surge in the unemployment rate, which has been especially steep among young males, although the continuing decline in alcohol consumption dampened the rate of increase. Finally, the strong association between aggregate alcohol consumption and suicide among younger males supports the Lederman hypothesis that changes in average consumption are linked to changes in the incidence of harmful consumption.

The question of the direction of causality needs to be considered. While suicidal tendencies might reduce a person's employability, it is much more plausible a priori that the relationship found between suicide and unemployment over time reflects causality running from unemployment to suicide rather than in the reverse direction. Similarly, while in the short run suicidal tendencies may prompt heavy drinking, it is implausible to suggest that variation in these tendencies was behind the major changes in alcohol consumption that have been observed in Ireland over the past four decades. The belief that alcohol is in fact a causal factor in suicide mortality is reinforced by the evidence that in the early years of this century, when unemployment was stable at a low level, the turning point in alcohol

consumption coincided with a turning point in the suicide rate, especially among younger males.

While our results are strong for young males, where suicide rates are highest and have grown fastest, they do not account for much of the observed variation in other demographic groups, notably women and the older men. Finally, we have drawn attention to the instability in recent years of the classification of deaths due to poisoning as between "suicides", "UDs" and "accidents".

V CONCLUSION

The Irish time series data for the period 1968–2009 support the hypotheses that rising unemployment and higher levels of alcohol consumption have led to increased suicide mortality among younger males. The level of alcohol consumption is a significant influence on suicide among men in all age groups between 15 and 54 years, while unemployment is a significant influence in the 25-34 and 35-44 age groups and may also play a role in the 15-24 age group. For females, these variables are not generally significantly associated with the suicide rate, although there is some evidence that alcohol consumption is significant in the 15-24 age group. Over the long-run influence of alcohol consumption on the male suicide rate has been much larger than that of the unemployment rate. In particular, the rapid rise in alcohol consumption when unemployment was still high in the 1990s was associated with a sharp rise in the male suicide rate. It is suggested that the suicide rate would have climbed higher in the current recession had the level of alcohol consumption not peaked before the unemployment rate soared. If alcohol consumption continues to decline the impact of the current recession on the suicide rate may be smaller than many commentators fear.

The challenge for suicide prevention policies is to reach at-risk individuals with effective interventions. But suicide is a rare event even in the high-risk groups. For example in the group with the highest suicide rate – young unemployed males – the annual suicide rate would seem to be no higher than 125 per 100,000 population or 1 in 800.[6] Similarly, although heavy drinkers as a whole have a high relative risk of suicide, only a small minority of them are actually suicidal. Among these groups effective preventive measures would have to identify those with severe depressive illness, for example, and even then the identification of individuals at particular risk would remain difficult. This leads to a pessimistic view about the possibility of effective preventive measures at the individual level and might be used to support the case for

[6] This estimate is based on data in Corcoran and Arensman (2010).

broad-based public health measures such as measures to discourage alcohol consumption.

The topic of the affordability of alcoholic beverages and the effectiveness of various control policies in reducing alcohol-related harm was recently reviewed extensively on behalf of the European Union (Rabinovich, *et al.,* 2009). The conclusion is worth quoting:

> If, as this study indicates, the affordability of alcohol *does* impact on levels of harmful and hazardous alcohol consumption, then it makes sense for policymakers to consider the appropriate policy levers available (in this case, measures affecting the price of alcohol, and therefore its affordability) to help curb this phenomenon. (p. 126)

Increased taxation of alcoholic beverages is generally regarded as the most effective of the available policies to discourage heavy drinking (Wagenaar *et al.,* 2009), but it entails costs to the wider public that have to be weighed against its possible benefits in deterring harmful consumption. Moreover, a recent meta-analysis of the available evidence found that while alcohol prices and taxes are significantly and inversely related to many alcohol-related diseases and causes of death, the data were too sparse to draw a firm conclusion regarding their effect on suicide (Wagenaar *et al.*, 2010). However, the close association between the level of alcohol consumption and suicide rates among young males documented in the present study suggests that heavier taxation of alcoholic beverages could play a role in reducing the suicide rate among young males. It is, therefore, anomalous that the incidence of tax on beer has declined from about 34 per cent of the final price in 1999 to 29 per cent in 2009. The tax take as a percentage of the final price of spirits has also declined, although less markedly (see Revenue Commissioners, 2009, Tables EX4 to EX8). While acknowledging that Irish excise taxation policy is constrained by the effect of differentials in tax rates on flows across our borders with less heavily taxed jurisdictions, the relatively lenient tax treatment of alcoholic beverages over the last decade does not reflect the widely-expressed concern about the high suicide rate among young people.

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