NBER WORKING PAPER SERIES

WELL-BEING AND SOCIAL CAPITAL:
DOES SUICIDE POSE A PUZZLE?

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NBER Working Paper No. 10896
November 2004
JEL No. I0

ABSTRACT

This paper has a double purpose: to see how well Durkheim's (1897) findings apply a century later, and to see if the beneficial effects of social capital on suicide prevention are parallel to those already found for subjective well-being (Helliwell 2003). The results show that more social capital and higher levels of trust are associated with lower national suicide rates, just as they are associated with higher levels of subjective well-being. Furthermore, there is a strong negative correlation between national average suicide rates and measures of life satisfaction. Thus social capital does appear to improve well-being, whether measured by higher average values of life satisfaction or by lower average suicide rates. There is a slight asymmetry, since the very high Scandinavian measures of subjective wellbeing are not matched by equally low suicide rates. To take the Swedish case as an example, this asymmetry is explained by Sweden having particularly high values of variables that have more weight in explaining life satisfaction than suicide (trust and quality of government), and less beneficial values of variables that have more influence in explaining suicide rates (Swedes have low belief in God and high divorce rates), because with the latest data and models the Swedish data fit the wellbeing and suicide equations with only tiny errors. If the international suicide data pose a puzzle, it is more because suicide rates, and their estimated equations, differ greatly by gender, while life satisfaction and its explanations are similar for men and women.

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1. Introduction

There are many reasons for wishing to see if the international evidence on the determinants of suicide is consistent with results already in hand supporting the positive effects of social capital on subjective well-being. First, and most immediate, is the need to answer the first question raised by those skeptical of the earlier results: If the Swedes and other Scandinavians are so happy, why is their suicide rate so high? In fact, the Swedish rate is currently below that in most industrial countries, so the refined form of the question is: If well-being is unusually high in the Scandinavian countries, why are suicide rates not also lower there than elsewhere?

Second, some researchers are wary of using subjective evaluations of well-being as the basis for national and cross-national comparisons of well-being. They wonder if the questions can mean the same thing in different languages. They also worry that the answers are likely to fluctuate with whim, mood and personality, and so may be of questionable validity. Suicide rates, if comparably measured, represent actions rather than mere opinions, and hence acquire more credibility in the eyes of some behaviorists.

Third, correlations between measures of subjective well-being and measures of social capital may be due to causal channels running in either direction, as well as from some other third source. Since suicide is the final act, at least for the individuals in question, it lessens or removes the risk of any correlation being due to reverse causation from suicide to the determinants of subjective well-being.

Even in the absence of skepticism about the use of subjective measures of life satisfaction to represent well-being, there would be good reason to be interested in the effects of social capital on suicide rates. Since suicide is commonly interpreted as an ultimate assessment of life satisfaction, if social capital is found to reduce suicide rates this would broaden and strengthen the case linking social capital to well-being. There is a further direct and predictive link between subjective measures of life satisfaction and suicide, as those with

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lower than average measures of life satisfaction are far more likely to commit suicide subsequently. For example, in one large Finnish sample those with below-average life satisfaction were four times more likely than others of the same age to commit suicide over the following ten years. There was also a dose-response relation; males near the top of the dissatisfaction scale were 25 times more likely than other males of the same age to have committed suicide over the first ten years of the follow-up period (Koivumaa-Honkanen et al.2001). This association should strengthen the case for relying on subjective measures of life satisfaction, while possibly also supporting the notion (Kahneman 1999) that is possible that a single well-being measure could cover the range from very good to very bad, even to the point of complete despair.

In section 2, I shall start by reviewing some of the existing studies that might be helpful in specifying and interpreting equations designed to explain international differences in suicide rates. Section 3 will first present some of the suicide data being explained, followed by the results from suicide and well-being equations estimated using a slightly larger sample of countries than was used earlier (Helliwell 2003) for the study of subjective wellbeing. Matched estimation of life satisfaction and suicide equations assures the measures of social capital and the underlying histories and institutional structures are identical, thus making the suicide and subjective well-being results as comparable as possible.

2. Why Do National Suicide Rates Differ?

When Durkheim (1897, 1952) undertook his magisterial analysis of suicide, he presented differences in suicide rates as a sociological challenge to those who were more inclined to consider the pre-disposition to suicide to "depend exclusively to individual factors, thus belonging to psychology alone." (Durkheim 1952, 46). By contrast, Durkheim argued that "each society has a definite aptitude for suicide… characteristic of the society under consideration." (Durkheim 1952, 48). My purpose mirrors Durkheim's in attempting to explain differences in average suicide rates among nations and over time. To aid the selection of suitable specifications, I shall first consider a broader range of evidence, in order to be

better informed about what variables should be included.

A striking proportion of the factors still considered relevant in explaining differences in suicide rates among individuals and communities were considered and tested by Durkheim more than a century ago. One of the reasons he chose suicide as a topic of sociological study was precisely because it was a vital event leaving statistical records almost as complete as those for births, deaths and marriages, often accompanied with a full range of demographic information, and having a well-defined location. Because he was aiming to establish a sociological basis for the explanation of suicide, Durkheim was quicker than modern scientists would be to dismiss the possibility that psychopathic states and cosmic factors might have effects on suicide beyond those flowing through the structure of society and social relations. But even here, his use of evidence is honest and powerful.

Climate, Latitude and Sunshine
Let's start with the effect of climate, since one of the puzzles we are exploring relates to Scandinavia and other parts of Northern Europe, where the long winters have sometimes been suggested to be a cause of the higher-than-expected suicide rates there. But which aspect of the long winters? Durkheim was quick to note that there is a strong seasonal variation in suicide rates. But the peak is in summer rather than winter, at the time of maximum daylight rather than maximum temperature. He argued that the mid-summer peak was due to the longer days giving more time for social life. More recent research has confirmed the mid-summer peak and also found a dose-response relationship, with the seasonal peak being greatest for countries furthest from the equator, and absent for countries close to the equator (Parker, Gao and Machin 2001). An intriguing study in Denmark (Rihmer et al 1998) found that an education and treatment programme for primary care physicians in Gotland led to a large reduction in the suicide rate accompanied by a complete elimination of its seasonality. The finding of summer suicide peaks is not without exceptions. For example, there has been a finding of a late fall seasonal suicide peak among the elderly in some northern countries, e.g. Finland (Hakko et al 1998) and British Columbia (Marion et al

1999).

The continuing relation between latitude and the seasonal pattern of suicides has given rise to an alternative hypothesis that the seasonal pattern is due to the exposure to sunlight (Petridou et al.2002). There are brain mechanisms sensitive to sunlight, for example controlling the hormone melatonin. However, a large study of electrical workers exposed to differing amount of sunlight in the course of their jobs showed no evidence of higher suicide rates among those with more exposure to sunlight. (Van Wijngaarden and Savitz 2000). And a study based on simple correlation has argued for a positive relation between latitude and suicide rates (Davis and Lowell 2002). We shall test the validity of latitude as an explanatory variable later in the context of a more fully specified model.

As for shorter-term variations in suicide rates, Durkheim reported them to be lowest in the middle of the night and highest in those parts of the morning and afternoon when existence is most active, with a pause for lunch (Durkheim 1952, 118). He further supports his link between activity and suicide by arguing that the lower suicide rates Friday through Sunday were due to the lower pace of activity then, citing railroad travel data as supporting evidence. Recent evidence shows more complicated daily and weekly patterns. One continuing finding that echoes Durkheim, although supported by different reasoning, is a suicide drop before and during major holidays, with a peak immediately following (Nishi et al 2000, Jessen and Jensen 1999).

Seasonal affective disorder (SAD) has often been alluded to as a possible reason for higher suicide rates in climates with long winters. But, as we have already seen, the seasonal pattern of suicide rates almost universally has its peak in mid-summer and not in mid-winter, while seasonal affective disorder is concentrated in the winter. Since clinical depression is a strong predictor of subsequent suicides, both attempted and complete (Blair-West et al. 1999, Marttunen et al. 1995, Qin et al 2000, Groholt et al 1997, Wickstrom and Rossow 2002), then either SAD must be atypical in some key respect (e.g. by having less damaging effects of

specific memories, as shown by Dalgleish et al 2001), or else be a small fraction of total depression. It seems implausible to suppose that SAD suicides follow the seasons with a full six-month lag and occur when mood is at its best for these individuals. The most likely answer appears to be that seasonal affective disorder is a form of depression that, unlike bipolar disorder (Chen and Dilsalver 1996), seldom leads to suicide or attempted suicide. Since seasonal affective disorder, to the extent that its source is understood, is likely to be seen by the sufferer as having a natural resolution, or at least a foreseeable respite, it may be less likely to lead to the hopelessness that has been seen as a prevalent wellspring of suicidal behaviour (Williams 2001, 90). However, even if seasonal affective disorder is not fatal in enough cases to produce a winter peak in suicide rates, it may nevertheless play some role in making suicide rates higher in countries further from the equator, if that result should be found in the empirical evidence presented in the next section.

Contagion

Durkheim (1952, 131) also considers imitation as a cause of suicide, citing many joint and mass suicides in history and literature by way of evidence. He finds however no geographic clustering of the sort this might lead one to expect. In modern times, the issue has been considered mainly in terms of imitation following media publicity. One recent meta-survey argues that the link between media reports of actual suicides and subsequent suicides is so solid as to be beyond contention (Gould 2001), with the role through fictionalized treatments being less certain. Cutler et al (2000) find strong contagion effects on attempted youth suicides in the United States from suicide attempts among their family and friends. Schmidtke and Haffner (1988) found that each of two showings of a German TV drama depicting a young man's fictional suicide on a railway line was followed by a significant increase in the number of railway suicides by young men.

Religion Protects

Durkheim then considers the effects of religion and education on suicide rates. He found suicide rates of 19 per 100,000 in Protestant states, 6 in Catholic states, and 4 in Greek

Orthodox states (Durkheim 1952, 152, but expressed in the units now used to measure mortality rates). He argued that the more religion encouraged independent thought the less integrated was the church and the community it served. He argues that "the more extensive the credo the more unified and strong is the society" (Durkheim 1952, 159). In modern studies, the protective effect of religiosity has been found strong within as well across societies. For example, a study of young males in Utah, the base of the (Mormon) Church of Latter Day Saints, found that suicide rates for males in their mid-20s were only one-sixth as large for active members of the Church of Latter Day Saints, compared to either non-members or inactive members (Hilton et al. 2002). Some studies suggest that the protective effect of religion may be greater in less religious parts of a country (Neeleman 1998) or in less religious countries (Neeleman and Lewis 1999). But at the national level the literature continues to support the suicide-reducing effects of religion, operating through some combination of channels, including social support, greater hope in the face of adversity, reluctance to commit a deadly sin, and official willingness to classify deaths as accidental rather than suicidal.

Education may be Dangerous

Durkheim argues that education, like weaker religion, encourages a spirit of free inquiry and is hence also likely to be associated with higher suicide rates. To make an independent case for the effects of education, he compared suicide rates among Italian regions, all of which were Catholic, and had roughly equal religious instruction. He found with only a single exception that those regions with higher levels of literacy also had higher suicide rates. He dealt with the otherwise puzzling case of the Jews, who had by far the highest education rates but suicide rates as low as among Catholics, by arguing that the persecution they endured led them to develop a society much more cohesive than those around, by enough to more than compensate for the effects of their greater education (Durkhein 1952, 167-8).

Recent evidence on the effects of education on suicide risk is mixed, appearing to depend much on what other factors are included. The long-standing myth of high suicide rates among

university students appears to have no broad support from the evidence, in samples ranging from Cambridge University (Collins and Paykel 2000) through a set of large U.S. universities (Silverman et al 1997) to a meta-analysis of 31 studies from many countries (Silverman 1993). For almost all sub-groups of students, suicide rates are below those of demographically matched members of the general population. Campus female rates mirror those in the general population in being significantly below male rates, except among graduate students (Silverman et al 1997, 9.1 for women, 11.6 for men).

Gender Differences

Durkheim argued that the lower suicide rates and lower education levels among women than men supported his argument linking education and suicide (Durkheim 1952, 166). This part of his reasoning has not stood the subsequent century of experience, as in most countries the male suicide rate is still four times that of women, just as it was in the late 1800s, while average education levels for women have approached and frequently surpassed those of men. The gender differences in suicide represent a double puzzle[1]: self-reported suicide attempts are significantly higher for females than males (Schmidtke et al 1996), while at all ages completed suicides are far more frequent among males than females. For example, female suicide attempts were significantly more frequent among Norwegian adolescent girls than boys (Wichstrom and Rossow 2002), while during the same years completed suicides among Norwegian boys were three times as frequent for boys as for girls (Groholt et al 1997). Thus it is unsurprising that a Finnish nationwide study found that young females who committed suicide were twice as likely as males to have made a previous suicide attempt, to have been diagnosed with major depression, or to have been in psychiatric care during the preceding year (Marttunen et al 1995).

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1 This paradox existed in Durkheim's data too, and formed part of his argument that mental illness could not be a very large determinant of suicide rates. After all, he argues, if females are a larger fraction of those in mental institutions, and if mental illness were the cause of suicide, then female suicides among the female insane would be equal to the male share, while in fact it is far smaller (Durkheim 1952, 70). He did not, however, compare the relative suicide rates among the mentally ill and the general population. This would almost surely have led him to be less secure in his conclusion. But the gender asymmetry between mental illness and suicide remains an important

A further implication of more frequent incidence of diagnosed depression among females, combined with the gender imbalance for completed suicides, is that lifetime suicide rates for those diagnosed with major depression are even more gender-biased, being 7% (or 7000 per 100,000) for males and 1% for females in one study based on US data (Blair-West et al 1999). Differing exposure to the common conditioning variables has so far proved inadequate to explain the large sex differentials (Qin et al 2000). This suggests looking for different responses by males and females to the conditioning variables, as will be done in the next section, although we will be expecting to find an unexplained constant term that is higher for males than females.

Families Help

After arguing that religion protects against suicide because, and only insofar as, it is a society, Durkheim (1952, 171) then argues that similar protection should be provided by other types of social support, and especially by the family and political society. He assembled all suicide data for France by age, gender and marital status for the years 1889-91, and found that for women of all ages and men over 25, suicide rates were lower among the married, to an extent that grew with age, and more so for men than for women. By the age of 65, suicides for both genders were 11 times as likely among the non-married (including widowed) as among the married. There are corresponding modern results. Durkheim's finding that the suicide-preventive power of marriage falls among elderly women is echoed in modern Hong Kong (Yip 1998). Widowhood remains a large risk factor in cross sections (Luoma and Pearson 2002). One study using US longitudinal data shows much smaller effects of divorce and widowhood, especially for women (Kposowa 2000), perhaps because the periods before divorce and widowhood may be equally stressful. Durkheim (1952, 259-60) reports data collected by Bertillon showing strong correlations between suicide rates and divorce rates, both across countries and among regions within a country, even after dividing the regions into groups sharing the same religion. Durkheim found that having children sharply reduced suicide risk, especially for women, another result echoed by modern findings (Brockington

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2001, Qin et al 2000).

But Some More Than Others: Genetic Buffering

There is evidence that life events likely to cause negative health and behaviour outcomes may be buffered in some individuals by protective genes. For example, childhood mistreatment was found to be less likely to lead to subsequent behaviour problems among males with a genotype conferring high expression of monoamine oxidase A (MAOA) (Caspi et al 2002)[2]. In the case of suicide, genetic buffering is most likely to flow from some features of the serotonergic system (Roy et al 1999, Mann et al 2001, Arango et al 2002, Souery et al 2003). If such genotypes are unevenly distributed among national populations, then we should expect to find long-term international differences in suicide rates, and perhaps different national responses to similar changes in the economic and social environment.

Suicide and the Life Cycle

Durkheim found that male suicide rates in France and Italy in the mid 19th century increased by three or four times from the teenage to seventy-year-old cohorts (Durkheim 1952, 101). He argued that this was further evidence that suicide was therefore dependent on social factors rather then genetic risk factors, which would have produced suicide rates more constant across age classes. The modern distribution of suicide rates still increases with age, but much less sharply. In several industrial countries there have been increases in youth suicide rates over the last fifty years (Cantor 2000), so much so that in the United States the youth rate tripled in fifty years (mostly between the mid-1950s and the mid 1970s), and has exceeded the national average rate for all ages since the 1980s (Cutler et al. 2000, Figure 9). Cutler et al (2000) link the US rise in youth suicide rates chiefly to the parallel rise in divorce rates. This echoes the evidence reported earlier on the importance of the family. In light of the evidence to be reported later on the importance of social capital, it is worth noting Putnam's finding that declines in trust and memberships in the United States since 1960 are

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2 The behavioural role of the MAOA genotype was previously established by Brunner et al (1993) and Craig (1994).

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primarily due to lower social capital among the young, with this being the first generation raised in the television era (Putnam 2000, 2001).

Death in the City?

One of the striking differences between Durkheim's findings and those of modern times relates to differences in suicide rates between urban and rural populations. In his data, suicide rates were higher in the cities, while homicide rates were higher in rural areas (Durkheim 1952, 353). In the modern data, this pattern is generally reversed (e.g. Singh and Siahpush 2002). The underlying causes of this long-term reversal do not appear to have been studied extensively, but may have implications for the explanation of international differences in suicide rates[3]. The relation may also be gender specific, as Qin et al (2003) find recent Danish suicide rates to be higher in rural areas for males and in cities for females.

Economics and Suicide

Durkheim generally saw the main protections against suicide coming from living in tighter and more integrated religions, families and societies. Education and income tend, in his view, to increase actual and perceived independence, and hence to expose the individual to higher suicide risks. On the other hand, economic crises he saw as triggering suicides. He argues that economic crises increase suicides because they are disturbances of the social order. He found evidence of rising suicide rates equally in times of booms (such as the Paris Exposition of 1878, and during the great German growth of the 1870s) and slumps, and could not just be due to the incidence of poverty in times of economic distress. Under this hypothesis, international differences in suicide rates could depend on the comparative volatility of their economies. In a similar vein, county-level US data for the 1980s show significant rises in suicide rates in the wake of severe earthquakes, floods and hurricanes (Krug et al 1998).

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3 Even the extent and nature of the reversal are uncertain. For example, in one study the excess rural suicide rate in rural New South Wales could be traced entirely to the higher rate among foreign immigrants to rural New South Wales, although among young men the suicide rate was significantly higher in rural than urban areas, more so for immigrants than the native-born (Morrell et al. 1999)

One link between the economy and suicide that has received considerable attention is the positive association between unemployment and suicide (Aihara and Iki 2002, Jin et al 1995, Gunnell et al. 1999, Lewis and Sloggett 1998). For example, one recent U.S. longitudinal study (Kposowa 2001) showed the risk of suicide to double for males and to treble for females following spells of unemployment[4] An Italian study showed suicide rates far higher among the unemployed, more so for males than for females (Preti and Miotto 1999).A Danish study found that unemployment was a significant risk factor for males, but not for females (Qin et al. 2000). But male rates of attempted suicide decreased significantly during a deep recession in Helsinki during the 1990s (Ostamo and Lonnqvist 2001a), while completed suicides in Finland as a whole fell during the 1990-1995 recession after rising during the preceding boom (Hintikka et al. 1999). The individual-level results are more clear-cut: even after allowing for confounding variables, unemployment materially increased the risks of subsequent suicide in a large Swedish follow-up study (Johansson and Sundquist 1997). A review of all Danish suicides over a 17-year period found that unemployment and low income increased suicide risks, especially for men.

What might we expect to find for the effects of income on suicide, holding other factors constant? Durkheim found suicide rates generally higher among those with higher education, greater literacy, and higher status occupations, which would suggest that suicide rates might therefore be expected to be higher in higher-income countries. On the other hand, as reported above, there is some evidence from the recent Danish experience (Qin et al 2003) that suicide is more prevalent among those with lower incomes, especially males. Our analysis of this issue in the next section makes use of purchasing power parities to construct average per capita incomes in each country, so that the same value should represent ability to buy comparable amounts of goods and services. Many complications of course flow from different private spending patterns, and large international differences in the extant and

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4 When comparing the effects for males and females, it is important to allow for the fact that average rates for males are three of four times those of females, so that the much larger proportionate increase in the female rate in response to unemployment represent a smaller absolute increase (measured in terms of the increased likelihood of suicide) than in the case of males.

quality of public provision of health care, education, and other services that might be expected to be important to individual health and welfare.

Depression: Diagnosis and Treatment

The link between clinical depression and suicide is well-established and almost universal (Cavanagh et al 2003). For example, US data have been used to calculate a lifetime suicide risk for those with diagnosed major depression as 7% for males and 1% for females (Blair-West et al 1999). For males, this represents an annual suicide rate among those with a history of depression that is about ten times as high as for the rest of the population. For those with unipolar or bipolar disorder, the lifetime risk of a suicide attempt has been calculated as approximately 15% and 30%, respectively (Chen and Dilsaver 1996). Those diagnosed as schizophrenics also have strikingly high subsequent suicide rates, especially so in cases where depression is also present (Rossau and Mortensen 1997). Suicide rates among previous suicide attempters have been found to be seven times higher among French adolescents (Laurent et al 1998), and 25 times higher in Canada (Holley et 1998) than in the general population. In Sweden, suicide attempters had an all-cause death rate fifteen times expected, with suicide being the largest contributor (Ostamo and Lonnqvist 2001b).

These linkages from mental illness, and especially depression, to suicide attempts and completed suicides are so strong that international differences in the successful diagnosis and treatment of mental illness are likely to significantly affect cross-country differences and changes over time in national suicide rates. For example, Danish suicide rates fell by more than one-third between 1980 and 2000, a period during which there were many experiments and changes in the analysis and treatment of depression. The Gotland study suggests that the sharp reductions in suicide rates there were due mainly to increased awareness and involvement by general practitioners, since the reductions were mostly reversed as the trained practitioners later moved to other parts of Denmark (Rutz 2001). A Finnish study showed that the sharply increased use of anti-depressants between 1990 and 1995 was accompanied by a drop in the suicide rate but an increase in the proportion of suicides caused by

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antidepressants, especially tricyclics (Ohberg et al 1997). Danish (Nilsson 1999) and UK (Coppen and Farmer 1998) studies showed sharply lower suicide risks (about one-quarter as great in both studies) among patients continuing with lithium therapy. In these studies it is difficult to disentangle the effects of the drug from the other benefits of continued treatment.

Method and Opportunity

There are large international differences in the availability of potential methods for suicide, and also large differences in the methods used for suicides. To what extent do the differing methods reflect the availability of the means? Furthermore, do the differences in opportunities and methods lead to international differences in average suicide rates? Since guns are an especially effective suicide weapon, and their use differs considerably across cultures, genders, and national boundaries, they have been a focus of special study. There appears to be a well-established connection between the availability of firearms and the rate of suicide by firearms. However, much or most of this link appears to be due to changes in the mix of methods used rather than changes in the overall suicide rate (e.g. Ludwig and Cook 2000). As part of the research for this paper, Haifang Huang collected comparable data for gun availability, total suicides, and suicides by firearms for thirty countries. There is a significant correlation between gun availability and the proportion of suicides by firearms (r=.5) but not between guns and the total suicide rate. Similarly, while changes in the rates of prescription of some drugs used for treating depression has been linked to higher rates of suicide by overdosage of these drugs, once again there is little echo in the overall suicide rate.

The link between suicide and the availability and use of alcohol and narcotics is especially complicated. First, alcohol and drug dependence at the individual level has been found to be a strong predictor of subsequent suicides and suicide attempts. At the national level, one study found that international differences in average alcohol consumption were found to be correlated with suicide rates only among so-called 'dry' cultures, and not among those 'wet' countries where alcohol was more regularly consumed (Ramstedt 2001). A distinction is presumably being made here between use and abuse, with the link between availability and

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abuse being not easy to establish. Nemtsov (2001) finds a strong correlation in Russia between alcohol consumption and male suicide rates, both over time and across oblasts (provinces) of Russia. He argues that the causal significance of alcohol consumption is revealed by the coincident drops in alcohol consumption and in male suicides during the Russian anti-alcohol campaign started in 1984.

Migration and Suicide

Since there are many differences in suicide rates across cultures, religions and nations, it should be expected that immigrants would have different suicide experiences than others in the countries to which they move. There is also the possibility that either the causes or the consequences of the migration might increase stress to levels that might pose risks of depression and suicide. Studies of the suicide experience of migrants has found, just as already discovered for trust (Rice and Feldman 1997, Soroka et al 2004), that migrants take with them the suicide propensities (and the methods used for suicide) that were typical in the countries from which they moved (Kliewer 1991, Burvill 1998). The longer the migrants are rooted in their new homes, the more their suicide rates come to resemble those in their new home countries (Hjern and Allebeck 2002), again echoing the results for trust (Soroka et al 2004). Some Swedish evidence has found that the suicide rates for most of their immigrant groups are higher than in their respective countries of origin (Ferrada-Noli 1997, Johansson et al 1997). An analysis of the entire 1970s birth cohort in Sweden showed inter-country adoptees and immigrants to have had 3 to 4 times higher odds of suicide, suicide attempts, and serious mental illness, when compared with the general population, even after controlling for a variety of other risk factors (Hjern et al 2002). A U.S. study (Singh and Siahpush 2001)showed significantly lower suicide rates among immigrants than among those born in the United States, but did not control for either the effects of religion or for the average suicide rates in their countries of origin. Mobility itself, whether domestic or international, may increase suicide risks, as one study found the odds of nearly lethal suicide attempts to be doubled during the twelve months following a move (Potter et al 2001).

A related hypothesis, supported by some US data (Ellison et al 1997) is that religious homogeneity might lead to lower suicide rates. If this finding were generally applicable, it might help to explain the higher than expected suicide rates among some immigrant groups, to the extent that they may be migrating to communities with different religions than their own. The possible effects of religious, ethnic and linguistic diversity will be tested in the next section.

Measurement Issues

Cross-national comparison of suicide rates requires comparable statistics. If suicide is heavily condemned by religious, legal or other community or family sanctions, it is presumably less likely to occur, and may also be under-reported. Cross-national comparisons of the methods and results of death statistics have tended to argue that there is likely to be significant under-reporting and re-classifications of deaths in countries with strong sanctions against suicide (Wasserman and Varnik 1998), but that corrections do not raise rates in such countries sufficiently to reverse any rankings (Jougla et al 2002). Even within countries, there are some differences in the relative accuracy of official statistics among regional sub-populations (Rockett and Thomas 1999).

3. Social Capital and Suicide at the End of the 20th Century

Suicide rate differences among nations, religions, genders and social groups continue to exhibit qualities that Durkheim thought would make them prime candidates for quantitative sociology. The differences are large; they vary greatly under changes in circumstances, and for many of the sub-groups of interest the sample sizes remain large enough to permit strong distinctions to be made. The analysis in this paper will be mainly at the national level, using data for 117 country-waves from 50 countries covered by the World Values Survey (WVS, Inglehart et al 2000) and the European Values Survey (EVS, Halman 2001) over the last two decades of the 20th century. This strategy permits the fullest use of the measures of social capital collected in those surveys, and provides suicide results that are comparable with studies of subjective well-being using the same data.

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The national suicide data underlying this study are shown in Figure 2, averaged across survey waves for each country, for total suicides and for males and females separately. Figure 3, showing national suicide rates for each of the country waves, reveals remarkable changes between 1980 and 2000, especially among the countries of the Former Soviet Union (FSU) and Eastern Europe that form a large part of the WVS and EVS samples for the 1990s. As has been noted in the literature, there was a striking fall in suicide rates in the countries of the FSU and Eastern Europe, especially the former, during the years of Perestroika[5], followed during the 1990s by larger increases, especially in the FSU. Suicide rates in the FSU are now more than double those of countries in Western Europe. The data also show large differences among other countries, and changes over time within countries. The widespread perception of high suicide rates in Scandinavia is supported only by the Finnish case. The Swedish and Norwegian rates are below the averages for the other industrial countries. Between 1980 and 2000, the Swedish and Danish suicide rates fell dramatically, by one-third in Sweden and by one-half in Denmark. The southern European and Latin American Catholic countries continue to have very low suicide rates throughout the twenty years. The suicide rates in Iceland, Ireland and Great Britain are sharply lower than in most industrial countries.

To put these recent data in a longer term context, Figure 1 compares suicide rates for the 1870s reported by Durkheim with late 1990s data for the same countries. It can be seen that changes over time within individual countries have often exceeded the already large inter-country differences. On average, suicide rates have about doubled over the century, but this average masks a great variety of experience. Russia, for example, has moved from the lowest to the highest rate over a century, from an average total rate of about 3 to about 40 per 100,000. Suicide rates in France have stayed fairly constant over the century at about 15, while the suicide rate in England and Wales has increased slightly, but in both periods remaining well below the rates in France and Germany. Among the Scandinavian countries,

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5 Varnik et al (1998) and Wasserman and Varnik (2001) argue that the hopes engendered by Perestroika were the primary cause of the sharp reduction, while Nemtsov (2001) argues that the the primary cause was the success of the anti-alcohol campaign started in 1984.

Norway and Sweden have seen suicide rates roughly doubling over the 120 years, while the Finnish rate has quadrupled, moving from one of the lowest in the 1870s to the highest in Western Europe in the 1990s. The Finnish average rate of about 23 is still only slightly more than half of the current rate in neighboring Russia, with both countries having moved up from about 3 in the 1870s.

Tables 1 and 2 show the results of suicide rate equations estimated for total suicides and separately for males and females. Table 3 shows equations separately for each age group, with separate equations for males and females. The discussion will start with an analysis of the basic equation reported in Table 1, followed by consideration of alternative models and tests of other hypotheses suggested by previous research.

To compare the male and female results, it is important to bear in mind the very different average sizes of the two rates. The dependent variable in each case is the average suicide rate per 100,000, so that the coefficients show the number of lives saved or lost, per 100,000 persons, from a unit change in one of the independent variables. To compare proportionate responses between males and females, the female effects should be slightly more than trebled, since the male suicide rate is typically between three and four times the female rate (in the 117 country-waves analyzed in this paper, the average is 7.9 for females and 25.6 for males).

To provide an example, the first coefficient shows the effect of changes in the average value of memberships per capita in non-religious voluntary organizations, the same variable as was used in the earlier study of well-being. In our sample, the average value of this variable is .38 memberships per capita. The statistical power of the membership effect, as well as its size, is larger for males than for females. The coefficient of 12.7 on the membership variable in the male suicide equation would suggest that raising the national average by 10%, by about .04, would reduce suicides by about 0.5 per 100,000, almost 2% of the sample average rate for males. The same increase in average memberships would lower the female suicide rate by

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about 0.08 per 100,000, about a fifth as large as the male effect in terms of lives saved. However in proportionate terms the female effect is two-thirds as large as the male effect.

Turning to the effects of trust, the effects are much larger for males than females, even in proportionate terms. The effects of trust on suicide rates appear to be very large. One-third of the respondents think that on average other people can be trusted. If 10% more of the population in each country thought that others could be trusted, the average value would rise from .33 to .43. This is a large increase, but is still only one-third of the difference between the average trust levels in Scandinavia and the FSU. It would, according to the basic equation in Table 1, be associated with a 4.0 per 100,000 drop in the annual suicide rate for males, and a smaller 0.5 per 100,000 drop for females.

The protective effects of religion are also still much in evidence. We have followed the earlier study of life satisfaction by using two different measures of religion: the proportion of the population that goes to church once a week or more and the number who say that god is very important to their lives (averaging 0.21 for church and 0.32 for god). The two component variables are correlated positively, as might be expected, +0.3 at the individual level and +0.74 at the national level. This high correlation at the national level reduces the separate significance of the church variable in some specifications, while the combined variable is always strongly significant. Earlier versions of this paper found equal effects from church and god, and the two variables were added together for our final estimates of the suicide equation. But we have since been able to develop comparable data for international differences in divorce rates. The correlation between church and the divorce rate is -.41, while that between divorce and the average number of years of schooling is +.48. Adding the divorce rate to the suicide equation drives out the variables for church and for education, as can be seen from the results in Table 2. The protective effect of a strong belief in god remains very great, however. If a further 10% of the population had a strong belief in god (i.e. moving the sample average from 3.1 to 4.1), the male suicide rate would be lower by 3.2 per 100,000, and the female rate by 1.4 per 100,000. The effect of religion is thus proportionately twice as

large for females as for males[6].

Divorce has a strong link to the suicide rate at the national level, mirroring the strong effect found by Durkheim and in many studies based on individual data. The divorce rate is measured as an annual rate per 1,000 people, with an average sample value of 1.9. Measured in comparable terms, the annual divorce rate thus averages more than ten times the suicide rate. The estimated coefficients suggest that for males, other things equal, a 10% rise in the divorce rate would be matched by a 6% increase in the male suicide rate and a 2.5% increase in the female rate. These effects are enough higher than the individual-level results as to suggest that at the national level divorce and suicide rates may have some common causes not directly included in the basic equation.

Figure 2 shows the predicted and actual values for national suicide rates (averaged across waves for compactness) shown in increasing order of predicted suicide rates. The figure makes it easy to spot which countries are the outliers. Robustness checks have been done to ensure that the coefficient values are not sensitive to the inclusion of the largest outliers, which in least squares regression have the largest influence on the choice of parameter values. The coefficient standard errors are robustly estimated, with errors clustered by country. Do the Scandinavian countries pose a puzzle? It would seem not. Norway, Sweden and Iceland are in the bottom half of the distributions of both the actual and predicted values for total suicides, with the equation fitting Norway and Sweden almost exactly, and over-predicting the Icelandic rate slightly. Finland has the highest rate among the Scandinavian countries, and its rate for both males and females is significantly under-predicted. The Danish rate is on average predicted accurately for males and under-predicted for females, but the average across waves fails to show the quite striking drop in the Danish rate over the 1980 to 1999 data period, so that at the end of the century the Danish rate was below average and over-predicted. The Swedish rate too has been falling over the same period. Perhaps the common presumption about Scandinavian suicide rates is based on out-of-date information,

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6 The greater protective effect of religion for females is also noted by Stack (2000).

or on some other set of comparison countries.

The remaining equations in Table 1 show the effects of adding variables measuring average per capita incomes, the quality of government, and latitude. These variables are here considered separately, as they are quite highly correlated (+.32 and +.37 between latitude and governmental quality and per capita incomes, and +.80 between per capita incomes and governmental quality).

The theoretical relevance of per capita incomes and latitude has been discussed in the previous section. Higher latitude is expected to increase suicide rates, with the effects of per capita income being uncertain. Higher income countries might have higher suicide rates for the reasons adduced by Durkheim; on the other hand such countries are also likely to have health care systems that are better able to diagnose and treat depressions that might otherwise lead to suicide. Higher-income countries might also have other policies better able to reduce the prevalence of hardships that have been found in other studies to be predictive of suicidal behaviour. Measures of the quality of government and of the inequality of incomes might also be expected to get at the latter factors, perhaps more directly than through average per capita incomes.

Thus societies with generally higher quality government might also be expected to have higher quality health care systems, and more effective social welfare policies. To measure the quality of government we considered the six component indexes of governmental quality prepared by Kaufmann, Kraay and Mastruzzi (2003). Of the six indexes, two are focussed on the nature, openness and stability of the electoral system, the first relating to voice and the other to accountability. The remaining four indices relate to the rule of law, the effectiveness of government services, the efficiency of the regulatory system, and the absence of corruption. In previous work on subjective well-being (Helliwell 2003), earlier versions of the six indexes were each found to have similar effects on subjective well-being, and were empirically dominated by a simple average of the six measures.

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The governance data have been through two subsequent rounds of improvement and updating, and our estimation sample has now been extended in breadth and length, so optimal aggregation has been considered afresh for the work reported in this paper. For the suicide equation, the six indexes can be most effectively combined into two sub-aggregates, with the two relating to the electoral system being combined into a variable called 'democ', and four relating to the effectiveness and trustworthiness of government combined into a measure of governmental effectiveness called 'govdo'. In the context of the suicide equation, govdo always dominates the overall variable. The same is now true for the well-being equations reported in the next section[7].

Male suicide rates fall with increases in per capita income and in the quality of government, but increase with latitude, when the variables are added to the basic equation. There are no significant effects on female suicide rates from any of these variables. If all three variables are added at the same time, as shown in Table 2, latitude and governmental quality maintain significance for men, as latitude does for total suicides. There is thus some evidence to support the latitude hypothesis, at least for men. Table 6 shows that when a variable representing the Scandinavian countries is added to the basic equation for males it has a slightly significant positive coefficient (8.0, t=1.7) which falls to one-third its previous size and significance when latitude is added.

The other equations in Table 2 give results of tests of some other variables which were suggested by prior research, and which might have made their way into the basic model had they received more empirical support. Several variables are included simultaneously in Table

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7 Indeed, as shown in Table 6, if both variables are included together in the aggregate suicide equation, there is a significant negative effect from govdo and a positive effect from democ, suggesting that harnessing the benefits of democracy requires an effective underlying set of social and governmental institutions. A comparable test in the latest life satisfaction equation, also shown in Table 6, shows that govdo dominates democ, but does not turn the latter negative. The two sub-aggregates have a high positive correlation, +.96, so that the opposite signs in the suicide equation may be capturing the high suicide rates in some of the countries of the former soviet union where democratic electoral processes have preceded effective delivery of government services. However, the negative effect of democ remains even if separate regional variables (which take positive coefficients in the suicide equation)

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2, while Table 6 shows the effects of adding the same variables individually to the basic equation, confirming their lack of significance in either form. The level of educational attainment measured by average years of schooling, the national average unemployment rate, and a measure of diversity all fail to reveal significant influences. The measure of diversity is the average of the measures of ethnic, linguistic and religious fractionalization compiled by Alesina et al (2002). Table 6 shows that even when ethnic, linguistic and religious fractionalization are allowed to have separate coefficients, none has the positive effect that might be supposed from some of the studies of suicide among migrant populations. The unemployment rate does not enter in the expanded sample, and there are some difficulties in obtaining comparable data for unemployment rates, especially in transition economies. However, even in this sample the national unemployment rate has a significant effect in the life satisfaction equation, as will be seen in the next section. Educational attainment drops out in part because of the inclusion of the divorce rate, with which it has a simple correlation, at the national level, of +.48.

Table 7 reports tests of some further variables for which the sample size is slightly smaller. Previous research has found that attitudes toward suicide differ by country, and that these differences help to explain international differences in suicide rates (Neeleman et al 1997). In our sample, there is a positive simple correlation between national average attitudes towards suicides and suicide rates (+.10 for males, +.36 for females), but attitudes add nothing to the explanatory power of the basic suicide equation for either gender. Prevalence of gun ownership and measures of income inequality (the Gini coefficient, and top/bottom income decile ratios) also have no measured impact, although issues of data comparability are arguably present in both cases. As noted in the previous section, a smaller sample of country data does reveal a correlation between gun availability and the proportion of suicides committed with guns, although not between gun availability and the total suicide rate.

Table 3 shows results from the basic equation estimated for each of six age groups, with

are included for the FSU and Eastern Europe.

males and females modeled separately. The effects of belief in god as a protection against suicide are always proportionately greater for females than males, and in both cases increase sharply with age, being twice as large for the over-65s as for the 40-somethings. Since the measure of religion used is national, part of the difference may relate to lesser religious beliefs among the younger cohorts. Memberships have their greatest benefits for middle-aged males. For those aged 45-54, the membership effect is four times as large as for the average of the population as a whole, and more than twice as large as for the average male. For females, the effects grow gradually with age, at a high enough rate that for the over-65s they are half as large in absolute terms, and twice as large in proportionate terms, for females as for males.

The suicide-preventing effects of trust rise with age for both genders, starting from a fairly low base among the very young, and reaching very large effects for the over-65s. Thus for both men and women over 65 the effects of trust are twice as high as the all-ages effect for the same gender.

The effects of national average divorce rates are greatest for those aged 45-54, being for both genders more than twice as great as in the top and bottom age groups.

Returning to the aggregate data, the measurement issue was addressed in part by estimating a parallel equation for traffic fatalities, as shown in Table 4. The average sizes of the death rates from suicide and traffic fatalities are almost identical in our sample (annual rates per 100,000 of 16.8 for suicide and 14.8 for traffic fatalities) and globally, where they tie as the tenth leading cause of death (Murray and Lopez 1996). Thus the scales of the coefficients are comparable between the total suicide and traffic fatality equations.

The first equation in Table 4 uses the identical data sample and specification employed in the basic suicide equation. The results are strikingly comparable to those for suicide, with the clear exception of religion. The apparent life-saving effects of social capital, as represented

by memberships and trust, are as great for traffic fatalities as they are for suicide. Countries with high divorce rates also have high rates of traffic fatalities, but the effect is only one-third as large as in the suicide equation. The effects of religion are absent from the traffic fatalities equation, suggesting that the anti-depressive effects of religion are being offset by the other effects: the possible under-reporting of suicide in countries where there are strong religious sanctions against suicide, and reckless driving behaviour by depressed individuals living in countries where suicide is a deadly sin. Those with suicidal tendencies have been found to engage in high-risk behaviour, and follow-up studies of suicide attempters have shown them to have far higher subsequent death rates from all causes, including especially suicide and accidental death8. The second equation in Table 4 adds the church variable to the basic equation. The two highly correlated (+.74) religious variables take opposite signs, with a positive sign on church and a negative sign on god. This suggests, if weakly, that the anti-depressive effects of religion are more concentrated in beliefs, with the suicide-proscriptive channels more evident in countries with high rates of weekly or greater church attendance. A variable denoting orthodox countries attracts a weak positive coefficient, while a similar variable for catholic countries has no effect.

The traffic fatality research will be considered in more detail elsewhere. But even here it seems worth testing the basic equation against some alternatives adding additional measures of the likely risks of traffic fatalities. Motor vehicle fatalities data in all countries show a strong downward time trend due to some combination of safer cars, safer roads, seatbelt use and other safety regulations. The third equation in Table 4 adds a time variable, which attracts a large negative effect, even larger than is apparent in the national time series data. Adding this variable leaves the other coefficients unaffected except for memberships, which become insignificant, possibly because there have been changes from wave to wave in the wording of the membership question, and substantial changes in the countries involved in the survey waves. The changing country participation makes it difficult to use our current data

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8 For example, one Canadian follow-up study of suicide attempters (Holley et al 1998) found them with far higher than normal subsequent mortality rates, especially for suicide itself (25 times the average) and accidental death (15 times normal rates).

sample to analyze changes from one decade to the next in either suicide rates or traffic fatalities.

The fourth and fifth equations of Table 4 add motor vehicle ownership (per 100 people) and income per capita as alternative measures of motor vehicle usage and presumably therefore of the risk of traffic fatalities. No systematic effect is shown, and the basic equation continues to show large effects from trust, significant effects from divorce and the time trend, and offsetting effects from church and god.

4. Social Capital and Well-Being: Pulling the Threads Together

How do these new results linking social capital and suicide add to what is already known about social capital and well-being? Table 5 reports the latest results for a life satisfaction equation estimated at the national level, plus an encompassing equation for the suicide equation that includes the national-level variables that have been shown to be significantly important for either of the equations. The life satisfaction equation has been adjusted from that used in earlier work (Helliwell 2003) in order to make its estimation and interpretation more comparable to the national-level equations for suicide. The country sample has also been enlarged, and includes data from an additional survey wave, so that the number of separate country-waves has been increased from 87 to 117. To make the estimation comparable to that for suicides, where only aggregate data are available, national averages are used for the latest life satisfaction equation. This requires introduction of national-level equivalents of some variables, such as unemployment, divorce, and trust, that were highly significant at the individual level and which also have important international differences.

The two equations of Table 5, taken together, provide a consistent message about the positive effects of social capital on well-being. The influence of trust is consistently strong. Belief in god and memberships in voluntary organizations increase life satisfaction and reduce suicide rates. The only measure of family-level social capital is the national average divorce rate, which increases suicide and decreases life satisfaction. Evidence of the effects of social

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capital rooted in the workplace are mostly absent from these national-level results, because appropriate national level variables are not yet available. However, one of the explanations of the aggregate-level effects of the unemployment rate on life satisfaction may relate to the lack of workplace social capital among the unemployed. Once divorce is included in either equation, it drives out church membership, while leaving intact the strength of the variable measuring the fraction of respondents having a strong belief in god.

To answer the question in the title of the paper, suicide does not appear to pose a puzzle for the previously established positive linkages between social capital and well-being. The same measures of social capital that improve life satisfaction also appear to reduce suicide rates. In particular, the suicide data from Scandinavia line up fairly closely with the estimated models for both life satisfaction and suicide. This can be seen by examining Figure 4, which shows the predicted and actual values for life satisfaction. Just as was seen in Figure 2, which shows the comparable data for suicides, the same basic model can be used to explain well-being, whether measured by high life satisfaction or low suicide rates.

To show the extent of the similarity of fit, Figure 5 compares standardized coefficients for the encompassing equations for suicide and life satisfaction. The beta coefficients shown in the figure reveal complete sign consistency and are closely comparable in magnitude. The signs are of course opposite, since variables that increase suicide rates lower life satisfaction. The two social capital variables, memberships and trust, have completely consistent coefficient values in the two equations. By contrast, belief in god is more predictive of suicide rates than of life satisfaction (with reporting issues possibly coming into play here as well). Divorce rates have larger effects for suicide than for life satisfaction, while differences in the quality of government are much more important for life satisfaction than for suicide. These differences in coefficients provide the main reasons why countries are sometimes ranked differently for suicide rates than for life satisfaction. For example, Sweden has very high values for the quality of government, high divorce rates and low belief in God. All of these factors contribute to explaining why Sweden is very high in life satisfaction and only average

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in terms of suicide rates.

In the course of dealing with the question posed about suicide in Scandinavia, another puzzle has been uncovered. This relates to the sharp differences between genders in average suicide rates, and in the factors that appear to explain those differences. This is in sharp contrast with the data and modeling of life satisfaction. Average measures of life satisfaction are the same for males and females, the cross-country variation of the two measures is almost identical (r= +.986, compared to +.746 between male and female suicide rates) and if the life satisfaction equation shown in Table 5 is estimated separately for males and females it produces the same results.

Gender effects need much more research, as they are strongly asymmetrical between the suicide and life satisfaction equations. There are no significant gender effects in life satisfaction or its determinants, while suicide rates are four times greater for males than for females, and are determined quite differently. This asymmetry is mediated by the fact that suicide attempts are more common for females than males. One way of interpreting these three facts might be to view life satisfaction as the primary well-being measure, with the excess of completed male suicides due to some combination of greater peer influence and impulsive behaviour, and the greater female rates of clinical depression and attempted suicide representing greater female willingness to develop and call upon social supports (Williams 2001, 219-220). The sharp gender differences in the completion rates for attempted suicides are apparently mirrored by gender differences in the ideation and visualization of the two actions. This paper has exposed rather than explained these gender differences, and has highlighted them by the sharp contrast with the gender symmetry appearing in the life satisfaction data. In any case, the estimated equations for suicide and life satisfaction are fully consistent with the established linkages between social capital and well-being, even if for suicide the strength and nature of the channels are gender specific.

There is one further issue for which the suicide data can perhaps provide reassurance to those

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who are skeptical about using subjective measures of life satisfaction as real indicators of the quality of life[9]. For example, it has been suggested that the international differences in average measures of life satisfaction are inexplicably large relative to the interpersonal differences within countries. How, it is asked, could an unemployed divorced Dane be as happy as an average French person? The international differences in life satisfaction are indeed large, as is shown in Figure 2. In the latest (1999-2000) survey wave, the average level of life satisfaction was 8.24 in Denmark and 7.00 in France. The encompassing equation attributes most of this to differences in the extent to which people think that others can be trusted (0.80), with an additional large contribution from differences in the quality of government (0.36). There are smaller contributions from membership and unemployment (both favouring Denmark) and divorce rates and belief in God (both favouring France). Both countries have positive residuals in that year, 0.44 for France and 0.26 for Denmark.

The fact that the same equations fit both bodies of data well, and provide similar explanations for both suicide and subjective well-being is reassuring. But is there some further way of using the suicide data to check to see if the international differences in life satisfaction are too large to be believed? I noted, by way of reassurance that the international coefficient of variation is much larger for suicide rates than for life satisfaction (as shown in Table 8). I was thus inclined to conclude that one need not fear that the dispersion of life satisfaction averages is too great to be credible. But this interpretation is too simplistic, since suicides are presumably drawn mainly from the extremely unhappy tail of the life satisfaction distribution, so that factors shifting national average measures of life satisfaction would be expected to have larger effects on suicide rates. Luckily, there is a Finnish study (Koivumaa-Honkanen et al 2001) that collected measures of life satisfaction for a large sample of individuals whose suicide experience were followed over the following twenty years. This made it possible for us to construct a distribution of suicides conditional on each person's initial assessment of life satisfaction. After allowing only for the higher average suicide rate in Finland, we used

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9 The following paragraphs and Table 8 were inspired by helpful correspondence and conversations with Danny Kahneman.

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the Finnish distribution based on micro data to construct a distribution of national suicide rates based on national average measures of life satisfaction. If skeptics are right to think that the international distribution of measures of life satisfaction are too large relative to interpersonal differences, then our constructed international distribution of suicide rates based on national average measures of life satisfaction would have a larger standard deviation than does the actual distribution of suicide rates. However, as can be seen from Table 8, the predicted suicide series based on the national average life satisfaction data transformed using the Finnish micro distribution not only has a high correlation with the actual suicide series (0.52), but has a larger mean and a smaller standard deviation. Thus there seems no reason to think that the international differences in life satisfaction are implausibly large in relation to those of suicide rates.

Table 8 also compares alternative ways of predicting international differences in suicide rates, beyond that based only on average measures of life satisfaction. Naturally, we would expect an improvement when allowance is also made for the fact that Finns have lower than average belief in God, since these beliefs are more relevant for suicide than for life satisfaction. Making this adjustment for each country lowers the mean of the predicted distribution closer to the actual distribution, and raises its correlation with the actual series to 0.70. Moving to the full encompassing model removes the life satisfaction data and replaces them with all of the variables in the suicide equation. This need not necessarily improve the correlation, since there may be important omitted variables that affect both suicide rates and life satisfaction without flowing though the few variables included in the encompassing model. As can be seen from Table 8, however, the correlation is 0.77, showing that this omitted-common-variables effect is smaller than the gain from allowing other key variables to take different coefficients in the two equations. This does not necessarily mean, however, that there is no suicide-predictive information in the life satisfaction data beyond that delivered through the variables of the encompassing model. The possibility of such additional predictive information can be assessed by adding the residual of the encompassing model for life satisfaction to the encompassing suicide model. It does slightly increase the correlation of

actual and predicted, from 0.77 to 0.79, suggesting that some variables not yet included in the explanations of suicide and life satisfaction may have influence on both. If any further evidence is needed, this adds to the mutually confirming nature of life satisfaction and suicide data as measures of interpersonal and international differences in the quality of life.

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Table1: Basic and Extended Suicide Equation, Total and By Gender

	Basic Equation			Adding INCNAT			Adding GOVDO			Adding LATITUDE		
	suicide	male	female	suicide	male	female	suicide	male	female	suicide	male	female
memntotc	-6.94	-12.7	-2.07	-5.34	-9.75	-1.5	-6.09	-10.9	-1.96	-4.97	-8.57	-2.08
	[3.02]	[3.18]	[1.81]	[2.17]	[2.17]	[1.19]	[2.52]	[2.57]	[1.57]	[2.46]	[2.58]	[1.78]
trustnat	-22.8	-43.5	-5.05	-18.4	-35.5	-3.48	-17.6	-32.6	-4.41	-26.8	-52	-5.03
	[3.59]	[3.84]	[1.93]	[3.02]	[3.26]	[1.16]	[2.73]	[2.83]	[1.25]	[4.48]	[5.15]	[1.71]
godn	-22.3	-31.4	-14.3	-23.2	-33.1	-14.6	-22.9	-32.6	-14.4	-17.5	-21.3	-14.3
	[5.20]	[3.93]	[9.13]	[5.62]	[4.25]	[9.24]	[5.44]	[4.13]	[8.93]	[4.42]	[3.25]	[6.64]
divorce	4.48	8.48	1.01	4.46	8.43	1	4.28	8.04	0.98	3.96	7.39	1.01
	[5.60]	[5.59]	[3.08]	[5.94]	[5.92]	[3.16]	[5.47]	[5.51]	[2.73]	[5.68]	[5.65]	[3.41]
incnat				-6.05	-11.2	-2.19						
				[2.26]	[2.09]	[1.23]						
latitude										0.23	0.48	0
										[2.83]	[3.67]	[0.03]
govdo							-1.61	-3.43	-0.2			
							[1.69]	[2.01]	[0.31]			
Constant	25.02	38.53	12.9	26.35	40.97	13.38	24.98	38.43	12.9	14.56	16.65	12.96
	[6.41]	[5.44]	[9.19]	[6.90]	[5.92]	[8.88]	[6.50]	[5.57]	[9.16]	[3.06]	[2.21]	[4.58]
# of obs	117	117	117	117	117	117	117	117	117	117	117	117
R-square	0.58	0.58	0.53	0.6	0.6	0.54	0.59	0.6	0.53	0.62	0.63	0.53
Mean of Dependent	16.39	25.58	7.87	16.39	25.58	7.87	16.39	25.58	7.87	16.39	25.58	7.87
S.D. of Dependent	10.18	17.47	4.7	10.18	17.47	4.7	10.18	17.47	4.7	10.18	17.47	4.7

Table 2: Additional Tests

	A; Adding INCNAT, GOVDO & LATITUDE			B: Keeping LATITUDE and adding CHURCHN, UR, EDATTNAT & DIVERSE		
	suicide	suim	suif	suicide	suim	suif
memntotc	-2.18	-3.18	-1.41	-4.47	-7.54	-2.01
	[1.01]	[0.94]	[1.10]	[1.93]	[1.93]	[1.69]
trustnat	-18.9	-35.37	-4.35	-23.63	-44.8	-5.11
	[3.23]	[3.73]	[1.28]	[3.78]	[4.47]	[1.47]
godn	-17.19	-20.41	-14.55	-15.16	-16.13	-14.49
	[4.92]	[3.50]	[7.08]	[2.31]	[1.52]	[4.07]
divorce	3.54	6.39	1.06	4.07	7.48	1.11
	[5.09]	[5.32]	[3.24]	[4.36]	[4.34]	[3.03]
incnat	-4.3	-5.56	-3.57			
	[1.16]	[0.90]	[1.74]			
latitude	0.3	0.64	0	0.27	0.58	0
	[3.97]	[4.89]	[0.07]	[2.68]	[3.35]	[0.06]
govdo	-1.92	-4.84	0.57			
	[1.29]	[2.01]	[0.75]			
churchn				-3.83	-7.92	-0.15
				[0.65]	[0.79]	[0.05]
edattnat				-0.58	-1.23	-0.06
				[1.21]	[1.56]	[0.21]
ur				0.07	0.15	0.01
				[0.40]	[0.52]	[0.06]
diverse				1	4.75	-1.42
				[0.17]	[0.51]	[0.43]
Constant	12.07	10.52	13.56	15.77	18.03	13.84
	[2.58]	[1.40]	[4.75]	[2.53]	[1.85]	[3.70]
Observations	117	117	117	117	117	117
R-squared	0.66	0.69	0.54	0.63	0.65	0.53
Mean of Dependent	16.39	25.58	7.87	16.39	25.58	7.87
S.D. of Dependent	10.18	17.47	4.7	10.18	17.47	4.7

Table 3: Basic Equations by Age and Gender

	Age 15~24		Age 25~34		Age 35~44		Age 45~54		Age 55~64		Age 65 up	
	sui1m	sui1f	sui2m	sui2f	sui3m	sui3f	sui4m	sui4f	sui5m	sui5f	sui6m	sui6f
memntotc	-4.35	0.51	-13.49	-0.64	-20.74	-3.07	-30.28	-4.11	-25.25	-5.45	-12.75	-5.32
	[1.37]	[0.53]	[2.84]	[0.70]	[3.38]	[2.28]	[3.66]	[2.10]	[3.83]	[2.87]	[2.20]	[1.85]
trustnat	-8.41	2.39	-27.87	4.52	-60.42	1.52	-87.49	-2.83	-73.24	-3.24	-93.64	-25.37
	[0.81]	[1.02]	[1.96]	[1.61]	[3.52]	[0.50]	[4.00]	[0.58]	[4.01]	[0.56]	[6.10]	[3.91]
godn	-8.72	-4.94	-20.15	-8.07	-35.16	-10.76	-47.82	-16.94	-45.98	-19.36	-76.07	-37.72
	[1.45]	[2.84]	[1.99]	[4.14]	[2.71]	[5.61]	[2.96]	[6.23]	[3.42]	[6.19]	[8.05]	[8.00]
divorce	5.21	0.19	9.62	0.45	13.04	1.43	16.28	1.99	12.81	1.42	8.74	1.18
	[4.33]	[0.51]	[4.66]	[1.21]	[5.04]	[3.62]	[4.86]	[3.75]	[5.07]	[2.78]	[5.64]	[1.25]
Constant	14.72	4.73	29.43	6.58	47.37	9.81	63.64	15.44	62	18.42	90.09	35.43
	[2.65]	[5.04]	[3.40]	[4.52]	[4.33]	[5.56]	[4.61]	[5.96]	[5.29]	[5.96]	[9.69]	[10.45]
# of obs.	117	117	117	117	117	117	117	117	117	117	117	117
R-squared	0.33	0.22	0.5	0.37	0.55	0.45	0.55	0.41	0.53	0.46	0.55	0.48
Mean of Dependent	17.55	4.55	27.19	6.18	33.35	8.53	39.2	11.45	38.14	11.92	46.76	15.34
S.D. of Dependent	11.73	2.87	18.42	3.81	25.60	5.13	33.58	7.61	28.36	7.44	27.97	11.62

Table 4: Traffic Fatalities (Motor Vehicle Accident Fatalities per 100,000 Population)

	Basic	Adding CHURCHN	Adding YEAR	Adding Vehicle Ownership per 100 people	Replace National Income with Vehicle Ownership
Dependent	Fatalities Rate	Fatalities Rate	Fatalities Rate	Fatalities Rate	Fatalities Rate
memntotc	-5.31	-4.82	-1.22	-0.38	0.06
	[4.04]	[3.82]	[0.79]	[0.22]	[0.03]
trustnat	-17.03	-18.94	-26.41	-25.09	-23.71
	[3.53]	[4.06]	[5.26]	[5.68]	[5.32]
godn	-1.59	-7.49	-8.84	-11.2	-11.01
	[0.44]	[1.69]	[2.18]	[2.48]	[2.53]
divorce	1.23	1.54	1.68	1.85	1.74
	[2.42]	[3.04]	[3.50]	[3.43]	[3.54]
churchn		8.92	7.75	10.58	10.06
		[2.07]	[1.97]	[2.74]	[2.51]
year			-0.38	-0.37	-0.37
			[4.69]	[4.63]	[4.56]
veh_100				-0.05	
				[1.64]	
incnat					-4.4
					[2.23]
Constant	20.6	20.42	771.3	756.82	770.12
	[7.41]	[7.79]	[4.79]	[4.74]	[4.67]
Observations	117	117	117	117	117
R-squared	0.26	0.29	0.38	0.4	0.41
Mean of Dependent	14.75	14.75	14.75	14.75	14.75
S.D. of Dependent	6.12	6.12	6.12	6.12	6.12

Table 5: Encompassing Equations of Suicide and Life Satisfaction

	Basic		Encompassing		Encompassing Adding Latitude				Encompassing Adding Latitude & FSU	
	suicide	lsatis	suicide	lsatis	suicide	lsatis	suim	suif	suicide	lsatis
memntotc	-6.94	0.51	-6.08	0.51	-2.82	0.34	-4.02	-1.91	-2.43	0.3
	[3.02]	[2.80]	[2.45]	[2.80]	[1.26]	[2.15]	[1.15]	[1.46]	[1.12]	[1.99]
trustnat	-22.75	1.83	-16.47	1.83	-18.25	1.93	-33.84	-4.45	-17.04	1.8
	[3.59]	[4.01]	[2.42]	[4.01]	[2.87]	[4.95]	[3.36]	[1.16]	[2.39]	[4.65]
godn	-22.33	1.6	-22.82	1.6	-16.87	1.28	-20.02	-14.27	-16.43	1.23
	[5.20]	[5.01]	[5.35]	[5.01]	[4.78]	[3.74]	[3.39]	[6.88]	[4.61]	[3.36]
divorce	4.48	-0.19	4.29	-0.19	3.44	-0.14	6.29	0.97	2.89	-0.08
	[5.60]	[4.01]	[5.37]	[4.01]	[5.20]	[3.39]	[5.48]	[2.91]	[3.59]	[1.88]
ur		-0.03	0.11	-0.03	0.07	-0.03	0.15	0	0.07	-0.03
		[3.23]	[0.58]	[3.23]	[0.39]	[2.86]	[0.55]	[0.02]	[0.38]	[3.10]
govdo		0.82	-1.66	0.82	-2.9	0.88	-6.13	-0.22	-1.44	0.73
		[10.31]	[1.71]	[10.31]	[2.79]	[12.81]	[3.71]	[0.34]	[1.14]	[5.75]
latitude					0.3	-0.02	0.64	0	0.24	-0.01
					[3.88]	[2.24]	[4.85]	[0.10]	[2.84]	[1.08]
fsu									5.38	-0.58
									[1.23]	[1.87]
Constant	25.02	5.5	23.73	5.5	10.36	6.21	7.7	12.7	11.67	6.07
	[6.41]	[22.27]	[5.42]	[22.27]	[2.12]	[14.23]	[0.96]	[4.74]	[2.58]	[13.87]
Observations	117	117	117	117	117	117	117	117	117	117
R-squared	0.58	0.81	0.6	0.81	0.65	0.83	0.69	0.53	0.66	0.84
Mean of Dependent	16.39	6.9	16.39	6.9	16.39	6.9	25.58	7.87	16.39	6.9
S.D. of Dependent	10.18	1.06	10.18	1.06	10.18	1.06	17.47	4.7	10.18	1.06

Table 6: Additional Test on Suicide and Life Satisfaction Equations

	DIVERSITY	UR & EDATTANT		GOVDO VS DEMOC		SCAN & LATITUDE						SCAN, LATITUDE & FSU			
	suicide	suicide	suicide	suicide	lsatis	suicide	suicide	suim	suim	lsatis	lsatis	suicide	suim	suif	lsatis
memntotc	-6.88	-6.79	-6.96	-5.42	0.5	-7.21	-5.25	-13.2	-8.97	0.5	0.24	-3.17	-4.34	-2.18	0.22
	[2.95]	[2.80]	[2.96]	[2.28]	[2.84]	[3.02]	[2.51]	[3.19]	[2.69]	[2.66]	[1.53]	[1.49]	[1.39]	[1.57]	[1.48]
trustnat	-22.07	-21.89	-21.92	-12.81	1.72	-28.83	-28.82	-54.97	-54.94	1.51	1.26	-22.19	-40.1	-5.77	1.27
	[3.38]	[3.59]	[3.43]	[2.10]	[3.93]	[3.91]	[4.01]	[4.31]	[4.64]	[2.83]	[2.74]	[2.92]	[3.34]	[1.38]	[2.90]
godn	-23.15	-22.83	-22.27	-21.65	1.57	-22.19	-17.84	-31.2	-21.82	1.61	1.16	-16.9	-19.74	-14.46	1.14
	[5.35]	[5.17]	[5.11]	[5.56]	[5.08]	[5.45]	[4.60]	[4.15]	[3.40]	[4.99]	[3.66]	[4.64]	[3.44]	[6.78]	[3.36]
divorce	4.74	4.63	4.5	4.12	-0.18	4.48	4.01	8.47	7.46	-0.19	-0.13	2.81	4.78	1.02	-0.08
	[5.53]	[5.40]	[5.47]	[5.39]	[4.18]	[5.84]	[5.85]	[5.85]	[5.81]	[3.90]	[3.17]	[3.56]	[3.66]	[2.49]	[1.89]
edattnat		-0.23													
		[0.55]													
ur			0.09		-0.03					-0.03	-0.03				-0.03
			[0.51]		[3.17]					[3.34]	[3.12]				[3.28]
govdo				-7.62	0.97					0.81	0.9				0.78
				[2.80]	[5.11]					[9.66]	[11.96]				[6.07]
democ				8.21	-0.22										
				[2.55]	[0.81]										
latitude							0.21		0.45		-0.02	0.16	0.34	-0.01	-0.02
							[2.68]		[3.56]		[3.63]	[2.37]	[3.55]	[0.17]	[2.00]
scan						4.23	1.65	7.96	2.4	0.23	0.51	2.49	4.3	0.62	0.43
						[1.40]	[0.49]	[1.66]	[0.45]	[1.30]	[3.02]	[0.80]	[0.90]	[0.33]	[2.42]
fsu												7.98	17.86	0.02	-0.45
												[2.37]	[3.21]	[0.01]	[1.49]
div_relg	-8.05														
	[1.99]														
div_ethn	1.06														
	[0.20]														
div_lang	2.75														
	[0.36]														
Constant	27.14	26.74	23.97	21.44	5.58	26.55	16.05	41.41	18.82	5.58	6.69	16.08	18.88	13.52	6.5
	[6.59]	[5.14]	[5.54]	[6.17]	[21.14]	[6.91]	[3.37]	[6.02]	[2.51]	[23.76]	[15.77]	[3.62]	[2.84]	[4.72]	[14.92]
Observations	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
R-squared	0.6	0.58	0.58	0.63	0.82	0.59	0.62	0.59	0.64	0.82	0.84	0.66	0.71	0.53	0.85
Mean of Dependent	16.39	16.39	16.39	16.39	6.9	16.39	16.39	25.58	25.58	6.9	6.9	16.39	25.58	7.87	6.9
S.D. of Dependent	10.18	10.18	10.18	10.18	1.06	10.18	10.18	17.47	17.47	1.06	1.06	10.18	17.47	4.7	1.06

Table 7: Test Involving Smaller Sample Due To Data Availability

	Suicide Attitude	Income Inequality	Firearm Prevalence
	suicide	suicide	suicide
memntotc	-6.36	-6.23	-6.03
	[2.62]	[3.06]	[2.88]
trustnat	-22.97	-22.82	-23.61
	[3.47]	[3.33]	[3.55]
godn	-22.83	-20.97	-20
	[5.19]	[3.81]	[4.53]
divorce	4.49	4.74	5.12
	[5.56]	[5.16]	[6.23]
sui_mean[1]	-0.18		
	[0.14]		
p9010		-0.02	
		[0.19]	
guns			-0.08
			[0.77]
Constant	25.5	24.43	24.41
	[5.33]	[5.33]	[6.14]
# of obs.	114*	100**	97***
R-squared	0.59	0.58	0.58
Mean of Dependent	16.39	16.39	16.39
S.D. of Dependent	10.23	10.23	10.22

Note:

1: a higher value of sui_mean means more approval or less disapproval

*: the 3 missing observations are croatia99, slovakia99, greece99

**: the 17 missing observations are: britain 81, denmark 81, spain 96, spain99, ireland 81, n ireland 81, japan 81, iceland 81, iceland 90, iceland99, argentina 81, e germany 90, e germany 97, e germany99, estonia 96 , dominic rep 96, and malta99

***: the 20 missing observations are ireland 81, ireland 90, ireland99, mexico 81, mexico 90, mexico 96, iceland 81 iceland 90, iceland99, s korea 90, chile 90, chile 96, e germany 90, e germany 97, e germany99, portugal 90 portugal 99, venezuela 96, uruguay 96, and dominic rep 96

Table 8: Descriptive Statistics and Correlations of Actual and Predicted Well-being Measure and Suicide Rates

|	
Lsatis	Actual level of life satisfaction measure
plsatis	Predicted level of life satisfaction from the encompassing model
Suicide	Actual suicide rate
psui_1	Predicted suicide rate from the encompassing model
psui_2	psui_1 improved by adding the life satisfaction residual from the encompassing equation to the suicide equation.
psui_3	The suicide rate predicted using the adjusted Finish suicide risk factor by self-reported life satisfaction and each nation's population distribution by self-reported life satisfaction in WVS/EVS
psui_4	psui_3 further adjusted for the difference in self-reported importance of god, using the estimated effect of godn from the encompassing suicide equation.

Panel a: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
lsatis	117	6.90	1.06
plsatis	117	6.90	0.96
suicide	117	16.39	10.18
psui_1	117	16.39	7.86
psui_2	117	16.39	8.00
psui_3	117	21.76	7.21
psui_4	117	18.91	8.85

Panel b- Correlations

|	lsatis	plsatis	suicide	psui_1	psui_2	psui_3	psui_4
lsatis	1						
plsatis	0.90	1					
suicide	-0.53	-0.51	1				
psui_1	-0.60	-0.66	0.77	1			
psui_2	-0.67	-0.65	0.79	0.98	1		
psui_3	-0.96	-0.86	0.52	0.55	0.63	1	
psui_4	-0.83	-0.75	0.70	0.80	0.85	0.83	1

Figure 1: European Suicide Rates 1870s vs 1990s
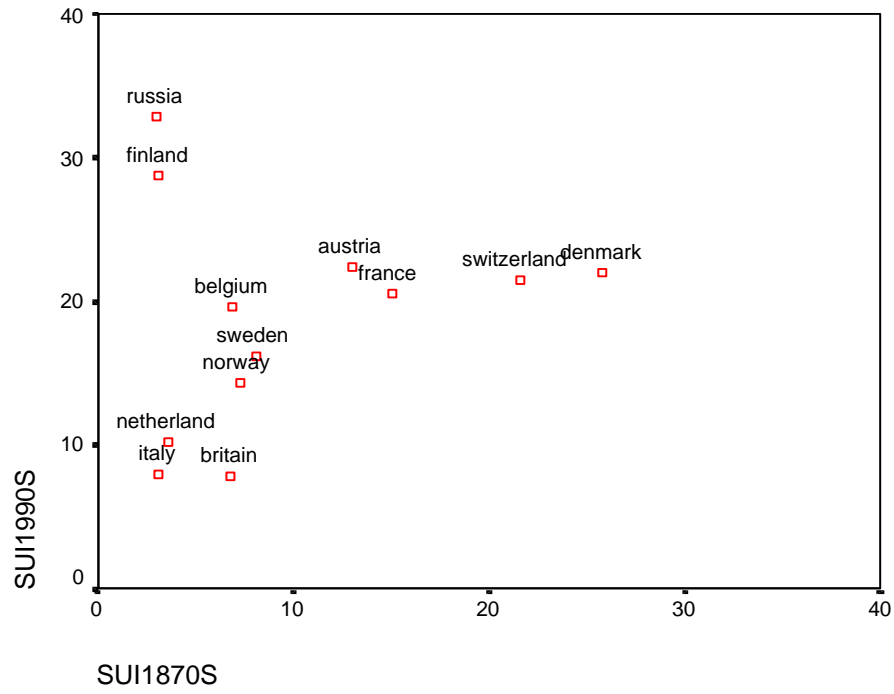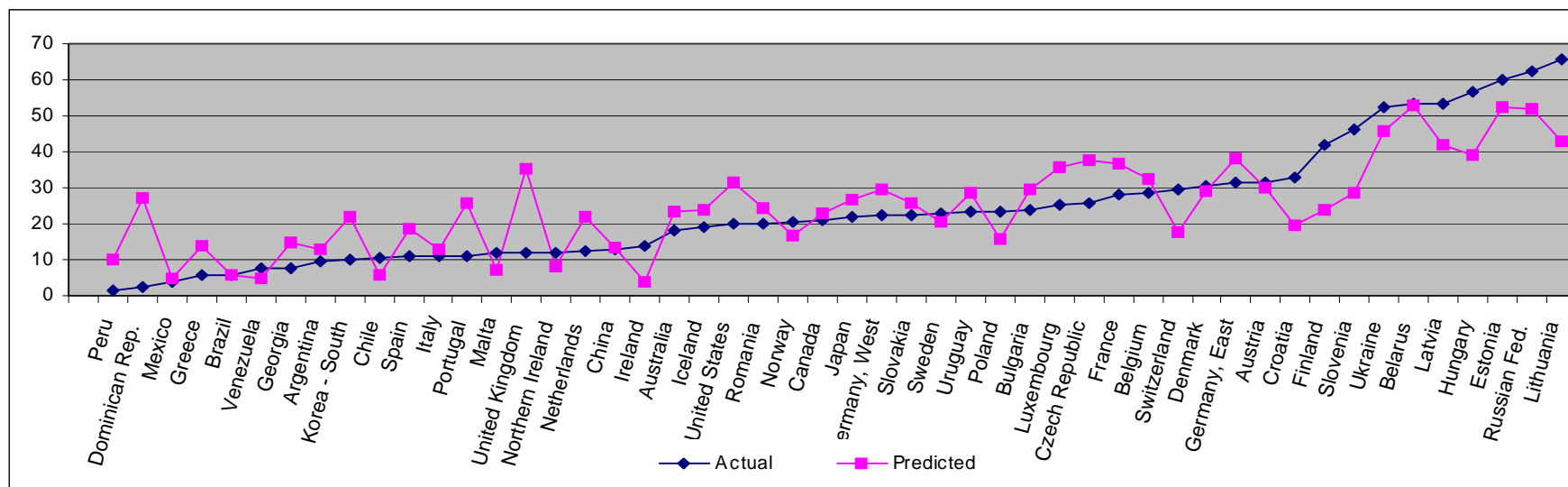

Source of data: Suicide, Durkheim, Free Press 1979, Page 50, 259
                & WHO Death by Causes Database

Figure 2: Regression Fits of the Basic Suicide Equations in Table 1. After Taking Average Across Waves For Compact Presentation With Nations Ranked By Actual Suicide Rate

A: Total Suicide Rate
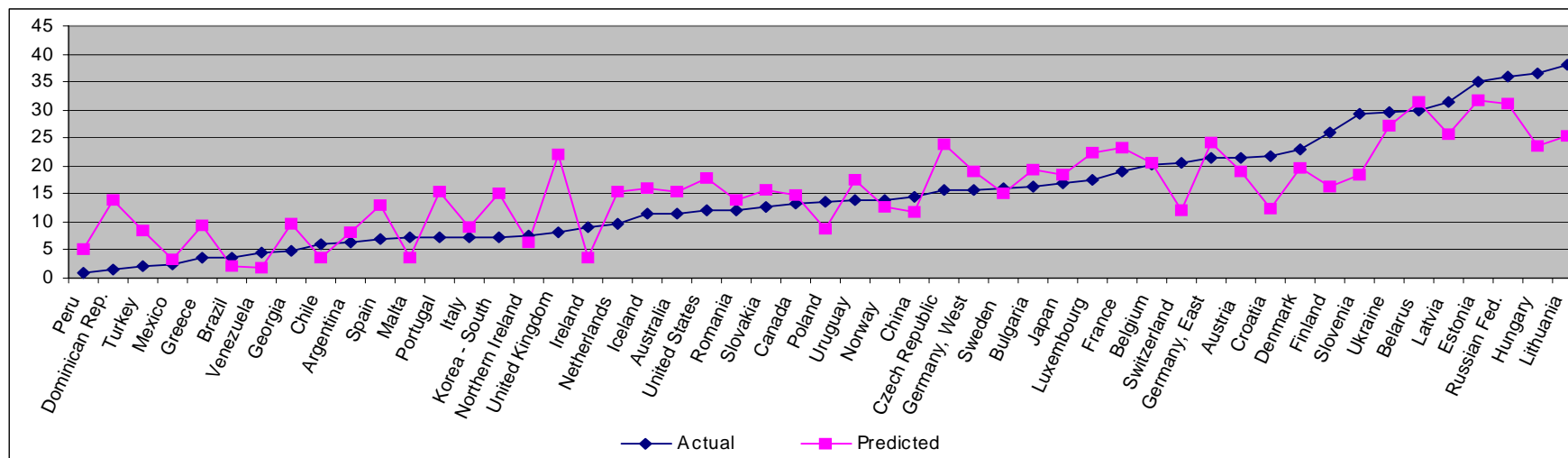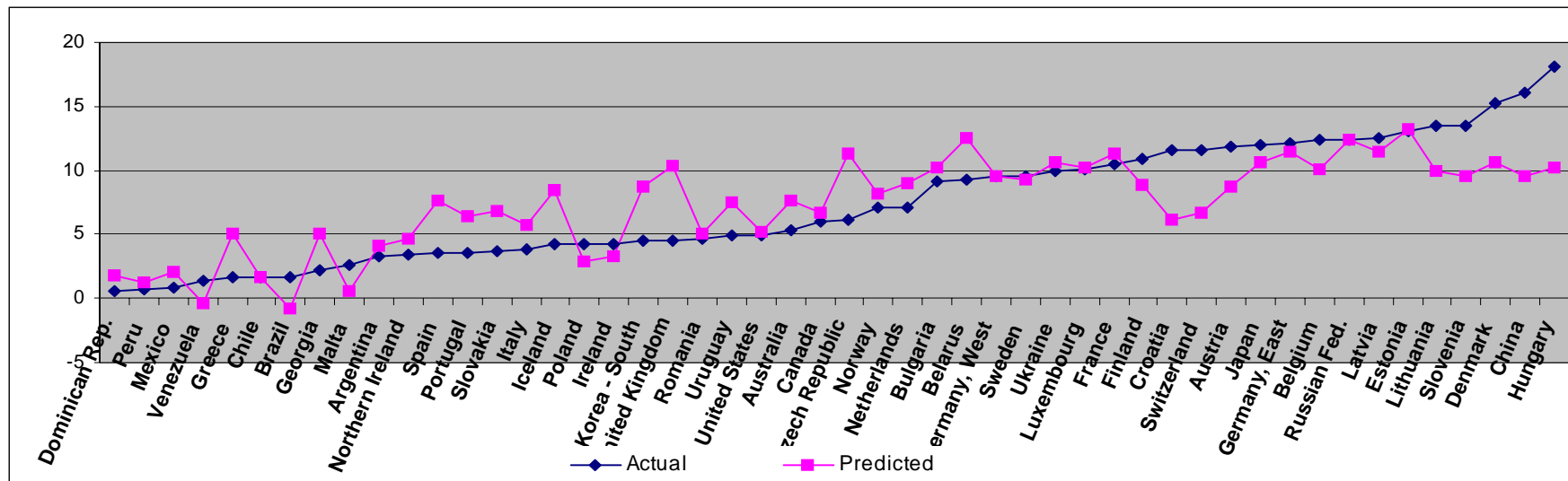

B: Male Suicide Rate

C: Female Suicide Rate

Figure 3: Regression Fits of the Basic Lsatis Equation in Table 1. After Taking Average Across Waves For Compact Presentation
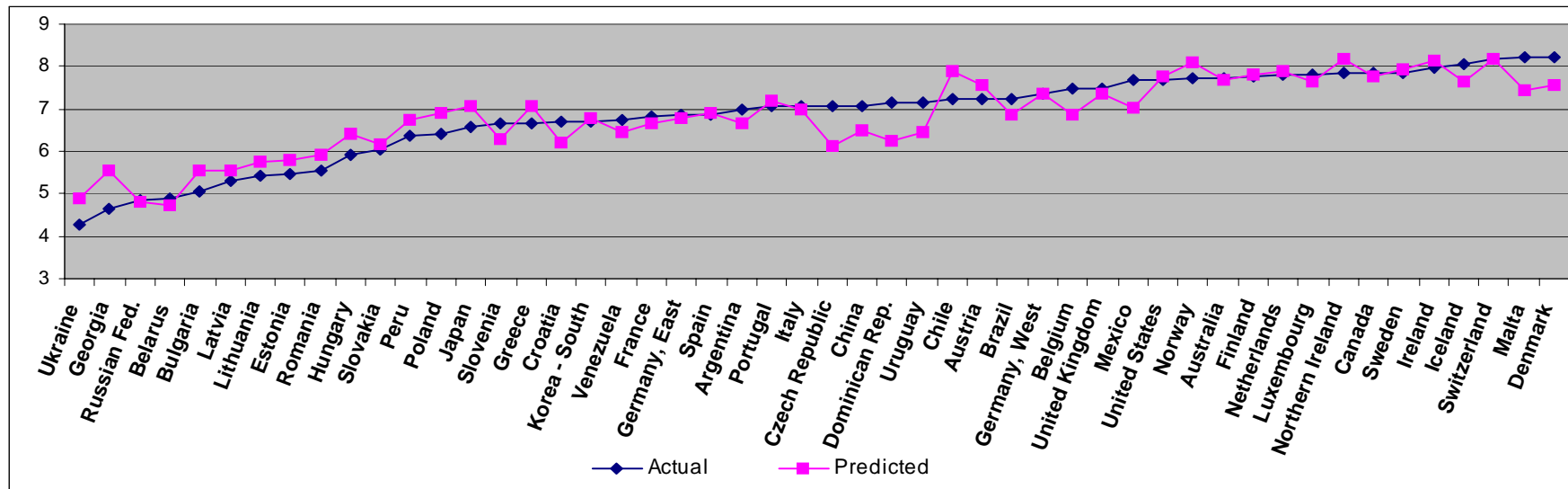
Figure 4: Suicide, Actual and Predicted by Nation-Waves, Ranked by Actual Suicide Rate
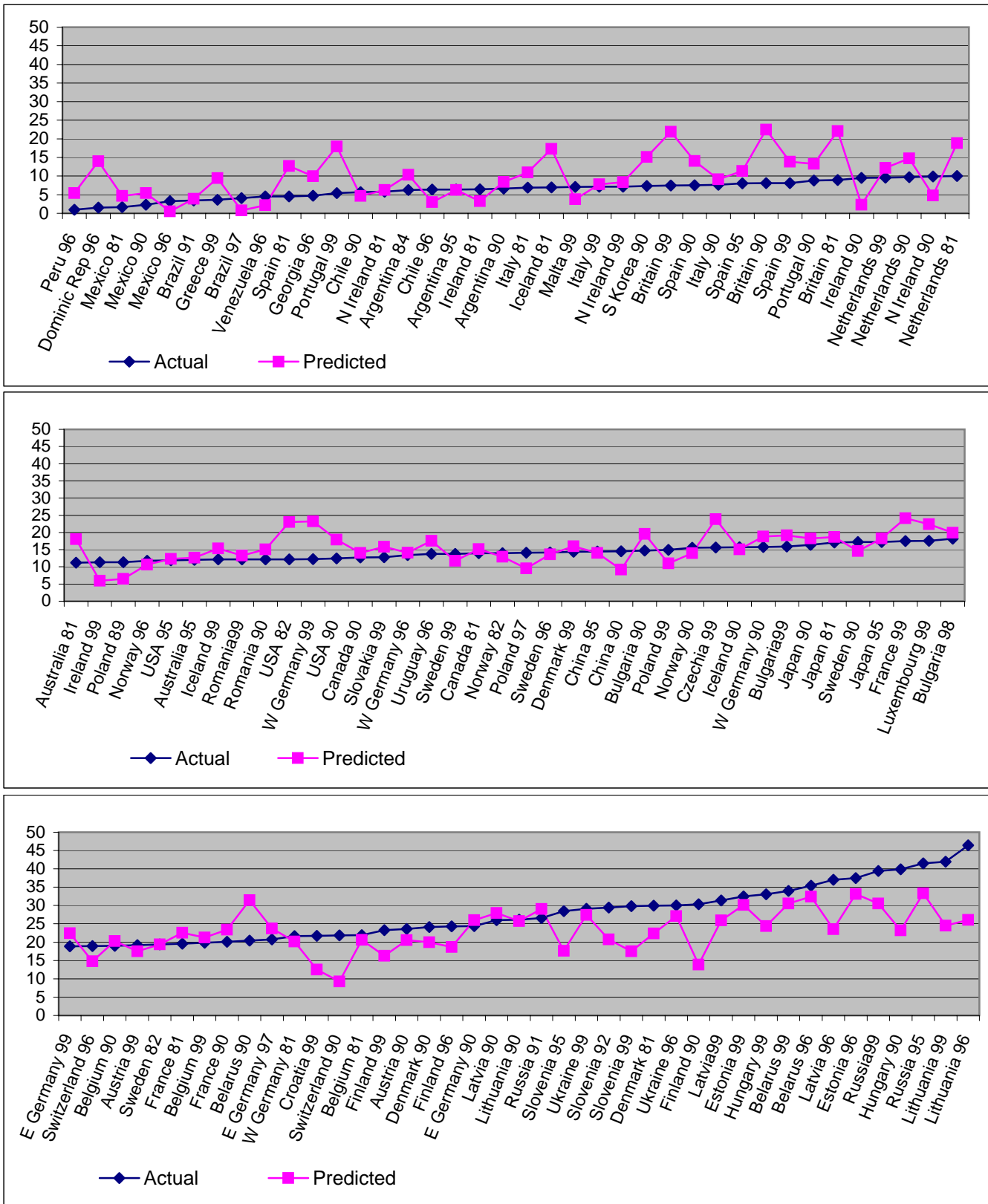
Figure-5: Standardized Coefficients From the Encompassing Model of Life Satisfaction and Suicide Rates