# Suicide, age, and wellbeing: an empirical investigation

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## ABSTRACT

Suicide rates, life evaluation, and measures of affect are all plausible measures of the mental health and wellbeing of populations. Yet in the settings we examine, correlations between suicide and measured wellbeing are at best inconsistent. Differences in suicides between men and women, between Hispanics, blacks, and whites, between age groups for men, between countries or US states, between calendar years, and between days of the week, do not match differences in life evaluation. By contrast, reports of physical pain are strongly predictive of suicide in many contexts. The prevalence of pain is increasing among middle-aged Americans, and is accompanied by a substantial increase in suicides and deaths from drug and alcohol poisoning. Our measure of pain is now highest in middle age—when life evaluation and positive affect are at a minimum. In the absence of the pain epidemic, suicide and life evaluation are likely unrelated, leaving unresolved whether either one is a useful overall measure of population wellbeing.

## 1. Introduction

This paper juxtaposes wellbeing measures and suicide rates. We use data from the United States and from other countries to examine patterns of suicide and wellbeing by age and across space.

Information on self-reported wellbeing (SWB) is now widely used in economics. SWB measures correlate with traditional real income measures in the expected way, but are also sensitive to a wide range of other welfare-related circumstances and outcomes, holding out the possibility that they may provide a broader window into human wellbeing than does real income. Yet, at least since Lionel Robbins (1932) argued that psychological measures were unnecessary for economic analysis, economists have been wary of measures that are not backed up by observable behavior, and have given greater weight to preference revealed through choice than to preferences that are self-reported. As noted by Daly, Wilson and Johnson (2013), suicide should reveal unhappiness, at least in its most extreme form. Suicides are rare, 12.6 per 100,000 in the United States today, and while it is possible for those contemplating suicide to be extremely unhappy when other people are not, it is also true that shifts of the whole distribution will show up in the tails, dramatically so for many distributions. In consequence, if suicide rates were positively correlated or uncorrelated with wellbeing measures, we would have something of a paradox, Helliwell (2007). Such a paradox, if real, would cast some doubt on the validity of self-reported wellbeing. Alternatively, if we maintain the validity of wellbeing measures, the paradox would cast doubt on the usefulness of suicide as an overall indicator of population mental health. Studying the patterns of suicide and wellbeing can thus potentially contribute to an understanding of both. Such is our aim here. Our purpose is *not* to ex-

plain suicide by happiness—indeed it seems likely that each is affected by other, more fundamental causes—but to look for the negative correlation that these theories predict.

Hamermesh and Soss (1974) propose an "economic theory of suicide" that links suicide to intertemporal utility as used in theories of intertemporal choice of consumption and labor supply. Hamermesh and Soss postulate that people will kill themselves when the utility of being dead is higher than the utility of staying alive, a theory whose implications have been explored by them, and extended and corrected by Cutler, Glaeser and Norberg (2001) and by Becker and Posner (2004). Goudie et al (2014) use the same theory to link life satisfaction and risk taking and Chen et al (2010) survey the field. Whether or not the utility of intertemporal choice in economics matches self-reported wellbeing, and if so how—for example whether SWB is the integral over life, or the forward looking integral, or instantaneous utility (felicity) for the period—remain open questions, but the links between suicide and SWB provide a fertile ground for testing the theory as well as for exploring the meaning of SWB itself.

There is a small previous literature that looks at SWB and suicide together. It includes the papers by Helliwell (2007), Daly and Wilson (2009), Daly, Wilson and Johnson (2013) as well as the book by Layard (2005, p.71), all of whom argue that the same factors that explain suicide also explain unhappiness or, more precisely, that the coefficients of the linear projections of suicide rates and SWB on selected covariates such as age, education, sex, race, time, and geography, have similar patterns in both sign and magnitude. We will follow this methodology; indeed there is little alternative in the absence of baseline wellbeing data in large follow-up studies.

A few studies have found marked differences between suicide and SWB patterns

in some contexts, including Daly, Oswald and Wu (2011) and Bray and Gunnell (2006) who examine suicide and life satisfaction over US states and European countries respectively. Daly et al find that suicide and life satisfaction are *positively* correlated across US states while Bray and Gunnell find a negative correlation across European countries that is entirely driven by the comparison of Eastern with Western European countries; exclusion of the East results in a perverse positive correlation. We shall return to these results below.

We are aware of only one prospective study that gathers life satisfaction at baseline and follows individuals over time; Koivumaa-Honkanen et al (2001) follow a sample of 29,173 Finnish adults from 1976 to 1995 and find that life-satisfaction was protective against suicide. However, their measure of life satisfaction—the sum of Likert scores on four items, interest in life, happiness, ease of living, and loneliness—is quite different from what is usually called life satisfaction. The Finnish measure, as noted by the authors, is conceptually and empirically close to a measure of clinical depression, a well-established risk factor for suicide. That depression predisposes to suicide is consistent with a protective role for SWB, but is essentially a different finding.

One contribution of this paper is to use Gallup data, from the Gallup Healthways Wellbeing Index (GHWBI) for the US, collected daily on a range of wellbeing measures—with nearly 2 million observations from 2008 through 2013—as well as The Gallup World Poll—which covers nearly all of the countries in Europe, the OECD, and Latin America for which suicide data can be obtained from the World Health Organization's mortality database, WHO (2014), in conjunction with UN population data, UN (2014). Because the Gallup data contain several wellbeing measures, including life eval-

uation, happiness, worry, stress, and anger, we can explore the possibility that suicide links differently to these different evaluative and hedonic measures.

The Gallup surveys also collect data on physical pain, in the same format as the hedonics, asking whether the respondent experienced physical pain during a lot of the day prior to the interview. We do not think of physical pain as a wellbeing measure, but pain is a risk factor for suicide, Goldsmith et al (2002), which makes it a useful variable in its own right. Pain is also associated with lower wellbeing, and so provides a potential link between suicide and SWB. Beyond that, obtaining the expected link between suicide and the pain measure from the Gallup data provides a baseline comparison for the hedonic measures. If pain as measured in the Gallup data is not correlated with suicide, it would not be surprising if the hedonics also are not; if pain is correlated with suicide, and the hedonics are not, we will have stronger case against the link between SWB and suicide. We therefore examine pain along with the hedonics in most of the calculations below.

We begin (Section 2) with summary data for the United States, tabulating suicide and SWB by age, sex, race, and education. Section 3 focuses on suicide and SWB over the days of the week; we argue that these patterns help discriminate between economic and other theories of suicide, rather in favor of the latter. Section 4 focuses on age, and examines whether the famous U-shape of life evaluation over life, with older Americans doing better than those in middle age, has any counterpart in the suicide data. Section 5 turns to spatial patterns, across the states of the US, as well as across countries of the OECD, Eastern Europe, and Latin America, with some attention to the age patterns within countries.

The suicide data come from the Compressed or Detailed Mortality Data from the

Centers for Disease Control, available through the CDC Wonder website. At the end of Section 2 we use the individual death records merged with population data from the American Community Survey (ACS), but we otherwise rely on tables generated by CDC Wonder. Suicides comprise deaths from intentional self-harm (ICD10 codes X60–84) as well as sequelae of intentional self-harm (ICD10 code Y87.0); we add the corresponding data from ICD9 in Section 4 below. Some suicides are certainly misclassified, particularly into the category of deaths from events of undetermined intent, but here we adopt the narrow definition. All data on SWB and pain come from the GHWBI poll, and in Section 5, from the Gallup World Poll.

**2. Suicide and wellbeing in the United States today**

Table 1 presents some of the basic facts on suicide and wellbeing by three broad age groups of adults aged 25 and older, by sex, and by education level. All data in the table are for 2013.

The relationship between suicide and wellbeing is like the curate's egg, good only in parts. Life evaluation (here the Cantril ladder, which ranges from 0 for the worst possible life to 10 for the best) is higher for women than for men—a standard finding in the literature—while women have more negative affect (especially stress and worry) than men and about the same amount of positive affect. Positive and negative affect measure short-run feelings ("Did you feel X during a lot of the day yesterday?" yes, or no) with positive affect defined as the average of happiness, smiling, enjoyment, and not sad, while negative affect is the average of worry, anger and stress. If (or when) suicide is an impulsive act, hedonic emotions are likely to be a better indicator than long-term life

evaluation. Men are almost four times more likely to kill themselves than are women. While this is consistent in direction with women's higher life evaluation, it is not consistent with the patterns of affect. Adding physical pain only deepens the puzzle; in the Gallup data on pain, as well as across a range of morbidities, Case and Paxson (2005), women fare less well than men in all age groups.

Turning to age, we have the well-known U-shaped pattern of life evaluation for both men and women; for both sexes, life evaluation is at its lowest in middle age. If suicide rates are to match this, they should peak in middle age. This is true for women, but not for men. The suicide rate for men in 2013 rises with age with no sign of a peak in middle age, at least across these coarse age categories. By contrast, women were more likely to commit suicide in middle age than in youth or in old age, matching the age-pattern in life evaluation. Durkheim (1897) argued that suicide should rise with age, as did Hamermesh and Soss (1974), though as noted by Cutler et al (2001), their prediction, though plausible, does not strictly follow from their analysis. That suicide should rise with age is especially likely in the presence of unanticipated negative health events that become harder to reverse with age, leading to the accumulation of irreversible conditions some of which involve great pain. If so, the puzzle is not with suicide, which rises with age at least for men, but with life evaluation, which fails to fall among the elderly. It is possible that suicide is an impulsive choice that depends, not on the sum of expected future utilities, but on instantaneous utility today. This works for women, but not for men. It is possible that suicide is a forward-looking rational choice for men, but an impulsive decision for women, but this is hardly a principled argument.

Negative affect is lower (i.e. better) in the oldest age group for both men and

women—Stone at al (2010) show that anger and stress decline steadily after young adulthood, and worry does so after middle age—yet neither men's nor women's suicide rates decline monotonically with age. We shall look at age patterns in more detail in Section 4.

Except among older women, a college degree or better is strongly protective against suicide. Durkheim (1897) argued that education would *increase* suicide rates, but the modern literature for the US is in accord with our findings; see e.g. Phillips et al (2010) who also cite other studies that reach the same conclusion. The protective effect of a college degree is larger for men than for women, and larger for young than for old; men aged 25–34 with a college degree are nearly three times less likely to kill themselves than are men of the same age with a high school diploma but without a BA. Yet the effect of education is not monotonic; for both men and women, and at all age groups, those without a high school degree are less likely to kill themselves than those with only a high school degree. Once again, this poses problems for the link between SWB and suicide; for the former, more education comes with higher life evaluation, more positive affect, less negative affect, and less physical pain, and this is true across all three education groups, unlike the suicide rate. Higher human capital raises earnings opportunities, so that more educated people have more opportunities for a better life, and more to lose by killing themselves. But only the first of these is consistently seen in the data. Note that while death certificates have information on education, they do not collect income, so with these data, it is not possible to examine whether education works through income, or directly, or both.

It is possible to tabulate these data in a many different ways, in particular to consider the relationship between suicide and SWB, not only by age, sex, and education, but

also by race, by Hispanic status, and by marital status. One economical way to show these patterns is to run descriptive regressions in which suicide rates and SWB are projected on these variables and on selected interactions, and then to examine the two sets of regression coefficients for similarities in sign patterns and in magnitude. We do this as follows. We start from the American Community Surveys (ACS) for 2009 through 2013. From these, we calculate the number of people in each of 2,520 cells defined by (5) years, (2) sexes, (4) marital status categories (never married, married, divorced, and widowed), (3) education levels (less than high school, high school diploma up to some college, four-year college degree or above), (3) race/ethnic categories (non-Hispanic whites, non-Hispanic blacks, and Hispanics), and (7) age groups (25–34, 35–44, 45–54, 55–64, 65–74, 75–84, 85 and over). The ACS gives the numbers of people at risk, and we gather the numbers of suicides in each cell from the micro data files on each death from the CDC. Dividing the suicides by the numbers at risk gives probabilities of death in each cell, and these probabilities are regressed (with the population in each cell as weights) on categorical dummies for each variable, as well as selected interaction terms. Including all interactions gives a fully saturated model that is equivalent to a six-dimensional cross tabulation, which would have obvious difficulties of both overfitting and presentation. Our regressions should be identical to running linear probability models on the ACS data with the mortality data merged in; of course, we can only use as explanatory variables the information that appears on the death certificates as well as in the ACS. (We here use the publicly available micro data, which does not contain any geographical identifiers.)

We process the GHWBI data to match the same categories so that we can run SWB regressions that have exactly the same explanatory variables as the suicide regres-

sions and that can be examined for matching patterns.

Figure 1 shows one (out of many) possible regressions. It excludes interactions other than running different regressions for men and women; beyond that, it is hard to find a succinct way of presenting the results. The top panel of the figure is for men, the bottom panel is for women, and the categories are arrayed horizontally. In each case, there is an omitted category (2009, whites, less than high school, never married, ages 25–34) and the red bars show the coefficients in the suicide regressions. The blue bars show the coefficients in the regression for the ladder, though we have changed the signs, so that the two sets of bars should go in the same direction if wellbeing and suicide match. We have also multiplied the ladder coefficients by ten, so as to put everything on (roughly) the same scale; this factor is the same for men as for women. If suicide and life evaluation match, the blue and red bars should be in the same ratio over all categories.

Note first that the blue bars are much larger relative to the red bars in the bottom panel for women than is the case in the top panel for men. The suicide scales (on the *y*-axis) are different for men and for women, given the much higher suicide rates among men. But, as we have already seen, the differences in the ladder by sex are small, and this carries over to the patterns in the coefficients of the various categories. For example, the blue (ladder) bar for women aged 85 and above is larger for women than for men, but checking the scales shows that the magnitudes are similar, about 8 suicides per thousand, once we examine the scales. This tells us that, even when we allow for all of these categories simultaneously, we cannot match the gender patterns of suicides to the gender patterns in the ladder, because the gender differences in the ladder, overall, and for each category, even when they are in the right direction, are much too small to match the huge

differences in suicides, overall, and for each category.

Perhaps there is some fundamental evolved difference between men and women in their propensity to kill themselves, a difference that is not reflected in their life evaluations or hedonic wellbeing. Indeed and with the possible exception of China, women kill themselves less often than men, although women evaluate their lives more highly in only about two-thirds of countries. If so, we should look at each sex separately, looking only horizontally along the upper and lower panels of Figure 1, without trying to match the top and bottom panels. Starting from the left, the time effects are in the wrong direction for both sexes. Suicides are increasing from 2009 to 2013, for both men and women—even controlling for the other variables—but the ladder is higher after 2009—which might be in part attributed to context effects in the poll in 2009, Deaton (2012)—and is increasing from 2010 to 2013 for both sexes—which cannot be so explained. Blacks and Hispanics are much less likely to kill themselves than whites, and while both groups have higher ladder scores than whites—this result depends on conditioning by education, and is not true in the raw data—the sizes of the differences are too modest to match the differences in suicide rates, as was the case for the comparison between men and women. Of course, we could rescale the ladder coefficients to better match these differences, but that would make the match even worse for the other categories.

The sign patterns are close to being correct for the education and marital status categories; both education and marriage come with higher life evaluation and lower suicide rates. (There are small sign violations for women with high school degrees and for widowers.) But for women, the effects of education on suicide are modest compared with the very large effects of education on life evaluation or, put differently, while the effects

of education on the ladder are similar for men and women, it is only among men that education, particularly a college degree, has a substantial effect on suicide. Marriage is consistently protective against suicide, though remarkably, widowhood, while bad for men, is protective for women. Again, the relative magnitudes do not match, with the effects on suicide much more marked than the effects on the ladder. As was the case for race and ethnicity, scaling up the ladder coefficients would exacerbate the differences over years and age groups.

The age-group patterns in Figure 1 mostly echo the results in Table 1, albeit with finer groups. For women, the U-shape in the ladder (here shown as an inverted U because of the sign change) matches the pattern of suicides with age while, for men over the age of 65, the patterns do not match, with life evaluation continuing to improve as suicide rates rise. As we shall argue in the next section, it is possible that the dip in life evaluation in middle age is relatively recent, and that it is indeed linked to the rise in suicide in middle age, with both driven by increasing physical and mental distress in middle age.

We do not show more interactions here, but we note that the estimated age profiles differ markedly by race. In particular, for black non-Hispanic men and women, suicide rates fall with age, showing no signs of the peak in middle-age suicide that we see in white men and white women. The ladder for blacks also has no dip in middle age, but *falls* steadily with age so that, once again, there is no match with the suicide rates.

Our results are much less favorable to the match between wellbeing and suicide than those of Helliwell (2007) and Daly and Wilson (2009). We suspect that these differences are more a matter of interpretation than of reality. Those earlier results also have a substantial number of mismatches, and our tests here, by checking magnitude as well as

direction, are more severe.

### 3. Circaseptan rhythms

Suicides are not equally spread over the days of the week. As most people might guess, and is confirmed in the literature, e.g. McMahon (1983), Maldonado and Kraus (1991), Monday is the peak day for suicides. Figure 2 shows averages over the years 2008 through 2013. Suicides fall steadily throughout the week from the Monday high to a low on Saturday, where there are about 950 fewer male suicides and about 200 fewer female suicides each year than on Mondays. From a baseline of around 4,000 (1,000) male (female) suicides each day, these effects are large. Sundays are marginally worse than Saturdays, but the biggest upward jump is between Sunday and Monday. As always, there are fewer female than male suicides, but the weekly patterns are the same; Mondays are bad for both men and women. We do not show similar graphs by age because the circaseptan shape is the always the same as in Figure 2 for ten year age groups, 25–34, 35–44, etc., up to 85 and above. It is worth noting that the pattern holds true even for the highest age groups, so that Mondays are bad even for those who are retired and do not have to go to work.

Deaton (2012, Figure 1) shows the corresponding patterns for self-reported well-being and we have checked that these hold over the longer and later 2008 to 2013 period. We do not show these graphs because they are easily summarized. Life evaluation is the same on every day, while affect is better on weekends than in the week, more smiling, enjoyment, happiness, and less sadness, worry, stress, anger and physical pain. Using the same data, Stone, Schneider, and Harter (2012) show that these patterns hold for all age

groups, with minor differences in the shapes across age groups. They also find a very small negative effect of Mondays on positive affect, and a larger but still small positive (negative) effect of Fridays on positive (negative) affect, but these differences between weekdays are small relative to the difference between all weekdays and all weekend days.

The fact that life evaluation is the same for all days of the week is exactly what we would expect of any measure that assesses life as a whole; indeed, its lack of circaseptan rhythm is almost a test of its validity. The same is largely true of lifetime utility in intertemporal choice models, or in the Hamermesh and Soss economic theory of suicide. Note however that if today's overall lifetime utility is the (discounted) sum of expected future utilities in each day of the rest of life, and if those future utilities are lower on weekdays, there will be a small (depending on the number of days of life remaining) drop on Mondays as the weekend moves from the future into the past, and an increase over the rest of the week as the weekdays move into the past, but the effect must be small except for those very near the end of life. Beyond that, if life evaluation refers to just the utility of each day, there are no circaseptan effects for expected future utility to work on. These arguments work against the claim that suicides are entirely driven by fluctuations in lifetime utility or life evaluation. That suicides have a large impulsive component appears to have a better chance of matching these data.

Even so, the circaseptan pattern of affect does not easily match the suicide patterns in Figure 2. If we are trying to match affect with suicides day by day, negative affect is only slightly higher on Mondays than on other weekdays, and positive affect is only very slightly lower. And although hedonics are somewhat better on Fridays than on Mondays through Thursdays, there is no steady pattern of improvement over the week to

match the steady decline in suicides through the week from the Monday peak.

A possible account can be constructed following Becker and Posner (2004) who postulate that the utility that matters for suicide depends on instantaneous utility relative to the person's past level. Happiness is high at weekends, so the suicide peak on Mondays comes, not just because of the lower happiness on Mondays, but also because of the fall in happiness from Sunday to Monday. Come Tuesday, instantaneous happiness is the same as on Monday, but Sunday now has less weight, and so there is an improvement in suicide-decision utility on Tuesday relative to Monday. If suicide is to go on declining through the week, Sunday's experience must only gradually fade into the background, and if we are to explain why there are more suicides on Sundays than Saturday, we will have to allow some anticipation of Monday on Sunday.

Table 2 presents regressions of deaths by suicide against positive affect, negative affect and the ladder, including both today's and yesterday's value; the data come from 2008 through 2013, though of course we only have seven observations. This procedure can be thought of as two-sample instrumental variable estimation, with day of the week as the instrument for the hedonics and life evaluation. In spite of the small number of observations, the results are remarkably strong and remarkably consistent. The ladder has no apparent effect on suicides, but both positive affect and negative affect do, with all signs in the expected direction, and all attracting very large *t*–values. The coefficient on yesterday's affect is between half and two-thirds of today's affect, consistent with the supposition that suicide decision utility depends on what happens today relative to what happened yesterday, though yesterday's affect gets less weight. When tomorrow's affect is added to these regressions, it never attracts a significant coefficient. Regressions on

today's affect only (excluding yesterday's affect) are significant, but the *t*–values are typically one-fifth of the size of those in the table. We have also run parallel regressions for the components of positive affect (smiling, enjoyment, happiness, and not being sad) and of negative affect (worry, anger, and stress.) All of these show the same patterns of today and (oppositely signed) yesterday, and all have large *t*–values.

The effect sizes in these regressions are substantial. Positive affect has a mean of 0.85 (0.84) for men (women) with a standard deviation over the seven days of 0.016 for both. From the definition of positive affect, this means that 85 percent of men report that, on the previous day, they experienced a lot of happiness, enjoyment, smiling, and not a lot of sadness. A one-percentage point decrease in positive affect is associated with an additional 224 (45) male (female) suicides, which is muted by a reduction of 128 (24) the next day. For men, the biggest effect is for pain, where a one percentage point increase (mean is 22 percent) comes with 282 additional suicides, followed by 227 fewer suicides on the next day. For pain, unlike positive or negative affect (or their components), it is essentially the *change* from the previous day that matters; the coefficients are almost equal and opposite.

Perhaps the most important result of this section is the fact that life evaluation is the same throughout the week while suicide rates are not. This casts doubt on (at least the completeness of) the economic theory of suicide and also questions the earlier-cited accounts that argue that happiness, invariably measured as life satisfaction, is determined by the same underlying variable as is suicide. If so, there is some unknown determinant that smooths out life evaluation while not smoothing suicide. In contrast to the lack of a link with life evaluation, and in accord with the idea that many suicides are impulsive, we

find that positive and negative affects, either singly, or in combinations, are strongly related to the circaseptan pattern of suicides, but only when we recognize that it is not only today's affect that matters, but also the change since yesterday. For pain, which has the strongest effect of all, it is the increase since yesterday that drives suicides.

**4. Changing age patterns**

Figure 3, for men, and Figure 4, for women, show suicide rates by age for selected single years between 1979 and 2013. As we have seen, women are much less likely to kill themselves than are men, but the age patterns are also quite different, and perhaps most remarkably, those patterns have seen large changes over the last 40 years, especially for women.

Durkheim's view that suicide rates increase with age is borne out—at least in part, and at least for men—by Figure 3. The suicide rate rises rapidly from 10-14 year-olds to 20-24 year-olds, and then is stable until the 60s, rising rapidly thereafter. Such a pattern is clearly consistent with the influence of accumulating disability on the probability of suicide. Suicide rates among elderly men rose steadily from 1979 through to the mid-1990s but fell thereafter, first among those aged 65–74, then among those aged 75–84, and finally among those aged 85 and over, whose suicide rate falls only after 1995. These are possible cohort effects associated with men (but not women) born between 1910 and 1920 who were particularly prone to suicide in old age. Among younger men, suicide rates fell with age until the mid-40s, but only from 1979 to 2000. Since then there is a clear increase in middle age, an increase whose size continues to climb.

Patterns of suicides among women are markedly different. In 1979 and the early 1980s, women were more likely to kill themselves in middle age, with the rate peaking in the early 40s. This pattern slowly changed as the peak shrank, so that by the early 1990s, suicide rates for women were close to constant after age 40. In recent years, the middle age peak has reappeared, and by 2013, is almost as high as it was in 1979. These changes are driven by changes in suicide rates in middle age. Suicide rates among elderly women were approximately constant from 1979 to the mid-1990s and, as has been the case for men, have been declining ever since.

The Gallup Healthways Wellbeing Index data started only in 2008, and are therefore not useful for matching to these patterns. As a substitute, the General Social Survey, which has a much coarser wellbeing question, is available from the early 1970s, though not for every year. The GSS question asks "Taken all together, how would you say things are these days—would you say that you are very happy, pretty happy, or not too happy?" We have coded this as 3, 2, and 1, and interpret this as a life satisfaction question, as does the literature; although the word "happy" appears in the question (in contrast to the Gallup ladder), it is offset by the "Taken all together," though it is certainly possible that answers to the question are influenced by the hedonic state of the respondent at the time of interview.

The GSS sample is small, between 1,400 and 2,000 per year, so we have pooled years centered around the years used in Figures 3 and 4—the precise years are marked on the panels in Figure 5—and we have split those data by sex and by the same age groups as the suicide data. Some of these cells have few observations; for those aged 15–19, and for those aged 85 and above, there are cells with around

50 observations. The minimum is for men aged 85 and above in the first group of years, which has 33 observations (there are 74 women). For the other age, sex, and year groups, all cells have more than 200 observations, except for men aged 75–84, and women aged 75–84 in the first year group, where there are still more than 100 observations.

Figure 5 shows, as expected, that the estimates of life-satisfaction are noisy. Given that we do not believe that life evaluation is very different for men and women, or has a different shape over life, putting them on the same graph gives an idea of the margins of error of the estimates. It also allows us to see some fairly clear patterns. Most surprisingly, the U-shape over the life cycle is only apparent in the last two panels—between 2004 and 2014—but not at all before that. Between 1977 and 1988, the GSS measure of life satisfaction rises with age, with a dip among the oldest men and women, something that might be expected given failing health. Subsequently, there are some signs of a middle age dip in wellbeing, and of falling wellbeing after age 75, but recall the small sample sizes for these groups, especially men. These graphs raise the intriguing possibility that the U-shape in life satisfaction is a relatively recent phenomenon in the US: it is certainly not universal in all countries and so cannot be a fixed biological trait; see Steptoe, Deaton, and Stone (2015).

As was the case in Section 2, it takes a great deal of imagination to match the wellbeing patterns to the suicide patterns. Most immediately, there is no clear difference in age profiles of life satisfaction for men and women, in spite of their markedly different life-cycle profiles of suicide. In recent years, the increasing dip in wellbeing for women in middle age matches the increasing rates of suicide in middle

age, but this does not work so clearly for men. Indeed, in the early period we have men's wellbeing and men's suicide rising in parallel through much of the life cycle, except for those aged 85 and over. Once again, these life satisfactions measures do not line up in any obvious way with the suicide data.

For the years since 2008, we can use the Gallup Healthways Wellbeing Index data to compare the age profiles of SWB with the suicide numbers. The ladder has the U-shape for both men and women, and so cannot be matched with both sets of suicide rates. Much more telling are the Gallup data on pain and on positive affect. For pain, we would expect a steady increase with age, but in fact, there is a peak between ages 50 and 60 when 28 percent of the population report that they experienced a lot of pain yesterday, compared with 15 percent of those in their 20s, and 23 percent among those in their 70s and 80s; there is indeed some increase between 70s and 80s, as we might have expected. Figure 6 shows also that, for men, the middle-age peak increased from 2008 to 2013; the corresponding graphs for women in the bottom panel have similar shapes, but the increase in the middle-age peak is only apparent in 2013. Figure 6 shows graphs for positive affect that look like the mirror image of the graphs for pain, attaining their lowest values in middle age.

We do not fully understand these data, nor their relationship with suicide. Other national data in the US show an epidemic of increasing morbidity and mortality in middle age, at the same time as similar indicators for the elderly are improving. Given this, we suspect that the peak in pain in middle age is both real and recent; indeed, the same factors are possibly implicated in the dips in life evaluation and in positive affect in middle age. If so, the U-shape is not a constant of biology, but is at

least in part a response to recent events among middle aged Americans. The link with suicide is clearly clouded, if only because of the different patterns for men and women. Note again, however, that Figure 3 shows increasing suicides among middle-aged men in recent years, with a magnitude that is actually two to three times larger than the (apparently much more dramatic) increase among middle-aged women; for men, the peak is less obvious, because there are so many more suicides to start with so that the increase does not change the shape of the whole curve.

We currently have no firm explanation for the changing patterns in Figures 3 and 4. We suspect that increasing suicides among both middle-aged men and women in the US is tied to the recent middle-age epidemic of sickness (mental and physical distress) and death (not only suicides, but accidental poisonings from alcohol, and from prescription and illegal drugs—particularly opioids—as well as a large category of deaths by poisonings where intent is unclear). Whether rising pain is the cause of prescription drug use and misuse, or their consequence, or both, is not presently clear. In any case, our best guess is that the patterns of positive affect and of pain in Figure 6 are real and, when other patterns are allowed for, match the suicide data.

Unless the epidemic is reversed, recent declines in morbidity among the elderly will not persist when the current cohort of middle-aged Americans move into old age.

**5. Geographies of suicide**

Figure 7 shows the state-by-state scatterplot of mean age-adjusted suicide rate

against the mean value of the ladder from the GHWBI data. In both cases means are calculated over the years 2008 to 2013. We take men and women together and, in order to avoid possible spurious effects from spatial variations in race and ethnicity, we use data only on non-Hispanic whites, both from the CDC suicide data and from the GHWBI.

The graph itself is somewhat more interesting than the correlation. Note in particular the very large variation in suicide rates even over areas as large as states. The lowest suicide rates are in New Jersey and Massachusetts (9.3 per 100,000), and the highest are in the "suicide belt" of (from low to high) Idaho, Colorado, Utah, Arizona, Montana, Wyoming, New Mexico, and Nevada, all of which have suicide rates of more than 20 per 100,000, with Nevada at 26.2. (Alaska at 19.5 is immediately before Idaho.) Several of the states in the suicide belt are among the top states in life evaluation. In this figure, Hawaii is an outlier in terms of high life evaluation; Hawaiians generally report high life evaluation, but less than half of Hawaii's population is non-Hispanic white, and this minority has substantially higher life evaluation than the majority.

The correlation in Figure 7 is 0.16, weak but positive, and is similar to that reported by Daly, Oswald and Wu (2011), who interpret it as a "dark contrast" in which relative effects are so strong that high general wellbeing drives the less fortunate to suicide. Inspired by this, we have redrawn Figure 7 using the fractions of people whose ladder scores are zero or one (out of ten), less than or equal to two, and less than or equal to three; the correlations of these measures with suicides rates are essentially zero. Once again, we find no obvious univariate relationship be-

tween life evaluation and suicide. The correlations between suicide and positive affect and negative affect are also small and perverse. However, and as we shall see repeatedly, there is a much stronger relationship between self-reported physical pain and suicide, where the correlation is 0.39 over the 50 states.

We have also looked at the relationship between suicide and wellbeing at the county level, which gives us many more data points as well as a wider range of variation. Because suicide is rare, and because many counties have small populations, we need a run of years to get reasonable precision (or indeed any CDC estimates for smaller counties), and the GHWBI data start only in 2008. Previous literature and state-level data suggest that geographical suicides are persistent over time—for example, the suicide belt has been that way for many years—so we have used average county level age-adjusted mortality rates for non-Hispanic whites for the whole period of ICD10, 1999–2013, and compared it with the GHWBI data from 2008 to 2013. This is not ideal, but will still turn out to be informative, if only because it gives us the ability to look at the correlations between suicide and SWB while controlling for other factors.

We start with the 2,259 counties for which we have age-adjusted suicide rates from the CDC as well as SWB data from the GHWBI. There is an extraordinary range of suicide rates across counties, from 38.2 in Sierra County, NM, and 37 in Nye County, NV to 5.3 in Holmes County, OH, and 5.4 in Rockland County, NY. Fourteen of the twenty counties with the lowest rates are in New York or New Jersey. If we confine ourselves to the 2,102 counties with at least 100 observations in the GHWBI, the correlation between suicide and the ladder is now negative, –0.12, and between

suicide and positive (negative) affect are negative (positive), –0.18 (0.11). The strong positive correlation with physical pain is 0.34, similar to that across the states.

Table 3 presents regression results of suicide rates on the SWB measures, physical pain, and a range of other variables suggested in the literature. An immediate question with these regressions is whether the cutoff of 100 for observations in GHWBI is sufficient, so we present regressions with cutoffs of 250, 500, and 1,000. Because the county sample sizes in the GHWBI are almost perfectly correlated with county population sizes, higher cutoffs, while reducing measurement error in the estimated means, also drop smaller-population counties from the analysis. As a result, there is no reason to suppose that, even in the absence of measurement error, the parameters being estimated will be the same. The effects of the cutoff can be illustrated by looking at New Jersey and Montana. With the cutoff of 100 in the first column, 22 Montana counties and 21 New Jersey counties are included; by the time we reach the cutoff of 1,000 in the last column, there are only 3 Montana counties left, but 17 in New Jersey. Even so, the qualitative pattern of results does not change greatly across the table.

All of the regressions include controls for the nine census divisions, with New England as the omitted category. Suicides become more prevalent as we move South and West, with the Mountain dummy picking up much of the suicide belt; there are around 9 more suicides per 100,000 in the Mountain division than in New England. With these geographical controls, the ladder has the expected protective effect, but negative affect (anger, stress, and worry) is also, and presumably perversely, protec-

tive. Positive affect is not significant, and physical pain, as always, is a strong risk factor. The effect of pain is large; an increase of one standard deviation, 5.9 percentage points (the median is 26 percent), is associated with 0.57 additional suicides per 100,000. As was the case with the age profiles, physical pain appears to be an important correlate of suicide.

Income and income inequality are both estimated to be significantly protective against suicide; we do not show it, but conditional on the log of income, the number of years of education has no effect. We have already noted the protective effect of education in Section 2, but there we could not control for income, which may be the mechanism through which education operates. Either way, suicide—like many other causes of death—is less common among those with the higher socioeconomic status that comes with income or education. It is often claimed that local income inequality is itself a cause of mortality, but the results here show the opposite effect for suicide; previous literature has been inconsistent, see Smith and Kawachi (2014).

Religious denominations are often thought to be protective, and all are here estimated to be so; there is no sign here of the often argued greater propensity of Protestants over Catholics to kill themselves, see Durkheim (1897) and Becker and Woessmann (2015). Belonging to the "other Christian" group, here mostly evangelicals, is always protective, but becomes more so on the right of the table among the larger counties. All religious denominations do better than those in the omitted category, which comprises non-Christians/non-Jews (Jews are included as one of the religious groups) and those who espouse no religion at all. We note the possibility

of ecological fallacy; if religion protects individuals, we would expect it to show up in the county aggregates, but the reverse is not true.

We have also added variables constructed from the Behavioral Risk Factor Surveillance Survey which collected data in 2001, 2003, and 2004 on gun ownership as well as information on whether an individual is at risk for alcohol abuse; guns are the primary means of committing suicide for men, and alcohol is an important risk factor. The BRFSS is large enough to calculate averages of these measures at the county level, though only for 1,237 counties, which are further reduced by the selection criteria in Table 3. The fraction owning a gun is not significant conditional on the census division dummies, even though there is substantial county level variation in gun ownership within divisions. The alcohol abuse variable is, however, highly significant with a coefficient of 19.2 when added to the final regression in the table. The mean of the alcohol abuse variable is 0.05, and ranges from 0 to 0.16.

Our purpose here is not to claim new findings on the spatial correlates of suicide in the US; for a comprehensive recent analysis see Phillips (2010). What is new here is the inclusion of the SWB measures; evaluative wellbeing is modestly protective against suicide, but so is negative affect. The effects of physical pain are what might be expected; the importance of pain and of alcohol in the county cross-section matches their link to changes in suicides over time, particularly among middle-aged Americans.

We conclude with a brief examination of international patterns in suicide, using data from the World Health Organization's mortality database. Figure 8 shows the scatter plot of suicide rates against mean ladder scores from the Gallup

World Poll using data from 2006 to 2010 for both. While there are a few other countries with data, the suicide information does not extend much beyond Europe and Latin America, both of which are included in the figure. The blue points are for the rich European and OECD countries, the green points are for Latin America, and the red points are for Russia and the former satellites of the former Soviet Union. Note that the US is not at all exceptional, and is in the middle of the cluster of points on the right. But there are several countries, including France, Belgium, Finland, and Austria, where suicide rates are much higher, though none are as high as the highest of the eastern European countries, with Belarus, Russia, and Kazakhstan leading the group with rates more than twice as high as in the US.

Bray and Gunnell (2006) earlier found *positive* relationships between life satisfaction (from the European Values Survey in 1999/2000) and suicide rates for western European countries, as well as for eastern European countries, when each group is examined separately, but a *negative* relationship when the two groups are pooled. The eastern European countries have low life evaluations, and high suicide rates. These results are replicated for the Gallup data in Figure 8. The addition of the Latin American countries groups them firmly with the western European pattern; they have somewhat lower ladder scores and somewhat lower suicide rates. Our other wellbeing measures are also related to suicide rates in less than obvious ways. Pain is positively correlated with suicide within the three regions, but not across them. Positive affect is negatively correlated with suicide rates both within and across regions, while negative affect, as was the case in the American counties, is *negatively* correlated with suicides.

Durkheim believed that suicide increased with age, as was true in his data. In 31 of these 52 countries, the suicide rate of those aged 60 and above is greater than the suicide rate of those aged 25–59. For men, the suicides rates for the older group are larger in 41 countries; for women in 31. As shown in Steptoe et al (2015), the U-shape in life evaluation, while evident in the English-speaking rich countries, is not apparent in the rest of Europe nor in Latin America. It is thus reasonable to ask whether international patterns in life evaluation match age patterns in suicide rates. Figure 9 plots the ratio of suicides rates of those 60 and above to those 25–59 against the ratios of the mean ladders for the two age groups. This analysis is unaffected by rescaling of ladder by countries, and is thus robust to cross-country (or cross-region) differences in reporting styles, or at least those that can be represented by rescaling. And indeed, here there is a strong negative link between suicide and life evaluation; in countries where the old are more likely to kill themselves, the old are more likely to have lower life evaluations.

## 6. Discussion and conclusions

This paper compares suicide rates with self-reported measures of wellbeing in the hope that each set of measures might provide insights about the other. We follow Bray and Gunnell (2006) in investigating the possibility that suicide and life satisfaction, or measures of hedonic affect, are markers of population mental health. We do this in a range of contexts, over geographies, over time, over life cycles, and over the days of the week, hunting for insights and tests of theory. We also look at pain, to

test whether "yesterday" questions work, because pain is a risk factor for suicide, and because pain has strong effects on SWB, thus providing a link.

There is an economic theory of suicide, rooted in intertemporal choice theory, which says that people kill themselves when the utility of being dead exceeds the utility of continuing to live defined as some forward looking integral. It predicts that higher utility people are less likely to kill themselves, because they have more to lose, and thus suggests that people are more likely to kill themselves as they age. An alternative to the economic theory is that suicide is often an impulsive choice, depending on feelings now, without much thought for the future. One hardly has to subscribe to economists' notions of rationality to agree that for those with accumulating burden of disease, including worsening pain, suicide can be a rational decision, and indeed the right to medical assistance in committing suicide under such circumstances is legally recognized in a number of countries.

Our findings suggest that, with some exceptions, suicide has little to do with life satisfaction. Correlations between suicide and measured wellbeing are either absent or inconsistent. Differences in suicides between men and women, between Hispanics, blacks, and whites, between age groups of men or of African Americans, between countries or US states, between calendar years, and between days of the week, do not match differences in life evaluation. Suicide rates in the US have risen in recent years, though there is no evidence of decreases in SWB. Marriage and education do indeed bring more life satisfaction and less suicide, though the relative sizes of the effects do not match the effects on SWB, even for men and women separately. For example, when we control for age, sex, and race, being married comes with higher

life evaluation and lower suicide. For men, and as we should expect, those who are divorced have lower wellbeing and higher suicide rates, but the magnitude of the effect on suicide is much larger relative to the effect on life evaluation than is the case for marriage. When we look at widowers, there is more suicide, comparable to the suicide associated with divorce, yet widowed men actually show slightly *higher* life evaluation.

Women's suicide rates peak in middle age, men's in old age; yet both men and women show a U-shape in life evaluation. Suicide rates among non-Hispanic blacks fall with age alongside *declines* in life evaluation.

Sixteen percent of suicides happen on Mondays and only thirteen percent happen on Saturdays. Yet life evaluation is the same on all days of the week. Monday suicides can be matched to positive affect, or to pain, if "suicide decision utility" depends on both today's feelings and the change since yesterday. Given that positive affect is not consistently connected to suicide in other contexts, and that pain is, it is possible that the higher pain on Mondays affects both positive affect and suicide, but not overall life satisfaction. These results are also hard to reconcile with an economic theory of suicide that emphasizes the benefits of future (dis)utility versus the (dis)utility of dying unless, for some unknown reason, death itself is less unpleasant on Mondays.

Age patterns of suicide are different for men and for women, and have changed differentially over time. The most important facts about suicide over the last decade is that for white non-Hispanics, both men and women, (a) suicide is rising overall, which is driven by (b) increasing suicide rates in middle age, offset by (c) falling sui-

cide rates among the elderly. The suicide epidemic in middle age is the tip of an iceberg of mortality and morbidity, especially pain, among middle-aged Americans. In the Gallup data, "pain yesterday" is now higher in middle age than in old age. We do not know what is driving this epidemic, but it is showing up in at least some of the SWB indicators, including low positive affect in middle age, and perhaps even as some of the dip in middle age life evaluation, the presence of which we find little evidence of prior to the last decade. Our tentative hypothesis is that pain is an underlying fundamental cause here, and that it is driving changes in both suicides *and* SWB.

There are very large variations in suicides across states in the US (by more than a factor of two) and across counties (by more than a factor of seven.) At the county level, but not the state level, suicide rates are lower where life evaluation is higher, but *higher* where negative affect is *lower*, and uncorrelated with positive affect. Pain is strongly correlated with suicide, across both states and counties, and is a significant predictor even conditional on standard predictors, such as income, income inequality and religious denomination.

Across 52 countries in the OECD, Latin America, and Eastern Europe, suicide rates are neither well nor consistently correlated with wellbeing measures. In a majority of countries, suicides are higher among the elderly, particularly for men. In countries where life evaluation is high in old age relative to middle age, suicides are relatively low in old age, and vice versa. At least some of this is driven by the extreme negative effects of the transition on the elderly in Eastern Europe.

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**Table 1: Life Evaluation, positive and negative affect, and suicide by age, sex and education, 2013**

| | | Ages 25-34 | | Ages 35-54 | | Ages 55+ | |
|---|---|---|---|---|---|---|---|
| Outcome: | Education category: | Men | Women | Men | Women | Men | Women |
| Suicide | Less than High School | 26.43 | 6.51 | 25.95 | 7.20 | 26.53 | 3.79 |
| | High School | 29.34 | 7.74 | 32.06 | 10.26 | 32.47 | 6.70 |
| | 4-year College | 9.95 | 3.47 | 16.98 | 6.70 | 23.80 | 6.90 |
| | All | 23.4 | 6.1 | 27.0 | 8.7 | 30.4 | 6.30 |
| Life Evaluation | Less than High school | 6.52 | 6.80 | 6.22 | 6.34 | 6.16 | 6.51 |
| | High School | 6.60 | 6.82 | 6.53 | 6.73 | 6.77 | 7.11 |
| | 4-year College degree | 7.13 | 7.32 | 7.22 | 7.36 | 7.49 | 7.56 |
| | All | 6.77 | 7.02 | 6.73 | 6.94 | 6.95 | 7.16 |
| Positive Affect | LT High School | 0.81 | 0.77 | 0.76 | 0.70 | 0.77 | 0.72 |
| smile/enjoy/happy/not sad | High School | 0.86 | 0.84 | 0.83 | 0.81 | 0.84 | 0.84 |
| | 4-year College | 0.88 | 0.89 | 0.87 | 0.87 | 0.88 | 0.87 |
| | All | 0.86 | 0.85 | 0.83 | 0.82 | 0.85 | 0.84 |
| Negative Affect | LT High School | 0.36 | 0.39 | 0.35 | 0.44 | 0.23 | 0.30 |
| anger/worry/stress | High School | 0.32 | 0.34 | 0.31 | 0.34 | 0.20 | 0.22 |
| | 4-year College | 0.30 | 0.33 | 0.30 | 0.31 | 0.19 | 0.22 |
| | All | 0.32 | 0.34 | 0.31 | 0.34 | 0.20 | 0.23 |
| Pain | LT High School | 0.30 | 0.28 | 0.38 | 0.47 | 0.37 | 0.45 |
| | High School | 0.20 | 0.23 | 0.26 | 0.31 | 0.29 | 0.32 |
| | 4-year College | 0.12 | 0.13 | 0.15 | 0.17 | 0.20 | 0.24 |
| | All | 0.19 | 0.20 | 0.24 | 0.27 | 0.27 | 0.31 |

**Table 2:**
**Circaseptan patterns of suicide, affect and life evaluation**

| | Men | | | |
|---|---|---|---|---|
| | Ladder | Positive Affect | Negative Affect | Pain |
| Today | –11,831 | –22,410 | 10,045 | 28,261 |
| | (1.7) | (12.3) | (8.4) | (5.2) |
| Yesterday | –5,269 | 12,821 | –6,420 | –22,686 |
| | (0.7) | (7.0) | (5.4) | (4.2) |
| | Women | | | |
| | Ladder | Positive Affect | Negative Affect | Pain |
| Today | –1,107 | –4,468 | 2,129 | 4,425 |
| | (0.7) | (7.0) | (11.0) | (5.2) |
| Yesterday | –932 | 2,356 | –1,325 | –4,272 |
| | (0.4) | (3.7) | (6.9) | (5.0) |

Notes: Each column shows a regression of the number of suicide deaths (average for each day for 2008 to 2013) on the SWB measure for that day of the week and for the previous day of the week. Absolute t-values are shown in parentheses.

**Table 3: County level regressions of age-adjusted suicide rate on SWB and other variables**

| | $n \geq 100$ | $n \geq 250$ | $n \geq 500$ | $n \geq 1000$ |
|---|---|---|---|---|
| Mean population | 1.2 | 1.7 | 2.60 | 3.95 |
| Median population | 0.48 | 0.84 | 1.52 | 2.63 |
| Number of counties | 2,102 | 1,326 | 789 | 431 |
| Ladder | –1.28 | –1.42 | –3.35 | –3.56 |
| | (3.2) | (2.6) | (4.3) | (3.2) |
| Positive affect | –2.96 | –4.43 | 1.25 | 15.3 |
| | (0.8) | (0.9) | (0.16) | (1.3) |
| Negative affect | –11.1 | –16.8 | –25.0 | –20.2 |
| | (3.9) | (4.2) | (4.5) | (2.5) |
| Pain | 9.61 | 15.5 | 19.1 | 33.0 |
| | (5.2) | (5.8) | (5.3) | (6.1) |
| Log income | –4.24 | –3.68 | –3.50 | –3.28 |
| | (8.8) | (6.5) | (5.4) | (3.9) |
| S.d. log income | –4.85 | –7.89 | –5.32 | –3.05 |
| | (4.5) | (5.5) | (2.9) | (1.2) |
| Fraction Catholic | –3.30 | –6.65 | –9.79 | –10.1 |
| | (2.2) | (3.8) | (5.0) | (4.2) |
| Fraction Protestant | –4.91 | –8.23 | –10.0 | –10.1 |
| | (2.9) | (4.2) | (4.3) | (3.4) |
| Fraction Jewish | –14.4 | –7.50 | –8.52 | –8.24 |
| | (2.2) | (1.2) | (1.4) | (1.3) |
| Fraction Mormon | –6.62 | –9.99 | –12.3 | –11.8 |
| | (3.9) | (5.2) | (5.6) | (4.5) |
| Fraction other Christian | –2.14 | –4.27 | –7.4 | –8.31 |
| | (1.3) | (2.3) | (3.5) | (2.9) |
| *Census Divisions* | | | | |
| Mid-Atlantic | –1.19 | –1.12 | –0.48 | 0.01 |
| | (2.4) | (2.6) | (1.1) | (0.0) |
| East North Central | –0.40 | –0.27 | 0.47 | 1.00 |
| | (0.9) | (0.7) | (1.1) | (2.0) |
| West North Central | 0.71 | 0.86 | 2.15 | 2.75 |
| | (1.5) | (0.8) | (4.3) | (4.5) |
| South Atlantic | 2.93 | 3.11 | 3.87 | 4.44 |
| | (5.9) | (6.6) | (7.9) | (7.9) |
| East South Central | 2.39 | 2.26 | 3.55 | 4.48 |
| | (4.4) | (4.2) | (6.0) | (5.9) |
| West South Central | 3.77 | 3.99 | 4.72 | 5.43 |
| | (7.4) | (7.9) | (8.9) | (8.5) |
| Mountain | 9.54 | 9.26 | 8.89 | 8.69 |
| | (19) | (19) | (17) | (15) |
| Pacific | 4.34 | 3.73 | 4.02 | 3.40 |
| | (8.8) | (8.3) | (8.9) | (6.2) |

Notes: Each column is a regression with the county age-adjusted mortality rate as dependent variable. *n* is the number of observations from the GHWBI surveys in each county. *t*–values in parentheses

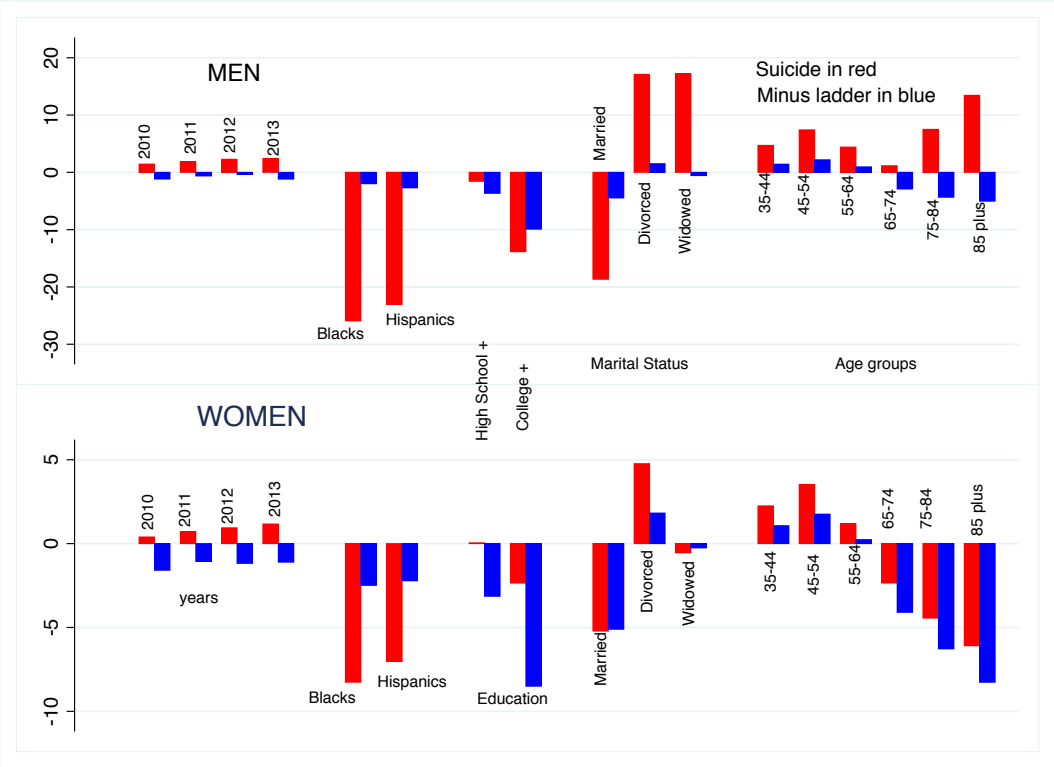


**Figure 1: Coefficients of matched variables on suicides and on ladder, 2009–2013, men and women**

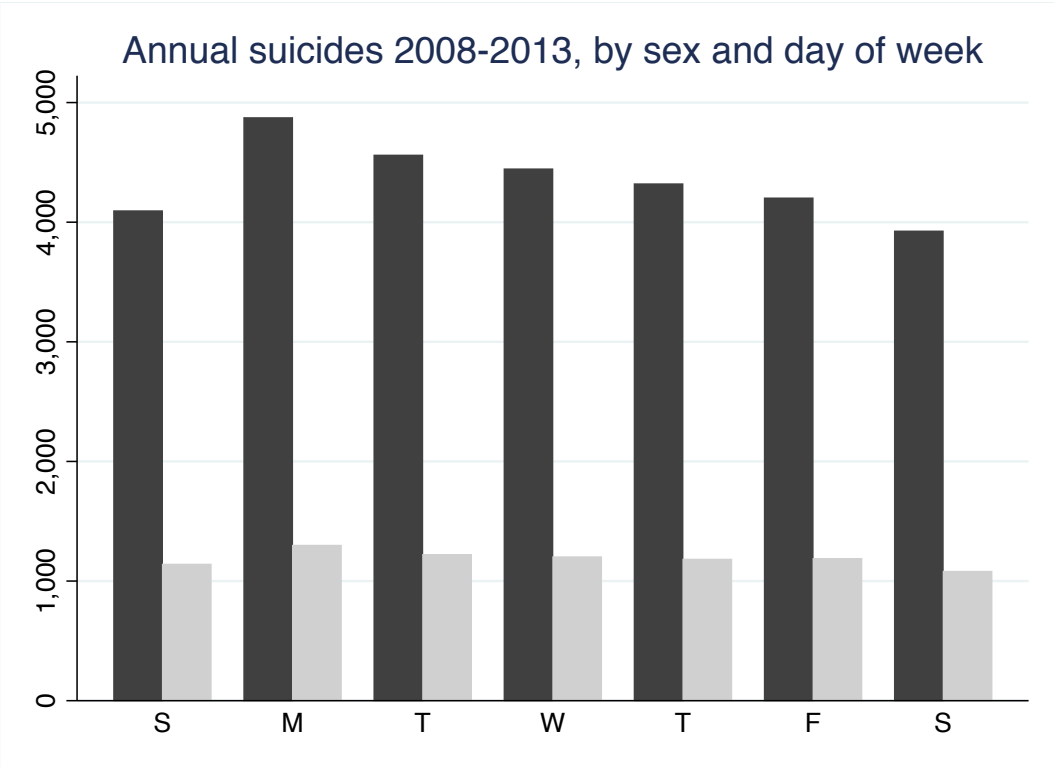


**Figure 2: Circaseptan pattern of suicides: average numbers of deaths per year**

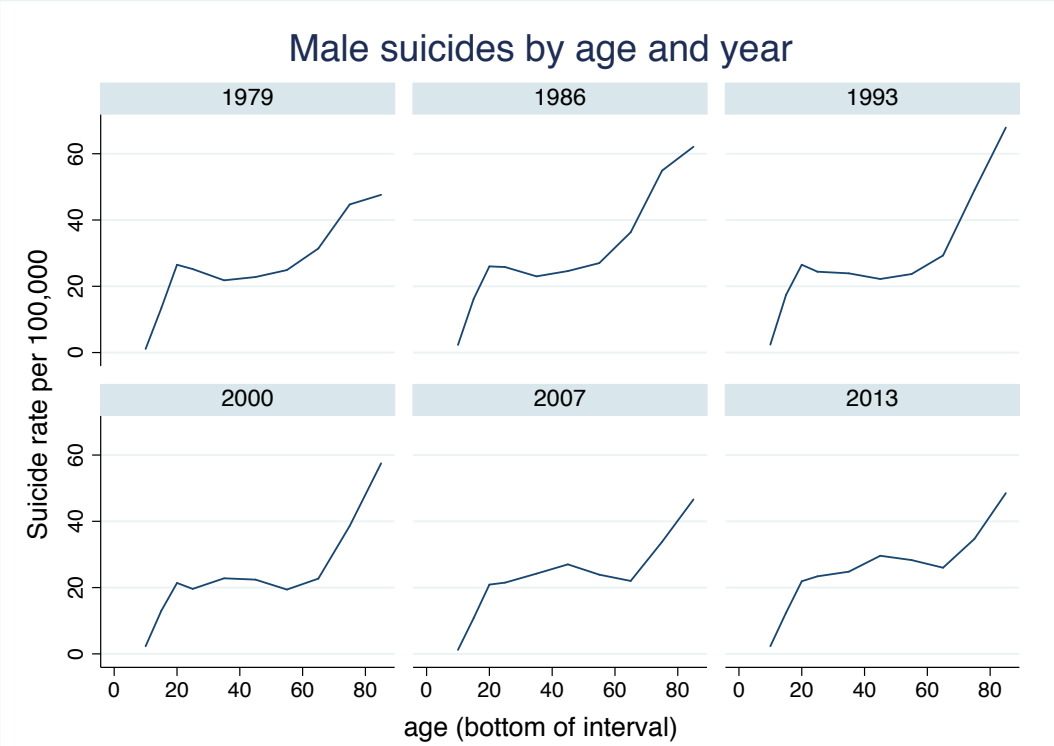


**Figure 3: Suicides by age, selected years, men**

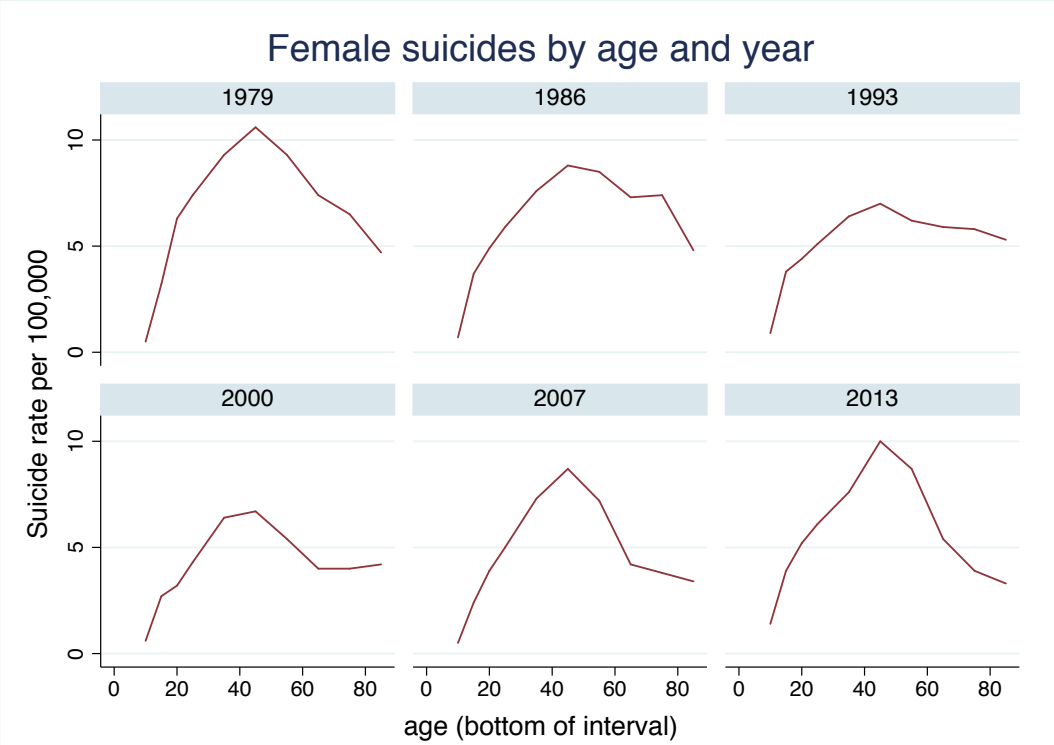


**Figure 4: Suicides by age, selected years, women**


**Figure 5: Life satisfaction (GSS) by age, selected periods, women in red**

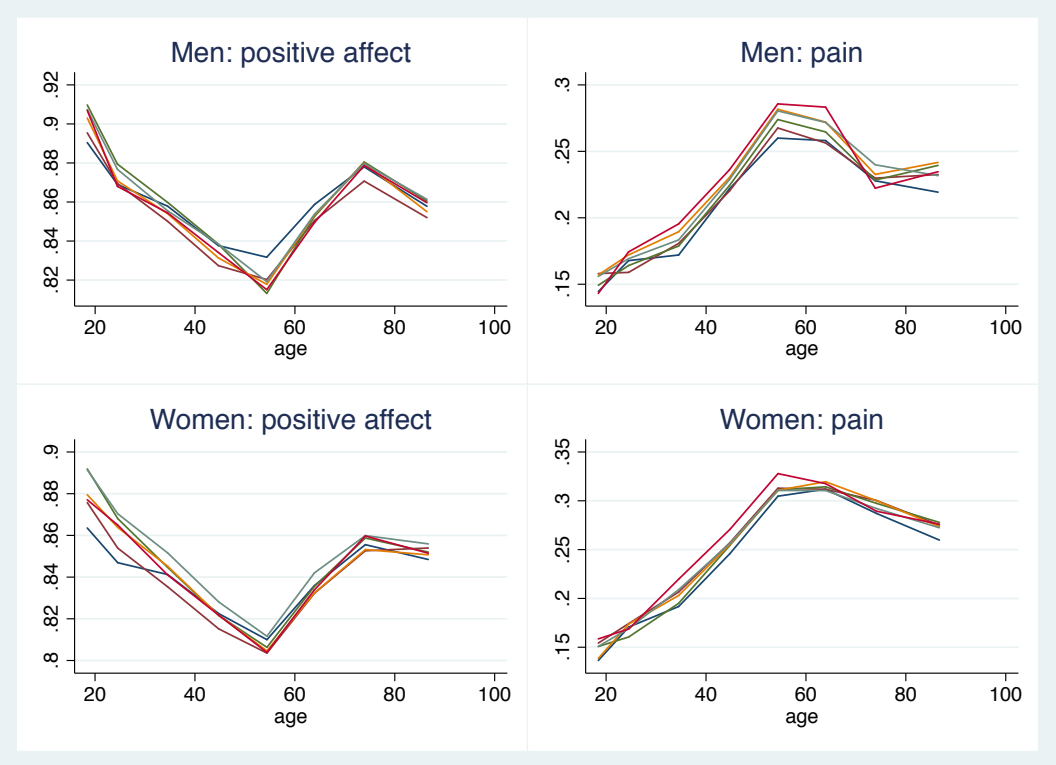


**Figure 6: Positive affect and pain by sex and year: 2008 (dark blue) to 2013 (red)**

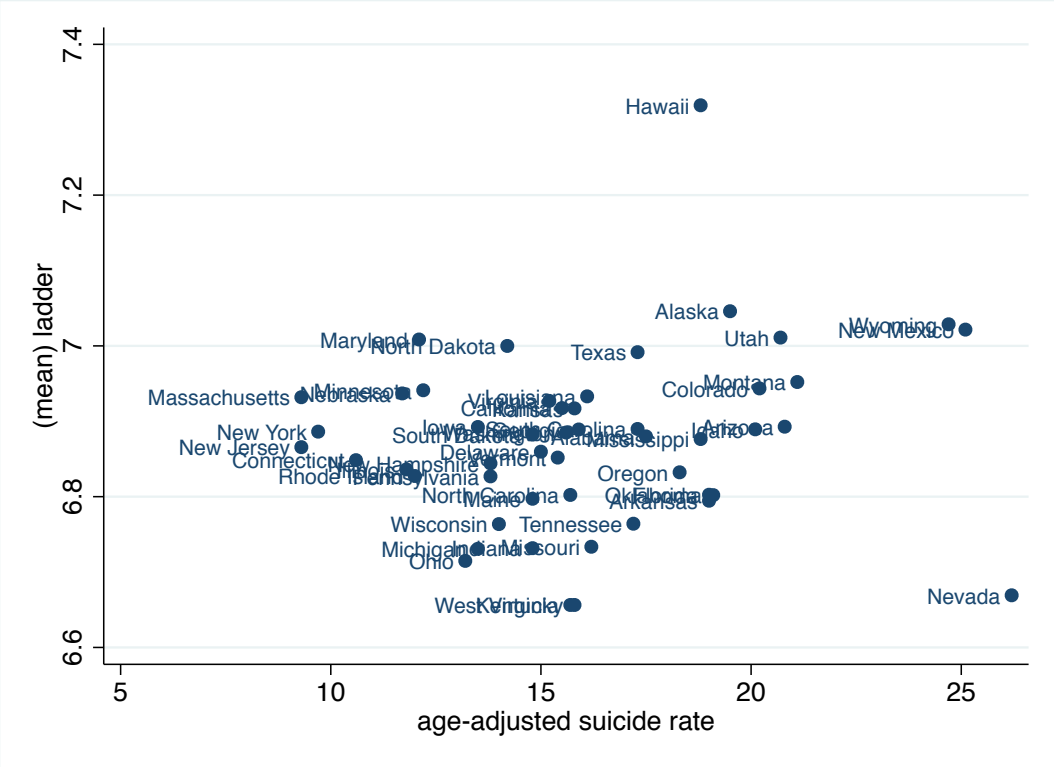


**Figure 7: Mean ladder and suicide in the US, 2008-2013, white non-Hispanics**


**Figure 8: Suicide and life evaluation across countries**

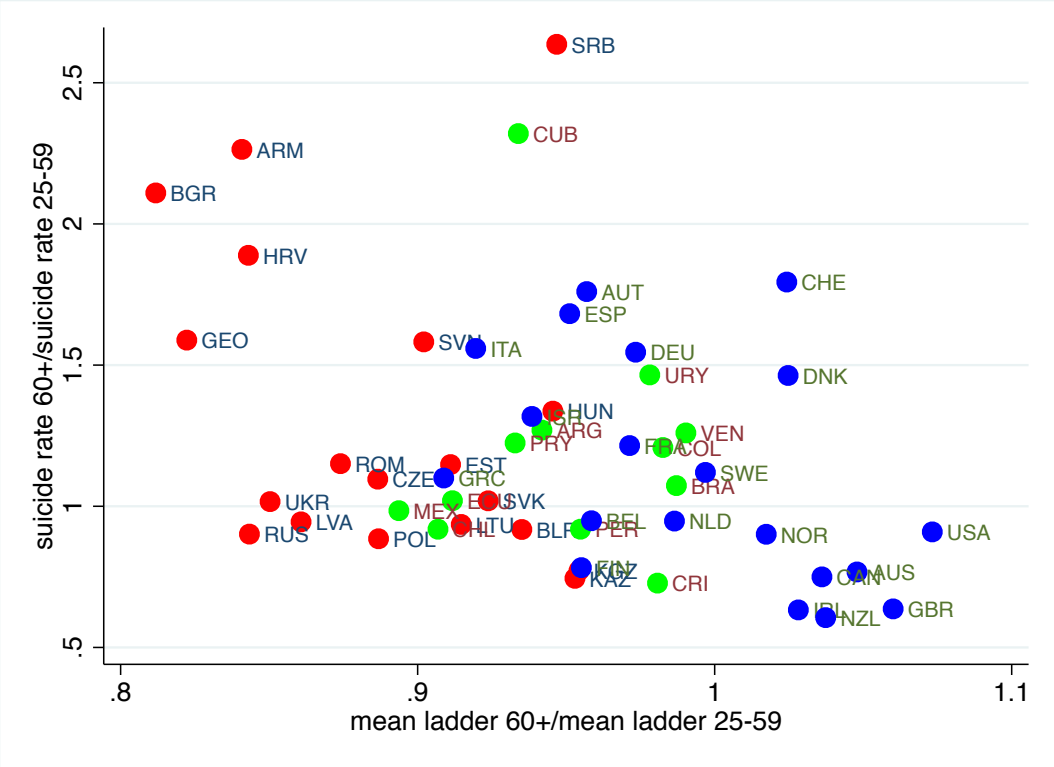


**Figure 9: Old versus young, suicide and life evaluation**