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A Suicidal Kuznets Curve?

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Abstract

In 1955 Simon Kuznets hypothesized an inverted U-shaped relationship between economic growth and income inequality. Environmental and obesity variants substitute pollution and body mass metrics for income inequality. Graphical depictions of both feature widely in economic literature. In this study, we investigate the existence (or lack thereof) of a suicidal Kuznets curve. Controlling for several country-specific socioeconomic suicide determinants among 73 countries over the period 1990–2010, we find evidence of an N-shaped suicidal Kuznets curve between per capita income and suicide rates of the male population of 25–34, 34–54 and 55–74 age groups and the female population of the 55–74 age group. The turning points of per capita income for the male population of 25–34, 34–54 and 55–74 age groups are \$7,727 and \$46,306, \$5,266 and \$22,726, and \$3,459 and \$53,260, respectively, while for the female population of the 55–74 age groups are \$4,022 and \$43,351. On average and across both genders, as per capita income increases, suicide rates for those aged 25–34 and 35–54 follow an increasing trend and peak when per capita income reaches \$7,304 and \$6,498, respectively, then follow a declining trend until \$60,819 and \$25,129, respectively, and increase thereafter again. These results remain robust to a battery of robustness checks.

Keywords: Suicide, GDP growth, Kuznets curve, Unemployment, Fertility, Life expectancy

JEL codes: C33, E32, I15, I31, J13

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1 Introduction

Worldwide increases in suicide rates, has generated mounting public concern over mental health issues and has sparked efforts to understand more clearly the underlying reasons for this phenomenon. According to the World Health Organization, WHO (2015): "*(i) over 800,000 people die due to suicide every year; (ii) for every suicide there are many more people who attempt suicide every year; (iii) a prior suicide attempt is the single most important risk factor for suicide in the general population; (iv) suicide is the second leading cause of death among the 15-29 age group; and (v) 75% of global suicides occur in low-and middle-income countries.*"

The mental health effects of variations in socioeconomic factors have received increasing attention from sociologists, as well as economists in the last couple of centuries. One particular aspect, the linkage of suicide mortality to unemployment, has prompted much discussion in recent decades (e.g. Kposowa, 2003; Preti, 2003; Kuroki, 2010; Chen et al., 2010, 2012; Antonakakis and Collins, 2014, 2015; Huijts et al., 2015, among others) and a sizeable literature on the link between several socioeconomic indicators, such as income and/or economic growth (Hamermesh and Soss, 1974; Jungeilges and Kirchgassner, 2002; Viren, 2005), divorce rates (Lester, 1996; Chuang and Huang, 1997; Brainerd, 2001; Kunce and Anderson, 2002; Neumayer, 2003a,b; Andrés, 2005; Chuang and Huang, 2007; Koo and Cox, 2008; Yamamura, 2010), fertility rates (Chuang and Huang, 1997, 2007; Neumayer, 2003a,b) and alcohol consumption (Brainerd, 2001; Neumayer, 2003a,b), among others (for survey on the various socioeconomic determinants of suicides, see Chen et al., 2012).

Despite the breadth and depth of the existing studies, no study to our best knowledge examines in a systematic fashion the suicide-income (growth) relationship.

From a theoretical perspective, an individual decides to commit suicide when the discounted expected life time utility remaining to him falls below some threshold (Hamermesh and Soss, 1974). According to this theoretical contribution, the higher future expected income is, the higher is the expected lifetime utility. Thus, living is relatively more attractive than committing suicide, and a higher income should lower suicide rates. Conversely, Lester (1996) and Unnithan et al. (1994) state that economic development increases suicide rates. This could be attributed to the fact that higher income levels could increase independence (the opposite of social integration) and might lead to higher suicide mortality. Given that during economic recessions, individuals' future expected income and as a consequence their consumption level decreases, individuals find living less attractive relative to committing suicide. Thus, economic prosperity can lead

to a decline in suicide mortality (e.g. Henry and Short, 1954). By contrast, Ginsberg (1966), argues that economic prosperity increases suicide rates. Further, Durkheim (1897) postulates that suicide rates tend to increase both in times of economic expansion and contraction.

Empirical work also offers mixed evidence. In particular, while several studies find that suicide rates have a positive association with income (e.g. Virén, 1999; Jungeilges and Kirchgassner, 2002), there are many others suggesting the opposite effect (e.g. Chuang and Huang, 1997; Brainerd, 2001; Neumayer, 2003a; Andrés, 2005; Chuang and Huang, 2007; Minoiu and Andres, 2008; Altinanahtar and Halicioglu, 2009; Andrés and Halicioglu, 2010; Andrés et al., 2011; Okada and Samreth, 2013). Yet, others have found an insignificant effect of income on suicide (Ruhm, 2000; Cuellar and Markowitz, 2007). Last but not least, the significant negative relationship between income and suicide rates seems to be stronger for males than that for females (Qin et al., 2010).

Thus both the existing economic and sociological theories present contested viewpoints, and they do not permit a firm determination as to whether the level of income (i.e. economic development) may have a positive or negative effect on suicide. Since the suicide toll and suicide-caused economic loss of any country over time may reflect its suicide vulnerability and resilience to economic change, in-depth scrutiny of the changes in suicide mortality in relation to economic development level can shed some light on the effectiveness of a nation's suicide prevention management and serve as a reference for future policy initiatives.

Against this backdrop, we aim to fill this apparent gap in the literature by examining whether suicide mortality differs with respect to the level of economic development among countries. Put differently, we investigate the existence (or lack thereof) of a 'suicidal Kuznets curve' (SKC) by adopting the rationale from the originally hypothesized Kuznets relationship (Kuznets, 1955). He hypothesized that income inequality first rises and then falls as economic development proceeds. The concept has been applied to environmental studies hypothesizing that the relationship between per capita income and the use of natural resources and/or the emission of wastes, such as the well-known environmental Kuznets curve (EKC), has an inverted U-shape. According to Stern (2004, p.1419), "*the EKC is a hypothesized relationship between various indicators of environmental degradation and income per capita. Specifically, in the early stages of economic growth degradation and pollution increase, but beyond some level of income per capita, which will vary for different indicators, the trend reverses, so that at high income levels economic growth leads to environmental improvement. This implies that the environmental impact indicator is an inverted U-shaped function of income per capita*" (see also Dinda, 2004; Nahman and Antrobus,

2005, for useful surveys on the environmental Kuznets curve hypothesis). Recently, the Kuznets curve has been expanded to an 'obesity Kuznets curve', showing that as development occurs, calorie intake and obesity rates first increase; then decrease because personal health becomes a more valued asset and people decrease their obesity levels (see Akee et al., 2010; Grecu and Rotthoff, 2015).

The results of our empirical analysis on an international annual panel dataset of 73 countries over the period 1990-2010 reveals several empirical regularities. First, we find evidence of an N-shaped suicidal Kuznets curve between per capita income and suicide rates of the male population of the 25-34, 34-54 and 55–74 age groups and the female population of the 55-74 age group. Second, the turning points of per capita income for the male population of the 25-34, 34-54 and 55–74 age groups are \$7,727 and \$46,306, \$5,266 and \$22,726, and \$3,459 and \$53,260, respectively, while for the female population of the 55-74 age group are \$4,022 and \$43,351. Third, average and across all ages and genders, as per capita income increases, suicides follow an increasing trend and peak when per capita income reaches \$2,250, then follow a declining trend until \$8,424, and increase thereafter again. These results remain robust to a battery of robustness checks.

The turning points of per capita income for the male population of the 25-34 and 34-54 age groups are \$2,416 and \$30,283, and \$1,534 and \$19,532, respectively, while for the female population of the 15-24 and 35-54 age groups are \$1,500 and \$13,049, and \$1,905 and \$24,479, respectively. On average and across all ages and genders, as per capita income increases, suicides follow an increasing trend and peak when per capita income reaches \$2,250, then follow a declining trend until \$8,424, and increase thereafter again. The extensive cross-country evidence presented in this study confirm the presence of an empirically founded N-shaped suicide Kuznets curve. The results are consistent with an explanation founded on a changing pattern of net negative and positive mental health spillover effects associated with income growth or economic development. We provide some strong intuitive conjecture to help account for this phenomenon.

The remainder of this paper is organised as follows. Section 2, outlines the theoretical and empirical model, and describes the data used. Section 3 presents the empirical results and Section 4 summarises and offers some concluding remarks.

2 Data and Methodology

2.1 Data

We collect annual observations of gender- and age-specific suicide data (with suicides defined as number of deaths by suicide and self-inflicted injury/intentional self-harm, ICD-7 codes E963, E970-E979, ICD-8 and ICD-9 codes E950-E959, ICD-10 codes X60-X84) and population data from the World Health Organization (WHO) Mortality Database. Missing values of suicide and population are supplemented (whenever available) with data from the Official National Statistics of each country and United Nations Statistics, respectively. After a careful inspection of the series we end up with panel dataset of 73 countries over the period 1990 to 2010. The choice of the specific countries and periods is purely based on data availability.

We then convert the number of suicides to suicide rates per 100,000 inhabitants (by diving suicides by population and multiplying the resulting number by 100,000), broken down by age and gender in each of the 73 countries. Further, following the previous literature (e.g. Chen et al., 2012), we additionally control for the potential socioeconomic determinants of suicide rates across countries. Specifically, we consider the following determinants: 1) real per capita GDP (in purchasing power parity, PPP, terms), 2) GDP growth defined as the first logarithmic difference of real per capita GDP, 3) unemployment rates broken down by gender, 4) fertility rates defined as births per woman, 5) urban population as a % of total population, and 6) life expectancy at birth defined as the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Each of these series were retrieved from World Development Indicators (WDI) database maintained by the World Bank. For further data description and discussion, please refer to the Online Appendix.

2.2 Empirical Methodology

We estimate variants of the following (extended) Suicidal Kuznets curve model:

$$S_{ijkt} = \alpha_0 + \alpha_1 S_{ijkt-1} + \beta_1 Y_{it} + \beta_2 Y_{it}^2 + \beta_3 Y_{it}^3 + \beta_4 E_{it} + \beta_5 D_{it} + \gamma_i + \delta_t + \varepsilon_{it} \quad (1)$$

where S_{ijkt} is the suicide rate in country i (where i = 1, 2, ..., 63), population j (where j = overall, male, female), age group k (where k = all, 15-24, 25-34, 35-54, 55-74, 75+ years) and time t (where t = 1990,...,2010); α_0 is a constant; S_{ijkt-1} is the first lag of S_{ijkt} and is included to account for dynamic effects and to filter autocorrelation of order one, AR(1), found

in the series; Y_{it}, Y_{it}^2 and Y_{it}^3 denote the logarithm of real per capita GDP (at purchasing power parity, PPP, rates; 2011 US$) in level, square and cubic terms, respectively; E_{it} is a vector of economic characteristics affecting suicide rates, such as the growth rate of real GDP, $Growth_{it}$, and the unemployment rate, $Unemp_{ijt}$; D_{it} is a vector of demographic and social characteristics affecting suicide rates, such as fertility rate, $Fert_{it}$, life expectancy, $Lifexp_{ijt}$ and the share of urban population, $Urban_{it}$. γ_{1i} are country fixed–effects controlling for time–invariant country characteristics, and δ_t are time fixed–effects, controlling for any time–varying differences in the dependent variable common to all countries, such as the global financial crisis. ε_{it} is the error term.

However, the inclusion of the lagged dependent variable, S_{ijkt} gives rise to 'dynamic panel bias' (Nickell, 1981), and any potential endogeneity of the right hand side variables, may give rise to inconsistent estimates under the fixed effects (FE) estimator. To overcome these issues, we employ the system generalised method of moments (System–GMM) estimator developed by Arellano and Bover (1995), and Blundell and Bond (1998). The System–GMM approach involves joint estimation of the suicide rates equation in levels and first differences, using first differences as instruments in the level equation and lagged levels as instruments in the first difference equation. Moreover, we use the two–step rather than the one–step approach, as the former is asymptotically more efficient than the latter (Windmeijer, 2005), and is also robust to substantial heteroskedasticity and autocorrelation within panels (Roodman, 2009).

The inclusion of the logarithm of per capita GDP in level, Y_t, square, Y_t^2, and cubic, Y_t^3, terms in model (1) serves as our primary focus in the examination of the potential relationship between suicide rates and economic development, which we name the 'Suicidal Kuznets curve' (SKC). The existence (or lack thereof) and shape of a Suicidal Kuznets curve depends on the significance and signs of the coefficients β_1, β_2 and β_3 from model (1). The various potential implied relationships between suicide mortality and economic development are summarized in Table 1. For instance, according to Table 1, an inverse U-shaped relationship corresponds to the case where β_1 is significantly positive, β_2 significantly negative and β_3 insignificantly different from zero, while an N-shaped relationship exists when β_1 and β_3 are significantly positive and β_2 significantly negative. The former case (inverse U-shaped curve), exists when suicide mortality first increases with increasing income per capita, but after a certain point in increasing income per capita, suicide mortality tends to decline. The latter case (N-shaped curve), exists when suicide mortality shows a positive, negative and positive relationship, respectively with income per capita. Essentially, suicide mortality first increases with income per capita, but decreases

after a certain level. This is how the first peak is formed. Along with further increase in income per capita, suicide mortality tends to rise again, which provides a trough in the N-shaped Suicidal Kuznets curve.

[Insert Table 1 around here]

As a first step in our endeavour to examine the existence (or lack thereof) of a Suicidal Kuznets curve, we plot average suicide rates and average logged per capita GDP across genders and age groups in Figures 1-6. A visual inspection of these scatter plots, which also include the median splines, reveals some interesting patterns. In particular, countries with low per capita income (e.g. Nicaragua, Armenia, Georgia, Paraguay and Croatia) are associated with low suicide rates. Then countries with per capita GDP at the sample mean of per capita GDP distribution exhibit the highest suicide rates (e.g. Lithuania, Russia, Hungary, Latvia, Estonia and Bulgaria). Countries with per capita GDP above the sample mean of the distribution experience low suicide rates (such as Malta, Portugal, Greece, Spain, Puerto Rico and Israel). Finally, countries at the highest quantiles of the per capita GDP distribution (such as Finland, Norway, Denmark, Sweden, Iceland, Switzerland, Luxembourg, the United States and Austria) experience higher suicide rates compared to those in the previous group, but higher to those in the sample mean of the distribution. Thus, this visual inspection of the scatter plots points to the direction of either an inverted U-shaped or an N-shaped Suicidal Kuznets curve. Yet, only a formal empirical analysis can convincingly reveal the real pattern (provided it exists) of the Suicidal Kuznets curve.

[Insert Figures 1-6 around here]

Thus, in the next section we present the results of our empirical analysis based on model (1) in an attempt to unravel the specific shape of the potential Suicidal Kuznets curve.

3 Estimation Results

3.1 Baseline Results

The main results of our empirical analysis based on the two–step System–GMM estimator of model (1) for overall, male and female population, across the various age groups, are reported in Tables 2, 3 and 4, respectively. We begin our discussion with the results of the main variables

of interest, i.e. income per capita, in Tables 2, 3 and 4, and then discuss the results of the remaining explanatory variables.

[Insert Tables 2-4 around here]

According to these results, there is evidence of gender– and age–specificity in the relationship between suicide rates and economic development. Focusing on the overall population results reported in Table 2, we observe that the coefficients of per capita income, its square and and its cubic counterparts are positive, negative and positive, respectively, across all ages in Table 2. Yet, they are only significant for the 25–34 (at the 10% level) and 35–54 (at the 5% level) age groups, under columns (3) and (4) of Table 2, respectively. This provides evidence of the existence of an N-shaped Suicidal Kuznets curve only for the aforementioned age groups. Further, the validity of our instruments is strongly supported, as the autocorrelation tests of order 1 and 2 in the first-differenced residuals of the GMM approach point to first–order but not second–order autocorrelation, as one would expect.

A similar pattern is observed for the male population results reported in Table 3. Specifically, there is evidence of the existence of an N-shaped Suicidal Kuznets curve for males in the 25–34 (at the 10% level), 35–54 (at the 5% level) and 55–74 (at the 10% level) age groups, under columns (3), (4) and (5) of Table 3, respectively. Again, the results of the autocorrelation tests reported in the lower panel of Table 3 provide strong support to the validity of our instruments. Turning to the female population results reported in Table 4, an N-shaped Suicidal Kuznets curve is identified for females in the 55–74 age group under column (5) of Table 4. Last but not least, our system GMM model is correctly specified, as the results of the autocorrelation tests provide strong support to the validity of our instruments.

The N-shaped Suicidal Kuznets curves identified empirically here are in line with the corresponding scatter plots presented in Figures 3-5 above. For instance, the median spline for the female population of the 55–74 age group, which is reported in Figure 5, indicates much stronger evidence of an N-shaped Suicidal Kuznets curve compared to that of the male or overall population in the same age group. That is, our empirical results suggest that a significant N-shaped Suicidal Kuznets curve exists only for the female population of the 55–74 age group.

The results for the remaining predictors of suicide mortality accounted for are correctly signed (i.e. in line with the existing literature) and significant in many instances. Yet, there is also evidence of gender– and age– heterogeneity in the responses of suicides rates to those predictors. In particular, unemployment is a significantly positive predictor of suicide mortality only in

the male population in the 15–24 and 25–34 age groups, while the female population across all ages is insulated to changes in unemployment as the unemployment coefficient is insignificant. This result is in line with Brainerd (2001) who finds that male suicide rates are highly sensitive to the state of the macroeconomy, while female suicide rates are insensitive to the state of the macroeconomy. Moreover, these results indicate that the aforementioned unemployment-stricken male population groups, i.e., the highly productive and well skilled parts of the labour force, have a higher probability to commit suicide if they become unemployed compared to the (female) population in any other age group (see e.g. Antonakakis and Collins, 2014, 2015). Economic growth is significantly associated with lower suicide mortality of the male population in the 35–54 and 55–74 age groups, and the female population in the 15–24 age group and, to a lower extent, in the 35–54 age group. These results again point to the direction that males are more heavily affected by the state of the macroeconomy compared to females (see e.g. Brainerd, 2001; Antonakakis and Collins, 2014, 2015).

Fertility is a significant predictor of lower suicide mortality in the male population of ages between 15 and 74, and in the female population in the 55–74 age group. This result is very much in line with the existing literature. For instance, Durkheim (1897) and Andrés (2005) make the case for fertility rate to be viewed as an indicator of social integration, suggesting high fertility rates are related to lower suicidality. The absence of children is thus associated by them with greater fluidity in family integration and social ties. Moreover, higher life expectancy is related with lower suicide mortality in the male population of ages between 15 and 34. Higher life expectancy is indicative of good nutrition, greater well-being/health investment and effective healthcare, all of which can be intuitively argued to lower suicide risk.

Finally, countries with high ratio of urban to total population are positively associated with suicide mortality in the middle-aged and elderly population. In particular, in males of 35–54 and 75+ age groups and females of ages between 35 and 54. That urban living is associated with higher suicide rates has been a reported feature in many countries except China (Qin, 2005). That said, specific studies exploring the effects of urbanicity on suicide may neglect to adjust risk estimates for possible confounding factors such as marital status, income, and psychiatric illness. These are different in rural and urban areas and strongly influence suicide rates (Qin, 2005). By contrast, urban population is a negative predictor of suicidality in young females (i.e. in the 15–24 age group). For young females such urban settings potentially afford greater opportunities for independent living (even in more patriarchal societies) and greater economic opportunities.

Having found evidence of an N-shaped Suicidal Kuznets curve in the aforementioned age groups and genders, we go one step further by calculating the turning points, i.e. the peak and trough of per capita income associated with the N-shaped curve as follows

$$\phi_1 = \frac{-\hat{\beta}_2 - \sqrt{\hat{\beta}_2^2 - 3\hat{\beta}_1\hat{\beta}_3}}{3\hat{\beta}_3} \tag{2}$$

and

$$\phi_2 = \frac{-\hat{\beta}_2 + \sqrt{\hat{\beta}_2^2 - 3\hat{\beta}_1\hat{\beta}_3}}{3\hat{\beta}_3} \tag{3}$$

where $\hat{\beta}_i$, with i =1,2 and 3, correspond to the coefficients of log of per capita income, its square and its cubic counterparts, respectively obtained from model (1).

A graphical representation of an N-shaped Suicidal Kuznets curve in the context of suicide mortality is given in Figure 7. As discussed, the N-shaped curve indicates that suicide mortality first increases with income per capita, but decreases after a certain level. This is how a peak is formed. Along with further increase in income per capita, suicide mortality tends to rise again, which provides a trough in the N-shaped Suicidal Kuznets curve.

[Insert Figure 7 around here]

The specific results of the peaks and troughs, i.e. the turning points of per capita income, of suicide mortality, which are calculated only when each of the β_i, where i =1,2 and 3, coefficients are significant at least at the 10% level of significance in Tables 2-4, are presented in Table 5. According to these results, the turning points of per capita income for the male population of 25–34, 34–54 and 55–74 age groups are \$7,727 and \$6,306, \$5,266 and \$22,726, and \$3,459 and \$53,260, respectively, while for the female population of 55–74 age groups are \$4,022 and \$43,351. On average and across both genders, as per capita income increases, suicide rates of 25–34 and 35–54 follow an increasing trend and peak when per capita income reaches \$7,304 and \$6,498, respectively, then follow a declining trend until \$60,819 and \$25,129, respectively, and increase thereafter again. These empirical results confirm an N-shaped suicidal Kuznets curve. It appears that the race to increase income over time to escape poverty has negative mental health spillover effects. Yet once poverty has been eradicated then for middle income countries, further income rises are seemingly associated with positive mental health spillover effects. For high income group countries, further income increases seem to be associated again with negative mental health spillover effects. It seems likely, however, that there are a different or wider range

of factors (compared to the low income countries) that account for these negative mental health spillover effects. In the second upswing they may be more likely, for example, to be triggered by work-life balance concerns, arduous commuting, peer group pressures and status anxieties that echo elements of Duesenberry's (1949) relative income hypothesis.

[Insert Table 5 around here]

Summing up, our results point to a significant finding in terms of 'money' and wellbeing/happiness. Conventional wisdom suggest that money does not buy happiness. We, however, find once poverty and the problems of very low income living have been addressed then money does buy happiness (some insulation from mental health issues and suicide) up to a certain point. Exceeding that point is where problems seem to begin.

Finally, the aforementioned results are very robust to various robustness checks presented in the Online Appendix.

4 Conclusions

In this study, we investigated the existence (or lack thereof) of a suicidal Kuznets curve. Controlling for several country-specific socioeconomic suicide determinants among 73 countries over the period 1990-2010 we found evidence of an N-shaped suicidal Kuznets curve between per capita income and suicide rates of the male population of 25-34, 34-54 and 55–74 age groups and the female population of the 55-74 age group. The turning points of per capita income for the male population of 25-34, 34-54 and 55–74 age groups are $7,727 and $46,306, $5,266 and $22,726, and $3,459 and $53,260, respectively, while for the female population of the 55-74 age group are $4,022 and $43,351. On average and across both genders, as per capita income increases, suicide rates of 25–34 and 35–54 follow an increasing trend and peak when per capita income reaches $7,304 and $6,498, respectively, then follow a declining trend until $60,819 and $25,129, respectively, and increase thereafter again. These results remain robust to a battery of robustness checks.

We provide some simple intuitive conjecture for this N-shaped relationship in terms of a changing pattern of net negative and positive mental health spillovers at different income levels. Specifically, we contend that striving to escape very low income and poverty is associated with negative mental health spillover effects (specifically higher suicide rates). Once achieved, further income increases up to a certain point are then associated with positive mental health spillover

effects (lower suicide rates). Beyond this point (for high income countries), further income rises are then associated with net negative mental health spillover effects as households confront relative income disparity concerns (Duesenberry, 1949), seemingly stark work-life balance concerns, long commuting journeys and other phenomena associated with high pressured living in mature industrialized economies.

The bulk of studies exploring the impact of economic growth (per capita income) on suicide rates posit a simple inverse relationship after controlling for other socio-demographic factors. While in no way claiming to completely reconcile the conflicting findings from some seemingly dissenting studies that have also explored this relationship (Unnithan et al., 1994; Lester, 1996), this study does at least go some way to help account for a degree of plurality in findings. It does so with respect to an N-shaped relationship for 73 countries at different stages of economic development. Potentially an even more global picture with a greater number of countries and explicit treatment of in-country income inequality across all of them might help in providing more nuanced identification of specific groupings of countries, such that they could more readily benchmark the effectiveness of their national anti-suicide strategies with useful comparators. In some cases (with the support of supra-national bodies such as the WHO) they may also more readily be able to exploit the scope for pooling or sharing public health resources, including specific community outreach communication materials targeted at particular age cohorts and demographic groups.

The results may serve as evidence to prompt some countries in the face of declining suicide rates to guard against complacency if increased economic prosperity is anticipated. Given the N-shaped form of the relationship there is a case for resisting very significant diminution of resources devoted to encouraging mental health wellbeing and addressing suicidal behaviour. Replicatory work on this sample and a wider sample of countries, however, remains warranted to affirm the robustness of our findings but subsequent work might also explore more fully the micro-foundations of this suicide-economic growth relationship, possibly enriched by household panel data elements. Additionally it might also be possible to identify suicidal Kuznets curve properties in some countries through regional variations in suicide rates and economic development. In which case there is merit in regional development and planning becoming more fully aligned in the service of mental health wellbeing and suicide abatement.

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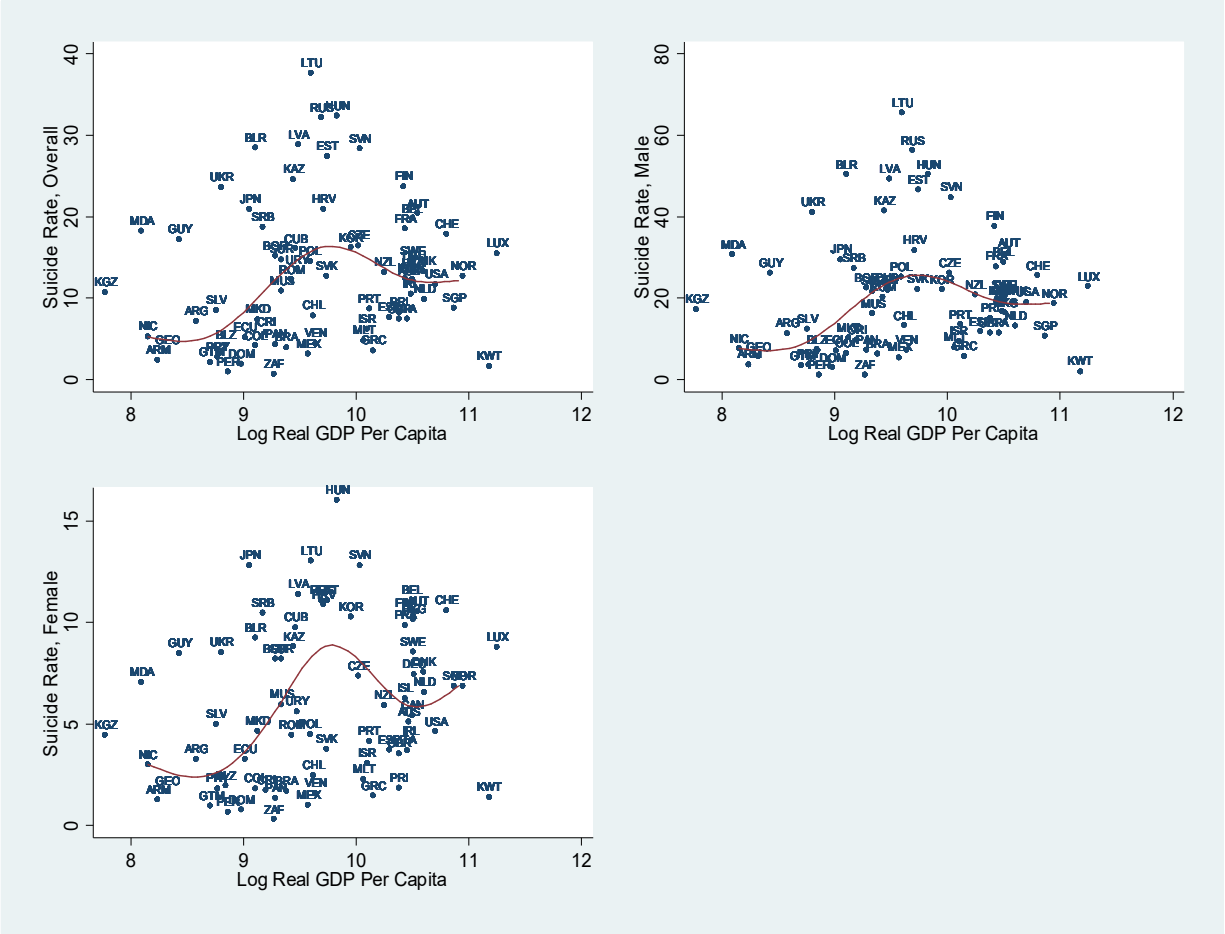
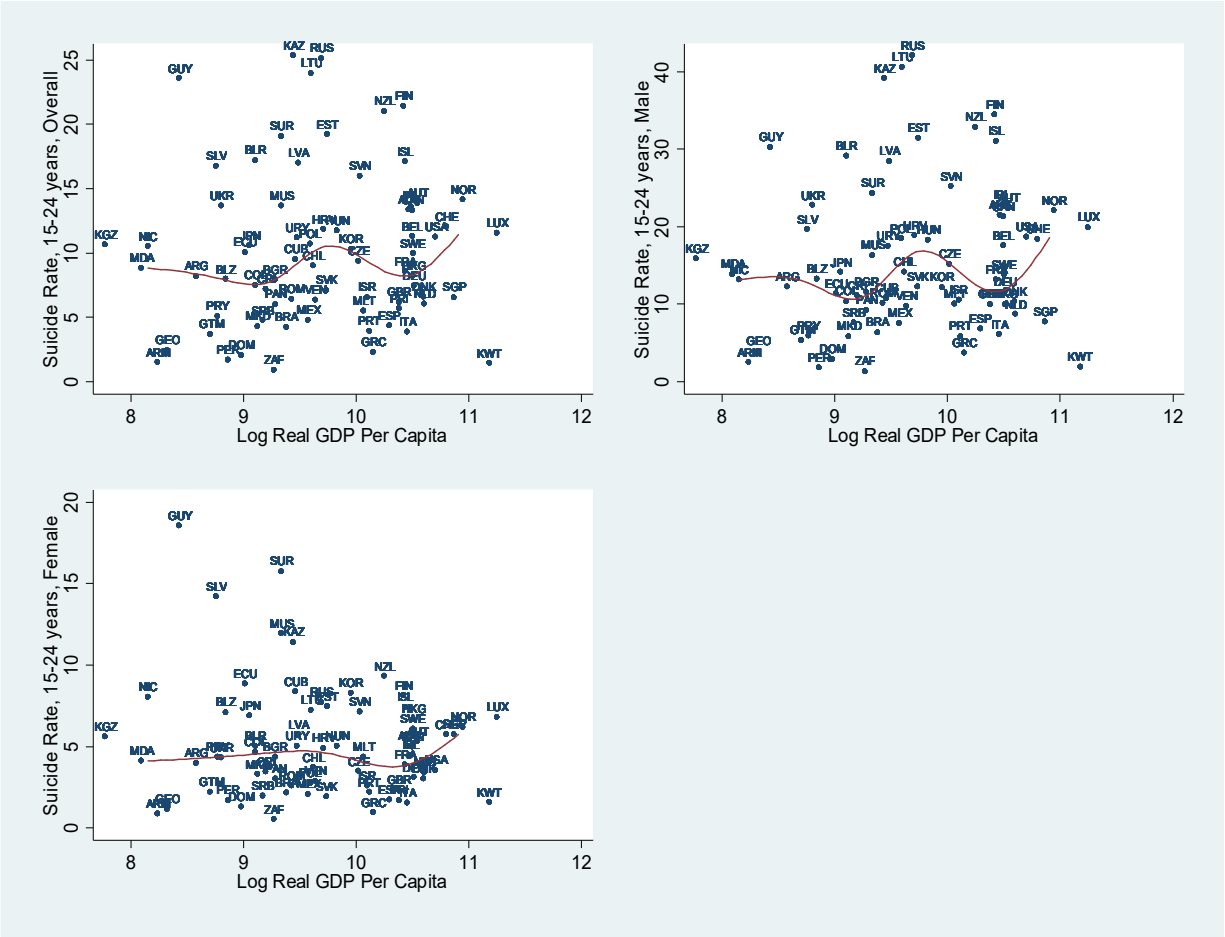
Figure 1: Scatter plot between suicide rates (per 100,000 inhabitants) of all ages and log of real GDP per capita (1990-2010 averages)



Note: Solid line is the median spline.

Source: Authors' calculations based on WDI, WHO and Official National Statistics databases.

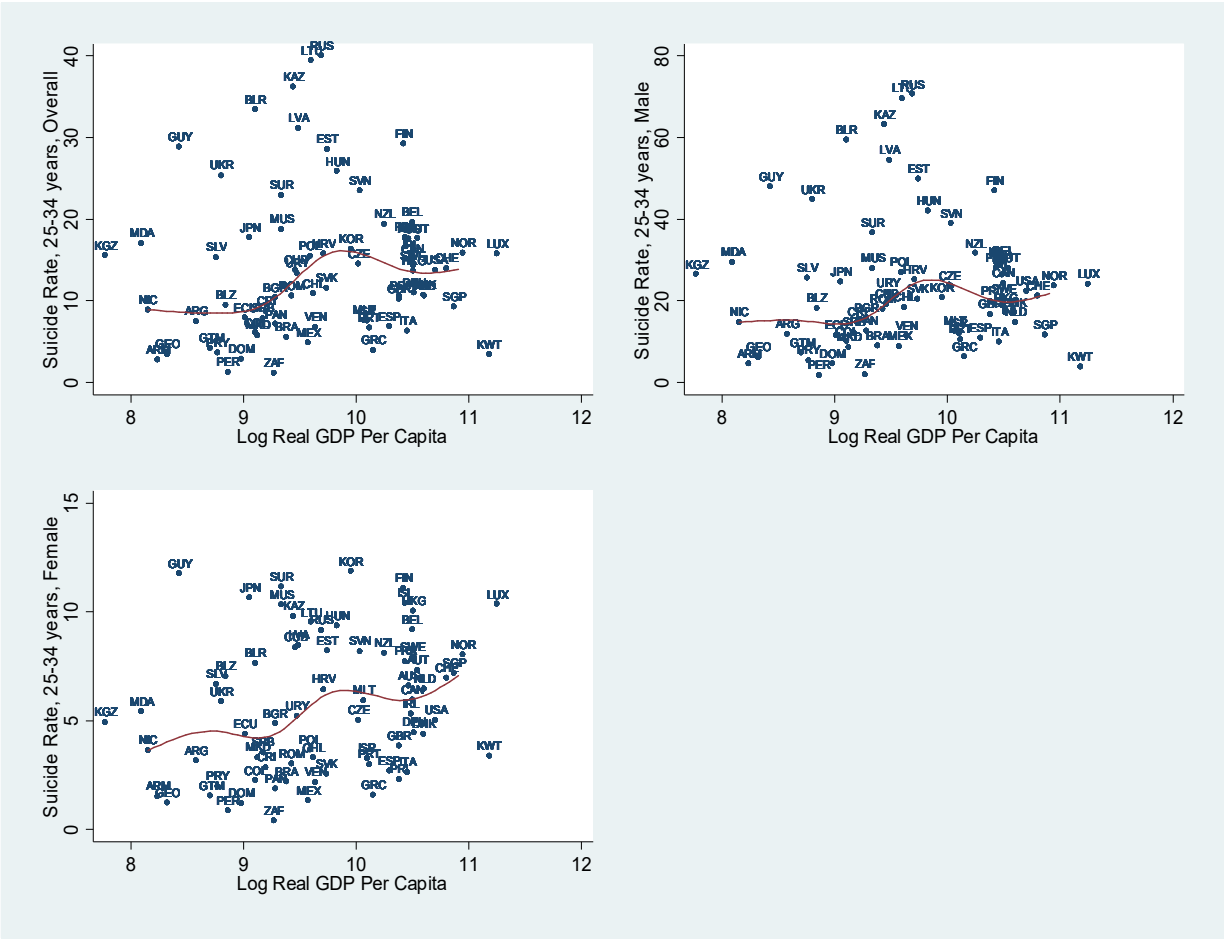
Figure 2: Scatter plot between suicide rates (per 100,000 inhabitants) of 15-24 age group and log of real GDP per capita (1990-2010 averages)



Note: Solid line is the median spline.

Source: Authors' calculations based on WDI, WHO and Official National Statistics databases.

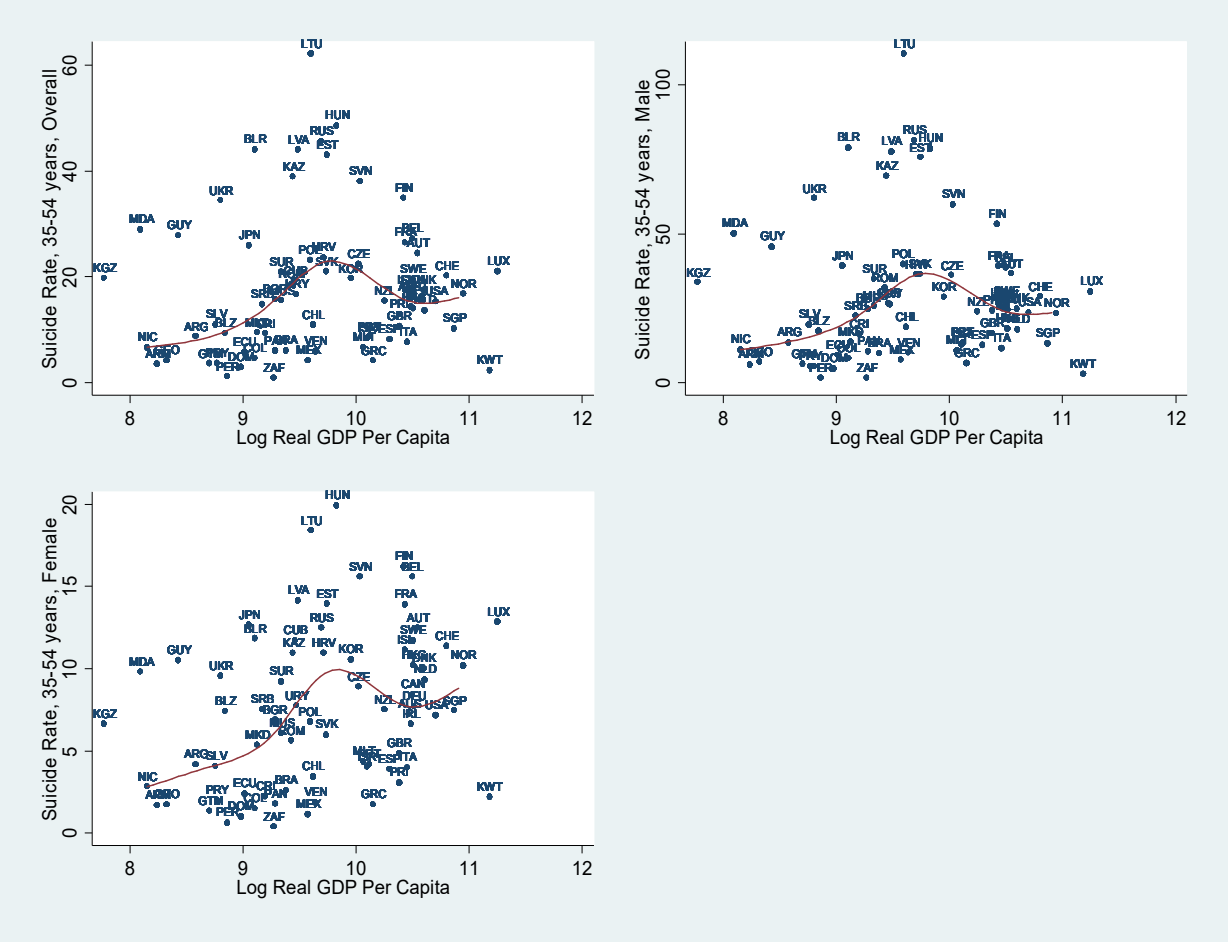
Figure 3: Scatter plot between suicide rates (per 100,000 inhabitants) of 25-34 age group and log of real GDP per capita (1990-2010 averages)



Note: Solid line is the median spline.

Source: Authors' calculations based on WDI, WHO and Official National Statistics databases.

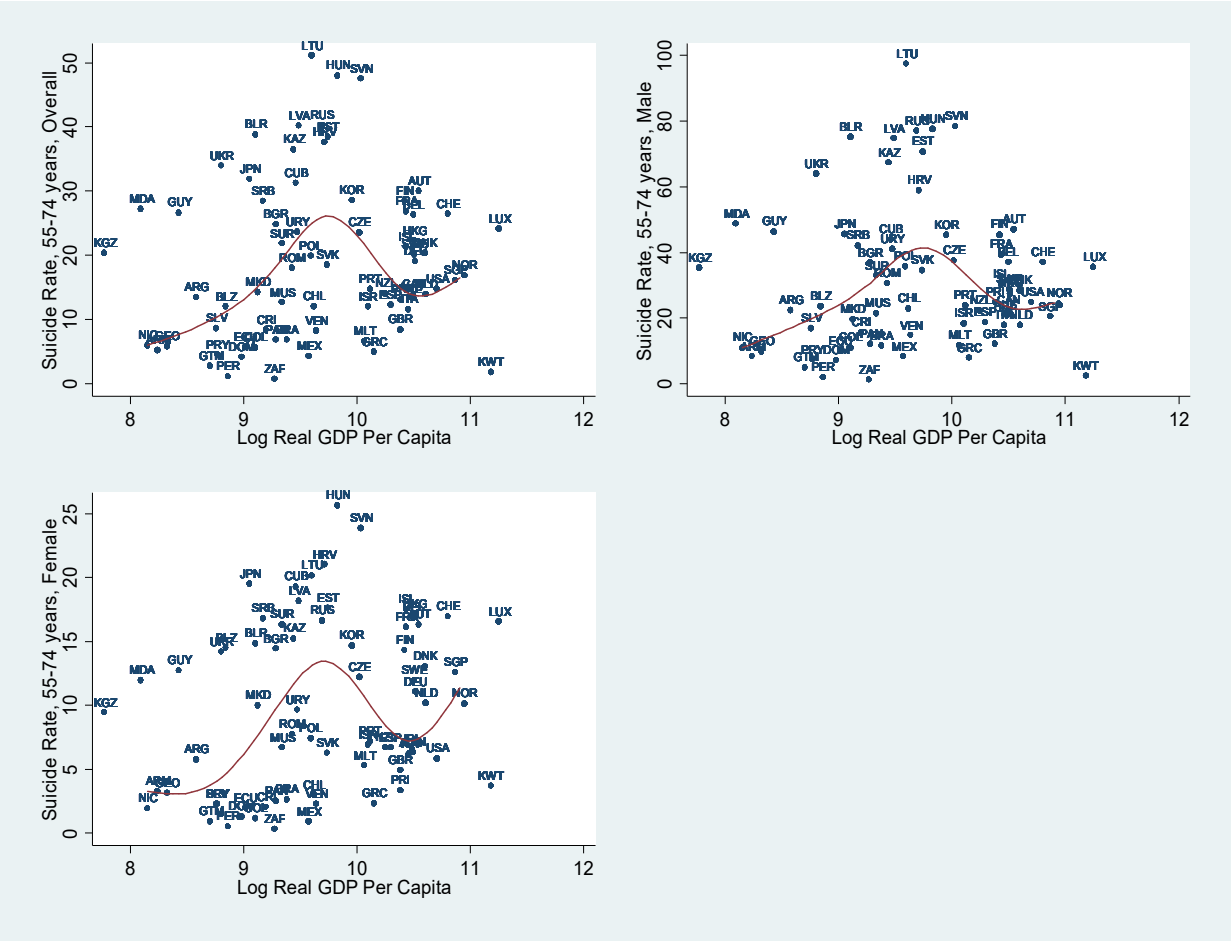
Figure 4: Scatter plot between suicide rates (per 100,000 inhabitants) of 35-54 age group and log of real GDP per capita (1990-2010 averages)



Note: Solid line is the median spline.

Source: Authors' calculations based on WDI, WHO and Official National Statistics databases.

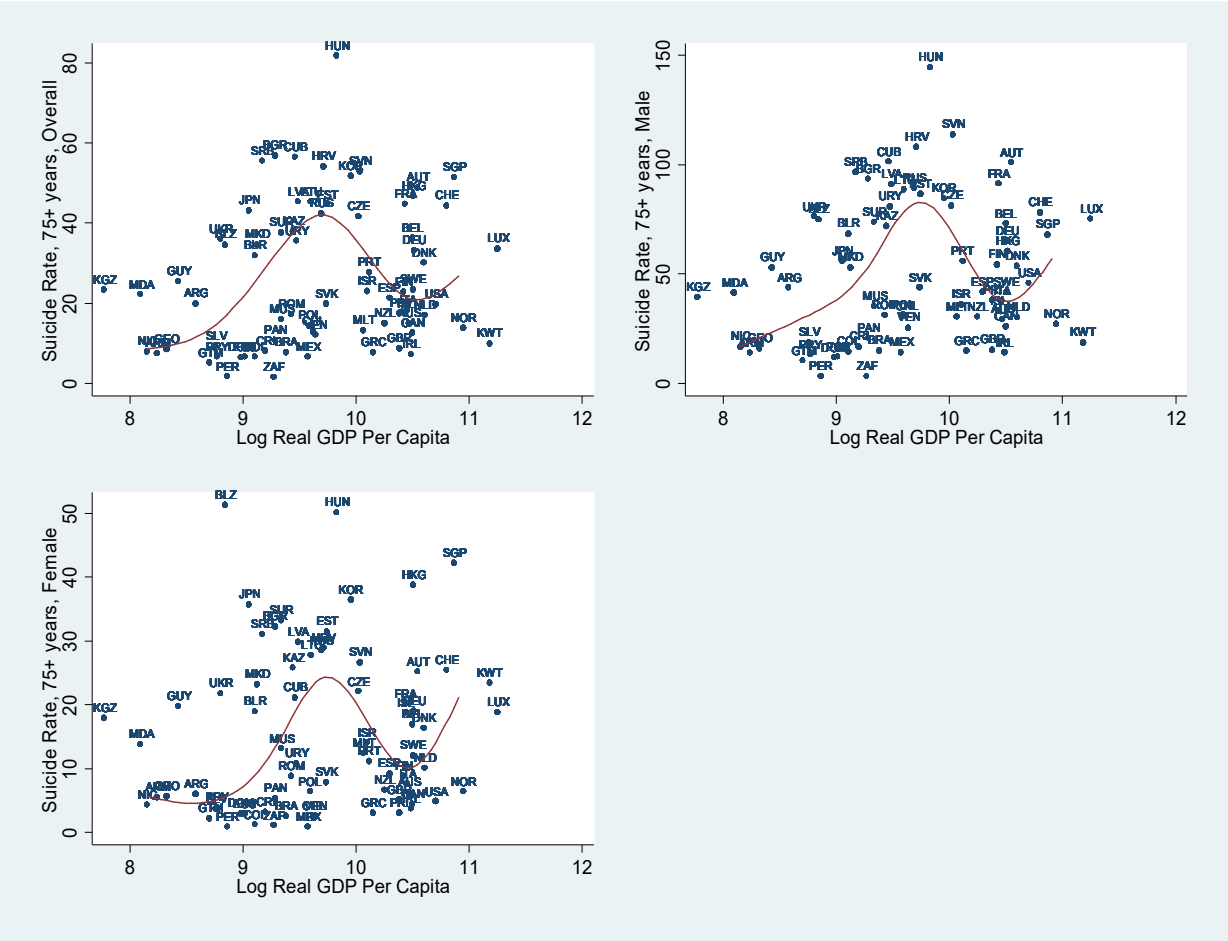
Figure 5: Scatter plot between suicide rates (per 100,000 inhabitants) of 55-74 age group and log of real GDP per capita (1990-2010 averages)



Note: Solid line is the median spline.

Source: Authors' calculations based on WDI, WHO and Official National Statistics databases.

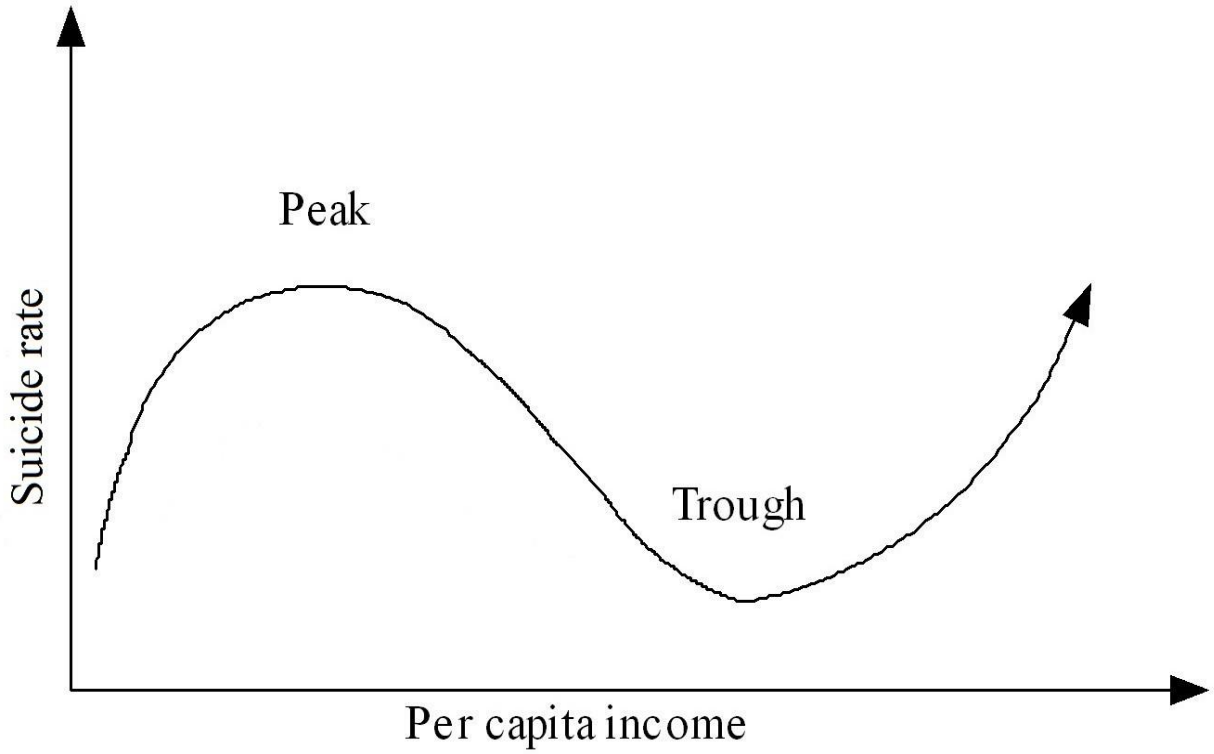
Figure 6: Scatter plot between suicide rates (per 100,000 inhabitants) of 75+ age group and log of real GDP per capita (1990-2010 averages)



Note: Solid line is the median spline.

Source: Authors' calculations based on WDI, WHO and Official National Statistics databases.

Figure 7: Peak and trough of an N-shaped Suicidal Kuznets curve



Source: Authors' calculations.

Table 1: Parameter values of the suicidal Kuznets curve and the implied relationship between suicide mortality and economic growth

β_1	β_2	β_3	Interpretation
>0	$=0$	$=0$	A monotonically increasing linear relationship
<0	$=0$	$=0$	A monotonically decreasing linear relationship
<0	>0	$=0$	A U-shaped relationship
>0	<0	$=0$	An inverse U-shaped relationship
>0	<0	>0	An N-shaped relationship
<0	>0	<0	An inverse N-shaped relationship
$=0$	$=0$	$=0$	A level relationship

Table 2: N-shaped Suicidal Kuznets Curve? Overall population

	(1) all	(2) 15-24	(3) 25-34	(4) 35-54	(5) 55-74	(6) 75+
Lagged Dep. Var.	1.0101***	0.5281***	0.4710***	0.9168***	0.7419***	0.7103***
	(0.0373)	(0.0519)	(0.1497)	(0.0393)	(0.0744)	(0.0706)
Per Capita Income	34.3655	42.5826	151.1112*	130.5958**	88.1711	-95.5058
	(22.7372)	(45.9863)	(78.8301)	(60.8059)	(93.5752)	(107.1579)
Per Capita Income^2	-3.7794	-4.1847	-15.3520*	-13.8826**	-9.4940	10.6911
	(2.4606)	(4.9392)	(8.3625)	(6.4484)	(9.9353)	(11.6444)
Per Capita Income^3	0.1386	0.1385	0.5140*	0.4894**	0.3338	-0.3858
	(0.0878)	(0.1762)	(0.2935)	(0.2257)	(0.3499)	(0.4186)
Growth	-4.4165**	-3.2462**	-3.5182	-7.8354*	-10.7238**	-5.2495
	(1.7507)	(1.3489)	(2.7664)	(4.3902)	(5.1199)	(3.6116)
Unemployment	0.0094	0.0757	0.0994	0.0231	0.0004	0.0353
	(0.0192)	(0.0536)	(0.0690)	(0.0496)	(0.0387)	(0.0735)
Fertility	-0.3169	-1.5337**	-2.0365**	-0.7322	-1.8195**	-1.7447
	(0.2692)	(0.6297)	(0.9262)	(0.4762)	(0.8345)	(1.3091)
Life Expectancy	-0.0553	-0.2789**	-0.6485**	-0.2195	-0.1770	0.1069
	(0.0840)	(0.1215)	(0.2726)	(0.1593)	(0.2039)	(0.1439)
Urban Population	0.0054	0.0210	0.0792	0.1340**	0.0543	0.1637*
	(0.0179)	(0.0512)	(0.0854)	(0.0594)	(0.0825)	(0.0973)
Country-Fixed-Effects	YES	YES	YES	YES	YES	YES
Time-Fixed-Effects	YES	YES	YES	YES	YES	YES
Observations	1,411	1,411	1,411	1,411	1,411	1,411
Number of countries	73	73	73	73	73	73
χ^2	22250***	1416***	834.4***	12131***	3099***	1573***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(1)	-4.183***	-3.470***	-2.518**	-2.943***	-3.073***	-4.025***
	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]
AR(2)	1.951*	0.451	0.597	0.411	0.621	0.325
	[0.05]	[0.65]	[0.55]	[0.68]	[0.53]	[0.74]

Note: Heteroskedasticity and autocorrelation robust standard errors in parentheses; p-values in brackets. Instruments are restricted to 2 lags to minimize instrument count. Endogenous variable is the lagged dependent variable. First order serial correlation in first-differenced residuals (AR(1) significant) with no second order serial correlation (AR(2) insignificant) supports the claim that instruments for the System-GMM models are valid. *, ** and *** indicate significance at 10%, 5% and 1% level, respectively.

Table 3: *N*-shaped Suicidal Kuznets Curve? Male population

	(1)	(2)	(3)	(4)	(5)	(6)
	all	15-24	25-34	35-54	55-74	75+
Lagged Dep. Var.	0.9853***	0.4552***	0.4725***	0.9074***	0.7232***	0.4893***
	(0.0351)	(0.0780)	(0.1320)	(0.0414)	(0.0924)	(0.0935)
Per Capita Income	61.5332	10.4950	277.9982*	246.8616**	232.6048*	-190.9893
	(40.9405)	(75.1504)	(153.0956)	(119.1554)	(137.3880)	(283.0908)
Per Capita Income^2	-6.8394	-0.3670	-28.4649*	-26.7090**	-24.9591*	23.0303
	(4.3601)	(8.1897)	(16.2027)	(12.6851)	(14.6648)	(31.2001)
Per Capita Income^3	0.2520*	-0.0081	0.9635*	0.9573**	0.8743*	-0.8903
	(0.1531)	(0.2959)	(0.5698)	(0.4451)	(0.5168)	(1.1341)
Growth	-8.2030**	-2.4913	-7.7748	-17.1962**	-13.0094*	-6.3905
	(3.2233)	(1.6648)	(5.2864)	(7.6698)	(6.9517)	(6.8996)
Unemployment	0.0267	0.1349**	0.2054**	0.0079	0.0509	0.0669
	(0.0390)	(0.0645)	(0.0961)	(0.0839)	(0.0871)	(0.1462)
Fertility	-0.9209**	-2.9390***	-2.9054**	-1.9080***	-2.8069*	-2.8918
	(0.4328)	(0.8679)	(1.4062)	(0.7194)	(1.4729)	(3.1257)
Life Expectancy	-0.1310	-0.5338***	-1.0843***	-0.3375	-0.2696	-0.1016
	(0.1215)	(0.1742)	(0.3866)	(0.2434)	(0.3793)	(0.4848)
Urban Population	-0.0012	0.1446	0.1344	0.2057*	0.0661	0.4788**
	(0.0340)	(0.1107)	(0.1309)	(0.1110)	(0.1292)	(0.1896)
Country-Fixed-Effects	YES	YES	YES	YES	YES	YES
Time-Fixed-Effects	YES	YES	YES	YES	YES	YES
Observations	1,411	1,411	1,411	1,411	1,411	1,411
Number of countries	73	73	73	73	73	73
χ^2	38506***	1078***	1410***	10452***	3353***	825.3***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(1)	-4.678***	-3.456***	-2.616***	-3.501***	-2.740***	-1.506***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(2)	1.247	0.397	0.989	0.776	0.752	0.0439
	[0.21]	[0.69]	[0.32]	[0.44]	[0.45]	[0.96]

Note: See notes of Table 2.

Table 4: *N*-shaped Suicidal Kuznets Curve? Female population

	(1)	(2)	(3)	(4)	(5)	(6)
	all	15-24	25-34	35-54	55-74	75+
Lagged Dep. Var.	0.8241***	0.4978***	0.2437**	0.6066***	0.5719***	0.6030***
	(0.0427)	(0.0421)	(0.0980)	(0.0554)	(0.0875)	(0.0820)
Per Capita Income	23.8123	39.0247	-1.7890	58.9856	120.0029**	-111.9262
	(16.8466)	(38.4215)	(66.1227)	(39.8600)	(60.2928)	(136.4606)
Per Capita Income^2	-2.4911	-4.2019	0.5390	-6.0478	-12.8491**	12.0443
	(1.7562)	(4.1969)	(7.0366)	(4.2406)	(6.4391)	(14.6911)
Per Capita Income^3	0.0871	0.1508	-0.0344	0.2041	0.4514**	-0.4337
	(0.0607)	(0.1513)	(0.2474)	(0.1499)	(0.2273)	(0.5265)
Growth	-1.6838*	-3.1782***	-0.5218	-1.7867*	-2.1579	-2.4504
	(0.8838)	(1.1305)	(1.2468)	(1.0380)	(2.3221)	(2.9392)
Unemployment	0.0087	0.0370	0.0134	0.0098	-0.0067	-0.0247
	(0.0085)	(0.0357)	(0.0272)	(0.0225)	(0.0259)	(0.0548)
Fertility	-0.4405**	-0.7270	-0.1711	-0.4285	-0.9797**	-1.5068
	(0.1948)	(0.4687)	(0.4581)	(0.3246)	(0.4110)	(1.1314)
Life Expectancy	-0.0158	-0.2085	0.0972	0.0237	-0.0459	0.0567
	(0.0360)	(0.1401)	(0.1812)	(0.0676)	(0.0874)	(0.2430)
Urban Population	0.0010	-0.0520**	0.0457	0.0547*	0.0802**	0.0490
	(0.0110)	(0.0255)	(0.0607)	(0.0306)	(0.0382)	(0.0651)
Country-Fixed-Effects	YES	YES	YES	YES	YES	YES
Time-Fixed-Effects	YES	YES	YES	YES	YES	YES
Observations	1,411	1,411	1,411	1,411	1,411	1,411
Number of countries	73	73	73	73	73	73
χ^2	2920***	821.3***	367.8***	981.3***	1423***	1027***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(1)	-3.755***	-2.764***	-2.342**	-2.527**	-3.243***	-3.590***
	[0.00]	[0.00]	[0.02]	[0.01]	[0.00]	[0.00]
AR(2)	2.128**	0.847	0.386	0.398	0.311	1.287
	[0.03]	[0.40]	[0.70]	[0.69]	[0.76]	[0.20]

Note: See notes of Table 2.

Table 5: Turning points of income per capita

	overall		male			female
	25-34	35-54	25-34	35-54	55-74	55-74
$\hat{\beta}_1$	151.1112	130.5958	277.9982	246.8616	232.6048	120.0029
$\hat{\beta}_2$	-15.3520	-13.8826	-28.4649	-26.709	-24.9591	-12.8491
$\hat{\beta}_3$	0.5140	0.4894	0.9635	0.9573	0.8743	0.4514
$\exp \phi_1$	\$7,304	\$6,498	\$7,727	\$5,266	\$3,459	\$4,022
$\exp \phi_2$	\$60,819	\$25,129	\$46,306	\$22,726	\$53,260	\$43,351

Note: $\hat{\beta}_1$, $\hat{\beta}_2$ and $\hat{\beta}_3$ denote the estimated parameters of per capita income, per capita income squared and per capita income qubic, respectively, from Tables 2-4. ϕ_1 and ϕ_2 are calculated based on equations (2) and (3), respectively. exp is the exponential operator. The turning points of per capita income, given in the last two rows, are calculated only when each of the β_1, β_2 and β_3 coefficients are significant at least at the 10% level of significance in Tables 2-4.

Online Appendix to: A Suicidal Kuznets Curve?

May 6, 2016

A Data description

The choice of the specific 73 countries (see Table A.1) and periods used in this study, is purely based on data availability.

[Insert Table A.1 around here]

A snapshot of the average number of deaths by suicide across genders and age groups is presented in Table A.2 and their evolution depicted in Figure A.1. One can observe that average deaths are consistently higher among the male population compared to the female population across all age groups. In particular, the male to female deaths by suicide ratio ranges between 1.58 and 4.81. Another pattern readily discernable is that suicides of males (females) are the highest in the 35–74 age group, followed by the age groups of 55–74, 25–34 (75+), 15–24 (25–34) and 75+ (15–24). Moreover, suicides have increased to unprecedented levels in 2010, and one could speculate that this might be due to the global financial crisis.

[Insert Table A.2 around here]

[Insert Figure A.1 around here]

Yet, any conclusions reached by observing the patterns of suicides in numbers will be biased due to the changing population patterns overtime that need to be accounted for. Thus, based on the above data, we convert the number of suicides to suicide rates per 100,000 inhabitants (by diving suicides by population and multiplying the resulting number by 100,000), broken down by age and gender in each of the 73 countries. A snapshot of the average suicide rates across genders and age groups presented in Table A.2 and their evolution presented in Figure A.2 reveals age, time and gender heterogeneity. In particular, male suicide rates are consistently higher than

female ones. In addition, overall, male and female suicide rates increase with age, which is in line with the theoretical predictions of Hamermesh and Soss (1974). Moreover, overall, male and female suicide rates peak around the mid-1990s and then follow a slight decreasing trend until the end of the sample. These features indicate the necessity to take into account the gender–, age– and time- heterogeneity, as well as controlling for country–specific effects in the empirical analysis of suicide rates.

[Insert Table A.3 around here]

[Insert Figure A.2 around here]

Descriptive statistics of the explanatory variables used in this study, as well as those for suicide rates, are reported in Table A.4.

[Insert Table A.4 around here]

A.1 Robustness Analysis

In this section, we perform several robustness checks. First, as the estimation results based on the cubic model (1) in the main text provided evidence of an N-shaped Suicidal Kuznets curve only for a subset of age groups across genders in our sample, we restrict model (1) from the main analysis to a quadratic version as follows

$$S_{ijkt} = \alpha_0 + \alpha_1 S_{ijkt-1} + \beta_1 Y + \beta_2 Y^2 + \beta_3 E_{it} + \beta_5 D_{it} + \gamma_i + \delta_t + \varepsilon_{it}, \tag{A.1}$$

where the variables are defined the same as those in the main analysis, and re-estimate model (A.1) again using the two-step System GMM estimator, in order to examine whether such examination could provide evidence for a (inverse) U-shaped Suicidal Kuznets curve. Note that evidence of a (inverse) U-shaped Suicidal Kuznets curve is supported when the coefficients β_1 and β_2 from the estimated model (A.1) are significantly negative (positive) and positive (negative), respectively. This is motivated by the fact that in several age groups across genders in our sample no significant N-shaped relation was found, and the scatter plots presented in Figures 1-6 in the main text were inconclusive between an N-shaped and (inverse) U-shaped Suicidal Kuznets curve.

The results of this analysis for the overall, male and female population are presented in Tables A.5, A.6 and A.7, respectively.

[Insert Tables A.5-A.7 around here]

According to these results, we observe that both the coefficients β_1 and β_2 are significantly positive and negative, respectively, only in the case of the overall population in the 25–34 age group (column (3) in Table A.5) and, more specifically, the male population in the 25–34 age group (column (3) in Table A.6). Yet, in the former case, there is evidence of misspecification in the System–GMM model as there is evidence of autocorrelation of order 2. Moreover, the corresponding results (and misspecification tests) of overall and male population in the 25–34 age group presented in column (3) of Tables 2 and 3 in the main analysis, respectively, provide evidence in favour of an N-shaped Suicidal Kuznets Curve over an inverse U-shaped one. The results of the remaining socioeconomic variables are much in line with our main findings resulting from model (1) in the main analysis, and in line with the existing litarature on suicide mortality; thus providing additional robustness evidence related to the socioeconomic predictors used in our analysis. For instance, the results in Tables A.5-A.7 again suggest that male suicide rates are highly sensitive to the state of the macroeconomy (i.e. to changes in economic growth and unemployment rates), while female suicide rates are generally insensitive to the state of the macroeconomy; and are also in line with the literature (see e.g. Brainerd, 2001; Antonakakis and Collins, 2014, 2015).

As a second robustness analysis, we examine the robustness of our baseline System–GMM results based on model (1) given in the main analysis to the fixed effects OLS results and compare the coefficient on the lagged dependent variable under fixed effects (FE) with that under the System–GMM. Since our emphasis on System–GMM is motivated by the downward bias in models that include a lagged dependent variable and exhibit unit effects (Nickell, 1981), the lagged dependent variable coefficient in a correctly specified GMM model should not lie below the lagged dependent variable coefficient in the FE model (Bond, 2002). The results of this analysis, which are not presented but available upon request, reveal that the lagged dependent variable coefficient in the GMM model lies above the lagged dependent variable coefficient in the FE model, thus providing additional robustness to the use of System–GMM and its resulting findings.

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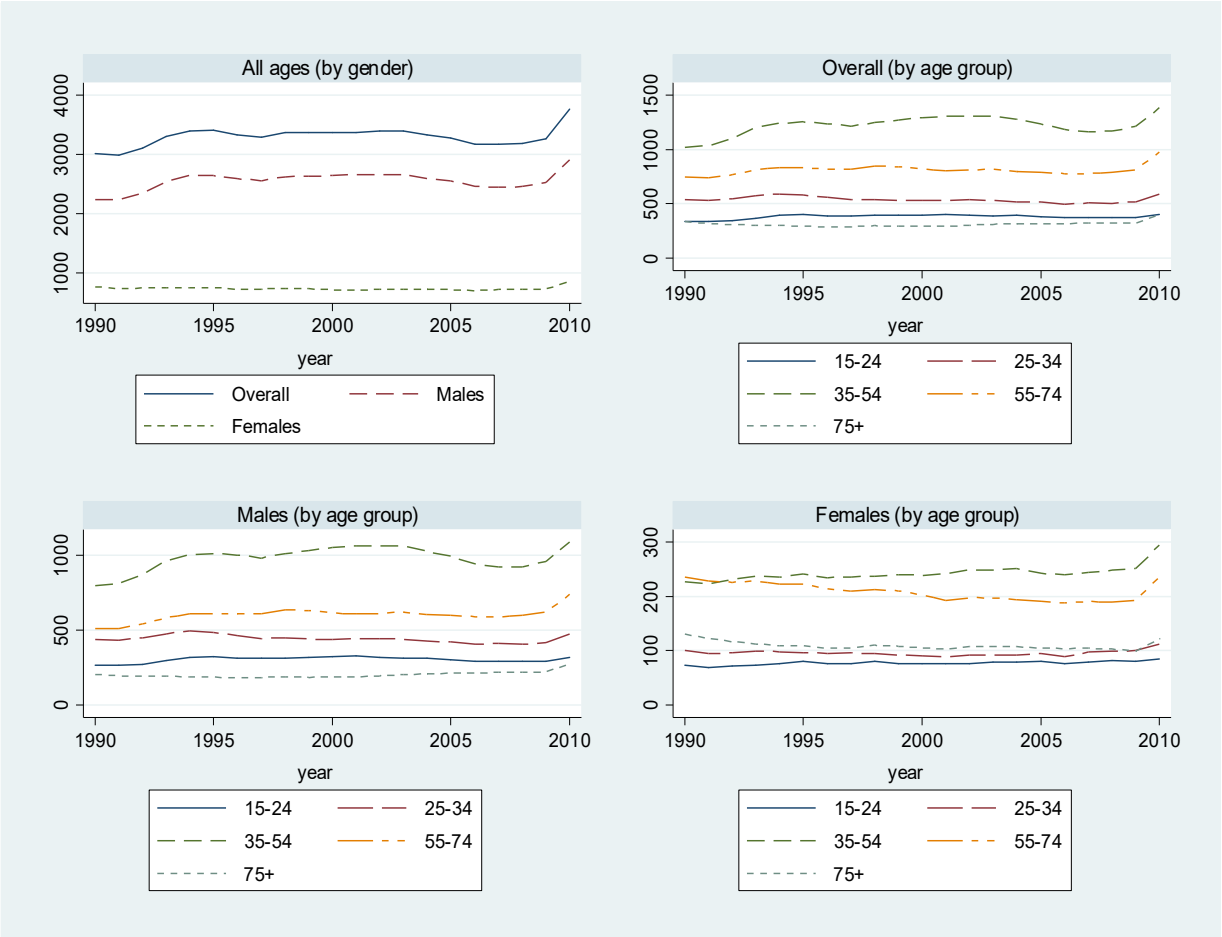
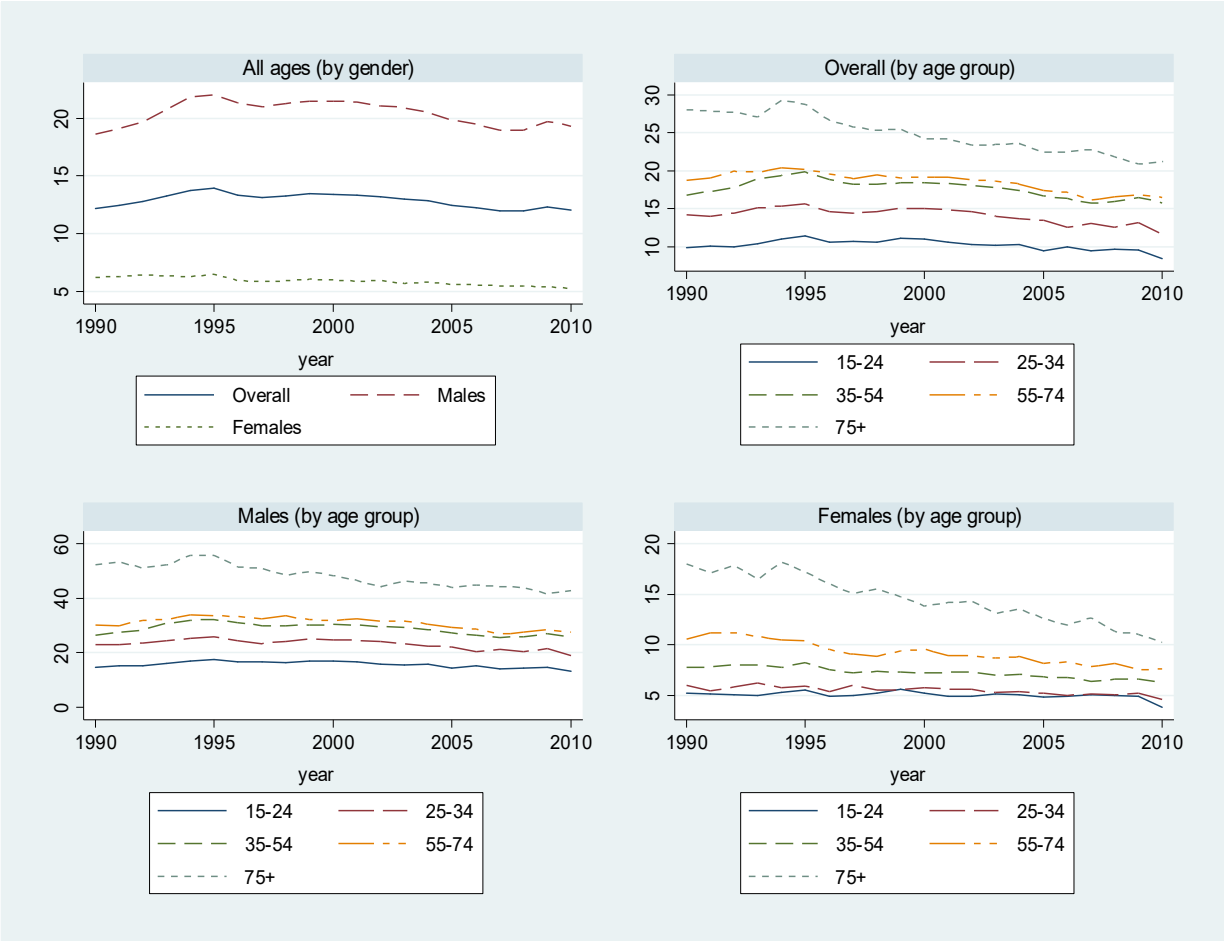
Figure A.1: Average deaths due to suicide, by gender and age group



Source: Authors' calculations based on WHO and Official National Statistics databases.

Figure A.2: Average suicide rates (per 100,000 inhabitants), by gender and age group



Source: Authors' calculations based on WHO and Official National Statistics databases.

Table A.1: 73 countries included in the study

Country	Acronym	Country	Acronym
Argentina	ARG	Kuwait	KWT
Armenia	ARM	Kyrgyzstan	KGZ
Australia	AUS	Latvia	LVA
Austria	AUT	Lithuania	LTU
Belarus	BLR	Luxembourg	LUX
Belgium	BEL	Malta	MLT
Belize	BLZ	Mauritius	MUS
Brazil	BRA	Mexico	MEX
Bulgaria	BLG	Moldova, Republic	MDA
Canada	CAN	Netherlands	NED
Chile	CHL	New Zealand	NZL
Colombia	COL	Nicaragua	NIC
Costa Rica	CRI	Norway	NOR
Croatia	HRV	Panama	PAN
Cuba	CUB	Paraguay	PRY
Czech Republic	CZE	Peru	PER
Denmark	DNK	Poland	POL
Dominican Republic	DOM	Portugal	PRT
Ecuador	ECU	Puerto Rico	PRI
El Salvador	SLV	Romania	ROM
Estonia	EST	Russian Federation	RUS
Finland	FIN	Serbia	SRB
France	FRA	Singapore	SGP
Georgia	GEO	Slovakia	SVK
Germany	DEU	Slovenia	SVN
Greece	GRC	South Africa	ZAF
Guatemala	GTM	Spain	ESP
Guyana	GUY	Suriname	SUR
Hong Kong SAR, China	HKG	Sweden	SWE
Hungary	HUN	Switzerland	CHE
Iceland	ISL	TFYR Macedonia	MKD
Ireland	IRE	Ukraine	UKR
Israel	ISR	United Kingdom	UK
Italy	ITA	United States	US
Japan	JPN	Uruguay	URY
Kazakhstan	KAZ	Venezuela	VEN
Korea, Republic	KOR		

Table A.2: Snapshot of average deaths by suicide, by age, gender and selected years in the 73 countries

		Overall	Male	Female	Male/female ratio
1990	All ages	3008	2234	774	2.89
	15–24	341	267	74	3.61
	25–34	537	437	100	4.37
	35–54	1022	795	227	3.50
	55–74	745	509	236	2.16
	75+	336	206	130	1.58
1995	All ages	3401	2642	759	3.48
	15–24	401	321	80	4.01
	25–34	582	485	97	5.00
	35–54	1252	1011	241	4.20
	55–74	832	610	222	2.75
	75+	296	186	110	1.69
2000	All ages	3365	2643	722	3.66
	15–24	397	321	76	4.22
	25–34	529	438	91	4.81
	35–54	1290	1051	239	4.40
	55–74	818	615	203	3.03
	75+	293	188	105	1.79
2005	All ages	3274	2550	724	3.52
	15–24	382	301	81	3.72
	25–34	515	420	95	4.42
	35–54	1233	991	242	4.06
	55–74	792	601	191	3.15
	75+	318	213	105	2.03
2010	All ages	3767	2909	858	3.39
	15–24	401	316	85	3.72
	25–34	585	473	112	4.22
	35–54	1381	1087	294	3.70
	55–74	975	739	236	3.13
	75+	395	273	122	2.24
1990-2010 average	All ages	3296	2554	742	3.44
	15–24	381	304	77	3.95
	25–34	538	442	96	4.60
	35–54	1222	980	242	4.05
	55–74	810	602	208	2.89
	75+	311	202	109	1.85

Note: Authors' calculations based on WHO and Official National Statistics databases.

Table A.3: Snapshot of average suicide rates, by age, gender and selected years in the 73 countries

		Overall	Male	Female	Male/female ratio
1990	All ages	12.20	18.65	6.23	2.99
	15–24	9.85	14.78	5.26	2.81
	25–34	14.27	23.04	6.01	3.83
	35–54	16.76	26.46	7.81	3.39
	55–74	18.73	30.11	10.56	2.85
	75+	28.08	52.18	18.02	2.90
1995	All ages	13.95	22.04	6.48	3.40
	15–24	11.41	17.56	5.57	3.15
	25–34	15.63	25.75	5.98	4.31
	35–54	19.86	32.26	8.27	3.90
	55–74	20.21	33.60	10.39	3.23
	75+	28.80	55.80	17.21	3.24
2000	All ages	13.44	21.48	5.98	3.59
	15–24	10.98	17.03	5.21	3.27
	25–34	15.07	24.85	5.80	4.28
	35–54	18.41	30.33	7.26	4.18
	55–74	19.16	31.91	9.58	3.33
	75+	24.27	48.37	13.84	3.49
2005	All ages	12.46	19.87	5.58	3.56
	15–24	9.53	14.49	4.85	2.99
	25–34	13.50	22.25	5.21	4.27
	35–54	16.70	27.24	6.83	3.99
	55–74	17.41	29.30	8.22	3.56
	75+	22.46	44.04	12.64	3.48
2010	All ages	12.04	19.35	5.25	3.69
	15–24	8.44	13.21	3.84	3.44
	25–34	11.64	18.86	4.65	4.06
	35–54	15.82	25.76	6.33	4.07
	55–74	16.53	27.55	7.65	3.60
	75+	21.26	42.67	10.26	4.16
1990-2010 average	All ages	12.89	20.45	5.88	3.48
	10–24	10.25	15.73	5.06	3.11
	25–34	14.13	23.21	5.52	4.20
	35–54	17.68	28.82	7.28	3.96
	55–74	18.58	30.98	9.24	3.35
	75+	24.88	48.21	14.52	3.32

Table A.4: Descriptive statistics and sources

Variable	Obs	Mean	Std. Dev.	Min	Max	Source
Male Suicide rate (per 100,000 inhabitants)						World Health Organisation,
All ages	1490	20.45	15.46	0.41	83.58	Mortality Database &
15-24	1490	15.73	11.06	0.49	65.52	Official National Statistics
25-34	1490	23.21	17.52	0.63	93.36	
35-54	1490	28.82	24.26	0.42	151.45	
55-74	1490	30.98	23.65	0.78	124.78	
75+	1490	48.21	34.39	0.74	191.00	
Female Suicide rate (per 100,000 inhabitants)						
All ages	1490	5.89	4.03	0.11	25.17	
15-24	1490	5.06	4.06	0.12	33.36	
25-34	1490	5.52	3.82	0.06	30.33	
35-54	1490	7.28	5.05	0.17	26.85	
55-74	1490	9.24	6.83	0.17	37.90	
75+	1490	14.52	13.34	0.28	104.38	
Overall Suicide rate (per 100,000 inhabitants)						
All ages	1490	12.88	9.11	0.26	47.87	
15-24	1490	10.25	6.86	0.33	39.52	
25-34	1490	14.13	10.03	0.38	52.54	
35-54	1490	17.68	13.82	0.33	85.94	
55-74	1490	18.81	13.36	0.48	71.64	
75+	1490	25.52	19.38	0.32	122.30	
GDP per capita, PPP	1529	21492.73	16717.24	1696.364	96711.05	World Development Indicators
(constant 2011 international US$)						
Economic growth	1,457	0.02	0.06	-0.60	0.66	World Development Indicators
Unemployment rate						World Development Indicators
male	1460	8.53	5.48	0.70	37.00	
female	1460	10.36	7.07	0.60	40.10	
total	1460	9.22	5.86	0.70	37.30	
Fertility rate	1525	2.02	0.75	0.90	5.58	World Development Indicators
Share of urban population	1533	70.23	15.82	28.31	100	World Development Indicators
Life expectancy						World Development Indicators
male	1525	70.75	5.46	50.31	87.70	
female	1525	77.38	4.57	52.87	86.44	
total	1525	73.98	4.93	51.56	85.16	

Table A.5: U-shaped Suicidal Kuznets Curve? Overall population

	(1)	(2)	(3)	(4)	(5)	(6)
	all	15-24	25-34	35-54	55-74	75+
Lagged Dep. Var.	0.9392***	0.5212***	0.4898***	0.9294***	0.7452***	0.7065***
	(0.0431)	(0.0567)	(0.1488)	(0.0386)	(0.0792)	(0.0703)
Per Capita Income	-1.9167	8.6512	13.5118*	1.6834	-2.3475	5.3555
	(2.2131)	(5.3307)	(7.9118)	(6.8773)	(14.9815)	(10.7046)
Per Capita Income^2	0.1144	-0.4206	-0.7258*	-0.0670	0.0675	-0.1584
	(0.1222)	(0.2898)	(0.4314)	(0.3822)	(0.8043)	(0.6280)
Growth	-4.6423**	-3.6482***	-3.8703	-8.1100*	-11.7009**	-4.9881
	(1.8702)	(1.3550)	(2.6595)	(4.4809)	(5.1582)	(3.5141)
Unemployment	0.0096	0.0823	0.1124*	0.0278	0.0027	0.0223
	(0.0196)	(0.0557)	(0.0660)	(0.0528)	(0.0394)	(0.0748)
Fertility	-0.2811	-1.5383**	-1.8514*	-0.4775	-1.7210**	-1.8221
	(0.2778)	(0.6539)	(0.9567)	(0.4415)	(0.8491)	(1.2608)
Life Expectancy	-0.0416	-0.3059**	-0.6347**	-0.1998	-0.1775	0.0971
	(0.0904)	(0.1280)	(0.2609)	(0.1585)	(0.2063)	(0.1405)
Urban Population	0.0031	0.0255	0.0675	0.1187**	0.0522	0.1782*
	(0.0183)	(0.0504)	(0.0744)	(0.0533)	(0.0827)	(0.0996)
Country-Fixed-Effects	YES	YES	YES	YES	YES	YES
Time-Fixed-Effects	YES	YES	YES	YES	YES	YES
Observations	1,411	1,411	1,411	1,411	1,411	1,411
Number of country_id	73	73	73	73	73	73
χ^2	28450***	1189***	910.2***	14422***	2392***	1469***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(1)	-4.188***	-3.440***	-2.846***	-3.895***	-3.189***	-4.520***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(2)	1.964**	0.592	1.789*	1.413	1.552	0.552
	[0.05]	[0.55]	[0.07]	[0.16]	[0.12]	[0.58]

Note: Heteroskedasticity and autocorrelation robust standard errors in parentheses; p-values in brackets. Instruments are restricted to 2 lags to minimize instrument count. Endogenous variable is the lagged dependent variable. First order serial correlation in first-differenced residuals (AR(1) significant) with no second order serial correlation (AR(2) insignificant) supports the claim that instruments for the System-GMM models are valid. *, ** and *** indicate significance at 10%, 5% and 1% level, respectively.

Table A.6: U-shaped Suicidal Kuznets Curve? Male population

	(1) all	(2) 15-24	(3) 25-34	(4) 35-54	(5) 55-74	(6) 75+
Lagged Dep. Var.	0.9929***	0.4523***	0.4802***	0.9235***	0.7339***	0.4754***
	(0.0365)	(0.0797)	(0.1262)	(0.0403)	(0.0939)	(0.0938)
Per Capita Income	-4.8041	13.0133	26.1023*	-6.8187	-2.8473	39.9132*
	(4.3920)	(8.5785)	(14.4900)	(12.3257)	(18.4420)	(23.9427)
Per Capita Income^2	0.2673	-0.6163	-1.3981*	0.3819	0.0115	-1.9337
	(0.2384)	(0.4690)	(0.7875)	(0.6799)	(1.0001)	(1.4616)
Growth	-8.0539**	-2.5804	-8.5781*	-16.8803**	-15.1422**	-6.8732
	(3.3205)	(1.7280)	(4.9978)	(7.7110)	(6.9605)	(7.0812)
Unemployment	0.0308	0.1372**	0.2070**	0.0133	0.0724	0.0367
	(0.0399)	(0.0646)	(0.0954)	(0.0848)	(0.0854)	(0.1479)
Fertility	-0.8214**	-2.9150***	-2.6058*	-1.3625**	-2.5988*	-3.1278
	(0.4052)	(0.8681)	(1.4093)	(0.6680)	(1.3659)	(3.1044)
Life Expectancy	-0.1049	-0.5392***	-1.0787***	-0.3011	-0.2894	-0.1426
	(0.1284)	(0.1735)	(0.3628)	(0.2358)	(0.3772)	(0.4860)
Urban Population	-0.0116	0.1436	0.1304	0.1888*	0.0543	0.4995***
	(0.0381)	(0.1093)	(0.1122)	(0.0973)	(0.1384)	(0.1774)
Country-Fixed-Effects	YES	YES	YES	YES	YES	YES
Time-Fixed-Effects	YES	YES	YES	YES	YES	YES
Observations	1,411	1,411	1,411	1,411	1,411	1,411
Number of countries	73	73	73	73	73	73
χ^2	41219***	979.5***	1447***	11816***	2538***	760.7***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(1)	-4.667***	-3.432***	-2.787***	-3.984***	-3.228***	-3.979***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(2)	1.266	0.685	1.606	1.396	1.647*	0.0943
	[0.20]	[0.49]	[0.11]	[0.16]	[0.10]	[0.92]

Note: Heteroskedasticity and autocorrelation robust standard errors in parentheses; p-values in brackets. Instruments are restricted to 2 lags to minimize instrument count. Endogenous variable is the lagged dependent variable. First order serial correlation in first-differenced residuals (AR(1) significant) with no second order serial correlation (AR(2) insignificant) supports the claim that instruments for the System-GMM models are valid. *, ** and *** indicate significance at 10%, 5% and 1% level, respectively.

Table A.7: U-shaped Suicidal Kuznets Curve? Female population

	(1)	(2)	(3)	(4)	(5)	(6)
	all	15-24	25-34	35-54	55-74	75+
Lagged Dep. Var.	0.8303***	0.4990***	0.2400**	0.6134***	0.5826***	0.6009***
	(0.0429)	(0.0435)	(0.0984)	(0.0583)	(0.0940)	(0.0810)
Per Capita Income	0.4517	-0.3145	8.1537	4.8661	1.1323	2.7854
	(1.5525)	(3.3591)	(5.8838)	(3.6336)	(6.9685)	(15.1322)
Per Capita Income^2	-0.0099	0.0349	-0.4888	-0.2659	-0.1050	-0.2130
	(0.0827)	(0.1972)	(0.3393)	(0.2085)	(0.3931)	(0.8752)
Growth	-1.5718*	-3.2142***	-0.4705	-1.8929*	-2.9453	-2.6901
	(0.8675)	(1.1767)	(1.3611)	(1.0855)	(2.5839)	(2.9683)
Unemployment	0.0111	0.0403	0.0145	0.0183	0.0096	-0.0296
	(0.0078)	(0.0345)	(0.0248)	(0.0226)	(0.0242)	(0.0539)
Fertility	-0.3980**	-0.7005	-0.1063	-0.3784	-0.8713**	-1.6486
	(0.1860)	(0.4638)	(0.4325)	(0.2901)	(0.4258)	(1.0957)
Life Expectancy	-0.0120	-0.1940	0.1097	0.0323	0.0006	0.0502
	(0.0332)	(0.1398)	(0.1822)	(0.0580)	(0.0843)	(0.2352)
Urban Population	0.0003	-0.0563**	0.0517	0.0515*	0.0717*	0.0552
	(0.0109)	(0.0262)	(0.0581)	(0.0284)	(0.0379)	(0.0658)
Country-Fixed-Effects	YES	YES	YES	YES	YES	YES
Time-Fixed-Effects	YES	YES	YES	YES	YES	YES
Observations	1,411	1,411	1,411	1,411	1,411	1,411
Number of countries	73	73	73	73	73	73
χ^2	2763***	845.5***	405.0***	1220***	1274***	969.5***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(1)	-3.755***	-2.909***	-2.664***	-3.543***	-3.869***	-3.599***
	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]
AR(2)	2.122	0.886	0.979	0.774	0.709	1.342
	[0.03]	[0.37]	[0.33]	[0.44]	[0.48]	[0.18]

Note: Heteroskedasticity and autocorrelation robust standard errors in parentheses; p-values in brackets. Instruments are restricted to 2 lags to minimize instrument count. Endogenous variable is the lagged dependent variable. First order serial correlation in first-differenced residuals (AR(1) significant) with no second order serial correlation (AR(2) insignificant) supports the claim that instruments for the System-GMM models are valid. *, ** and *** indicate significance at 10%, 5% and 1% level, respectively.