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Economics of Suicide: Does Level of Development of Countries Matter?

Name student: Olena Krynina

Student ID number: 451244

Supervisor: Paul Bose

Second assessor:

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"Economics are the method; the object is to change the soul"

Margaret Thatcher

Introduction

According to the evidence provided by the World Health Organization (2018), every year 800 000 people all over the world commit suicide, meaning one person dies from self-harm every 40 seconds. Suicide is one of the most controversial and difficult to study phenomena, due to its deep psychological causes and the inability to reach people, who were affected by it. There exist multiple ways of explaining the reasons that lead to one's decision to commit suicide. This paper is going to address an economic component of suicide. Various studies have investigated the relationship between numerous socio-economic factors and suicide rate in different countries. However, as will be shown in theoretical framework, the results of these studies are quite mixed. More specifically, the magnitude and direction of correlations between economic factors and suicide rates vary between developed and developing countries.

To continue the discussion, it is important to clarify, what is meant by developed and developed countries throughout this paper. According to Eckersley (2010), development or progress is usually judged based on the wealth and health of the population. Zhang et al. (2010) mention in their work that economic development is often followed by industrialization and urbanization, more labor force participation and jump in Gross Domestic Product (here: GDP). In addition, development and economic growth are also associated with lower poverty, more advanced infrastructure in cities, strong military and security systems and a higher standard of living. All the aforementioned characteristics of developed countries are strongly correlated with how rich the country is. It is indeed hard or even impossible to achieve better quality of life, fight poverty, crime and guarantee access to high-quality education or medicine without considerable financial inputs. Thus, the classification of countries in this paper is based on the classification performed by Development Policy and Analysis Division of the Department of Economic and Social Affairs of the United Nations Secretariat, who separated countries into three groups: developed, developing and economies in transition - based on GNI per capita. This paper works with the richest (developed) and the poorest (developing) countries and uses GDP as a continuous measure of development, because GDP is one of the primary indicators of how many opportunities to achieve a higher quality of life a country has.

Getting back to how development is linked to suicide rate, Eckersley (2010) argues that the standards of living, which are typically higher in more developed countries, are not the same as the quality of one's life. Moreover, he discusses a hypothesis that assumes that for every society there is a point, where progress and economic development start to lower wellbeing and happiness. A possible explanation is that after satisfying the basic desires of a modern person, such as stable income or feeling of safety, an individual faces more complex psychological needs, such as need of self-actualization and overestimated future expectations. However, if those needs and expectations are unmet, the feeling of despair and dejection grows, leading to more suicidal thoughts, despite improved living conditions (Dolan, Peasgood & White, 2008). Nonetheless, there is not enough evidence showing that the level of development determines differences in impact of economic factors on wellbeing proxied by suicide. The point is that the existing researches studied only one side of the problem, meaning developed or developing countries in isolation. Also, the choice of countries is usually limited to OECD countries and much less evidence is provided on developing countries. With regards to this, the target of this research is to find out, if there are differences in influence of various economic factors on level of suicide between developed and developing countries. So, the central research question is the following: **How do the effects of major socio-economic factors on the rate of suicide differ among countries according to their levels of development?** The method used to study this research question is estimation of an OLS regression with fixed effects, with suicide rate as dependent and various socio-economic factors as independent variables, which account for the level of development when calculating regression coefficients by interacting main variables of interest with the chosen measure of development – GDP per capita. This study shows that unemployment significantly increases suicide rate for low levels of GDP, and significantly decreases suicide rate for high levels. Moreover, GDP significantly decreases the suicide rate in developing countries, and increases it in developed ones. The effect of female labor force participation on suicide rate is found to be significantly positive and diminishing with a rise in GDP. The effects for these three variables are in line with the theoretical predictions discussed in the next section. Finally, the effect of the GINI index is found to be mostly insignificant, but negatively influencing suicide rate for low levels of development, and positively for high levels, which does not go in line with theoretical predictions about income inequality.

This research differs from the previous studies, as it considers a large sample of developed (35) and developing (30) countries throughout a time span of 18 year and many control variables. After obtaining regression coefficients and their changes according to the level of development of a country, the level of development, captured by GDP per capita indeed influences the direction of the relationships between main variables of interest and suicide rate. A possible explanation lies in several distinctive features that are typical for less or more developed countries. For example, different perception of wealth and richness (Eckersley, 2002), life-improving versus health-destructing effect of employment (Gerdtham & Ruhm, 2006), overstated expectations (Dolan et al, 2008) or individualism (Eckersley & Dear, 2002). It is socially important to determine, if the differences in how economic forces affect suicide rate do really depend on the level of development of countries. This would allow to construct economic and social policies aimed at improvement of wellbeing more accurately. For example, in less developed countries the level of wellbeing is heavily dependent on income obtained through employment and there is little social support or small unemployment benefits. Therefore, one of the primary policy actions should be to develop labor markets, introduce retraining programs to facilitate the process of changing employment, and stimulate entrepreneurship that will create more working places. On the other hand, in developed industrialized countries, harmful ecological conditions or stress and burnout at work become a primary reason of deterioration of health. In this case, it is important to improve working conditions, and introduce mandatory health checks that will be aimed at preventing physical exhaustion and mental breakdowns.

Suicide rate is the center of attention of this paper as a proxy of wellbeing of a nation. One of the primary functions of economics is to serve as an instrument to guarantee personal wellbeing for each and every citizen of a certain country. However, measuring wellbeing is not an easy task, since ‘happiness’ or ‘welfare’ are quite abstract terms. For example, Dolan, Peasgood and White (2008) work with a measure of social happiness described by Subjective Wellbeing (SWB) and define the most important economic factors affecting it as: absolute and relative income, unemployment, education, income inequality, inflation and urbanization. Nevertheless, the term ‘subjective wellbeing’ relies more on mood and feelings, not on facts and actions. Suicide, by contrast, is an action, which allows economists to measure and analyze it empirically. Hamermesh and Soss (1974) argue that because suicide is a voluntary choice, it is a critical point of one’s life and an important indicator of the living conditions surrounding an

individual, including economic factors. As economists, we are interested in ways to improve welfare. And because self-harm is responsible for around 1.4% of deaths worldwide (World Health Organization, 2018), it may help to identify, which aspects of living conditions, which are under control of economists, lead to dissatisfaction and willingness to end one's life.

In the context of wellbeing proxied by suicide rate, it is important to discuss central factors, which were found to be important for individual welfare. To begin with, it is necessary to discuss income. From the literature review constructed by Dolan et al. (2008), income is considered to have a positive impact on wellbeing. However, this effect potentially suffers from reverse causality, as a higher level of happiness in the past contributes to the ability to earn more money due to more stable psychological conditions. The work by Graham (2005) supports the idea that income has a connection to happiness, however, he argues that money is not everything, and judging one's wellbeing in absolute monetary terms would be erroneous. Also, he mentions that happiness increases together with income, but does not go over a certain threshold. With regards to the fact that income is more important in a within-countries comparison, the idea is that income should be complemented by other factors related to happiness. Easterlin (1973) adds to this discussion by studying the question of "Would the money make you happier" through analysis of historical cases and long time-span experiments. The surprising result he finds suggests that, if income rises throughout the life-period, it does not always involve a rise in one's happiness. This suggests that not only absolute, but relative income matters for a feeling of satisfaction and happiness. An example of similar approach is found in the work of Dolan et al. (2008), who argue that average wellbeing levels remain unchanged, when all members of a community receive the same proportional increase in income. Similarly, Graham (2005) claims that income inequality improves happiness for rich people but reduces it for poor. The reason is that inequality in poor countries strengthens feeling of injustice and dissatisfaction, but in rich societies some degree of inequality is favored due to more space for opportunities and further improvement of living conditions. The same author emphasizes an additional factor that those who escape poverty face a higher fear of failure, from which arises a negative effect of income on wellbeing.

Turning to other economic factors, it is important to talk about inflation and unemployment. These are usually analyzed together with each other, as, from macroeconomic

theory, expansion in an economy is followed by rising inflation, but lowered unemployment. The opposite holds for recessions (Burda & Wyplosz, 2017). Graham (2005), for example, claims that both variables have a negative impact on happiness, however, the effect of unemployment is considerably larger. Similar evidence is suggested by Dolan et al. (2008) provide evidence that unemployment decreases one's happiness, because during the period of unemployment, one becomes less productive, less motivated and loses skills needed to obtain a job again. Furthermore, education is broadly found to be positively associated with wellbeing, however, the effect can go through some other channels, for example, improved career opportunities and positive personality traits such as motivation and persistence (Dolan et al., 2008). Finally, urbanization seems to have an influence on happiness. Dolan et al. (2008) find that people living in rural areas are typically happier than those living in cities. Consequently, it might be useful to mention a hypothesis described by Graham (2005). It states that lower happiness can be explained by the fact that after satisfying all the basic needs of the individual (which is more likely to be the case in large developed cities or countries), a certain focal point for individual happiness is set. A person returns to this point of private subjective happiness after some time, without regards to the events that happened in his or her life.

To sum up, it goes without saying that the only way to improve the welfare of a larger number of people is by carefully analyzing channels of influence of various factors surrounding humans and their lives. Moreover, it is important to find out, which factors gain or lose significance, or change the direction of their effects throughout the process of development of a society. With regards to this, a huge social relevance of this paper lies in understanding, to which degree economic changes and trends can negatively affect wellbeing, leading to self-induced harm.

Theoretical Framework

In order to analyze the central research question, several hypotheses are going to be introduced, and supported by the existing literature that studied the influence of various economic factors on suicide rate in developed and developing countries.

The motivation to separate the effects of economic factors on suicide rate in developed and developing countries refers to cultural qualities that are typical for countries, which achieve higher level of development. For example, Eckersley and Dear (2002) test a hypothesis of correlation between suicide among young people and several socio-economic and cultural factors inherent to Western countries. Their central assumption concerns a failure of Western society to provide appropriate support for an individual's need for self-actualization. The authors show that suicide is significantly correlated with several cultural factors, such as life satisfaction, social connection and individualism. The last one is found particularly important for developed OECD countries, as after obtaining individual freedom and independence, people are more likely to choose to die due to an increased feeling of self-autonomy, as well as self-blaming, and absence of social ties. Suicide is seen as an unfortunate consequence of obtaining control over one's life. When it comes to economic determinants of suicide, the authors point out one significant negative correlation with suicide rate – unemployment.

Hamermesh and Soss (1974) also argue for unemployment being one of the major economic determinants of suicide. They find a positive relation between unemployment and suicide rate, which is explained through theory of expected income. In fact, when unemployment hits an individual, his or her expectations about future utility are lowered. In addition, if unemployment lasts for longer, the skills and qualifications of an employee suffer, diminishing his or her opportunities to find a job again. In support to this, Haw, Hawton, Gunnell & Platt (2015) associate unemployment during recessions with a loss of social status, enormous amount of stress, increase in anxiety, depression, aggression and self-reproach, followed by alcohol and drug abuse. Such a psychological state is likely to be followed by suicide. Similarly, Weyerer and Wiedenmann (1995) found that unemployment is positively influential on suicide rate, explained by the fact that economic conditions affect mostly people without income, so, the unemployed. Moreover, Oswald (1997) finds that mental distress is twice as common for

unemployed people. This is not only because of loss of income, but because of a shock due to losing work, leading to a twelve times larger chance of committing suicide. At the same time, Noh (2009) finds an unusual tendency for developed countries. The surprising result connects the effect of unemployment with the level of income in those countries. The author shows that unemployment increases suicide rate for lower income but decreases it for higher-income countries. In support to that, Gerdtham and Ruhm (2006) found that while mental health deteriorates from stress, physical health might be improved as a result of unemployment, leading to lower suicide rate. These somewhat contradictory views give grounds for the first hypothesis to be tested in this research. **Hypothesis 1:** ***Unemployment has a positive effect on suicide rates for all countries, but for higher levels of development, unemployment begins to lower the suicide rate.***

An economic theory of suicide is valueless unless it considers the impact of GDP and GDP growth. According to the classification made by the United Nations Secretariat, GDP is a central measure of development of a country, which is used to separate countries into three groups: developing, economies in transition and developed. This paper will not use any thresholds to distinguish between the types but will use GDP as a continuous variable to track changes in influence of other economic variables and GDP itself on suicide attached to different levels of GDP.

GDP per capita is a good approximation of the average income of the population. Income is highly important for determining one's wellbeing, as well as willingness to commit suicide. For example, Hamermesh and Soss (1974) found that permanent income has a stable negative effect on suicide rate for most of the age groups studied. This is explained by the fact that in most cultures, material wealth is a primary indicator of wellbeing. When it comes to developing countries, a case of China discussed by Zhang et al. (2010) shows that a decreased rate of suicide in both urban and rural areas in the past few decades is correlated with significant economic development and growth. In China, the positive consequences of economic growth such as improved living conditions, dominate negative consequences, such as "value conflict" or "discrepancy between aspiration and reality" (Zhang, 2010, p. 162). Economic growth in this paper implied an increased range of opportunities, lower unemployment rates and more wealthy population. Moreover, Weyerer and Wiedenmann (1995) found that when real income drops, the

purchasing possibilities of people are reduced, pursuing them to live in worse conditions and feel more depressed. However, the view of the authors suggests that not only recessions are harmful for general wellbeing, but also prosperity may have an adverse effect. They argue that wellbeing raises expectations, which may bring substantial disappointment, if being unmet. In line with these findings, Ruhm (2000) claims that recessions, contrary to development, may have positive effect on health. He provides a few reasons, why physical and mental health declines in periods of upturns. For example, health is an input into working process. Stress, physical exhaustion and pollution are associated with developed nations and high GDP rates, causing more severe health problems, that can lead to suicidal behavior. Noh (2009) also mentions that in industrialized countries people are not becoming happier over time, despite further development and income growth. In addition, according to his findings, the suicide rate rises with an increase in GDP and its growth. Finally, Yang, Lester and Yang (1992) argue that rising GDP signals economic growth, technological development and boost of quality of life. However, they find that, in the United States, it is it associated with higher suicide rates. The authors discuss their vision on this phenomenon, namely with regards to the fact that as modern society becomes ever more characterized by an intensified separation of the individual from community and more stress due to a faster pace of life, a free choice of suicide is made more easily. From all the above, the second hypothesis is formulated. **Hypothesis 2:** ***GDP and GDP growth are expected to have a negative effect on suicide rates for countries in a process of economic development or lower-income countries, however, they are expected to have an adverse effect, when the country is already rich and developed***.

The question of why the growth in GDP may not always constitute higher wellbeing might be studied through the notion of relative income. For example, referring to Noh (2009), who found that increase in average income on the country level is not followed by increase in overall happiness, however, if individual income rises, with respect to others, this does bring additional happiness. Dolan et al. (2008) explain this phenomenon by claiming that the effect of relative income dominates the effect of absolute. Therefore, it is possible to assume that too much equality in society is detrimental for the level of happiness and might lead to suicidal behavior. Nevertheless, it is necessary to consider that equality works in different directions for developed and developing countries, as mentioned by Graham (2005). He found that in developing countries the problem of inequality is felt much stronger due to higher poverty and a

larger gap between rich and poor. At the same time, in Europe and the US inequality does not matter that much, or is even seen as an opportunity, leading to more satisfaction and boosting happiness. Findings of Dolan et al. (2005) are in line with this statement, showing that the perception of inequality differs among countries and, for example, in the US inequality is a driver of mobility, which is generally favored by the population. Therefore, the third hypothesis of this research will check these different perceptions of inequality. **Hypothesis 3:** ***income inequality increases suicide rate; the effect diminishes or becomes negative for countries with higher level of development.***

Lastly, it goes without saying that one of the features that follows the process of development and economic growth is an increase in employment, particularly, among women. The theory developed by Noh (2009) assumes that lower female labor force participation is a guarantee of social and family ties that bring society together. However, in rich and developed countries, unemployment among women can also be associated with a feeling of loneliness and lower self-appreciation. Consequently, the last hypothesis to be inspected in this study is the following: **Hypothesis 4:** ***Female labor force participation is positively associated with suicide rate for lower levels of economic development and negatively for higher levels.***

Data

In this section a description of the data used to construct this research is presented. The main variables of interest, as well as additional control variables and the predicted correlations with suicide rate, are going to be listed. The central question of this research is: How do factors characterizing the economic wellbeing of countries affect suicide rate, and do these effects differ between countries at varying stages of development? To study this issue, the annual data from 1990 to 2016 on 35 developed and 30 developing countries from all around the world is studied. The countries are classified into developed or developing based on GNI by the Department of Economic and Social Affairs of the United Nations Secretariat. The outcome variable is the suicide rate – number of suicides per 100 000 of population of a certain country. This variable is obtained by dividing the number of suicides, retrieved from the World Health Organization Mortality Database, by population over 100 000, obtained from the World Bank Datasets. As can

be seen from Table 1, the average suicide rate is considerably larger in developed countries. An important aspect to mention about suicide is a difference in time trends between developed and developing countries. Graphs 1 and 2 depict the average number of suicides each year for developed and developing countries. The trends are completely different: the average number of suicides in developed countries rises initially and goes down almost over the whole period of observation. However, even the lowest average suicide rate in developed countries is still higher than the average rate in developing countries over the whole timespan. The trend for suicide rate in developing countries shows a large jump between 1991 and 1993 and a lot of deviation afterwards, but the average number stays around 7,5.

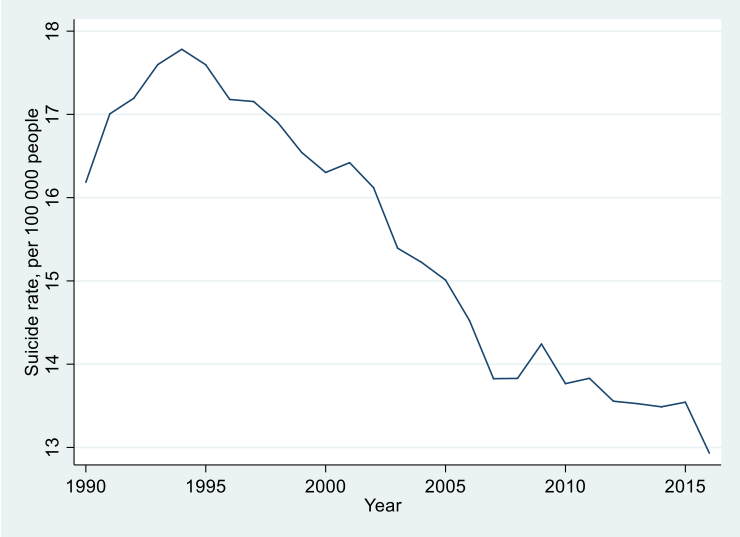

Figure 1: Suicide rate in Developed countries

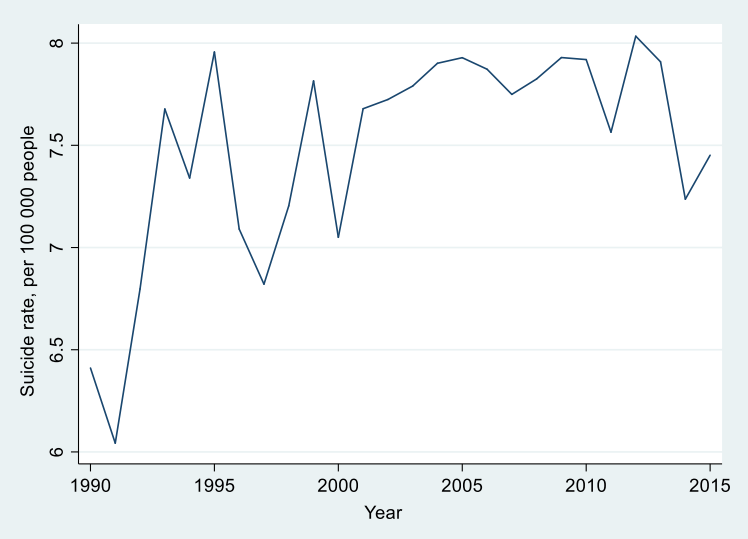

Figure 2: Suicide rate in Developing countries

The hypotheses announced before and the assumed correlations are going to be studied with the following data: Following a procedure of Noh (2009), the level of development is going to be proxied by GDP per capita – Gross Domestic Product, in order to account for differences in effect of the variables listed below on suicide rate. GDP is measured in US dollars. Data is retrieved from the World Bank national accounts data and OECD national accounts files. GDP is considerably larger in developed countries. GDP growth rate was obtained by subtracting GDP in the previous period from current GDP and dividing by GDP in the previous year. GDP growth rate is much higher in developing countries.

The relationship between GDP and suicide rate also varies notably between developed and developing countries. The red solid line shows quadratic relationship between GDP and suicide rate, which is convex for developed and concave for developing countries. In case with developed countries, the graph shows a decrease in variance of suicide rate with a rise in GDP, moreover, suicide has a decreasing pattern with rise in GDP. However, when GDP reaches approximately 60000$, suicide remains more-or-less stable or, according to a quadratic line – increases. Suicide rate in developing countries increases at the beginning until GDP reaches ~20000$ but has a decreasing trend later most of the time while GDP rises.

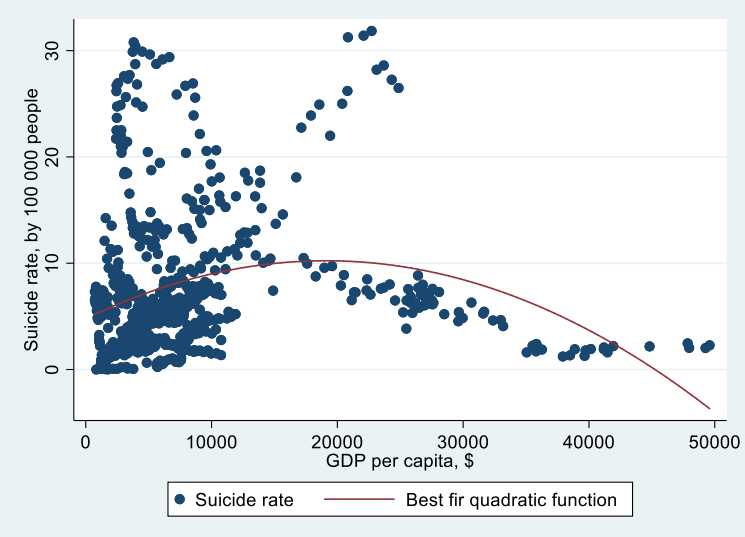

Figure 3: Suicide rate by GDP in Developed Countries.

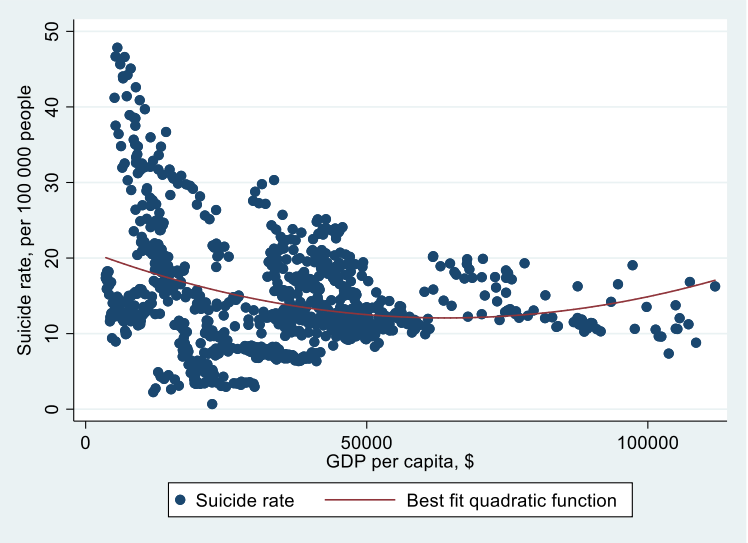

Figure 4: Suicide rate by GDP in Developing Countries

The data on unemployment rate is taken from the database of International Labor Organization. The average unemployment rates do not differ much between developed and developing countries. The data on income inequality, captured by GINI index is retrieved from the World Bank datasets. Income inequality is considerably higher in developing countries. The estimates for female labor force participation are taken from the World Bank data, and it can be seen from a summary table that there are more working women in developed countries.

Table 1: Summary statistics (mean, standard deviation)

Variable	Developed	Developing
GDP per capita, US$	34428,37 (21255,55)	8234,053 (8517,885)
Child mortality, %	35,751 (27,845)	33,481 (31,727)
Life expectancy, years	71,794 (6,586)	70,723 (6,171)
Education, %	93,378 (13,975)	92,738 (12,05)
Crime rate, per 1000 people	6,375 (6,375)	6,757 (6,79)
Inflation, %	12,831 (79,319)	27,782 (195,53)
GINI index	30,738 (4,287)	45,485 (9,348)

Unemployment, %	8,238 (4,262)	7,336 (5,397)
Poverty headcount, %	9,93 (9,93)	31,272 (21,148)
GDP growth, 0,01%	0,021 (0,033)	1,478 (40,592)
Female labor force participation, %	51,595 (7,994)	47,295 (9,818)
Suicide rate, per 100 000 people	15,51 (8,021)	7,708 (8,46)

Note: Standard errors reported in parentheses.

Next, there are several control variables added to the estimated models, which are supposed to increase robustness of the results. For example, according to Dolan et al. (2008), inflation lowers life satisfaction of the population and may cause higher suicide rates. The data on inflation rates is available on the website of International Monetary Fund and International Financial Statistics. It is seen that inflation rate is much higher in developing countries. Further, data on poverty rates is retrieved from the OECD Datasets. The poverty rate is a sign of how well the social welfare and social security systems in a country operate and is found to be much higher in developing countries. According to Haw et al. (2015), sufficient welfare spending minimizes negative consequences of recessions and prevents suicidal behavior caused by unemployment and insufficient income. Therefore, poverty is predicted to increase suicide rate. Child mortality rate is added as a control variable too. It is predicted that high child mortality is a sign of poor healthcare and leads to a depressive mood of the population (Dolan et al., 2008) and, as a result, higher suicide rates. Life expectancy, as well as child mortality, is determined by healthcare and general living conditions and is expected to be negatively correlated to suicide rate. The data on these two variables is retrieved from the website of the World Bank. Next, the Education Index is retrieved, which shows the percentage of primary school enrolment, following Ruhm (2000), from the website of United Nations Development Program. It is expected to have negative effect on suicide rate by improving skills and job opportunities for people. Finally, crime rate, proxied by the number of homicides per 1000 people, is used as a sign of how well the legislative system in a country works. This is found at the website of European Statistics. According to Eckersley & Dear (2002), crime rate has a negative association with suicide rate. Average indexes of life expectancy, child mortality, education and crime rate do not differ significantly between developed and developing countries.

Methodology

In this section the procedure to study the research question and the hypotheses is going to be presented.

First, the correlation coefficients between the variables and suicide rates are going to be assessed and analyzed, separately for developed and developing countries. Correlations are only used to find out about the co-movements, strength and direction of the possible relations of the variables studied, but they cannot be used to argue about causality. Also, the simple correlation coefficients do not consider the presence of other factors, which determine suicide.

Therefore, the second part of the methodology is dedicated to the multivariate regression model using the Ordinary Least Squares to estimate the parameters and significance of the relationships between suicide rate and the supposed variables of influence.

First, a simple model with suicide rate as dependent variable and all explanatory variables as independent is going to be constructed. The model is as follows:

$$Y_{it} = \alpha + \beta_1 * X_{1,it} + \cdots + \beta_n * X_{n,it} + \varepsilon_{it}$$

, where Y_{it} is suicide rate in country i at time t, X_1 to X_n are the explanatory variables: GDP, GDP growth, unemployment rate, female labor force participation rate, child mortality rate, crime rate, inflation and GINI index. ε_{it} is an error term.

Obviously, this naïve model cannot capture differences in relationships between suicide rate and the main explanatory variables for countries with different levels of development. Therefore, the interactions of the main variables of interest: unemployment, GDP, GINI index and female labor force participation, are going to be added to this simple model. This model is:

$$Y_{it} = \alpha + \beta_1 * X_{1,it} + \cdots + \beta_n * X_{n,it} + \delta_1 * X_{1,it} * GDPpercapita_{it} + \cdots + \delta_5 * X_{4,it} * GDPpercapita_{it} + \varepsilon_{it}$$

, where X_1 to X_4 are the variables, that will be interacted with GDP per capita.

In order to account for the time trend in suicide rate and for all unobserved time-invariant characteristics of the countries studied, the models above are going to be extended to include fixed effects for years and countries. This model is more reliable, since it allows to consider more unobserved variables that might influence suicide rate, so they won't cause a bias to the

obtained coefficients. Therefore, it is possible get closer to the true coefficients of the variables of interest. The model with interactions with GDP and fixed effects looks as follows:

$$Y_{it} = \alpha_t + \beta_1 * X_{1,it} + \cdots + \beta_n * X_{n,it} + \delta_1 * X_{1,it} * GDPpercapita_{it} + \cdots + \delta_5 * X_{5,it} * GDPpercapita_{it} + \mu_i + \varepsilon_{it}$$

, where α_t captures year-specific effects and μ_i captures unobserved country-specific effects.

The biggest problem that accompanies the method chosen to construct this research is omitted variable bias. Omitted variables are those, which influence the dependent variable and are correlated with independent. They bias the coefficients produced by a regression and lead to incorrect conclusions. For example, an abstract term as level of happiness would surely determine suicide rate and be correlated with GDP or unemployment rate, however, it is impossible to measure happiness and express it through numbers. Feeling of happiness would obviously have an adverse effect on suicide rate and a positive correlation with GDP. Therefore, the effect of GDP in a regression without a measure of happiness would be overestimated. In order to address the problem of omitted variables, multiple controls were added into regression. The omitted variables are captured by the error term in the models presented above.

Extension

In order to see, if the differences in effects of various socio-economic factors on suicide rate in more and less developed countries go beyond the main aforementioned hypotheses, an extension of the model is going to be presented. It will include interactions of all explanatory variables with GDP and serve as an incentive to further research the topic of this paper. The model appears as follows:

$$Y_{it} = \alpha_t + \beta_1 * X_{1,it} + \cdots + \beta_n * X_{n,it} + \delta_1 * X_{1,it} * GDPpercapita_{it} + \cdots + \delta_n * X_{n,it} * GDPpercapita_{it} + \mu_i + \varepsilon_{it}$$

, where all terms are interpreted as before.

Results

In this section the main empirical results are going to be presented, following the methodology.

First, the correlation coefficients between all independent variables and suicide rates are presented in a table below. The correlation coefficients are presented separately for two different levels of development, and they already suggest some interesting results. Most of the coefficients for the main variables of interest are different in sign for developed and developing countries. For example, GDP has negative association with suicide rate for developed, while, surprisingly, positive association for developing countries, however, the magnitude is quite low. GDP growth is, by contrast, moderately positively correlated with suicide rate in developed and moderately negatively in developing. Unemployment is moderately positively associated with suicide rate for developed countries, while moderately negatively for developing. In addition, female labor force participation is weakly negatively associated with suicide rate for developed and moderately positively for developing. Only GINI index for both types of countries is negatively associated with suicide rate.

Almost all the correlation coefficients for other control variables, such as life expectancy, education, crime rate, inflation and poverty rate, also change their sign between developed and developing countries. Child mortality does not change the sign.

Table 2: Correlation coefficients for variables of interest with suicide rate

Variable	Developed	Developing
GDP per capita	-0,4363	0,0475
Child mortality	-0,042	-0,073
Life expectancy	0,0142	-0,1353
Education	-0,2645	0,1417
Crime rate	-0,0421	0,2685
Inflation	0,2155	-0,025

GINI index	-0,2552	-0,4553
Unemployment	0,2535	-0,129
Poverty headcount	0,434	-0,2681
GDP growth	0,2263	-0,2761
Female labor force participation	-0,0887	0,3957

Now, the focus is on the coefficients produced by the 4 main and 2 additional regressions. The results can be found in a table below. First thing to mention is that the results for the main variables of interest vary considerably in terms of sign, magnitude and significance along the 4 main models. However, it is important to mention that the most trustworthy model, from the main ones, is the 4th one, which considers the interactions between GDP and 5 central variables of interest, and accounts for the time- and country-specific effects. This model is the best one, because it considers the biggest number of effects, allowing to minimize the bias due to omitted variables and make the predictions close to the true effects within the available dataset. Moreover, this model has the highest predictive power out of the 4 main models, at 97,8%.

Table 2: Regression Results of Suicide Rate on Control Variables

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model Simple	Model Simple FE	Model GDP	Model GDP FE	Model Extended	Model Extended FE
GDP per capita	0.000197*	-0.000094***	0.000325	-0.00103***	-0.00283***	-0.000652
	(0.000112)	(3.44e-05)	(0.000329)	(0.00036)	(0.00091)	(0.000616)
Child mortality	-0.166***	-0.183***	-0.208***	-0.146***	-0.401***	-0.0928*
	(0.043)	(0.061)	(0.066)	(0.043)	(0.125)	(0.0529)
Life expectancy	-0.781***	-0.377**	-0.447**	-0.679***	-1.023***	-0.722***
	(0.171)	(0.155)	(0.199)	(0.171)	(0.368)	(0.234)
Education	-0.0314	-0.347***	-0.358	-0.315***	-0.595***	-0.0321
	(0.0266)	(0.086)	(0.085)	(0.027)	(0.150)	(0.0421)
Crime rate	0.0969	0.289**	0.268**	0.0571	0.155	0.231
	(0.0979)	(0.115)	(0.134)	(0.0951)	(0.188)	(0.168)
Inflation	-0.0375	0.00178	-0.0121	-0.0293	0.0161	-0.00210
	(0.0264)	(0.07470)	(0.0635)	(0.0256)	(0.0832)	(0.03150)
GINI index	0.0920	-0.419***	-0.352**	-0.0161	-0.338**	-0.00838
	(0.0644)	(0.083)	(0.154)	(0.0757)	(0.130)	(0.07200)
Unemployment rate	0.242	0.220***	0.604	0.0586***	0.641**	0.00209
	(0.063)	(0.171)	(0.214)	(0.1090)	(0.256)	(0.11300)
Poverty headcount ratio	0.153***	-0.0681	-0.0716	0.0942**	-0.105	-0.0551
	(0.030)	(0.0687)	(0.0749)	(0.0365)	(0.103)	(0.0515)
Female labor force participation	0.0134	0.0741*	0.138	0.134*	0.160	0.166
	(0.0853)	(0.0538)	(0.106)	(0.127)	(0.112)	(0.128)
GDP growth	9.656**	1.286	-29.37	7.430	-16.77	-2.168
	(4.408)	(13.350)	(18.67)	(5.040)	(18.96)	(5.327)
GDP per capita # GDP per capita			0.000000001	0.00000001***	0.0000000004	0.000000006
			(1.88e-09)	(3.51e-09)	(2.25e-09)	(3.75e-09)
Child mortality # GDP per capita					0.000007*	0.000003*
					(3.68e-06)	(2.24e-06)
Life expectancy # GDP per capita					0.00002**	0.0000009
					(1.01e-05)	(6.82e-06)
Education # GDP per capita					0.00001***	-0.0000003
					(3.97e-06)	(1.35e-06)
Crime rate # GDP per capita					0.000002	-0.000008
					(6.55e-06)	(3.81e-06)
Inflation # GDP per capita					-0.0000002	-0.000005
					(9.21e-06)	(3.78e-06)
GINI index # GDP per capita			0.000005	0.000008	-0.000001	0.000008**
			(4.80e-06)	(3.48e-06)	(4.82e-06)	(3.51e-06)
Unemployment rate # GDP per capita			-0.00002	-0.000002**	-0.000021*	0.000001
			(8.80e-06)	(4.23e-06)	(1.11e-05)	(4.17e-06)
Poverty headcount ratio # GDP per capita					0.000012***	0.000024***
					(3.52e-06)	(6.94e-06)
Female labor force participation # GDP per capita			-0.000004	-0.0000003*	-0.000002	-0.0000004
			(3.43e-06)	(3.99e-06)	(3.45e-06)	(4.01e-06)
GDP growth # GDP per capita			0.00172**	0.000147	0.000945	0.000228
			(0.000670)	(0.000197)	(0.000666)	(0.000199)
Constant	62.12***	88.97***	88.99***	69.74***	155.80***	63.17***
	(15.25)	(15.80)	(15.14)	(16.00)	(31.28)	(19.67)
Country Fixed Effects	-	YES	-	YES	-	YES
Year Fixed Effects	-	YES	-	YES	-	YES
R-squared	0.430	0.975	0.479	0.978	0.542	0.981

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In terms of the hypotheses, the results show mixed outcomes. The first hypothesis assumed a positive effect of unemployment on suicide rate on the low levels of development of the countries and a negative effect on highest. Unemployment showed results, which are consistent with the theoretical predictions throughout all models, however, only in the models, that include country and year fixed effects, the coefficients of unemployment are significant. For example, a model with interactions and fixed effects predicted that one percentage point of unemployment significantly increases suicide rate by ~0,06; however, when GDP becomes larger than 30 000, the effect of unemployment on suicide rate becomes negative. This is a sound conclusion, as employment is one of the main sources of income, which is crucial for survival and wellbeing. Without income produced by employment a person is unable to satisfy even their basic needs and must live in poverty. A similar view is held by Zhang et al. (2010), who argue that unemployment leads to social disintegration, loss of feeling of stability and confidence. Similarly, Hamermesh and Soss (1974) argue that unemployment disrupts expectations of future income, negatively affects individual's self-appreciation and independence by causing dramatic differences in how a person lives and wishes to live. The findings of Oswald (1997) also support the idea that unemployed people have a greater chance to commit suicide, as they feel more unhappy and stressed due to joblessness. By contrast, a possible reason for unemployment to lower suicide rate in richer and developed countries might be an enormous amount of stress that a person gets, especially, if he or she lives in a large industrialized city. Moreover, Gerdtham and Ruhm (2006) by finding negative association between unemployment and total mortality rates argue that better economic conditions, which lead to higher employment, are also associated with various problems such as smoking, unhealthy diet, burnout at work and physical exhaustion, which cannot be a part of flourishing life. **Therefore, the first hypothesis is approved.**

The second hypothesis predicted negative impact of GDP and GDP growth on suicide rate in developing countries, but positive in developed. GDP growth and its interaction are insignificant throughout 3 of 4 main models. It only showed a significant positive result in a simple model without fixed effects. Considering that this model does not have much explanatory power, the result is not reliable. In the most complete model with interactions and fixed effects, GDP growth shows positive result, which increases with rise in GDP, however, it is insignificant, so, does not have a noteworthy impact on suicide rate within the present study. GDP itself shows positive effect on suicide rate for all countries in the models without fixed effects, however, the

predictions of the last model, which includes fixed effects and the interactions, are in line with the theoretical predictions. It shows that $1000 increase in GDP indeed significantly lowers suicide rate by 1,03 in all countries, however, the effect becomes smaller with an increase in GDP and, when GDP becomes more than $100 000, the effect becomes positive. **The result approves the second hypothesis in terms of its predictions about GDP.** It goes without saying that GDP is one of the primary indicators of wealth and development of a country. Higher GDP on individual level is a source of higher consumption expenditures, more opportunity in terms of savings and investments, access to better education, healthcare and possibility to live with more comfort. On the national level it means that a country is rich, may invest in social support and healthcare systems, infrastructure and education. Therefore, the negative effect of GDP on suicide rate in less developed countries might be explained by these reasons. This result is supported by the findings of Zhang et al. (2010), who found a negative effect of improvement in economic conditions on suicide rate in China at the end of the last century. However, according to the predictions of Eckersley (2000), Ruhm (2000), Noh (2009) and Yang et al. (1992), the present research showed that richer countries with higher GDP are associated with higher suicide rates. These surprising results might be explained by the fact that wealth does not always imply high quality of life. Despite economic freedom and improved opportunities, people face more mental and health problems related to work. Depressions, chronic fatigue and absence of time for preventive healthcare have an adverse effect on overall feeling of happiness, life satisfaction, leading to higher possibility of physical and mental disorders (Eckersley, 2000). Moreover, referring to Eckersley and Dear (2002), developed and rich countries are characterized by higher degree of individualism and weaker social ties. This enhances a feeling of loneliness, depressive moods and brings more space for intrapersonal conflicts, leading to more suicidal behavior.

The third hypothesis assumed positive relationship between inequality captured by GINI index and suicide rate in low-income countries, and smaller positive or even negative relationship for high-income countries. The theory was based on a view held by Dolan et al. (2008) and Graham (2009), who argued that rich countries tend to like inequality, while poor countries do not. It is believed that more heterogeneity in society raises interpersonal conflicts and lowers solidarity, which might cause depression, feeling of envy and self-disappointment. In contrast, rich countries typically see inequality more as a space for opportunity and mobility (Oswald, 1997), while poor countries as a source of injustice, enhancing feeling of despair and

removing incentives to work and fight for better life. (Graham, 2009). However, the results obtained by 3 out of 4 main models are completely opposite to the theoretical predictions. All except for the simplest model without fixed effects predicted that a higher GINI index, meaning higher income inequality, is associated with lower suicide rate. At the same time, the models with interactions predicted that income inequality only starts to increase suicide rate, when GDP is higher than 70 000 in a model without fixed effects and 2000 in a model with fixed effects. A possible explanation might be that the other factors, besides income inequality, are relevant in countries with low income, where people are focused on survival and do not pay attention to inequality. However, when a certain threshold in income is met, people start comparing themselves to other members of society and might get upset, if their living conditions are poorer than their neighbors'. Moreover, the effect of GINI index becomes insignificant, when adding fixed effects to the model with interactions. This further approves the idea that there exist a few unobserved factors, which are particularly relevant for one's decision to commit suicide, other than income inequality. **So, the third hypothesis is rejected.**

The last hypothesis predicted that female labor force participation is positively associated with suicide rate for low-income countries and negatively for high-income countries. The coefficients for female labor force participation and its interactions with GDP show results, which are in line with the theoretical predictions throughout all 4 models, however, they produce significant results only in models with fixed effects. In those models, a one percentage point increase in female labor force participation indeed significantly increases suicide rate by 0,134; however, the interaction with GDP shows that the impact of female labor force participation diminishes with a rise in GDP. Such findings are in line with Yang et al. (1992) and their conclusion about the US, where female labor force participation is associated with higher economic prosperity brought by development and labor market growth. However, when it comes to less developed countries, it can be argued that cultural norms and traditions play a bigger role than personal development and self-realization. In those cases, as pointed by Noh (2009), females are a guarantee of family unity and social bonds. When a role of a female changes, this might negatively affect harmony in families and might be met with disappointing suicidal statistics. **So, the fourth hypothesis is partially approved.**

Extension

In this section a more detailed explanation is given to the variables, that were not part of the theoretical framework and were not listed as the hypotheses to be checked. In two additional models all control variables were interacted with GDP per capita and included into a regression with and without fixed effects. In this case, the most reliable model is also the one which includes country- and year-specific effects, as it accounts for a larger number of unobserved variables and allows to make more precise conclusions. Unfortunately, what happened here is that the extended model with fixed effects made the coefficients of the main variables of interest, as well as their interaction, insignificant. Only the interaction of GINI index and GDP stays significant and suggests an increasing in GDP positive effect of GINI index on suicide rate. Moreover, this model, which had to be the most reliable one, shows that almost none of the additional control variables, nor their interactions, is significant. This result might be explained by a phenomenon called over controlling. When including too many control variables, which are also closely related to each other, they begin to take away the significance and crowd-out each other's causality. Besides having the highest goodness of fit, the extended model with fixed effects does not allow us to make trustworthy conclusions about which factors indeed influence suicide, and which change the direction of their effects with a rise in GDP. Therefore, further explanation will be structured around the significant results obtained by an extended model with fixed effects. In case with insignificant coefficients, an explanation to the variables will be given based on their signs and magnitudes in a main model with fixed effects.

The four main models provide stable results in terms of the direction of relationships and significance of the coefficients of the other variables, that were not interacted with GDP. However, there are several interesting results to look at in the extension of the final models. For example, the effect of child mortality and its interactions is significant in all models. A one-point increase in child mortality rate is found to have a negative impact of ~0,09 on suicide rate within an extended model with fixed effects. However, this is only true for the low levels of GDP, while in more developed countries (with GDP>30 000) child mortality increases suicide rate. The result follows the theoretical predictions, as, according to Dolan et al. (2008), children are one of the main constituents of life satisfaction and happiness, child mortality causes stronger shock and sorrow, which might be associated with more severe suicidal behavior. However, in less

developed countries, child mortality is more common and does not have such a detrimental effect on the population. Also, in the countries, where survival is more problematic due to weak healthcare systems and poverty, people are aimed more at fighting for their lives, rather than killing themselves.

One additional year of life expectancy is found to have a negative effect of 0,722 in an extended model with fixed effects on suicide rate, the interaction term in that model is insignificant. A possible explanation is that the living conditions are typically worse in poorer and less developed countries. Due to this, life expectancy there is typically lower too and, as a result, every additional year of life expectancy is a sign of improvement in medicine, welfare and prosperity, leading to lower willingness to commit suicide. With regards to the countries with highest GDP, a supporting result was obtained by Aihara and Iki (2002), who found that a proportion of elderly population is positively associated with suicide rate. Moreover, Hamermesh and Soss (1974) show that suicide indeed rises with age. The reasons for that are not only health and mental problems, which are more typical for elderly people, but also a higher sensitivity of older people to unemployment and decline in their income.

Education shows unstable results in terms of significance. The extended model with fixed effects shows insignificant coefficient for Education and its interaction. In the main model with fixed effects one additional percentage point of education shows significant negative impact on suicide rate of ~0.3. The results are approved by theory of Dolan et al. (2008). Education is a good indicator of development of society, it enriches opportunities available to people and allows for better career choices. This enhances people's happiness and helps to achieve higher standards of life. The extended model without fixed effects produces a positive coefficient for education, if GDP is higher than 60 000, which might be due to the fact that in more developed countries, where the level of education is higher, the favorable effect of education diminishes and becomes less important for suicide rate. Nevertheless, the extended model with fixed effects, does not produce significant results for education.

Poverty is found to be significantly influential in the model with main interactions and fixed effects. Its effect is in line with the theoretical predictions of, for example, Zhang et al. (2010), showing that one percentage point increase in poverty is associated with higher suicide

rate by ~0,09. Moreover, within the extended models, poverty is significant only in interaction with GDP and shows a positive impact on suicide rate, which increases in size with rising GDP. This sounds logical, as poverty, especially in a prospering society, is associated with unfavorable living conditions, mental disorders and inability to satisfy even the basic needs of an individual.

Crime rate is found to be positively associated with suicide rate in all models, however its effect is only significant in 2 out of 6 models. In these models, a one-point increase in crime rate is associated with ~0,3 increase in suicide rate. This result is approved by the theory of Dolan et al. (2008). A higher crime rate shows that people are dissatisfied with their quality of lives, it might be a sign of psychological disorders, high level of injustice or certain degree of inequality. Therefore, crime brings uncertainty, may be a cause of unemployment and even higher poverty and inequality, leading to more suicidal thoughts. Nevertheless, the effect of crime rate is insignificant in the main and extended models with fixed effects.

Lastly, inflation and its interactions in the extended models are found to be insignificant in all models estimated.

Overall, the results obtained from the extended models suggest that it might not be a good idea to overload a regression with too many controls and various interactions. It is important to carefully work-out the theoretical part of the question that is going to be studied and thoughtfully decide, which controls will help to get closer to the answer to the research question. After estimating six models, preference is given to the main model with fixed effects. It does not only have a high goodness of fit, but also has a high proportion of significant coefficients. The extended model might be used as a motivation to conduct further research with use of more interaction but considering the problem of over controlling in order to obtain more robust results for the factors that affect suicide rate in developed and developing countries.

Conclusion

In this section an answer to the research question and concluding remarks regarding the results of this research are going to be given.

The results of this study showed that the effects of various socio-economic factors that influence suicide rate are indeed correlated with the levels of development of the countries studied. Variables that decrease suicide rate in developing countries, which is rather a good sign, have diminishing or totally opposite effects for highly developed societies and vice-versa. For example, increase in GDP and decrease in unemployment lower down suicide rate in developing countries, but start to increase it in richer and developed countries. Female employment brings favorable decrease in suicide rate in more developed countries but increases it in less developed. The reasoning for such results mostly lies in the difference in living conditions that depend on the level of developed of countries and a perception of certain socio-economic phenomena by people with different living standards (Eckersley, 2002). According to the theory of diminishing marginal utility, the more an individual obtains, increasing his or her utility, the less additional happiness it brings. A similar mechanism works here. The more needs of people are satisfied, the more wealth, opportunities and wellbeing is brought to the society, and the more stable life becomes, the less precious all these things become. Moreover, development brings other problems, such as intrapersonal despairs, value conflicts, harmful comparisons among individuals, depression and loss of meaning of life (Zhang et al., 2010). After all, as argued by Eckersley and Dear (2002), development is also associated with independence and autonomy, which lead not only to a possibility to act on personal preferences, but also to a higher degree of responsibility for one's actions, successes and failures. When this feeling dominates, a person's autonomy together with the theory of individualism (Eckersley and Dear, 2002) makes him or her more vulnerable to stresses and more sensitive to problems, leading to possible suicidal thoughts.

The results of this work, of course, do not suggest that government of more developed countries should immediately stop any attempts to develop further, shut down GDP growth, etc. Obviously, wellbeing is a highly controversial concept, and it is hard to determine, what constitutes it (Oswald, 1997) Nevertheless, it seems prominent to consider people's happiness

not only from a monetary point of view, but also attach significant value to socialization, importance of family, culture and the role that environment and society play in one's life. It is important to improve medical care aimed at mental health, develop mechanisms that would allow to recognize mental problems on early stages and try to apply treatment in time in order to prevent suicidal behavior.

This study has some important drawbacks and, therefore, suggests space for further development in this area of interest. First, it is challenging to retrieve reliable data on suicide rate and different explanatory variables for many developing countries, which is why it is difficult to include all of them into the analysis. However, doing so would bring results with higher external validity. Moreover, development is a broad definition, which was only determined by GDP in this study. Nevertheless, development might include many other dimensions that might affect an impact of different economic indicators on wellbeing and suicide rates. These mechanisms might be developed and studied more in-depth by future research. However, the most important issue of any study based on the OLS regression with fixed effects, is the problem of omitted variables. It is impossible to identify all time-variant causes of suicide and include them into one model, that would be able to perfectly predict relationships between them. Moreover, certain abstract terms such as life satisfaction, happiness, equality of opportunity or psychological health can hardly be conceptualized and properly measured, which also adds to the drawbacks of the method used to construct this research. Further studies might include data on wider range of countries, years and variables, as well as use more robust research techniques. These would allow to solve the problem of omitted variables and endogeneity, in order to present more reliable results for causes of suicide and help to reduce it in future.

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