

***Measuring the Impact of Video Game Addiction on Mental Health
Status: Evidence from East Asia***

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Abstract

This paper aims to determine the relationship between video game addiction and an individual's mental health. The paper also sheds light on the other factors that affect said individual's mental health and how they impact the individual when coupled with video game addiction. The research paper has been conducted using the East Asian Social Survey (EASS), and focuses primarily on respondent data from Taiwan, South Korea, China and Japan. In order to determine the impact of said factors on mental health, regression analysis was conducted using the ordinary least squares (OLS) model. The results indicated that factors influencing an individual's social life and wellbeing do have a significant impact on an individual's mental health when coupled with video game addiction. Video game addiction, being female and having a higher number of work hours tended to have a negative impact on mental health status, while the presence of a spouse had a positive impact on mental health. On the other hand - age, education, presence of a sibling and having a steady source of income were factors found to be less significant in impacting mental health.

1. Introduction

In today's day and age, technology is an inseparable part of an individual's life. It is almost impossible to imagine life without technology or the internet. The internet helps us fulfil every one of our needs and wants. One such want is that of entertainment. Video games are one of the most widespread forms of entertainment. Video gaming is so popular that over 2 billion people around the world play video games (von der Heiden et al., 2019). A video game can be defined as "a game which we play thanks to an audiovisual apparatus and which can be based on a story" (von der Heiden et al., 2019). In recent years, video games have been the focus of a raging debate. The focal point of this debate is whether playing video games has potential negative effects, if so, what is the extent of such negative effects.

Several researchers have explored the correlation of videogame playing and multiple correlates. Some studies such as (Primack et al., 2012; Granic et al., 2014; Colder Carras et al., 2018) have suggested that playing video games has positive effects and possible therapeutic effects while others such as (Loton et al., 2016) have emphasized its potential dangers.

In the technology age, where almost every other child and adolescent has access to the internet and therefore video games, be it on a mobile phone, tablet, computer or a console, excessive usage is a concern. Video game addiction however, is not limited to just excessive usage. While video game addiction is associated with negative consequences, high engagement with video games is not (Brunborg et al., 2014). Issues such as craving and loss of control are indicative of video game addiction. While calling this a "behavioral addiction" is still a matter of debate, problematic video game play has been established as a disorder (von der Heiden et al., 2019).

The question we as researchers seek to answer is how does addiction to video games affect an individual's mental health. This question is becoming more and more relevant as the COVID-19 pandemic has forced everyone indoors. When adolescents face pandemic related stress, they may resort to negative coping mechanisms leading to the development of the "internet gaming disorder (IGD)" ("*gaming addiction is on the rise in adolescents due to covid-19 pandemic,*" 2021). The World Health Organization (WHO) defines mental health as a state of well-being in which an individual is able to realize his or her abilities, cope with the normal stresses of life, work productively and contribute to his or her community ("*Mental health: Strengthening our response,*" 2018).

This study aims to explore the impact of video game addiction (Independent variable) on Mental health (Dependent variable). However, this paper also aims to shed light on whether social factors affecting an individual's life coupled with addiction to videogames have a different impact on their mental health. The contribution of this study is to identify the above mentioned social factors and highlight their effects on an individual's mental health.

Moreover, this particular study has not been conducted in the southeast Asian nations of Japan, China, Taiwan and South Korea. We plan to focus on this phenomenon particularly in the abovementioned Southeast Asian countries due to the stark differences in population, economy, HDI and other similar factors as compared to the West.

While the Internet Gaming Disorder is relatively new, policies need to be implemented at the earliest to nip this growing issue in the bud. Policies can't be implemented without knowing the factors affecting IGD and mental health. Countries such as China have adopted aggressive policies to combat this issue. China's government banned the sale of gaming consoles in the country between 2000 and 2015. However, whether the ban achieved the intended results is questionable as between 2002 and 2009, at least 1.2 million consoles were sold illegally, each year (Hanson, 2014). Despite this ban, 24 million Chinese citizens between the ages of 13 and 29 were addicted to the internet or gaming (Snyder, 2018). While it can't be said with certainty that the console ban didn't work, it is certain that the issue prevailed despite the aggressive policy implementation. In order for governments to establish successful and effective policies to combat IGD, it is important to understand the factors affecting it. Identifying said factors in order to aid effective policy curation is the primary purpose of this study. We believe this can also be helpful for parents and educators who can use this data to develop healthy habits from an early age in order to avoid severe mental strain.

2. Literature Review

Since the nature and magnitude of the effect of videogames has been widely discussed, there has been a variety of literature linking videogames to good/bad mental health. (Jones et al., 2014) for instance looks at the positive impact that videogames have on an individual's mental health. (Jones et al., 2014) says that lower psychosocial well-being is the cause of pathological gaming and not the result of it. An individual's psychosocial wellbeing can have a positive/negative impact on their life. For example (Nambi, 2005) states that married men are less likely to face mental health issues such as depression as compared to divorced men. (Loton et al., 2016) further corroborate this observation. In a survey of 1556 Korean students, males were three times more likely to be addicted to online games. Similarly, in another study conducted amongst Chinese adolescents, males were more likely to develop addictions to online games than were females (Kevin H. Chen, 2018). It is to be noted that the proportion of males and females in both the studies were roughly equal.

(Loton et al., 2016) state that there is a direct correlation between videogame addiction and poor mental health. It also states that playing video games is a maladaptive coping strategy which individuals use to deal with negative situations in their lives. (Gentile et al., 2011) has also linked pathological gaming to poorer social and emotional competence. This link is consistent with the findings of the other papers that an addiction to video games could be a coping mechanism to poor psychosocial wellbeing. However, several papers such as (Loton et al., 2016), and (Brunborg et al., 2014) state that there is a clear distinction between video game engagement and video game addiction. The number of hours one plays video games is not an indicator of whether one is addicted to videogames or not, rather it is symptoms such as withdrawal that are indicative of addiction. Therefore, strong engagement with video games is not associated with negative consequences. On the other hand, multiple studies such as (Goldfield et al., 2015) (Mei et al., 2016, Rasmussen et al., 2015, Wu et al., 2016) all state that being addicted to videogames is what leads to poorer psychosocial well being and therefore leads to having low self-esteem, poorer self-control and a myriad of other problems.

A study by Reuters on video game obsession found that the average video gamer was 35, often overweight, introverted and may be depressed (Average gamer is 35, often overweight and sad: Study, 2009). This study became a strong foundation for us to include variables such as age and weight in our study.

While a lot of literature indicates that there is a clear relationship between an individual's psychosocial wellbeing, there is no clarity on whether it is the poor social situation that leads to addiction or vice-versa. Another gap in the literature is that the factors affecting an individual's psychosocial wellbeing differ from paper to paper. We as authors of this paper aim to shed more light on what these factors are and the extent of their impact on an individual's mental health.

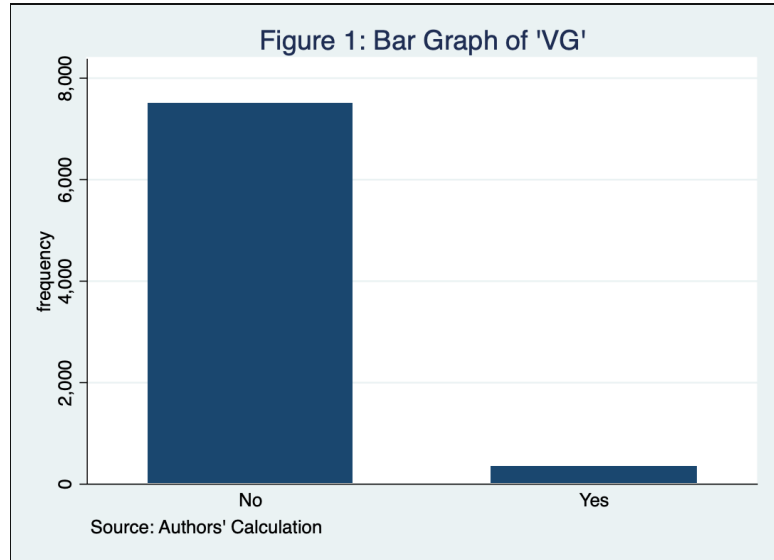
3. Data Description

The dataset used for this research topic is the “East Asian Social Survey (EASS), Cross-National Survey Data Sets: Health and Society in East Asia, 2010 (ICPSR 34608)” (<https://www.icpsr.umich.edu/web/ICPSR/studies/34608>). This is a biennial survey conducted and serves as a cross-national network for the general surveys in the southeast nations of China, Japan, Taiwan and South Korea and examines multiple aspects of social life in these countries. Survey information in this module focused on issues that affected overall health, such as specific health conditions, physical functioning, aid received from family members or friends when needed, and lifestyle choices. The study consists of an initial sample size of 16614 respondents across the aforementioned nations. However, the number of valid survey respondents was estimated at 10137. Therefore, our study has been based on survey data from 10137 individuals. It is to be noted that the EASS collects data of individuals above the age of 18.

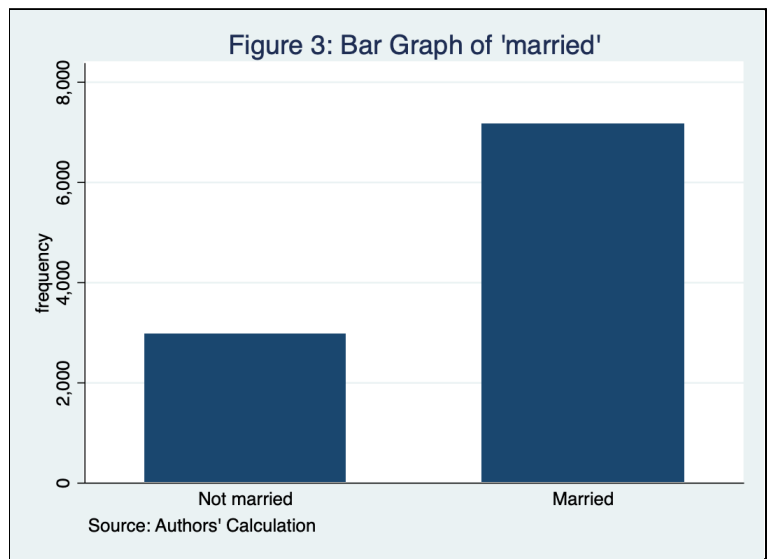
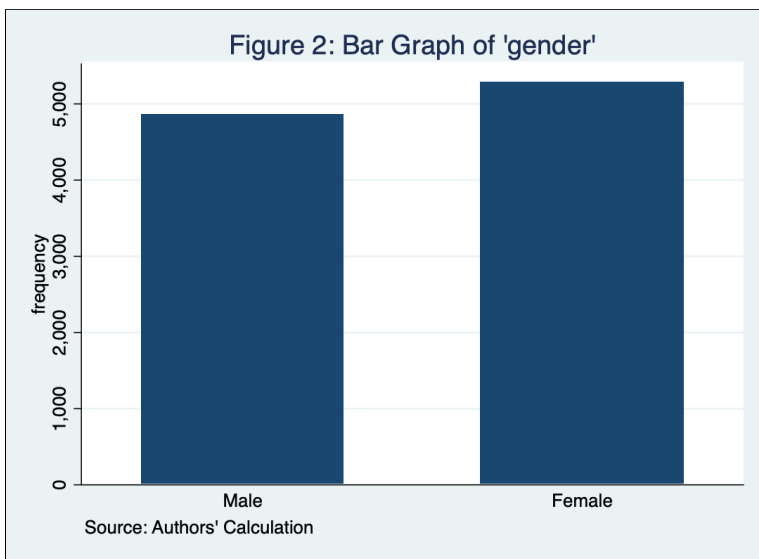
For the purpose of this study, we have taken into consideration variables that affect an individual’s mental health. The primary dependent variable(s) will be the mental health sub score (MH) for our regression model. This subscore is derived from a sample of survey questions which are graded on a 5 point opinion scale, and a consolidated subscore is created. The sample survey questions asked specifically to contribute to this subscore were as follows:

- *During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? Accomplished less than you would like.*
- *During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? Did work or other activities less carefully than usual.*
- *How much of the time during the past 4 weeks...Have you felt calm and peaceful?*
- *How much of the time during the past 4 weeks...Did you have a lot of energy?*
- *How much of the time during the past 4 weeks...Have you felt downhearted and depressed?*

Studies such as (Loton et al., 2016) assert that there is a correlation between an individual’s addiction to video games and poor mental health. Hence, the primary independent variable considered for the study is an individual’s addiction to video games (VG). VG is a binary variable which categorizes respondents as either addicted or not addicted to videogames. It should be noted that a majority of the respondents are not addicted to videogames (95.52%), hence making this variable a highly skewed variable. However, this does undermine the significance of this study.



From the literature available, it is abundantly clear that, while there is an impact of video game addiction on one's mental health, there is also a correlation between social factors affecting an individual's psychosocial wellbeing and their mental health. (Nambi, 2005) states that unmarried/ divorced individuals, especially men, are more susceptible to mental health issues such as depression. This motivated us as researchers to include an individual's gender (gender) and marital status (married) as control variables. Both of the above mentioned variables are binary with an individual being either male or female and their marital status being married or unmarried.



Other papers such as (Gentile et al., 2011) indicate that if an individual has poor psychosocial wellbeing, they use pathological gaming as a coping mechanism. Other control variables have been selected based on this relation. Work hours (*work*), Weight (*weight*), level of education (*edu*), Age (*age*), steady source of income (*income*), only child or has siblings (*sibling*) are all the other control variables taken for this study.

‘Work’ is a categorical variable that categorizes the number of hours an individual works in a week as low working hours, moderate working hours and high working hours. A study conducted by (Park et al, 2020) on the relation between long work hours and mental health among South Korean respondents concluded that long working hours were associated with stress, depression, and suicidal ideation in young employees, aged 20 to 35. Since a majority of our sample size is within the same age bracket, work hours has been taken as a control variable. Similarly, to control for social factors mentioned earlier, we have also taken variables such as weight, age, education completed and income. The reason for using the above-mentioned variables in our study is that most literature points to a strong correlation between psychosocial well being and video game addiction as well as the impact of these factors on an individual’s mental health. As researchers, we believe that these variables can give an accurate picture of an individual’s psychosocial functioning and wellbeing. For example, being over or underweight, a lack of steady income or regret over failure in academic pursuits may give rise to detrimental feelings. ‘Weight’ is a continuous variable that ranges between 30kg and 146 kg. Both ‘edu’ and ‘age’ are categorical variables. The categories under edu being: no formal qualification, has completed schooling, and has completed some level of university. The categories under age are: Young, Middle aged, and Old. income is a binary variable which checks if an individual has a steady source of income or not.

‘Sibling’ is a binary variable which checks if an individual is an only child or has siblings. This is another social factor often left unstudied. Although we have not found any specific literature studying the impact of having a sibling on mental health, we felt it was important to add as a variable given the innate likelihood of feeling neglected. This feeling may arise as a consequence of parents having paid more attention to a younger or older sibling depending on the case.

In 2000, the sale of video game consoles (but not other forms of gaming such as mobile gaming and computer gaming) was banned in China due to fears of adverse mental and physical effects on Chinese youth. This ban lasted a total of 15 years before it was lifted in 2015 (Chen, 2015). As our study was conducted in 2010, this policy motivated us to create the interaction variable ‘*VGchin*’ which looks at whether an individual is both Chinese and addicted to video games to see how this affected their mental health status.

Table 1: Descriptive Statistics

Variable	Definition	No. of Observations	Mean	Standard Deviation
<i>MH (Main Y)</i>	Mental health subscore: 0: 0 1: 12.5 2: 25 3: 37.5 4: 50 5: 62.5 6: 75 7: 87.5 8: 100	7,895	69.45852	21.3405
<i>VG (Main X)</i>	Addicted to videogames? 0- No 1- Yes	7,837	1.955212	.2068504
<i>weight (continuous)</i>	Weight range from 30kg to 146kg	10,065	184.0495	213.2737
<i>gender</i>	Sex: 0: Male 1: Female	10,137	1.520963	.499585
<i>age</i>	Age: 0- Young- between 18 and 30 yrs 1- Middle aged- between 31 and 50 yrs 2- Old- above 50 years	10,137	1.266548	.7331228
<i>edu</i>	Education level: 0- No formal qualification 1- Has completed schooling 2- Has completed	9,334	.6611313	.5676329

	some level of university			
<i>married</i>	Marital status: 0- Not married 1- Married	10,137	.7055342	.4558247
<i>work</i>	Work hours: 0- Low working hours- less than 21 hours/ week 1- Moderate working hours- between 21 and 50 hours/ week 2- High working hours- greater than 50 hours/ week	10,137	1.549965	.6088131
<i>income</i>	Steady source of income: 0- No 1- Yes	10,078	.6212542	.4850987
<i>Chinese*</i>	Chinese or not: 0- No 1- Yes	10,137	.3813752	.4857483
<i>Interaction variable: VGchin (interaction)</i>	Combined effect of video game addiction and Chinese heritage.	7,837	.0150568	.1217866

Source: Authors' Calculation

*Not included in the actual regression model.

4. Empirical Model

For the empirical model, the OLS regression model has been used to understand the effect of the above mentioned variables and video game addiction on an individual's mental health. Therefore, the focus Y variable is 'MH' and the focus X variable is VG. We chose to include dummy variables in our regression model to make the results easier to understand. We've assumed that zero denotes the lack of a specific event, whereas one denotes the presence of that event. For example, in the variable sibling, 0 denotes that the respondent does not have a sibling while 1 indicates the presence of siblings. The benchmark categories have been decided based upon existing literature as well as the hypothesis of the study.

Moreover, it is essential to consider that the inclusion of too many independent variables can cause overfitting within the model, causing undesirable results. As Prof. Jeffrey Wooldridge noted, overspecifying a model can exacerbate multicollinearity problems, decrease the efficiency of estimators, and result in increased variance of estimators.

Our regression model is as follows:

$$MH = \beta_0 + \beta_1 VG + \beta_2 gender + \beta_3 age + \beta_4 weight + \beta_5 work + \beta_6 married + \beta_7 income + \beta_8 sibling + \beta_9 edu + \beta_{10} VGchin + u.$$

The **research hypothesis** is as follows:

Primary: Video game addiction is likely to cause a negative effect on mental health status.

Secondary: Video game addiction may actually be a contributing factor that gives rise to other social factors such as weight, gender, age & education issues to cause severe detrimental effects on an individual's mental health and well being. On the other hand, positive factors such as the presence of a spouse (married) or a steady flow of income (income) may positively affect mental health, significantly reducing the impact of video game addiction. Hence, we hypothesize that several of our control variables will significantly affect our Y variable.

5. Results & Discussion

The results obtained after running the OLS regression are given in Table 3. The tests conducted on our regression model have been summarized in Table 2. On running the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity, a p-value of 0.000 was obtained. Due to the presence of heteroskedasticity, a robust regression (MLR2) was run on the model to control for it. The OLS model used passed the Variance Inflation Factor (VIF) Test for collinearity. The test showed a mean VIF of 1.44 with a maximum VIF of 1.69. Thus, we concluded that our model has little to no collinearity. On running the Ramsey RESET test for omitted variable bias, it was observed to have a p-value of 0.4631. Therefore, the null hypothesis was not rejected and our chosen regression model did not have any omitted variable bias. The kdensity test conducted on our regression residuals are approximately normal and fit the assumption of normality (Appendix 1). We also conducted the Durbin–Wu–Hausman test for endogeneity and concluded that our regression model was endogenous in nature (Appendix 2).

Moreover, our model is linear in parameters – this assumption is satisfied because the relationship between the dependent and independent variables are linear. The data has been obtained from a dataset by ICPSR and was collected using random sampling. It is also important to point out that regression results after running a robust regression on our initial model did not provide any significant changes, proving that our initial model was suitable regardless of the presence of heteroskedasticity.

Table 2: Regression Tests

ovtest H_0: model has no omitted variables Omitted Variable Bias Test		
<i>Model</i>	<i>Prob > F</i>	<i>Conclusion</i>
MLR 1	0.4631	Fail to reject H_0
MLR 2 (<i>Robust</i>)	0.4631	Fail to reject H_0
vif Variance Inflation Factor Test for Collinearity		
<i>Model</i>	<i>Mean VIF</i>	<i>Conclusion</i>
MLR 1	1.44	No multicollinearity
MLR 2 (<i>Robust</i>)	1.44	No multicollinearity
estat hettest H_0: Constant variance Heteroskedasticity Test		
<i>Model</i>	<i>Prob > chi2</i>	<i>Conclusion</i>
MLR 1	0.0000	Reject H_0
<i>Note: We don't run this command for MLR 2 as standard errors are robust to heteroskedasticity.</i>		

Source: Authors' Calculation

As visible in Table 3, the selected variables in the model had a linear relationship with the ‘MH’ variable. Further, the variables VG(main X), gender, work, married & VGchin(interaction) were significant at less than 1%, while weight was significant at less than 5%. Age, income & edu were significant at less than 10% while sibling was the only insignificant variable present in our regression model. The model produced an R² value of 0.0189. Also, both our regression models contained F-stats at 13.66 and 13.48 respectively, with a Prob > F = 0.000, indicating that our model is highly significant.

From the coefficients observed after running the robust regression, keeping all other factors constant we find that for every unit increase in VG, there is a decrease of 5.9394 units in the mental health subscore. This means that those addicted to video gaming are likely to have a decrease of 5.9394 units in their MH subscore than those who are not addicted. Similarly, females are likely to have a decrease of 4.0454 units in their MH subscore as compared to males. For every unit increase in work hours, the MH subscore decreases by 1.7019 units. Other highly significant variables include marital status and our interaction variable (VGchin). Married individuals are likely to have an increased MH subscore by 3.7463 units compared to unmarried individuals. The final observation was that Chinese individuals who were admittedly addicted to video gaming were likely to have a 7.7074 unit increase in their MH subscore as compared to Chinese individuals who were not addicted. This was the highest coefficient of our regression model (positive or negative) and the most surprising.

Weight was the only variable found significant at the 95% confidence interval. Being a continuous variable, we found that for every unit increase in weight, there is a decrease of 0.0035 units in the mental health subscore.

Moving on to variables found to be significant at the 90% confidence interval, we found that for every unit increase in age, there is a decrease of 0.7169 units of the MH subscore. There was a decline in MH status as the individual grew older, but only marginally. Similarly, the presence of a steady income source indicated a decrease of 1.1828 units in the MH subscore. On the other hand, for every unit increase in education level, there is a 1.0170 unit increase in the mental health subscore. Those individuals able to achieve a higher level of education had a higher MH subscore.

The only insignificant variable of our regression model was sibling. This meant that the presence of having a sibling did not significantly affect the MH subscore/status of an individual positively or negatively.

Regression Equation

$$MH = 77.6409 - 5.9493VG - 4.0454gender - 0.7169age - 0.0035weight - 1.7019work + 3.7463married - 1.1828income - 1.1065sibling + 1.0170edu + 7.7074VGchin + u.$$

Table 3: OLS Regression Results

Variables	MLR 1: Regressing MH	MLR 2: Regressing MH (Robust)
VG	-5.9493*** (1.5119)	-5.9493*** (1.5028)
gender	-4.0454*** (0.5169)	-4.0454*** (0.5170)
age	-0.7169* (0.4298)	-0.7169* (0.4284)
weight	-0.0035** (0.0014)	-0.0035** (0.0014)
work	-1.7019*** (0.5045)	-1.7019*** (0.4974)
married	3.7463*** (0.6055)	3.7463*** (0.6233)
income	-1.1828* (0.6701)	-1.1828* (0.6846)
sibling	-1.1065 (0.7643)	-1.1065 (0.7663)
edu	1.0170* (0.5807)	1.0170* (0.5848)
VGchin (VG*chinese)	7.7074*** (2.4744)	7.7074*** (2.3556)
_cons	77.6409*** (1.7512)	77.6409*** (1.7391)
No. of Obs	7095	7095
F(10, 7084)	13.66	13.48
Prob > F	0.0000	0.0000
R-squared	0.0189	0.0189
Adj R-squares	0.0175	-
Root MSE	21.128	21.128
Standard Deviations are in parenthesis Significant at *10%, **5%, ***1%		

Source: Authors' Calculation

6. Conclusion & Limitations

Based on our initial hypothesis, we found that video game addiction does indeed have a negative effect on an individual's mental health status. Not only was this a significant result in our regression model, but other important factors were also proved to have a substantial impact. Considering that our respondents' genders were roughly proportionate, we found it surprising that females were more likely to have a negative impact on their mental health than were males. Our results were also consistent with the literature that unmarried individuals were more likely to face mental health issues than married individuals.

However, when we conducted an SLR model (Appendix 3) to purely understand the impact of video game addiction on mental health, we found that video game addiction as a single variable was not very significant (only significant at 90%), which indicates that perhaps it is our secondary hypothesis that is more true than our primary. Social factors such as marital status, gender, work hours and weight were found to have a significant impact on mental health alongside video game addiction.

One of the most interesting observations from this study was the impact of our interaction variable. VGchin was formed out of combining addiction to video games and being Chinese. As per the Chinese console ban discussed earlier, the expectation was that Chinese citizens who were addicted to video games were likely to have a worse mental health status than those citizens who were not. However, our regression analysis showed a highly significant result indicating the opposite. While our data was also skewed for this variable, we believe this surprising result may be cause for further research into this subject, specifically focusing on the Chinese demographic. A gap in literature that was found was the lack of clarity on whether video game addiction led to poor social wellbeing or vice versa. Our paper was unable to shed light on the same.

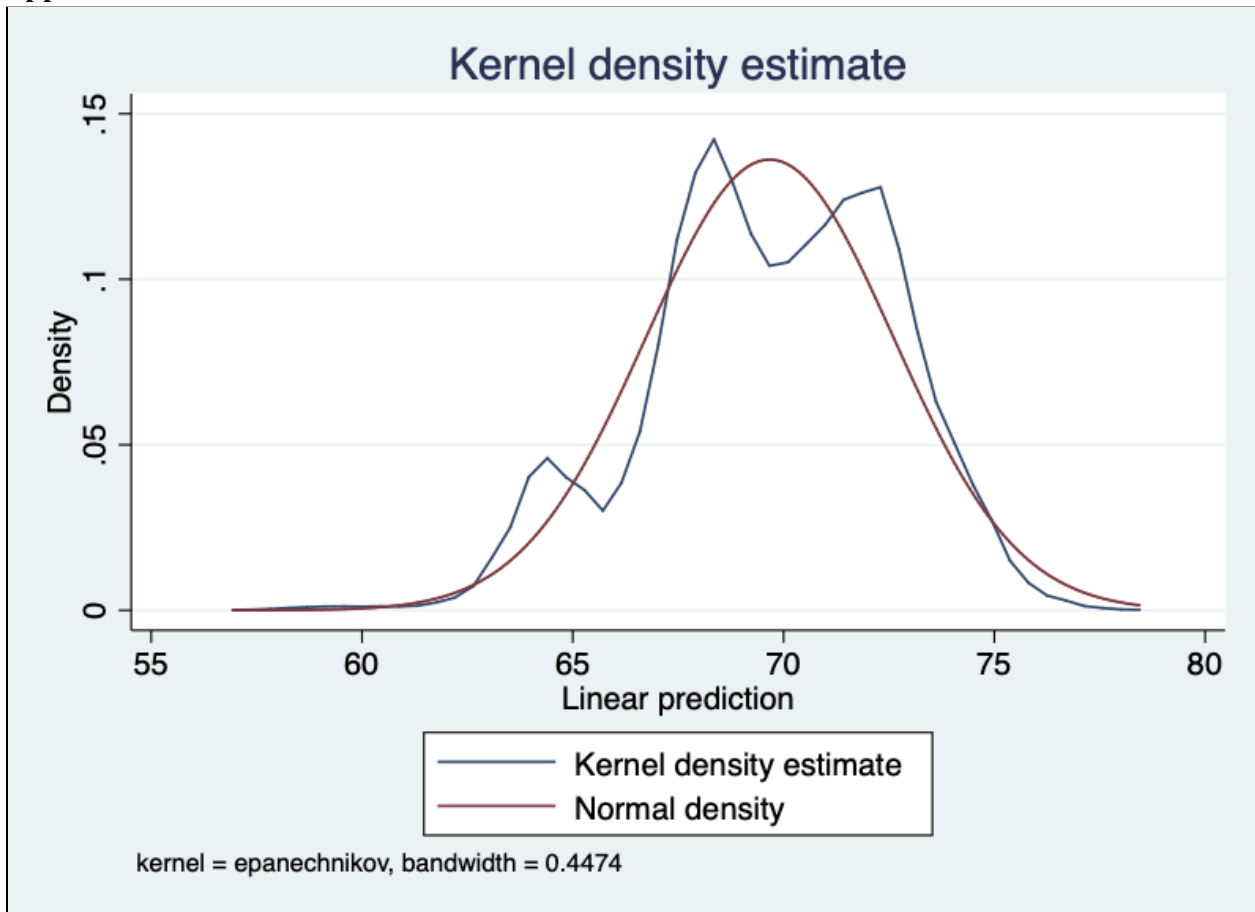
In terms of our research study focused on East Asia, the lack of available mental health data specifically from Taiwan may be a hindrance. Moreover, as the survey was conducted for individuals over the age of 18, the lack of available data for children makes this a cause of concern. Policies that can be implemented at early stages of growth and development may not find our research very useful. However, this study can definitely be used as a foundation to conduct further research within the younger demographic.

Another limitation of our study was the low R^2 of our regression model. However, one should note that R-square, even when small, can be significantly different from 0, indicating that our regression model has statistically significant explanatory power. One of the most important OLS assumptions is that the errors are uncorrelated with the dependent variables. Although our model did not have any omitted variable bias, in the presence of endogeneity, OLS can produce biased and inconsistent parameter estimates. Hypotheses tests can be seriously misleading. Although a possible solution would be to use an alternative dependent variable that is exogenous, that may prove a difficult task considering the nature of the study and the chosen variable (Mental Health). Therefore, we suggest that an additional model be conducted using instrumental variables (IV) techniques to control for endogeneity.

Policy decisions must be focused at limiting the negative effects of video gaming, not just eliminating it. Many studies have found that video gaming (when not addictive) actually has many cognitive benefits (Hisam et al, 2018), so further research in this area is warranted.

7. Appendix

Appendix 1



Source: Authors' Calculation

Appendix 2

<i>test ehat</i> Test for endogeneity	
ehat	0
F(1, 7083)	3.5e+18
Prob > F	0.0000
Conclusion: Endogeneity exists	

Source: Authors' Calculation

Appendix 3

Variable	MLR 1: Regressing MH
VG	-2.0984* (0.065)
_cons	69.514 (0.2474)
No. of Obs	7087
F(10, 7085)	3.40
Prob > F	0.0652
R-squared	0.0004
Adj R-squares	-
Root MSE	21.341
Standard Deviations are in parenthesis Significant at *10%, **5%, ***1%	

Source: Authors' Calculation

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