How Economic Development affects alcohol consumption trends across the globe?

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Introduction

Alcohol is the most readily available and widely used drug. It contains ethyl alcohol and is consumed largely for their physiological and psychological effects. From Ancient Greece to modern America, alcoholic beverages have been used to create friendships and social connections. It acts as a social lubricant that can facilitate social interactions and connections between people as the effects of alcohol relax the mind and make you feel more confident. Along with the positive support alcohol provides it is also associated with damaging your health and relationships and disrupting your work, education or lifestyle. In 2018, the World Health Organization (WHO) reported that alcohol contributed to more than 200 diseases and injury-related health conditions, including liver diseases, road injuries, violence, cancers, cardiovascular diseases, suicides, tuberculosis and HIV/AIDS. Jakob, Syed and Sinclair (2021) studied the economic costs of alcohol use on society and concluded that if all cost components were considered, the economic costs of alcohol consumption would amount to 2.6% of global Gross Domestic Product (GDP). The estimates includes both direct costs (38.8%) and indirect costs (61.2%). For example, in 2017, the medical cost attributable to substance use disorder (SUD) in America was $13.2 billion, out of which alcohol-related disorders accounted for more than 50% of the costs (Jakob et al. 2021). Developed and developing economies have imposed different tax policies, but the effect of these policies varies with the country. These policies imposed in the end reflect in the growth of the economy.

As economies grow, people are fundamentally supposed to have more disposable income and bound to consume more. Economic growth can drive not only moderate consumption but also problematic drinking which could lead to an increase in alcohol-related diseases, accidents, and deaths, putting a strain on healthcare systems. Increased alcohol consumption can result in

decreased productivity, absenteeism, and increased workplace accidents. In the long run, even with economic growth, these effects can negatively impact overall economic performance and erode some of the benefits the growth brings. The purpose of this paper is to observe if global economic growth is affecting alcohol consumption positively or negatively across the world.

Literature Review

There are no research articles that analyze the link between GDP per capita to alcohol consumption but there are various articles that consider factors affecting GDP per capita and show a relation to alcohol consumption. In this research we will take a step further and include variables for cultural and environmental effects.

One such article as the one written by Cantarero-Prieto, Marta and Maria (2019) on examining an alcohol consumption Kuznets curve for developed countries. The Kuznets curve was developed by Simon Kuznets in 1955 for describing the relationship between the dynamics of income inequality. It concludes that inequality first increases and then decreases with economic growth. The authors here aim to show that as income rise, further resources become available to buy more alcohol, hence people consume more alcohol and alcohol consumption rates increase. The authors use a fixed effect model from 1990 to 2017 using the OECD Health Data for 17 countries. They concluded that alcohol consumption can be considered a cross-sectional social issue that depends directly on the purchasing power of the individuals measured through the income and inequality.

They also concluded that when unemployment rises alcohol consumption decreases which contradicts Compton, Gfoerer, Conway and Finger's(2014) research on unemployment and substance outcomes in the United States in the period of 2002-1010. They used surveys conducted by the U.S National Survey on Drug Use and Health (NSDUH) to study the difference

in substance use among 405,000 respondents aged 18 years or older. Their main objective was to study the difference in substance use among the employed and non-employed. They calculated the results for every year using multivariate logistic regression and concluded that substance use was more prevalent among the unemployed for every time period. The effect of unemployment on alcohol consumption changes with time and economic factors, having a significant effect on alcohol consumption.

Income, education and overall health collectively determine your social economic status. A combination of these would determine how your social status differs with your peers. Xu, Geldsetzer and Manne-Goehler (2022) used pooled individual-level data from WHO between 2005 and 2017 to investigate the association between individual and household level socioeconomic status, and alcohol drinking habits in 55 low-income and middle-income countries. They used logistic regression models controlling for age, country, and survey year stratified by sex and country income groups to investigate the association. They found in low-income countries and lower middle-income countries, drinking is more prevalent with higher socioeconomic status while in upper-middle-countries drinking being more common among those with higher socioeconomic status, heavy episodic drinking is more prevalent among those with lower socioeconomic status.

A higher socioeconomic status comes with a higher-level education. The more educated you are the more likely you are to contribute to society and have a higher income. Murakami and Hashimoto (2019) in their research to study the association of education and income with heavy drinking conduct and collect questionnaire surveys in metropolitan areas in Japan from 2010 to 2011 among residents aged 25 to 30 years. They conduct multiple logistic regression on the data they collect to find that lower educational attainment (high school or less) was significantly

associated with increased risks of problematic heavy drinking compared to people with university education or higher. Along with that they found that lower income was associated with lower risk of problematic heavy drinking compared to those of higher income. The research showed that level of education and income have a significant effect on alcohol consumption.

The Gini index is a world economic indicator that measures the extent to which the distribution of income or consumption among individuals or households within an economy deviates from a perfectly equal distribution. Basically, the Gini index represents the income inequality within the country. A rise in income correlates to an increase in alcohol consumption (Cantarero-Prieto, Maria, Martha 2019). Similarly, Karriker-Jaffe et al.(2019) examines the relationship between state-level income inequality and alcohol outcomes using data from National Alcohol Surveys from the period 2000 to 2005. Through multivariate regressions they found that across states the Gini index was negatively associated with light drinking and heavy drinking, meaning as income inequality increases there is a decrease in alcohol consumption.

The previous research papers tell us that education and standard of living are important factors that affect alcohol consumption. One such variable that calculates both and more is the HDI index, which stands for Human Development Index. It is an index used to measure and compare overall development of countries. It combines three key dimensions of human development, including health (life expectancy at Birth), education (mean years of schooling and expected years of schooling) and standard of living (measured by the Gross National Income per capita, adjusted for purchasing power parity). Spada and Rana (2020) in their econometric research investigating the link among wine consumption, HDI and geographical region, conducted a random effects regression on a panel data of 45 countries from 2005 to 2015 all from the European region to assess the effect of HDI on wine consumption. Through their

analysis they found that increase in HDI decreases wine consumption meaning that with a cumulative increase in life expectancy, education, and standard of living there is a decrease in wine consumption.

There are various cultural factors that affect the calculation of alcohol consumption and one of them being the rich culture of brewing liquor at home. A variable to consider is the unaccounted alcohol consumption through home brewed wines, beers and spirits that substitute commercial alcohol. In eastern countries like Korea and China there is a culture of making their own wines at home, which is not calculated in the national product (Anderson, Meloni and Swinnen, 2018). While some countries have laws restricting them from brewing liquor at home, some countries allow the brewing but make it unlawful to sell. This variable is an important cultural factor that affects alcohol consumption but remains uncalculated.

Just like cultural factors, there is also environmental factor that affects alcohol consumption which is weather. A recent study conducted by a group of researchers on the topic of whether colder weather constitutes to increase in alcohol consumption found that an increase in temperature decreases alcohol consumption (Valtera-Cots, 2018). This research was done across 193 sovereign countries and across United States with macroeconomic indicators such as alcohol consumption and weather. The multivariate regression results concluded that countries that are exposed to colder climates have an increased incidence of alcohol consumption.

Overall, my econometric analysis would be a global analysis on alcohol consumption and would consist of 51 countries diversified to account all income groups across a three-year time period from 2017-2019. The most major difference from the previous research involves a diverse selection of countries and using GDP per capita and HDI index as my independent variables for economic growth. While most of the previous econometric research have been done within a

country, or across a region, this paper will consider a global effect. Macroeconomic indicators do not comprise of cultural, social, regional and environmental variables thus I included two variables, one that accounts for the cultural aspect and one that accounts for the environmental effect. I also have included annual unemployment rate. This paper would differ from most of the previous research in the sense that it would be a macroeconomic analysis rather than a microeconomic one.

Hypothesis Model:

This study investigates the relationship between alcohol consumption per capita and various macroeconomic indicators, particularly focusing on GDP per capita and HDI index. Other factors affecting alcohol consumption such as unemployment, average annual temperature, Gini index, and a dummy for home brewing liquor are included as independent variables. Based on economic theory and prior research, it is hypothesized that macroeconomic conditions influence individual behavior regarding alcohol consumption. This analysis will help us understand the effect on alcohol consumption given the change in economic factors globally.

My null hypothesis is that there is no significant relationship between economic growth and alcohol consumption per capita. This null hypothesis posits that changes in a country's wealth or human development, as measured by GDP per capita and HDI index, do not have measurable effect on how much alcohol is consumed on average by its citizens. This assumption stems from the notion that consumption of alcohol may be influenced more by social, cultural, or personal preferences rather than pure economic output.

My alternative hypothesis is that there is a significant positive relationship between economic growth and alcohol consumption per capita. This assumption stems from the economic literature review done that shows that economic indicators do influence alcohol consumption and

growth in an economy would mean a growth in income and development thus reflecting an increase in alcohol consumption.

Other variables that would contribute to the econometric model include:

1. Unemployment rate: It has been found to have varying effects on alcohol consumption. Compton et al. (2014) suggest higher unemployment correlates with higher substance use, while Cantarero-Prieto et al. (2019) conclude that higher unemployment may lead to reduced alcohol consumption.

2. HDI index: It serves as a composite index of life expectancy, education, and standard of living that measures the human development. This index provides yearly a picture of the three essential levels of development necessary for a decent standard of living (Spada et al. 2020).

3. Gini index: From Cantarero-Prieto et.al (2019) and Karriker-Jaffe et. al (2019) we saw that income inequality has a significant role to play when it comes to alcohol consumption. This index would reflect the change in income inequality.

4. Home Brew: The rich culture of substituting commercial alcohol with home brewed liquor is allowed to continue by some countries. This variable would serve as a dummy variable with the purpose of identifying the countries that allow brewing liquor at home and those who do not.

5. Annual Mean Temperature: As Ventura-Cots et. al (2019) finds through her research that weather has a significant effect on alcohol consumption, this variable would contribute to the econometric analysis by serving as a measure of change in temperature.

I have two econometric models with my dependent variable remaining the same. I will be conducting regression on two variables namely GDP per capita and HDI index that indicate growth in the economy but in different perspectives.

My econometric model is:

$$Alcohol\ Consumption\ per\ capita = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_4 + \beta_4 X_4 + \beta_5 X_5 + u$$

My dependent variable(Y) is alcohol consumption per capita and X_1 is GDP per capita. My other X_1 is HDI index. X_2 is unemployment rate. X_3 is Gini index, X_4 is annual mean temperature and X_5 is home brew which is the dummy variable accounting for countries that allow homebrewing. u represents the error term. My coefficients $\beta_1, \beta_2, \beta_3, \beta_4$ would represent a litre change in alcohol consumption for a unit change in the independent variables.

Data

I have created a pooled data set of 51 countries in the time period of 2017-2019. The countries are: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Latvia, Lithuania, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Rwanda, Singapore, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, Thailand, Uganda, United Kingdom, United States. I chose these countries as they have abundant macroeconomic data available. The total number of observations equal to 153. I collected if not all of it but most of my data from the World Bank Database.

 Below is the description of my data:

Alcohol Consumption per capita (in litres of pure alcohol, 15+ years of age): This is my dependent variable, and all the observations collected are from the World Bank Database. The

estimates for the total alcohol consumption are produced by summing up the 3-year average per capita (15+) recorded alcohol consumption and an estimate of per capita (15+) unrecorded alcohol consumption for a calendar year. Tourist consumption takes into account tourists visiting the country and inhabitants visiting other countries (World Bank, 2024).

Gross Domestic per capita (in $US): This is the first dependent variable that I am regressing to, to observe any relation between economic growth and alcohol consumption: The values are collected from the World Bank Database. These values are produced by the combination of World Bank national accounts data, and OECD National Accounts data files (World Bank, 2024).

HDI index: This is my other first independent variable that would indicate economic growth in terms of human development. All the values for this variable were taken from the World bank database. It is calculated from a collection of different data sets, namely life expectancy at birth: UNDESA; mean years of schooling: Barro and Lee(2010); expected years of schooling: UNESCO institute for Statistics; Gross National Income: World Bank and IMF. It is a geometric mean of normalized indices measuring achievements in each dimension (World Bank, 2024). An index of 0 indicates the lowest possible human development, while that of 1 represents the highest possible human development.

Unemployment rate: This my second dependent variable. Values are percentage of total labor force estimated by the International Labour Force The data is collected from the World Bank database. Some countries did not have unemployment rates for the time-period 2017-2019 so I took the most recent value before 2017. Some countries had two values but were missing the third one, so I took the value of the year before the current year (World Bank, 2024).

Poverty rate: This is my third dependent variable. These values are the poverty headcount ratio at $6.85 a day based on 2017 purchasing power parity. This is a percentage of the population living on less than $6.85 a day at 2017 international prices. The data was collected from the World Bank Database. Data are based on primary household survey data obtained from government statistical agencies and World Bank country departments. Data for high-income economies are mostly from the Luxembourg Income Study database. Some countries do not conduct surveys, have no data on poverty in their country, or consider themselves poverty free. In that case, I have assumed their poverty rate is zero (World Bank, 2024).

Gini Index: This variable measures the extent to which the distribution of income or consumption among individuals or households within an economy deviates from a perfectly equal distribution. The data for the values were all taken from the World Bank Database. The data is based on primary household survey data obtained from government statistical agencies and World Bank country departments. Data for high-income economies are mostly from the Luxembourg Income Study database (World Bank, 2024). The index is calculated on a two-year basis and for some countries it remains uncalculated for several years, while some of them do not calculate it at all. For all cases the latest available value is taken. Countries that have never calculated the index have a value of zero. The value is represented in percentage. A value of 0 would indicate perfect equality or everyone has the same income. A value of 100 would represent perfect inequality, where all income is held by one person or household.

Annual mean temperature: This variable indicates the air temperature in celcius. The value remains constant for each country as the temperature does not change much in 3 years. The data for the weather is taken from a website called "Weather Spark" that produces climate reports for all the countries.

Inflation rate: This is my fourth dependent variable. The data for the inflation rate was collected from the World Bank Database. It is measured by the consumer price index and reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly (World Bank, 2024). The Laspeyres formula is generally used to collect the data which basically compares the cost of a fixed basket of goods and services in one period to the cost of the same basket in a base period, keeping the quantities constant at base period levels.

Homebrew: This is my dummy variable that marks the countries that allow legal production of alcohol in their home as 1 and for those who do not as 0. This data was collected from a publicly available database ("Homebrewing legality: Countries Compared", 2024). Killian, Braddick and Rehm (2024) also provide information on the legality of brewing alcohol in the European Union.

The table below gives a summary of the details of the variables.

Table 1:Descriptive Statistics of Variables

	Mean	Standard Deviation	Minimum	Maximum
Alcohol Consumption Per Capita (in litres)	7.62	3.36	0.10	13.20
GDP per capita (in $USD, 1000s)	32.07	25.57	0.75	116.78
Unemployment rate	6.42	4.29	0.72	25.54
HDI Index (in %)	85.53	10.6	52	96.1
Gini Index (in %)	34.11	10.4	0	63
Annual Mean Temperature (in °C)	13.8	8.3	-15	29
Home brew	0.37	0.48	0	1

As observed from Table 1, the minimum alcohol consumption is of Indonesia while the maximum alcohol consumption is of Estonia in 2017. The standard deviation shows that there is not much spread in the data of alcohol consumption. The minimum GDP per capita is of Rwanda in 2017 while the maximum is of Luxembourg in 2018. The standard deviation for GDP per capita shows that there is a high level of variability or spread in the data.

The maximum unemployment is of South Africa while the minimum is of South Korea. The minimum HDI index is that of Rwanda while the maximum is that of Switzerland. The mean value of 85.53 indicates that most countries are developed.

The minimum Gini index is that of New Zealand and Singapore as they have never calculated it. The maximum is that of South Africa. The mean value is almost in the middle of the dataset indicating a balance of countries with income inequality.

The minimum annual mean temperature is that of Canada while the maximum is that of Thailand. From the mean temperature we can observe that most countries in the sample set are cooler than average.

Empirical results:

The main objective of this empirical research is to analyze the effect of economic growth on alcohol consumption. We have GDP per capita as one of the measures to see how an increase in individual wealth would affect alcohol consumption and then on the other hand, we have HDI index which would measure how development in aspects other than income would affect alcohol consumptions per capita. My dependent variable in all the cases is alcohol consumption per capita. My main independent variables are GDP per capita measured in $1000 and HDI index measured in percentage.

First, we will observe the individual effect of these two independent variables on the dependent variables and then move on to conduct multivariate regressions.

1st Simple Regression:

$Alcohol\ Consumptin\ per\ capita = \beta_0 + \beta_1 GDP\ per\ capita + u$

2nd Simple Regression:

$Alcohol\ Consumptin\ per\ capita = \beta_0 + \beta_1 HDI\ index + u$

1st Multivariate Regression:

$Alcohol\ Consumptin\ per\ capita = \beta_0 + \beta_1 GDP\ per\ capita + \beta_2 Unemployment\ rate + \beta_3 Average\ Annual\ Temperature + \beta_4 Gini\ Index + \beta_5 Homebrew + u$

2nd Multivariate Regression:

$Alcohol\ Consumptin\ per\ capita = \beta_0 + \beta_1 HDI\ index + \beta_2 Unemployment\ rate + \beta_3 Average\ Annual\ Temperature + \beta_4 Gini\ Index + \beta_5 Homebrew + u$

Table 2 shows the results. In the first specification you can see that the GDP per capita is positively and statistically significant. This means that for every thousand dollar increase wealth there is 0.04 litre increase in alcohol consumption. The GDP per capita alone does not explain enough variation in the dependent variable thus in the second specification I have added the rest of the independent variables. We can observe that the effect of GDP per capita is positive but no longer significant but the unemployment rate, average annual temperature and gini index are all significant. A one percent increase in unemployment rate would observe a 100 ml increase in alcohol consumption.

Table 2: Regression Results

VARIABLES	(1) Simple 1 Alcohol Consumption	(2) Multiple 1 Alcohol Consumption	(3) Simple 2 Alcohol Consumption	(4) Multiple 2 Alcohol Consumption
GDP per capita	0.04***	0.008		
	(0.01)	(0.01)		
Unemployment rate		0.10*		0.09
		(0.05)		(0.05)
Average Annual Temperature		-0.21***		-0.16***
		(0.03)		(0.03)
Gini index		-0.05**		-0.01
		(0.02)		(0.02)
Home brew		-0.15		-0.23
		(0.48)		(0.46)
HDI index			0.17***	0.09***
			(0.02)	(0.02)
Constant	6.18***	11.43***	-6.937***	1.933
	(0.41)	(1.17)	(1.86)	(3.15)
Observations	153	153	153	153
R-squared	0.11	0.36	0.29	0.40

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

A 1-degree celcius increase in temperature would observe a 200 ml decrease in alcohol consumption. The coefficient of the gini index shows that a 1 percent increase in the index would decrease alcohol consumption by 50 ml. This means that the more income inequality a country has the less alcohol they would consume. Compared to the simple regression the independent variables express more variation in the dependent variable.

Moving on to the regressions with the HDI index. In specification three we can observe that in the HDI index is positively and statistically significant just like the GDP per capita. In this case, a percentage increase in the index would increase alcohol consumption by 170 ml. The

variation in the dependent variable is more than double than that shown by GDP per capita. 29% of the variation is explained by HDI index alone. The multiple regression in specification 4 shows a 10% increase in variation compared to the simple regression. We can observe that HDI index continues to be positively and statistically significant while the annual average temperature remains negatively and statistically significant. The rest of the variables show similar results to that of specification 2 but are insignificant.

The home brew coefficient is negative showing that if a country were to brew their liquor at home, then the calculated alcohol consumption per capita would decrease but remains insignificant for both the multiple regressions.

Conclusion

The empirical results observed approve the alternative hypothesis and reject the null hypothesis proving that economic growth does affect alcohol consumption per capita. The increase in the GDP per capita and HDI index observes an increase in alcohol consumption meaning as a person becomes more wealthy, healthy, educated, and experiences an overall increase in their standard of living they are more likely to drink alcohol. Countries with high unemployment and a lower GDP per capita, with an increase in either would increase the alcohol consumption. While, countries with high income disparities would experience lower alcohol consumptions. An interesting observation is the significance of the effect of temperature on alcohol consumption. Cooler countries experience an increase in alcohol consumption while in warmer countries you would consumer less alcohol. The cold temperature in Estonia might have a role to play in making it the country with the highest alcohol consumption. In Eastern countries it could be that the freedom to brew their own liquor contributes to the low alcohol consumption considered here. The promising results come with certain limitations though.

Some of the variables used were heavily correlated with each other such as GDP per capita and HDI index. The combination of GDP per capita and HDI index could have resulted in a greater variation of the dependent variable, but they are heavily correlated. The dependent variable could have seen a greater variation if these variables were combined but as they are measured in two different units it would be difficult to find the appropriate way to combine them. Thus, I took them as two separate independent variables and conducted separate regressions.

The variation from the regressions amount to a maximum of 40% meaning there are more factors that affect alcohol consumption. There are several factors that might increase the variation and significance of the results. First, this research paper only considers 51 countries with a certain bias towards European region. A larger dataset would provide more accurate results as it would comprise of more countries that have different cultural, social, regional, and political regulations.

The price of alcohol relative to income also plays an important role in alcohol consumption. Price has a linear relationship with alcohol consumption and has a significant effect on it (Chaloupka and Grossman, 2002). Individual countries have their unique drinks that are appropriate for the domestic incomes. A person with lower income would buy cheap alcohol while the one with a higher income would buy expensive alcohol. The level of income would not stop the person from drinking alcohol, rather just regulate which alcohol they purchase.

A country's demography consists of people from various ethnicities and races. This paper does not consider the diversity in the population. The geographical vastness of the region implies a strong diversity of social, economic, cultural and health situations, which obviously are reflected in the different habits related to wine consumption (Spada et al, 2020). I have not

considered any Muslim majority countries as according to their religion it is taboo to drink alcohol but some Muslim majority countries like the ones in United Arab Emirates have an excellent economy but do not consume alcohol at all. While countries like India and Indonesia have a significant Muslim population that would negatively affect alcohol consumption. Since there is no accurate measure of the Muslim population across the world it is difficult to assess the effect.

The rest of the variation can be further explained by cultural and social factors, that cannot be calculated on paper. Every country has their culture has their own drinking culture. In most cases alcohol is consumed in social gatherings as it reduces social awkwardness and promotes social engagement among each other. In Japan, sales executives take their clients out to drink to become friendly and close the deal. In fact, this business culture is so eminent that turmeric drinks are sold in the convenience stores that help reduce the effects of alcohol or prevent getting drunk.

All the countries have different tax policies on alcohol imported and domestically produced. Some countries like USA and India have different tax policies based on their state. The implication of this research is to observe the effects of the growth in the economy. The results show a positive relation signifying that more stricter tax policies need to be in place to further regulate alcohol consumption. Colder countries need to be more careful during winters as the consumption of alcohol increases. Certain restrictions can be imposed during the winter months that would decrease the consumption. Such as an increase in excise taxes during winter would limit the purchase of alcohol and thus reduce consumption.

Further addition of variables to the regressions would improve the results but the empirical results succeed in informing us that economic growth is associated with an increase in

alcohol consumptions and measures to prevent serious adversities by all the economies need to

be imposed to prevent any negative consequences.

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