ALCOHOL, CRIME AND SUICIDE: EMPIRICAL EVIDENCE FROM OECD COUNTRIES

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ABSTRACT

Alcohol, a legal psychoactive substance in many countries, is associated with both physical and mental wellbeing. Besides diseases, such as liver cirrhosis, cardiovascular diseases, digestive system cancers, alcohol has been shown to be associated with a number of social problems, involving crime and suicide. This study aimed to investigate the long-run and causal linkages between suicide, alcohol and crime for 15 OECD countries. Panel co-integration, FMOLS, DOLS, and the Panel Granger causality tests were implemented. The empirical findings revealed that (i) there is a positive linkage between alcohol consumption and crime rate and between crime rate and suicide rate in the long run ;(ii) there is also feedback causality between alcohol consumption and crime rate and between crime rate and suicide rate.

Keyword; OECD Countries; Alcohol; Crime; Suicide; Panel Cointegration.

JEL Codes; C33; A14; C01.

ALKOL, SUÇ VE İNTİHAR: OECD ÜLKELERİNDEN DENEYSEL KANITLAR

ÖZET

Birçok ülkede yasal bir pisikoaktif madde olan alkol hem fiziksel hem de mental sağlıkla ilişkilidir. Alkol, karaciğer sirozu, kardiyovasküler hastalıklar, sindirim sistemi kanserleri gibi fiziksel hastalıklar dışında, suça teşebbüs ve intihar gibi birçok sosyal problem de neden olduğu bilinmektedir. Bu çalışma, 15 OECD (Avrupa Ekonomik İşbirliği Örgütü) ülkesinde intihar, alkol ve suç oranlarının uzun süreli ve nedensel ilişkisini çalışmayı amaçlamıştır. İntihar, alkol ve suç oranları verileri Panel Eşbütünleşme, FMOLS, DOLS, ve Panel Granger Nedensellik analizleri kullanılarak değerlendirilmiştir. Analiz sonucunda elde edilen bulgular göstermiştir ki: (i) alkol tüketimi ve suç oranları ve suç oranları ve intihar oranları arasında uzun süreli pozitif yönde bir ilişki; (ii) alkol tüketimi ve suç oranları , ve suç oranları ve intihar oranları arasında geribildirim nedenselliği vardır.

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Anahtar Kelimeler; *OECD Ülkeleri; Alkol; Suç; İntihar; Panel Eşbütünleşme.*

Jel Kodları: *C33; A14; C01.*

1.INTRODUCTION

Alcohol is a psychoactive substance that is legal to be sold in most countries (Sung, 2016) and has been extensively consumed globally. Recent data reports that 6.2 litres of alcohol are consumed in those aged 15 and over per annual year, with the developed countries having greater alcohol consumption levels than developing countries. Excessive use of alcohol has been reported to cause many diseases, especially alcohol dependence, cancers of digestive system, cardiovascular diseases and liver cirrhosis. High consumption of alcohol leads to an estimated 6% of all deaths worldwide. Alcohol overuse can lead to alcohol dependence that is considered as a psychological disease, affecting more men compared to women (Hasin et al., 2007; Hufford, 2001). As well as the harmful effects on physical wellbeing, alcohol also causes crucial circumstances associated with social problems in populations. Crime and suicide are among the events that are highly related with excessive use of alcohol.

Although there is evidence on the association between alcohol consumption and crime, alcohol consumption and suicide separately, no study has related both crime and suicide with alcohol consumption. This study is aiming to evaluate the causal relationship between suicide, crime and alcohol abuse in the long-run in the selected 15 OECD countries. This study is presented as follows: Following the introduction, Section 2 provides information on evidence on the relation between alcohol consumption and crime and alcohol consumption and suicide, Section 3 presents the data and methodology. Section 4 provides empirical findings. In Section 4, some concluding remarks and policy recommendations are provided.

2. LITERATURE REVIEW

Alcohol consumption causes changes in the mind and behaviours (Sung, 2016), making both committers (Greenfeld, 1998; Collins & Messerschmidt, 1993) and victims susceptible to be involved in criminal cases (Cherpitel, 1994; Cherpitel, 1997). Alcohol-related crime is defined as criminal activities that occur due to the alcohol use and defilements of regulations relative to the sale or consumption of alcohol (Sung, 2016). Alcohol drinking can be associated with a number of different types of offences, including minor crimes that interrupt public order, traffic accidents and associated crimes, attacks and homicide. Evidence shows that alcohol consumption is widespread in younger populations and this is associated with increased risk of alcohol-related crime, mainly violence and traffic accidents, in this population group (Johnston et al., 2004). Facial injuries are among those that result from the violence due to alcohol; facial injuries occurring at home are seen generally in women because of domestic violence (Jacobs, 1998). There are discussions on the association between crime activities and alcohol in the way that if the relationship is a causal. Although the arguments are mostly

supporting that alcohol leads people to lose consciousness leading to behaviours causing crime, some also argue that people having propensity to be violent and committing crime tend to use more alcohol as a means to medicate themselves or reduce any punishment relative to their violence or crime (Markowitz, 2005). Reducing crime associated with excessive alcohol use therefore warrants efficient policies. Policies on the prices on alcoholic beverage, such as taxes on alcohol and other governmental policies to control alcohol usage, such as punishments on driving when drunk are among those that can be effective in reducing the crime associated with alcohol. A number of studies have studied the impact of these policies on preventing crime, but recent evidence suggests that price policies, taxing on alcoholic beverage, can have some impact on reducing alcohol associated crime and there is no evidence on the impact of other policies on crime (Markowitz *et al.*, 2012).

Today's world has been struggling with suicide as one of the major public health problems, which is associated with substance use. Approximately one million people die due to completed suicide, whilst much more than this number commit suicide (World Health Organization, 2018). Suicide has been shown as the 15th cause of mortality and 2nd cause of death in younger individuals (aged 15 to 29 years) (World Health Organization, 2014). Alcohol is one of these substances that may induce suicidal behaviour, leading to either attempted suicide that is non-lethal attempt or completed suicide ending up with death (Vijayakumar *et al.*, 2011). It is reported that heavy drinking increases the risk of suicide attempts, with those drinking alcohol heavily having five times greater risk of committing suicide compared with those drinking for social purposes (Pompili *et al*., 2010). A recent meta-analysis reported that acute alcohol use increases the risk of attempting suicide, with an increasing risk with greater levels of alcohol consumption (Borges *et al*., 2017). The evidence suggests that the association between alcohol and suicide is significant particularly in younger individuals. There are different arguments on the association between gender and suicide in heavy drinkers. Whilst more men who commit suicide are found to have consumed alcohol, it has ben also reported that women who commit suicide are more likely to be alcohol abusers (Brady, 2006).

3. DATA AND METHODOLOGY

A dataset on fifteen OECD countries, namely Australia, Austria, Belgium, Denmark, Finland, France, Greece, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, and United States, has been used in this study to investigate the relationship between alcohol consumption, suicide rates and crime over the period of 1975-2010. The dataset used in this study was constructed using the World Bank dataset. The variables are employed in natural logarithm forms. To our best knowledge, no such a study has ever previously been undertaken by any researcher in particular on OECD countries. This study is, therefore, novel in its own field.

In this study, we used three equations to explore the causal and long-run relationship among the variables. The equations are as shown below;

$$CR_{it} = \rho_{it} + \beta^i t + \upsilon_{1i}SU + \upsilon_{2i}AR + u_{it} \qquad (1)$$

$$AL_{it} = \rho^o{}_{it} + \beta^{oi}t + \upsilon^o{}_{1i}SU + \upsilon^o{}_{2i}CR + u^o{}_{it} \qquad (2)$$

$$SU_{it} = \rho^o{}_{it} + \beta^{oi}t + \upsilon^o{}_{1i}AL + \upsilon^o{}_{2i}CR + u^o{}_{it} \qquad (3)$$

In these equations, ρ_i denotes country specific effects, β^i is the deterministic time trends and u_{it} is the error symbol, indicating the deviations from the long-run relationship towards short-run one. CR, AL, SU indicates crime rates (Per 100 000 persons), suicide rates (Per 100 000 persons), Alcohol consumption (Total Litres capita (aged 15 and over)), respectively.

As an initial step, we used several unit root tests to detect the integration order of the variables. Levin et al. (2002), LLC hereafter; Im et al. (2003) IPS hereafter; Dickey and Fuller (1979 and 1981), Phillips and Perron (1988), Choi (2001) panel unit root tests in this study are used to investigate the stationarity of the variables. After detecting the integration order of the variables, we use Pedroni Cointegration test, proposed by Pedroni (1999) and Kao Cointegration test proposed by Kao (1999) to capture the long-run equilibrium relationship among the variables in the OECD countries.

In the literature, to obtain co-integration equation among the variables allows us to employ FMOLS and DOLS estimators to estimate panel coefficients. The numerous estimators available included within and between group FMOLS and DOLS estimators. Yorucu and Kirikkaleli (2017) argues that the FMOLS is a non-parametric approach examine the correcting for serial correlation, whereas the DOLS is parametric approach, which estimates lagged first differenced terms. Kirikkaleli (2006) and Kirikkaleli et al. (2018) underlined that the lags, lead and contemporaneous values of the regressors are augmented when DOLS is performed. Thus, to investigate the long-run linkages between alcohol consumption, suicide rates and crime over the period of 1975-2010 in the OECD countries, we employ FMOLS and DOLS models. As a last step of this study, we perform Panel Granger causality test to explore the causal linkage between alcohol consumption, suicide rates and crime over the period of 1975-2010 in the OECD countries.

4. EMPIRICAL FINDINGS AND DISCUSSION

In this study, we propose to explore the causal and long-run linkages between alcohol consumption, suicide rates and crime over the period of 1975-2010 in the OECD countries. As a primary step, we checked the stationarity of the variables. Table 1 shows the results from panel unit root , namely LLC, Breitung, IPS, ADF-Fisher and PP- Fisher, tests. The results revealed that the CR, SU and AL variables have unit root at their levels. However, at the first difference, the variables were seem

stationary, implying that the order of integration of the variables are one, I(1),. These results allowed us to investigate the e the possibility of cointegration relationship among the variables.

Table 1. Panel Unit Root Tests

Variables		LLC	Breitung	İPS	ADF-Fisher	PP-Fisher
		t-statistic	t-statistic	W-statistic	Chi-square	Chi-square
Level	CR	-0.862	6.289	2.351	17.521	30.677
		(0.1943)	(1.000)	(0.990)	(0.965)	(0.431)
	SU	-0.594	0.552	-1.199	39.724	31.648
		(0.690)	(0.709)	(0.115)	(0.110)	(0.384)
	AL	3.285	1.421	1.364	41.815	18.487
		(0.9995)	(0.922)	(0.913)	(0.074)[b]	(0.950)
First difference	CR	-19.102*	-10.935*	-20.456*	362.527*	958.842*
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	SU	−19.413*	-14.848*	-18.374*	300.259*	331.029*
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	AL	-9.450*	−14.123*	-11.779*	200.562*	557.491*
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: *, [a], and [b] donate 1%, 5%, and 10% significance levels, correspondingly. The model is performed with a trend and constant.

The next step was to employ Pedroni and Kao Cointegration test to capture whether there is any cointegration or long-run equilibrium relationship existing between alcohol consumption, suicide rates and crime in the OECD countries. Panel based Pedroni and Kao Cointegration tests are reported in Table 2. The results from Pedroni cointegration test revealed that 6 out of 11 statistics in model 1, 6 out of 11 statistics in model 2, and 7 out of 11 statistics in model 3 were significant at the 5 % level. This result mirrors that no cointegration null hypothesis for all models can be rejected. The findings from the Kao panel cointegration test for all models supported this result as well. Therefore, we can conclude that there is a long run equilibrium relationship among the variables in OECD countries.

Table 2. Panel Co-Integration Test

Pedroni co-integration test								Kao co-integration test		
	Alternative hypothesis: Common AR coefficients (within-dimension)				*Alternative hypothesis: Individual AR coefficients (between-dimension)*					
Model 1. CR AL SU										
	Statistic	Prob.	Weighted statistic	Prob.					t-stat.	Prob.
Panel v-statistic	2.472	0.006	1.453	0.0730	Group rho-statistic	0.383	0.6492	ADF	-1.820	0.034
Panel rho-statistic	-0.337	0.367	-0.010	0.4959	Group PP-statistic	-2.095	0.0181			
Panel PP-statistic	-2.145	0.016	-1.808	0.0457	Group ADF-statistic	-2.224	0.0123			
Panel ADF-statistic	-1.936	0.030	-1.377	0.0841						
Model 2. AL CR SU										
	Statistic	Prob.	Weighted statistic	Prob.					t-stat.	Prob.
Panel v-statistic	5.631	0.000	-0.474	0.682	Group rho-statistic	-0.099	0.4604	ADF	-2.847	0.002

Panel rho-statistic	-1.623	0.052	-1.049	0.147	Group PP-statistic	-4.719	0.0000		
Panel PP-statistic	-4.520	0.000	-5.085	0.000	Group ADF-statistic	-5.223	0.0000		
Panel ADF-statistic	-3.229	0.000	-1.509	0.065					

Model 3. SU CR AL

	Statistic	Prob.	Weighted statistic	Prob.					t-stat.	Prob.
Panel v-statistic	2.611	0.001	1.786	0.037	Group rho-statistic	-0.003	0.498	ADF	-1.988	0.032
Panel rho-statistic	-2.187	0.009	-1.184	0.118	Group PP-statistic	-1.814	0.034			
Panel PP-statistic	-0.636	0.262	-1.758	0.039	Group ADF-statistic	-2.823	0.002			
Panel ADF-statistic	-5.111	0.000	-1.915	0.027						

Note: *, [a], and [b] denote 1%, 5%, and 10% significance levels, correspondingly.

Table 3 reports findings from Panel FMOLS and DOLS estimations for the variables of SC, CR, and AL. As precisely observed in the model one, long-run elasticities of CR variables ranges from 0.0185 to 0.0303 and the outcomes of the FMOLS and DOLS estimators were found to be significant at the 1% significance level and positive, implying that 1% increase in crime rate leads to 1.85% to 3.03% increase in alcohol consumption. In the second model, our findings revealed that crime rate in the OECD countries significantly and positively affects suicide rate. Positive and significant coefficients obtained for suicide rate and alcohol consumption in the third model indicates that crime rate in the OECD countries are significantly triggered by alcohol consumption and suicide rate. This finding is the consistent with the literature, which evaluated the impact of alcohol consumption on crime rate and suicide rate separately (Carpender & Dobkin, 2015; Cherpitel, 1994; Cherpitel, 1997).

Table 3. Panel FMOLS and DOLS Estimations

FMOLS (Between Dimensions)			DOLS (Between Dimensions)		
Variables			Variables		
Model 1. AL	SC	CR	Model 1.	SC	CR
	-0.065	0.030		-0.025	0.018
	(-1.044)	(5.140)*		(-1.034)	(3.558)*
Model 2. SC	AL	CR	Model 2.	AL	CR
	-0.161	0.110		-0.058	0.110
	(-1.791)	(12.797)*		(-0.597)	(8.967)*
Model 3. CR	AL	SC	Model 3.	AL	SC
	2.432	3.166		2.441	3.309
	(5.979)*	(14.974)*		(3.394)*	(7.618)*
FMOLS (Within Dimensions)			DOLS (Within Dimensions)		
Variables			Variables		
Model 1. AL	SC	CR	Model 1.	SC	CR
	-0.073	0.028		-0.025	0.018
	(-1.556)	(3.293)*		(-1.017)	(3.525)*
Model 2. SC	AL	CR	Model 2.	AL	CR
	0.173	0.108		0.058	0.110
	(4.289)*	(8.488)*		(4.212)*	(8.851)*
Model 3. CR	AL	SC	Model 3.	AL	SC
	2.412	3.220		2.441	3.309

(3.524)*	(9.052)*		(3.347)*	(8.105)*

Note: *, ^{a}, and ^{b} denote 1%, 5%, and 10% significance levels, correspondingly.

To obtain information about the causal linkage between alcohol consumption, suicide rates and crime in the OECD countries, Panel based Granger causality test is performed. Table 4 shows the findings from such test. Panel causality tests indicated that the null hypotheses of Alcohol Consumption do not cause crime rate in the OECD countries can be rejected at the 5% level, meaning that changes in Alcohol Consumption significantly lead to changes in crime rate. The reverse casual direction is also statistically significant; implying that crime rate in the OECD countries causes Alcohol Consumption. Table 4 also reveals that there is feedback causality between suicide rate and crime rate in OECD countries. In a study conducted using data from 65 regions, crime and suicide were found to be correlating in some parts of the world, which is consistent with our finding showing that there is causality relationship between particular variables (Bills & Li, 2005).

Table 4. Panel Granger Causality Test

Direct of Causality	F-Statistic	Prob.
CR → AL	4.01660	0.0456^b
AL → CR	6.71921	0.0098*
SU → AL	0.82403	0.3644
AL → SU	0.03479	0.8521
SU → CR	5.48942	0.0195^b
CR → SU	5.62039	0.0143^b

Note: *, ^{a}, and ^{b} denote 1%, 5%, and 10% significance levels, correspondingly.

5. CONCLUSIONS

Understanding long-run and causal linkages between Alcohol Consumption, Suicide Rates and Crime in the OECD countries is quite important for policy makers. Therefore, in this study, we aimed to explore long-run and causal linkages among the variables in the fifteen OECD countries. To the best of our knowledge, the linkage among the three variables using single dataset has not been investigated in the literature. This study, therefore, fills this gap in the literature. In this study, we used panel based Pedroni Cointegration, Kao Cointegration, FMOLS, DOLS and Granger causality test. The World Bank dataset is used in this study over the period of 1975-2010. Our finding showed that in the long-run, while alcohol consumption contributes to the crime rate in OECD, rising crime rate is also associated with increasing alcohol consumption. In addition, there is a positive linkage between crime rate and suicide rate in the long run. We also find that there is also feedback causality between alcohol consumption and crime rate and between crime rate and suicide rate.

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