RESPONSIBLE DRINKING PROGRAMS AND THE INVISIBLE HAND

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Abstract

This article aims to better understand motivation for responsible drinking programs (RDPs) implemented by alcohol industry, namely if these activities are public interest or profit oriented. The goal of alcohol industry is to sell great quantities of their product. On one hand, binge drinking appears to improve alcohol's sales and to be profitable for the alcohol industry. On the other hand, binge drinking causes sort-term deaths, which correspond to a direct shortfall for alcohol's companies. In this paper, we explore coexistence of these two forces using a two-period model. We find that there exists a level of alcohol consumption beyond which binge drinkers are costly for the alcohol industry. Finally, we calibrate our model with the U.S. data from the *Behavioral Risk Factor Surveillance System* for the year 2011, and we estimate that this threshold should be between 10.3 and 10.83 drinks per binge drinking occasion (or 144.2 – 151.6 grams of pure alcohol). This result proves that conducting RDPs is a profit oriented strategy for the alcohol industry. However, because binge drinking is the main source of alcohol social cost, in undertaking RDPs alcohol industry contributes to increase social welfare. Then, RDPs appear to be driven by an *invisible hand* rather than CSR motivated.

Keywords: Alcohol industry, Responsible drinking programs, Binge drinking, Corporate social responsibility, Fatal injuries.

"He intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was not part of his intention."

Adam Smith (1976, p. 477)

1. INTRODUCTION

Since the 90s, corporate social responsibility (CSR) activities from companies selling products deemed dangerous or risky have drastically increased in developed countries (Barry and Goodson, 2010; Pantani *et al.*, 2012). According to Maignan and Ferrell (2004, p. 4), CSR can be viewed as social obligation incorporating: "(a) economic obligations (be productive and economically viable), (b) legal and ethical obligations (follow the law and acknowledged values and norms), and (c) philanthropic obligations (proactively give back to society)". On the other hand, CSR activities can be perceived as a way to increase benefits and to preserve reputation of the firms (Friedman, 1970; Scherer and Palazzo, 2008; Sprinkle and Maines, 2010). Thus, literature analyzes the motivations for conducting CSR activities for industries selling dangerous products such as alcohol (Barry and Goodson, 2010; Pantani *et al.*, 2012) and tobacco (Barraclough and Morrow, 2008; Massin, 2012).

In the end, there are two possible motivations: either CSR activities are achieved because of the encompassing interest of firms or they just are profit-oriented strategies conducted in order "to make as much money as possible while conforming to the basic rules of the society, both those embodied in law and those embodied in ethical custom" (Friedman, 1970). In the latter case, it would mean that there exists an *invisible hand* promoting social return. This corresponds to the 'win-win' vision of CSR defended by Bénabou and Tirole (2010): in conducting CSR, firms maximize long-term profits rather than short-term ones, leading to a gain for society. In this paper we address the question of the existence of such a mechanism in the case of the alcohol industry.

Alcohol is a specific good in the sense that it is addictive, and involves health, social and economic cost (Anderson and Baumberg, 2006). In conducting CSR activities, alcohol industry thus process to harm reduction, contributing to reduce alcohol social cost. Responsible drinking programs (RDPs), promoting responsible, moderate alcohol consumption, are a part of CSR activities. For example, in 2011, Bacardi Limited launched the advertising campaign "Champions drink responsibly" aiming at diminishing alcohol problems and to mirror public health concerns with binge drinking.

In promoting non-excessive alcohol consumption, RDPs seems to be at the opposite of the commercial goals of the alcohol producers. Indeed, "producers would find no financial

advantage in such actions because they are typically interested in selling great quantities of their product" (Massin, 2012, p. 1857). However, binge drinking causes sort-term deaths which involve a direct shortfall for alcohol's companies due to the decrease of the consumers' number. In addition, if long term deaths mainly concern individuals aged 65 and more, short-term deaths concern younger individuals (Guérin *et al.,* 2013), implying a larger shortfall for the alcohol industry. Considering binge drinking phenomenon from the alcohol industry point of view, two antagonists effects are thus at stake. On the one hand, the high level of alcohol consumption of binge drinkers tends to increase immediate profit. On the other hand, inherent risks of fatal injuries related to binge drinking diminish next period's profit: "killing the customer is not good for business in the long run" (Earl, 2005, p. 148).

Therefore, RDPs could be just a part of profit maximization of alcohol industry. This view is defended by Piazza-Gardner and Barry (2011, p. 3), who stated that "the advertising activities, partnership, and program development/involvement in which the alcohol industry engages are only intended to sell more alcohol". Nonetheless, because heavy drinkers represent a large part of the alcohol social cost (Mohapatra *et al.*, 2010), by reducing the deaths associated to alcohol consumption, RDPs also have the unintended consequence of increasing social welfare through an *invisible hand.*

In this work, we study alcohol industry's motivations to implement RDPs, in wondering if there is an *invisible hand* driving the behavior of the alcohol industry. We adopt a sector analysis (rather than a firm one) in order to eliminate motivations due to competition between firms. By doing so our study directly addresses the link between profitability and alcohol consumption regardless of firms' positioning strategies.

After a short presentation of alcohol related deaths, we propose a two-period model highlighting under which conditions binge drinkers are costly for the alcohol industry. We find that there exists a threshold of alcohol consumption beyond which conducting RDPs is profit-enhancing. Pursuant to the U.S. *Behavioral Risk Factor Surveillance System* data for the year 2011, we estimate this threshold may be between 10.3 and 10.83 drinks (or 144.2 – 151.6 grams of pure alcohol) per binge drinking occasion. Then, beyond this threshold, alcohol industry has an interest to develop RDPs, the latter leading to improve social welfare in diminishing alcohol related deaths.

2. ALCOHOL RELATED DEATHS AND BINGE DRINKING

Alcohol mortality burden can be divided into short-term deaths, resulting from a single consumption episode, and long-term deaths arising from patterns of alcohol consumption (e.g.

chronic diseases, cancers). Short term injuries both intentional (e.g. self-inflicted injuries, homicides) and unintentional (e.g. motor vehicle collisions, poisonings, falls) are by far the most important causes, representing 32% of alcohol-attributable deaths (Rehm *et al.*, 2012).

Binge drinking, which can be defined as consuming 60+ grams of pure alcohol per day for men (the equivalent of at least 5 standard drinks of 12 g pure alcohol) and 40+ grams for women (WHO, 2014), is the critical feature in determining the risk of fatal injury (Li *et al.*, 1994). In addition, literature generally consider that there is an exponential dose-response relationship between the amount of alcohol consumed and the risk of injury (Borges *et al.*, 2006; Hels *et al.*, 2013; Rehm *et al.*, 2012). If there is no level of alcohol consumption for which injury risk is null, drinking less than three drinks per day for a man, and two drinks per day for a woman, fits with the "low-risk" guidelines, minimizing risks associated to alcohol consumption (Latino-Martel *et al*., 2011).

Then, in order to reduce mortality associated to alcohol consumption, "strategies for reducing consumption should aim for consumption below recommended thresholds (two drinks per day for women, three for the men) or, at least, in that direction" (Brousse *et al.*, 2014, p. 11665).

3. THE MODEL

We consider a two-period model in which fatal injuries are accounted for by a decrease in the number of drinkers at the end of the first period. 'Alcohol' is supposed to be a homogeneous and perfectly divisible good.

3.1. Alcohol consumptions

Consider a drinking population divided into binge drinkers (B) and moderate ones (M) differing only according to their mode of alcohol consumption. Each period of the model contains a fixed share θ, $(0 \leq \theta \leq 1)$, of festive time depending on cultural and social factors. We call it binge drinking episodes. In the rest of the period, $(1-\theta)$, there is no special occasion and drinkers have a 'daily' moderate consumption. In order to stay tractable, we make the two following behavioral assumptions:

ASSUMPTION 1:

(i) Outside binge drinking episodes, binge drinkers and moderate ones have the same level of alcohol consumption, $\underline{C}$.

(ii) During binge drinking episodes, moderate drinkers do not change their consumption $(\underline{C})$ whereas binge drinkers consume a level $\bar{C} > \underline{C}$ during these occasions.

Under this assumption, the total level of alcohol's consumption for a period $t, t = \{1,2\}$, is defined as follows:

$$C_t = M_t\underline{C} + B_t(\theta\ \bar{C} + (1-\theta)\underline{C}) \quad (1)$$

Without loss of generality, we suppose a unitary drinking population in the first period of the model such as:

$$B_1 + M_1 = 1, \qquad B_1 > 0, M_1 > 0 \quad (2)$$

3.2. Risks of fatal injuries and drinking population laws

Drinkers (both B and M) consume alcohol and are exposed to different risks of fatal injuries at the end of the first period. Let ρ be the risk of fatal injuries related to excessive consumption during 'festive' episodes.

$$\rho = \lambda e^{\bar{C}} \quad (3)$$

where λ is a positive parameter. It should be noticed that the global risk could be decomposed as a the weighted sum of individual risks borne by each kind of drinkers: $\rho = M_1\beta^M + B_1\beta^B$, where β^j is the probability of death for a j-type drinker, $j = \{B, M\}$. Let RR be the relative risk for a binge drinker compared to a moderate one $(RR = \beta^B/\beta^M)$. We can deduce from (3) the following two relations:

$$\beta^M = \frac{\lambda e^{\bar{C}}}{M_1 + B_1 RR} \quad (4)$$

$$\beta^B = \frac{RR\lambda e^{\bar{C}}}{M_1 + B_1 RR} \quad (5)$$

In order to capture modifications in alcohol use from period 1 to period 2, we need some *ad hoc* assumptions concerning the drinking population.

ASSUMPTION 2:

(i) Let $\mu(\rho)$ be a function representing the net number of new consumers at the beginning of the period 2. They start as moderate drinkers and are linearly sensitive to the global risk associated with alcohol consumption, such as $\partial\mu/\partial\ \bar{C}$ is a negative constant.

(ii) There is a share φ^B, $0 \leq \varphi^B \leq 1$, of moderate drinkers in period 1 who become binge drinkers in period 2. The value of φ^B does not hinge on the level of risk, ρ.
(iii) There are $\varphi^M B_1$, $0 \leq \varphi^M \leq 1$, binge drinkers who quit binge drinking to become moderate drinkers in period 2. Here again, φ^B does not hinge on the level of risk, ρ.

Assumption 2 is sustained by some scholar works. First, justifications of (i) can be found in Everingham and Rydell (1994) and Massin (2012). Second, the independence of the change in uses of alcohol regarding to the risk of fatal injuries is supported by Ward *et al.* (2010).

Following Assumption 2, we can design 'drinking population laws' as the following system:

$$\begin{cases} \Delta M = \mu + (-\beta^M - \varphi^B) M_1 + \varphi^M B_1 \\ \Delta B = (-\beta^B - \varphi^M) B_1 + \varphi^B M_1 \end{cases} \quad (6)$$

3.3. The behavior of the industry

Consider now the alcohol industry. Our model includes only two periods of time because the alcohol industry could be regarded as myopic agent and, it allows us to provide tractable and testable results. Using the levels of alcohol consumption defined in equation (1), profit of the alcohol industry could be depicted by:

$$\pi = \sum_{t=1}^{2} \frac{\alpha C_t}{(1+\delta)^{t-1}} \quad (7)$$

Where $\alpha > 0$ corresponds to the unit margin associated with the sale of one 'unit' of alcohol, and δ is the discounted rate.

DEFINITION: In the case of RDPs, there exists an invisible hand if and only if a decrease in the level of alcohol consumption during binge drinking ($\bar{C}$) leads to an increase of the global profit. In other terms, it supposes that $\partial\pi/\partial\bar{C} < 0$. According to equation (7) an invisible hand exists if and only if:

$$\alpha \frac{\partial C_1}{\partial \bar{C}} < -\frac{1}{1+\delta}\left(\frac{\partial C_2}{\partial \bar{C}}\right)\alpha \quad (8)$$

Inequality (8) means that if actualized losses of alcohol sales in period two are superior to the gains realized during the first period, implementation of RDPs increases alcohol industry's profit. Using equations (4), (5) and (6), we can rearrange (8) as follows:

$$\beta_1\theta < -\frac{1}{1+\delta}\left[\left(\frac{\partial\mu}{\partial\bar{C}} - \frac{\bar{C}\lambda e^{\bar{C}}}{M_1 + B_1 RR}\right)\underline{C} + \left(-\frac{\bar{C}\lambda e^{\bar{C}} B_1}{M_1 + B_1 RR}\right)\left(\theta\bar{C} + (1-\theta)\underline{C}\right)\right.$$
$$\left. + \theta\left(\left(1 - \frac{\lambda e^{\bar{C}}}{M_1 + B_1 RR} - \varphi^M\right)B_1 + \varphi^B M_1\right)\right] \quad (8')$$

We face a computational difficulty related to the use of the (*realistic*) exponential relation between the global risk of fatal injuries, ρ, and $\bar{C}$. In order to isolate $\bar{C}$ on the left-hand side, we use the Lambert W function, noted $W(.)$, where $W(.)$ is the inverse function $f(W) = We^W$. It should be noticed that $\forall\bar{C} \in \mathcal{R}_+, W(\bar{C}) > 0, W' > 0$ and $W'' < 0$.

$$\bar{C} > W\left(\frac{(M_1 + RRB_1)(\varphi^B M_1 + B_1(2 + \delta - \varphi^M) + \frac{\partial\mu}{\partial\bar{C}}\frac{\underline{C}}{\theta}}{\lambda B_1 RR} e^{\frac{B_1 RR\left(\underline{C}(1-\theta)+\theta\right)+M_1\underline{C}}{\theta B_1 RR}}\right)$$
$$- \frac{\underline{C}(1-\theta)}{\theta} - \frac{M_1\underline{C}}{B_1\theta RR} - 1 \quad (9)$$

RESULT: according to our framework, there exists an invisible hand if inequality (9) holds. In other terms, there is a threshold of $\bar{C}$ beyond which implementing RDPs is a profit-enhancing strategy. Table 1 summarizes the impact of model's parameters on the likelihood to fulfill (9), all things being equal.

Table 1. Impact of parameters on the likelihood of satisfying inequality (9)

$\underline{C}$	$\partial\mu/\partial\bar{C}$	RR	θ	φ^B	φ^M
+	-	+	-	-	+

4. CALIBRATION WITH 2011 UNITED STATES DATA

We use 2011 U.S. data to calibrate the value of the parameters of our model. First, in a study mobilizing the 2011 *Behavioral Risk Factor Surveillance System*, Kanny *et al.* (2013) stated that binge drinkers represent 18.4% of the U.S. population. Binge drinkers reported 4.2 occasions of binge drinking by month, with an average of 7.7 drinks by binge drinking episode. Note that for the U.S. one standard drink is equal to 14 grams of pure alcohol. In order to shape our model to the available data, let the 'unit' of alcohol be a drink and the period be a year. We suppose that outside heavy drinking episodes, the average consumption

is 2.5 drinks per day (Latino-Martel *et al.*, 2011). Finally, we consider the 2011 inflation rate (2.962%) as a sufficient approximation of the discount rate.

In 2011, the percentage of fatal injuries in the U.S. was 0.06%, and according to Guérin *et al.* (2013) the percentage of injuries attributable to alcohol consumption reaches 21.82%. The probability of dying from a fatal injury caused by alcohol per year is 0.01% and 0.095% per binge drinking episode. By doing so, we assume that fatal injuries caused by alcohol are only related to 'festive' episodes, but we recognize both binge drinkers and moderate ones have a probability of fatal injury of β^B and β^M, respectively. Following Borges *et al.* (2006), we consider that the relative risk between a consumption higher than 6 drinks and a consumption around 2-3 drinks ($\beta^B/\beta^M = 10.1/3.9$) equals 2.59. Using equations (4) and (5), we get $\beta^M = 0.0007$ and $\beta^B = 0.0019$. All parameters are summarized in Table 2.

Last, we cannot find information relative to the change in alcohol uses. In order to avoid hazardous valuations of theses parameters, we consider that there is no change at all between the two periods ($\mu = \varphi^M = \varphi^B = 0$). This assumption seems acceptable because it will lead to an underestimation of our results.

Table 2. Parameters of the model for the case of the United States in 2011

	Binge drinkers	Moderate drinkers
Population*	$B_1 = 0.184\ (0.181 - 0.186)$	$M_1 = 0.816\ (0.814 - 0.819)$
BD episodes per period*	$\theta = 0.138\ (0.133 - 0.14)$	
'Daily' consumption†	$\underline{C} = 2.5\ (2 - 3)$	$\underline{C} = 2.5\ (2 - 3)$
BD's consumption	$\overline{C} = 7.7\ \ (7.6 - 7.7)$*	$\underline{C} = 2.5\ (2 - 3)^{\dagger}$
Probability of fatal injury during a BD episode§	$\rho = 0.00095\ \ (0.00090 - 0.001)$	
Risk parameter§	$\lambda = 0.00000043\ (0.00000041 - 0.00000045)$	
Risk of fatal injuries§	$\beta^B = 0.0019\ (0.0018 - 0.00201)$	$\beta^M = 0.0007\ (0.00069 - 0.00078)$

* Ranges of values are 95% confidence interval (Kanny *et al.*, 2013).

† Ranges of values are defined by Latino-Martel *et al.* (2011).

§ The lower bounds and the higher bounds are defined considering the minimum and maximum of fatal injury rates during the period 2009-2013 calculated with data of the *Centers for Disease Control and Prevention*.

We use a Monte Carlo-like approach in order to test the sensitivity of our result considering the ranges of values of the parameters used. We randomly and simultaneously simulated all parameters 10,000 times to obtain a consistent estimation of equation (9). We find that (9) holds when the level of consumption during a binge drinking episode ($\bar{C}$) is superior to 10.6 drinks (or 148 grams) fluctuating into 10.30 – 10.83. This threshold is higher than the average number of drinks (7.7 drinks) consumed during 'festive' episodes in the U.S. in 2011. However, this figure disregards the variance of the average number of drinks. In fact,

the intensity of binge drinking varies largely across socioeconomic data (Kanny *et al.*, 2013). A salient illustration is provided by Dawson *et al.* (2010). They show that people subject to alcohol use disorder report an average number of drinks included in a range between 9.4 and 15.4 per 'festive' episodes. Following our model, these drinkers would represent a shortfall for the U.S. alcohol industry.

5. CONCLUSION

In this article we argue that, due to the short-term risks of fatal injuries, conducting RDPs might be a profit-enhancing strategy rather than a CSR one. We use a two-period model and we find that there exist a threshold of alcohol consumption during festive episodes beyond which binge drinkers represent a shortfall for the alcohol industry (see equation (9)). Regarding the U.S. case in 2011, the threshold estimated equals 10.6 drinks (or 148 grams of pure alcohol), fluctuating into 10.30 – 10.83 drinks (or 144.2 – 151.6 grams of pure alcohol) per binge drinking occasion. U.S. alcohol industry has an interest to conduct RDPs in order to limit the alcohol consumption of binge drinkers exceeding this threshold. Consequently, recent observed RDPs, like advertising targeting the heaviest drinkers, seem to be implemented in pursuit of a higher profit, on a long-term perspective. Nonetheless, because binge drinkers represent a large part of alcohol social cost (Mohapatra *et al.*, 2010), RDPs also have the unintended consequence of increasing social welfare through an *invisible hand*.

This article can be characterized as a modest theoretical contribution to the analysis of CSR activities conducted by companies selling addictive goods, extending the work conducted by Barraclough and Morrow (2008), Barry and Goodson (2010), Massin (2012) and Pantani *et al.* (2012). If initially two antagonist motivations for conducting CSR exist (public interest and profit-oriented strategies), our work highlights that RDPs are motivated by profit-seeking when binge drinkers consume high levels of alcohol, generating substantial risks of fatal injuries. Then, RDP "is about taking a long-term perspective to maximizing (intertemporal) profits. This suggests that socially responsible investors should position themselves as long-term investors who monitor management and exert voice to correct short-termism" (Bénabou and Tirole, 2010, p. 10, initially talking of CSR). Consequently one could find in this work a theoretical support for the "public-private collaborations" recently promoted by the OECD (2015) in order to decrease alcohol social cost. Indeed, at least for short-term risks' prevention, alcohol industry may have economic interests to fight binge drinking, and may constitute a non-negligible partner of the State.

Finally, it should be noticed that this study faces several methodological limitations. First, in order to stay tractable we have made strong assumptions shaping the model (and therefore the results obtained). Second, data from the *Behavioral Risk Factor Surveillance System* are self-reported and thus suffer from underreport, especially for binge drinking (Kanny *et al.*, 2013; WHO, 2014). This is due to recall bias, social desirability response bias, and nonresponse bias (Stockwell *et al.*, 2004). Third, all data we need to calibrate the model were not available – notably concerning (non-)drinkers' movements between groups. In order to not make fanciful assumption, we disregarded them. Consequently, results exhibited during the calibration are likely underestimated.

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ANNEX: DIAGRAM FLOW