

Zhang, Jing Hua; Tam, Kwo Ping; Zhou, Nan

Article

Do smoking bans always hurt the gaming industry? Differentiated impacts on the market value of casino firms in Macao

Economics: The Open-Access, Open-Assessment E-Journal

Provided in Cooperation with:

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

Suggested Citation: Zhang, Jing Hua; Tam, Kwo Ping; Zhou, Nan (2016) : Do smoking bans always hurt the gaming industry? Differentiated impacts on the market value of casino firms in Macao, Economics: The Open-Access, Open-Assessment E-Journal, ISSN 1864-6042, Kiel Institute for the World Economy (IfW), Kiel, Vol. 10, Iss. 2016-28, pp. 1-32,
<https://doi.org/10.5018/economics-ejournal.ja.2016-28>

This Version is available at:

<https://hdl.handle.net/10419/147482>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<http://creativecommons.org/licenses/by/4.0/>

Do Smoking Bans Always Hurt the Gaming Industry? Differentiated Impacts on the Market Value of Casino Firms in Macao

Jing Hua Zhang, Kwo Ping Tam, and Nan Zhou

Abstract

The gaming economy has expanded rapidly in East Asia over the past decade. Despite the known public health hazards of secondhand smoking, smoking bans in casinos remain controversial due to concerns over the potential economic harm to casino firms. Applying an event study, the authors examine the abnormal returns of casino stocks in response to three unexpected smoking ban announcements from 2011 to 2015 in Macao. Their analysis reveals that these announcements were associated with differentiated abnormal returns of casino stocks. Stocks of traditional casinos suffered abnormal losses of 0.58–3%, while the Las Vegas themed casinos enjoyed positive abnormal returns of up to 3%. Furthermore, the authors find that low air quality in gaming venues and high dependence on gaming revenues are associated with abnormal losses, while positive management initiatives are significantly correlated with positive abnormal returns. The findings of this study provide a full picture of the impacts of smoking bans on casinos and thus will be a useful policy references for the Macao government, as well as for the rapidly growing gaming industry in Asia and developing economies elsewhere.

JEL L83 K32 Z33

Keywords Smoking bans; economic impacts; casinos; abnormal returns; Macao

Authors

Jing Hua Zhang, ✉ Macau University of Science and Technology, Taipa, Macau (China), jhuzhang@must.edu.mo

Kwo Ping Tam, Macau University of Science and Technology, Taipa, Macau (China)

Nan Zhou, Macau University of Science and Technology, Taipa, Macau (China)

Citation Jing Hua Zhang, Kwo Ping Tam, and Nan Zhou (2016). Do Smoking Bans Always Hurt the Gaming Industry? Differentiated Impacts on the Market Value of Casino Firms in Macao. *Economics: The Open-Access, Open-Assessment E-Journal*, 10 (2016-28): 1–31. <http://dx.doi.org/10.5018/economics-ejournal.ja.2016-28>

Received March 28, 2016 Published as Economics Discussion Paper May 20, 2016

Revised October 7, 2016 Accepted October 26, 2016 Published November 4, 2016

© Author(s) 2016. Licensed under the [Creative Commons License - Attribution 4.0 International \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/)

1 Introduction

The Macao Special Administrative Region (SAR) of China, the world largest legal gambling economy, enjoyed a double-digit growth rate from 2002 to 2014 (DICJ, The Gaming Inspection and Coordination Bureau of Macao, 2015). Following this example, many East Asian countries (such as South Korea, Taiwan, Singapore, Japan, Cambodia, Vietnam and Malaysia) are hurrying to open more casinos of their own (Leong, 2015). These up-and-coming casinos are all smoker friendly, with the exception of those in Korea. Even the Singapore government has applied a “double-standard” which allows smoking in casinos even as it remains completely banned elsewhere in Singapore.

Smoking in casinos causes Second Hand Smoking (SHS) hazards to the health of staff and non-smoker patrons (Pilkington et al., 2007, Achutan et al., 2007; Repace et al., 2011). However, lobbying by the gaming industry often poses a severe hindrance to smoking bans as these may lead to losses in casino revenue (Babb et al., 2014; Chan et al., 2012). Although considerable research has been devoted to the economic impacts of smoking bans in the hospitality industry, few of these studies have been done with casinos specifically due to a limited number of cases to study. Existing studies about the smoking bans in the casinos are of cases from the USA and Australia and have found mixed results (Babb et al., 2014). Additionally, little has been done to analyze potential factors that lead to the differential impacts on casinos with varied characteristics (Hirschberg and Lye, 2010). Furthermore, the studies of smoking bans in casinos are often subject to two types of bias – the confounding bias when using time series (Fleck and Hanssen, 2008; Tomlin, 2009) and the “subjective” bias when using survey method (Eriksen and Chaloupka, 2007; Lund and Lund, 2011).

The Macao SAR of China is currently the largest gaming economy in the world. More than twenty percent of Macao’s working population is involved in the gambling industry and consequently their health is severely affected by second hand or passive smoking in casinos. The implementation of a smoking ban in casinos has long been delayed due to the opposition from the gaming industry. From 2011 to 2015, the government of Macao announced the implementation of a number of smoking bans in casinos, and in each instance surprised the investors in the stock markets. However, the recent economic slowdown and anti-corruption crackdown in Chinese mainland has seriously affected the revenue of the gaming

industry in Macao. Due to these entangled compounding issues, it has become nearly impossible to analyze the economic impacts of casino smoking bans with traditional time series method or panel data methods. However, the unexpected announcements of smoking bans in casinos allows us to use an event study to analyze their immediate effects on expected casino revenue.

The event study has proven to be an effective alternative method of measuring the impact of new information on stock returns, hence being able to avoid confounding factor bias when using time series data and the subjective bias with survey methods (Ferreira and Karali, 2015; Tomlin, 2009). Event studies have been effectively used by various researchers to examine a range of social and economic issues. Recently, this method has also been applied to examine the impacts of smoking bans on the tobacco industry in India (Tomlin, 2009) and the local hospitality industry in Scotland (Adda et al. 2012). In our study, we find that the announcements of smoking bans were associated with differentiated abnormal returns. In Macao, traditional casinos experienced abnormal losses of 0.58–3%, while the Las Vegas style casinos saw positive abnormal returns of up to 3%.

Further, we have also analyzed whether some casino operating characteristics (such as the air quality in gaming venues, the dependence on gaming revenues and the management initiatives toward smoking bans) are related to the abnormal returns of the casino stocks upon the announcement of the smoking bans. Our results suggest that lower level of air quality and high dependence on gaming revenue are significantly associated with greater cumulative abnormal loss, whereas the active management initiatives are closely associated with cumulative abnormal returns.

2 Background: Smoking bans in Macao and its influence

Being a special administrative region of China, Macau has developed its economy with a blooming gaming industry which contributes to 60% of the local GDP and 70% of the local tax revenue. Furthermore, there are approximately 83,300 people, or 23.1 % of Macao's working population, involved in the gaming industry at the end of 2014 (DSEC , 2013).

2.1 Economy and gaming business in Macao

At present, there are six licensed large casino firms operating in Macao, SJM Holdings (SJM), Sands China, Galaxy Macao, Wynn Macao, Melco Crown and MGM Macao. In 2014, each of the top three casino firms had 20%–23% of Macao's gambling market shares (DICJ, The Gaming Inspection and Coordination Bureau of Macao, 2015). The first casino firm in Macao is the SJM casino, which is the subsidiary of The Society of Travelling and Entertainment of Macao (STDMM). The Las Vegas resort-themed casino firms entered the Macao market after the liberalization of commercial gambling in 2002.

The casinos in Macao can be classified broadly into three categories on the basis of the ownership structure and the management style, namely, the traditional group, the Las Vegas group and the hybrid group. SJM and Galaxy Macao are functional by their Macao and Hong Kong owners under the gaming business model of the traditional Chinese style. In the Las Vegas group, Sands China and Wynn Macao have successfully transplanted their Las Vegas model to Macao. In the hybrid group, Melco Crown and MGM Macao are managed by Stanley Ho's family members (the corporate owner of SJM casino) along with their international partners.

The six casinos in Macao are different in terms of their operating characteristics and completion strategies. First, the conditions of the infrastructural facilities are different. Most of the venue buildings in SJM and Galaxy Macao were constructed around the year 1987 and 1992 respectively, thus, the infrastructural facilities are largely outdated with poor ventilation systems. Also, at the time of their construction there was no scenario of smoking bans, so the entire construction gave no consideration to maintaining air quality under a smoking ban. As the results, the designs of the casinos have small floor plates with limited space, relatively low ceilings along with the poor ventilation systems (Monaghan and Varma, 2012; Stradbroke, 2013). Also, it will be difficult in practice to renovate and redesign the ventilation system of these traditional gaming venues, and the renovating may lead to shut down of these traditional casino venues for months. By contrast, Sands China and Wynn Macao were established in Macao after 2004 and had designed the casino projects with modern infrastructural facilities and an excellent ventilation system, based on their experience and knowledge of smoking bans in the USA.

Second, there are major differences in the patron mix and the revenue source structure between these casino groups. The business models of the traditional and hybrid casinos still focus on gambling activities and generate 97–99% of the revenues from gambling games (DICJ, 2015). A large proportion of their patrons are traditional Chinese gaming players, who are stereotyped as hardcore players with high involvements and strong interests of the gambling games (Lam, 2012; Loo et al., 2008).

A high-level association between gambling and smoking among these players has also been observed. Prior to the smoking ban, many gaming players used to puffed at virtually every baccarat table in Macao. “It felt like a scene from the original 1960 film, *Ocean’s Eleven*” (Balfour, 2009). About 80–90% of the male gamblers were identified to be very active smokers (Macao Daily Times, 2010). In contrast to the traditional casinos, the Las Vegas casinos in Macao have attracted the attention of a large group of leisure players from the upper middle class Chinese, especially female tourists, who more often play for socialization and fun, rather than financial interest (Wong and Rosenbaum, 2010; Wong et al., 2012). Smoking incidence is also very lower among the leisure fun loving players. The non-gaming entertainment activities in Sands China and Wynn Macao contribute about 12–15% of their total revenue (DICJ, 2015). The management committee of the Sands China has disclosed that its revenue and win per unit are higher in the non-smoking venue than in the smoking gaming venue (Trigger, 2010).

Third, the management teams of the casinos have taken different operational initiatives and strategies regarding the smoking bans in the casinos. The management team of the traditional casinos has shown great resistance to the implementation of the smoking bans. By contrast, casino firms from Las Vegas have taken initiatives to adapt to non-smoking regulation environment and demands. As a response to the partial smoking ban in 2012, Wynn Macao voluntarily chose to limit its smoking area to 41.44%, which is lower than the government limit. Sands Macao has voluntarily established the non-smoking venues since it entered Macao. After the implementation of smoking ban in Macao in 2012, Sands Macao has also set up an air quality monitoring system and discloses the real time air quality data in its venues.

2.2 Smoking bans in Macao

The progress of the smoking ban legislation in Macao was noticeably slow, due to concerns about the economic loss in the gaming industry. As per the concerns of casino labor activists in Macao, they advocated strongly that employee’s health should not be sacrificed for casino gaming profit and advocated that a full smoking ban in casinos should be seriously implemented. Better health does not have to wait for an improved economy; rather, measures to reduce the burden of disease will contribute to more social benefits (Husain, 2010). Due to the crucial role of the casino industry in Macao’s economy, it was getting difficult to predict the final policy draft in Macao (Journal Cheng Pou, 2011; Monaghan and Varma, 2012).

The Macao government submitted the first smoking ban draft to the legislative assembly on December 7th, 2009 (Monaghan and Varma, 2012). We have identified three major unexpected policy announcements through analyzing the Wisers Information Portal and Xinhua News Net, which covers all news media and print publications in Macao area. These events are listed in Table 1.

At first, a partial smoking ban starting from 2012 was announced by the Health Bureau in February 2011 (Tou, 2011). According to this partial ban, the casinos should set up non-smoking areas, and the smoking areas should not exceed half of the casinos’ public areas. The Health Bureau of Macao also set up the air quality standards and assessment plans for casino venues, and very seriously implemented the smoking ban by setting up regular air quality assessments in casinos. Given the firm stand of the government, the gaming industry expected that all gaming areas, except the VIP rooms, eventually would have total smoking ban de facto (Lewis, 2012).

Table 1: Major events of the non-smoking legislation in Macao

Date	Major events
February 15, 2011	A de-facto partial smoking ban in casinos was announced.
March 19, 2014,	A full smoking ban in the whole mass market areas in Macao was announced by The Health Bureau of Macao.
January 29, 2015	A full smoking ban proposal was announced by the Health Bureau of Macao and was expected to be implemented starting from anytime during October 2015 to August 2016.

On the second stage, a full smoking ban on mass market gaming areas (VIP room excluded) was unexpectedly announced on March 19, 2014. After repeated failures of passing the official air quality reassessments under the partial ban, Macao casino operators submitted in December 2013 a proposal for an immediate full ban on the mass market, rather than reexamining the partial ban in 2015 as formerly stipulated. It was unclear to the stock market and the general public, whether the Macao government would adopt an immediate smoking ban or maintain the current regulations. However, on March 19, 2014, the Health Bureau of Macao suddenly announced that a full smoking ban in the whole mass market gaming areas in Macao would start from October 6, 2014. Meanwhile, smoking was still permitted in half of the VIP gaming area. Upon the announcement of this mass market smoking ban, the casino operators had to rush to build up special smoking rooms on the mass gaming floors to provide convenience to their smoker patrons.

On the third stage, the Health Bureau of Macao suddenly announced on January 29, 2015 that an ultimate full smoking ban would be implemented starting from anytime during October 2015 to August 2016, and that the authority will firmly enforce the full ban. Since the Macao government denied officially in May 2014 the possibility of a full smoking ban in future two years (2015–2016), the announcement of this full smoking ban again was totally unexpected by the financial market and the general public.

In summary, Macao government made three highlighted announcements during its anti-smoking legislation process from 2011 to 2015. In the background of heated debates with strong lobbies from both sides, the announcements of these government decisions were completely unexpected among financial market investors. Hence, it is valid for us to apply an event study method to analyze the changes in the stock prices of the casino firms upon the announcement of the smoking bans, and further conduct an empirical study to analyze the implications of these policies.

On the second stage, a full smoking ban on mass market gaming areas (VIP room excluded) was unexpectedly announced on March 19, 2014. After repeated failures of passing the official air quality reassessments under the partial ban, Macao casino operators submitted in December 2013 a proposal for an immediate full ban on the mass market, rather than reexamining the partial ban in 2015 as formerly stipulated. It was unclear to the stock market and the general public,

whether the Macao government would adopt an immediate smoking ban or maintain the current regulations. However, on March 19, 2014, the Health Bureau of Macao suddenly announced that a full smoking ban in the whole mass market gaming areas in Macao would start from October 6, 2014. Meanwhile, smoking was still permitted in half of the VIP gaming area. Upon the announcement of this mass market smoking ban, the casino operators had to rush to build up special smoking rooms on the mass gaming floors to provide convenience to their smoker patrons.

On the third stage, the Health Bureau of Macao suddenly announced on January 29, 2015 that an ultimate full smoking ban would be implemented starting from anytime during October 2015 to August 2016, and that the authority will firmly enforce the full ban. Since the Macao government denied officially in May 2014 the possibility of a full smoking ban in future two years (2015–2016), the announcement of this full smoking ban again was totally unexpected by the financial market and the general public.

In summary, Macao government made three highlighted announcements during its anti-smoking legislation process from 2011 to 2015. In the background of heated debates with strong lobbies from both sides, the announcements of these government decisions were completely unexpected among financial market investors. Hence, it is valid for us to apply an event study method to analyze the changes in the stock prices of the casino firms upon the announcement of the smoking bans, and further conduct an empirical study to analyze the implications of these policies.

3 A conceptual framework and literature review

3.1 A conceptual framework: The expected profits of the casinos

We consider a general linear differentiated product demand curve for each gaming product (Deneckere and Davidson, 1985). Assuming that the prices of substitutes are not affected by a smoking ban, the demand for gaming product i (q_i) is given by equation (1),

$$q_i = V_i(s) - \alpha p_i \quad (1)$$

The impacts of a ban enter the demand function through changing the value (V) that patrons attach to the gaming activities, which depend on their smoking preference (s).

For each gaming product, we define three types of patrons. Type-One patrons are indifferent to the smoking environment and their demand q_{1i} is unaffected by smoking bans. Type-Two patrons are hardcore players, who have strong smoking inclinations so that their demand q_{2i} will decrease under a smoking ban. Type-Three patrons are leisure players, who prefer a non-smoking environment and their demand q_{3i} will increase under a smoking ban. Therefore, the accounting profit is given by equation (2),

$$\pi_i = p_i * (q_{1i} + q_{2i} + q_{3i}) - c_i. \quad (2)$$

Here p_i refers to the price and c_i refers to the typical operating cost of gaming product i . Therefore, the impacts of a smoking ban (partial or total one) can be shown as:

$$\frac{\partial \pi_i}{\partial s} = p_i \left(\frac{\partial V_{2i}}{\partial s} + \frac{\partial V_{3i}}{\partial s} \right) - \frac{\partial c_i}{\partial s} \quad (3)$$

As described above we assume that $\frac{\partial V_{2i}}{\partial s} < 0$ and $\frac{\partial V_{3i}}{\partial s} > 0$ and furthermore, we expect that $\frac{\partial c_i}{\partial s} > 0$ as the casino incurs additional costs occur to meet the new air quality standards. However as equation (3) shows, we cannot precisely predict the overall effect of smoking bans on the expected profitability of a casino. This must ultimately be estimated empirically, with the result largely dependent on the patron mix of a casino and its own costs.

3.2 Literature review

Conflicting results have been found in existing studies on the economic impacts of smoking bans and the estimated impacts of smoking bans are often affected by other confounding economic factors (Babb et al., 2014). In the US, there was an intense debate about the economic impacts of the smoking ban in New Jersey in November 2002 (Mandel et al., 2005; Pakko, 2008; Pakko, 2006; Thalheimer and Ali, 2008). Studies of the Illinois smoking ban of 2008 found that the revenue decline of Illinois casinos after 2008 was due to a coincidence of economic recession (Harris et al., 2012). In Australia and New Zealand, it is challenging to

evaluate the economic impacts of the smoking bans, because these bans there were also accompanied by harm minimization legislations, which aimed at mitigating problem gambling (Edwards et al., 2008; Lal and Siahpush, 2008).

3.2.1 Mechanisms of negative impacts on casinos

A smoking ban has negative impacts on the profitability of casinos through multiple mechanisms. Firstly, loss in gaming time and changes in patron behaviors caused by a smoking ban may negatively affect the gaming revenue (Hirschberg and Lye, 2010; Monaghan and Varma, 2012), since the comorbidity of smoking and gambling are commonly observed (McGrath and Barrett, 2009). With a smoking ban in casinos, smokers have to interrupt their play and travel to a designated smoking area when their smoking urges come. Meanwhile, during a smoking break, smokers may rethink their decision of gambling activities and plan not to return to gambling, or shorten the duration of their play (Harper, 2003).

Also, the air quality regulations imposed by a smoking ban may also bring legal penalties and extra costs to the casinos. It is technically difficult for casinos to accommodate both smokers and non-smoker players as per the infrastructure and technical constraints. Because the air filters in the venues are not effective at reducing PM2.5, especially when a single ventilation system serves both types of areas (Drope et al., 2004; Pritsos and Muthumalage, 2015). Installing “air curtain” system in venues is not effective either.

However, with rising Corporate social responsibility trends and attention towards sustainable development, casino firms are under strong pressure to follow a sustainable economic development model (Wan et al., 2013). Due to hazardous health effects of second hand smoking, the casinos that fail to take the initiative to fulfill their social responsibilities are expected to suffer the negative impacts of employee turnover and employee loyalty (Inoue and Lee, 2011). Also, investors in the stock market of China had paid more attention to environmental issues (Wang, 2015; Xu et al., 2014; Zhang et al., 2014).

In addition, it is widely believed that patrons may move to neighbor gambling area where the smoking ban is not present. But for Macao this is not a major concern, because gambling is considered to be a deep-rooted tradition in Chinese culture (Tse et al., 2010) and the majority of the gaming patrons in Macao casinos are from the mainland China. Chinese gaming patrons have more inclination

towards gambling as compared to their western counterparts (Loo et al., 2008; Tse et al., 2010). Also, in the mainland China gambling is still illegal and there is no alternative nearby destination other than Macao (Stradbroke, 2012; Trigger, 2010).

3.2.2 Potential positive impacts of smoking bans

The non-smoking gaming environment may also help to promote a positive image of healthy and joyful environment in casinos, thus, can help to attract more fun loving leisure players, mainly female players. The smoking prevalence among the female is around 4% in China (Dan et al., 2014). Most females consider smoking highly negatively because they tend to associate smoking with violence and insecurity (Lam, 2012; Shaw, 1994; Wong et al., 2012).

Also, the non-smoker patrons have a stronger tendency to avoid the second hand smoking than smoking patrons as they consider second hand smoking highly hazardous to their health (Bradley and Becker, 2011; Timberlake et al., 2012). If smoking were prohibited in a casino in California, Timberlake et al. (2012) finds that the non-smokers patrons expressed a much stronger willingness to extend their stay and visit again. Brokenleg et al. (2014) finds that 54% of American tribal casino patrons were likely to visit more and only 18% patrons to visit less, and that smoke-free-preferring patrons also tended to visit casino restaurants. Similar findings are reported in Macao. 76.7% of the randomly selected visitors to Macao expressed a positive attitude towards a smoking ban, 33.3% of them showed a larger likelihood of revisiting Macao after a smoking ban, while only 4.6% were negative about this (ITRC, 2015).

As per these studies, smoking bans may have differentiated impacts on the casinos in Macao, according to the heterogeneities in the characteristics of casino venues and management strategies. We hypothesize that, upon the announcements of the smoking bans, the Macao traditional casinos, which is highly dependent on gaming revenue with poor air quality and passive management strategies, may have significant negative abnormal returns in their stock. By contrast, the stocks of casino firms from Las Vegas may be associated with non-negative abnormal returns.

4 Research methods

4.1 An event study method to identify abnormal returns

According to the efficient market hypothesis, the current stock price fully reflects all available information (MacKinlay, 1997). In the event that new information is revealed which will impact firms' future profitability, an efficient market would react in a timely manner so that this new information is reflected in the stock price (Fama et al., 1969). An event study method estimates the impacts of an event on the expected future profits, and therefore the current market value, of a firm by examining the abnormal return of its stock on or surrounding the event date. An abnormal return is defined as a substantial departure from daily price variation on the event day (Kothari and Warner, 2007).

The classic event study adopts a market model to estimate the relationship between a stock's return ($R_{i,t}$) and that of the market portfolio ($R_{m,t}$) (MacKinlay, 1997) as shown in equation (4).

$$R_{i,t} = \alpha + \beta R_{m,t} + \varepsilon_{i,t}, \quad (4)$$

The additional change in stock i 's return upon the arrival of unexpected new information on day t is then defined as Abnormal Return ($AR_{i,t}$), which is given by the difference between the actual return and the expected return predicted by the market model on day t as shown in equations (5) and (6).

$$AR_{i,t} = R_{i,t} - E(R_{i,t}|R_{m,t}), \quad (5)$$

$$E(R_{i,t}|R_{m,t}) = \alpha_i + \beta_i R_{m,t}. \quad (6)$$

The event date is defined as the day of the unexpected news release and represents "Day 0". To test for the abnormal returns, and event windows are set to include some number of days both before and after the event date. Long event windows include between three and ten days before and after the event ($[-3,+3]$, $[-10,+10]$) to allow for prior leakage of information, or a slightly postponed response (Konchitchki and O'Leary, 2011; MacKinlay, 1997). On the other hand, short event windows include only one day before or after the event ($[-1,+1]$, $[-1,0]$, $[0,+1]$) (Khotari and Warner, 2006; Konchitchki and O'Leary, 2011).

In this study, we use a short event window and include only the announcement day itself in the event window, which has some advantages over the traditional

long event window. Firstly, a short window event study is considered to be the “cleanest evidence on market efficiency” (Fama, 1991; Tomlin, 2009). It can capture the majority of the stock market’s reaction, while reducing potential confounding events that might interfere with the response. Short window tests are especially powerful when the abnormal performance is concentrated in the event window (Konchitchki and O’Leary, 2011). Secondly, using a test-statistic that does not control for autocorrelation can be appropriate and straightforward for many short window event tests, because the test statistic is not highly sensitive to assumptions on the time-series dependence of abnormal returns (Khotari and Warner, 2006; Konchitchki and O’Leary, 2011). By contrast, long window studies are sensitive to various assumptions related to returns.

The key to a powerful short event window study is a precisely defined event date with abnormal performance concentrated within the chosen event window (Khotari and Warner, 2006). As discussed in our background section, the event dates of smoking bans in Macao precisely meet these conditions.

In order to identify abnormal returns, we use a modified market model with a dummy variable (Izan, 1978; Dufour, 1980; Thompson, 1985; Binder, 1985; Binder, 1998) as shown in equation (7).

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \lambda_i D + \varepsilon_{i,t}, \quad (7)$$

D is the event date dummy and is the main variable of interest as its coefficient measures the abnormal return (Karafiath, 1988; Karafiath, 2009). This approach is quite similar to the classic two stage method of Fama, but has the advantage of also providing predicted errors and robust test statistics from a standard regression package in a single step (Karafiath, 1988; Karafiath, 2009; Tomlin, 2009).

We estimate equation (7) using ordinary least squares with bootstrapped standard errors, which remain reliable even when the residuals exhibit heteroscedasticity, non-normality or time-series dependence (Ford and Kline, 2006; Hein and Westfall, 2004; Jackson et al., 2006; Kramer, 2000).

Using equation (7), each of the individual casino stocks is tested upon each event. This allows the coefficients of variable D to differ across the sample firm (Binder, 1998). Rather than examining the mean abnormal return of some portfolio of homogeneous casino firms, this study focuses on the heterogeneous abnormal returns of the individual firms, allowing us to estimate the differentiated impacts on casinos with differing characteristics.

4.2 Regressions on the abnormal returns

We will further regress the abnormal returns on three operating characteristics to further analyze their relationship with the abnormal returns on the event dates. The dependent variable $AR_{i,t}$ is casino i 's abnormal return upon each event test window. These three operating characteristics are the air quality in gaming venues, the gaming revenue dependence and the management initiatives toward smoking bans. Similar approaches can be found in existing literature (Al-Ississ and Miller, 2013; Wang, 2015; Zhang et al., 2014).

The air quality in gaming venues is measured by a proxy variable, poor-air-quality ratio, because there are no direct air quality data available in every venue. However, the Health Bureau of Macao in November 2013 published a list of sixteen casinos venues, which had not met the air quality standard due to their poor ventilation systems and outdated infrastructural facilities. These sixteen venues are all from SJM, Galaxy and Melco Crown groups. According to this disclosed list of poor-air-quality venues, we defined the Poor-air-quality Ratio as the ratio of the gaming tables located in the poor-air-quality venues out of the total gaming tables owned by a casino firm. On the basis of the above mentioned literature review, we hypothesize that the Poor-air-quality Ratio and the abnormal returns have negative correlations.

The gaming-revenue dependence is measured by Gaming Revenue Ratio, which is calculated as the ratio of Gross Gaming Revenue to the Total Revenue of a casino. On the basis of the above mentioned literature review, we hypothesize that the dependence on gaming revenue and the abnormal returns also have a negative correlationship.

Since we cannot directly measure the management initiatives toward smoking bans, a foreign equity ratio of a casino is used as a proxy measurement. The foreign equity ratio is calculated as the ratio of equity owned by foreign investors in the total asset of a casino. As discussed in the literature review section of this paper, the casino owners with successful operating achievements in the US and Australia may foresee the international trends of non-smoking regulations, thus are more likely to take strategic initiatives to adapt to the smoking bans.

We have to perform univariate analysis due to the limited observation numbers in the dataset. We test the full sample, as well as a sub-sample of the first two events because the greatest impacts of the smoking bans may occur upon the first

two announcements. Also we have adopted the bootstrapping method to generate robust standard errors for inference. Bootstrapped standard errors are robust even in small samples, because the bootstrapping method estimates the asymptotic covariance matrix by randomly sampling from the empirical distribution, rather than assuming a normal distribution of the data (Hall, 1992). According to Chernick (2011), bootstrapped standard errors are robust in a sample of eight or more observations. We have a complete dataset of sixteen observations from three smoking ban events, thus our models have met the minimum sample size requirement.

5 Empirical study

5.1 Data and samples

At present, there are six licensed casino firms operating in Macao, as shown in Table 2. Among these firms, five of them are listed on Hong Kong Stock Market except that Melco Crown is listed on NASDAQ stock market. The market index of the Hong Kong Stock Market is the Hang Shang Index. With semi-strong form of market efficiency, the Hong Kong Stock Market is able to react efficiently to the inflows of new information (Chan et al., 1992; Cheung and Coutts, 2001). The market index used for tests of Melco Crown is also the Hang Shang Index, because we find no significant relationship between the returns of Melco Crown and NASDAQ Composite Index, but a close relationship with the Hang Shang Index, which is an effective index for the economy environment in which Melco Crown operates in.

The daily closing prices of the casinos and the data of the market indices from January 02, 2010 to January 30, 2015 are obtained from the Datastream database. Table 2 reports the daily returns and stock market capitalizations of each casino firms in the sample from January 1, 2010 through February, 2015. The daily volatilities in the returns of these stocks are very close to each other. Melco Crown and MGM Macao have less trading days than other casino firms and are not included in the test for the first partial ban because they went public in late 2011.

Table 3 reports the descriptive statistics of the casino operation characteristics variables in this study. The Gaming Revenue Ratio on average is as high as 0.94,

indicating a high level of dependence on gaming revenue, despite the business diversification strategy advocated by Macao and Chinese central governments.

Table 2: Descriptive statistics for the stocks of Macao casino firms

Firm	Average Daily Return	S.D. of Daily Return	Average Market Value (in bil. HK\$)	S.D. of Market Value	Trading Days
Galaxy ¹	0.23%	2.91%	178.0	77.3	1326
SJM ¹	0.11%	2.69%	103.7	20.6	1326
Sands China ¹	0.14%	2.69%	337.6	100.3	1326
Wynne Macao ¹	0.10%	2.63%	128.4	28.3	1326
Melco Crown ²	0.14%	2.18%	103.3	42.0	804
MGM Macao ²	0.05%	2.63%	77.4	25.2	955

Note:

1. The sample period is from January 1st, 2010 to January 29th, 2015.
2. Melco Crown Entertainment and MGM Macao went public later in 2011. The sample period is from January 1st, 2012 to January 29th, 2015.

Table 3. Descriptive Statistics of the casino operation characteristics

Variable	Mean	S. D.	Min	Max
Poor-air-quality ratio	0.10	0.11	0.00	0.285
Gaming Revenue Ratio	0.94	0.07	0.81	1.00
Foreign Equity Ratio	0.44	0.45	0.00	1.00
Number of observations	17			

5.2 Identifying abnormal returns

Table 4 shows the abnormal returns of each casino firm upon the smoking ban announcements. Evidence suggests that on February 15, 2011 upon the first unexpected announcement of the partial smoking ban in casinos in Macao, the traditional casino firms in Macao, namely Galaxy Macao and SJM, undergone statistically significant negative abnormal returns of 1.6% and 0.58%, while Las

Table 4. Abnormal returns during the smoking ban announcements in Macao

Firms	AR (2011/02/15)	AR (2014/03/19)	AR (2015/01/29)
Galaxy Macao	-0.0160*** (0.0019)	-0.0305*** (0.0007)	-0.0110*** (0.0010)
SJM	-0.00584*** (0.0020)	-0.001 (0.0008)	0.0151*** (0.0010)
Sands China	0.00467*** (0.0018)	0.0054*** (0.0007)	0.0007 (0.0009)
Wynne Macao	0.0329*** (0.0017)	0.0007 (0.0007)	0.0031*** (0.0011)
Melco Crown		-0.0037*** (0.0012)	0.0092*** (0.0014)
MGM Macao		-0.0185*** (0.0009)	-0.0023** (0.0010)

Note:

1. The test period is from January 1st, 2010 to February 15th, 2011. Melco Crown Entertainment and MGM Macao went public later in 2011.
2. The test period for the first four casinos is from 2010.01.01~ 2014.03.20. The test period for Melco Crown Entertainment and MGM Macao is from 2012.01.01~ 2014.3.19.
3. The test period is from January 1st, 2012 to January 29th, 2015 for all six firms.
4. Bootstrapped (with repetition of 1000 times) standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
5. Since we use One-day event window method in this study, there is only one dummy variable for one event window. The AR of one event window actually equals to the CAR of that window.
6. We only report the separately estimated parameters of $\lambda_i(\text{AR})$ for each casino:
$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \lambda_i D + \varepsilon_{i,t}.$$

Vegas casinos (Sands China and Wynne) had significant positive abnormal returns of 0.467% and 3.29% respectively.

Upon the surprise announcement of the total ban on mass market (VIP rooms excluded) on March 19, 2014, the abnormal returns of the casino stocks again exhibit similar patterns between traditional Macao casino firms and those from Las Vegas. Sands China and Wynne Macao had significant positive abnormal return or insignificant positive impact, while the traditional group and the hybrid group suffered significant negative abnormal returns. SJM had no significant abnormal returns, because smoking was still allowed in VIP rooms for High-Roller patrons, who account for more than 70% of SJM's gaming revenue. Galaxy Macao suffered the largest negative stock return of 3.05% this is probably because during the recent years Galaxy Macao has been focusing on increasing dependence on the gaming revenue from the mass market.

Upon the unexpected announcement of a total ban (including VIP gaming area) on January 29, 2015, casino firms in the traditional group and the hybrid group had mixed results of the abnormal returns. Casinos with high ratio of VIP revenue proportions, like Galaxy Macao and MGM Macao, again suffered significant negative abnormal returns of 1.1% and 0.23 % respectively. SJM had positive abnormal return this time, because under a full ban SJM does not need renovate the aged venues to meet air quality standards. Meanwhile, Las Vegas casinos (Sands China and Wynne) still had non-negative abnormal returns consistently.

In summary, empirical results suggest that upon the surprise announcements of the smoking bans in Macao (either partial or total mass market bans), stock market investors made differentiated reactions to the casino stocks. While stocks of Las Vegas themed casinos (Sands China and Wynne Macao) have consistently statistically significant (or insignificant) positive abnormal returns, stocks of local background casinos (both traditional and hybrid groups) have consistent negative abnormal returns.

5.3 Robustness checks

To rule out the influence of potential confounding factors of the gaming industry, we have performed the same tests on listed gambling finance and junket operators in Macao. The business strategies of the gambling finance and junket operators

were highly dependent on high roller gaming patrons, who could still smoke during most time of the smoking ban legislation. Their stock returns therefore would not be affected by the smoking bans. Indeed, we found no significant abnormal returns from the stocks of firms in this group.

To control for potential contemporary factors other than the market index, we test multi-factor models, including market indexes such as the Shanghai Stock Exchange Index and international gaming industry indexes such as the VanEck Vectors Gaming ETF. However, our results show that returns to Macao casino stocks are not significantly correlated with these indexes and the models do not improve with their inclusion. Indeed, the advantages of multifactor models for event studies are limited, as the marginal explanatory power of additional factors is small (MacKinlay, 1997).

We apply Seemingly Unrelated Regression (SUR) as an alternative method, which allows for disturbance terms in different equations are highly correlated. “A model estimated by the SUR method is a generalization of a linear regression model that consists of several regression equations, each having its own dependent variable and potentially different sets of exogenous explanatory variables. The model can be estimated equation-by-equation using standard ordinary least squares (OLS). Such estimates are consistent, however generally not as efficient as the SUR method, which amounts to feasible generalized least squares with a specific form of the variance-covariance matrix.” (Zellner, 1962) As shown in Table A1 of Appendix, the SUR results are consistent with separate equation regression results by the OLS method.

We also check Wisers Information Portal and Xinhua News Net to ensure there were no other competing releases of information (such as quarterly earnings reports, gaming table quota, land development license for a casino, or restrictions on using imported labor for staffing in Macao, or anti-corruption actions) which could have had a significant impact on casinos individually or the whole industry. Some policy changes by the central government of China, such as overseas consumption limit on banking cards (both debit and credit cards) or visitor number controls, may have strong negative impacts on the casinos business. We have not found any potential confounding information released on the event days.

5.4 Association between abnormal returns and operation characteristics

We further analyze the relationship between the abnormal returns and the casino operational characteristics. As reported in Table 5, there is no significant correlation between the Poor-air-quality ratio and the abnormal returns, whereas Poor-air-quality ratio, Gaming Revenue Ratio and Foreign Equity Ratio are all highly significantly correlated.

Table 6 reports the results of the univariate regressions on the abnormal returns upon the smoking ban announcements. The result in Column (1) of Table 6 indicates a highly significant negative relationship on average between Poor-air-quality Ratio and the abnormal returns upon the first two smoking ban events. Further, when data from the ultimate total ban is included, as shown in Column (4) of Table 6, the coefficient of Poor-air-quality ratio remains negative but insignificant. This change in the significance of the coefficient may have been caused by including the insignificant abnormal return of SJM upon the announcement of the total ban. SJM has highest Poor-air-quality ratio among all casinos and suffered from significant negative abnormal returns upon the first two announcements of the smoking bans. The stock market did not make significant negative response to SJM’s stock upon the total smoking ban, because SJM had great difficulties to meet the air quality requirement under a particle ban, and actually preferred to switch to a total ban to avoid this problem.

Table 5. Correlation analysis of variables

	Abnormal Return	Poor-air-quality Ratio	Gaming Revenue Ratio
Poor-air-quality Ratio	-0.415 (0.111)	1	
Gaming Revenue Ratio	-0.482* (0.059)	0.615** (0.011)	1
Foreign-equity Ratio	0.489 * (0.055)	-0.818*** (0.000)	-0.827*** (0.000)

Note: p-value in the parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

As shown in Column (2) and (5) in Table 6, the coefficients of Gaming Revenue Ratio are consistently negative in both subsample and full sample. The positive coefficients of Foreign Equity Ratio in Column (3) and (6) in Table 6 also support our hypothesis.

Among the three variables tested, the coefficients of the Gaming Revenue Ratio consistently have the largest absolute value. This result may suggest that the Gaming Revenue Ratio is the most important factor that is associated with a Macao casino's profit loss under a smoking ban.

Table 6. Regressions on abnormal returns (OLS)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Subsample(first two events only)			Full Sample		
Poor-air-quality Ratio	-0.1060*** (0.041)			-0.057 (0.036)		
Gaming Revenue Ratio		-0.1865* (0.098)			-0.108* (0.058)	
Foreign-equity Ratio			0.0272*** (0.009)			0.017** (0.008)
Constant	0.0051 (0.007)	0.1685* (0.095)	-0.0181*** (0.005)	0.003 (0.005)	0.098* (0.055)	-0.010* (0.005)
Observations	10	10	10	16	16	16
R-squared	0.437	0.555	0.514	0.172	0.232	0.239

Note: Bootstrapped (with repetition of 1000 times) standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

6 Discussion and conclusions

We have applied an event study method in this study to analyze the impacts of smoking bans on returns to Macao casino stocks upon three unexpected announcements of smoking bans from 2011 to 2015. We have found differentiated

impacts on local traditional casinos and Las Vegas themed casinos, with traditional casinos and some hybrid casinos suffering significantly negative abnormal returns of 0.58–3%, while Las Vegas style casinos enjoying positive abnormal returns of up to 3%.

Among the factors associated with adverse responses to smoking bans, high dependency on gaming revenue plays the most important role. Poor air quality in gaming venues, due to dated infrastructure or poor ventilation systems, is negatively associated with abnormal returns during partial bans announcements, but there is no significant result when all the smoking bans announcements examined together (although still negative). In addition, positive management initiatives and strategies are consistently associated with positive abnormal returns upon smoking ban announcements.

With the current gaming revenue downturn in Macao, smoking regulations are coming under especially great pressure from the gaming industry (Harris et al., 2012; Macao Post, 2015) and the findings of this study have important policy implications for implementing smoking bans. We provide empirical evidence with which the Macao government can strengthen its smoking ban policy. Firstly, the differentiated impacts and the associated factors will help policy makers toward a fuller understanding of the impacts of their regulations. Secondly, our findings suggest that a partial smoking ban is consistent with the business diversification strategy in Macao which can be beneficial for casinos aiming to attract more leisurely patrons. Finally, our results also suggest that smoking bans will not have significantly negative impacts on casinos if they take the initiative to adapt to air quality regulations.

Taking the above results together, we conclude that policy-makers may re-examine the timing of implementing a total ban, or further examine the effectiveness of establishing enclosed smoking rooms as a solution to the prevalence of second hand smoke in casinos. The successful experience of implementing smoking bans in Macao will provide a useful policy reference for the rapidly growing gaming and tourism industry at other destinations in Asia as well as other developing economies worldwide.

The limitations of this study are largely due to the drawbacks of the event study method and the small sample size in the regressions on the abnormal returns. Firstly, the abnormal returns estimated by an event study method only directly capture the stock market's response, or, reflect the financial investors'

expectations about the impacts of the smoking bans on the future profits of the casinos. In fact, the actual realized profit data may be different from the financial investors' expectations. Secondly, the event study method cannot completely rule out the possibility that the test results may be contaminated by unobserved confounding factors in the stock market, though we are not aware of such factors in this study at this stage. Thirdly, patron switching is not a major concern in the case of Macao due to its special location to the Chinese mainland. The findings from Macao's case should be generalized with caution wherever patron switching is a strong concern. Lastly, since there are totally only six listed casino firms in Macao and two of them were not yet publicly listed on the first event, the dataset of the abnormal returns upon the smoking ban events does not have an ideal sample size for making a strong inference.

Acknowledgements The authors are very grateful to Keith Morrison and Mary E. Deily for many helpful comments and suggestions on earlier drafts of this paper. The authors have declared that no competing interests exist. Jing Hua Zhang was supported by a research grant from Macao Foundation (Grant No: 0398j), however, the funder had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

References

- Achutan, C., West, C., Mueller, C., Bernert, J.T., and Bernard, B. (2011). Environmental tobacco smoke exposure among casino dealers. *Journal of Occupational and Environmental Medicine*, 53(4), 346–351. doi:10.1097/JOM.0b013e318212235f. <http://www.ncbi.nlm.nih.gov/pubmed/21436733>
- Adda, J., Berlinski, S., and Machin, S. (2012). Market regulation and firm performance: The case of smoking bans in the united kingdom. *Journal of Law and Economics*, 55(2), 365–391. <http://www.jstor.org/stable/10.1086/663349>
- Al-Ississ, M.M., and Miller, N.H. (2013). What does health reform mean for the health care industry? Evidence from the Massachusetts special senate election. *American Economic Journal: Economic Policy*, 5(3), 1–29. doi:10.1257/pol.5.3.1 <http://www.aeaweb.org/articles?id=10.1257/pol.5.3.1>
- Babb, S., McNeil, C., Kruger, J., and Tynan, M.A. (2014). Secondhand smoke and smoking restrictions in casinos: A review of the evidence. *Tobacco Control*, 25:Suppl_1 i26–i31. <http://tobaccocontrol.bmj.com/content/early/2014/03/07/tobaccocontrol-2013-051368>
- Balfour, F. (2009, May 03). Macao should ban smoking in casinos. Retrieved from <http://archive.tobacco.org/news/283331.html>
- Binder, J. (1998). The event study methodology since 1969. *Review of Quantitative Finance and Accounting*, 11(2), 111–137. <http://link.springer.com/article/10.1023/A:1008295500105>
- Binder, J.J. (1985). On the use of the multivariate regression model in event studies. *Journal of Accounting Research*, 23(1), 370–383. <http://www.jstor.org/stable/2490925>
- Bradley, G.T., and Becker, C. (2011). Consumer attitudes and visit intentions relative to a voluntary smoking ban in a single casino resort with a dense competitive set. *Academy of Health Care Management Journal*, 7(2): 41–56. <http://search.proquest.com/docview/886542900?pq-origsite=gscholar>
- Brokenleg, I.S., Barber, T.K., Bennett, N.L., Peart Boyce, S., and Blue Bird Jernigan, V. (2014). Gambling with our health: Smoke-free policy would not reduce tribal casino patronage. *American Journal of Preventive Medicine*, 47(3), 290–299. doi:10.1016/j.amepre.2014.04.006. <http://www.sciencedirect.com/science/article/pii/S0749379714001718>
- Chan, K.C., Gup, B.E., and Pan, M. (1992). An empirical analysis of stock prices in major Asian markets and the United States. *Financial Review*, 27(2), 289–307. <http://onlinelibrary.wiley.com/doi/10.1111/j.1540-6288.1992.tb01319.x/abstract>

Chan, S. H., Pilkington, P., and Wan, Y.K.P. (2012). Policies on smoking in the casino workplace and their impact on smoking behavior among employees: Case study of casino workers in Macao. *International Journal of Hospitality Management*, 31(3), 728–734.
<http://www.sciencedirect.com/science/article/pii/S0278431911001538>

Chernick, M.R. (2011). *Bootstrap methods: A guide for practitioners and researchers* John Wiley and Sons.

Cheung, K., and Andrew Coutts, J. (2001). A note on weak form market efficiency in security prices: Evidence from the Hong Kong stock exchange. *Applied Economics Letters*, 8(6), 407–410.
<http://www.tandfonline.com/doi/abs/10.1080/135048501750237865>

Dan, X., Yuankai, S., and Chen, W. (2014). Tobacco in China. *Lancet (London, England)*, 383(9934), 2045–2046. doi:10.1016/S0140-6736(14)60995-8.
[http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(14\)60995-8/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)60995-8/abstract)

Deneckere, R., and Davidson, C. (1985). Incentives to form coalitions with Bertrand competition. *The Rand Journal of Economics*, 16(4), 473–486. <http://www.jstor.org/stable/2555507>

DICJ, The Gaming Inspection and Coordination Bureau of Macao. (2015). Gaming statistics. Retrieved from <http://www.dicj.gov.mo>

Drope, J., Bialous, S. A., and Glantz, S. A. (2004). Tobacco industry efforts to present ventilation as an alternative to smoke-free environments in North America. *Tobacco Control*, 13 Suppl 1, i41–7.
http://tobaccocontrol.bmj.com/content/13/suppl_1/i41.abstract

DSEC (The Statistics and Census Bureau of Macau). (2013). Statistics database. Retrieved from <http://www.dsec.gov.mo/TimeSeriesDatabase.aspx>

Dufour, J. (1980). Dummy variables and predictive tests for structural change. *Economics Letters*, 6(3), 241–247. <http://www.sciencedirect.com/science/article/pii/0165176580900221>

Edwards, R., Thomson, G., Wilson, N., Waa, A., Bullen, C., O’Dea, D., Woodward, A. (2008). After the smoke has cleared: Evaluation of the impact of a new national smoke-free law in New Zealand. *Tobacco Control*, 17(1), e2–e2. <http://tobaccocontrol.bmj.com/content/17/1/e2.short>

Eriksen, M., and Chaloupka, F. (2007). The economic impact of clean indoor air laws. *CA: A Cancer Journal for Clinicians*, 57(6), 367–378. <http://onlinelibrary.wiley.com/doi/10.3322/CA.57.6.367/pdf>

Fama, E.F. (1991). Efficient capital markets: II. *The Journal of Finance*, 46(5), 1575–1617.
<http://onlinelibrary.wiley.com/doi/10.1111/j.1540-6261.1991.tb04636.x/abstract>

Fama, E.F., Fisher, L., Jensen, M.C., and Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review*, 10(1), 1–21. <http://www.jstor.org/stable/2525569>

Ferreira, S., and Karali, B. (2015). Do earthquakes shake stock markets? *PloS One*, 10(7), e0133319. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0133319>

Fleck, R.K., and Hanssen, F.A. (2008). Why understanding smoking bans is important for estimating their effects: California's restaurant smoking bans and restaurant sales. *Economic Inquiry*, 46(1), 60–76. <http://onlinelibrary.wiley.com/doi/10.1111/j.1465-7295.2007.00080.x/abstract>

Ford, G.S., and Kline, A.D. (2006). Event studies for merger analysis: An evaluation of the effects of non-normality on hypothesis testing. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=925953

Hall, P. (1992). *The bootstrap and edgeworth expansion*, Springer.

Harper, T. (2003). Smoking and gambling: A trance inducing ritual. *Tobacco Control*, 12(2), 231–233. <http://tobaccocontrol.bmj.com/content/12/2/231.full>

Harris, J.K., Carothers, B.J., Luke, D.A., Silmere, H., McBride, T.D., and Pion, M. (2012). Exempting casinos from the smoke-free illinois act will not bring patrons back: They never left. *Tobacco Control*, 21(3), 373–376. doi:10.1136/tc.2010.042127. <http://tobaccocontrol.bmj.com/content/early/2011/06/14/tc.2010.042127.short>

Hein, S.E., and Westfall, P. (2004). Improving tests of abnormal returns by bootstrapping the multivariate regression model with event parameters. *Journal of Financial Econometrics*, 2(3), 451–471. <http://jfec.oxfordjournals.org/content/2/3/451.abstract>

Hirschberg, J., and Lye, J. (2010). The indirect impacts of smoking bans in gaming venues. *Current Issues in Health Economics*, 290, 243. https://www.researchgate.net/profile/Jenny_Lye/publication/254429512_The_Indirect_Impacts_of_Smoking_Bans_in_Gaming_Venues/links/544ec18f0cf26dda08901b0b.pdf

Husain, M.J. (2010). Contribution of health to economic development: A survey and overview. *Economics: The Open-Access, Open-Assessment E-Journal*, 4 (2010-14): 1—52. <http://dx.doi.org/10.5018/economics-ejournal.ja.2010-14>.

Inoue, Y., and Lee, S. (2011). Effects of different dimensions of corporate social responsibility on corporate financial performance in tourism-related industries. *Tourism Management*, 32(4), 790–804. <http://www.sciencedirect.com/science/article/pii/S0261517710001305>

ITRC (IFT Tourism Research Centre, Macao) (2015). Report of the Macao visitor profile survey (VPS). Retrieved from "VPS ARCHIVE" at <http://itrc.ift.edu.mo/visitor-profile-segment-vps>

Izan, H.Y. (1978). An empirical analysis of the economic effects of mandatory government audit requirements. Diss.University of Chicago.

Jackson, J.D., Kline, A.D., and Skinner, S.J. (2006). The impact of Non - Normality and misspecification on merger event studies. *International Journal of the Economics of Business*, 13(2), 247–264. <http://www.tandfonline.com/doi/pdf/10.1080/13571510600784490>

Journal Cheng Pou. (2011, January 31). Protesting delays on smoking ban disapproved. *Journal Cheng Pou*, pp. 1.

Karafiath, I. (1988). Using dummy variables in the event methodology. *Financial Review*, 23(3), 351–357. <http://onlinelibrary.wiley.com/doi/10.1111/j.1540-6288.1988.tb01273.x/abstract>

Karafiath, I. (2009). Detecting cumulative abnormal volume: A comparison of event study methods. *Applied Economics Letters*, 16(8), 797–802. <http://www.tandfonline.com/doi/abs/10.1080/17446540802277187>

Konchitchki, Y., and O'Leary, D.E. (2011). Event study methodologies in information systems research. *International Journal of Accounting Information Systems*, 12(2), 99–115. <http://www.sciencedirect.com/science/article/pii/S1467089511000030>

Kothari, S., and Warner, J. (2007). Econometrics of event studies. *Handbook of corporate finance: Empirical corporate finance*. Vol. 1. Available at SSRN 278109. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=608601

Kramer, L.A. (2000). Alternative methods for robust analysis in event study applications. University of Toronto – Rotman School of Management Available at SSRN 278109. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=278109

Lal, A., and Siahpush, M. (2008). The effect of smoke-free policies on electronic gaming machine expenditure in Victoria, Australia. *Journal of Epidemiology and Community Health*, 62(1), 11–15. doi:62/1/11 [pii]. <http://www.ncbi.nlm.nih.gov/pubmed/18079327>

Lam, D. (2012). An observation study of Chinese baccarat players. *UNLV Gaming Research and Review Journal*, 11(2), 5. <http://digitalscholarship.unlv.edu/grrj/vol11/iss2/5/>

Leong, G. (2015, June 11). Asia-Pacific's bet on casino-fuelled economic growth. SPH Website Opinion. <http://www.straitstimes.com/opinion/asia-pacifics-bet-on-casino-fuelled-economic-growth>

Lewis, L. (2012). Casinos in Macau weigh the odds of imposing smoking ban. *The Times*, December 26. <http://www.thetimes.co.uk/tto/business/industries/leisure/article3640580.ece>

- Loo, J.M., Raylu, N., and Oei, T.P.S. (2008). Gambling among the Chinese: A comprehensive review. *Clinical Psychology Review*, 28(7), 1152–1166.
<http://www.ncbi.nlm.nih.gov/pubmed/18486290>
- Lund, I., and Lund, K.E. (2011). Post-ban self-reports on economic impact of smoke-free bars and restaurants are biased by pre-ban attitudes. A longitudinal study among employees. *Scandinavian Journal of Public Health*, 39(7), 776–779. doi:10.1177/1403494811414245.
<http://www.ncbi.nlm.nih.gov/pubmed/21727146>
- Macao Post. (2015). Blanket smoking ban would be disastrous. *Macao Post*, June 8, p1.
<http://macaunews.com.mo/blanket-smoking-ban-macau-disastrous-junket-rep/>
- Macau Daily Times. (2010). Smoking ban to harm casino revenues. *Macau Daily Times*, June 9, pp. 1–1.
- MacKinlay, A.C. (1997). Event studies in economics and finance. *Journal of Economic Literature*, , 13–39. http://econpapers.repec.org/article/aeajeclit/v_3a35_3ay_3a1997_3ai_3a1_3ap_3a13-39.htm
- Mandel, L.L., Alamar, B.C., and Glantz, S.A. (2005). Smoke-free law did not affect revenue from gaming in Delaware. *Tobacco Control*, 14(1), 10–12. doi:14/1/10 [pii].
<http://tobaccocontrol.bmj.com/content/14/1/10.abstract>
- McGrath, D.S., and Barrett, S.P. (2009). The comorbidity of tobacco smoking and gambling: A review of the literature. *Drug and Alcohol Review*, 28(6), 676–681.
<http://www.ncbi.nlm.nih.gov/pubmed/19930023>
- Monaghan, S., and Varma, S. (2012). Smoking bans: Expect limited impact in 2013. *HSBC Global Research*, 11, 1–6.
<https://www.research.hsbc.com/midas/Res/RDV?ao=20&key=zVh0s3pPB3&n=348509.PDF>
- Pakko, M.R. (2008). No smoking at the slot machines: The effect of a smoke-free law on delaware gaming revenues. *Applied Economics*, 40(14), 1769–1774.
<http://www.tandfonline.com/doi/abs/10.1080/00036840600905241>
- Pakko, M.R. (2006). Smoke-free law did affect revenue from gaming in delaware. *Tobacco Control*, 15(1), 68–9; author reply 69. doi:15/1/68 [pii].
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2563623/>
- Pilkington, P.A., Gray, S., and Gilmore, A.B. (2007). Health impacts of exposure to second hand smoke (SHS) amongst a highly exposed workforce: Survey of london casino workers. *BMC Public Health*, 7, 257. doi:1471-2458-7-257 [pii] <http://www.ncbi.nlm.nih.gov/pubmed/17888155>

- Pritsos, C.A., and Muthumalage, T. (2015). The impact of commonly used air filters in eliminating the exposure to secondhand smoke constituents. *Environ.Sci.: Processes Impacts*, 17(3), 543–551. <http://www.ncbi.nlm.nih.gov/pubmed/25586051>
- Repace, J. L., Jiang, R., Acevedo-Bolton, V., Cheng, K., Klepeis, N.E., Ott, W.R., and Hildemann, L.M. (2011). Fine particle air pollution and secondhand smoke exposures and risks inside 66 US casinos. *Environmental Research*, 111(4), 473–484. <http://www.ncbi.nlm.nih.gov/pubmed/21440253>
- Shaw, S. M. (1994). Gender, leisure, and constraint: Towards a framework for the analysis of women's leisure. *Journal of Leisure Research*, 26(1), 8. <http://search.proquest.com/openview/fedcb663a9890ab8ec1df7c73d81c660/1?pq-origsite=gscholar&cbl=1816610>
- Stradbroke, S. (2013). SJM CEO suggests a plague on all Macau's smoking houses. *Gambling News with an Edge*, , 11 January 2016. <http://calvinayre.com/2013/09/05/casino/sjm-ceo-suggests1-macau-total-smoking-ban/>
- Stradbroke, S. (2012). Will smoking ban butt out Macau'S mass market growth? *Gambling News with an Edge*, December 13. <http://calvinayre.com/2012/12/13/casino/will-smoking-ban-butt-out-macau-massmarket-growth/>
- Thalheimer, R., and Ali, M.M. (2008). The demand for casino gaming with special reference to a smoking ban. *Economic Inquiry*, 46(2), 273–282. <http://onlinelibrary.wiley.com/doi/10.1111/j.1465-7295.2007.00060.x/abstract>
- Thompson, R. (1985). Conditioning the return-generating process on firm-specific events: A discussion of event study methods. *Journal of Financial and Quantitative Analysis*, 20(02), 151–168. http://journals.cambridge.org/abstract_S002210900001156X
- Timberlake, D.S., Wu, J., and Al-Delaimy, W.K. (2012). Tribal casinos in California: The last vestige of indoor smoking. *BMC Public Health*, 12(1), 144. <http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-12-144>
- Tomlin, J.T. (2009). The impact of smoking bans on the hospitality industry: New evidence from stock market returns. *BE Journal of Economic Analysis and Policy*, 9(1), 1935–1682. <http://www.degruyter.com/view/j/bejeap.2009.9.1/bejeap.2009.9.1.2069/bejeap.2009.9.1.2069.xml>
- Tou, I.S. (2011). Health chief says 'grace period' for smoking ban at casinos just a 'typo'. *Macau Post Daily*. February 16, p. 1.
- Trigger, R. (2010). Adelson calls for singapore-style smoking law in macau.. *Macau Post Daily*, June 21, p. Headline.

Tse, S., Yu, A.C., Rossen, F., and Wang, C.W. (2010). Examination of Chinese gambling problems through a socio-historical-cultural perspective. *TheScientificWorldJournal*, 10, 1694–1704. doi:10.1100/tsw.2010.167. <http://www.ncbi.nlm.nih.gov/pubmed/20842314>

Wan, X., Stillman, F., Liu, H., Spires, M., Dai, Z., Tamplin, S., and Yang, G. (2013). Development of policy performance indicators to assess the implementation of protection from exposure to secondhand smoke in China. *Tobacco Control*, 22 Suppl 2, ii9–15. doi:10.1136/tobaccocontrol-2012-050890. <http://tobaccocontrol.bmj.com/content/early/2013/06/10/tobaccocontrol-2012-050890>

Wang, Y. (2015). Politically connected polluters under smog. *Business and Politics*, 17(1), 97–123. <http://www.degruyter.com/view/j/bap.2015.17.issue-1/bap-2014-0033/bap-2014-0033.xml>

Wong, I.A., Fong, H.I., and Liu, T. (2012). Understanding perceived casino service difference among casino players. *International Journal of Contemporary Hospitality Management*, 24(5), 753–773. <http://www.emeraldinsight.com/doi/full/10.1108/09596111211237282>

Wong, I.A., and Rosenbaum, M.S. (2010). Beyond hardcore gambling: Understanding why mainland Chinese visit casinos in Macau. *Journal of Hospitality and Tourism Research*, October 21, doi: 10.1177/1096348010380600. <http://jht.sagepub.com/content/early/2010/10/21/1096348010380600>

Xu, X., Zeng, S., Zou, H., and Shi, J.J. (2014). The impact of corporate environmental violation on shareholders' wealth: A perspective taken from media coverage. *Business Strategy and the Environment*, 25(2), 73–91. <http://onlinelibrary.wiley.com/doi/10.1002/bse.1858/abstract>

Zellner, A. (1962). An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American Statistical Association*, 57(298), 348–368. <http://www.tandfonline.com/doi/abs/10.1080/01621459.1962.10480664>

Zhang, L., Wang, T., and Fung, H. (2014). Market reaction to corporate social responsibility announcements: Evidence from China. *China and World Economy*, 22(2), 81–101. <http://onlinelibrary.wiley.com/doi/10.1111/j.1749-124X.2014.12063.x/abstract>

Appendix

Table A1: Abnormal returns during the smoking ban announcements in Macao (SUR)

Firms	AR (2011/02/15)	AR (2014/03/19)	AR (2015/01/29)
Galaxy	-0.0160*** (0.00202)	-0.0302*** (0.000796)	-0.0110*** (0.00104)
JM	-0.00584*** (0.00200)	-0.000366 (0.000775)	0.0151*** (0.000950)
Sands China	0.00467*** (0.00174)	0.00566*** (0.000791)	0.000684 (0.000906)
Wynne Macao	0.0329*** (0.00168)	0.00107 (0.000836)	0.00307*** (0.00109)
Melco Crown		-0.00370*** (0.00115)	0.00937*** (0.00134)
MGM Macao		-0.0192*** (0.000834)	-0.00228** (0.00108)

Note:

1. Melco listed on Nasdaq and Nasdaq market index is applied accordingly.
2. The test period is from January 1st, 2010 to February 15th, 2011. Melco Crown Entertainment and MGM Macao went public later in 2011.
3. The test period for the first four casinos is from 2010.01.01~ 2014.03.20. The test period for Melco Crown Entertainment and MGM Macao is from 2012.01.01~ 2014.3.19.
4. The test period is from January 1st, 2012 to January 29th, 2015 for all six firms.
5. Bootstrapped (with repetition of 1000 times) standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
6. Since we use One-day event window method in this study, there is only one dummy variable for one event window. The AR of one event window actually equals to the CAR of that window.
7. All results are based on estimation equation: $R_{i,t} = \alpha_i + \beta_1 R_{m,t} + \lambda_1 D + \varepsilon_{i,t}$.

Please note:

You are most sincerely encouraged to participate in the open assessment of this article. You can do so by posting comments.

Please go to:

<http://dx.doi.org/10.5018/economics-ejournal.ja.2016-28>

The Editor