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

Jing Hua Zhang, Kwo Ping Tam, and Nan Zhou

Abstract

The gaming economy has expanded rapidly in East Asia during the past decade. Despite the public health hazards of Second Hand Smoking (SHS), smoking bans in casinos remain controversial due to concerns over potential economic losses for casino firms. Applying an event study method, the authors examine the abnormal returns of casino stocks in response to three unexpected announcements of smoking bans in casinos from 2011 to 2015 in Macao. The analysis reveals that the announcements were associated with differentiated abnormal returns of casino stocks. The stocks of the traditional casinos in Macao suffered significant cumulative abnormal losses of 1% to 6%, while the Las Vegas themed casinos in Macao enjoyed significant cumulative abnormal excess returns of 1.4% to 4.8%. Furthermore, the authors find that the low air quality in gaming venues and high dependence on gaming revenues are associated with abnormal losses, while positive management initiatives are significant correlated with positive abnormal returns. This study provides a full picture of the impacts of smoking bans on casinos and will thus be a useful policy reference for the Macao government, as well as for the rapidly growing gaming industry in Asia and other developing economies.

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Keywords Smoking bans; economic impacts; casinos; abnormal return of stocks; Macao

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Introduction

The Macao Special Administrative Region (SAR) of China, the world largest legal gambling economy, enjoyed double-digit growth 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 keen to expand their own gaming sectors. (Leong, 2015, June 11). With the exception of Korea, these planned casinos are all smoker-friendly and even the Singapore government has applied a “double-standard”, allowing smoking only in casinos, while continuing to ban it in the rest of Singapore.

Smoking in casinos presents Second Hand Smoking (SHS) hazards to staffs and non-smoker patrons (Achutan, West, Mueller, Bernert, & Bernard, 2011; Pilkington, Gray, & Gilmore, 2007; Repace et al., 2011). However the gaming industry often resists smoking bans as these may lead to losses in revenue (Babb, McNeil, Kruger, & Tynan, 2014; S. H. Chan, Pilkington, & Wan, 2012). Although a considerable amount of research has been devoted to studying the economic impacts of smoking bans in the hospitality industry, few studies have been done with casinos due to the limited number of cases to investigate. Existing studies on cases from the USA and Australia have shown mixed results (Babb et al., 2014) and little has been done to analyze potential factors that lead to these divergent outcomes (Hirschberg & Lye, 2010). Further, the studies of smoking bans in casinos are often subject to two types of biases, the first of which is the confounding bias when using time series methods (Fleck & Hanssen, 2008; Tomlin, 2009), and the second the

“subjective” bias when using survey methods (Eriksen & Chaloupka, 2007; Lund & Lund, 2011).

Macao 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 smoking in casinos. However, the implementation of a smoking ban in casinos has long been delayed due to opposition from the gaming industry. From 2011 to 2015, the government of Macao has repeatedly announced the implementation of smoking bans in casinos, which surprised investors in the stock markets. Concurrently, the economic slowdown and anti-corruption crackdown in the Chinese mainland has also seriously affected the revenue of the gaming industry. Due to these entangled compounding issues in Macao and the Chinese mainland system, it is nearly impossible to analyze the economic impacts of the casino smoking bans by traditional time-series or panel data methods. However, unexpected announcement of smoking bans in casinos allows us to apply event study methods to analyze the immediate effects of smoking bans on expected casino revenues.

The event study method is an effective alternative for analyzing changes in stock returns in response to new information in financial markets, hence avoiding confounding factor bias in time series data and the subjective bias in survey methods (Ferreira & Karali, 2015; Tomlin, 2009). This method has been used effectively by various researchers to examine many social and economic events and recently has been applied to examine the impacts of smoking bans on the tobacco industry in India (Tomlin, 2009) and in the local hospitality industry in Scotland (Adda, Berlinski, &

Machin, 2012). We find that announcements of smoking bans were associated with differentiated abnormal returns in casino stocks. In Macao, traditional casinos suffered cumulative abnormal losses of 1 to 6%, while Las Vegas style casinos saw cumulative abnormal excess returns of 1.4% to 4.8%.

We have also analyzed how casino operating characteristics such as air quality in gaming venues, dependence on gaming revenues and management initiatives toward smoking bans can explain these divergent results. Our results indicate that lower air quality and high dependence on gaming revenue are significantly associated with greater losses, whereas active management initiatives are closely associated with higher abnormal returns.

Background: Casinos and Smoking Bans in Macao

Macao is a special administrative region of China, south of Guangdong Province and 60 kilometers west of Hong Kong (China). The gaming industry is the most important part of Macao's economy and contributes more than 60% of local GDP and 70% of local tax revenue. Around 83,300 people, or 23.1 % of Macao's working population, were involved in the gaming industry as of 2014 (DSEC (The Statistics and Census Bureau of Macau), 2013).

Casinos and the Economy of Macao

Currently, SJM Holdings (SJM), Sands China, Galaxy Macao, Wynn Macao, Melco Crown and MGM Macao are the six largest licensed casino firms operating in Macao.

In 2014, each of the top three firms held between 20% and 23% market share (DICJ, The Gaming Inspection and Coordination Bureau of Macao, 2015). The oldest casino firm in Macao is the SJM casino, a subsidiary of The Society of Travelling and Entertainment of Macao (STDM), while the Las Vegas resort-themed casino firms entered Macao after the liberalization of commercial gambling in 2002.

Casinos in Macao can be classified into three broad categories based on ownership structure and management style – traditional, Las Vegas, and hybrid. SJM and Galaxy Macao function under Macao and Hong Kong ownership under the traditional Chinese style gaming model while 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 the family of Stanley Ho, the corporate owner of SJM casino, along with their international partners.

The six casino firms in Macao differ greatly in their operating characteristics and completion strategies. Firstly, the conditions of the facilities themselves are different. Most of the venues owned by SJM and Galaxy Macao were constructed between 1987 and 1992, and the infrastructure is largely outdated with poor ventilation systems. At the time of their construction a smoking ban was inconceivable, and no consideration was given to maintaining air quality. As the results, the casinos have small floor plates with limited space and low ceilings along with the poor ventilation systems (Monaghan & Varma, 2012; Stradbroke, 2013). As it will be highly difficult to renovate and redesign the ventilation systems of these traditional gaming venues, smoking bans may cause these casinos to shut down. In contrast, Sands China and Wynn Macao were

established after 2004 and have designed their casinos with modern infrastructure and an excellent ventilation, based on their experience and knowledge of smoking bans in the USA.

Secondly, there are major differences in the patron mix and the revenue structure between these groups. The business models of the traditional and hybrid casinos still focus on gambling and generate 97-99% of their revenues from games (DICJ, The Gaming Inspection and Coordination Bureau of Macao, 2015). Their patrons are traditional Chinese players, stereotyped as hardcore gamblers with high involvement and strong interest in the games themselves (Lam, 2012; Loo, Raylu, & Oei, 2008).

A strong association exists between gambling and smoking among these players. In traditional casinos before the ban, players puffed at virtually every baccarat table in Macao. "It felt like a scene from the original 1960 film, *Ocean's Eleven*" (Balfour, 2009). Between 80-90% of male gamblers were identified as very active smokers (Macau Daily Times, 2010). By contrast, Las Vegas style casinos attracted large numbers of leisure players from the Chinese upper middle class, particularly women, who more often play for socialization and enjoyment, rather than financial gain (Wong & Rosenbaum, 2010; Wong, In Veronica Fong, & Tingchi Liu, 2012). Smoking incidence is far lower among these leisurely, fun-loving casual players. Non-gaming entertainment activities in Sands China and Wynn Macao contribute 12-15% of their total revenues (DICJ, The Gaming Inspection and Coordination Bureau of Macao, 2015). The management committee of Sands China has disclosed that its revenue and

win rate per unit are higher in the non-smoking venue than in the smoking venue (Trigger, 2010).

Finally, the management teams of these casinos have taken different operational initiatives and strategies in response to smoking bans. The traditional casinos have shown great resistance to the implementing these bans while the Las Vegas group has taken initiatives to adapt to the non-smoking regulation environment and its demands. In response to the partial smoking ban of 2012, Wynn Macao limited its smoking area to 41.44%, below the mandated limit, and Sands Macao has voluntarily established non-smoking venues ever since it entered Macao. After 2012, Sands Macao also set up an air quality monitoring system and discloses real time air quality data in its venues.

Smoking bans in Macao

The progress of smoking ban legislation in Macao was very slow, due to concerns about the economic losses in the gaming industry. Casino labor activists in Macao advocated strongly that employees' health should not be sacrificed for gaming profits and advocated that a full smoking ban in casinos should be implemented and strictly enforced. Due to the disproportionate role of the casinos in Macao's economy, it was difficult to predict the terms of the final policy draft (Journal Cheng Pou, 2011; Monaghan & Varma, 2012).

The Macao government submitted the draft of the first smoking ban to the legislative assembly on December 7th, 2009 (Monaghan & Varma, 2012). Through analyzing the Wisers Information Portal and Xinhua News Net, which covers all news

media and print publications in Macao area, we have identified three major unexpected policy announcements which are listed in Table 1.

Initially, in February 2011 the Health Bureau announced a partial smoking ban starting from 2012 (Tou, February 16, 2011). According to this policy, casinos should set up non-smoking areas, and the remaining smoking areas should not exceed half of the casinos' public areas. The Health Bureau of Macao also set up air quality standards and assessment plans for casino venues, and stringently enforced the ban with regular air quality assessments in casinos. Given the firm determination of the government, the industry expected that all gaming areas, except the VIP rooms, eventually would soon see a de facto total smoking ban (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.

In the second stage, the government announced on March 19, 2014 a full smoking ban in mass market gaming areas, excluding VIP rooms. After repeated failures to pass the official air quality reassessments stated in 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 both 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 a full smoking ban in all mass market gaming areas in Macao, effective October 6, 2014, though it would still be permitted in half of the VIP areas. Upon this announcement, casino operators rushed to build special smoking rooms on gaming floors for their smoker patrons.

In the final stage, the Health Bureau of Macao announced on January 29, 2015 that they would implement and firmly enforce a complete smoking ban some time between October 2015 and August 2016. Since the government had previously denied in May 2014 that any full smoking ban would be forthcoming in the next two years, this announcement came as a complete surprise both to the financial market and the general public.

In summary, from 2011 to 2015 the Macao government made three significant announcements regarding its anti-smoking legislation. Despite heated public debate with strong lobbying from both sides, these announcements were completely unanticipated by the financial market. Hence, an event study to analyze the changes in the stock prices of the casino firms upon the announcement of the smoking bans, and to further infer about the expected economic impacts on the future profits of the casinos.

Literature review

The existing empirical studies on the economic impacts of smoking bans give conflicting results, with the estimated impacts often biased by other confounding economic factors (Babb et al., 2014). In the US, there was intense debate over the economic impacts of the New Jersey smoking ban of November 2002 (Mandel, Alamar, & Glantz, 2005; Pakko, 2008; Pakko, 2006; Thalheimer & Ali, 2008). Studies of the Illinois ban of 2008 found that the diminished revenues of Illinois casinos after 2008t were due to the economic recession (Harris et al., 2012). In Australia and New Zealand, estimating the economic impacts of smoking bans is especially challenging, because the they were accompanied by harm minimization legislation, aimed at mitigating problem gambling (Edwards et al., 2008; Lal & Siahpush, 2008).

Mechanisms of negative impacts on casinos

A smoking ban negatively impacts the profitability of casinos through multiple mechanisms. Firstly, reduced gaming time and changes in patron behavior negatively affects the gaming revenue (Hirschberg & Lye, 2010; Monaghan & Varma, 2012), since the comorbidity of smoking and gambling are commonly observed (McGrath & Barrett, 2009). As smokers must interrupt their play and travel to a designated smoking area when their cravings arise, this presents them an opportunity to re-evaluate their gambling activities and either stop or shorten the duration of their play (Harper, 2003).

Secondly, air quality regulations may also bring legal penalties and extra costs to casinos. It is difficult for casinos to accommodate both smokers and non-smokers with

their infrastructure and technical constraints. Air filters are not effective at reducing PM2.5, especially when a single ventilation system serves both types of areas (Drope, Bialous, & Glantz, 2004; Pritsos & Muthumalage, 2015) and installing “air curtain” system has not proved effective either.

However, with the current trends of rising corporate social responsibility trends and attention towards sustainable development, casinos are under strong pressure to follow a sustainable model as well (Wan et al., 2013). With the hazardous health effects of second hand smoking, casinos that fail to take initiative in fulfilling their social responsibilities are expected to suffer the negative impacts of employee turnover and employee loyalty (Inoue & Lee, 2011). The stock market in China has also driven significant decisions regarding environmental issues (Wang, 2014; Xu, Zeng, Zou, & Shi, 2014; Zhang, Wang, & Fung, 2014).

Finally, a smoking ban may induce patrons to move to a neighboring location where no such ban is present. However this is not a major concern for Macao, as gambling is a deep-rooted tradition in Chinese culture (Tse, Yu, Rossen, & Wang, 2010) and the majority of the gaming patrons in casinos are from mainland China, and they are more inclined to gamble than their western counterparts (Loo et al., 2008; Tse et al., 2010). As gambling remains illegal in the mainland, there is no alternative destination nearby for gamblers (Stradbrooke, 2012; Trigger, 2010).

Potential positive impacts of smoking bans

Studies have shown that only about half of the mainland visitors and a quarter of Hong

Kong visitors engage in casino gambling(Zeng, Prentice, & King, 2014). Especially, only 9% of the mainland respondents reported gambling as their primary purpose of visit to Macao (Zeng et al., 2014). A non-smoking gaming environment may also help to promote a healthier and more joyful image of casinos to attract these fun loving leisure players, predominantly female. In contrast to the high rate found among men, smoking prevalence among women is only around 4% in China (Dan, Yuankai, & Chen, 2014). Most women perceive smoking highly negatively because they tend to associate it with violence and insecurity (Lam, 2012; Shaw, 1994; Wong et al., 2012).

In addition, non-smoker patrons have a stronger tendency to avoid second hand smoke as they likewise consider it a major health risk (Bradley & Becker, 2011; Timberlake, Wu, & Al-Delaimy, 2012). Timberlake et al (Timberlake et al., 2012) found that, were smoking to be prohibited in a California casino, non-smoking patrons would express a much stronger willingness to extend their stay or visit again. Brokenleg et. al (Brokenleg, Barber, Bennett, Peart Boyce, & Blue Bird Jernigan, 2014) finds that 54% of Native American tribal casino patrons were likely to visit more often and only 18% to visit less, and that non-smoker patrons were also more likely to visit casino restaurants. Similar findings are reported in Macao, as 76.7% of randomly selected visitors reacted positively to a smoking ban and 33.3% were more likely to return to Macao after a ban, while only 4.6% reacted negatively (ITRC(IFIT Tourism Research Centre), 2015).

As per these studies, smoking bans may have differentiated impacts on casinos in Macao, given the heterogeneous characteristics of the casino venues and their

management strategies. We hypothesize that, upon the announcements of smoking bans, Macao's traditional casinos, which are highly dependent on gaming revenue with poor air quality and passive management strategies, will see significantly negative abnormal returns to their stock, whereas the stocks of Las Vegas style casinos will see positive abnormal returns.

Empirical Methods

Event Study Methodology

According to the efficient markets hypothesis, the current stock price fully reflects all available information (MacKinlay, 1997). When new information is revealed that may impact the future profitability of the firms under study, an efficient market would react in a timely manner and the stock price would change to reflect its impact (Fama, Fisher, Jensen, & Roll, 1969). Given this theoretical foundation, the economic impact of an event on the expected future profits, and therefore current market value, of a firm can be estimated with an event study, examining the abnormal returns of the stock on or surrounding the event date. Abnormal returns that represent a substantial departure from daily price variations on the event day can thus be taken as the impact of the event itself (Kothari & Warner, 2007).

The classic event study method 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 (1).

$$R_{i,t} = \alpha + \beta R_{m,t} + \varepsilon_{i,t}, \quad (1)$$

The additional return to stock i upon the arrival of unexpected new information on day t is defined as the Abnormal Return ($AR_{i,t}$), calculated as the difference between the actual return ($R_{i,t}$) and the expected return based on the market model ($E(R_{i,t})$) as shown in Equation (2)–(3).

$$AR_{i,t} = R_{i,t} - E(R_{i,t}), \quad (2)$$

$$E(R_{i,t}) = \hat{\alpha} + \hat{\beta}R_{m,t}, \quad (3)$$

The coefficients $\hat{\alpha}$ and $\hat{\beta}$ are estimates of the true parameters obtained via an ordinary least squares (OLS) regression analysis of Equation (1).

The Event Date is defined as the day on which the unexpected news is released and is labeled as Day 0, and a test window is set as some interval around the Event Date. In some cases, test windows are quite lengthy, from three to ten days both before and after events ($[-3,+3]$, $[-10,+10]$) to allow for leakage of information prior to the event or for a slightly delayed response to it (Konchitchki & O’Leary, 2011; MacKinlay, 1997). We have adopted the short window test approach in this study, to focus on abnormal returns at the Event Date only. This actually represents the “cleanest evidence on market efficiency” (Fama, 1991; Tomlin, 2009), as it can capture the majority of the market reaction while reducing the potential for confounding events to interfere with the market’s response. The short window test is especially powerful when abnormal performance is concentrated within the event window (Konchitchki & O’Leary, 2011).

For the empirical estimation of the abnormal returns, we use a modified market model with a dummy variable as shown in Equation (4).

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \beta_2 R_{m,t-1} + \lambda_i D + \varepsilon_{i,t}, \quad (4)$$

As before, $R_{i,t}$ is the daily rate of return of firm i on date t , and $R_{m,t}$ is the corresponding return of the market index. The lagged market benchmark $R_{m,t-1}$ is included to capture event impacts that are not yet fully reflected in the stock price. D is an event date dummy, which equals 1 on the event date and 0 otherwise, and $\varepsilon_{i,t}$ is the usual error term.

D is the main variable of interest as its coefficient of variable D measures the abnormal return attributable to the event (Karafiath, 1988; Karafiath, 2009). This approach, introduced in 1988, is equivalent to the classic two-stage event method of Fama (Fama, 1991) shown in Equation (2), but has proven more successful because it can also provide predicted errors and robust test statistics using the standard regression package in a single step (Karafiath, 1988; Karafiath, 2009; Tomlin, 2009).

We estimate non-normality of the residual returns in Equation (4) using Ordinary Least Square (OLS) regressions with bootstrapped standard errors, which remain reliable even when the residuals exhibit heteroscedasticity or non-normality (Ford & Kline, 2006; Hein & Westfall, 2004; Jackson, Kline, & Skinner, 2006; Kramer, 2000).

Regressions on the abnormal returns

Furthermore, we regress the abnormal returns on three operating characteristics to analyze the differential impact of the event on the various casino types discussed previously. These are air quality, gaming revenue dependence, and management initiatives toward smoking bans. Similar approaches can be found in other literature too (Al-Ississ & Miller, 2013; Wang, 2015; Zhang et al., 2014).

Air quality in gaming venues is proxied using the poor-air-quality ratio, as there is no direct air quality data available for every venue. However, the Health Bureau of Macao in November 2013 published a list of sixteen casino venues which had not met the air quality standard due to their poor ventilation systems and outdated infrastructure. These sixteen venues are all operated by SJM, Galaxy, or Melco Crown. We define the poor-air-quality ratio as the proportion of gaming tables owned by each firm located in the listed venues. As discussed in the literature review, we hypothesize that the poor-air-quality ratio and the abnormal returns have negative correlations.

Gaming revenue dependence is measured by taking the ratio of gross gaming revenue to the total revenue of a casino. As discussed in the literature review, we hypothesize a negative relationship between dependence on gaming revenue and abnormal returns .

As we cannot directly quantify management initiatives toward smoking bans, the foreign equity ratio of a casino is used as a proxy, calculated as the ratio of equity owned by foreign investors as a proportion of its total assets. As discussed before, casino owners with successful operations in the US and Australia can foresee international trends of anti-smoking regulations, and are thus more likely to take the initiative to adapt to local smoking bans.

We performed univariate analysis due to the limited number of observations in the dataset. We tested the full sample, as well as a sub-sample comprising only the first two events because we anticipated these to have the greatest impact. We also adopted the bootstrapping method to generate robust standard errors for the estimated coefficients.

The bootstrapped standard error is a consistent estimator even for small samples, because it estimates the asymptotic covariance matrix by randomly sampling from the empirical distribution, rather than assuming normality of the data (Hall, 1992) and is valid for a sample with 8 or more observations (Chernick, 2011). Our dataset contains 16 observations from three smoking ban events, and thus meets the minimum sample size requirement for bootstrapping.

Data and Samples

Presently, there are six licensed casinos firms operating in Macao, shown in Table 2.

Both the Melco Crown and MGM Macao are excluded for the first event, as they did not go public until late 2011.

The market benchmark is given by the Hang Seng Index of the Hong Kong Stock Market. Under semi-strong efficiency, the market is able to react efficiently to new information (K. C. Chan, Gup, & Pan, 1992; Cheung & Andrew Coutts, 2001). As

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.

Melco Crown is listed on NASDAQ, its performance is instead measured against the NASDAQ index.

The daily closing prices of the casino stock and market indices from January 2, 2010 to January 30, 2015 were obtained from the Datastream database. Table 2 reports the daily returns and stock market capitalizations of each firms in the sample during this period. Note that these stock returns show similar daily volatilities.

Table 3 reports the descriptive statistics of the casino characteristic proxies. The average gaming revenue ratio of 0.94 indicates a high level of dependence on gaming, despite the business diversification strategies advocated by both the Macao and Chinese central governments.

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			

Results

Abnormal returns on smoking ban events

The abnormal returns to each stock for the three events are shown in Table 4. The results show that upon the unexpected announcement of the partial smoking ban on February 15, 2011, the traditional casinos (including Galaxy and SJM), saw significantly negative abnormal returns of 1-2 %, while Las Vegas casinos (Sands

China and Wynn) enjoyed significantly positive abnormal returns with Wynn Macao seeing over 3% higher returns.

Table 4. The Daily abnormal returns during Macao smoking ban events.

Variables	Galaxy	SJM	Sands China	Wynn Macao	Melco Crown ¹	MGM Macao
	(1)	(2)	(4)	(3)	(5)	(6)
Dummy for Feb. 15, 2011 (Partial ban) ²	-0.0211*** (0.0026) ⁵	-0.0108*** (0.0031)	0.00628** (0.0025)	0.0331*** (0.0023)		
Dummy for Mar. 19, 2014 (Mass market ban) ³	-0.0316*** (0.0008)	-0.0018** (0.0008)	0.0048*** (0.0007)	0.0002 (0.0007)	-0.0163*** (0.0016)	-0.0189*** (0.0009)
Dummy for Jan. 29, 2015 (Total ban) ⁴	-0.0114*** (0.0010)	0.0002 (0.0009)	0.0026** (0.0011)	0.0148*** (0.0009)	0.0114*** (0.0013)	-0.0024** (0.0011)
Cumulative Abnormal Return (CAR)	-0.064	-0.013	0.0137	0.0479	-0.0049	-0.0213

Note:

1. Melco Crown is 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~ 2014.3.20.
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.
6. *** p<0.01, ** p<0.05, * p<0.1

Upon the surprise announcement of the total ban on mass market gaming venues, that is, excluding VIP rooms, on March 19, 2014, abnormal returns again demonstrate similar patterns. Sands China and Wynn saw small gains, while both the traditional and hybrid groups suffered setbacks. SJM had a moderately negative abnormal return of -0.18%, since smoking was still allowed in VIP rooms for “high roller” patrons, who account for more than 70% of SJM’s gaming revenue. Galaxy suffered the most with abnormal returns of -3.16%, due to its increasing dependence on the mass market at which the ban was targeted.

Upon the unexpected announcement of a total ban on January 29, 2015, casino firms

in the traditional and hybrid groups had varying results due to differences in their operations. Casinos with high ratios of VIP revenue proportions, like Galaxy and MGM Macao, again suffered significantly negative abnormal returns of -1.14% and -0.24% respectively. However, the full ban had the expected insignificant effect on SJM, because it actually removes the burdens of renovating the aged venues to meet air quality standards.

In a summary, our results suggest that upon the surprise announcements of smoking bans in Macao, casino firms saw differentiated effects on their stocks. Sands China and Wynn Macao, the Las Vegas themed casinos, consistently reported non-negative abnormal returns, and had cumulative abnormal returns (CARs) of 1.37% to 4.79% as shown in Table 4. Meanwhile, traditional and hybrid casinos had negative CARs, ranging from -0.49% to -6.4 %.

We performed the same tests on listed gambling finance and junket operators in Macao to rule out the influence of potential confounding factors in the gaming industry. As the business strategies of these firms were highly dependent on “high roller” patrons, who were mostly unaffected by the bans, their stock returns should not have been affected. Indeed, we found no significant abnormal returns to stocks in this group.

We also checked Wisers Information Portal and Xinhua News Net to ensure that there were no competing releases of information, such as quarterly earnings reports, gaming table quotas, land development licenses, or restrictions on imported labor, or anti-corruption actions, which could have had a significant impacts on casinos individually or collectively. Policy changes enacted by the Chinese central government,

such as overseas limits on debit and credit cards or visitor limits, may hurt the casinos business, but we found no such potentially confounding information released on the event days.

Relationship between abnormal returns and operation characteristics

We further analyzed the relationship between abnormal returns and casinos' operational characteristics. As reported in Table 5, poor-air-quality ratio and abnormal returns show no significant correlation, whereas all three operational proxies are highly correlated with one another.

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

Table 6 reports the results of univariate regressions of abnormal returns on the smoking ban events. The first column indicates a significantly negative relationship between poor-air-quality ratio and abnormal returns for the first two events. However, when data from the third event is included, the coefficient remains negative but is no longer significant, possibly due to the insignificant effect this total ban had on SJM upon the announcement of the total ban. SJM has worst air quality among all casinos and suffered badly from the first two bans. However its stock had a muted response to

the third ban, as SJM had great difficulty meeting the air quality requirements of the partial bans, and actually preferred to switch to a total ban to avoid this problem.

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

The coefficients of gaming revenue ratio are consistently negative in both the subsample and full sample, while those for foreign equity ratio are consistently positive, support our hypothesis.

Among the three variables, gaming revenue ratio had the largest coefficients in absolute value, suggesting that it is the most important factor in determining the economic impact of smoking bans on Macanese casinos.

Discussion and conclusion

We used an event study to analyze the performance of casino stocks in Macao in response to three unexpected smoking ban announcements from 2011 to 2015 and

found that impacts differed for traditional and Las Vegas themed casinos. Traditional and hybrid casinos suffered negative cumulative abnormal returns of -1% to -6% while by contrast, Las Vegas style casinos enjoyed positive cumulative abnormal returns of 1.37% to 4.79%.

Among the operational factors considered, high dependence on gaming revenue plays the most important role. Poor air quality, stemming from dated infrastructure or poor ventilation systems, are associated with negative impacts for partial bans, but for the full ban. Additionally, positive management initiatives and strategies are consistently associated with higher stock returns.

With the current downturn of gaming revenue, smoking regulations are under great pressure from the gaming industry (Harris et al., 2012; Macao Post, 2015). Thus the findings presented here have important policy implications, providing the empirical evidence necessary for Macao government to improve its policy. Firstly, the differentiated impacts of smoking bans on casinos and relationships with associated factors provide policy makers with a fuller understanding of the impacts of its regulations. Secondly, these 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 leisure patrons. Finally, our results also suggest that smoking bans will not have significantly negative economic impacts on casinos once they take the initiative to adapt to air quality regulations.

Considering the various factors discussed above in conjunction, our results suggest that policy makers should re-examine their timing when implementing a total smoking

ban, or further investigate the effectiveness of establishing enclosed smoking rooms as a solution to the problem of second hand smoking. Furthermore, the results from Macao will provide a useful policy reference for rapidly growing gaming and tourism destinations elsewhere in Asia and in other developing economies worldwide.

The limitations of this study are largely due to the chosen empirical method and the sample size of the data. Firstly, abnormal returns estimated by an event study only directly capture the stock market's response, reflecting financial investors' expectations about the impacts of bans on the future profits, while actual realized profits may turn out to differ from these expectations. Secondly, the event study method cannot completely rule out the possibility that the results may be contaminated by unobserved confounding factors, though we found no such plausible factors in our study. Thirdly, patron switching is not a major concern in Macao due to its special location in relation to the Chinese mainland, and the findings here should be generalized only with caution wherever patron switching is a strong concern. Finally, since there are only six listed casino firms in Macao and two of them had not yet gone public as of the first event, the data set used here is not the ideal sample size for making strong inferences.

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