Complying with voluntary energy conservation agreements (I): Air conditioning in Hong Kong’s shopping malls

Tin Fai Kwok, Yuan Xu, Pui Ting Wong

Keywords: Voluntary agreements Energy conservation Thermal comfort Shopping malls

A R T I C L E   I N F O
Article history:
Received 21 May 2016
Received in revised form 25 October 2016
Accepted 25 October 2016
Available online 4 November 2016

A B S T R A C T
Voluntary agreements might play an alternative, complementary role in environmental governance. However, its effectiveness could be compromised because entities are not obliged to participate. Utilising the economic theory of crime and punishment, this research explains energy management decisions on complying with a voluntary energy conservation agreement. The 25.5 °C guideline for indoor air conditioning in Hong Kong’s shopping malls is studied. A thermal sensation profile of shopping mall visitors is presented, with more people feeling cold, and the voluntary agreement was not under widespread compliance. We rationalise air conditioning management decisions through soliciting the behavioural responses in a field survey of shopping mall visitors. People’s reactions to hotness, such as leaving the shopping malls, essentially result in higher costs for shopping malls, while they respond to coldness in a less costly manner, mainly by putting on an overcoat or scarf. Monitoring and penalty on non-compliance are too insignificant to tilt the decision. The conventional argument of saving money by energy conservation could thus be ineffective because shopping mall managers have to consider other potential benefits of energy consumption, like retaining visitors. We conclude with a relatively pessimistic outlook for the effectiveness of voluntary energy conservation agreements on air conditioning.

© 2016 Elsevier B.V. All rights reserved.

1. Introduction
Voluntary agreements have been used around the world as an alternative environmental policy instrument but “the environmental effectiveness of voluntary approaches is often questionable, and their economic efficiency is generally low” (OECD, 2003). Despite the pessimistic view, one study in Hong Kong provides promising hope that voluntary approaches could result in significant energy saving in buildings (Lee and Yik, 2002). Although energy efficiency has been pointed out as the most important means to mitigate CO2 emissions, its realisation suffers from a difficult-to-close behaviour gap (Allcott and Mullainathan, 2010; Wu et al., 2015; Xu et al., 2013). Where mandatory regulations are often ineffective or inappropriate to intervene behaviours, voluntary agreements could be a sound compliment.

As people spend 90% of time indoors, indoor environment has a far-reaching impact on human wellbeing. Parameters like air quality, visual, acoustic and thermal conditions influence human comfort and standards have been developed to delineate their acceptable ranges. In addition to the comprehensive literature survey by Frontczak and Wargocki (2011) on the factors influencing human comfort in indoor environments, numerous studies have explored users’ perception of the indoor thermal environment and neutral temperature, that is the thermal sensation of feeling neither warm nor cool (Givoni, 1998). A great number of research has been conducted to examine indoor thermal comfort in residential buildings (Al-ajmi and Loveday, 2010; Becker and Paciuk, 2009; Djamila et al., 2013; Li et al., 2011), schools (de Giuli et al., 2014; Fong et al., 2011; Hwang et al., 2006; Zhang et al., 2007) and offices (Erlandson et al., 2003; Indraganti et al., 2011; Wagner et al., 2007; Wu and Sun, 2012).

Shopping malls have also received much attention as temperature is considered one critical ambient condition of the shopping environment. d’Astous (2000) stated temperature as a tangible stimulus that would influence shoppers’ satisfaction. In retail and marketing literature, high temperature was discovered as an irritation for mall shoppers (d’Astous, 2000) and temperature had a negative effect on shopping excitement (Wakefield and Baker, 1998). Other studies on thermal comfort in shopping malls were found in architectural and human bio-meteorological literature (Chun and Tamura, 1998; Debiasse, 2010; Miura and Ojima, 1991;
Morgan and de Dear, 2003). A thermally comfortable indoor environment has significant impacts not only on shoppers’ well-being, but also the attractiveness of shopping malls as uncomfortable conditions could drive shoppers away. Chow and Fung (1995) studied 84 shopping malls and discovered occupants felt comfortable at a mean temperature of 20–24 °C, relative humidity of 50–65% and wind speed of 0.2–0.4 m/s. Lam et al. (2001) examined the thermal conditions of ten shopping malls and detected temperatures were 1–2 °C lower than 25.5 °C in summer.

However, the human reaction under unsatisfying thermal conditions in indoor public spaces is not fully addressed. Unlike private buildings, shopping malls are public space holding different people with a spectrum of demand, as people have different thermal comfort zones. For a given temperature, some people prefer warmer temperatures and others cooler. Even at the lowest point, about 40% of the people are not satisfied with the current temperature, half want it warmer and half want it cooler (Hwang and Cheng, 2007; Hwang et al., 2006). If the temperature is set at such level, it is assumed people who want it cooler or warmer would have equal strength. In reality, their weighting for thermostat setting may not be equal due to their different responses.

Hong Kong’s air pollution has attracted wide attention (Lee, 2013) and consumption-based CO₂ emission per capita stands among top ten in the world (Davis and Caldeira, 2010). The Hong Kong government has proposed targets to reduce carbon emission, almost exclusively through replacing coal with other types of lower-carbon fuels in power generation with little substantive emphasis on energy conservation (Environment Bureau, 2014; Environmental Protection Department, 2010a,b). The control of energy consumption has been pointed out as a key measure for CO₂ emission mitigation, especially in the short term. Among all, air conditioning is a remarkable part of energy consumption in Hong Kong with long, hot and humid summer. Besides, electricity consumption by air conditioning is closely associated with the thermostat setting. An experiment found that by raising the temperature set point from 22 °C to 24 °C, 23.3% of the electricity can be saved (Manning et al., 2007). As an attractive shopping paradise with shopping activities being a critical component to the economy (Heung and Qu, 1998), Hong Kong is ideal for studying the topic. In Hong Kong, buildings utilize around 89% of the electricity generated (Environmental Protection Department, 2010a) and about 25% of the electricity is used for space conditioning (Bağcı, 2010). Despite the governmental promotion of the 25.5 °C thermostat setting for indoor environment as the recommended indoor temperature in the guidelines on energy efficiency of air-conditioning (Electric and Mechanical Services Department, 1998), overheating often occurs in various types of buildings (offices, cinema and shopping malls) and public transport (buses, mini-buses and trains) (Chow and Lam, 1992; Bağcı, 2010). Local concern groups have taken measurements in major shopping malls in previous years, and the temperature is reported to be lower than 24 °C in certain shopping malls (Apple Daily, 2014; Oriental Daily, 2012).

This paper presents a thermal sensation profile of local shopping mall visitors in real life situation, to examine the current perception of local shopping mall thermostat setting. Their shopping-related behaviour under the current thermal condition and reactions toward unsatisfactory conditions are also studied. From the perspective of visitors’ behaviour, this paper empirically examines the potential costs or benefits for shopping malls to adjust their current thermostat setting and comply with the voluntary 25.5 °C agreement. In doing so, this paper aims to understand the possible considerations of the enterprises when choosing to comply with the voluntary agreement, and the feasibility to make such agreements as an alternative environmental policy instrument by conducting a cost and benefit analysis, in which the economic theory of crime and punishment is adopted. The rest of the paper is organized as follows. Section 2 introduces data and methodology. Section 3 reports our major findings. Conclusion and implications are provided in Section 4.

2. Data and methodology

2.1. Analytical framework

This paper utilises the economic model of crime and punishment as the analytical framework, to examine the feasibility of voluntary agreement as an alternative environmental policy instrument, particularly in tackling behaviour related issues, such as the indoor thermostat setting which is taken as the case study in this paper. Crime is understood as an informed choice resulted from the decision of choosing between criminal and non-criminal actions, considering the gains, costs and risks behind the actions (Fielding et al., 2000) from the economic perspective. A change in the factors considered in the process, such as the risk of conviction and values of goods stolen, would affect the amount of offenses committed. As Becker (1968) stated the assumption about a criminal act is that it would be committed by a person “if the expected utility to him exceeds the utility he could get by using his time and other resources at other activities”.

This is essentially a typical “cost and benefit” analysis, considering the utility gain from the non-criminal act as the (opportunity) cost for criminal acts, and the gain from criminal acts as the benefit, which could also be considered as the cost of the non-criminal act. Instead of following the framework of Becker’s seminal work which focuses more on the crime control issue, this paper focuses on the rational thinking process of the “offender” based on the cost and benefit analysis of crime commitment. To prevent crime, the following condition would be required:

gain from crime < cost of crime

which can also be written as:

cost of non-criminal act < cost of criminal act

As stated in Clarke and Cornish (1985) the model should be crime specific, pinpointing the type of crime, the individual committing and the motivations, to facilitate policy goals related to it. In the current paper, enterprises who operate the shopping malls are the individuals and the criminal act refers to the enterprise’s decision of not complying with the voluntary agreement—breaking the promise, while the punishment refers to 1, the material sanction given by the public such as boycotting the enterprise’s products, and 2, a non-material loss of business image of the enterprise. Borrowing from the framework of Becker (1968), the punishment, both material and non-material, comprises two components: the risk of conviction and the amount of punishment for each offense. In the current issue, the two components are specified as 1, the rate of detection (r) which refers to the probability for the public to detect the enterprise’s non-compliance, and 2, the voluntary penalty of non-compliance (p), which includes the reduction in product consumption and change in business image.

Based on the economic theory, as a rational being, the enterprise’s basic motivation of non-compliance would be to maximise the potential revenue of the mall, by retaining as many visitors as possible. The costs and benefits of compliance with the regulation are compared (Shimshack, 2014; Xu, 2011). Enterprises would choose to comply should the cost of compliance be less than the benefit and vice versa. For the factors concerned in this paper, the following condition should be attained for the enterprise to comply with a voluntary agreement, in other words, to prevent the criminal act of non-compliance:
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات