On the economic impact of smoking bans in restaurants

Renaud Foucart (ECARES)
Université Libre de Bruxelles - CP 139
50, av. F. Roosevelt
1050 Bruxelles - Belgium
rfoucart@ulb.ac.be

May 11, 2009

Abstract

In the many countries and US states that adopted smoking bans in restaurants, the economic outcome of this policy seems difficult to rationalize using classical economic theories. Indeed, several studies show that smoking bans implemented in places where supply for non-smoking restaurants hardly existed appear not to lead to profit losses. This implies that the decentralized decisions of those firms were not necessarily profit-maximizing. I propose a model that aims to explain this counter-intuitive result given the intrinsic characteristics of this competitive market with local externalities: a market in monopolistic competition with taste for diversity, where the valuation of goods depends for a large part on a reference level, and where consumption is often the result of a consensual decision among members of a group. I show that there exist an equilibrium where, even with a majority of Non-Smokers in the population, the Best Response of almost every restaurant is to allow smoking. At this equilibrium, a 100% smoking ban involving every competitor is expected to lead to an increase in the profits of the firms.

1 Introduction

The introduction of smoking ban laws in Europe and the US over the last decades has generated an important debate about public health and economic concerns. As will be discussed below, the most salient empirical results of those laws can be summarized the following way: smoking bans do not reduce profitability of restaurants, even when the market did not naturally supply this type of restaurants before a law was voted.

This outcome is difficult to rationalize with classical economic theory. A simple economic statement could be the following: if individuals and restaurant owners are rational utility maximizers, there is no reason to vote a law that decides of the best choice to make instead of the individuals. Second-hand smoke is a known phenomenon, and consumers going to a restaurant that allows smoking are informed of the risk they take. Even employees that work in a smoking environment are doing an optimal choice, knowing the risk they take and being rewarded for this.

Boyes and Marlow (1994), in their paper on the public demand for smoking bans, discuss whether the Coase theorem can be applied to property rights on the air quality in restaurants. The Coase Theorem predicts that private markets internalize negative externalities when there are zero transaction costs and property rights are clearly assigned to all resources. The authors argue that, as the air space within privately-owned establishments is also private, owners of these establishments are owners of the air space and are free to allocate the air space between two distinct demanders: smokers and nonsmokers. So, the property rights are clearly assigned.

Concerning the cost of transactions, the authors assume that negotiation between smokers and nonsmokers occurs via the owners of the private establishments:

> *Owners determine what air space allocation between smokers and nonsmokers is consistent with maximum profits and therefore externalities are fully internalized within the decision calculus of the owners.*

So, they argue that smoking bans shift ownership of the airspace away from owners of firms to non-smokers. By voting a law, the government allocates air space at zero price to nonsmokers. Smokers transfer income to nonsmokers without being compensated. Therefore, a smoking ban law can be seen as a way for the majority to give themselves an income transfer from the minority. As the *laissez faire* is expected to maximize the profit, the ban should of course lower it.

In an early version of his paper on *Competition in Two-sided Markets* (2002), Armstrong proposed another theoretical framework. In two-sided markets, there are two different types of agents (here smokers and non-smokers), generating externalities on each others. They pay a platform (here the restaurant) from which they extract utility, and on which they interact. The platform takes decisions (here the fact of allowing smoking or not) to maximize its profit by attracting both sides.

He sets up a Hotelling model with transportation costs, where two restaurants have to choose to allow smoking or not. The result is that all restaurants will take the same decision, and naturally decide to ban smoking when a sufficient fraction of consumers do not smoke. He also considers that the model has not to be taken too seriously.

> *There are at least two problems with the model. First, it is assumed that all non-smokers prefer to eat with smokers rather than not to go out at all. Second, a model with free entry of restaurants is likely to have an asymmetric outcome: a fraction of restaurants will allow smoking (perhaps a fraction similar to* the fraction of smokers*) while the remainder will forbid it. (Armstrong, 2002, p.20)*

Restaurants are mostly described as a market of monopolistic competition with scale economies. In this framework, Dixit and Stiglitz (1977) have shown that the market may fail to supply some varieties efficiently. In their setup, though, unproduced commodities should be the ones that are demanded by few consumers (with high and inelastic demand). This does not correspond to the case of restaurants, where a majority of consumers are non-smokers.

To explain this counter-intuitive empirical outcome, we need to understand what characterize the market for restaurants. I propose a model based on the following specificities:

1. There exist options besides going to the restaurant. Thus, how many times you go to the restaurants depends on the fit between your tastes and the resturant characteristics. This contrasts with the specification of Armstrong (2002).
2. As in Dixit and Stiglitz (1977), consumers value diversity (you do no want to eat out every night at the same restaurant). So, the demand for an individual restaurant has negative slope.
3. Consumers value a restaurant given its characteristics, but also by comparison to the other restaurants. This will be discussed in the first part of the model, while presenting the literature on utility functions using a reference level.

Moreover, we show that the results are reinforced if the market features either of the following characteristics:

1. Going to the restaurant is often not an individual choice, and results from a consensual decision within a group.
2. Restaurant owners do not observe the true fraction of non-smokers in their demand function, but only the fraction of non-smokers actually eating in their restaurant.

Our main findings can be summarized as follows:

1. There exists a Subgame Perfect Nash Equilibrium where all restaurants allow smoking, even if a majority of consumers are non-smokers.

2. Under such an equilibrium, a law that totally bans smoking strictly increases aggregate profits of restaurants.

In the extensions of this basic model, we show the following results:

1. The possibility of a choice between smoking and non-smoking restaurants reduces the demand from mixed groups (with smoking and non-smoking consumers) for every restaurant.
2. With asymmetric information, there exist restaurants that oppose the ban ex ante and increase their profit ex post.

Related literature

The most frequent argument in favour of smoking bans is the protection against smoke and second-hand smoke. As restaurants are places where smokers and non-smokers eat in the same room (even when separated), enacting a law that forbid to smoke in restaurants can be seen as a good way to protect consumers and employees and reduce mortality. Moreover, in countries with a public social security, such a ban can be seen as beneficial for the public budget balance.

Many of the supporters of bans prefer to avoid the economic discussion, arguing, as Allwright (2004) that:

> *Given the seriousness of the health consequences of exposure to passive smoke, the economic argument is hardly relevant. For example, would anyone seriously propose that because removing asbestos from buildings costs money and may put marginal businesses out of business, workers should continue to work in dangerously contaminated buildings?*

However, all the studies based on sales data and published in scientific journals conclude that a smoking ban law has either no or a significantly positive effect on restaurants.sales.

One can refer to Huang and McCusker (2002) about the effect of a smoking ban in El Paso, Texas, on sales taxes in bars and restaurants, Bartosh and Pope (2002), using monthly data from the Massachusetts, Glantz and Smith (1994) about the sales effects of smoking bans in 15 communities in California and Colorado, Sciacca and Ratliff (1998) in Flagstaff, Arizona, Glantz (2000) for the effect on the sales in bars of the total smoking ban in 1998 in the state of California, or Huang and al. (1995) for the effect of a 100% smoking ban on restaurants sales in West Lake Hills, Texas

Dunham (manager at Philip Morris) and Marlow (2000) put those results into perspective, mostly because they did not take into account distributional effects, considering aggregate data. They also analyzed a survey carried out among 600 owners of restaurants randomly chosen in the US. They conclude that an important percentage of owners (39%) predicted a decrease in their revenues if a "smoking law" has to be voted. They argue that the predictions of the owners of restaurants not affected by a smoking regulation did not differ from the ones of the owners of restaurants affected by the law.

A first problem is that they consider as *Law States* not only the ones that voted a 100% smoking ban, but also those who voted laws of regulation (for instance, laws asking the restaurants to have at least a certain percentage of their seating in nonsmoking zones) or partial smoking bans. Indeed, while looking more carefully at the 32 states defined as *Law States*, only 3 of them had a 100% smoking ban on bars and restaurants at the time the study was published. In fact, the only necessary condition to be considered as a *Law State* is *to have voted laws allowing or requiring non-smoking sections in restaurants.* Moreover, the question that has been asked refers to expected variation of profit if a smoking law has to be voted, without defining precisely what kind of ban of restriction is considered, allowing implicitly the owners to interpret this regarding the kind of law they face or fear to face.

A very different approach has been used by Alamar and Al. (2004). They tested the effect of a 100% smoking law in two US states (Utah and California). They conclude that there was a slightly positive effect on the value of restaurants. This do not necessarily means that sales increased, because costs are lower when restaurants are non-smoking. This paper appears to be the most accurate, because it is not only based on sales or sales taxes that can be influenced by increases in the price, but on a variable that can be seen as a good proxy for profitability.

Looking again at the survey presented by Dunham and Marlow, we learn that, in the US, only a very small number of restaurants ban smoking (100% of their seating dedicated to non-smoking consumers) in states where no smoking ban law has been voted.

This seems to have been also the case in most of the European countries. For example, the day before the smoking ban in France, the website of the city of Paris (paris.fr) counted slightly more than 100 restaurants or bars offering a hermetic non-smoking environment (the city counted 12 699 restaurants and bars in 2005). The existing websites trying to reference non-smoking restaurants in Brussels (rookvrij.be, thinkabout.be) counted slightly more than 20 non-smoking restaurants or bars in the city (among the more than 3000 referenced by the Belgian institute of statistics) before the smoking ban. Even if those surveys failed to reference all the existing non-smoking supply, it is unlikely that a large supply for non-smoking hospitality existed.

Moreover, those countries all appear to have a majority of non-smokers in the adult population. And Hersh. and al. (2004) showed for the US states that the existence of a law was consistent with the preferences of the voters. So, we can consider that smoking bans reflect the will of a majority.

2 Model

2.1 The reference level

In this model, we take into consideration the existence of a reference level, introducing the idea that the utility function does not only depend on the intrinsic value of a good. This specification allows explaining the "anomalies" in the theory of utility raised by behavioural economics[1], without questioning the principle of rationality, as defined by Thaler (1988):

> Agents have stable, well defined preferences and make rational choices consistent with those preferences

To answer those issues, various papers slightly modified the utility function to introduce a reference level. Quoting Helson (1964), Rabin (1998, p.13) states that:

> [...O]verwhelming evidence shows that humans are often more sensitive to how their current situation differs from some reference level than to the absolute characteristic of the situation. For instance, the same temperature that feels cold when we are adapted to hot temperatures may appear hot when we are adapted to cold temperatures.

Kirchsteiger (1994) proposes a model where envy is a potential explanation for most of the experimental *anomalies.* He argues that the results of ultimatum game experiments are not driven by fairness motivation on the side of the proposers, but by the proposer's fear of rejection of their offers by envious responders. Therefore, one needs to also include in the utility function the total amount of money to be shared.

Bolton (1991) argues in the same way that bargainers' propensity to make surprisingly equalitarian offers is not driven by fairness. He builds a comparative model, where agents care about not only absolute earnings, but also about a proportional index that allows for comparison between players.

In an earlier paper, Boskin and Sheshinski (1978) develop a model where individual welfare is a function of relative income. They justify progressive taxation schemes with this idea, even when it seems to be Pareto dominated when using a welfare function that only depends on the absolute wealth.

[1] Many experiments showed that the experimental results of an ultimatum game similar to the one presented by Rubinstein (1982) did not correspond to the results predicted by the theory. See for instance Güth, Schmittberger and Schwarze (1982), Güth and Tietz (1990), Ochs and Roth (1989), and Thaler (1988)

In this paper, I use a specification close to the one proposed by Clark and Oswald (1996). They show that the satisfaction of an individual with respect to his job does not only depend on wage or number of hours worked, but also on a comparison level of income. This reference level is the potential wage one can get given it own characteristics.

2.2 Setup

There exist a continuum of restaurants with mass 1. Each restaurant simultaneously chooses its price p and smoking policy (s or ns), observing his own demand function and the strategy played by the other restaurants. A smoking policy s means the restaurant allows to smoke. We assume a simple cost function with constant marginal cost c and fixed cost a.

There are 2 types of consumers, smokers (s) and non-smokers (ns). Denote by α the fraction of non-smokers in the population, $(1-\alpha)$ the fraction of smokers. In the basic model, we assume that people go alone to the restaurant.

The demand from a consumer i for a restaurant j is given by:

$$D \equiv q_i = \frac{f_i(s_j, \theta)}{p_j^{\varepsilon}}$$

Where:

- $f_i(s_j, \theta)$ denotes the intensity of the consumer's i preference for the restaurant j with smoking policy s_j. $i \in \{s, ns\}$ and $s_j \in \{s, ns\}$
- $\theta \in [0,1]$, is the mass of restaurants that ban smoking.
- ε is the constant own-price elasticity of demand
- p_j is the price chosen by restaurant j.

We make the following assumptions on the function and the parameters:

Condition 1 ***Symmetry:*** *the preference intensity of smokers and non-smokers are symmetric:*

- $f_s(s, \theta) = f_{ns}(ns, 1-\theta)$, $\forall \theta \in [0,1]$
- $f_s(ns, \theta) = f_{ns}(s, 1-\theta)$ $\forall \theta \in [0,1]$

Condition 2 ***Reference Level:*** *the demand from a consumer for a restaurant is decreasing in the mass of restaurants corresponding to his type. Indeed, the more restaurant matching your smoking preferences, the highest your reference level.*

The reference level of a non-smoker is strictly increasing in the number of non-smoking restaurants. Therefore, the demand of a non-smoker for any restaurant is strictly decreasing in the number of non-smoking restaurants.

$$\frac{df_{ns}(:;\theta)}{d\theta} < 0$$

and, by symmetry

$$\frac{df_s(:;\theta)}{d\theta} > 0$$

Condition 3 ***Strict preference:*** *a smoker strictly prefers a smoking environment; a non-smoker strictly prefers clean air, for any θ.*

- $f_s(s,\theta_i) > f_s(ns,\theta_j)\ \forall\theta_i,\theta_j \in [0,1]$
- $f_{ns}(ns,\theta_i) > f_{ns}(s,\theta_j)\ \forall\theta_i,\theta_j \in [0,1]$

Condition 4 ***Decreasing returns:*** *the impact of each of the two arguments of the function $f(.)$ is decreasing in the value of the function $f(.)$*

Concerning θ, this implies the following inequality:

$$\frac{df_s(s;\theta)}{d\theta} < \frac{df_s(ns;\theta)}{d\theta}$$

Thus, we assume that a restaurant that already matches the preferences of a consumer benefits less from a decrease in the reference level than a restaurant that does not[2]. And conversely, as the first argument is discrete, for any $\theta_1 > \theta_2$:

$$f_s(s,\theta_1) - f_s(ns,\theta_1) < f_s(s,\theta_2) - f_s(ns,\theta_2)$$

We will need this assumption for most of our results, even if it will be partially relaxed when introducing imperfect information. The intuition is as follows: If a restaurant corresponds to your smoking preferences, you do not care that much about the other restaurants. On the other hand, you will be much more concerned while considering a restaurant that does not correspond to your smoking preferences[3].

[2] One can think about the following condition: the parameters s_j and θ_j enter additively in the f_i function (they are substitutes), and the function f_i is concave. For instance, $f(g_i(s_j) + h_i(\theta_j))$,with $f'' < 0$.

[3] For instance, it can be "acceptable" for a non-smoker to eat in a smoky environment if he knows all other restaurants allow to smoke. But it won't be acceptable if he is used to eat in various non-smoking restaurants. On the other hand, a non-smoking restaurant will be acceptable anyway, and it won't be considered that better if many restaurants allow smoking.

3 The problem for a restaurant

The demand function for a restaurant that allows smoking, given a fraction θ of restaurants that ban smoking is given by:

$$D(s,\theta) \equiv q_j = \frac{\alpha f_{ns}(s;\theta) + (1-\alpha) f_s(s;\theta)}{p_j^{\varepsilon}}$$

The profit maximization problem of a restaurant is then:

$$Max_p \pi_s = (p-c)\{\frac{\alpha f_{ns}(s;\theta) + (1-\alpha) f_s(s;\theta)}{p_j^{\varepsilon}}\} - a$$

, Which has a unique solution:

$$p_j^* = (\frac{\varepsilon}{\varepsilon - 1})c \tag{1}$$

Hence, the profit:

$$\pi_s^* = [\frac{\varepsilon-1}{c}]^{\varepsilon-1} \frac{\{\alpha f_{ns}(s;\theta) + (1-\alpha) f_s(s;\theta)\}}{\varepsilon^{\varepsilon}} - a$$

As the problem is similar for a non-smoking restaurant, we have:

$$\pi_{ns}^* = [\frac{\varepsilon-1}{c}]^{\varepsilon-1} \frac{\{\alpha f_{ns}(ns;\theta) + (1-\alpha) f_s(ns;\theta)\}}{\varepsilon^{\varepsilon}} - a$$

Denote $D(s,\theta) = \{\alpha f_{ns}(s;\theta) + (1-\alpha) f_s(s;\theta)\}$ and $D(ns,\theta) = \{\alpha f_{ns}(ns;\theta) + (1-\alpha) f_s(ns;\theta)\}$. A restaurant will choose to allow smoking if[4]:

$$\begin{aligned} \pi_s^* &> \pi_{ns}^* \\ [\frac{\varepsilon-1}{c}]^{\varepsilon-1} \frac{D(s,\theta)}{\varepsilon^{\varepsilon}} - a &> [\frac{\varepsilon-1}{c}]^{\varepsilon-1} \frac{D(ns,\theta)}{\varepsilon^{\varepsilon}} - a \\ D(s,\theta) &> D(ns,\theta) \end{aligned}$$

3.1 Equilibrium in the basic model

In this first specification, α is common knowledge. We want to find the best responses of the restaurants.

In light of the optimal price found in (1), we want to derive the optimal smoking policy. A restaurant will prefer to allow smoking as long as:

$$\begin{aligned} &\alpha f_{ns}(s;\theta) + (1-\alpha) f_s(s;\theta) > \alpha f_{ns}(ns;\theta) + (1-\alpha) f_s(ns;\theta) \\ &\Leftrightarrow (1-\alpha)(f_s(s;\theta) - f_s(ns;\theta)) > \alpha(f_{ns}(ns;\theta) - f_{ns}(s;\theta)) \end{aligned} \tag{2}$$

This holds $\forall \theta \in [0,1]$

[4]Note that I do not consider introducing switching cost. As will be clear in the next subsections, this can only reinforce the results of the model.

Proposition 1 *There exist* $0 < \underline{\alpha} < \frac{1}{2}$ *such that* $\forall \alpha < \underline{\alpha}$ *the only NE is to allow smoking.*

Proof. We need to show that, for any value of θ, there exist a value of α such that it is a best response to allow smoking. From decreasing returns, we know that

$$\frac{df_s(s;\theta)}{d\theta} < \frac{df_s(ns;\theta)}{d\theta} \tag{3}$$

and

$$f_s(s,\theta_1) - f_s(ns,\theta_1) < f_s(s,\theta_2) - f_s(ns,\theta_2) \tag{4}$$

if $\theta_1 > \theta_2$

Using Symmetry, we have:

$$f_{ns}(ns;\theta) - f_{ns}(s;\theta) = f_s(s;1-\theta) - f_s(ns;1-\theta) \tag{5}$$

We want to find a value of α such that

$$(1-\alpha)(f_s(s;\theta) - f_s(ns;\theta)) > \alpha(f_{ns}(ns;\theta) - f_{ns}(s;\theta)) \tag{6}$$

$\forall \theta$

Using Strict Preference, we know that $\underline{\alpha} > 0$, as $(f_s(s;\theta) - f_s(ns;\theta)) > 0$

From equation (4), we know that the left-hand side of equation (6) is decreasing in θ, while the right-hand side is increasing in θ. Thus, if the inequality in equation (6) is true for $\theta = 1$, it is true $\forall \theta$. We also know from Symmetry that

$$(f_s(s;\frac{1}{2}) - f_s(ns;\frac{1}{2})) = (f_{ns}(ns;\frac{1}{2}) - f_{ns}(s;\frac{1}{2}))$$

Hence, for $\theta = 1$

$$\begin{aligned} (f_s(s;1) - f_s(ns;1)) &< (f_{ns}(ns;1) - f_{ns}(s;1)) \\ \frac{(f_{ns}(ns;1) - f_{ns}(s;1))}{(f_s(s;1) - f_s(ns;1))} &> 1 \end{aligned}$$

Equation (6) can thus be rewritten as:

$$\begin{aligned} \frac{(1-\alpha)}{\alpha} &> \frac{(f_{ns}(ns;1) - f_{ns}(s;1))}{(f_s(s;1) - f_s(ns;1))} > 1 \\ (1-\alpha) &> \alpha \\ \underline{\alpha} &< \frac{1}{2} \end{aligned}$$

■

Corollary 1 *There exist* $\frac{1}{2} < \bar{\alpha} < 1$ *such that* $\forall \alpha > \bar{\alpha}$ *the only NE is to ban smoking.*

Proof. We use the same strategy for the proof as for proposition 1. It is a best response to ban smoking if

$$(1-\alpha)(f_s(s;\theta) - f_s(ns;\theta)) < \alpha(f_{ns}(ns;\theta) - f_{ns}(s;\theta)) \tag{7}$$

From Decreasing Returns, we know the left-hand side is decreasing in θ, while the right-hand side is increasing in θ. Thus, if the inequality in equation (7) is true for $\theta = 0$, it is true $\forall\theta$. One can show that:

$$\frac{(f_{ns}(ns;0) - f_{ns}(s;0))}{(f_s(s;0) - f_s(ns;0))} < 1 \tag{8}$$

Rewriting equation (7), using equation (8) leads to:

$$\begin{aligned}
\frac{1-\alpha}{\alpha} &< \frac{(f_{ns}(ns;0) - f_{ns}(s;0))}{(f_s(s;0) - f_s(ns;0))} < 1 \\
\frac{1-\alpha}{\alpha} &< 1 \\
\bar{\alpha} &> \frac{1}{2}
\end{aligned}$$

And we know that $\bar{\alpha} < 1$, as $(f_{ns}(ns;\theta) - f_{ns}(s;\theta)) > 0$ ■

Until now, we have shown that there exist a single best response for $\alpha < \underline{\alpha}$ and $\alpha > \bar{\alpha}$ leading to two (pure strategy) Nash Equilibria.

We want to see what happens when α lies in between those two values.

Proposition 2 *For any value of α such that $\underline{\alpha} < \alpha < \bar{\alpha}$, there exist three NE. Two are stable (all allow, all ban) and one is not (a fraction of restaurants allows, a fraction bans)*

Proof. (a) For any $\alpha < \bar{\alpha}$, all allow is a NE. If all other restaurant allow smoking, the best response of a restaurant is to allow smoking too. Therefore, at this equilibrium, $\theta = 0$. We need α such that

$$\alpha\{f_{ns}(ns;0) - f_{ns}(s;0)\} < (1-\alpha)\{f_s(s;0) - f_s(ns;0)\} \tag{9}$$

Replacing α by $\bar{\alpha}$ leads to

$$\frac{\bar{\alpha}}{(1-\bar{\alpha})} = \frac{\{f_s(s;0) - f_s(ns;0)\}}{\{f_{ns}(ns;0) - f_{ns}(s;0)\}}$$

Hence, for any $\alpha < \bar{\alpha}$

$$\frac{\alpha}{(1-\alpha)} < \frac{\{f_s(s;0) - f_s(ns;0)\}}{\{f_{ns}(ns;0) - f_{ns}(s;0)\}}$$

(b) For any $\alpha > \underline{\alpha}$, all ban is a NE. We need α such that:

$$\alpha\{f_{ns,ns}(ns;1) - f_{ns,ns}(s;1)\} > (1-\alpha)\{f_{s,s}(s;1) - f_{s,s}(ns;1)\} \tag{10}$$

Replacing α by $\underline{\alpha}$ leads to

$$\frac{\underline{\alpha}}{(1-\underline{\alpha})} = \frac{\{f_s(s;1) - f_s(ns;1)\}}{\{f_{ns}(ns;1) - f_{ns}(s;1)\}}$$

Hence, for any $\alpha > \underline{\alpha}$

$$\frac{\alpha}{(1-\alpha)} > \frac{\{f_s(s;1) - f_s(ns;1)\}}{\{f_{ns}(ns;1) - f_{ns}(s;1)\}}$$

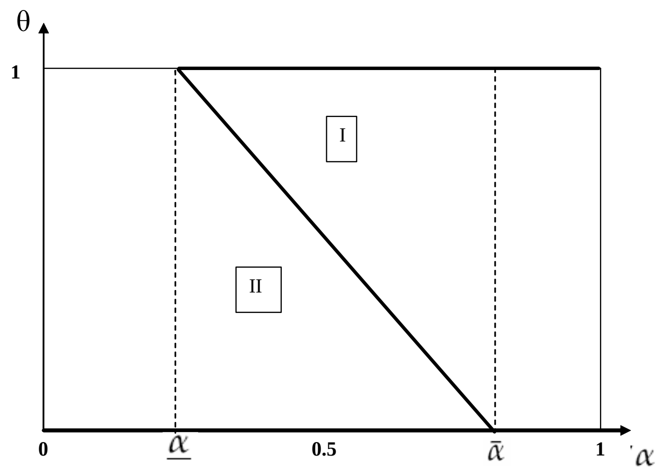
(c) For any $\underline{\alpha} < \alpha < \bar{\alpha}$, there exist a value of θ such that a restaurant is indifferent between ban or allow smoking. A mixed strategy on $\{ban, allow\} = \{\theta, 1-\theta\}$ is a Nash Equilibrium.

$$\alpha\{f_{ns}(ns;\theta) - f_{ns}(s;\theta)\} = (1-\alpha)\{f_s(s;\theta) - f_s(ns;\theta)\} \tag{11}$$

for some θ. Note that, the higher the value of α, the lower the value of θ at the mixed equilibrium.

(d) The equilibrium described in (c) is not stable because, for any change in θ, one of the pure strategies is strictly dominated, the same for every restaurant.

(e) As a corollary of (d), the two other equilibria are stable. ■



The bold lines correspond to the Nash Equilibria. For every fraction of non-smoking restaurants θ in zone I, the best response of the restaurant is to ban smoking. In zone II, the best response is to allow smoking. The mixed strategy is an equilibrium on the diagonal.

The Nash Equilibria on the diagonal are somehow counter intuitive, because it involves a small number of non-smoking restaurants when most consumers do not smoke, and a large number of non-smoking restaurants when most consumers smoke.

Proposition 3 *If a majority of consumers are non-smoker, a smoking ban leads to no profit change if all firms banned smoking, to an increase in the profit (and a lower price) if all firms allowed smoking, and an ambiguous effect if the equilibrium corresponds to the mixed strategy.*

Proof. For a given number of firms, if a smoking ban occurs with $\alpha > \frac{1}{2}$, we can consider three cases:

1. If all restaurants already ban smoking, there is no change in the profit, no new firms enter the market and the equilibrium price remains constant

2. If all restaurant allowed smoking, the individual profit of a firm becomes

$$\pi(ns,1) = [\frac{(\varepsilon-1)}{c}]^{\varepsilon-1}\frac{\{\alpha f_{ns}(ns;1)+(1-\alpha)f_s(ns;1)\}}{\varepsilon^{\varepsilon}} - a$$

Instead of

$$\pi(s,0) = [\frac{(\varepsilon-1)}{c}]^{\varepsilon-1}\frac{\{\alpha f_{ns}(s;0)+(1-\alpha)f_s(s;0)\}}{\varepsilon^{\varepsilon}} - a$$

Using symmetry, we know that $f_{ns}(s;0) = f_s(ns;1)$, $f_{ns}(ns;1) = f_s(s;0)$, and, using Strict Preference, $f_{ns}(ns;1) > f_{ns}(s;0)$. Hence, as $\alpha > \frac{1}{2}$, we now that $\pi(ns,1) > \pi(s,0)$. As we are in monopolistic competition, we expect new firms to enter the market and profits to go back to zero. We have defined that the entry of new firms leads to higher elasticity of demand for the *dd* curve, ε, the price is expected to be lower

$$(\frac{\varepsilon'}{\varepsilon'-1}) < (\frac{\varepsilon}{\varepsilon-1})$$

if $\varepsilon' > \varepsilon$

3. If we are in a "mixed" equilibrium, with a small fraction of the restaurants that ban smoking, we already now that firms are indifferent between allowing smoking or ban it. Hence, we now that for a $\theta \in [0, \frac{1}{2}[$, $\alpha \in]\frac{1}{2}, \bar{\alpha}[$ such an equilibrium has to fulfill the following condition:

$$\pi(ns,\theta) = \pi(s,\theta)$$

After a smoking ban law, the profit is, as defined in the first case, $\pi(ns,1)$. The profit in the "mixed" equilibrium is given by

$$\pi(ns,\theta) = [\frac{(\varepsilon-1)}{c}]^{\varepsilon-1}\frac{\{\alpha f_{ns}(ns;\theta)+(1-\alpha)f_s(ns;\theta)\}}{\varepsilon^{\varepsilon}} - a$$

The individual profit of a firm increases thus if:

$$\begin{aligned} \pi(ns,1) - \pi(ns,\theta) &> 0 \\ \alpha f_{ns}(ns;1) + (1-\alpha)f_s(ns;1) &> \alpha f_{ns}(ns;\theta) + (1-\alpha)f_s(ns;\theta) \end{aligned}$$

The effect is ambiguous, as $f_{ns}(ns;1) < f_{ns}(ns;\theta)$, $f_s(ns;1) > f_s(ns;\theta) > 0$, $\alpha > \frac{1}{2}$, and, from Decreasing Returns $|(f_{ns}(ns;1) - f_{ns}(ns;\theta))| < |(f_s(ns;1) - f_s(ns;\theta))|$

■

3.2 Imperfect information

In this subsection, we relax condition 4 (Decreasing Returns), and replace it by the following[5]:

Condition 5 ***Constant Returns:*** *the impact of each of the two arguments of the function $f(.)$ is constant in the value of the function $f(.)$*

We also relax the hypothesis of perfect information of the restaurants on the fraction of non-smokers in the population, α, and on the demand function. Instead, we assume that restaurants make a guess on the fraction of non-smoking consumers that corresponds to the fraction of non-smokers they actually observe, $\hat{\alpha}$. If they observe a majority of smoking consumers, they prefer to allow smoking, if they observe a majority of non-smokers, they prefer to ban smoking.

Proposition 4 *There exist $0 < \underline{\alpha} < \frac{1}{2}$ such that $\forall \alpha < \underline{\alpha}$ the only NE is to allow smoking.*

Proof. The observed fraction of non-smokers, $\hat{\alpha}$, correspond to the fraction of the demanded quantities coming from non-smoking consumers, i.e. for a smoking restaurant:

$$\hat{\alpha}_s = \frac{\frac{\alpha f_{ns}(s;\theta)}{p^{\varepsilon}}}{\frac{\alpha f_{ns}(s;\theta)+(1-\alpha)f_s(s;\theta)}{p^{\varepsilon}}}$$

$$\hat{\alpha}_s = \frac{\alpha f_{ns}(s;\theta)}{\alpha f_{ns}(s;\theta)+(1-\alpha)f_s(s;\theta)}$$

As, from condition (1) $f_s(s;\theta) > f_{ns}(s;\theta)$, this yields $\hat{\alpha}_s < \alpha$.

Conversely, for a non-smoking restaurant

$$\hat{\alpha}_{ns} = \frac{\alpha f_{ns}(ns;\theta)}{\alpha f_{ns}(ns;\theta)+(1-\alpha)f_s(ns;\theta)}$$

with $\hat{\alpha}_{ns} > \alpha$.

It is never a best response for a restaurant to allow smoking if $\hat{\alpha} < \frac{1}{2}$. As $\hat{\alpha}_{ns} > \alpha > \hat{\alpha}_s$, it is enough to find $\underline{\alpha}$ such that $\hat{\alpha}_{ns} < \frac{1}{2}$. Moreover, as we want this best response to hold for any θ, it is a sufficient condition to show that it

[5] Notice that the results in this section also hold with Decreasing Returns. We present Constant Return as a less restrictive assumption.

holds for $\theta = 0$[6]. Hence, $\underline{\alpha}$ is the solution to

$$\begin{aligned}
\alpha f_{ns}(ns;0) &= \frac{\alpha f_{ns}(ns;0) + (1-\alpha) f_s(ns;0)}{2} \\
\alpha f_{ns}(ns;0) &= (1-\alpha) f_s(ns;0) \\
\frac{\alpha}{(1-\alpha)} &= \frac{f_s(ns;0)}{f_{ns}(ns;0)} < 1 \\
\alpha &< (1-\alpha) \\
\underline{\alpha} &< \frac{1}{2}
\end{aligned}$$

■

Proposition 5 *There exist $\frac{1}{2} < \bar{\alpha} < 1$ such that $\forall \alpha > \bar{\alpha}$ the only NE is to ban smoking.*

Proof. Using the same strategy, one can show that such an $\bar{\alpha}$ corresponds to the solution of

$$\begin{aligned}
\alpha f_{ns}(s;1) &= \frac{\alpha f_{ns}(s;1) + (1-\alpha) f_s(s;1)}{2} \\
\alpha f_{ns}(s;1) &= (1-\alpha) f_s(s;1) \\
\frac{\alpha}{(1-\alpha)} &= \frac{f_s(s;1)}{f_{ns}(s;1)} > 1 \\
\bar{\alpha} &> \frac{1}{2}
\end{aligned}$$

■

Notice that, conversely to the case with perfect information, $\bar{\alpha}$ corresponds to $\theta = 1$ and $\underline{\alpha}$ corresponds to $\theta = 0$.

Proposition 6 *There exist $\underline{\alpha} < \alpha^- < \frac{1}{2}$ such that, $\forall \alpha > \alpha^-$, $\forall \theta$ it is always a best response for a restaurant that already bans smoking to ban smoking*

Proof. It is a best response to ban smoking, for a restaurant that already bans smoking, if

$$\begin{aligned}
\hat{\alpha}_{ns} &= \frac{\alpha f_{ns}(ns;\theta)}{\alpha f_{ns}(ns;\theta) + (1-\alpha) f_s(ns;\theta)} > \frac{1}{2} \\
\alpha f_{ns}(ns;\theta) &> \frac{\alpha f_{ns}(ns;\theta) + (1-\alpha) f_s(ns;\theta)}{2} \\
\frac{\alpha}{(1-\alpha)} &> \frac{f_s(ns;\theta)}{f_{ns}(ns;\theta)}
\end{aligned}$$

[6]Using Reference Level, it can be shown that f_s is increasing in θ while f_{ns} is decreasing in θ. This ratio is expected to be minimum when $\theta = 0$

As the right hand side is increasing in θ, it is enough to find α^- such that

$$\frac{\alpha}{(1-\alpha)} = \frac{f_s(ns;1)}{f_{ns}(ns;1)}$$

As $\frac{f_s(ns;1)}{f_{ns}(ns;1)} < 1$, $\alpha^- < \frac{1}{2}$. And as

$$\begin{aligned} \frac{f_s(ns;1)}{f_{ns}(ns;1)} &> \frac{f_s(ns;0)}{f_{ns}(ns;0)} \\ \frac{\alpha^-}{(1-\alpha^-)} &> \frac{\underline{\alpha}}{(1-\underline{\alpha})} \\ \alpha^- &> \underline{\alpha} \end{aligned}$$

■

And, conversely,

Proposition 7 *There exist* $\frac{1}{2} < \alpha^+ < \bar{\alpha}$ *such that,* $\forall \alpha < \alpha^+$*,* $\forall \theta$ *it is always a best response for a restaurant that already allows smoking to allow smoking*

Proof. Such an alpha needs to fulfill $\forall \theta$

$$\alpha f_{ns}(s;\theta) < \frac{\alpha f_{ns}(s;\theta) + (1-\alpha) f_s(s;\theta)}{2}$$

$$\frac{\alpha}{(1-\alpha)} < \frac{f_s(s;\theta)}{f_{ns}(s;\theta)}$$

As the right-hand side is increasing in θ, it is enough to find α^+ such that

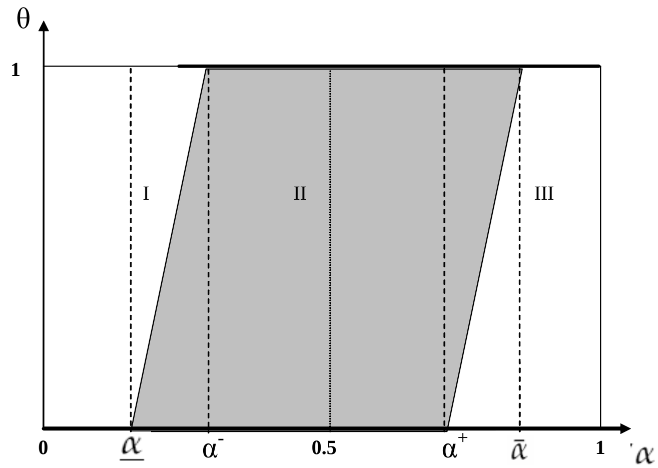
$$\frac{\alpha}{(1-\alpha)} = \frac{f_s(s;0)}{f_{ns}(s;0)}$$

As $\frac{f_s(s;0)}{f_{ns}(s;0)} > 1$, we know that $\alpha^+ > \frac{1}{2}$, and as

$$\frac{f_s(s;0)}{f_{ns}(s;0)} < \frac{f_s(s;1)}{f_{ns}(s;1)}$$

we know that $\alpha^+ < \bar{\alpha}$. ■

Hence, the picture becomes the following:



In zone I, the only Nash Equilibrium is to allow smoking. In zone III, the only equilibrium is to ban smoking. In zone II (the grey zone), there exist a large variety of Nash Equilibria. In this zone, it is always a best response to allow smoking for a restaurant that used to allow smoking, and always a best response to ban smoking for a restaurant that used to ban smoking.

The grey zone clearly corresponds to the idea of self-fulfilling equilibria. It is a best response for a restaurant owner to allow smoking because he already allows it, and therefore faces more demand from smokers than from non-smokers.

Notice that the two diagonals have positive slope in this case. This means that if, in a world with a majority of non-smokers, a restaurant decides for some reason to ban smoking, it will decrease the observed fraction of non-smokers $\hat{\alpha}_s$ for the smoking restaurants. And it will still be a best response to allow smoking for a majority of restaurant, even for some $\alpha > \alpha^+$

In this simple "imperfect information" case, the effect on the profit is quite similar to the perfect information case. For $\alpha > \frac{1}{2}$, if all firms banned smoking, there is no change in the profit. If all firms allowed it, the profit is expected to increase for every firm. The interesting case corresponds to the equilibria with supply for smoking and non-smoking restaurants.

Proposition 8 *In a world with a majority of non-smokers, if only a small fraction of restaurants ban smoking, the aggregate effect on the profit will be positive, the individual effect for restaurants that already banned smoking will be negative, and the individual effect for restaurants that allowed smoking will be positive.*

Proof. Assume that a small fraction of restaurants ban smoking, $\theta < \frac{1}{2}$. The profit variation for such a restaurant will be positive if $\pi(ns, 1) > \pi(ns, \theta)$, i.e. if

$$\alpha f_{ns}(ns; 1) + (1-\alpha) f_s(ns; 1) > \alpha f_{ns}(ns; \theta) + (1-\alpha) f_s(ns; \theta)$$

From Constant Returns and Reference Level, we have $f_s(ns; 1) - f_s(ns; \theta) = f_{ns}(ns; \theta) - f_{ns}(ns; 1) > 0$. Set $f_s(ns; 1) - f_s(ns; \theta) = \Delta_1$. The profit variation for a non-smoking restaurant is strictly lower than zero:

$$\begin{aligned}
\pi(ns, 1) - \pi(ns, \theta) &< 0 \\
(1-\alpha)\Delta_1 - \alpha\Delta_1 &< 0 \\
(1-2\alpha)\Delta_1 &< 0
\end{aligned}$$

with $\alpha > \frac{1}{2}$. Using the same strategy, the profit gain for the restaurant that used to allow smoking is strictly positive

$$\begin{aligned}
\pi(ns, 1) - \pi(s, \theta) &> 0 \\
\alpha f_{ns}(ns; 1) + (1-\alpha) f_s(ns; 1) &> \alpha f_{ns}(s; \theta) + (1-\alpha) f_s(s; \theta) \\
\alpha(f_{ns}(ns; 1) - f_{ns}(s; \theta)) &> (1-\alpha)(f_s(s; \theta) - f_s(ns; 1)) \\
\alpha(f_{ns}(ns, \theta) - f_{ns}(s, \theta) - \Delta_1) &> (1-\alpha)(f_s(s, \theta) - f_s(ns, \theta) - \Delta_1)
\end{aligned}$$

Again, using Constant Returns, we can define $\Delta_2 = f_{ns}(ns, \theta) - f_{ns}(s, \theta) = f_s(s, \theta) - f_s(ns, \theta) > 0$. And using Strict Preference, we know that $\Delta_2 > \Delta_1$. We then have

$$\alpha(\Delta_2 - \Delta_1) > (1-\alpha)(\Delta_2 - \Delta_1)$$

Which is always true as $\alpha > \frac{1}{2}$.

The aggregate effect is positive if

$$\begin{aligned}
\theta\{(1-2\alpha)\Delta_1\} + (1-\theta)\{(2\alpha-1)(\Delta_2 - \Delta_1)\} &> 0 \\
(2\alpha - 1)(\Delta_2(1-\theta) - \Delta_1) &> 0
\end{aligned}$$

As $(2\alpha - 1) > 0$, and as from Constant Returns Δ_2 does not depends on θ it is enough to show that:

$$(1-\theta)\Delta_2 - (f_{ns}(ns; \theta) - f_{ns}(ns; 1)) > 0$$

Again, using Constant Returns, we can rewrite

$$\begin{aligned}
(1-\theta)\Delta_2 + \frac{df_{ns}(ns; \theta)}{d\theta}(1-\theta) &> 0 \\
(1-\theta)[\Delta_2 + \frac{df_{ns}(ns; \theta)}{d\theta}] &> 0
\end{aligned}$$

Which is true $\forall \theta < 1$, because of Strict Preference. ■

3.3 Imperfect matching

Until now, we have assumed a simple framework, where individuals go to the restaurant alone. In the real world, this would correspond to a case of perfect matching, where non-smokers only go out with other non-smokers.

A more realistic case would be to introduce some "mixed" groups, where a non-smoker go out with a smoker. For simplicity, we will present an extension of the model of perfect information, with groups of two people going to the restaurant, and perfectly random matching.

In this case, a fraction α of non-smokers yields a fraction α^2 of groups of non-smokers, a fraction $(1-\alpha)^2$ of groups of smokers, and a fraction $2\alpha(1-\alpha)^2$ of "mixed" groups.

We assume that a group of two non-smokers has demand function for a non-smoking restaurant:

$$D \equiv q = \frac{f_{ns,ns}(ns;\theta)}{p^{\varepsilon}} = \frac{f_{ns}(ns;\theta)}{p^{\varepsilon}}$$

and conversely for smokers $f_{s,s}(ns;\theta) = f_s(ns;\theta)$. We keep conditions 1 to 4. We add the following condition for "mixed groups":

Condition 6 *The utility for a restaurant is not perfectly transferable, hence, the demand from a "mixed" group is strictly lower than the mean demand of the members of the group.*

$$f_{ns,s}(ns;\theta) = \frac{f_{ns}(ns;\theta) + f_s(ns;\theta)}{2+\lambda}$$

with $\lambda > 0$ *(there is a positive cost of transferring utility) and* $\lambda < \frac{f_{ns}(ns;\theta)+f_s(ns;\theta)}{f_s(ns;\theta)}$ *to allow* $f_{ns,s}(ns;\theta) > f_s(ns;\theta)$

Indeed, one can expect the choice of a restaurant to be the result of a consensual decision. A bargaining with monetary compensation can be seen as a possible conflict, and therefore avoided. However, some compensation can occur, so that the demand of the group does not necessarily correspond to the lower of the demands.

A first result from this hypothesis is the following:

Proposition 9 *A mixed group has always higher demand for a restaurant that shares the smoking policy of a majority of restaurants.*

$$f_{s,ns}(s;\theta) > f_{s,ns}(ns;\theta) \text{ if } \theta < \frac{1}{2}$$

Proof. To prove this proposition, we need to show that

$$\begin{aligned}\frac{f_{ns}(s;\theta)+f_s(s;\theta)}{2+\lambda} &> \frac{f_{ns}(ns;\theta)+f_s(ns;\theta)}{2+\lambda}\\ f_s(s;\theta)-f_s(ns;\theta) &> f_{ns}(ns;\theta)-f_{ns}(s;\theta)\end{aligned}$$

This is true, as from Decreasing Returns the left-hand side is increasing in θ while the right-hand side is decreasing in θ, and as, from Symmetry:

$$f_s(s;\frac{1}{2})-f_s(ns;\frac{1}{2})=f_{ns}(ns;\frac{1}{2})-f_{ns}(s;\frac{1}{2})$$

■

Now, we can come back to the value we found for $\bar{\alpha}$ and $\underline{\alpha}$.

Proposition 10 *With random matching, the size of the zone where three Nash Equilibria exist increases.*

Proof. The new threshold value $\underline{\alpha}'$ is the solution to

$$\begin{aligned}\alpha^2\{f_{ns,ns}(ns;1)-f_{ns,ns}(s;1)\} &= (1-\alpha)^2\{f_{s,s}(s;1)-f_{s,s}(ns;1)\}\\ &\quad +2\alpha(1-\alpha)\{f_{s,ns}(s;1)-f_{s,ns}(ns;1)\}\end{aligned}$$

Rewriting the expression and replacing α' by the threshold value we found in perfect matching, $\underline{\alpha}$ yields

$$\begin{aligned}&\underline{\alpha}^2\{f_{ns,ns}(ns;1)-f_{ns,ns}(s;1)\}-(1-\underline{\alpha})^2\{f_{s,s}(s;1)-f_{s,s}(ns;1)\}\\ \lesseqqgtr\ &2\underline{\alpha}(1-\underline{\alpha})\{f_{s,ns}(s;1)-f_{s,ns}(ns;1)\}\end{aligned}$$

Using proposition (1), one can show that the left-hand side equals zero. Using proposition (10), we know that the right-hand side is strictly lower then zero. To satisfy the condition with equality, we need to decrease the value of the left-hand side, which is only possible by decreasing α. This means $\underline{\alpha}' < \underline{\alpha}$. Using the same strategy, we can show that $\bar{\alpha}' > \bar{\alpha}$. ■

4 Discussion and conclusions

A first refinement to this simple model is to question the independence between smoking preferences of the consumers and the kind of food served by the restaurant. One can argue that, for instance, there are few smokers in the demand function of a vegetarian restaurant, even in countries where a majority of the population smokes.

Analytically, this corresponds to let the parameters of the individual demand vary. In this case, our vegetarian restaurant facing $\alpha_i > \bar{\alpha}$ will ban smoking, alone, even when all others allow it. With perfect information, if we look at the structure of our Nash Equilibria, this will not change the best response of the other restaurants, as long as they stay in zone II. In the case of imperfect information, this will lead smoking restaurant to keep on allowing smoking, even for some $\alpha > \alpha^+$.

As this more realistic framework allows for some non-smoking supply to exist in a mostly smoking environment, one should also expect that, even when the aggregate impact of a smoking ban does not hurt business, there can be a distributional effect.

Indeed, when a smoking ban exists, restaurants facing a demand consisting in almost only smoking consumers are expected to see their profit decrease. This can be an additional explanation to the initial opposition of many restaurant owners to smoking bans.

Using industry documents publicly available on the Internet as a result of litigation in the USA, Dearlove and al. (2002) argue that:

> [The tobacco industry] mount an aggressive and effective world-wide campaign to recruit hospitality associations, such as restaurant associations, to serve as the tobacco industry's surrogate in fighting against smoke-free environments.

But there is no need for manipulation to explain the reluctance of many restaurant owners. As long as we do not expect restaurant owners to observe the true fraction of non-smokers in their demand function, but only the total quantities demanded, there is uncertainty about future profits in case a smoking ban was voted. This gives also a plausible explanation to why the support to smoking ban is significantly higher after the smoking ban has been implemented than before.

In this paper, we presented a model based on a framework of monopolistic competition, with a demand function depending on a reference level.

This hypothesis allows us explaining why, when most of the population does not smoke, there exists an equilibrium where all restaurants allow smoking. This can be explained by the way consumers behave with a reference level, but also by imperfect information of restaurant owners. Indeed, one expects them to overestimate the fraction of smokers in their demand function if they allow smoking, because the consumers that actually go to their restaurant are mostly smokers.

A last part of the explanation comes from the fact that people do not go alone to the restaurant, and that the choice of a restaurant results of a consensual decision. If utility is not perfectly transferable, one could expect restaurants owners to have incentive to all play the same strategy toward smoking policy, because supplying both kinds of environments can make it difficult for a "mixed" group to agree on a choice.

When a majority of the population does not smoke, one could expect a smoking ban law not to hurt business on an aggregate basis. However, there can be distributional effects that have to be taken into account for the policy to be easily accepted by restaurants owners. This has to be taken into account while considering smoking bans in other hospitality markets, such as bars.

5 Bibliography

ALAMAR B and GLANTZ S (2004) ; Smoke-free ordinances increase restaurants profits and value ; *Contemporary Economic Policy* ; 22/4 ; 520-526

ALLWRIGHT S (2004) ; Republic of Ireland's indoor workplace smoking ban ; *Brititsh Journal of General Practice* ; november 2004 ; 811-812

ARMSTRONG, Mark (2002) ; Competition in Two-Sided Markets ; mimeo

BARTOSH W and POPE G (2002) ; Economic effect of restaurant smoking restrictions on restaurant business in Massachussets, 1992 to 1998 ; *Tobacco Contro*l ; 11 ; 38-42

BOYES W and MARLOW M (1996) ; The public demand for smoking bans ; *Public Choice* ; 88 ; 57-67

BRAUER M and 't MANNETJE A (1998) ; Restaurant Smoking Restrictions and Environmental Tobacco Smoke Exposure ; *Amercian Journal of Public Health* ; 88(12)

CLARCK A and OSWALD A (1996) ; Satisfaction and comparison income ; *Journal of Public Economics* ; 61 ; 359-381

DEARLOVE J, BIALOUS S and GLANTZ S (2002) ; Tobacco industry manipulations of the hospitality to maintain smoking in public places ; *Tobacco Control* ; 11 ; 94-104

DIXIT and STIGLITZ (1977), Monopolistic competition and optimum product diversity, *The American Economic Review*; 67(3) ; pp. 297-308

DUNHAM J and MARLOW M (2000) ; Smoking Laws and their differential effects on restaurants, bars, and taverns ; *Contemporary Economic Policy* ; 18(3) ; 326-333

GLANTZ S (2000) ; Effects of smokefree bar law on bar revenues in California ; *Tobacco Control* ; 9 ; 111-113

GLANTZ S and Smith L (1994) ; The Effects of Ordinances Requiring Smoke-Free Restaurants on Restaurants Sales ; *American Journal of Public Health* ; 84(7) ; 1081-1085

GLANTZ S and Smith L (1997) ; The effect of ordinances requiring smoke-free restaurants and bars on revenues: a follow-up ; *American Journal of Public Health* ; 88(4) ; 1122-1129

GÜTH W, TIETZ, R (1990) ; Ultimatum bergaining behaviour: A survey and comparison of experimental results ; *Journal of Economic Psychology* ; 11 ; 417-449

HERSH J, DEL ROSSI A, KIP VISCUSI W (2004) ; Voter Preferences and State Regulation of Smoking ; *Economic Enquiry* ; 45(3) ;

455-468

HUANG P and McCUSKER M (2002) ; Impact of a Smoking Ban on Restaurants and Bar Revenues - El Paso, Texas, 2002 ; *Morbidity and Mortality Weekly Report* ; available on cdc.gov ; accessed 11 january 2008

HUANG P and al. (1995) ; Assessment of the Impact of a 100% Smoke-Free Ordinance on Restaurants Sales - West Lake Hills, Texas, 1992-1994 ; *Morbidity and Mortality Weekly Report* ; 44(19) ; 370-372

KIRCHSTEIGER, Georg (1994) ; The role of envy in ultimatum games ; *Journal of Economic Behavior and Organizations* ; 25 ; 373-389

LAMBERT W, SAMET J and SPENGLER J (1993) ; Environmental Tobacco Smoke Concentrations in No-Smoking and Smoking Sections of Restaurants ; *American Journal of Public Health* ; 83(9) ; 1339-1341

PAKKO M. (2006) ; On the Economic Analysis of Smoking Bans ; Federal Reserve Bank of St. Louis ; *Regional Economic Development* ; 2(2) ; 115-130

RABIN, Matthew (1998) ; Psychology and Economics ; *Journal of Economic Litterature* ; 36 ; 11-46

ROCHET JC and TIROLE J (2004); Two-Sided markets: an overview ; Institut d'Economie Industrielle (Working Paper)

SCIACCA J and RATLIFF M (1998) ; Prohibiting Smoking in Restaurants: Effects on Restaurants Sales ; *American Journal of Health Promotion* ; 12(3) ; 176-184

THALER Richard (1988) ; Anomalies: The Ultimatum Games ; *The journal of Economic Perspectives* ; 2(4) ; 195-206