



**Universitat Autònoma  
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**Master in Management, Organization and Business Economics**

# **The impact of deregulating the retail industry**

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## **Abstract**

Shopping hour's regulation has been widely debated in many European countries, and according to this debate the degree of regulation varies to a large extent among the countries, as such policies are regulated by the state in many countries. The raising competition indicates a debate about the rentable and rational strategies of the players in a market. The previous literature tried to analyze the behavior of the firms on the market from two directions; experiments were written about real data in a specific country, but at the same time many papers established to analyze the topic by the assets of game theory models. In this experiment we'll try to analyze the possible sub games of a two players' game, and we'll discuss our results in both a competitive and social point of view. We'll try to get a clear view about the decisions in a simple environment, where two firms are competing in prices, and in each sub game the policies or the strategies are changing to have a comparable data. By using these results we'll draw a simple model of competition, where one of the shops will be able to set its opening schedule first, and when the other shop decides when to be open, they will compete in prices. Our results suggest that a regulation of the market has negative impact on the companies' profits and on social welfare as well, just as on consumer surplus.

## **1. Introduction**

### **1.1. Shopping hours policy in different countries**

Even though the trend goes towards less regulation, the issue is still controversial. In the past decades, countries such Sweden and the U.K. extended their opening hours in the retail industry. Others countries, e.g. Austria, Denmark, Finland and Norway, are more skeptical and maintain restriction on shopping hours. For example, in Germany up until very recently stores were required to close by 8 p.m. on weekdays, and by 1 or 2 p.m. on Saturdays, except in city centers where shops typically remained open until 4 p.m. There were some exceptions to these rules during the weekends prior to Christmas. At present these regulatory restrictions on the retail industry are being considerably liberalized but it is still an issue subject to much political debate to determine how far to proceed with the process of shopping hour liberalization as well

as to decide whether shopping hour regulation should be a federal policy issue or not. The international trend toward Sunday shopping deregulation has been most extensive in North America, but is more recently showing signs of gaining momentum in Western Europe. In the United States a steady decline in the number of states that impose a general ban on all Sunday business activity began in the early 1960s so that by 1985 only 22 states still had general bans compared to 35 in 1961. A similar decline began in Canada in the early 1980s and continued until 1998, when Newfoundland became the last province in the country to pass some form of deregulating legislation. In contrast, in Europe only Belgium, Luxembourg, Sweden and Spain had taken any formal steps to deregulate Sunday retail activity prior to the 1990s. However, over the following decade England and Wales, the Netherlands and then Finland opted to relax their restrictions on Sunday shopping. Furthermore, there is indication that France and Italy are similarly moving in the direction of deregulation.

## **1.2. The view of economists about shopping hours' regulation**

A growing common concern among economists in all these debates is the expected labor demand impact of Sunday shopping. Opponents and proponents of deregulation have often based their arguments on their expectations of these labor demand effects. Despite the widespread debate in the popular press there is a dearth of empirical research examining the labor demand effects of Sunday shopping. However the main concern of shopping hours' liberalization is how deregulation may affect the structure on the competitiveness of the retail industry. There is particular controversy about how deregulation affects competition between large retail chains and smaller, independent competitors. Smaller retailers fear that they may be harmed by deregulation of shopping hours. The reason is that small retailers might not be able to match long shopping hours at chain stores. After deregulation, a firm with cost advantage might decide to open longer hours in order to attract additional consumers from those firms without such a cost advantage and, thus, affecting the composition of different firms' size in equilibrium. This disadvantage in shopping hours could then lead to a drop in demand as more customers make use of the longer hours offered by chains. Via this chain of reasoning, independent retailers may lose profits. If these effects are strong enough, deregulation of shopping hours could even lead to the exit of independent retailers. Short service hours typically save costs for service operators, but short

business hours hurt consumers, who may face disutility associated with having to advance or postpone their business transactions relative to their ideal time. On the demand side, since consumers might prefer to go shopping at different times, when opening hours are liberalized retailers can attract additional demand by extending their opening time and charge higher prices because some consumers are willing to pay for time flexibility. On the other hand, deregulation of shopping hours might also affect the incentives of entry into the market and how incumbent firms may respond to a threat of entry.

## **2. Literature review**

### **2.1. Theoretical background**

From a strategic point of view *Edmiston (2007)*<sup>1</sup> discusses both the advantages and disadvantages of working for a small or a larger firms focusing on economic fixtures from the United States. He explores the most recent economic growth strategies and the role that small businesses play in creating jobs, and also compares job quality between small firms and larger firms. Last but not least the author examines how important small businesses are in the development of new products and new markets. The overarching question is whether promoting entrepreneurship and small businesses makes sense as an economic development strategy. More importantly, data show that, on average, large businesses offer better jobs than small businesses, in terms of both compensation and stability. Further, there is little convincing evidence to suggest that small businesses have an edge over larger businesses in innovation.

From 1990 to 2003, small firms (less than 20 employees) accounted for 79.5 percent of the net new jobs, despite employing less than 18.4 percent of all jobs in 2003. However we should consider this fact as an outcome of small businesses' growth, as they change classes from small to the middle size by hiring more and more people. The statistics show evidence that stability and working conditions are better at a larger firm, however innovation is more efficient at smaller firms. The first two facts are coming from scale efficiency and public incentives made by the government to fertilize business in a region, the last evidence is not totally clear, but in sense of critical innovators and net

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<sup>1</sup> Edmiston K., (2007) The Role of Small and Large Businesses in Economic Development, *Federal Reserve Bank of Kansas City, Economic Review, Second Quater*

job creation the author states his commitment with the results, and declares an evidence of an advantage of smaller businesses.

The base of our model – as well as some other models – is the analysis of *Shy and Stenbacka (2006)*<sup>2</sup> who were checking the effect off peak business hours on the opening hours when there's only one firm on the market, and they were curious whether longer opening hours are covering the additional cost raised by longer operating. They were also looking for the effect on the social welfare, which they identified as the sum of the consumer surplus and the industry profit. They find a positive difference between the basic monopolistic environment and the one by considering the effect of peak business hours. Then they assumed a duopolistic environment, and they find that there would be a leader and a follower firm on the market, where the leader would open around the clock and the follower would choose shorter opening period.

A bit more detailed picture has been drawn with regards to welfare and social implications in *Shy and Stenbacka's (2008)*<sup>3</sup> more recent paper. Their two stage competition model among symmetric firms compared customers among their shopping time preferences, whether they are able to postpone shopping or they prefer to make the shopping in advance according to the location and opening hours of the shops. They categorized customers as forward or backward-oriented according to this, and they didn't allowed two directions in a particular customers' preference. The authors found that with parallel opening hours, both stores earn a higher profit when they both restrict their opening hours to part-time operation compared with both operating full-time. By asymmetric opening schedule the longer shopping hours lead to higher prices and more costumers.

*Shy and Stenbacka (2008)* found that cost differences generate two asymmetric equilibrium, where one shop operates around the clock and the other operates part-time. They came to the result that an increase in the transportation cost and/or a decline in the value of time, decrease the range of operation costs under which equilibrium with unequal business hours exist, thereby making asymmetric business hour

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<sup>2</sup> Shy, O. and Stenbacka, R. (2006). 'Service hours with asymmetric distributions of ideal service time', *International Journal of Industrial Organization*, vol. 24, pp. 736–71.

<sup>3</sup> Shy, O. and R. Stenbacka (2008), 'Price Competition, Business Hours, and Shopping Time Flexibility', *Economic Journal* 118, 1171–1195.

equilibrium less likely to emerge. In a social point of view the article indicates that daytime shoppers are better off when the store operates half time, whereas at least some night time shoppers are better off with non-stop operation.

Summarizing their findings, they suggested that retailers would not expand their business hours above the social optimum. They also find an interesting fact, which states firms' commitment to opening hours on the long run and to prices on short term. In comparison *Miguel Flores (2011)*<sup>4</sup> was examining a three steps model focused on the, in particular how an incumbent firm may respond to an entry threat. He finally arrived to some interesting conclusions, which is interesting in light of the findings of *Shy and Stenbacka (2008)*. In his duopolistic competition model first the incumbent chooses its opening hours, then decides whether to enter or not the market and, in the entry case, chooses its opening time, and then the incumbent and the entrant compete in prices. In some cases incumbent can use opening hours to deter entry. Flores found that social welfare can be greater under entry deterrence when product differentiation is low, social welfare can be lower under entry deterrence when product differentiation is high. He also proposed that when product differentiation is (not) sufficiently high, an entry deterrence strategy is welfare (enhancing) reducing. Summing up his findings the most important conclusion is that this paper shows that shopping hours deregulation is not always welfare enhancing.

However *Tobias Wenzel (2010)*'s<sup>5</sup> model tries to eliminate the previous failures and allows a free entry on the market, and also a continuous choice for shopping hour's decision instead of static one. He was looking for the effect of higher prices and free entry on welfare and the number of entrants, and he found that opening hours are affecting transportation costs and costs related to enter the market, which are affecting welfare. He assumes also that there isn't any need for further regulation on the market; there is a need for a deregulation instead.

The author normalized the number of consumers to one in an  $n$  number shop market, where marginal costs are increasing by the increase of shopping hours. Also a key

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<sup>4</sup> Flores M., (2011) Working Paper No. 11/51, University of Leicester Department of Economics, November 11, 2011

<sup>5</sup> Wenzel, T. (2010), Liberalization of Opening Hours with Free Entry, *German Economic Review* 11, 511–526.

element is consumers' preference for shopping, which can allow or retard longer opening hours, and also has an effect on prices. He found that compared with the social optimum, the market outcome leads to excessive entry behavior and opening hours that are too short, and that liberalization leads to higher total industry opening hours.

So firmly summarize his ideas we can say that for a given number of firms in the retail sector, the model predicts that a larger concentration in the retail sector leads to longer shopping hours. Furthermore, the model generates a negative relationship between the degree of regulation and retail concentration. After deregulation the model predicts a positive change (increase) in prices thanks to the increased concentration. *Inderst and Irmen (2005)*<sup>6</sup> focused also on the problem of prices and their respond to deregulation in a framework where the choice of opening hours is endogenous.

They found that asymmetric shopping hours are raising when consumers attach a great value to time, however demand reflects less to price changes. These facts indicated that a retailer with a cost advantage is better off as he or she is opened around the clock, because it maximizes profits, and mitigates price competition. They compare their results with *Halk and Trager (1999)*<sup>7</sup>, a paper that examined shopping hours after the deregulation in 1998 in Germany. *Halk and Trager (1999)* found that, after the new policy had been introduced, only 39% of the existing shops shifted their opening hours, which matches with this particular paper's finding about cost advantages. Usually larger retailers have cost advantage from the synergies of a retailer chain; however the authors showed that even a small retailer can gain from deregulation through the higher price in a short run equilibrium.

In a more recent experiment of *Wenzel (2011)*<sup>8</sup> the author considers competition between an independent store and a chain that owns several shops. There are two firms in a retail market. One firm is a retail chain that operates multiple (two) stores, and the other firm is an independent retailer that operates a single store. Those two firms compete in a spatially differentiated market, and they are competing in a two-stage

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<sup>6</sup> Inderst, R. and Irmen, A. (2005). 'Shopping hours and price competition', European Economic Review, vol. 49, pp. 1105–24.

<sup>7</sup> Halk, K., Trager, U., (1999). Wie wirkt das neue Ladenschlugesetz auf den Einzelhandel? IFO Schnelldienst, 1-2/99, 7–13.

<sup>8</sup> Wenzel T., (2011) Deregulation of Shopping Hours: The Impact on Independent Retailers and Chain Stores, Scand. J. of Economics 113(1), 145–166

game; first in shopping hours and during the second stage in prices. In this setting the independent store tends to act more competitively. If the cost difference between the chain and the independent retailer is not too large, the independent store might choose longer opening hours and gain from deregulation, and it never chooses shorter opening schedule. The situation reverses when the retail chain is much more efficient than the independent retailer.

*Wenzel (2011)* studied the impact of deregulation on profits of the chain and the independent retailer. The author obtains a simple condition to evaluate this impact. If deregulation leads to longer shopping hours in both firms, both retailers lose in terms of profits deregulation leads to asymmetric shopping hours, the retailer that chooses longer shopping hours gains and the retailer that chooses shorter shopping hours is harmed by deregulation. Hence, whether deregulation favors retail chains or independent retailers depends to a large extent on cost efficiency differences between the two competitors. If the cost difference is sufficiently small, deregulation might favor the independent retailer, while with a large efficiency difference; deregulation might favor the chain and harm the independent retailer. Overall, the problem for smaller retailers does not arise through the deregulation of shopping hours per se, but it originates only in combination with lower efficiency.

*Wenzel (2011)* also studied the impact of deregulation on consumer surplus and welfare. He shows that welfare and consumer surplus increase unambiguously due to deregulation. Thus, from this point of view, the model delivers no reasons for regulating shopping hours.

As we can see shopping hours policy has a large and dense literature, which includes many sub-fields in the analysis, and sometimes they reject the idea of each other. In the following section we'll analyze some theories application on real data mainly from the U.S. and Canada.

## **2.2. Experiments with real data sets**

As it has been already mentioned before the frequency of field experiments are relatively rare in this topic, but still we can find some. Just as in an experiment with



real data of *Tanguay et al. (1995)*<sup>9</sup>, who analyzed the short-term effect of extended shopping hours by the changes in July 1990 in Quebec, Canada. They split the price of goods into two parts, first its initial price and second the transportation costs, above the location they also took into consideration the size of the shops to get a more diversified picture on the upcoming impacts of deregulation. They predict that larger shops are more likely to increase by the effect of extended shopping hours, and they also gain cost advantage when they work with longer opening hours and larger number of consumers. They tested their hypothesis on the weekly time series of five homogenous products' per kilogram prices before and after the changes in the legislation from April to November 1990. They found that more accessible shops (corner shops) are more likely to charge higher prices, than supermarkets. An interesting finding of the paper was related to economies of scale, as it has been already found out, that deregulation may not increase cost (it was investigated in a simulation of *Desormeaux, Nantel and Amesse in 1988*<sup>10</sup>). They tested their above-mentioned hypothesis in 3 large stores in Quebec, and they assumed the same results in the other stores of the same chains. They ran a regression for all of the products and they found a positive and significant effect on the prices after the deregulation. The authors were helped out by some industry experts, who declared that longer shopping hours let the stores to distribute workers along the week more correctly, so a more efficient way of working hours distribution lead to the same amount of working hours (i.e. the same level of costs). Experts also ought that stocks could be managed more efficiently, as managers doesn't have to sell highly perishable products on Saturday as they're open on Sundays, so stock levels can be also distributed more balanced during the week, which decrease the level of sunk costs.

*Skuterud (2005)*<sup>11</sup> was particularly looking for the effect of deregulation on employment. He asked whether retail firms satisfy their need for Sunday employment

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<sup>9</sup> Tangay, G., Valle, L., and P. Lanoie (1995): 'Shopping hours and price levels in the retailing industry: a theoretical and empirical analysis', *Economic Inquiry*, Vol. 33, pp. 516-524.

<sup>10</sup> Desormeaux R., Amesse F., Nantel J., (1988), École des hautes études commerciales (Montréal, Québec)

<sup>11</sup> Skuterud, M. (2005), 'The Impact of Sunday Shopping on Employment and Hours of Work in the Retail Industry: Evidence from Canada', *European Economic Review* 49, 1953–1978.

by increasing the weekly hours of existing employees or by hiring new workers? Or is it possible that deregulation has neither an hours nor an employment impact as labor demand is reduced during the rest of the week? Opponents and proponents of deregulation have often based their arguments on their expectations of these labor demand effects. The Canadian experience in deregulation between 1985 and 1993 offers an ideal setting to examine the consequences of Sunday shopping, as the legislation is provincial and was introduced at different times. The data was recorded from the very beginning of the changes until 2001. This paper exploits how retail employers that choose to open on Sundays following deregulation adjust their employment level and weekly hours of work. He took into consideration only the provinces in which Sunday shopping hours significantly had a increasing effect on monthly sales according to the Canadian legal experience. Then by having the relevant territories *Skuterud (2005)* used regressions to check the connection between the theoretical findings and the empirical data. He finally found three levels of retail industry in Ontario, Manitoba and Alberta to analyze, and finally his results were showing a slight but significant increase in sales after the deregulation in accordance with the theory of *Edmiston (2007)*. By combining the results with the labor intensity estimates a 1-2% of sales increase was predicted from the data set. The author explained the results by two factors, first the more obvious one is the effect of tourism, second the effect of retail margins and consumer price index effect, which reflects in retail prices. However the lack of the regional data didn't let space to analyze these effects.

A different application of the theory with field data is *Maarten Goos's (2005)<sup>12</sup>* paper, which focused on how consumer behavior and retail competition can explain the observed impact of deregulation on retail labor and product markets and therefore ultimately employment. He exploits recent changes in Sunday Closing Laws in the US to find that total employment, total revenue and the number of shops increase in deregulating industries and possibly decrease in non-deregulating industries. The author identified three channels of growth by deregulation. First is that longer shop opening hours will increase employment, second as longer shopping hours increase

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<sup>12</sup> Goos M., (2005), The Impact of Shop Closing Hours on Labor and Product Markets, London School of Economics

sales level it also requires larger employment rate, which indicates the third effect on the long run, that by the increasing sales the number of shops and consequently the employment will grow as well. For the latest one they analyzed the extending shopping hours' impact on deregulated and regulated industries, and finally they checked the wages and the output prices of both industries. With the above detailed method they examined how employment in deregulating industries increases because of an increase in threshold labor (a threshold labor effect), an increase the total volume of sales (sales effect) and an increase in the number of shops (entry effect). However, it was also argued that employment in exempted industries would fall because of a decrease in total expenditure in exempted industries (sales effect) as well as a decrease in the number of shops (exit effect). After we have a clearer mind about the topic we'll analyze our model, which is more similar to the ones mentioned in the theoretical models section.

### 3. The model

Our model is based mainly on the assumptions of *Shy and Stenbacka (2008)* and *Wenzel (2011)*, as we try to analyze customer preferences on shopping hours, but we created a specific measure to make our results easy to calculate and discuss. Our model assumes (similarly to *Shy and Stenbacka (2008)* for instance) a duopolistic market where the two firms are competing in a static game in prices, but under different circumstances and policies, which we'll discuss as separate sub games. Then we'll summarize the results of these sub games to arrive to a conclusion in the below detailed model.

The two retailers are selling homogenous product for costumers with a mass  $M$ , who can even buy one or zero unit from the product. Consumers perceive the same utility  $v$  from buying the good in either shop, but they dislike finding the shop closed (or dislike modifying their most preferred shopping time and adapt to the firm's shopping hours policy). Consumers differ in the cost of adapting to the firm's B shopping hour policy  $s$ , namely, some consumers are more patient while others are more impatient. Assume that consumer's impatience is uniformly distributed, that is  $s \sim U [ 0, S ]$ , in other words, every "point" in the segment  $[ 0, S ]$  represents a consumer with a particular level of impatience, being 0 the less impatient and  $S$  a highly impatient consumer.

The analysis is organized as follows: first we assume an asymmetric market, and then in the next two sections we'll try to have a deeper view on a symmetric market assumption from two different assumption. In the first sub game we assume a market where firm A is able to keep a 24/7 opening schedule without any costs, and firm B is not interested in setting a similar extended schedule but a 12/6 instead. We derive the reaction functions by applying the mentioned gam, and then we try to analyze the demands and profit functions just as the impact of them on consumer surplus and social welfare.

Then we analyze the symmetric situation where differences between the two firms disappear by some circumstances (e.g. a regulation), so both shops can keep the same extended or restricted shopping hours and costumers are not having any differences in their impatience level. Following these assumptions we're counting on a competitive outcome (i.e. solution a la Bertrand), because the shops are not differentiated and neither the products are. In this section we assume two sub games; one where bot shops are holding the extended 24/7 shopping hours and another one where all the players are restricting their schedule to 12/6. By having the results of both situations we'll be able to discuss and order the social effect of each sub game on welfare in general and from a consumers or firms' point of view.

### **3.1. The asymmetric sub game**

We analyzed a model where we follow a model similar to the one has been analyzed by *Shy and Stenbacka (2008)* and others like *Wenzel (2011)*, however our model is more simplified, as we don't consider different types of transportation costs (e.g. preferred shopping hours or location in accordance to the shop). In our model  $s$  stands for such costs (which could be linked more or less to time schedules in the paper of *Shy and Stenbacka (2008)*), besides these people are uniformly distributed here in terms of their shopping costs.

As the disutility if the consumer buys at shop B when frequently facing the shop closed at its most preferred hour and having to switch to another hour, therefore it is similar to a transportation cost.

The utility they gain from shopping in a certain shop is described in the following utility function below:

$$U = \begin{cases} v - P_A \\ v - s - P_B \end{cases}, \quad (1)$$

Where  $s$  denotes the consumer's level of impatience, as shop A have a 24 hour opening schedule it is "costless" for a consumer to shop there, because it is always an available option. A certain consumer prefers shop B if prices in shop B are lower then in shop A and its shopping cost is not very high. If  $s$  is large, then this consumer buys at shop A, even if the price is higher than at shop B. Therefore an indifferent consumer can be described as follows:

$$v - P_A = v - P_B - s', \quad (2)$$

In any kind of prices some very patient consumers would probably buy at shop B while those very impatient at Shop A. Therefore, there must exist a consumer, say  $s'$ , such that he is indifferent between buying at shop A and face no cost  $s$ , or buying at shop B but wait till the shop is open. This  $s'$  draws us a border between the two groups of customers:

$$s' = P_A - P_B \quad (3)$$

From this equation we can have a guess on the final results, as it shows us that if there's a difference between the consumers shopping preferences, so  $s'$  is positive, in equilibrium shop A can charge higher prices for its availability, and shop B has to win the more price sensitive local people to shop there for lower prices but just during its given opening hours. In the next calculations we'll try to verify this hint. Since we assume a uniform distribution with a density of 1, we can clearly describe then the demand functions of shop A as:

$$D_A = [s'; S] = S - s' \quad (4)$$

and for shop B:

$$D_B = [0; s'] = s' - 0 \quad (5)$$

since:

$$S - s' = S - P_A + P_B \quad (6)$$

and:

$$s' - 0 = P_A - P_B \quad (7)$$

We can rewrite demands of the two shops as follows:

$$D_A = S - P_A + P_B \quad (8)$$

$$D_B = P_A - P_B \quad (9)$$

Hence both demands depend on the prices that shops choose, not just on the price of one of the firms.

From these functions we can easily calculate the profit functions of each shop:

$$\Pi_A = [P_A - c] \times [S - P_A + P_B] \quad (10)$$

and:

$$\Pi_B = [P_B - c] \times [P_A - P_B] \quad (11)$$

Maximizing these profit functions implies to solve the first order conditions:

$$\frac{\partial \Pi_A}{\partial P_A} = 0 \text{ and } \frac{\partial \Pi_B}{\partial P_B} = 0 \quad (12)$$

By the maximization we can get out the reaction functions of each firm in sense of prices, as they compete in prices:

$$P_A = \frac{S + P_B + c}{2} \text{ and } P_B = \frac{P_A + c}{2} \quad (13)$$

Having a look at on the reaction functions in such situation our guess is that shop A will set higher prices than shop B. Why do we think so? And does it make sense? The answer is obvious for the first question if we solve the equations, but let's analyze a

little bit the second question. Shop A holds a 24/7 opening schedule, so anybody who cannot wait to buy the product can go there to buy it anytime. However every service has a cost, and if we think about it a bit, we get to the conclusion that shop A is giving an extra service comparing to shop B, which is availability. We didn't considered in this model any operational or labor cost which can affect shop A's prices, however we'll see that the single fact that A is available anytime makes A able to set higher prices, because the impatient consumers are not price sensitive, so they are able to pay more for a good at the right moment, than postponing their needs for another day to buy it for a more affordable price. So *whenever*  $P_B < S + c$  (i.e. not too high) shop A is willing to sacrifice some market share in order to have a larger mark-up in its customers.

After we created the reaction functions by the maximization, we are able to calculate the equilibrium prices by applying one function in the other:

$$P_A = \frac{2S}{3} + c \text{ and } P_B = \frac{S}{3} + c \quad (14)$$

It is clear that in equilibrium  $P_A > P_B$ , which guarantees the highest profit for firm A, so it won't change its prices in such circumstances in any way. The equilibrium profits are easily countable then by introducing the equilibrium prices in the profit functions:

$$\Pi_A = \frac{4S^2}{9} \text{ and } \Pi_B = \frac{S^2}{9} \quad (15)$$

So firm A realizes higher rate of profits in equilibrium than firm B by charging higher prices for larger amount of customers. Shop A is charging a higher price as it contains the price of accessibility as well, as it holds an opening schedule around the clock, so even impatient customers can access it as well as it is still cheaper for customers around the neighborhood to shop there then go to the other shop and waste more money on transaction costs.

From the viewpoint of the firm A (which could set a price to serve the whole demand on the market as it has an advantage to be open around the clock) this price maximizes its profits as well. Imagine if firm A would set a price just as firm B, it would serve a larger demand, but with a lower rate of profit.

### 3.2. Symmetric market circumstances with 24/7 schedules

Change a little bit in the model, and let's assume that shop B is behaving in a mimic way, as it can do so because it is not discriminatively costly for it to do so. In a situation like this both shops are holding the same opening schedule, so both would be open around the clock. The utility function differs then from the basic one in a way like there won't be any differences in senses of disutility coming from the customers' impatience, so:

$$U = \begin{cases} v - P_A \\ v - P_B \end{cases} \quad (16)$$

Then the indifferent customer can be described by only the prices:

$$P_A = P_B \quad (17)$$

Summarizing the market conditions; the shops are competing with the same marginal cost, and selling the same good for consumers who are indifferent between the two shops until the prices are the same. What happens then here? Who'll serve the market and how? Which price is the optimal one? Who'll gain profit? The model of Bertrand gives the answer. Bertrand was thinking like what if one of the firms - let's say shop A - would charge lower prices than shop B. In this case shop B would lose its demand and shop A will serve the market, because nobody is interested in buying a product for a higher price if it's available somewhere else for cheaper and it doesn't generate any additional cost. So the both firms will decrease its price by a small amount and serve the whole market temporary, as this is the only profit maximizing strategy. The same stands for the case when shop B wants to charge less than shop A is selling its product, so shop A would lose its customers too. So the other firm will decrease its price by a small amount and serve the whole market, as this is the only profit maximizing strategy. The only equilibrium is therefore the one where both firms are charging the same price, and they will split the market among each other. But what will be the price where none of the shops would deviate? The lowest available price: the marginal cost ( $c$ ), because none of the firms will decrease their prices under their marginal costs, because this would probably mean additional customers, but the shop with lower prices than the marginal cost it wouldn't be able to cover the cost of operation and it would



realize a negative profit. So the equilibrium prices therefore are the ones like in a competitive environment, because this is the unique stable price setting, since otherwise there'd exist a unilateral deviation from one of the firms.

$$P_i = P_A = P_B = c \quad (18)$$

By applying such prices none of the shops would be able to realize profits (as they reach the ultimate price that covers their costs), so equilibrium profits are:

$$\Pi_i = \Pi_A = \Pi_B = 0 \quad (19)$$

If we consider that the reachable profits on the market are lower with a mimic strategy by assuming similar schedules, than the profits with the asymmetric opening timetable. We have to say then shop B is behaving rationally if it chooses a limited opening schedule rather than copy the other firm's behavior on the market, because it hurt the profits of the competitor but its own as well.

### 3.3. Symmetric market circumstances with 12/6 schedules

Now let's assume a market where for example a policy exists, which has been made by the government, that both shops has to hold a specific time schedule for their opening hours (e.g. they aren't able to be open at night and on Sundays). In these circumstances the utility function changes a bit, as the utility for a customer shopping at shop A includes an amount of disutility for the hours, when it is not open ( $s$ ):

$$U = \begin{cases} v - s - P_A \\ v - s - P_B \end{cases} \quad (20)$$

The situation then is really similar then to the above written case, as here the indifferent consumer can be explained by the function of prices (equation 16.). Then the ultimate solution for the game is the equivalent that has been detailed before, the same which is based on the assumptions of Bertrand, because both firms are dealing again with the same circumstances, such as same marginal costs, same demand and therefore same profits and prices. Consequently in case of a regulation on the market both shops would choose the prices equals to the marginal cost to cover their costs, and

then none of them would be able to realize profit, as a deviation from this behavior would lead to negative profits, or in an extreme case to the loss of their own demand.

An example for this situation from the real world is, when firm with the limited possibilities tries to ask for a ban on the behavior of its competitor to regulate its unlimited schedule. Therefore if the government accepts this request, then the market behaves the same as it was detailed above; differences are disappearing and the ultimate choice of the competitors: accepting the lowest possible price (marginal cost) and operate without profit. So our model suggest that

### 3.4. More patient consumers

We have to consider now the market from the consumers' point of view, there might be some cases when the consumers are changing behavior and their taste will be less sensitive in some senses or more sensitive in others. In both cases - at least in our model –  $S$  changes we already analyzed in the first part what if  $S$  a number that tends to infinite, but what happens if this change in people's taste would decrease  $S$  so it would tend to 0? Recall the equation 2.) and let's see what happens in a situation like this:

$$v - P_A = v - P_B - s' , \quad (2)$$

As we stated before  $s'$  the border where consumers are splitting into two parts and  $s'$  the part of the  $s \sim U [ 0, S ]$  interval. So then if  $S$  is decreasing, and the difference between customers is disappearing,  $s'$  decreasing as well, because it is part of the interval. Consequently if  $S \rightarrow 0$  then  $s' \rightarrow 0$ , so the difference between the two parts of the basic equation that gives us the indifferent customer would tend to zero as well, and the result will be similar like in the previous two sections, so indifferent consumer could be described by the prices of the firms:

$$P_A = P_B \quad (17)$$

Therefore the outcome would be the same as we analyzed in the last two cases, so the model will be a Bertrand duopoly, and the outcome will be the same as the competitive one.

## **4. Implications of consumer surplus and welfare**

Taking into consideration all of the participants of the market to act so we have to calculate the consumer surplus to see how a existing or non-existing regulation influences consumers' well-being, which is generated by their consumption. In the following parts we'll analyze the consumer surplus in the two basic environment that we've described before; deregulated market in optimum (e.g.: asymmetric case) and the prices driven duopoly namely the Bertrand equilibrium (namely the symmetric case), which has two parts: the one where both shops hold a 24 hours opening schedule during all week, and the one where both shops restrict their schedule to a 12 hours opening time on 6 days. This part will contain both of the solutions and will give a calculation for the economic welfare, which is calculated from the sum of the consumer surplus and the related profits. First we'll take a look at the consumer surplus and welfare in a deregulated market in optimum, and then we'll see whether the Bertrand solution would give a better result from the consumers', firms' point of view or the welfare in general, last but not least we'll try to compare the different solutions from every point of view. This section will try to give an answer to the question, which is the social optimum from the cases that have been analyzed. In each cases we'll calculate the consumer surplus from the given consumer utility, which is gives us the consumer surplus, if we integrate these utility functions to get the territory underneath them. For the calculation of the welfare we use the basic economic theory of welfare, where it equals to the sum of profits (realized by each firm depending on the existence or non-existence of regulation) and the consumers' surplus in each situation. We'll use the calculations from the previous sections, and somewhere we'll reflect them just by their number. Our assumption is that the deregulated market serves larger welfare for the whole market, than in a regulated market (e.g. Bertrand duopoly).

### **4.1. Consumer surplus in a deregulated market assuming an optimum**

To analyze this optimum from a social point of view we've to recall the basic utility function from the very first section, where shop A was open around the clock and B

was not interested to do so, but holding a 12 hours long schedule six days a week. Therefore the utility was given by the very first equation:

$$U = \begin{cases} v - P_A \\ v - s - P_B \end{cases}, \quad (1)$$

Where  $s$  denotes the consumer's impatience regarding to shopping, because shop B is not always an available option. And  $v$  stands for the maximum utility, which is realizable for the consumer. We'll integrate these functions with regards to the asymmetry on the market, that comes from the prices in equilibrium, which are:

$$P_A = \frac{S + P_B + c}{2} \text{ and } P_B = \frac{P_A + c}{2} \quad (13)$$

It indicates that we've to analyze the territory of the consumer's utility shop A on the interval from  $S$  to  $S/3$  as this is the range of customers (coming from the prices) are interested in the service of shop A. Similarly we integrate the consumer's utility of shop B on the remaining interval, therefore from  $S/3$  to 0. Adding up these two equations will give us the consumer surplus on the market assuming such circumstances (asymmetry).

$$CS = CS_A + CS_B = \int_{\frac{S}{3}}^S [v - P_A] + \int_0^{\frac{S}{3}} [v - s - P_B] \quad (21)$$

Introducing the prices as the function of  $S$  and  $c$  (as we've given above), we'll be able to make the simplifications and get the solutions for  $CS_A$ ,  $CS_B$  and  $CS$ :

$$CS_A = (v - c) \times \frac{2s}{3} - \frac{4s^2}{9} \quad (22)$$

and

$$CS_B = (v - c) \times \frac{s}{3} - \frac{s^2}{6} \quad (23)$$

so

$$CS = (v - c) \times S - \frac{11s^2}{18} \quad (24)$$

By adding the profits gained by the firms in an economy like this, which are the profit functions below:

$$\Pi_A = \frac{4S^2}{9} \text{ and } \Pi_B = \frac{S^2}{9} \quad (15)$$

We'll get the total welfare realized on the market where an asymmetric situation exist in sense of opening hours:

$$W = (v - c) \times S - \frac{S^2}{18} \quad (26)$$

## 4.2.Consumer surplus in a symmetric market

The calculation of consumer surplus in a Bertrand oligopoly is a little bit simpler, because the model predicts the competitive outcome. Recall that the prices are the same as the competitive ones:

$$P_i = P_A = P_B = c \quad (18)$$

Profits are also the same as in a competitive environment, so none of the firms are able to realize any surplus because they are only covering their operating costs in optimum. Therefore the calculation is a bit simple comparing to the previous one, as both firms have the same demand, prices and profits as we discussed it before in the previous sections. However we've to split this into two different cases; the one where everybody is open around the clock and the one where every shop hold restricted opening schedules. The reason behind is pretty easy, because in the first case  $s$  is becoming meaningless, as there won't be any disutility for none of the consumers, while each shop are maximizing its length of opening. But in the second case every consumer would face a disutility regarding his or her shopping-hours preference. We'll start with the first case without disutility and then we'll continue with the second one, where a disutility appears everywhere.

### 4.2.1. When both shops are open around the clock

Let's first analyze the case when both shops hold an opening schedule around the clock. It means none of the customers will face any disutility, because every shop on the market are available all day long, so customers doesn't have to apply the schedules

to their shopping hours preferences. Therefore the utility function (e.g. the consumers' surplus) contains only  $v$  and  $c$ , so the maximum utility available and the cost of the product. As there wouldn't be any differences between the shops, the market would be split between the two firms equally in optimum, so there isn't any need for distinguishing between the demands of the players, and it indicates we can just simply integrate the function on the whole interval from 0 to  $S$ . So the consumer surplus is counted like:

$$CS = \int_0^S (v - c) dS \quad (27)$$

Recall that the profit functions are the same and equal to zero in case of Bertrand (as it gives the competitive outcome in prices and profits and also in case of the demand):

$$\Pi_i = \Pi_A = \Pi_B = 0 \quad (19)$$

So the total welfare will equal to the sum of consumer surplus, which is the result of the integration:

$$CS = (v - c) \times S = W \quad (28)$$

#### 4.2.2. When both shops restrict the opening hours

If we assume that both shops restrict its schedule to 12 hours per 6 days in a week, then every consumer will realize a certain disutility according his or her preferences of shopping. We assume here a Bertrand duopoly, so still profits, prices and demands are the same for both players. However the disutility will make a difference between the two Bertrand solutions, and the consumer surplus will equal to the result of the following integration:

$$CS = \int_0^S (v - c - s) dS \quad (29)$$

Therefore, as the situation is the same here as before and the profit for both shops equals to zero just like in the previous case, consumers' surplus equals to:

$$CS = W = (v - c) \times S - \frac{S^2}{2} \quad (30)$$

## 5. Results of the sub-games

Summarizing our results from the previous sections we can create the following table to see the differences between the cases:

	Profit		Consumer Surplus	Welfare
	Shop A	Shop B		
<b>Situation I.</b>	$\Pi_A = \frac{4S^2}{9}$	$\Pi_B = \frac{S^2}{9}$	$(v-c) \times S - \frac{11S^2}{18}$	$(v-c) \times S - \frac{S^2}{18}$
<b>Situation II.</b>	$\Pi_i = \Pi_A = \Pi_B = 0$		$(v-c) \times S$	$(v-c) \times S$
<b>Situation III.</b>	$\Pi_i = \Pi_A = \Pi_B = 0$		$(v-c) \times S - \frac{S^2}{2}$	$(v-c) \times S - \frac{S^2}{2}$

Table 1.

Where Situation I. refers to the asymmetric opening schedule, Situation II. is the Bertrand duopoly with 24/7 opening schedule and Situation III. is the game, where both shops holds a restricted schedule.

We can see that from the firms' point of view the asymmetric opening schedule is the most valuable, as this is the only case where they are able to realize profits, so if they would like to maximize their profits the only way is to set asymmetric opening schedules which occurs asymmetric prices and different but positive profits. In any other circumstances (e.g. holding the same opening hours) none of the firms will obtain any profits according to our analysis, because the situation would indicate a price competition, which would lead to the competitive outcome. However the social point of view shed a light on another implication of the results, which suggests Situation II. (when both shops are open around the clock) as the best solution if public welfare is the most important factor. To show the meaning behind this idea is quite easy, if we recall that in this situation nobody needs has limited access to the goods on the market, therefore nobody is facing a defeat in his or her shopping preferences,

because every shop is open all day long. Of course this is the best opportunity that can happen on the market in sense of welfare, but as this is not the best option for the firms it is not the perfect equilibrium. When firms are setting asymmetric schedules their prices are raising as it has been already discussed above, this increase in prices has a negative effect on welfare obviously, so asymmetric opening hours make a decrease in welfare, but still it is the second best opportunity for consumers as it decreases public welfare by exactly  $\frac{S^2}{18}$  instead of  $\frac{S^2}{2}$ . Situation III. is the worst one from the others, because shops are not taking any profits, and it generates the lowest rates of consumers' surplus too. In this sub game players are similarly not able to obtain any profits as in Situation II, but at the same time – differently from the second situation – consumers are suffering from the restricted opening hours. Taking into consideration that this is the best example to show the effect of regulation policies, we can agree that a regulated market would occur worse results in both public and private surplus, than the competitive one. So the asymmetric case is the second best option in a welfare point of view, and the best from the firms' point of view, therefore we can call it an optimum. And we can observe that deregulation has a welfare enhancing effect.

## 6. Solving the game

After we solved three static games, we'll try to find the link between them, and by this we'll try to make a model on them, to see which strategy would the players prefer in a market we assumed. To do so, we assume a three-stage game, where one of the players is the leader and the other firm is the follower. In the first stage firm A chooses a shopping hour policy (i.e. 24/7 or 12/6), in stage 2 firm B chooses its shopping hours policy, and in stage 3 firms compete in prices. Table 3. contains the normal form of the game with its outcomes.



Normal form		Shop A	
		24/7	12/6
Shop B	24/7	(0;0)	$\frac{S^2}{9}$ ; $\frac{4S^2}{9}$
	12/6	$\frac{4S^2}{9}$ ; $\frac{S^2}{9}$	(0;0)

Table 2.

As it is a sequential game we can exclude the lowest rates of profits, so when both shops are dealing with the same schedule. Now we arrive to two quite similar results, where we'll use the method of backward induction. Assuming that A always step into the competition with a profit maximizing attitude, B can assume that A will choose the opportunity with the higher outcomes, therefore A will be open around the clock. Applying this assumption to shop B's strategy the only solution to realize profits is holding a restricted schedule besides A is open all day long. Any other solutions would generate zero profit for both firms, so we expect the same outcome on a real market, ad we believe that this is the sub game perfect equilibrium. This case shows how a minor advantage could generate difference in terms of profits. Here shop A was able to set schedule first, so it had a technical advantage on the market, but there are several types of advantages which lead to the same outcome. A couple of nice examples for this issue are when a firm has already multiple shops, so it could organize better the logistics of a longer schedule, or the same stands when a shop with an around the clock schedule is already existing on the market.

There are several implications of this type of competitions, which has been already analyzed or needs some deeper examination, the problem of entering the market has been analyzed by *Maarten Goos (2005)* and *Miguel Flores (2011)*, or the difference in preferences (which we covered by one single measure, but *Shy and Stenbacka (2008)* has analyzed) can be a nice base of future studies, but in a broader way of thinking real world examples can enlarge our knowledge about the case. According to these experiments and our results we think that above the basic competition law there's no need for further ones, as it would decrease the companies' profits, consumers' surplus, and through them welfare as well, if we're talking about a restriction. If the regulation would indicate all day long schedules it would maximize public welfare in one hand,

but in the other hand it'd not allow firms to earn profit via transparent methods (which is a problem at the previous type of regulation as well). So in our opinion regulation would create a hard situation for all companies on the market, and it also could decrease social welfare, and at the same time it'd create a need for agreements between the shops, which are not allowed by the competition law. Therefore regulation won't bring enough positive effect on the market in such circumstances that we've been analyzing, so it is not necessary to introduce such regulations.

## **7. Summary**

In our analysis we tried to discuss the effect of consumer's shopping preferences on two firms prices. In a two players model we analyzed whether consumers and firms are better off in case of a regulation on shopping schedule or they obtain less by it. Many researchers have examined this topic in the past, and according to their ideas we developed a duopolistic model, where the two players are competing in prices after they set their opening schedules. The two retailers are selling homogenous product for costumers, who can even buy one or zero unit from the product. Consumers perceive the same utility from buying the good in either shop, but they face a disutility when they find a shop closed. This disutility was measured by a single measure in our simple model. First we assumed that firms are holding asymmetric timetables, then we analyzed the situation when they are open according to a similar schedule.

We found that the ultimate situation when the shops are realizing profits is the one when they hold asymmetric schedules, in any other circumstances the profits tend to zero (i.e. the competitive outcome). Then we tried to analyze our model from a social view, and we found that there's a difference between firms' and consumers' interest, as consumers' are better off when both shops are open around the clock, however firms' won't be able to realize any profits in such situation. From the three outcomes we built a three-stages sequential game to get out the sub game perfect equilibrium from our results. This game indicated similar outcomes we expected, as the optimum is the asymmetric solution, when firms' realizing profits and consumers' have a choice to decide where to shop.

We've chosen a sequential game to show when firms are choosing different prices. In a simultaneous model they would most probably choose the same opening hours (24/7)

to get the leading position, but at the same time they won't make any profit. In an environment where one firm has the opportunity to set its schedule first the solution is clear, and firms are willing to choose the optimum, which maximizes their outcome and market. This solution obviously get a small part from the surplus of the consumers but still serves better opportunities as a regulated market according to our experiment. In our opinion a regulation above the competition law would harm consumers' and firms' interest, and would have a negative effect on their surplus, so we don't recommend such regulations based on this simple model.

In this experiment we tried to analyze the basics of pricing and time schedules in a duopolistic market (in a similar model like *Shy and Stenbacka (2006)*), we arrived to a similar conclusion like *Shy and Stenbacka's (2008)*, that by asymmetric opening schedule the longer shopping hours lead to higher prices and more costumers. Despite the simplicity of our model, we could show some evidences and verify some from the previous literature, as well as our model reflects well to the problems and cases in the real world.

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