Abstract

The Liberalization of the Retail Market of Non-Prescription Medicines

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This dissertation develops a framework that evaluates the recent changes in the regulation of the Portuguese retail pharmacy market and analyzes the subsequent impact on market structure, price and firms' profitability. The theoretical methodology on spatial competition is extended by including (1) asymmetric retailers and (2) demand substitution between markets in which the retailers operate.

Based on the simple mechanisms of the Hotelling classical model of horizontal competition, the circles' approach (Waterson, 1993) describes competition in the pharmacy retail market quite satisfactorily since it confers a relevant role to the impact of transport costs on market behavior, associating firms' ability to attract consumers to their location and the price they set. As a result, a retailer's profit is crucially determined by its influence area (which depends on the firm's price strategy and its relative location with respect to other competitors) and by demand characteristics such as spatial consumers' distribution and the per capita consumption of non prescription medicines. We build on this methodology by considering asymmetric retailers, i.e., pharmacies are multiproduct sellers while parapharmacies are monoproduct sellers. It is also assumed that consumers may decide to substitute one product for another in some situations given the relative cost of buying them, which is incorporated by retailers in the definition of their market strategies.

The model is then applied to the Portuguese market.A simulation is made based on previous estimations of the specific parameters of cost functions and of the demand of prescription and non-prescription medicines. First, we examine the effect of price

deregulation while maintaining entry regulated. If there were only pharmacies in the market, price liberalization would decrease the retail margin for most provinces. The exception would be provinces with very low population density due to the absence of scale economies. The entry of parapharmacies increases the number of retailers, competition intensifies, and the retail margin diminishes. However, the impact of the liberalization of entry is conditional on the cost structure of parapharmacies. Next, I build on the deregulated scenario by assuming that the potential entry of parapharmacies induces consumers to increase their consumption of non prescription medicines by substituting consumption of prescribed products by non-prescribed ones in the presence of minor ailments. In this scenario the model predicts that pharmacies have incentives to decrease their price in order to prevent the entry of parapharmacies, since consumers may reduce their consumption of prescription medicines with the increase of parapharmacies, via substitution effects. Finally, I suggest that the social equilibrium leads to a number of retailers and to a retail margin that is ¾ of the previous scenario.

The importance of this work is two-folded. First, it describes and measures the impact of the changes operating in the retail pharmacy market in order to support governmental policy-making. The model predicts that the liberalization of price and entry benefits consumers by decreasing transport costs and retail price, as long as fixed cost of parapharmacies are sufficiently lower than the pharmacies fixed costs. Second, this work extends the original theoretical model by including asymmetric retailers and a substitution effect between the demands of two products.

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Chapter 1

Introduction and Summary

In many European countries, the retail market of pharmaceuticals is strictly regulated by the respective authorities namely on issues such as barriers to entry, ownership and market prices. Nonetheless, some of these countries, such as Portugal, have been introducing significant amendments to the current legislation to promote competition and increase social welfare. These adjustments embrace mostly the retail market of non-prescription medicines and comprise the enhancement of price competition, the reduction of barriers to entry and changes in ownership structure. Similar to the liberalization or deregulation processes of other economic sectors, these pro-competitive policies are mainly intended to benefit consumers and, ultimately, to boost firms' efficiency. Hence, they have been acquiring broaden importance within the governments' agenda in recent years.

In the last decade, competition authorities of several European countries have been evaluating the effects of different deregulation policies in the retail market of pharmaceuticals on consumers' well being, market structure and public health. Some of those countries, like Norway and Iceland, have implemented such policies, whereas others have not (Spain and Belgium). In general, the recent evidence from the countries which have placed these policies into practice shows that consumers benefited from the increase number of retailers and intensity of price competition. Nonetheless, the mean dimension of retailers has diminished (less scope for scale economies) and has been followed by a process of horizontal integration, which has raised some concerns on anti-competitive practices. The aim of this dissertation is to evaluate the effects of deregulation policies adopted by policymakers on social welfare and market structure. Other type of potential competitive strategies, such as vertical and horizontal integration, is disregarded in this dissertation.

The changes introduced in the Portuguese retail pharmacy were motivated by several factors. First, the growing share of public and private spending on medicines required the implementation of policies to control this trend. Second, the current market structure of the Portuguese retail pharmacy and its normative environment allow pharmacies to exert their local market power and operate quasi-monopolistically. Finally, consumers should benefit from the increase competition in this sector and have an easier access (less transport costs) to the non-prescription medicines, even considering the reasonable geographic coverage of the Portuguese pharmacies in comparison with other European countries. The introduction of price competition and the abolition of barriers to entry[1] in the retail market of non-prescription medicines were carried out to achieve such objectives.

With the implementation of such policy, pharmacies will face price competition in the market of non-prescription medicines as new retailers (parapharmacies) enter. Despite the product transacted is quite homogeneous, cost structure of parapharmacies is likely to be quite different from that of pharmacies. Therefore, the main avenue of competitive advantage for new retailers will arise from favorable geographical locations, where demand intensity is high (e.g., hypermarkets and city center), given the location of incumbents (pharmacies). Additionally, as the product is homogeneous, and it is relatively inexpensive, consumers are likely to rationally select the closest retailer since they have to face transport costs. This means that consumers will not be willing to travel long distances to obtain cheaper medicines. As a result, retailers will have to take into consideration the horizontal differentiation of their products since it may determine their relative market power.

Seminal studies on entry and competition in retail markets (Bresnahan and Reiss, 1991 and Berry, 1992) have recognized that firms should evaluate the intensity of competition and the available market demand, when deciding whether or not to enter in a new market. In fact, the higher is the quantity demanded of a firm's product, the greater should be its profit. However, better demand conditions will attract more competitors, diminishing the relative market power of each firm. In particular, in retail

[1] The liberalization of entry refers to the permission of entry of retailers other than pharmacies.

markets, where the competition is highly localized, the degree of competition between retailers oscillates with the mean distance amongst them, which is a reasonable measure of product differentiation. Despite the importance of the intensity of competition and demand, other variables may influence retailers' strategies. Specifically, I evaluate the impact of a change of consumers' preferences on the equilibrium of retail markets.

The liberalization of the Portuguese retail market of non-prescription medicines provides a suitable empirical environment to evaluate the effects of spatial differentiation on market structure. As the product transacted is quite homogeneous, the main avenue of spatial differentiation arises from geographic dispersion of the intensity of demand and the per capita consumption of non-prescription medicines. In addition, since prices do not oscillate much amongst retailers, transport costs will drive significantly the intensity of market competition.

To formalize both the introduction of price competition and liberalization of the entry in the retail pharmacy, I build on the circular model of Waterson (1993). I employ its framework for the preliminary scenario, in which retailers are homogeneous as regards the cost structure and market strategies. The result is a symmetric Nash equilibrium where retailers maximize their profits with respect to the demand of non-prescription medicines. The demand function for each retailer is essentially driven by its influence area, the per capita demand of non-prescription medicines, population density and mean distance between retailers and consumers. The market equilibrium changes as the liberalization is being introduced.

Nonetheless, the above clear-cut framework assumes that the consumption of non-prescription medicines does not vary with the market structure. Later, I introduce an innovative assumption that consumers may be induced to substitute professional prescription of medicines by self-medication of non-prescription medicines as the number of retailers (parapharmacies) increases in the retail market and mean distance between consumers and retailers decreases. In such scenario, pharmacies act as multiproduct firms and incorporate the possibility of medicines' substitution on the demand for prescription medicines when maximizing their profit (in order to the non-prescription market). Introducing equilibrium with heterogeneous retailers seeks to 1)

incorporate different price strategies of retailers, 2) comprise the possible substitution between prescription and non-prescription drugs and, 3) assume that the consumption of non-prescription medicines may increase with the number of retailers.

In the simulation, the parameters used in the model are either estimated or assumed. The number of expected number of entrants and the market price are then a function of demand characteristics and parameters employed as well. Specifically, when I consider the possibility of consumers' substitution between demands, the parameter which measures the degree of substitution acquires significant importance, inducing different price strategies by incumbents when facing potential entrants. Moreover, this extension allows us to observe positive and negative impacts on different retailers resulting from changes in consumers' preferences.

This dissertation proceeds as follows. The next chapter sets up the empirical context for the model employed. I describe the main consequences of the deregulation process on the pharmaceutical retail and report facts and figures on the most significant variables of this market. The third chapter contains a summary of related work on entry and competition in the context of models of spatial competition and its employment in the pharmaceutical retail markets. Chapter 4 outlines the circular model of geographical competition and introduces an asymmetric market equilibrium allowing for different types of retailers. The model is simulated in chapter 5 and the empirical results are discussed. Chapter 6 concludes by examining the expected future trends of competition in the pharmaceutical retail market.

Chapter 2

The market of non-prescription medicines

2.1 - The Legislation

2.1.1 - Ex-ante

In Portugal, the strict regulation that embraced the retail market for medicines has becoming gradually less restrictive in the last two years. Until 2005, and among other aspects, a set of administrative rules determined where, in what conditions, by whom, and at what price medicines should be sold. Accordingly, pharmacies (the only type of pharmaceutical retailer allowed) were compelled to firmly follow administrative procedures in order to develop their activities. Hence, the licensing, location, price, and nature of the delivered service were some of the aspects regulated in the pharmacy retail. This framework clearly confined competition in retail market of medicines since it has prevented pharmacies to carry out price reductions and has restricted their entry by ruling several aspects.

Legal groups of pharmaceutical products were established by Decree of law No. 72/91 of 8 February and Directive 2001/83/EC. Accordingly, all human medicines are classified in two categories: the prescription and non-prescription medicines (or over-the-counter drugs). The latter are available to consumers for purchasing without professional prescription but could only be acquired in pharmacies until October 2005.

Before the liberalization of the non-prescription medicines, the production, storage, distribution and commercialization of overt-the-counter (OTC) drugs were regulated by *Decree No. 713/2000*, except those which were subject to the

reimbursement system of prescription drugs. This decree predicted free price setting for pharmaceutical manufacturers, for those who have the respective approval to introduce a new product in the market. However, if prices or price variations were not justified, the General Directorate for Trade and Competition (DGCC) had the possibility to disagree with such setting and after a detailed study, rearrange a new price. With respect to the distribution and retail, the price was regulated and the (gross) margins of wholesalers and retailers (pharmacies) were about 8% and 20%, respectively.

The number of retailers and their location is restricted by the process of conferring activity licenses (Edict No. 936-A/99 of 22 October). These licenses are subject to public contest and must follow some ruling, essentially the minimum distance between pharmacies (500 meters) and from hospital and health centers (100 meters), and minimum population density per pharmacy (4.000 inhabitants). Finally, the owner of each pharmacy must be a pharmacist who can not possess more than one establishment, which indicates than the number of establishments in the market should correspond to the number of firms.

2.1.2 - Ex-post

The *Decree-law n.º 134/2005* of 16 August, triggered the restructuring of the pharmaceutical retail of non-prescription medicines, by introducing price competition and allowing retailers other than pharmacies to sell non-prescribed drugs as long as they are supervised by a pharmacist or pharmacy assistant. This measure mainly sought to enhance effective competition in the retail pharmacy market for non-prescription medicines, since the price level of OTC drugs in Portugal is one of the highest in the EU. On the other hand, the liberalization of entry of new retailers (hereafter, parapharmacies[2]) permits easier access to consumers to this type of medicines.

[2] These refer to new retailers which have emerged after the *Decree-law No 134/2005* with the main purpose of selling OTC products.

The market introduction of new drugs and drug surveillance is being still regulated under the former legislation, including inherent mechanisms to pharmacovigilance system, in order to guarantee service quality and use safeness. Accordingly, *Decree No. 827/2005* stipulates the whole guideline about introduction of new retailers. For instance, each new potential retailer must be registered in the National Institute of Pharmacy and Drug (INFARMED) before starting its activity, and has to possess electronic means to transmit their activities' information. Apart from that, parapharmacies have no restrictions to entry or to set prices regarding to OTC medicines. The activity of pharmacies keeps being regulated by the former legislation except the fact that now they may compete in the non-prescription market, facing price competition of new entrants.

Considering other European Countries, the Portuguese liberalization process of the retail of non-prescription medicines was rather unrestricted in the sense that Portugal has liberalized the retail of all OTC drug types (except those reimbursed). In fact, some countries such as Ireland, U.K., Germany and Netherlands have also liberalized the sale of OTC drugs but only a part of them (the remaining continue to be pharmacy-only medicines). Nonetheless, the present legislation requires that new retailers have to ensure technical supervision of a pharmacist of pharmacy assistant, while in European countries this is not required for the establishments which sell over-the-counter drugs.

Apart from the free price competition, the liberalization process additionally introduces an extra channel to sell non-prescription medicines following the same conditions[3] as if it was sold within pharmacies. This means that drugs will not be directly available to consumers' purchase by self-service (drugs liberalization). Hence, every new retailer must have or be supervised by qualified staff (pharmacist or pharmacy assistant) recognized by INFARMED so as to maintain available pharmacovigilance system, drug quality and useful information to consumers. Furthermore, the OTC drug list is available on INFARMED site, as well as a

[3] The presence of the pharmacist or pharmacy assistant in new retailers is not compulsory, it is required only the supervision by one of this health professional.

pharmacovigilance system to help the consumer manage non-prescription medicines better.

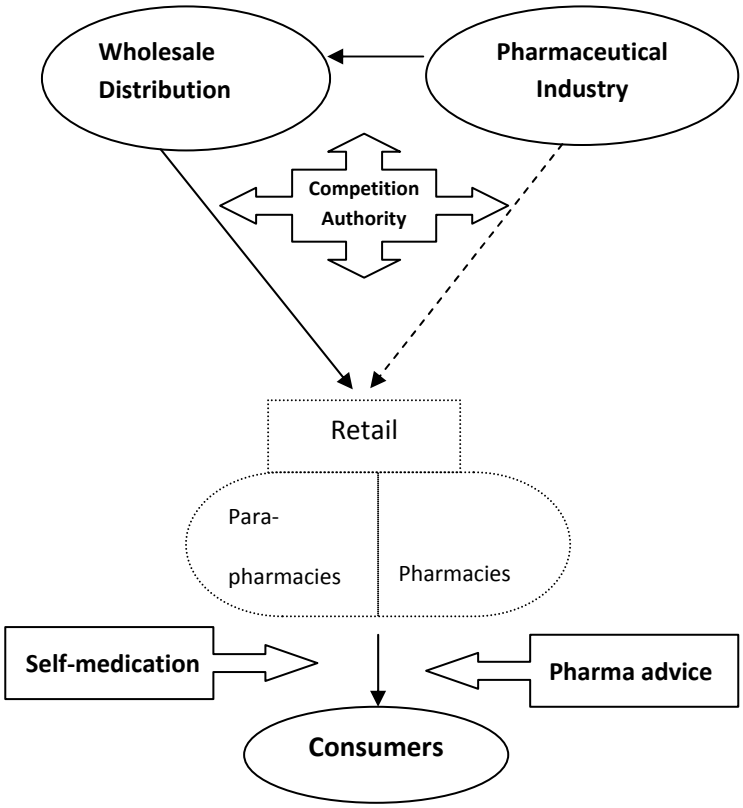
2.2 - OTC market environment

The non-prescription market is less peculiar than the prescription market in the interaction amongst its agents. In addition, the latter involves, three agents more than the non-prescription market: general practitioners, the government and health insurers. In the OTC market, the web of interactions is established essentially between industry, distribution, retail and consumers which transact the product, non-prescription medicines, for consumer's healthcare or well being[4]. However, their policies and decisions do not necessarily follow the same goals and their individual interests may diverge. In this case, heavy regulation could be unsuitable and inflexible since is necessarily driven by ethical concerns and it is subject to various judgments of value. For this reason, industry and wholesale distribution should not restrict the competition in the retail and reduce the effectiveness of the adopted deregulation (for instance, increasing their margins).

A possible framework for the current Portuguese non-prescription market is shown in figure 1. The pharmaceutical industry produces and sells medicines to wholesalers or directly to retailers (small number). The horizontal competition or the vertical interaction between these agents and market performance is done under close watching by the Competition Authority, who tries to avoid anti-competitive (also known as anti-trust) practices such as dominant position, tacit collusion or mergers which may have harmful consequences on final prices. This surveillance should enhance the market functioning efficiency and promote larger benefits to consumers not only encouraging price competition but also ensuring the quality of the service.

[4] For instance, the feminine contraceptives (pills) are not directly purchased seeking health improvements but can contribute to a better well-being.

Figure 1 – A framework for the Portuguese retail market of non-prescription medicines



In the retail market, consumers can obtain non-prescription medicines with or without professional advice. Given its regulated activity, pharmacies are required to have the presence of a pharmacist or a technical assistant, who can inform and advice the correct administration of a non-prescription drug for a minor ailment. In parapharmacies, the presence of a pharmacist or technical assistant is not compulsory.

According with Decree-law No 134/2005, the sale of OTC products in parapharmacies should be carried out directly by a pharmacist or technical assistant, or only by their supervision. Consequently, consumers' self-medication might assume noteworthy importance. As the consumption of non-prescription medicines may be independent from professional prescription or instruction, consumers might unreservedly choose and consume the medicines most advertised or promoted by the new establishments. This could generate greater incentives to pharmaceutical industry to promote DTC advertising in order to encourage their products. Furthermore, general

practitioners should have also an active role on influencing self-care behavior on patients as to practice responsive self-medication. Nevertheless, professional orientation and recommendations will continue to be considerably important on consumer's choice.

Wholesalers, in their turn, will look for the best manufacturing price in order to obtain the best price-to-cost margin as well as providing better price conditions to retailers competing with the remain competitors.

The consumption of non-prescription medicines may be influenced by the price, physical availability drugs and consumer's characteristics (e.g., income, age and willingness to self-care). In fact, elderly patients are less able and prone to practice self-medication without a prescription or retailer advice (Martins *et al*., 2002). Therefore, they are likely to show lower willingness to change from traditional pharmacies to parapharmacies to buy non-prescription medicines even when there may be higher price differences.

2.3 - Policy implications

2.3.1 - Price, retail margin and number of retailers

As noted in the early section, the first implication to social welfare derives from price competition. Briefly, the deregulation implies the introduction of price competition for non-prescription medicines and absence of entry barriers for new retailers (pharmacies' entry remains regulated). Consequently, the retail price (PVP) of these medicines will depend mostly on the competition intensity between retailers. Variables such as population density and per capita demand for OTC drugs are critical to predict the number of retailers and the intensity of competition between them in a given area. Price variations and market behavior will be under the supervision of the Portuguese Competition Authority (AC) in order to avoid restrictive practices to competition and dominant position abuse. Despite the peculiar characteristics of the

retail pharmacy, the expected increase of retailers is likely to drive prices down. In fact, the entry of parapharmacies which will differentiate its product spatially will decrease the relative market power of pharmacies.

The second implication regards to the entry in the market. Since there are no entry restrictions for parapharmacies and pharmacies' entry remains regulated, this will induce strategic locations of parapharmacies. Therefore, consumers may benefit from higher OTC drugs availability and a potential low price.

After the manufacturing price is set (PVA), each wholesaler will try to look for new customers (parapharmacies) in order to enlarge his distribution net. Theoretically, if it does so the wholesaler margin may rise with the increasing of retailers. Nonetheless, wholesalers would be able to purchase high volumes of drugs at more competitive prices directly from manufacturers and this could have impact on retail price, except when retailers are supplied directly from the industry. The direct distribution assumes significant importance on the retail market of non-prescription medicines. An increasing number of retailers have been adopting direct distribution methods for their products mainly due to the increasing power of wholesalers, which have also started to manufacture certain OTC products. The possibility for new retailers of being provided directly from manufacturers would remove the margin of wholesaler allowing a lower retail price (PVP). The ready availability of sales data (enables manufacturer to do a continuous analysis of the performance of key parameters) and the improvement of the new retailers' technical knowledge through the strengthening of the manufacturer-retailer relationship are examples of potential advantages from the direct OTC products distribution.

2.3.2 - Self-medication

Consumers are starting to become conscientious about their health status and to look for relevant information as much as possible from expert sources in order to help

them make appropriate decisions in health care[5]. Before the liberalization took place, consumers had been managing some of their minor diseases through self-medication[6] but frequently and closely supervised by pharmacist or from another health professional. The increase of retailers (without compulsory presence of a health professional) in the market may induce consumers to practice self-medication more frequently, and this requires more consumers' conscientiousness and knowledge about the choices they made.

The role and importance of self-care practices in health care all over the world seems to rapidly increase due to the overcrowding of the health systems and the need for cost savings related to healthcare services. Self-care products have been arising tremendously, not only the conventional OTC drugs (e.g., pain relief, medicines for cough and cold) but also herbal medicines, dietary supplements, nutraceuticals and health foods, beauty concerns (eye and skin care) and smoking cessation aids, as never before. Simultaneously, the increasing of individual management of non-prescription medicines by consumers makes the present policy of liberalization suitable to address the current challenges of healthcare services. Improvement of consumers' general knowledge about health and healthcare, and the increasing information on therapeutic use and adverse effects may create a reasonable basis for successful self-medication practices.

Self-care assumes a relative importance in modern societies due to two main reasons: First, the need for higher consumers' conscientiousness on their individual "health profile", taking an active role on their individual health care management. The deeper knowledge about our own health profile is essential to obtain more efficient

[5] For instance, 59% of the North-Americans said that now they are more likely to treat their own health condition than they were a year ago. 73% would rather treat themselves at home than see a doctor and an overwhelming majority (96%) are generally confident about the healthcare decisions they make for themselves.

[6] World Self-Medication Industry (WSMI) define self-medication as the treatment of common health problems with medicines especially designed and labeled for use without medical supervision and approved as safe and effective for such use. This means that consumers diagnosis their own ailments and buy non-prescription medicines to treat them.

results from patient-health professional's interaction when dealing with minor diseases. The second reason is associated with the growth of new concerns on other types of health and body care. The most illustrative and recent example is the demand for medicines to aid smoke cessation. However, demand for medicines to skin and eye care, to reduce cholesterol and to other dietetic purposes are also growing fast. Since 2000, the consumption of non-prescription medicines has been rising on average 8,5% per year (in value). Throat, cough and cold preparations, beauty care, and smoking cessation aids medicines are the main therapeutic groups which present the largest consumption increases (AESGP, 2004).

Despite that self-medication practices may increase in Portugal, there are some determinants that may delay its progression. Socio-economic, cultural and education characteristics of Portuguese consumers may be clear obstacles for such evolution. The low education level of general population, and in particular of those away from the urban centers, predicts a more apprehensive behavior when dealing with minor illnesses. Often, seeking the pharmacist's advice or the guidance of the general practitioner is the most adopted solution. For them, the introduction of parapharmacies may emphasize their preferences on buying OTC medicines in pharmacies. In fact, Goodloe (1996) found that 94% of pharmacists pointed out that the question most commonly asked by consumers about OTC medications was "What is the best medicine to treat…?" This was followed by questions concerning side effects, the dosing and duration of therapy, the patient's condition itself and the cost. If we consider these results when we look at the Portuguese consumer's sample, it can be deduced how reticent consumer's attitude could be in the presence of self-medication behavior incentives.

On the other hand, pharmacies which are the most reticent with respect to the liberalization of non-prescription medicines, have lost their exclusiveness in the retail market, and therefore, will make efforts to promote the quality of their services as a source of product differentiation. Accordingly, pharmacists will continue to provide ample information about the therapeutic use of medicines and opportune suggestions on treatment of minor ailments, increasing the consumers' knowledge and possibly helping the increase of self-medication. The Pharmacists Association (OF) and ANF are afraid

that OTC retail liberalization could lead to abusive use of these medicines, considering that this policy may involve some risk to public health. Taking the liberalization of OTC drugs in United Kingdom as an example, we observe that OTC drugs liberalization hasn't substantially increased the incidence of chronic and grave hepatic problems.

The general practitioners, who are also concerning about the wrong and abusive self-medication behavior, have supported the new policy encouraging their patients to practice self-medication providing helpful guidance and information in that direction. The Doctors Association (OM) has admitted that the sale of OTC medicines in parapharmacies is not a public health problem, giving emphasis to the importance of providing adequate information to consumers.

Wholesalers are pleased with the end of pharmacies' monopoly, emphasizing that the key for further strategies should be based on perceptible available information, about self-medication options and on the cooperation between the health professionals. Moreover, the Portuguese Wholesalers Association (APED) noticed that universities should graduate professionals having in mind the need of providing the suitable information on healthcare and self-medication.

The pharmaceutical industry has been quite concerned with the OTC drugs liberalization but the Portuguese Association of Pharmaceutical Industry (APIFARMA) has unambiguously supported the recent legislation through his Special Commission to Self-medication (CEPA). This Body is conscious of his role on providing privileged information to consumers, and is prepared to support them to have a responsible health management with OTC drugs.

Given these facts, it seems that mostly drug stakeholders support the recent liberalization policy and are willing to give a useful contribution for its best implementation. *De facto*, the possibility of buying OTC drugs without any professional advice emphasizes the importance for consumers to have greater knowledge about their own health, about drugs therapeutic use and also about adverse reactions. Hence, two different behaviors could be adopted. Consumers may continue to buy their OTC medicines only in pharmacies receiving pharmacist support if necessary; or consumers may start to learn more about therapeutic value of medicines, their use and adverse

reactions, with respect to their own health profile, and therefore may buy their OTC medicines in parapharmacies more frequently, with the same quality and safeness conditions as they did in pharmacies. Consumers who adopt the last alternative may benefit from greater physical drug availability at a potential low price. The more consumers adopt the second behavior, the more the probability of intensifying the competition on OTC drugs market. We can expect that the slighter consumers' dependence from health professionals, the more magnitude will acquire the role of parapharmacies in the retail market of non-prescription medicines.

However, there are some considerations to address with respect to the economic and public health benefits of self-care and self-medication. The first is that not every consumer may feel sufficiently confident or with enough knowledge to practice responsible self-medication. Second, the increase of self-medication may be a source for higher wealth related equality problems. This means that wealth and education differences are likely to affect the way consumers take care of their own health. Third, since the therapeutic effect of medicines may vary among the individuals, an effective medicine for a person might not be successful for another.

Nowadays, there is little evidence of widespread problems associated with the use of medicines without prescription, since the switch of prescription to over-the-counter implies sound evidence of therapeutic efficiency and safety. However, their extensive and increasing use requires that manufacturers, healthcare professionals and regulatory authorities should be vigilant for potential problems, identifying the more dangerous adverse reactions for each category of OTC medicines. This could be reached by several processes. For instance, in New Zealand pharmacists and pharmacy assistants are actively encouraged to report adverse drug reactions involving OTC medicines to the Centre for Adverse Reactions to Medicines. These sporadic reports are followed up by requests for further clinical details from the patient's general practitioner. Another illustrative example is the well-known Yellow Card Scheme in UK which has been created to identify and make available all information on adverse reactions. The Yellow Card Scheme is run by the British MHRA (Medicines and Health Regulatory Authority), and is used to collect information from health professionals and patients on suspicious adverse drug reactions or side-effects or even defective OTC medicines.

2.3.3 – Costs containment

Healthcare cost containment is referred as one of the incentives to the sustainable growth of non-prescription medicines consumption for minor illnesses. The intention is to promote the reduction of the financial burden of national healthcare providers for the provision of their services. Governments and health insurers are increasingly encouraging self-care and self-medication when appropriate, as one means of limiting the rate of increase of the third party funding of health care.

Portuguese government has been observing an increasing burden of healthcare costs, which wastes a large amount of the existing limited resources. This burden mainly comprises the social insurance services, hospital expenses and reimbursement costs. In recent years, this issue has gained increasing importance given the quick growth of the Portuguese elderly population. The increase in life expectancy, and the declining of birth rate over the time, had led to an increase demand for healthcare services. The liberalization of the non-prescription medicines should not be understood as one solution to control health care costs but rather as a supplementary measure.

To illustrate this point, it is suggested that the increase of self-medication may reduce the expenses of social security systems for the Government and health care costs for patients. Based on a detailed analysis of seven European countries, including Portugal, carried out by the Association of the European Self-Medication Industry (AESGP, 2004), total annual savings resulting from moving 5% of prescribed medications to self-medication would exceed 16 billion Euros. In accordance with AESGP's empirical results[7], a shift of 5% from prescribed medications to self-medication (in packs) would exceed 149 million Euros of total annual savings in Portugal. This illustrates that self-medication encouragement would make a significant contribution to relieving the financial burden of the Portuguese National Health System. At the same time, the availability of a growing variety of non-prescription medicines would make an important contribution to public health. Case studies were carried out on

[7] For further information see AESGP (2004).

vaginal mycosis, smoke cessation and heart disease prevention which demonstrate how innovative OTC medicines could improve treatment as well as prevention of illness.

Figure 2 – Impact of a volume shift of prescribed items to self-medication

Type of impact	Affected party	
Treatment by medical professionals	Doctors	(-)
	Patients	(+)
	Public Funds	(+)
Treatment with medicines	Patients	(-)
	Public funds	(+)
Patient co-payments	Patients	(+)
	Public funds	(-)
Freed up doctors' time	Patients	(-)
	Doctors	(+)
Absence from work caused by treatment	Economy	(+)
	Employers	(+)
Absence from work caused by treatment	Economy	(+)
	Employers	(+)
Absence from work caused by illness	Economy	(+)
	Employers	(+)
Travel:		
a) Time-related	Patients	(+)
b) Travel-related	Patients	(+)

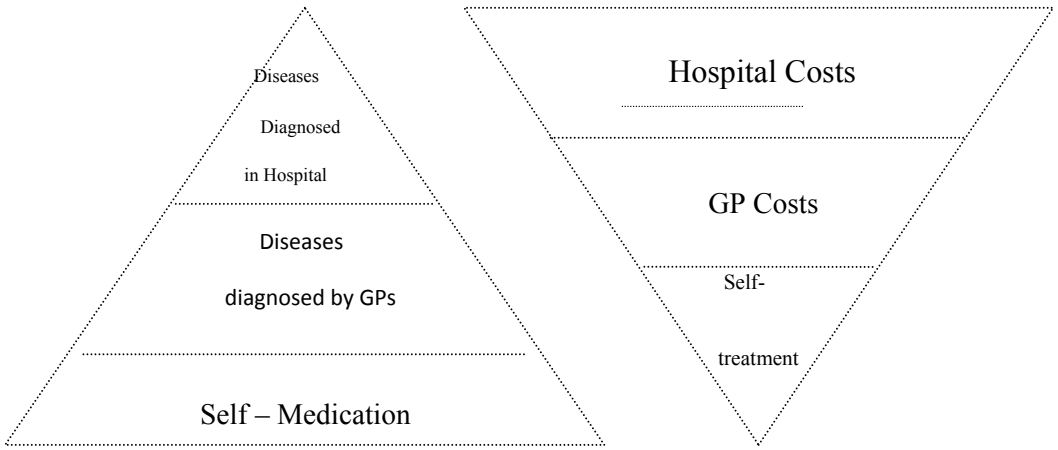
Source: AESGP, 2004

The impact of self-medication is well illustrated in Figure 2. Clearly, positive effects overweight the negative impact. Actually, for the Portuguese market, there are three types of impacts with noteworthy importance. First, the decrease in the number of visits to doctors reduces the number of prescriptions and their cost to patients (3.610 million Euros annual saving) and to health spending (33.577 million Euros). Second, when fewer medicines are prescribed and this volume is replaced by self-medication, this will represent a saving in public funds (32.373 million Euros) related to the reimbursement expenses but the patient will pay the full price of the OTC medicine. Finally, the decreasing absence from work caused by illness and subsequent treatment has also positive economic impact to consumers and to the economy as a whole. This study suggests that people are absent from work for a shorter period of time when they practice responsible self-medication instead of staying at home for periods lasting less than three days. The estimated saving from this impact having into account the loss of productivity and employers income, is about 77.626 million Euros.

As a whole the savings on public funds, to patients and the economy have been estimated to be about 150.000 million Euros. This study allows us to conclude that more or less healthcare costs savings could be accomplished as a result of the conscientious self-medication development in the Portuguese society.

The information above provides a comprehensive view of the great contribution of self-medication behavior to relieving the financial burden of the European healthcare systems. Facing the differences in the *per capita* income (and knowledge), Portuguese consumers should not feel apprehensive to practice self-medication but regard it as a valuable option which in many cases may provide the most efficient way of treating their health problems. Hence, the greater availability of the OTC drugs through competition is expected to have not only a positive impact on the price but also a positive influence on the development of self-medication as an efficient and safe way of transferring greater responsibility to consumers in the management of their own health.

Figure 3 – Treatment *versus* costs



Since self-medication may induce a cost transfer from Hospital and general practitioners to patient self-treatment, as we can observe in figure 3, one can believe that there would be fewer incentives to be concerned about the self-management of health. In fact, the costs of non-prescription medicines may exceed the value of the reimbursed price of prescription medicines but consumers may benefit from avoiding to get medical consultation beforehand (thus avoiding a doctor's fee). Furthermore, taking into account that 50% of doctor visits are made by the active population and 25% these persons visit the doctor during working hours[8], there is a significant time (money) saving to both the consumer and the health professional in case of minor ailments.

2.3.4 - Information and Advertising of OTC drugs

Consumers' misperceptions frequently puzzle these two designations, information and advertising, which have different purposes and sometimes different targets. The Decree of law n. º 100/94 of 19 April establishes the legal framework of

[8] Evidence from AESGP (2004).

advertising on pharmaceutical sector. The direct-to-consumer (DTC) advertising is forbidden for prescription medicines and non-prescription which are subject to the reimbursement system, while it is allowed for the remaining OTC drugs. The promotion of these medicines must be effectuated in accordance with their therapeutic use and other crucial information described in the leaflet which are enclosed within the medicine's package. This type of advertising must promote the rational use of the product and should be understandable to all.

Although the pamphlet proposes to be informative, the advertising of OTC drugs intends rather to promote and persuade the purchase of a given medicine. Indeed, the pharmaceutical industry often takes into account the role of pharmacists as intermediary players to promote more efficiently non-prescription medicines[9]. The liberalization of the OTC drugs retail may enhance the importance of advertising by promoting the characteristics and quality of a given medicine differentiating it over the rivals. Predictably, the promotion of OTC products in Portugal has been growing since the government announcement of the retail liberalization of these products, with the medicines for cough, cold and smoke cessation aid being the most advertised.

Furthermore, internet starts to be the most powerful mean to promote these products in modern societies, which have changed their media preferences over the time. The technology and internet evolution has allowed pharmaceutical companies to use their homepages not only to inform and advice consumers about their products' specificities but also to promote their own products. By these means they call for feedback from consumers with respect to the use of their products, providing sometimes forums as to educate and discuss useful information.

Despite the absence of prescription, the OTC drugs keep their "special good" status, and therefore, do need to be wisely managed by the patients in order to avoid unsuitable consumption. Advertising is helpful in informing people about medicines that are available without prescription. It should always be responsible and should not discourage the individual from seeking advice from a pharmacist or physician. The supervision by a pharmacist or pharmacy assistant may ensure adequate consumer

[9] For instance, they frequently recommend the help of pharmacists if necessary.

information seeking to avoid wrong consumers' procedures, which could be harmful to them.

The information assumes an imperative role as to keep safe the self-care conduct of consumers such as self-medication. Since the technical information enclosed in the informative leaflet could be of hard understanding for general Portuguese consumers, it would be peremptory to clearly provide this information to less educated groups (e.g., elderly and rural population). Apart from the advantages of the liberalization of non-prescription drugs market, consumers need to be aware that those drugs should be treated with the same cautiousness as the prescription ones and all the information should be ready available by all healthcare stakeholders. The traditional close monitoring of prescription medicines on their appropriateness and safety should also be applied to OTC medicines.

2.4 - Portuguese OTC drugs market – Facts and figures

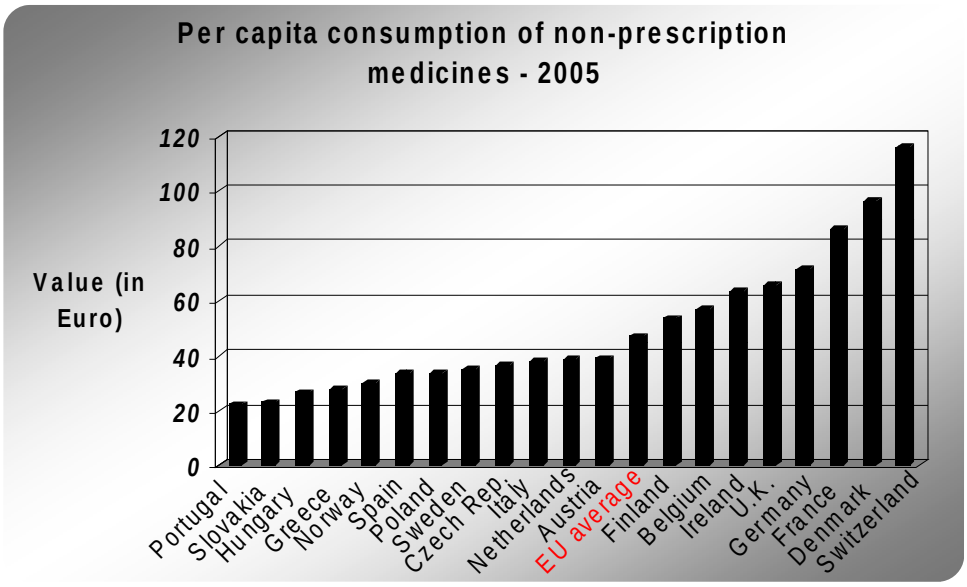
2.4.1 – The consumption

As I stated earlier, the Portuguese market exhibits low levels of OTC consumption, indicating that consumers may prefer the prescription of general practitioners rather than follow self-treatment. In fact, Portugal has one of the lowest *per capita* consumption of non-prescription medicines of the EU countries[10] (Figure 4). Indeed, the low demand for OTC medicines might be influenced not only by social and cultural factors (e.g., the high level of elderly people and the low level of education of consumers) but also by income determinants. For that reason, the reimbursement of the prescription medicines and their costs' inclusion on personal income tax (IRS) may have impact in consumers' decision between prescription or non-prescription

[10] All EU-25 countries except Slovenia, Estonia, Lithuania and Latvia, Luxembourg and Malta.

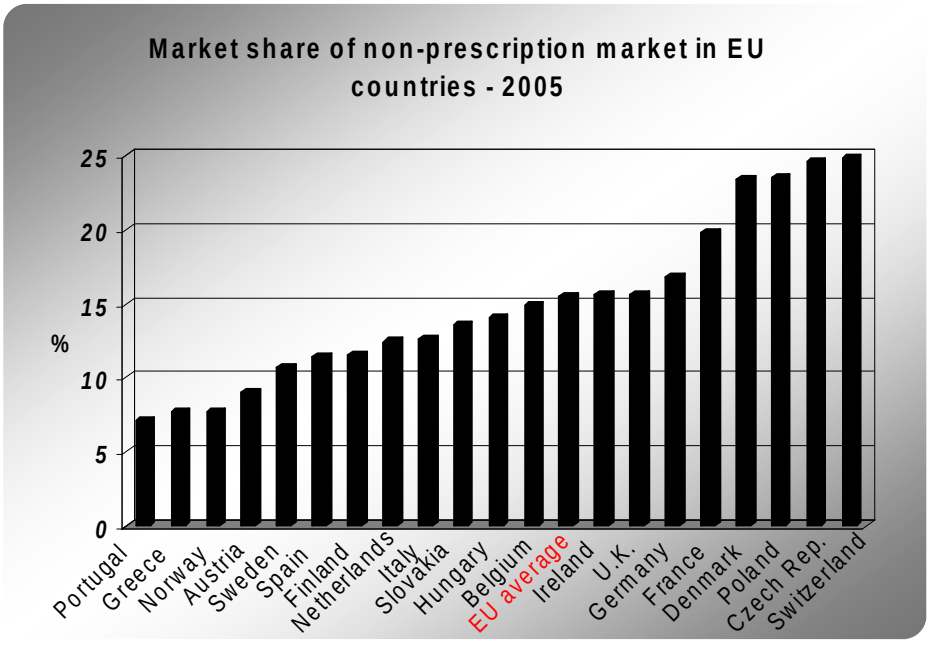
medicines. Power purchasing differences amongst European countries might bias the conclusions derived from information on *per capita* consumption showed below.

Figure 4 – *Per capita* consumption of non-prescription medicines in EU countries



Source: Apifarma, 2006

Figure 5 – Market share of non-prescription drugs in Europe

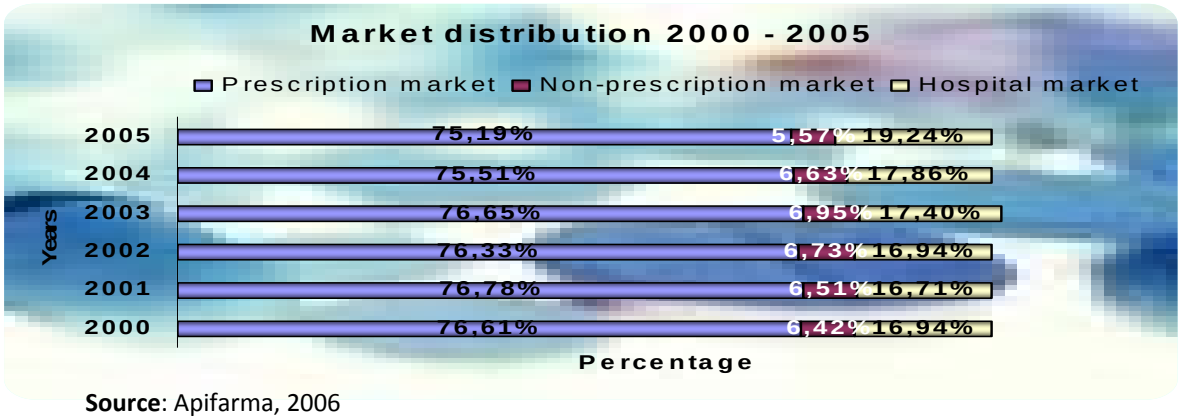


Source: Apifarma, 2006

However, Figure 5 supports the idea that the dimension (in value) of Portuguese non-prescription market in the ambulatory market is definitely small (7%). This level is fairly low compared to the EU average (16%), which may point up the persistent preference of prescription medicines rather than self-medication by Portuguese consumers for minor ailments.

The distribution of pharmacy retail market between prescription, non-prescription and hospital sub-markets illustrates a clear steadiness over the years, except for the hospital market which evidences a clear increasing in its share. We should note that the market of non-prescription medicines slightly decreased in 2005 because Ben-U-Ron has been switched to the prescription market.

Figure 6 – Ambulatory and hospital markets



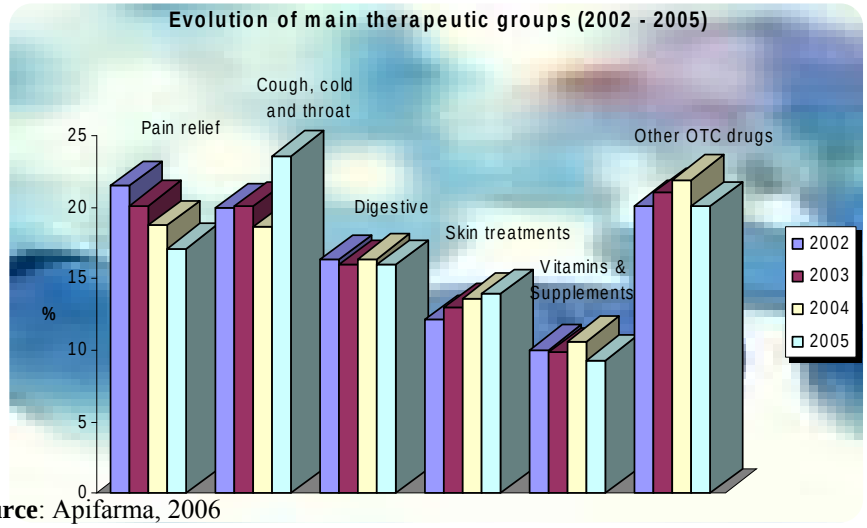
Source: Apifarma, 2006

As shown by figure 6, the non-prescription market represents a quite modest fraction of the total market corroborating the evidence of the low level of non-prescription consumption.

Clearly, the hospital market illustrates the highest growth rates (more than 12% per annum) comparing with the ambulatory market, since 2002. The growing consumption of non-prescription medicines may release in some extent the crescent

burden of hospital costs induced by the cost transfer from Hospital to patient self-treatment.

Figure 7 – Non-prescription medicines, by therapeutic groups



Source: Apifarma, 2006

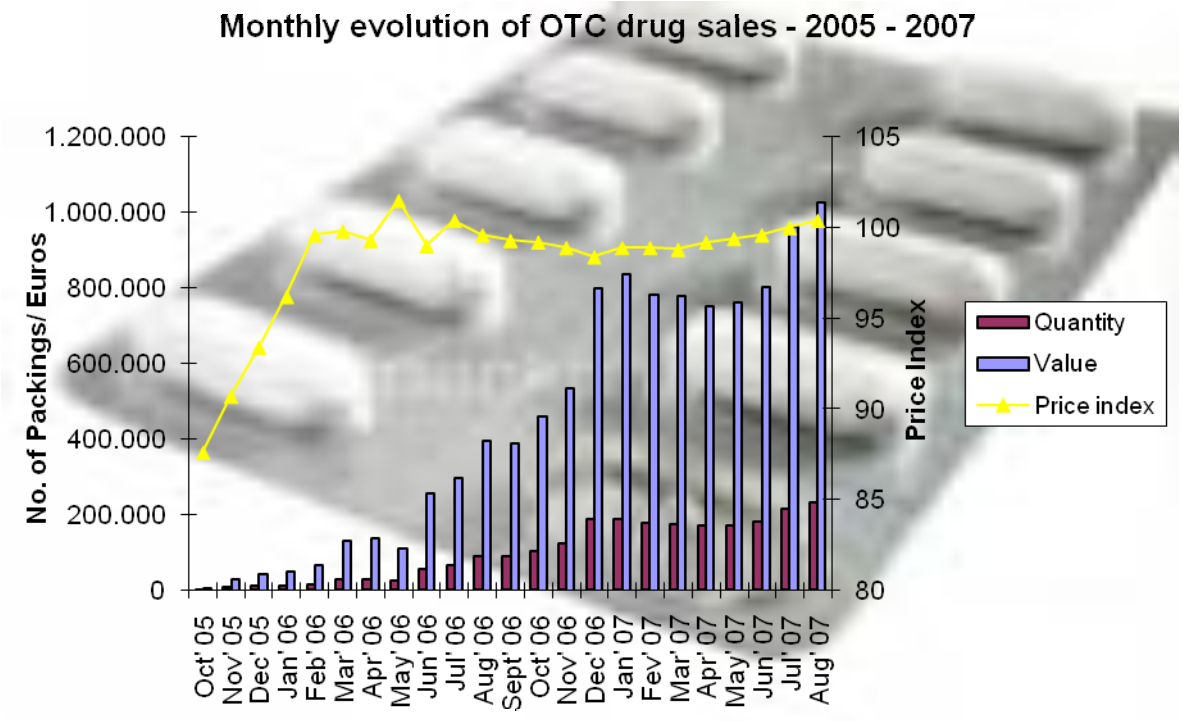
Figure 7 visibly illustrates that there is no clear trend for the evolution of the most therapeutic groups of OTC products along the recent years in Portugal. The pain relief group (analgesics) similar to the major OTC pharmaceutical markets (UK, USA, France and Germany) showed a modest growth and its share on total market has been decreasing. The instability of the cough, cold and throat medicines consumption caused mainly by weather conditions does not allow us to conclude the market trend, but in volume this sector has increased slightly due to the preference movement to more expensive products.

The skin treatments and others OTC products like cessation smoke aid (OTC category which has the fastest growing at worldwide level), eye care and cardiovascular control (cholesterol, high blood pressure and diabetes) have enlarged their share along the recent years and it is expected to grow further in future. It is likely that the great OTC medicines availability and the intensifying of retail price competition as well as the increase of direct-to-consumer (DTC) advertising will emphasize this movement.

For instance, smokers are more interested using cessation smoke aid medicines if they are cheaper and easier to get.

Since the *Decree-law No. 134/2005* was set, in October of 2005, retail sales of non-prescription medicines by parapharmacies have been growing (in quantity) on average more than 30% a month. The evolution of the market in value has followed the real sales in spite of the sharp increase of prices in the early five months as shown by the Figure 8. Indeed, this indicates not only the increasing number of parapharmacies in the market but also the higher demand of non-prescription medicines induced by the greater availability of those medicines.

Figure 8 – Evolution of OTC sales of parapharmacies

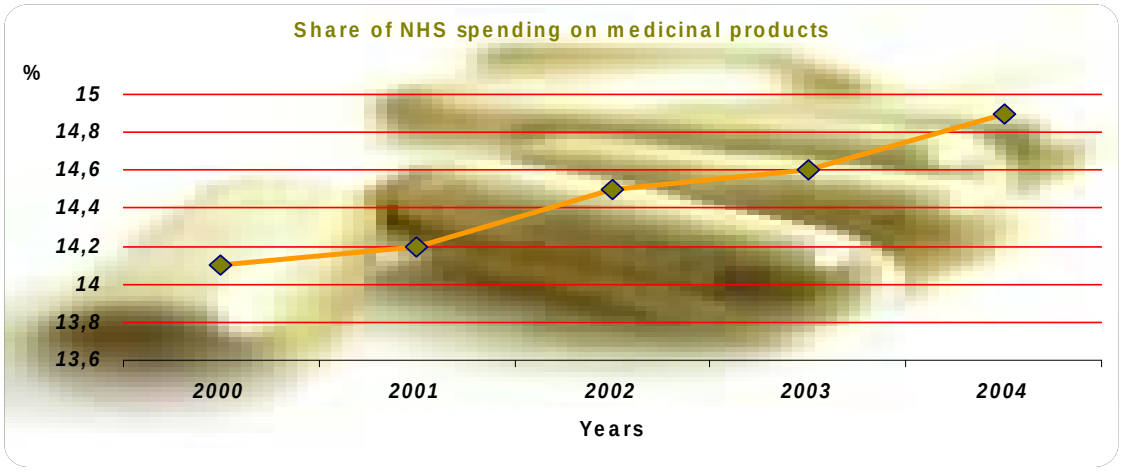


Source: Infarmed, 2007

2.4.2 – Medicine costs

Portuguese government will need proficient measures to face the growing share of NHS spending on reimbursement system in the public health care spending since 2000 (figure 9), as well as to reduce excess demand of the prescriptions of health professionals. To some extent, the recent liberalization of the retail market of OTC medicines might have a positive impact on seeking these objectives. The length of its influence will depend on the consumers' behavior, i e, for minor ailments consumers may reduce doctors visits and the demand for prescription medicines, preferring non-prescription medicines to the prescription ones. Accordingly, this reduction might diminish the burden of reimbursement costs on NHS spending.

Figure 9 – Share of NHS spending on medicinal products in the public health care spending



Source: Apifarma, 2006

For instance, the French and British Governments have been taking encouragement actions in order to induce self-care and self-medication behaviors as to reduce public healthcare expenditure. Indeed, the average per capita consumption of OTC drugs is about €86 and €63 in France and U.K., respectively, and only €23 in Portugal. The expected higher demand for OTC medicines in the future is likely to be

associated to changes in the society's preferences and needs. For instance, it has been observed around the Europe that the OTC drugs market has increased mainly due the high growth rates of smoke cessation aid medicines, dietary supplements and cholesterol control.

The variable price is strictly regulated in the pharmaceutical industry. As a two-step process, the set up of the manufacturing price is initially recommended by industry or importers (maximum) being rigorously based on the lowest ex-factory price with similar active ingredients in the three reference countries: Spain, France and Italy. Then, the manufacturing price is agreed by Directorate-General for Trade and Competition (DGCC) a part of Ministry of Finance, according to Regulation No. 29/90 and its further updates. The inclusion or exclusion of the medicine in the reimbursement system is based on clinical evidence (e.g., clinical trials) as well as on economic evaluation (e.g., prices comparisons, impact on National health services, cost-benefit evaluations), which becomes compulsory since 1999.

The recent liberalization of the retail market of OTC drugs was one of the few measures implemented by the Portuguese government seeking the price decrease in the pharmaceutical sector. In fact, regular price increases of medicines or healthcare services have been driving the health care spending growth along the recent years, due to some structural and institutional barriers. (1) There is excessive negotiation power of pharmaceutical industry with respect to wholesalers and retailers in delimiting the manufacturing price[11], and this is also true for the non-prescription market. (2) The introduction of generic medicines[12] in Portugal had greatly influence on the decreasing of health care expense due mainly to the increasing substitution of brand drugs by

[11] For instance, the hospital sector has shown limited ability to build an effective central system of medicines purchasing which would allow it to arrange more attractive prices with pharmaceutical companies. The evidence shows that the pharmaceutical spending of hospital has been growing more quickly than the spending with prescription drugs.

[12] The generics are medicines with the international common denomination (without Trademark), and its price must be 35% lower than those of similar brand medicines which have at least 10% of market share (Decree-law 577/2001).

generics of homogeneous groups[13]. However, it has been insufficient to induce price decreases of brand medicines.

Given these facts, the price competition in the non-prescription market assumes greater relevance since these medicines are not reimbursed, and consumers have to support all their cost. Since the introduction of price competition in October 2005, and taking as reference the price of August 2005, the price level of OTC medicines have decreased in most of the Portuguese provinces. With exception of Coimbra, the most populated provinces (and with high retailer density) show a price index lower than its respective base in August 2005. Therefore, it is likely that more demand density will intensify price competition, though Portalegre e Castelo Branco (with low population density) are also evidence for low price levels.

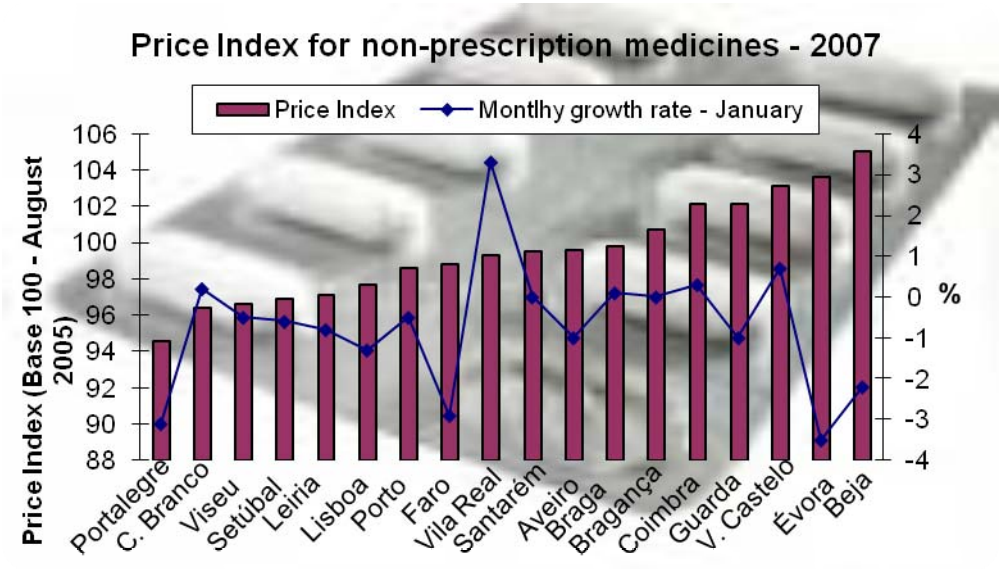
The most provinces show price index levels fairly inferior after the liberalization of the retail market of non-prescription medicines. Province with low demand intensity such as Beja, Évora, V. Castelo and Guarda are evidence for the highest price index levels. We cannot gather clear conclusions when looking at the 2006-2007 price variations, but all provinces in general illustrate negative variation for prices of OTC medicines except Vila Real, C. Branco and Viana do Castelo as it is shown in Figure 10.

2.4.4 – Market structure

In early 2007 there were 2709 pharmacies and almost 500 parapharmacies (which grow gradually each month). Given the fact that each owner can only possess one pharmacy, the number of pharmacies (establishments) is equal to the number of firms in the market.

[13] The current generics market share is barely 11% and from all European countries which have liberalized the OTC drugs market only Netherlands has a relative higher level of price drugs than Portuguese one.

Figure 10 – Price Index and variations for non-prescriptions drugs



Source: Infarmed, 2007

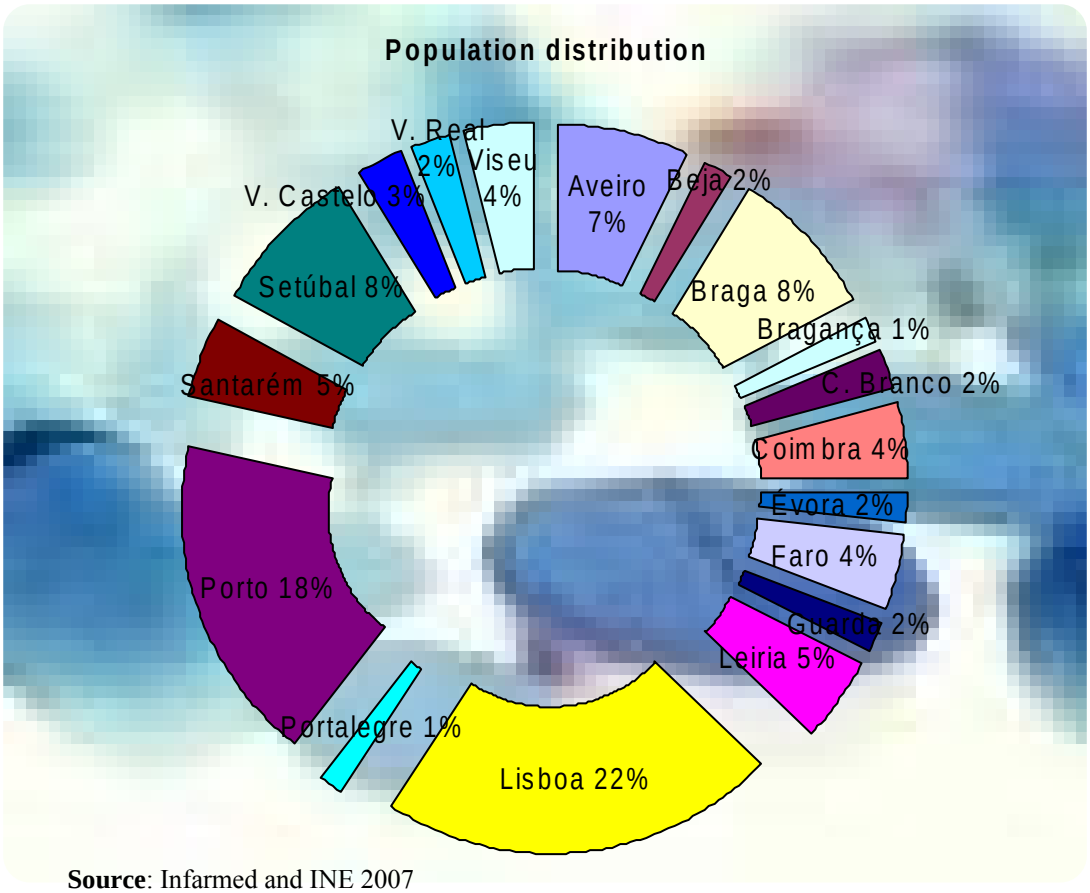
On the other side, parapharmacies' owners are not restricted to possess only one establishment, and therefore, the number of firms in the market is inferior to the number of parapharmacies. For instance, the retail company Sonae Distribuição owns about 40% of all parapharmacies established since October 2005.

The distribution of pharmacies and parapharmacies roughly follows the distribution of the population[14]. For each variable, Porto and Lisboa cover about 40% of all market[15]. This indicates that the retailer location is pretty related with the population density.

[14] Note that the number of retailers is relative to early 2007 while the sample for population is from 2004.

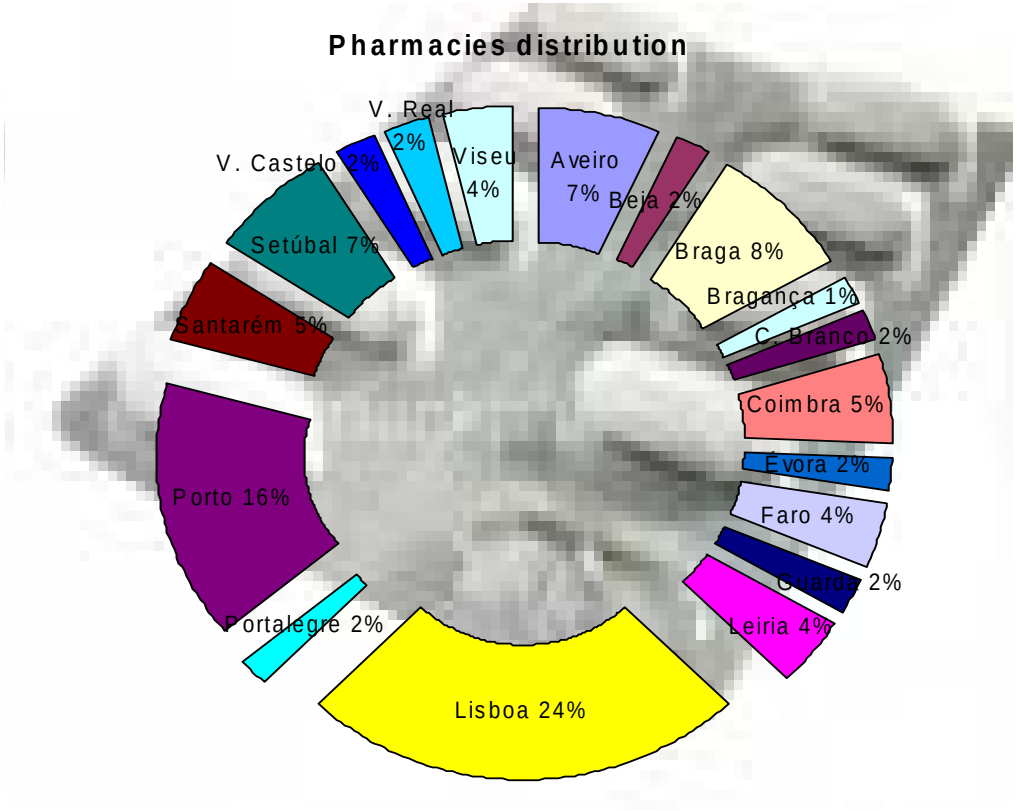
[15] The province was chosen as unit of measure given the reduced number of parapharmacies which would not make sense in smaller geographical regions (districts).

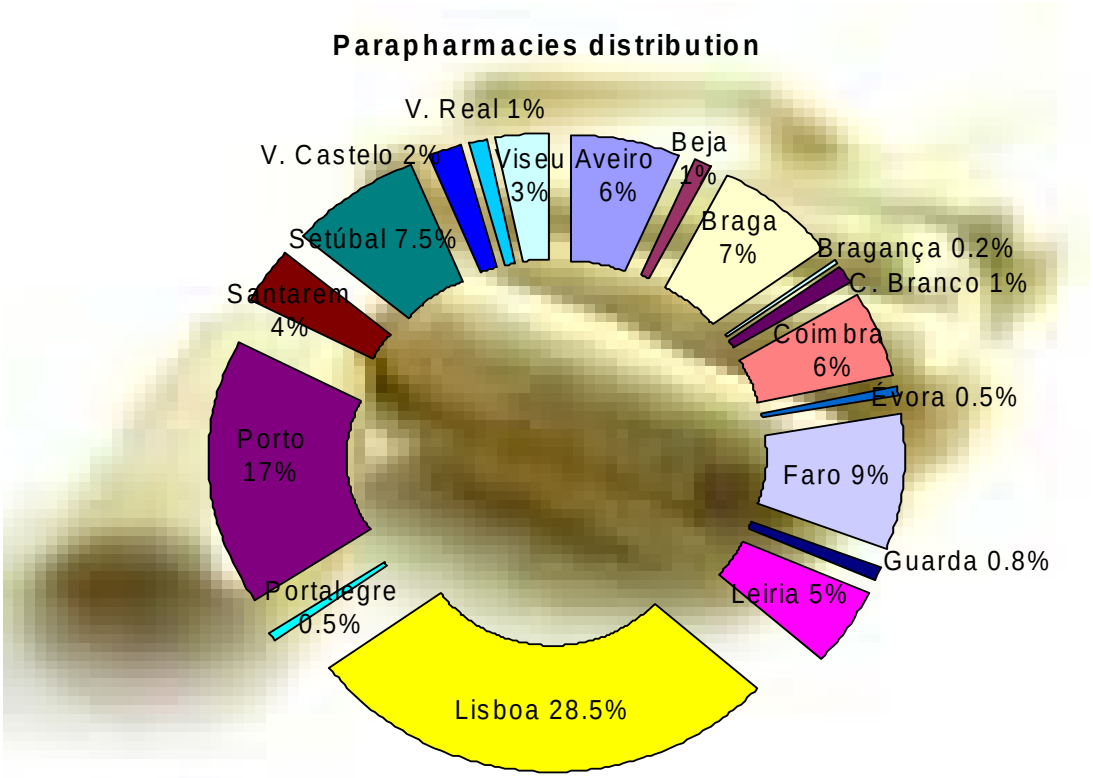
Figure 11 – Portuguese distribution of population



Source: Infarmed and INE 2007

Figure 12 – Pharmacies and parapharmacies distribution





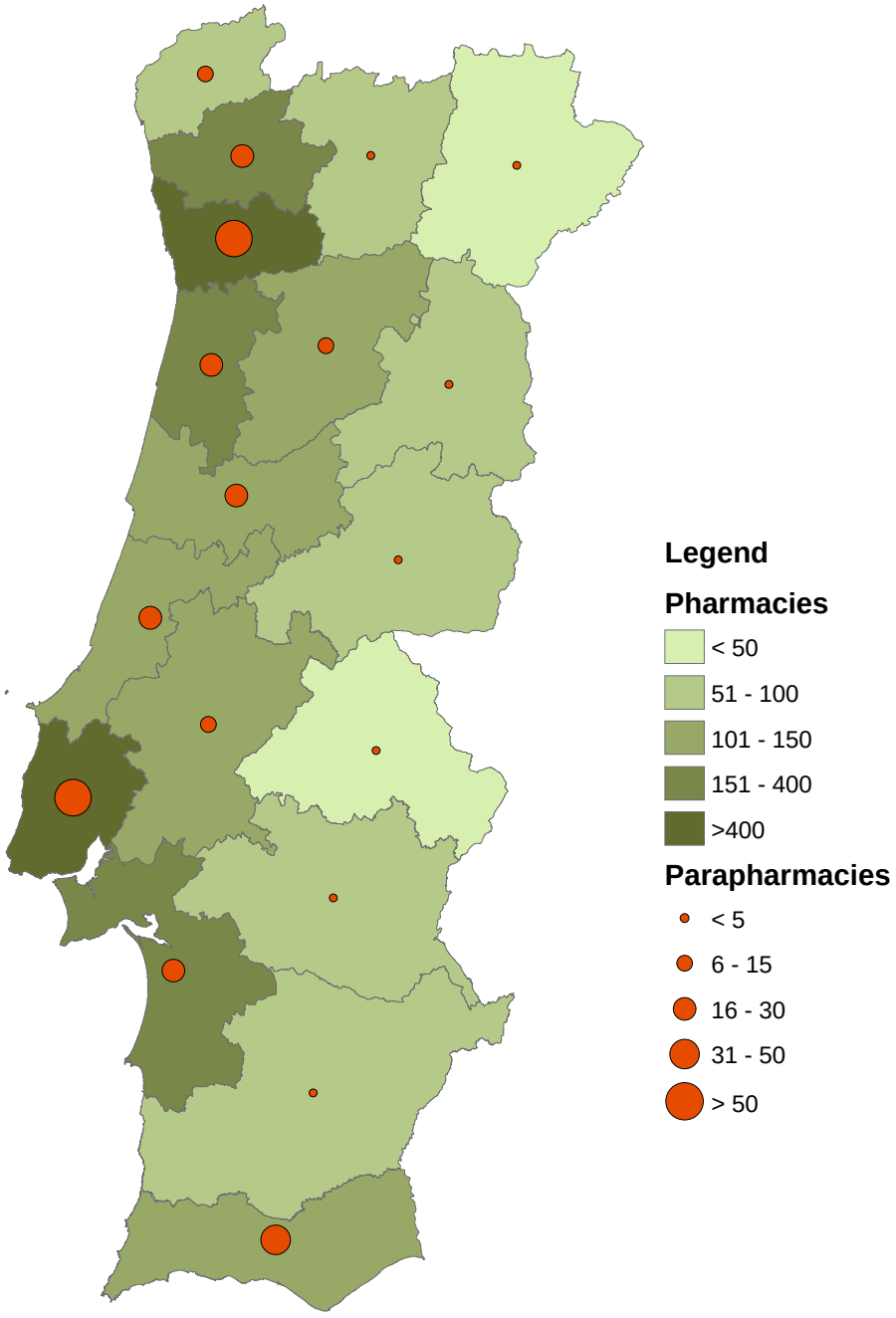
Source: Infarmed and INE, 2007

As can be observed in Map 1, the large number of retailers is located in the coastline from V. Castelo to Setúbal and Algarve, particularly in large urban regions such as Porto and Lisboa. Clearly, the density of parapharmacies *per* province is approximately the same as for pharmacies and follows roughly the intensity of demand. This corroborates the idea that spatial differentiation may assume a secondary position in the location decision of parapharmacies. When new retailers decide to entry, they first take into account the intensity of demand (joint per capita consumption and population intensity) and then differentiate spatially their product.

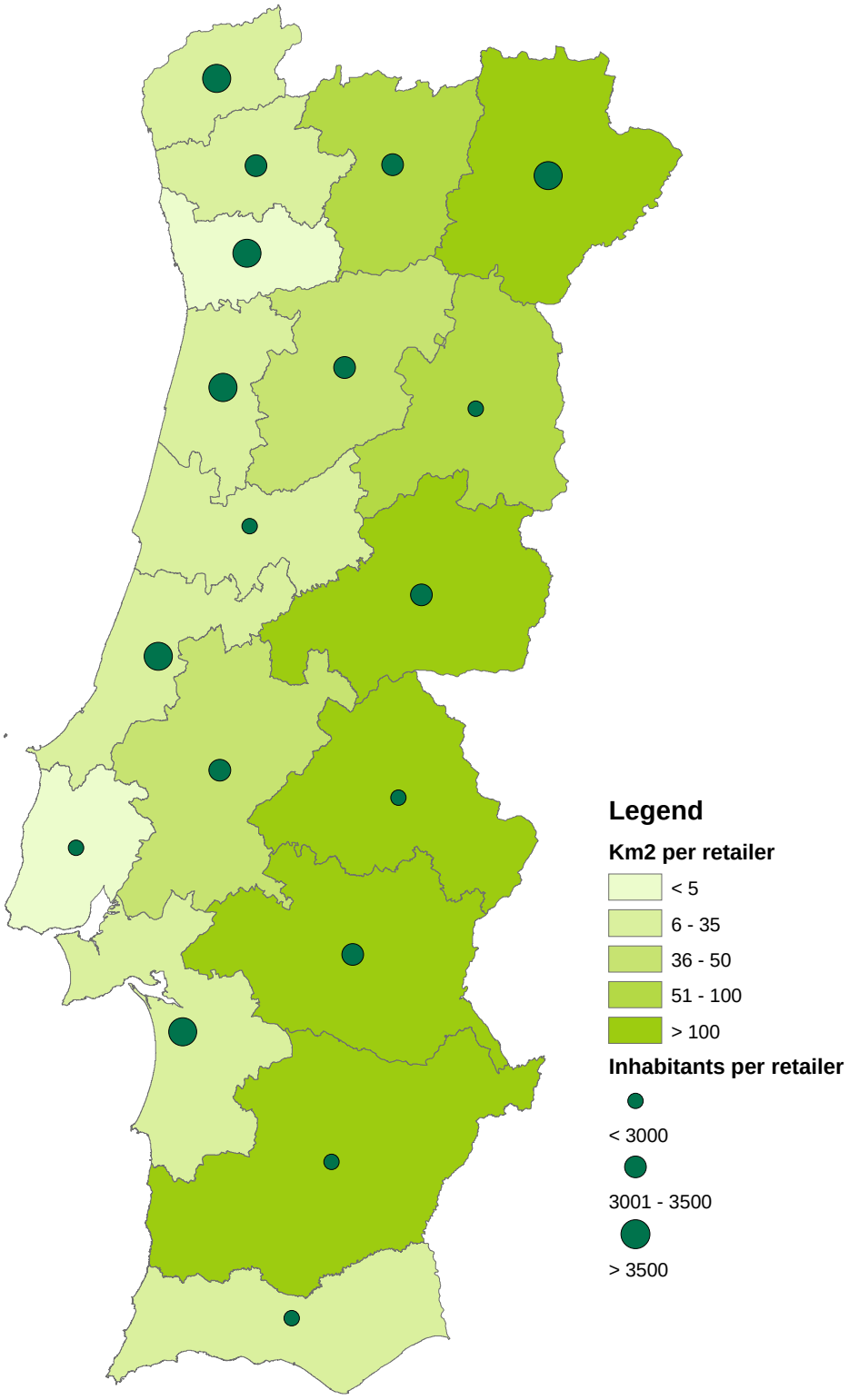
Evidently, it is a hard job to assess exactly the distance between all retailers but it is possible to examine the mean area per retailer along the provinces of Portugal. Map 2 illustrates in detail the relation between the number of retailers and potential consumers, and served area on average. The mean area per retailer is positive related with the geographical dimension of the province and diminishes with the number of

retailers in that province. The coastal provinces have, in general, less spatial area and comprise a high number of retailers, leading to relative small areas per retailer in those provinces. The mean number of inhabitants per retailer in the non-prescription market in Portugal is about 3232, which is decreasing over the time. One can expect that provinces with high retailer density would have a relative small number of inhabitants per retailers. However, Map 2 demonstrates that some of these provinces have a relative high number of inhabitants per retailer (e.g., Porto and Setúbal). Indeed, provinces with high population density may have proportionately less retailers which can be explained by the administrative rules on entry of pharmacies (minimum distance between them) as suggested by Rodrigues *et al.* (2005).

Map 1 - Pharmacies & parapharmacies distribution



Map 2 - Inhabitants and area per retailer



Chapter 3

Related Literature

3.1 - Entry and competition in retail

Researchers' knowledge on the entry and competition dynamics in most economics sectors has significantly increased over the last decades. However, most of the theoretical (e.g., Hause and Rietz, 1984; Mankiw and Whinston, 1986; Geroski, 1991; Hopenhayn, 1992; and Ericson and Pakes, 1995) and empirical (e.g., Dunne, 1988; Acs and Audretsch, 1989; Geroski, 1989; Cabral, 1993; Mata, 1993; and Agarwal and Gort, 1996) work on entry and competition focuses mainly on the manufacturing sector; the retail market, on the contrary, has been relatively neglected, despite its increasing importance in contemporary economies. As a consequence, beside general measures like market structure characteristics, barriers to entry and incumbent's behavior, these studies have predominantly used manufacturing-specific determinants to explain entry and competition such as productivity growth, innovation rates, and technological and experience measures.

Regardless of the market under consideration, the critical idea behind most entry models is that entry should occur whenever the expected profits are positive. Hence, the decision of the entrant is mainly influenced by the structural characteristics of the markets, the firm-specific features, and the incumbents' strategic behavior.

Theoretically, the existence of positive economic profit will attract new entries until the point where further entry would be unprofitable. If free entry was possible, only the most efficient firms would be in the market in the long-run, and price would be equal to marginal cost. Hence, in the retail markets, where entry faces few obstacles and capital requirements, the market is almost automatically kept near the equilibrium. Still, empirical evidence has revealed the existence of economic profit in the absence of

"natural" entry barriers, suggesting that there are "strategic" barriers which prevent new profitable entries.[16] Clearly, the intensity of competition and market structure will influence the ability to use strategic barriers as competitive advantage.

Some of the stylized facts and empirical results about entry and competition in the manufacturing industry described by Geroski (1995)[17] are also appropriate to empirically characterize the entry and the dynamic of the evolution process in the retail sector. Others, on the contrary, are rather different. The first relevant finding is that we observe higher entry rates than market penetration rates (Audretsch *et al.*, 1997)[18]. This might happen because of the entrant's lower market power, which is consistent with the idea that small-scale entry is relatively easily reached but is also associated with low survival rates. Second, it is common to observe higher entry rates early in the life of retail markets, and the number of firms operating does not vary very much over time (Jarmin *et al*., 2004). Third, the costs of adjustment seem to have more impact on large-scale initial entry and in the first years of activity (Hoffmaister, 2006). High rates of entry are often associated with high market experience, reputation and efficiency (Stavins, 1995). Four, it is suggested that entry has a slight impact on the average retail margins and on the profits of the incumbent firms (except for duopolies and triopolies – Abraham *et al*., 2005 and Mazzeo, 2002). Five, firms' size and age are likely to be relevant determinants of survival and growth (Audretsch *et al.*, 1997). Finally, and contrary to what is postulated for the manufacturing industry, entrants in the retail sector do seem to react more or less immediately to high profit opportunities which arise in the market, and usual measures of profitability usually explain entry behavior (Amel and Liang, 1997 and Carree and Thurik, 1999). Additionally, it is suggested that the pos-entry performance is rather different in retail markets given the frequent lower weight of sunk costs and scale economies.

[16] Natural entry barriers may exist independently of incumbent's behaviour, while strategic barriers are a result of deliberate actions of incumbents aiming to make new entry unprofitable.

[17] Although never explicitly stated by Geroski (1995), his insightful synthesis of the empirical literature on entry and competition is based on studies that analyze the manufacturing sector.

[18] The difference between entry rates (ratio of new entries on the total number of firms) and penetration rates (ratio of sales by entrants on total market sales) evidences that often entrants are much smaller than incumbents, and small-scale entry is easier than large-scale entry.

Some of these papers have examined the effects of entry on firms' performance and market structure, while in opposite, others have rather studied the impact of market structure, firms' heterogeneity and incumbents' conduct on entry[19]. Despite the difficulty of dealing with this mutual causality, my work is far related with the first set of papers. In fact, in our case the entry of new firms in the market derived from a specific cause, a deregulation policy, and not from private decisions or strategies of potential entrants.

Seminal empirical studies of entry and competition in retail markets (Bresnahan and Reiss, 1987, 1991; and Berry, 1992) have examined the firm's decision of entering a new market with respect to the intensity of competition and market demand availability, i.e., how the number of firms in a market should vary with market structure and demand dimension. Based on homogeneous firm models, these papers have used data on demand size, number of firms, and fixed costs to draw a relationship between market size and number of retailers (*entry threshold*). Bresnahan and Reiss (1987, 1991) suggested that if a larger number of firms operating in the market compress the average mark-up of all firms in operation, then an increase in the market size is needed to support additional entries. Additionally, Berry (1992) has allowed for heterogeneity of entrants with respect to cost structure and demand. However, this work added little to the results of Bresnahan and Reiss since the heterogeneity among firms' costs gave no rise to changes in competition intensity. However, these results apply more often to concentrated markets where sunk costs and scale economies play a crucial role in the market dynamics, and more firms mean that the average market size per firm should be greater.

In less concentrated markets, Dunne *et al.* (2005), for instance, observed that an increase in the market size (demand) induces greater product differentiation. Despite the increase of competition intensity due to market growth, Dunne has observed greater average revenues and profits per firm, reinforcing the importance of market dimension. However, an increase of market size in less concentrated markets allows the entry of a higher number of firms than it would result in concentrated markets. In fact, horizontal

[19] For a good survey on these topics see Berry and Reiss (2007).

or vertical differentiation permits greater firms' revenues even when the average market size per firm is low.

Mazzeo (2002) extends the equilibrium entry models of Bresnahan and Reiss (1991) and Berry (1992) by making product choice endogenous. Taking into consideration that entry of additional firms decreases the retail margins, firms will decide to entry whenever expected margins cover the fixed costs, which might depend on the relative product space location of competitors. The product choice and entry are analyzed simultaneously in a two-stage game[20], depending mainly on the demand dimension for that type of product and the intensity of competition of firms which offer the same quality product. Mazzeo (2002) mainly found that firms in differentiated product markets will attempt to offer the most different products from those of their competitors. Indeed, the negative effect on firms' payoffs from additional entries is more significant (twice as high) if that competitor is of the same product type. Here, the impact of demand dimension also plays a significant role in entry decision and subsequent product quality choice, and these effects may, in some cases, outweigh the competitive effects.

Recent empirical work followed by Seim (2006) has developed further considerations regarding entry in the retail sector which, in some extent, complement the theoretical and empirical work that had been done in the last two decades in entry and endogenous spatial differentiation. Using a static equilibrium model with asymmetric information, she has studied firms' joint entry and location choices in retail markets. This work extends the empirical model of Mazzeo (2002) considering the geographical location rather than quality type as a measure for product differentiation. In practice, the expected number of entries will be determined by the market dimension and its distribution in the market, being the former an important indicator of the number of firms that the market can support. As expected, Seim (2006) found a negative relation between the distance between firms and the intensity of competition which indicates, as in Mazzeo (2002), that firms have strong incentives to differentiate its

[20] In this equilibrium concept, firms decide to entry or not before choosing the type of product they will offer. However, the two versions of the model predict very similar results, suggesting that the overemphasized role of strategic firm behaviour by theoretical literature may be quite extraneous.

product. Indeed, it is suggested that product differentiation in less concentrated retail markets offsets the reduction of margins as the number of competitors increase, which does not happen straight in concentrated markets.

3.1.1 – The retail pharmacy market

The entry and competition in the pharmaceutical retail sector has received little attention from economic research given the regulation that embraced this monopolistic competitive market, limiting retailers' strategies regarding to location and pricing at the time of entry and pos-entry competition. Since entry and competition in retail pharmacy are, in most countries, widely restricted by regulation, we are interested in examining to what extent the abolition of the legal restrictions will influence the current market structure and consumers' welfare in Portugal. The decision of regulating or not, in each country where the liberalizing of the sector has been considered, has been addressed considering the potential incongruence between the promotion of both market competition and public health.

The experience from liberalization of entry and price competition (via price reductions) in retail pharmacy markets in Iceland and Norway (Annel, 2005), has supported the idea that regulation in this sector could be softened. In fact, the number of pharmacies has increased by 40% and 32% in Iceland and Norway, respectively, and the price of medicines decreased via competition effect. Even for the Norwegian retail pharmacy which had experienced little reduction in price of medicines after pro-competitive policies[21], keeping barriers to entry at the lowest level still is the best way to promote competition, and to oppose the concentration conduct.

Making a similar analysis for the Portuguese retail pharmacy market, Rodrigues *et al*. (2005) suggests that the abolition of the restrictions to entry and competition in this sector would change the current market structure. The increase of the number of

[21] The impact on prices in the Norwegian market was lessened by the emergence of horizontal concentration which has limited the competition effect from the increasing number of pharmacies.

retailers and competition intensity would reduce their margins, and therefore, the prices would decrease. Consumers would benefit from lower price of medicines and widely spatial availability of those medicines. However, the entry and price competition were relaxed only for retail market of non-prescription medicines. This dissertation seeks to evaluate whether this deregulation policy will induce price competition, and enhance the consumers' welfare.

3.2 – Spatial competition

In general, horizontal or vertical product differentiation and the strategic importance of product positioning are essential for firms to potentially acquire localized market power while it allows consumers with heterogeneous preferences and locations to be better provided. Since consumers are quite heterogeneous in their locations and preferences when choosing where to go shopping, the retailer location is central in most retail markets, although this importance is hard to quantify empirically. Contrary to manufacturing industries where firms' location is influenced by natural advantages of the region, such as natural resources and labor costs (Ellison and Glaeser, 1997), the spatial competition in most retail markets is mostly driven by demand characteristics[22] and rivals' location. The concept of global market competition is reduced to local competition in the sense that each retailer compete directly only with its neighbors, and the space dimension is not necessary the unity. The relevance of spatial competition models is that it allows an empirical analysis of product differentiation at retail level, and its influence on competition intensity.

In most retail markets, and in accordance with the theoretical literature, firms should be located farther from its rivals in order to relax price competition. In accordance with demand, firms would spread out in product or physical space, as to increase their market power (preventing new entries), and therefore, profits (e.g.,

[22] The equilibrium location is mainly driven by the distribution of consumer locations (including the form of transport cost), the elasticity of demand, and consumer heterogeneity.

D'aspremont et al, 1979, and Netz and Taylor, 2002). However, empirical literature (e.g., Irmen and Thisse, 1998; and Pinkse *et al.*, 2002), suggested that the Hotteling's principle of minimum differentiation may dominate. In fact, in retail markets such as fast food, movie theatres, and supermarkets, firms (retailers) tend to be located close to each other where the demand is more concentrated[23], in an attempt to capture more consumers. When the demand is less concentrated, firms have more incentives to differentiate.

The partial liberalization of the Portuguese pharmaceutical retail market triggered free entry and spatial product differentiation in the non-prescription market. Although in its beginning, the deregulation process has enhanced firms' incentives to differentiate their products geographically in order to increase localized market power given the geographic dispersion of demand. At the same time, these retailers may tend to concentrate in areas with higher demand. Together, these aspects may explain the current patterns of location choice of parapharmacies observed empirically[24]. Therefore, the literature on the demand estimation for spatial competition models is clearly relevant to the goals of this dissertation.

Building on the model of differentiated product demand by Berry *et al.* (1995), and using detailed data on the geographic layout of the U.S. scenery, Seim (2006) and Watson (2005) have illustrated the impact of the spatial differentiation on the retail market structure. In markets with a homogeneous product, the positive relationship between market size and the number of retailers grows to the point where the retail margins equals zero and the number of consumers will not induce an additional entry, as suggested initially by Bresnahan and Reiss (1991). Furthermore, Seim (2006) found that the increase differentiation in product characteristics enhances only to some extent the localized market power. This has important significance for our work if we consider that pharmacies may offer a vertically differentiated product (with pharmaceutical advice) comparing to some parapharmacies. Hence, it is likely that pharmacies will not acquire high competitive advantage for having a slightly different product.

[23] Sault *et al.* (2004) suggested that firms learn from their rivals where the best locations are, and then locate as close as possible.

[24] See INFARMED Report (2007), *Vendas de Medicamentos não Sujeitos a Receita Médica*.

More complex models of demand systems for spatially differentiated products were developed by Davis (2000, and 2006) and Thomadsen (2001), focusing on the role of spatial differentiation in relaxing the intensity of competition in retail markets. These works' approach mainly differs from those mentioned in the earlier paragraph, because they use price and quantity data rather than market size and number of retailers, and also because the firms' locations are taken as exogenous rather than endogenously determined as outcome of firms' interaction in equilibrium. These studies have also followed Berry *et al.* (1995) techniques for empirical analysis of demand and supply in differentiated product markets, but added the spatial dimension to that framework.

Thomadsen (2001) has estimated indirect utility functions of consumers and cost functions of firms, employing only price (does not use quantity data) and location data, in order to evaluate the effect of spatial differentiation on price in the motel retail market (which presents large price variation). Estimating a model of demand (hicksian utility functions) and supply (profit maximization), he found that the impact of geographical differentiation on prices increases with popularity (higher quality). This could be particularly relevant in the retail pharmacy, where one may claim that the products of pharmacies have higher quality relatively to the same product of parapharmacies. Thomadsen (2001) also found that the consumers' distribution plays a significant role in the firm's market power, and when the demand is concentrated enough there is less incentives to spatially differentiate.

Employing a similar demand model, Davis (2000, and 2006) has examined the effects of spatial differentiation, quality choice, and the distribution of consumers on retail competition. Focusing on the role of transport costs (quadratic functions) and consumers' distribution, he suggests that introducing spatial differentiation induces low cross price elasticities and enhances retailer market power. However, the impact of spatial differentiation has a modest magnitude in local competition since little price variation across the movie theatre market is observed, as was also suggested by Davis (2005). Furthermore, Davis (2006) supports that the social and private location equilibrium differ, given the existence of welfare gains from moving retailers (theatres) to the centre of the town.

Very recent empirical work has been drawing upon these demand models, focusing on spatial differentiation and distribution of consumers, and applying them to other retail sectors such as retail gasoline (e.g., Houde, 2006 and Chan, 2006), and supermarkets (e.g., Orhun, 2005). The results are very similar among those works, and briefly, it is suggested that the competition intensity and demand distribution effects decrease with product differentiation.

3.2.1 – Horizontal differentiation and multiproduct firms

The emergence of heterogeneous retailers, monoproduct and multiproduct, is an additional characteristic drawn from the retail pharmacy liberalization in Portugal. Indeed, asymmetric retailers arise from the assumption that prescription medicines and OTC drugs are different products. Pharmacies still possess the exclusiveness in the retail of prescription medicines, while have started to compete in non-prescription products with parapharmacies.

Recently, theoretical and empirical analysis of multiproduct firms with product differentiation variants has been growing as fast as the described phenomenon[25]. However, very little related literature has stressed the horizontal differentiation jointly with asymmetric firms. Giraud-Héraud *et al*. (2003) shed some light on this topic, extending the spatial differentiation approaches of Salop (1979) and d' Aspremont *et al.* (1979). He introduces a theoretical asymmetric equilibrium, between a multiproduct firm and monoproduct competitors, and examines the asymmetric price schemes of the multiproduct firm. The presence of a multiproduct firms leads the market to behave in an asymmetric manner (even though there is initial symmetric competition) since spatial differentiation induces higher exploitation of market power in some market segments[26].

[25] For an extensive survey on this topic see, for instance, Manez and Waterson (2001).

[26] The firm coordinates its pricing policy by exploiting each of its product position with respect to those of its monoproduct competitors, given the distribution of consumers.

This dissertation will work on this issue though in a distinct way and with different purposes.

3.3 – Models of spatial competition

Models of spatial competition have been assuming several space approaches for retail markets such as the linear street (Hotelling, 1929), the hexagonal market area (Losch, 1954), the circular market (Salop, 1979), and other more complex configurations.[27] Describing the dynamics of spatial differentiation through the competition model (Chamberlinian-style) of circles was introduced by Waterson (1993). This work has assumed the retail pharmacy as a quasi-monopolistically market (subject to regulation) considering that the spatial differentiation offers in some extent local monopoly power to each retailer. Indeed, a new entrant in local markets is unable to capture the entire consumer surplus given its location, while it absorbs the stealing business effects from the increasing differentiation in the local market.

Waterson (1993) assumes that the retailers are homogeneous and symmetrically located in a lattice, and each one sells to a circular area around it[28], which may expand (diminish) with price decreases (increases). Firms differentiate their product geographically and exploit their relative market power given the distribution of consumers and the length of their influence area. One may cast doubts on the model approach and the fitness of the circles to describe the retail pharmacy competition. Waterson (1993) has suggested the square-metric as an alternative, in which the streets of the city are assumed to be a perfect grid and consumers walk in right-angled paths to the closest pharmacy. However, the results of this alternative approach suggest a larger

[27] Eiselt, Laporte and Thisse (1993) and Kilkenny and Thisse (1999) present selective surveys on this topic.

[28] Since the circles do not overlap, any geographical area will not be exacted covered by the influence areas of retailers. Still, the model seems to be a fairly close description of the real market.

difference between the monopolistically competitive equilibrium and the social optimum, indicating the higher robustness of the circles model.

Similar approaches have been developed to depict the retail pharmacy sector in Spain (Jansson, 1999) and Portugal (Rodrigues *et al.*, 2005), the textbook market (Gonzalez *et al.*, 2001) and the supply of public services (Laborda and Fumas, 2000) using Spanish data. All these studies have analyzed deregulation processes with respect to market entry and price competition. They have used firms' fixed costs, transportation costs and asymmetric consumers' distribution to describe the existence of localized market power of retailers in deregulated scenarios. It is suggested that market liberalization would promote price competition, though leading to an excessive number of retailers comparing with the desirable social equilibrium. Stealing-effects associated with new entries and diminishing of transport costs by differentiating spatially the product lessen the relative market power and retail margins. Since firms compete horizontally, the prices will decrease and an excessive number of retailers will arise.

This dissertation intends to extend the theoretical model of Waterson (1993) by introducing asymmetric equilibrium between the pharmacies and parapharmacies, and focusing on the non-prescription drugs retail rather than the whole pharmacy retail market.

Chapter 4

Theoretical Model

4.1 - Baseline Model

Based on the linear city competition model of Hotelling (1929) and the circular city model of Salop (1979), the circles' approach (Waterson, 1993) describes competition in the pharmacy retail market quite satisfactorily since it confers a relevant role of transport costs on market behavior, associating firms' ability to attract consumers to their location and the price they set. In addition, variables such as population density and per capita demand for OTC drugs are critical to predict the number of retailers and the intensity of competition between them in a given area, predicting high appropriateness of the circular model.

The province is the unit of observation used in the model described below in this chapter, describing a market which is divided into cells that do not overlap. Each retailer (pharmacy or parapharmacy) is hypothetically located in a centre of a circle, selling to a circular area surrounding it, and attracting the consumers located on a given radius. As a result, the retailer's profit is crucially determined by its influence area (which depends on firm's price strategy and its relative location with respect to other competitors) and demand characteristics such as spatial consumers' distribution and the per capita consumption of non prescription medicines. The existence of spatially differentiated firms may explain why one retailer operates more profitably in a given location than its rivals. Each consumer will decide from which retailer to buy taking into consideration the transport cost to the closest retailer jointly with the price of the medicines. This means that the retailer's influence area may expand or diminish with price competition.

4.1.1 - The Demand

The demand for non-prescription (R_i) and prescription medicines (Q_i) that retailer *i* faces, is measured by the area surrounding it (defined by the radius), the population density, and the total *per capita* consumption of medicines. Subsequently, the entire *per capita* consumption is distributed in the *per capita* demand for non-prescription (w) and prescription drugs (1-w), with $w < 1$, such that,

$$R_i = \int_0^r 2\pi x Y w q(a).dx = \pi r^2 Y w q(a) \quad (1.1)$$

$$Q_i = \int_0^s 2\pi x Y (1-w) q(a).dx = \pi s^2 Y (1-w) q(a) \quad (1.2)$$

Where, Y is the population density, $q(a)$ is the *per capita* demand for medicines, and πr^2 and πs^2 represent the influence area of a given retailer, in the retail markets of non-prescription and prescription medicines, respectively.

The total amount paid by consumers when buying from a given pharmaceutical retailer *i*, comprises the price of medicines and the "transport cost" associated with the covered distance as follows,

$$\mathrm{P} = p_i + v x^{\tau}$$

where, x is the distance to the retailer, v is the unitary cost of transport, and τ is the "sensibility" of consumers to the covered distance $(\tau \geq 1)$.

The consumer will buy in the retailer which allows him to pay the lowest total price. Thus, a consumer located to a distance r from the retailer *i*, is unresponsive to be served by retailer *i* or retailer *j*, given the corresponding prices p_i and p_j, if:

$$p_i + vr^{\tau} = p_j + v(u-r)^{\tau} \quad (2)$$

where, u is the distance between retailer i and retailer j.

4.1.2 - Cost and profit functions

I assume that overall costs for pharmaceutical retailers are given by a linear function. Despite the following simple approach, this cost function appears to be a valid estimation for a given dimension of retailers in the Portuguese retail pharmacy[29]. Accordingly, the marginal cost (c) comprises the manufacturing cost of the medicines and other operational costs which are assumed to be the same for both prescription and non prescription medicines[30]. The fixed cost (F) roughly designates the dimension of the firms.

$$C_i(Q,R) = F + c(Q+R) \quad (3)$$

[29] For instance, Waterson (1993) make reference to Cobb-Douglas and translog cost functions as alternative cost functions for pharmaceutical retailers. The Cobb-Douglas function has attractive mathematical characteristics but assumes constant output elasticities over the time and inputs dependence. The translog function allow to evaluate the optimal output ratio, i e, the optimal production of each output which minimizes the cost production. This is fairly valuable since it indicates what output is more beneficial to increase its production, taking into account only costs. The drawback is that this functional form will have both positive slope and negative slope; this may be a problem because our regression should always have the same slope.

[30] For simplicity, I assume only c to describe the marginal cost of overall medicines. In the next chapter, we account for cost differences between the prescription and non-prescription markets and also between different retailers, while simulating the theoretical model.

Since firms face fixed costs, they may have scale economies. Given the definition of scale economies (*S*), I allow the following relation between marginal cost and average cost. For a multiproduct firm, I deduct *S* by deriving the cost function (3),

$$S_i = \frac{AC_i(Q,R)}{MC_i(Q,R)} = \frac{F}{c(Q+R)} + 1 \tag{4}$$

Lastly, the profit of each retailer is described as follows,

$$\pi_i = \bar{p}Q_i + p_iR_i - C_i(Q,R) \tag{5}$$

where, p_iR_i ($\bar{p}\ Q_i$) is the revenue of the non-prescription (prescription) market. Only the non-prescription market will be explored and it is assumed that the retailers will maximize their profits in order to the non-prescription market. Considering this and the maximization problem of a multiproduct firm, I have,

$$\underset{p_i}{Max}\ \ \pi_i = \bar{p}Q_i + p_iR_i - C_i(Q,R)$$

$$F.O.C.: \quad \Rightarrow \frac{\partial \pi_i}{\partial p_i} = 0 \quad \Leftrightarrow \quad R_i + p_i\frac{\partial R_i}{\partial p_i} - \frac{\partial C(.)}{\partial R_i}\frac{\partial R_i}{\partial p_i} = 0 \tag{6}$$

In order to evaluate the market power of a given pharmacy I need to assess the firm's minimum margin (the breakeven) reached when $\pi_i = 0$, which implies setting the price equal on average to average cost. Thus, I obtain[31]:

[31] The market power measure by price demand elasticities is: $\frac{p_i - c}{p_i} = \frac{1}{\varepsilon_{QQ}} - \frac{(P^R - MC^R)R}{P^Q Q}\frac{\varepsilon_{QR}}{\varepsilon_{QQ}}$

$$\xi_i = \frac{P_i - MC_i}{P_i} = 1 - \frac{1}{S} \tag{7}$$

where, S is the measure of economies of scale from equation (4), and ξ is the multiproduct margin (market power) of each firm. As a result, I can rewrite the breakeven price (which equals on average the average cost) for the non-prescription market as a function of the measure of economies of scale,

$$p_i = \frac{C_i(Q,R)}{R_i} = S * c \tag{8}$$

4.2 - Preliminary setting

Before the liberalization policy took place, the activity of pharmaceutical retailers (pharmacies only) was strictly regulated with respect to price competition and market entry, as we pointed out in chapter 2. Thus, the price is set administratively determining the value of price-cost margin to pharmacies $(p-c)$. The number of pharmacies is also exogenously determined by the government. In a given region, the policymaker sets the number of pharmacies which, in the limit, equals the number derived from free entry. Considering that the number of retailers in a given region (A) is equal to the ratio of the area of that region to the relative area of each retailer, I can deduce the maximum number of pharmacies in the market. As a result, given the fixed retail margin, I obtain:

$$N_{Max} = \frac{(p-c)AYq(a)}{F} \tag{9}$$

Accordingly, the quantity for each pharmacy will be in the limit equal to that of "breakeven" derived from free entry, *i. e.*, it allows to cover the fixed cost, given the set price-cost margin.

4.3 – Price competition

The liberalization of the retail market of non-prescription medicines has comprised two distinct but simultaneous courses of action: (1) the introduction of price competition of OTC drugs and (2) the entry of parapharmacies. First, I will examine the market equilibrium with competitive prices but without the introduction of new retailers as to assess the particular impact of parapharmacies' entry.

Pharmacies will maximize their profits in order to non-prescription market, since they cannot compete in the market of prescription medicines[32]. Thereby, the number of pharmacies in market is still exogenously decided but once installed they compete in prices on non-prescription market. The influence area of each pharmacy will depend on the price charged and the population density. Hence, each pharmacy will maximize its profits solving condition (6):

$$\frac{\partial \pi_i}{\partial p_i} = 0 \quad \Leftrightarrow \quad R_i + p_i \frac{\partial R_i}{\partial p_i} - \frac{\partial C(.)}{\partial R_i} \frac{\partial R_i}{\partial p_i} = 0$$

The impact of price of non-prescription drugs on the respective demand is not directly observable. The length of the pharmacy's radius is a function of the price of non-prescription drugs. Subsequently, the price's impact on the influence area is given

[32] Now we assume that pharmacies are multiproduct (prescription and non-prescription medicines) firms.

through the length of the radius related to each pharmacy. Consequently, I can split the original derivate in two fractions:

$$\left.\frac{\partial R_i}{\partial p_i}\right|_{p_j} = \frac{\partial R_i}{\partial r_i}\left.\frac{\partial r_i}{\partial p_i}\right|_{p_j}$$

Because the radius depends on the relative prices, it is clear that the higher the price charged by a given pharmacy *i*, the bigger the radius of rival (pharmacy *j*), where p_j is the non-prescription price of pharmacy *j* (with $i \neq j$). The marginal consumer located at distance *r* from the pharmacy *i* and (*u*-*r*) from the pharmacy *j* is unresponsive between buying from either pharmacy *i* or *f* if equation (2) bears out. Hereafter, as assumption, I take $\tau = 1$[33]. This means that the consumer will pay the same unitary cost by every unit of distance. Simplifying I obtain:

$$p_i + vr = p_j + v(u - r) \quad \Leftrightarrow \quad r = \frac{p_j - p_i + vu}{2v} \tag{10}$$

This equation allows a negative relation between the radius surrounding a pharmacy *i* and the price charged by it, and a positive relation between that radius and the price charged by competitors.

$$\left.\frac{\partial r_i}{\partial p_i}\right|_{p_j} = -\frac{1}{2v}$$

[33] Rodrigues *et al.* (2005) have suggested, for Portuguese pharmacy retail, linear $(\tau = 1)$ and quadratic $(\tau = 2)$ functions of cost distance. They have found that linear costs produce better results. For $\tau = 2$, the consumers would be insensitive to short distances and very sensitive to large distances, and for that reason the prices would vary greatly from a region to another with different density population. Moreover, they noted that the price-cost margins derived from the liberalization are fairly unrealistic in the presence of quadratic functions of cost distance.

This derivate shows that the length of the influence area associated to each pharmacy *i*, is negatively related with the price charged by that pharmacy. This negative effect increases with the diminishing of the transport cost (*v*). The demand variation of each pharmacy facing price changes is given by,

$$\left.\frac{\partial R_i}{\partial p_i}\right|_{p_j} = \frac{\partial R_i}{\partial r_i}\left.\frac{\partial r_i}{\partial p_i}\right|_{p_j} = 2\pi r_i Ywq(a).\left(-\frac{1}{2v}\right) = -\frac{\pi r_i Ywq(a)}{v} \qquad (11)$$

Pharmacies will set theirs prices seeking profit maximization. The price equilibrium is the output of the Nash Game corresponding to the simultaneous setting of those prices. From equation (1.1), (3), (6), (10) and (11) I have,

$$\left.\frac{\partial \pi_i}{\partial p_i}\right|_{p_j} = 0 \quad \Leftrightarrow \quad R_i + (p_i - c)\left.\frac{\partial R_i}{\partial p_i}\right|_{p_j} = 0$$

$$\pi\left(\frac{p_j - p_i + vu}{2v}\right)^2 Ywq(a) - (p_i - c)\frac{\pi\left(\frac{p_j - p_i + vu}{2v}\right)Ywq(a)}{v} = 0$$

from where I get the symmetric Nash price equilibrium ($p_i = p_j$) [34],

[34] Note that in the symmetric equilibrium, the equation (10) reduces to $r = u/2$, and the number of pharmacies within a given region is $N = A/\pi r^2$, thus I can get the radius in order to the parameters: $r = \left(\frac{A}{\pi N}\right)^{\frac{1}{2}}$.

$$p_i = p_j = c + \frac{vu}{2} = c + v\left(\frac{A}{\pi N}\right)^{\frac{1}{2}} \quad (12)$$

The price is above the marginal cost level, showing the market power associated with the transport costs, that is related to the influence area. The profit of the multiproduct pharmacy is given by,

$$\pi_i = m_Q * Q_i + (p_i - c) * R_i - F$$

$$\pi_i = \left[m_Q(1-w) + vw\left(\frac{A}{\pi N}\right)^{\frac{1}{2}} \right] \frac{AYq(a)}{N} - F \quad (13)$$

Where m_Q is the retail margin of the market of prescription medicines.

4.4 – The entry of parapharmacies

In this scenario, I follow the entry of parapharmacies in the market considering price competition between pharmacies and parapharmacies in the retail market of non-prescription medicines, and assuming that there is no connection between both prescription and non-prescription market. Indeed, I assume that the demand quantity with respect to non-prescription drugs is independent of the prescription market. This

assumption and the cost linearity allow me to draw a partial equilibrium only in the non-prescription side. Moreover, it is assumed that the consumption of non-prescription drugs is autonomous with respect to the number of retailers in the market.

Given that, I assume that parapharmacies adopt the same price strategy of the pharmacies. Hence, the variable cost for parapharmacies (*j*) will depend only on the quantity of non-prescription drugs as follows:

$$C_j(R) = F + cR \tag{14}$$

As a result, each parapharmacy has the profit function described below (15), and follows similar maximization problem of pharmacies stated in equation (6).

$$\underset{p_j}{Max} \quad \pi_j = p_j R_j - C_j(R) \tag{15}$$

Pharmacies may compete in prices with parapharmacies but only the latter may enter without restraints into the market. Introducing price competition between both types of retailers, will lead parapharmacies to enter into the market, in the limit, until zero profit is reached. Thus, under monopolistic competition, they will charge the "breakeven" price, which implies that on average the price equals the average cost ($\pi_j = 0$). Since the parapharmacies maximize their profit according to the same price strategy of pharmacies, I can deduct from (3) and (12) the radius that satisfies entry until zero profit is accomplished.

$$\begin{cases} p_j = AC_i \\ \\ p_j = p_i = c + vr \end{cases} \Leftrightarrow \quad c + vr = \frac{F}{R} + c \quad \Leftrightarrow \quad r^* = \left(\frac{F}{Ywq(a)\pi v} \right)^{\frac{1}{3}} \tag{16}$$

Straightforwardly, considering equilibrium radius (15), I find the equilibrium number of retailers in the non-prescription side,

$$N^* = \frac{A}{\pi\left(r^*\right)^2} = \frac{A}{\pi}\left(\frac{Ywq(a)\pi v}{F} \right)^{\frac{2}{3}} \tag{17}$$

Given the independence of the both prescription and non-prescription markets, and the same non-prescription marginal cost and price strategy for pharmacies and parapharmacies, I depict the *breakeven* price substituting equation (17) on the Nash equilibrium price given by condition (12).

$$p_j = p_i = c + v\left(\frac{A}{\pi N^*} \right)^{\frac{1}{2}} = c + v\left(\frac{F}{Ywq(a)\pi v} \right)^{\frac{1}{3}} \tag{18}$$

and subsequent the profit output,

$$\pi_i = m_Q . s^2 (1 - w) Yq(a) \tag{19}$$

4.5 – A connection between markets

On the previous scenario I have assumed the independence between the non-prescription and prescription market of medicines. Now I will assume that the demand in each one of those markets are inversely related, i. e., the greater the demand in one market, the lesser the consumption in the other. In this case, the proportion of *per capita* demand for non-prescription drugs becomes endogenous and assumes the value, $\widetilde{w} = w\left(\frac{s}{r}\right)^{\gamma}$.

$$R = \int_0^r (2-\gamma)\pi x Y w\left(\frac{s}{x}\right)^{\gamma} q(a).dx = \pi r^2 Y w\left(\frac{s}{r}\right)^{\gamma} q(a) \qquad (20.1)$$

$$Q = \int_0^s \pi x Y\left[2-(2+\gamma)\left(\frac{x}{r}\right)^{\gamma}\right] q(a).dx = \pi s^2 Y\left[1-w\left(\frac{s}{r}\right)^{\gamma}\right] q(a) \qquad (20.2)$$

The new proportion of per capita demand for non-prescription medicines is influenced by the increasing dimension of the market adjusted by parameter γ. The new structure of the demand for non-prescription denotes that an increase in the number of parapharmacies (diminishing *r*) would increase the demand of non-prescription drugs. On the other hand, the same increase in the number of parapharmacies would reduce the *per capita* demand for prescription medicines via a substitution effect. This might happen as non-prescription medicines become physically more available at competitive prices, conferring greater incentives to consumers to substitute prescription medicines by OTC drugs for minor ailments.

Now each pharmacy (*i*) maximizes their profit in order to the non-prescription market but including the demand substitution effect on prescription market. Thus, from

equation (20.1) and (20.2) I deduce the new impact on the price of non-prescription medicines in each market,

$$\left.\frac{\partial R_i}{\partial p_i}\right|_{p_j} = \frac{\partial R_i}{\partial r_i}\left.\frac{\partial r_i}{\partial p_i}\right|_{p_j} = (2-\gamma)\pi r Yw\left(\frac{s}{r}\right)^{\gamma} q(a).\left(-\frac{1}{2v}\right)$$

$$\left.\frac{\partial Q_i}{\partial p_i}\right|_{p_j} = \frac{\partial Q_i}{\partial r_i}\left.\frac{\partial r_i}{\partial p_i}\right|_{p_j} = \frac{\gamma\pi s^2 Ywq(a)}{r}\left(\frac{s}{r}\right)^{\gamma}.\left(-\frac{1}{2v}\right)$$

Giving the derivates above and handling equation (6) I develop the current maximization problem for each pharmacy,

$$\left.\frac{\partial \pi_i}{\partial p_i}\right|_{p_j} = 0 \quad \Leftrightarrow \quad m_Q\left.\frac{\partial Q_i}{\partial p_i}\right|_{p_j} + R_i + p_i\left.\frac{\partial R_i}{\partial p_i}\right|_{p_j} - \frac{\partial C(.)}{\partial R_i}\left.\frac{\partial R_i}{\partial p_i}\right|_{p_j} = 0 \qquad (21)$$

Solving for p_i I have,

$$p_i = c + \frac{2vr}{2-\gamma} - \frac{\gamma.m_Q}{2-\gamma}\left(\frac{s}{r}\right)^2 \qquad (22)$$

For parapharmacies (j) the maximization problem is similar but involves only the non-prescription market as follows,

$$\left.\frac{\partial \pi_j}{\partial p_j}\right|_{p_i} = 0 \quad \Leftrightarrow \quad R_j + p_j \left.\frac{\partial R_j}{\partial p_j}\right|_{p_i} - \frac{\partial C(.)}{\partial R_j}\left.\frac{\partial R_j}{\partial p_j}\right|_{p_i} = 0$$

$$p_j = c + \frac{2vr}{(2-\gamma)} \tag{23}$$

The asymmetric equilibrium between different retailers (pharmacies and parapharmacies) is possible under some conditions. First, I have been assuming the same fixed and marginal cost for both types of retailers. This assumption is arguable but the lack of data for the cost structure of parapharmacies has induced me to assume cost structure homogeneity. Second, I strictly assume competition between one pharmacy and one parapharmacy. The reason for that is more intuitive than methodological. The competition between pharmacies in the non-prescription market appears to be residual in the sense that they cannot choose their location. The competition between parapharmacies would lead approximately to the same result of the previous scenario (18). Now I introduce the asymmetric equilibrium by using equations (17), (22) and (23),

$$\begin{cases} p_i = c + \dfrac{2vr}{2-\gamma} - \dfrac{\gamma . m_Q}{2-\gamma}\left(\dfrac{s}{r}\right)^2 \\ p_j = c + \dfrac{2vr}{2-\gamma} \\ p_j = AC \end{cases}$$

Again, parapharmacies will enter the market until the zero profit condition is reached. Hence, the equilibrium radius between retailers is derived from the free entry condition of parapharmacies,

$$\begin{cases} p_i = c + \left[\left(\dfrac{2v}{2-\gamma} \right)^{2-\gamma} \dfrac{F}{\pi Ywq(a)s^{\gamma}} \right]^{\frac{1}{3-\gamma}} - \dfrac{\gamma . m_Q}{2-\gamma} \left(\dfrac{2v\pi Ywq(a)s^3}{(2-\gamma)F} \right)^{\frac{2}{3-\gamma}} & (24) \\ p_j = c + \left[\left(\dfrac{2v}{2-\gamma} \right)^{2-\gamma} \dfrac{F}{\pi Ywq(a)s^{\gamma}} \right]^{\frac{1}{3-\gamma}} & (25) \\ r^* = \left(\dfrac{(2-\gamma)F}{2v\pi Ywq(a)s^{\gamma}} \right)^{\frac{1}{3-\gamma}} & (26) \end{cases}$$

From (26) it is possible to deduce the number of retailers in the market,

$$N^* = \frac{A}{\pi} \left(\frac{2v\pi Ywq(a)s^{\gamma}}{(2-\gamma)F} \right)^{\frac{2}{3-\gamma}} \quad (27)$$

The results of this scenario suggest that when the substitution effect is taken into consideration, the pharmacies diminish their price in order to prevent further entries of parapharmacies in the market. This may happen because if consumers substitute prescription medicines by non-prescription medicines the entry of parapharmacies would be detrimental in two ways: (1) the price decreasing due to greater competition and (2) the lesser demand for prescription drugs via substitution effect. As a result, pharmacies would decrease prices in order to discourage parapharmacies' entry, and those prices may be expressed as follows, being p_j the breakeven price.

$$p_i = p_j - \frac{\pi\gamma.s^2 m_Q}{(2-\gamma)A} N^*$$

Price differences between pharmacies and parapharmacies are increasing with the number of retailers in the market (N). Knowing that, the profit of pharmacies is given by,

$$\pi_i = m_Q \pi s^2 Yq(a)\left[1-\left(\frac{ws^\gamma}{2-\gamma}\right)^{\frac{3}{3-\gamma}}\left(\frac{2v\pi Yq(a)}{F}\right)^{\frac{\gamma}{3-\gamma}}\right] \quad (28)$$

4.6 – A social optimum

The efficient equilibrium in the non-prescription market for the society would be reached when the consumers' welfare is maximized considering the breakeven condition of retailers. The number of retailers in the market has impact on the demand side (physical availability of non-prescription medicines) and on the supply side (the scope of scale economies). Consequently, the highest social welfare is achieved when the sum of transport cost (vx) and the losses related to scale economies (F) with the increase of retailers is minimized. This social problem can be described as follows,

$$SC(N) = N\left(\int_0^r 2Y\pi xw\left(\frac{s}{x}\right)^\gamma q(a).(vx)dx + F\right) = N\left(v\pi r^3 Ywq(a)\frac{2}{(3-\gamma)}\left(\frac{s}{r}\right)^\gamma - F\right) \quad (29)$$

From equation (29) I get the minimum social cost (SC),

$$F.O.C.: \frac{\partial\, SC(.)}{\partial\, N} = 0 \quad \Leftrightarrow \quad N_s^* = \frac{A}{\pi}\left(\frac{2v\pi Ywq(a)s^{\gamma}}{(3-\gamma)F}\right)^{\frac{2}{3-\gamma}} \tag{30}$$

I can examine that for all values of γ we get $N_s < N^*$, specifically,

$$N_s^* = \left(\frac{2-\gamma}{3-\gamma}\right)^{\frac{2}{3-\gamma}} N^*$$

This means that the number of retailers that would be desirable by society is quite inferior (about three quarters) of the number derived from free entry equilibrium. To obtain the optimal social price, we simply substitute (29) in the condition of zero profit of retailers ($\pi_s = 0$)[35] as follows,

$$(p_s - c)AYwq(a) - NF = 0 \quad \Leftrightarrow \quad p_s = c + \left(\frac{2vs^{\gamma}}{3-\gamma}\right)^{\frac{2}{3-\gamma}}\left(\frac{F}{\pi Ywq(a)}\right)^{\frac{1-\gamma}{3-\gamma}} \tag{31}$$

[35] Note that here is the zero profit condition set by the policymaker as in equation (9).

Table 1 – Summary of the results of the theoretical model

Scenario	Price	Number of retailers	Profit
Price competition	$p_i = c + v\left(\frac{A}{\pi N}\right)^{\frac{1}{2}}$	$\overline{N}$	$\pi_i = \left[m_Q(1-w) + vw\left(\frac{A}{\pi N}\right)^{\frac{1}{2}} \right] \frac{AYq(a)}{N} - F$
Entry of parapharmacies	$p_i = c + v\left(\frac{F}{Ywq(a)\pi v}\right)^{\frac{1}{3}}$	$N^* = \frac{A}{\pi}\left(\frac{Ywq(a)\pi v}{F}\right)^{\frac{2}{3}}$	$\pi_i = m_Q.s^2(1-w)Yq(a)$
Market substitution[36]	$p_i = p_j - \frac{\pi\gamma.s^2 m_Q}{(2-\gamma)A} N^*$ $p_j = c + \left[\left(\frac{2v}{2-\gamma}\right)^{2-\gamma} \frac{F}{\pi Ywq(a)s^\gamma} \right]^{\frac{1}{3-\gamma}}$	$N^* = \frac{A}{\pi}\left(\frac{2v\pi Ywq(a)s^\gamma}{(2-\gamma)F}\right)^{\frac{2}{3-\gamma}}$	$\pi_i = m_Q \pi s^2 Yq(a)\left(1 - \left(\frac{ws^\gamma}{2-\gamma}\right)^{\frac{3}{3-\gamma}} \left(\frac{2v\pi Ywq(a)}{F}\right)^{\frac{\gamma}{3-\gamma}}\right)$
Social optimum	$p_i = c + \left(\frac{2vs^\gamma}{3-\gamma}\right)^{\frac{2}{3-\gamma}} \left(\frac{F}{\pi Ywq(a)}\right)^{\frac{1-\gamma}{3-\gamma}}$	$N = \frac{A}{\pi}\left(\frac{2v\pi Ywq(a)s^\gamma}{(3-\gamma)F}\right)^{\frac{2}{3-\gamma}}$	$\pi_i = 0$

[36] For *i* = *pharmacy* and *j* = *parapharmacy*

Chapter 5

Model's simulation

The model described in the previous chapter comprises different scenarios regarding regulatory changes in the retail of non-prescription medicines. To measure the impact of each normative change in this market a simulation of the theoretical model is carried out. Two complementary reasons justify the choice for simulation instead of estimation. First, the deregulation policy was introduced quite recently and its effects are still in progress, which makes any evaluation inconclusive. For example, the demand and retail supply of non-prescription medicines are sharply increasing[37], which suggests that some conclusions on the policy's results at the moment could be fallacious. Second, the limited data availability on the retail pharmacy in Portugal restricts the intentions of this dissertation to estimate the model both in terms of the cost structure of pharmacies and parapharmacies and in terms of the demand function. Hence, the simulation of the model is done based on an update of previous estimations of cost functions of pharmacies, on the demand of prescription and non-prescription medicines, and on the values of parameters suggested by the preceding literature.

[37] For instance, from October 2005 to December 2006 about 300 new parapharmacies entered in the market, and the quantity sold was roughly more than 800 thousand units. However, if we concentrate in the first quarter of 2007, we could see that the number of parapharmacies had increased by more than 50% and the consumption had reached almost the 700 thousand units only in this period.

5.1 – Cost structure of retailers

The cost functions of pharmacies and parapharmacies described in the theoretical model comprise both fixed and variable costs which are initially assumed to be equal for both types of retailers. Given this assumption, and the difficulty to get data from parapharmacies, a cost function of pharmacies was estimated in order to provide some empirical support to the simulation.

I use data from about 280 pharmacies[38] integrated in SABI[39] database of Coface Mope & Bureau Van Dijk, for the years 2000 to 2005. This dataset is the best publicly available source for this purpose. The main weakness of this source is perhaps that, since firms are not required to reveal the data to Coface, the data of a given pharmacy may fail to appear every year.

Equation (1) illustrates the estimation of pharmacies' cost structure evaluated at 2005 prices[40]. The dependent variable is the total cost (C), from which I subtracted extraordinary costs (this includes not anticipated costs which we expect to be on average approximately zero), i. e., it includes the cost of commodities (manufacturing cost of medicines) and all other operating costs. The explanatory variables used are the quantity (in units) of medicines sold in pharmacies (Q)[41], the establishments' fixed assets as a proxy of their dimension (FA), and time (T). Consequently, the autonomous parameter and the coefficient of Q provide an estimate of the fixed and marginal cost of pharmacies, respectively.

[38] This number slightly differs from year to year.

[39] Sistema de Análises de Balanços Ibéricos (SABI) is a comprehensive survey covering the 100.000 largest firms in Portugal in all sectors of economy. The data is mainly obtained through individual interviews, Diário da República and available balance sheets.

[40] The average cost of the medicines was used as an indicator of the retail price (RP) set by pharmacies The retail price in 2005 was about €16,6 according to INFARMED (INFARMED, 2005).

[41] The quantity of medicines was obtained by dividing the total business volume of pharmacies by the mean value of the retail price.

$$C = \underset{(5,18)}{44.474} + \underset{(91,83)}{14,85}\,Q + \underset{(11,34)}{0,00000015}\,FA*Q + \underset{(1,93)}{0,027}\,T*Q \qquad R^2 = 0,99 \qquad (1)$$

All variables are statistically significant at a 5% level[42]. The estimation suggests a fixed cost of around €44.500, which is slightly greater than the value estimated by Rodrigues *et al.* (2005). In addition, regression (1) suggests a marginal cost of €14,85 per package[43]. This implies a net retail margin of 10,5% on the retail price.[44] In regression (2) I also estimate the relation between cost and sales, which suggests the same net retail margin for pharmacies (1-0,894 ≈ 10,5 %), strengthening the robustness of the findings. The estimates are shown below.

$$C = \underset{(5,18)}{44.474} + \underset{(91,83)}{0,894}\,Sales + \underset{(11,34)}{0,000000009}\,FA*Sales + \underset{(1,93)}{0,0016}\,T*Sales \qquad R^2 = 0,99 \qquad (2)$$

In order to examine the presence of scale economies, I compute them for all provinces using the identity (*S*) derived in the theoretical model. Considering this indicator and that the average retail margin for 2005 was about 10%, I conclude that the breakeven margin, which guarantees the zero profit condition, is 2 to 6 percentage points lower than the current pharmaceutical retail margin.

[42] Estimation with fixed effects for pharmacies. The values in parentheses are the t-statistics.

[43] This measure of quantity is the more detailed assessment provided by the available data.

[44] Net retail margin = (RP – MC)/ RP.

Table 2 – Scale economies indicator and breakeven margin

Province	S	Breakeven Margin (ξ)	Population density
Aveiro	1,049	4,65%	22,6
Beja	1,090	8,28%	13,2
Braga	1,053	5,06%	20,8
Bragança	1,067	6,28%	17,0
C.Branco	1,050	4,76%	22,1
Coimbra	1,069	6,50%	16,5
Évora	1,057	5,41%	19,5
Faro	1,053	5,02%	21,0
Guarda	1,063	5,96%	17,8
Leiria	1,051	4,85%	21,7
Lisboa	1,053	5,02%	21,0
Portalegre	1,052	4,90%	21,5
Porto	1,053	5,02%	21,0
Santarém	1,076	7,10%	15,2
Setúbal	1,047	4,53%	23,1
V.Castelo	1,041	3,97%	26,2
Vila Real	1,062	5,86%	18,1
Viseu	1,056	5,33%	19,8

As predicted in chapter two and three, population density plays a significant role on pharmacies' decision to entry and on competition. Provinces which have lower levels of population density (e.g., Beja, Santarém, Coimbra and Bragança) need higher minimum margins in order to satisfy the breakeven point. On opposite, the breakeven margins are minimal where the population density levels are higher (e.g., V. Castelo, Setúbal, C. Branco and Aveiro).

5.2 – Per capita consumption

Despite the theoretical model assumes that the overall consumption of medicines does not vary with the increase in the number of retailers, some variables may influence consumers' spending on non-prescription medicines. For instance, it is likely that the mean distance between consumers and pharmacies (radius), and the per capita income have some impact on consumers' behavior. To test this empirically, I estimate the per capita consumption using data by districts (municipalities) provided by the National Institute of Statistics (INE)[45]. I used the logarithm (because of the long tail of the data) of the per capita sales volume of pharmacies (*Salespc*) as a proxy for the per capita consumption. The radius (the mean distance between consumers and pharmacies), per capita income (I), and the percentage of population with age superior to 65 years old (*Sup65*) are used as explanatory variables. The equation (3) shows the results of the estimation:

$$Sales_{per\ capita} = \underset{(23,53)}{5,01} + \underset{(1,52)}{0,048}\,Radius + \underset{(3,75)}{0,006}\,I - \underset{(-2,59)}{1,998}\,Sup65 \qquad R^2 = 0,15 \qquad (3)$$

[45] The available data is a sample of firms from the pharmaceutical retail sector (CAE 52310). This sample does not cover all pharmacies in each district, but I estimate the per capita sales volume per district by using a relation between pharmaceutical sales, population and the number of retailers. Furthermore, I also used the per capita sales volume of pharmaceutical retail provided by INFARMED. I found that the values from the two sources are very similar.

The variable *radius* is statistically not significant. This means that there is no statistical evidence to confirm the impact of the increase of the number of retailers on the per capita consumption[46]. All other variables are statistically significant, which denotes, for instance, that the per capita income has a positive effect on the per capita consumption of medicines. A 1% increase in the per capita income induces an augment in the per capita sales of 0,6%.

To support the robustness of the findings, I estimate the equation again, this time using data on the pharmaceutical per capita consumption (*conspc*) by province. I found that the results of both estimations are quite similar. Once again, there is no statistical evidence to support a relationship between the mean distance of consumers to retailers and the consumption.

$$Cons_{per\ capita} = \underset{(6,20)}{5,84} + \underset{(0,59)}{0,046}\,Radius + \underset{(0,19)}{0,035}\,I + \underset{(0,98)}{0,176}\,Sup65 \qquad R^2 = 0,21 \qquad (4)$$

Current data on per capita consumption of non-prescription medicines by province is shown in Table 2. The average proportion of non-prescription medicines on the ambulatory market is assumed to be the same for all provinces[47].

[46] Note that this result is based on total consumption of ambulatory market. Particular data only on consumption of non-prescription medicines is not available.

[47] The mean retail price for the ambulatory market in 2005 was €16,6. The proportion of non-prescription medicines (in units) on the ambulatory market was estimated to be around 17% by the Portuguese Pharmaceutical Industry Association (APIFARMA).

Table 3 – The per capita consumption of non-prescription medicines, in 2005

	Per capita consumption			
Province	**Total Ambulatory**		**OTC**	**Pharm pc**
	(Eur)	**(Q)**	**(Q)**	**(Eur)**
Aveiro	317	19	3,25	3994
Beja	319	19	3,26	2946
Braga	281	17	2,88	3874
Bragança	276	17	2,82	3730
C.Branco	356	21	3,64	3567
Coimbra	339	20	3,48	3126
Évora	402	24	4,11	3229
Faro	290	17	2,97	3775
Guarda	327	20	3,35	3143
Leiria	373	22	3,82	4077
Lisboa	299	18	3,06	3344
Portalegre	376	23	3,85	2765
Porto	282	17	2,89	4277
Santarém	362	22	3,71	3312
Setúbal	298	18	3,05	4458
V.Castelo	340	20	3,48	4063
Vila Real	307	19	3,15	3301
Viseu	305	18	3,13	3764

Source: INFARMED and APIFARMA

Although the data presented above is fairly macro, it is clear the absence of a positive relationship between the number of retailers and per capita consumption. It is easily observable that provinces with high levels of consumption have visibly low number of pharmacies per capita (e.g., Santarém, Évora and Portalegre) and vice-versa (Setúbal, Porto and Braga).

5.3 – Calibrating the parameters

The results derived in the last chapter for each scenario depend on the parameters τ, v *and* γ. The transport cost has been assumed, in the previous chapter, to be linear with the covered distance to a retailer. This implies that the sensibility of consumers to that distance is unitary, $\tau = 1$, *i. e.*, consumers will bear the same unitary cost for each additional unit of distance. As mentioned earlier, the assumption of linear cost in detriment of quadratic costs $(\tau = 2)$ is supported by empirical evidence (Rodrigues *et al.*, 2005)[48].

The unitary cost (per kilometer), v, is assumed to be greater than the costs of travelling by bus and lesser than the cost of taxis' service. Since I have assumed the cost function as linear with the distance $(\tau = 1)$, I use $v = 0{,}6$ Euro for every covered unit of distance (km).

The values for the parameter γ, which defines the impact of the increasing number of parapharmacies on the consumption of non-prescription medicines, should have into consideration the impact of the radius dimension on the per capita consumption of non-prescription medicines. For that reason, I assume $0 < \gamma < 0{,}3$. If γ assumes the value zero, then there is no substitution effect caused by the entry of parapharmacies. In the presence of such effect, γ takes the value 0,3 at maximum,

[48] The hypothesis of quadratic costs leads to large differences of costs bearded by consumers relative to short and longer distances. This means that the cost is considerably low for small distances but increases quickly with the distance.

which follows the impact of the variable radius on the demand of non-prescription medicines as suggested above.

5.4 – Simulation by province

Next, I simulate the main consequences resulting from the introduction of price competition and the liberalization of entry on the retail market of non-prescription medicines. I use data from the National Institute of Statistics (INE) and National Institute of Pharmacy and Drug (INFARMED) and I employ the results estimated above in this chapter and the assumed values for the parameters. The territorial unit of analysis is the province.

5.4.1 - The introduction of price competition

The introduction of price competition in a scenario in which there are only pharmacies in the retail market of non-prescription medicines is explained by two main reasons. First, I intend to measure the individual impact of the entry of parapharmacies. Second, more than 90% of the volume of non-prescription drugs is still sold in pharmacies. This illustrates the relative importance of pharmacies with respect to the other retailers in this market, and the significance of evaluating the impact of the liberalization only in the presence of pharmacies.

According to the theoretical model, the introduction of price competition in retail pharmacy would result in a final margin in the market of non-prescription medicines of $v\left(\frac{A}{\pi N}\right)^{\frac{1}{2}}$. As expected, this value depends on the mean distance of consumers to the pharmacies (influence area), measured by the transport cost.

Table 4 – The introduction of price competition on pharmaceutical retail margin

	Retail Margin			
Province	**2003**	**2005**	**Price competition**	
			v = 0,5	**v = 0,7**
Aveiro	1,89	1,7	1,11	1,55
Beja	2,14	1,85	3,92	5,49
Braga	1,02	0,72	0,99	1,38
Bragança	2,19	2,06	3,67	5,14
C.Branco	2,29	2,5	3,05	4,27
Coimbra	2,03	1,89	1,50	2,10
Évora	2,98	2,79	3,33	4,67
Faro	2,96	3,07	1,90	2,66
Guarda	2,19	2,29	2,80	3,92
Leiria	2,25	2,24	1,55	2,17
Lisboa	1,8	1,72	0,58	0,81
Portalegre	1,8	1,84	3,31	4,64
Porto	1,18	0,84	0,67	0,94
Santarém	2,04	2,1	1,96	2,74
Setúbal	2,11	2,19	1,47	2,06
V.Castelo	3,1	2,99	1,70	2,38
Vila Real	2,23	2,26	2,44	3,41
Viseu	1,8	1,68	1,81	2,54

The value of the retail margin for pharmacies with the introduction of price competition depends significantly from the assumption that is made about the unitary transport cost (v)[49]. Assuming that transport costs are linear ($\tau = 1$), the introduction of price competition in the presence of pharmacies would benefit (damage) consumers of provinces with relative higher (smaller) number of pharmacies per square km. The model predicts that provinces with very low population density do not allow pharmacies to reduce the retail margin due to the absence of scale economies Indeed, the distribution of pharmacies is strictly related to the population distribution as can be observed in Table 1. For that reason, the liberalization may increase prices in provinces where the competition is sparse and the influence area (market power) of pharmacies is higher. The increase of the unitary transport cost emphasizes the regional margin disparities, but the results are overall similar for *v=0,5* and *v=0,7*.

5.4.2 - The entry of parapharmacies

The results of the previous scenario and Table 2 suggest that the liberalization of the retail market of non-prescription medicines allows pharmacies to have higher retail margins than those necessary to have zero profit. Therefore, I expect that new entries arise in the market with the liberalization process. Nonetheless, the fixed cost faced by new entrants will determine to a great extent the number of entries. I assumed that in the long run the main fixed costs are establishment expenses (rental, medicines stock maintenance and other costs) and staff costs. Straightforwardly, I expect that parapharmacies support in average between one third (F') and one half (F'') of the pharmacies' fixed costs. Table 5 describes the current entries of parapharmacies and the simulated results.

[49] For remaining scenarios I will take $v = 0.6$, the value assumed initially.

Table 5 – The liberalization of entry

		ΔN		RM		
Province	**Current**	**Simulation**		**1st scenario**	**Simulation**	
		F'	**F''**		**F'**	**F''**
Aveiro	28	64	0	1,33	1,11	1,40
Beja	5	83	33	4,70	2,84	3,58
Braga	38	28	0	1,18	1,08	1,36
Bragança	1	63	25	4,41	2,64	3,33
C.Branco	6	94	38	3,66	2,18	2,74
Coimbra	27	65	0	1,80	1,44	1,81
Évora	4	98	42	4,00	2,29	2,89
Faro	44	82	12	2,28	1,67	2,10
Guarda	3	66	21	3,36	2,21	2,78
Leiria	25	106	24	1,86	1,31	1,65
Lisboa	133	0	0	0,69	0,78	0,98
Portalegre	3	64	24	3,98	2,46	3,10
Porto	72	0	0	0,81	0,81	1,02
Santarém	18	126	28	2,35	1,65	2,08
Setúbal	42	127	11	1,77	1,32	1,66
V.Castelo	12	56	12	2,04	1,43	1,81
Vila Real	7	65	16	2,93	2,02	2,55
Viseu	15	79	11	2,17	1,59	2,00
Total	483	1268	297			

When the ratio of fixed costs of parapharmacies is one third, the number of entries predicted by the model is much superior to the current entry of parapharmacies, for most provinces. For the values assumed, Lisboa and Porto show no entries of retailers in the market with the liberalization of entry. This means that for the current values of population density, the per capita consumption of non-prescription medicines, and the per capita density of pharmacies in these provinces, parapharmacies would entry only when the fixed cost is exceptionally low (about one sixth). The increase of fixed costs would lead to fewer entries as we observe in the third column. The model predicts these results because fixed cost are too high and because we also assume that the equilibrium derives only from the market of non-prescription medicines.

The retail margin (RM) derived from the entry of parapharmacies is lower for all provinces, except Lisboa, when the ratio of fixed costs is lesser than one third. Once more, the liberalization of entry and price competition would benefit consumers if the fixed cost of parapharmacies is sufficiently low. In addition, significant variables such as per capita consumption of non-prescription medicines and population density play a relevant role on entry and competition in this market.

5.4.3 - The substitution between prescription and non-prescription markets

Up to the moment, I have been assuming that there is no connection between prescription and non-prescription markets. In this setting I consider that the introduction of price competition and the liberalization of entry in the pharmaceutical retail of non-prescription medicines may induce consumers to substitute prescription medicines by non-prescription ones for non critical ailments. The extent of the effect of the substitution between markets will increase with γ, the parameter of adjustment. When $\gamma = 0$, the results obtained in the previous scenario are replicated. The possibility of substitution has implications on the quantities demanded of each type of medicines. As a consequence, and considering that more than 90% of pharmacies' sales are related to the prescription market, parapharmacies (Pph) and pharmacies will set different prices for non-prescription medicines. For this scenario I assume that the ratio of parapharmacies' fixed costs is one third.

Table 6 – Substitution between markets

Province	N				RM						
	$\gamma = 0$	$\gamma = 0{,}1$	$\gamma = 0{,}2$	$\gamma = 0{,}3$	$\gamma = 0$	$\gamma = 0{,}1$		$\gamma = 0{,}2$		$\gamma = 0{,}3$	
						Ph	**Pph**	**Ph**	**Pph**	**Ph**	**Pph**
Aveiro	262	275	290	308	1,11	1,14	0,80	1,17	0,42	1,20	-0,06
Beja	145	155	168	183	2,84	2,89	2,24	2,94	1,45	2,98	0,41
Braga	263	275	288	303	1,08	1,11	0,83	1,15	0,53	1,18	0,15
Bragança	108	116	126	137	2,64	2,68	2,02	2,73	1,21	2,76	0,14
C.Branco	161	173	187	204	2,18	2,21	1,54	2,25	0,70	2,28	-0,39
Coimbra	219	230	243	259	1,44	1,48	1,11	1,51	0,70	1,55	0,17
Évora	161	174	188	206	2,29	2,33	1,60	2,36	0,69	2,39	-0,51
Faro	204	216	230	247	1,67	1,71	1,27	1,75	0,76	1,79	0,10
Guarda	130	139	149	161	2,21	2,25	1,70	2,29	1,04	2,33	0,19
Leiria	236	251	268	288	1,31	1,33	0,85	1,36	0,28	1,39	-0,46
Lisboa	524	538	556	576	0,78	0,81	0,63	0,84	0,44	0,87	0,22
Portalegre	115	123	133	145	2,46	2,50	1,88	2,54	1,12	2,58	0,13
Porto	421	436	454	475	0,81	0,84	0,61	0,86	0,36	0,89	0,06
Santarém	284	301	322	346	1,65	1,69	1,21	1,72	0,64	1,76	-0,08
Setúbal	334	353	375	402	1,32	1,35	0,93	1,38	0,43	1,41	-0,20
V.Castelo	126	134	143	154	1,43	1,46	0,99	1,50	0,42	1,53	-0,32
Vila Real	141	149	160	172	2,02	2,06	1,57	2,11	0,99	2,15	0,23
Viseu	196	208	221	238	1,59	1,63	1,19	1,66	0,67	1,70	0,01
Total	4031	4246	4500	4802							

Under the new assumption, the number of entries enlarges and this increase is crescent with the substitution effect. Accordingly, the increase of parapharmacies would augment the quantity demanded of non-prescription medicines and would reduce the demand for prescription medicines. Incorporating such effect on their strategies, pharmacies and parapharmacies would respond with different price as can be observed in Table 6. Pharmacies would reply with lower prices in order to prevent further entries while at the same time trying to attract consumers. The gap between the two prices enlarges with γ. This means that the more consumers substitute one medicine by the other the greater are the price differences between the two types of retailers. Pharmacies would set, in the limit, price equals to marginal cost (*RM=0*) when the substitution effect is very significant ($\gamma = 0{,}3$).

5.4.4 – A social optimum

This equilibrium takes into consideration the minimization of the fixed costs of retailers and transport costs of consumers on determining the optimal number of retailers and price equilibrium. As a result the optimal number of pharmacies and retail margins (*SO*) are relatively inferior comparatively with those which result from the maximization of profit (*PM*). For this setting I assume that the ratio of parapharmacies' fixed costs is one third. Table 7 shows the results.

Table 7 – A social optimum

		Δ N		Δ RM					
Province	**PM**	**Social Optimum**		**PM**		**SO**	**PM**		**SO**
				$\gamma = 0{,}1$			$\gamma = 0{,}3$		
	$\gamma = 0{,}1$	$\gamma = 0{,}1$	$\gamma = 0{,}3$	**Ph**	**Pph**		**Ph**	**Pph**	
Aveiro	275	205	218	1,14	0,80	0,87	1,20	-0,06	0,92
Beja	155	116	130	2,89	2,24	2,28	2,98	0,41	2,55
Braga	275	205	215	1,11	0,83	0,84	1,18	0,15	0,88
Bragança	116	87	97	2,68	2,02	2,12	2,76	0,14	2,37
C.Branco	173	129	145	2,21	1,54	1,75	2,28	-0,39	1,96
Coimbra	230	172	184	1,48	1,11	1,13	1,55	0,17	1,21
Évora	174	130	146	2,33	1,60	1,84	2,39	-0,51	2,08
Faro	216	161	175	1,71	1,27	1,32	1,79	0,10	1,43
Guarda	139	104	114	2,25	1,70	1,76	2,33	0,19	1,94
Leiria	251	187	205	1,33	0,85	1,04	1,39	-0,46	1,13
Lisboa	538	402	409	0,81	0,63	0,60	0,87	0,22	0,61
Portalegre	123	92	103	2,50	1,88	1,97	2,58	0,13	2,19
Porto	436	326	337	0,84	0,61	0,62	0,89	0,06	0,65
Santarém	301	225	246	1,69	1,21	1,31	1,76	-0,08	1,43
Setúbal	353	264	285	1,35	0,93	1,04	1,41	-0,20	1,13
V.Castelo	134	100	109	1,46	0,99	1,14	1,53	-0,32	1,24
Vila Real	149	112	122	2,06	1,57	1,60	2,15	0,23	1,76
Viseu	208	155	169	1,63	1,19	1,26	1,70	0,01	1,36
Total	4246	3172	3409						

The optimal values derived from the social optimum are about three quarters of those resulting from profit maximization as predicted by theoretical model. The retail margins of the social optimum are slightly higher than those set by pharmacies in the previous scenario supporting the idea that pharmacies may lower prices as to dissuade parapharmacies to enter the market. Additionally, the optimal values derived from social optimum are less responsive to variations of γ since they regard to the minimization of both supply and demand costs whatever is the level of substitution.

Chapter 6

Concluding Remarks

Following other deregulation's experiences in the retail pharmacy in Europe, normative alterations have been introduced in the Portuguese retail pharmacy in order to soften the strict regulation in the sector and the excessive local market power of pharmacies. The Portuguese Government has evidenced three main reasons for supporting the changes introduced in this market. First, the former market structure of the Portuguese retail pharmacy and its normative environment allowed pharmacies to exert their local market power and to operate quasi-monopolistically. Second, consumers are likely to benefit from the increase of price competition in the market and better physical access to the non-prescription medicines. Finally, they propose that consumers may develop self-care, and specifically self-medication, as an effective way to prevent and take care of minor ailments. The potential substitution of medical prescription by non-prescription medicines for trivial diseases seems to be relevant to relieve the growing share of expenses on medicines on public health care spending. The introduction of price competition and the abolition of barriers to entry in the retail market of non-prescription medicines were carried out to achieve such objectives.

This dissertation has developed a framework for incorporating the recent changes in the regulation of the retail pharmacy and has analyzed the subsequent impact on the market structure, price and firms' profitability. A theoretical circular approach is used to examine these effects of introducing competition on the retail market of non-prescription medicines. The interaction between retailers is modeled as monopolistically competitive in a spatial dimension. This classical model of horizontal competition a la Hotelling has significant advantages with respect to Bresnahan and Reiss - type of entry and competition models, since it incorporates the effect of price on the exercise of the local market power.

Notwithstanding the limitations of data and the assumptions made in the theoretical model, significant results were achieved throughout this work. First, pharmacies will keep on playing a relevant role in retail market of non-prescription medicines. In fact, comparing with the main European countries (e.g., Germany and U.K.) the Portuguese per capita distribution of pharmacies is high, and their current share in the market of OTC drugs is over 90%. Moreover, pharmacies have two unarguable advantages over parapharmacies: the inherent reputation of their healthcare support, and the possibility of attracting consumers via market of prescription medicines. Hence, the introduction of price competition, even merely amongst pharmacies, will benefit most of the Portuguese population as suggested by the simulation. Nevertheless, given the full liberalization of price, pharmacies may enlarge their margins in provinces (with low population density) in which they have high market power[50].

Second, the model predicts that the entry of parapharmacies will benefit consumers by decreasing transport costs as well as the retail price. The fixed cost faced by new entrants will determine to a great extent the number of entries and the magnitude of the benefits to consumers. When the fixed cost of parapharmacies is between one half and one third of pharmacies' fixed costs, the entry of parapharmacies will benefit most consumers. However, in the provinces of Porto and Lisboa, the number or retailers decreases with the liberalization when we consider these values for fixed costs. Given the current values of population density and the per capita consumption of non-prescription medicines in these provinces, parapharmacies would entry only when the fixed cost is exceptionally low (around one sixth).

Third, pharmacies may be induced to prevent the entry of new entrants as consumers increase their self-medication practices. In this dissertation it is suggested that the greater availability of non-prescription medicines with the entry of parapharmacies may induce consumers to increase the consumption of these medicines in substitution of prescribed medicines for non-critical ailments. Despite the

[50] For instance, in the retail market of prescription medicines the price regulation was relaxed allowing pharmacies to set only lower prices for medicines but not higher than the regulated price set by government.

strengthening of this assumption I believe that the larger accessibility of OTC drugs is likely to have impact in the levels of self-medication. As a result, the share the retail market of non-prescription medicines may increase and come up to the levels for the Anglo-Saxon countries.

Finally, the simulation supports that the optimal values derived from the profit maximization condition are fairly superior of those resulting from maximizing social welfare, as advocated by Rodrigues *et al.* (2005). Furthermore, and remarkably, it is suggested that the retail margins of the social optimum are higher than those set by pharmacies, supporting the idea that pharmacies may diminish their prices to discourage entry of further parapharmacies in the retail market.

Notwithstanding these results, the work presented here has some limitations. The main weakness of the theoretical model is perhaps that I have assumed that pharmacies maximize their profit only in order to the non-prescription market. This means that they are competing with parapharmacies ignoring the effect of the market of prescription medicines while formulate their price strategies. In fact, the price regulation in the market of prescription medicines has also been recently relaxed, providing scope for such work. For this reason, further work should be done allowing a relation between price strategies of both markets of prescription and non-prescription medicines.

In addition, the linear segregation of costs may be arguable, since marginal costs of pharmacies are not clearly distinct for both types of medicines. For instance, it could be adopted a Cobb-Douglas cost function as employed by Waterson (1993), which confers a non-linear connection between costs of the two markets.

The data employed is far from fairly satisfactory, and has constrained to a certain extent the empirical work of this dissertation. Further work should make use of more detailed data on cost structure of pharmacies and parapharmacies, and per capita consumption segregated by prescription and non-prescription medicines as well.

Regardless of the limitations pointed above, the overall work of the dissertation has noteworthy theoretical and empirical substance as regards the economics of spatial competition and pharmaceutical retail. In the theoretical perspective, this work extends

the original theoretical model by introducing asymmetric retailers and the possibility of substitution between the demands of two products. It is suggested that retailers indeed do react differently depending on whether the substitution effect is negative or positive.

The empirical relevance of the dissertation is that it mainly helps to describe and measure the impact of the changes operated in the Portuguese retail pharmacy, in order to support governmental policy-making. It is suggested that the liberalization of price and entry benefit consumers by decreasing transport costs and retail price as well. The introduction and intensification of competition emphasizes the relevance of demand intensity, fixed costs, and transport cost on explaining the spatial distribution of retailers in the market.

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