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Determinants of out-of-pocket pharmaceutical expenditure and access to drugs in Catalonia

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Abstract

This paper examines the determinants of the demand for pharmaceuticals in the Spanish Autonomous Community of Catalonia using the latest available official survey data. Having accounted for the individual differences in cost-sharing among consumers, as well as the influence of self-medication, the paper builds a model of the (household) determinants of pharmaceutical expenditure and consumption. The econometric application deals with the infrequency of purchases and the non-distinction between out-of-pocket spending and drug cost sharing. The empirical evidence suggests that income and the variables accounting for cost sharing were significantly associated with drug use but not drug expenditure. Furthermore, gender, health status and having health insurance appear to be significant predictors. Access to pharmacies increases both drug use and expenditure; self-medication also increases drug expenditure as expected. These results are relevant for the entire Spanish case where current reform proposals have recommended the introduction of means-tested income-related rather than age related co-payments. The same applies to the need for controlling self-medication which results from individual behaviour of consuming medicines for minor ailments without a prescription and which can be acquired OTC and are priced cheaply.

Keywords: pharmaceutical expenditure, demand for pharmaceuticals, cost containment, user charges and cost-sharing, household budget surveys, Catalonia, Spain.

JEL classifications: I11, I18

1. Introduction

Pharmaceutical spending is the most dynamic component of health care expenditure in most European Union (EU) countries (Mossialos and Le Grand, 1999). However, research on the determinants of pharmaceutical expenditure is still limited. Studies indicate that, in addition to price regulation, pharmaceutical expenditure is sensitive to cost sharing (Newhouse et al, 1993). The understanding of the causes of pharmaceutical expenditure requires an examination of the process leading to the demand for medicines. Conceptually, the demand for prescription drugs results from the physician-patient agency relationship. The physician takes into account the patient's utility and, arguably, the costs of prescribing to the health insurer as well as the patient in the presence of cost sharing arrangements (Hellerstein, 1994, Dranove, 1989). Patient insurance is argued to affect doctor's prescribing decision as well as patient consumption (Pavcnik, 2000). Indeed, the physician may be acting as a perfect agent for the patient; he might not be a perfect agent for the (public or private) insurer (Feldstein, 1976).

One of the most frequently used tools to control utilisation of health care resources, and, indirectly, health care expenditure, is cost-sharing, whereby the patient bears part of or the entire cost of health care use. Cost sharing has been found to reduce health expenditure with limited effects on health (Manning et al, 1993; Newhouse et al, 1993). Additional research indicates that high cost-sharing rates increase compliance with medications (Dor, 2004). Further evidence suggests that most of the effects of cost sharing are determined by the numbers of prescriptions filled (Leibowitz *et al*,1986). Indeed, the rationale for introducing co-payments for pharmaceuticals relates to the pursuit of controlling potential physician/consumer moral hazard in prescribing/consuming drugs without bearing the costs for the health system (Cossley et al, 2000). Even though rising costs may justify insurance coverage to reduce the burden of out-of-pocket drug spending (Stuart et al, 2000) significant moral hazard effects may induce individual drug consumption to rise. Nonetheless to reduce moral hazard, cost sharing is employed by most of European health systems either in the form of a fixed fee (Germany (until end-2003), Ireland and the United Kingdom) or co-insurance, whence the insuree pays a proportion of the price (Spain, Greece, France), or a deductible, where the insuree pays a fixed amount out-of-pocket before health insurance coverage kicks in (Sweden, Denmark, Norway, Finland), or, most often, a combination of the above. Yet, the effectiveness of co-payments in containing expenditure and improving system efficiency is disputed (Tamblyn et al, 2001). In Spain, effective cost sharing in pharmaceuticals has declined progressively between 1986-2000 while real pharmaceutical expenditure has

increased significantly as Table 1 shows. There is also some evidence arguing that elderly patients are using their exemption rights under the Spanish NHS to fill prescriptions on behalf of their relatives in order not to pay the statutory co-payment (Costa-Font and Puig, 2004; López-Bastida and Mossialos, 2000). This feature points to the need of examining the determinants of drug consumption and expenditure to assess which predictors have an impact on household consumption, and whether co-payment determinants, such as age and disability significantly influence expenditure. Furthermore, in examining the association between income and expenditure on the one hand and demand for drugs on the other, one might determine whether the current co-payment structure might determine access to drugs and expenditure patterns. Co-payment structures not linked to income could lead to inequality in accessing medicines. Evidence suggests that subsidising prescription drugs to elderly in Canada turns out to be less beneficial compared with what would have been if the same amounts had been put into a programme of fixed cash transfers paid equally to all households (Alan *et al*, 2002).

[INSERT TABLE 1 ABOUT HERE]

Previous studies on the demand for health care in Spain from household budget surveys have tended to exclude the demand for pharmaceuticals, mainly because the existence of statutory patient co-payments limits the likelihood of identifying its influence with accuracy (López , 1998). Only one study estimated the effects of co-payments using aggregate data and found a low-price elasticity (Puig, 1988). Evidence from the US suggests that insurance coverage for pharmaceuticals increases the use of and expenditure on prescription drugs, and may lead to a reduction of out-of pocket expenditures (Lillard et al 1999; Coulson et al, 1995). However, there is still little evidence of this phenomenon in European countries including Spain.

In this context, the objectives of the paper are twofold: first, to estimate the impact of the variables influencing cost sharing and the individual demand for pharmaceuticals. Second, to analyse whether demographic, socio-economic and health status characteristics influence the out-of-pocket demand and expenditure for pharmaceuticals along with the influence of self-medication. Therefore, the dependent variables are (a) individually adjusted household pharmaceutical expenditure and (b) whether household respondents have consumed drugs in the last month. Thus, this study deals with the determinants of the access to pharmaceuticals and out-of-pocket expenditure along with other potential determinants

such as demographics, the impact of self-medication, socio-economic and health status variables, and the presence or not of chronic conditions among respondents. We employ a two-equation model to estimate the determinants of pharmaceutical expenditure due to the censoring nature of the data. In explaining drug use we also employ a sample selection model (Heckman, 1978) to capture the potential influence of physician gate-keeping in accessing prescription medicines. From the variables included in the model we are in a position to investigate the influence of cost sharing policies, self-medication and income effects on the demand for pharmaceuticals.

Section two provides a description of the market for medicines in Spain as well as the regulatory features of the Spanish pharmaceutical market. Section three develops the theoretical model and the expected determinants. Section four analyses the empirical specification and section five discusses the results. Finally, section six draws the main conclusions.

2. The Spanish Pharmaceutical Market and Regulation

The Spanish National Health System (NHS) is tax-funded and provides universal and free health care coverage, with some exceptions such as non-refundable co-payments for prescribed pharmaceuticals. The general rate of co-payment for drugs has remained at 40% since the early 1980s. However, prescription medicines for pensioners and medicines consumed in hospitals are provided free of charge, and chronically ill patients under 65 (for example, diabetics) only pay 10% of their prescription drug costs, with a price cap of €2.64 per prescription item. Private health care outlays account for 20% of total health care outlays in Spain. Approximately 15% of the population has supplementary private health insurance, which does not cover prescription drugs. In the early 1980s the NHS underwent radical reform, with the gradual introduction of a decentralised model involving the creation of 17 autonomous regional health services, corresponding to the 17 Autonomous Communities (ACs) into which Spain is divided. These regional bodies have political responsibility for health care, although, with the exception of Navarre and the Basque Country, they remain financially dependent on the central government.

The market for pharmaceuticals in Spain comprises three main segments: (i) over-the-counter (OTC) medicines for which consumers pay the entire cost out-of-pocket (which may include vitamins and other supplements), (ii) prescription medicines (patented novel medicines, branded and unbranded generics) sold under NHS GP prescription which are subjected to co-payments depending on patient characteristics and (iii) medicines purchased

through a private prescription, where the consumer bears the entire cost out-of-pocket. Prescription drugs account for approximately 92% of total pharmaceutical expenditure and 85.5% of the total market by volume, with OTCs accounting for the remainder (Costa-Font and Puig-Junoy, 2004). Although the Spanish NHS provides comprehensive drug coverage, patients purchase a significant proportion of all drugs consumed as OTC. OTCs are mainly analgesics (19% of total OTC expenditure), cough and cold preparations (17%), respiratory system drugs (16%), dermatological drugs (11.9%), and laxatives, vitamins and supplements (6%). The prescription market dominates pharmacists' sales. On average, prescription drugs are three times more expensive than OTCs[1]. In the 1990s, there was some debate on the hypothetical effects of cost-containment policies (such as introducing a negative list and implementing additional barriers to obtaining prescriptions for less expensive drugs) on the development of the OTC market, since OTCs can be advertised directly to the consumers whereas prescription drugs cannot. However, the volume of OTCs has remained stable over time; though expenditure increased by 7.5% between 1990 and 2001, the market for prescription drugs increased significantly in terms of both number of packs (1.5% increase annually) and sales growth (10.7% increase)[2]. In an environment where direct-to-consumer (DTC) advertising is banned for prescription drugs, promotional campaigns that are indirectly linked with prescription-only medicines focus on GPs only, whereas they do focus on the general public through TV advertising in the OTC market.

Pharmaceutical regulation comprises measures on the supply-, proxy demand- and demand-side. Supply-side policies comprise intervention on the prices of medicines, whereas proxy demand-side policies deal with the prescribing and dispensing of medicines. Finally, demand-side policies target patients, through cost sharing. The central government in Madrid is responsible for setting prices of medicines and determining the overall cost sharing and reimbursement strategy at national level the latter with the participation of representatives from the 17 autonomous communities, whereas the regions, including Catalonia, are responsible for implementing national policy and paying providers within their jurisdiction. Experiments with proxy demand policies, for instance on prescribing, have been observed at regional level. Controlling pharmaceutical expenditure is one of the main policy priorities of the Spanish NHS. Pharmaceutical expenditure accounts for 1.2% of GDP and has risen systematically since the establishment of the NHS in 1986. In the 1990s, expenditure growth has been driven by volume increases rather than pharmaceutical price inflation (Costa-Font

[1] Average (per pack) prices were €6.07 for prescription drugs and €2.05 for OTCs in 2001.

and Puig, 2004). Decentralisation of the Spanish NHS has meant that each of the 17 autonomous regions has had significant flexibility in organising and delivering health services. Catalonia was the first autonomous region to have obtained responsibility for health care organisation and delivery in 1981. Regional health services are only partially responsible for pharmaceutical care, especially in promoting generic pharmaceuticals and prescribing policies, whereas the central government, through the Ministry of Health (MoH) and other interdepartmental commissions and agencies, undertakes drug registration and licensing and sets drug prices. Pharmaceutical expenditure accounts for roughly 20% of total public health care expenditure in Spain, making this share one of the highest in the EU.

2.2 Supply-side policies and pricing of pharmaceuticals

Price regulation of pharmaceuticals is mainly based on the decision of a Commission at the Spanish Ministry of Health and Consumption (MoHC) that determines the *maximum reimbursable price* for every pharmaceutical speciality. This price includes generics but excludes OTCs. Drug prices differ depending on the setting in which they are sold. For instance, drugs sold to hospitals, attract discounts to payers that are explicitly contemplated in the maximum price setting that the MoHC undertakes. Drugs consumed on an outpatient basis include wholesale and retail margins on top of the ex-manufacturer price.

A special Commission on rational drug use determines reimbursement policy where the 17 autonomous regions as well as the pharmaceutical industry, consumers, trade unions, professional associations and experts designated by the Ministry of Health are present. The objective of this Commission is to consider drugs for inclusion into the reimbursement (positive) list. The general criteria for inclusion are: a) the characteristics of the disease, b) the inclusion of inpatient groups, c) the drug's therapeutic benefit, d) public expenditure limitations, and e) the existence of therapeutic alternatives. OTCs are excluded from reimbursement, unless prescribed by a physician. 68% of prescribed drugs are subject to co-payments.

With the passing of the General Health Act in 1986, GPs became integrated into the public network. The act improved the general public's access to primary care. However, it has also led to an increase in the number of GP visits, a development likely to have had some influence on the number of prescriptions. As GPs are paid on a fixed salary basis, they have few incentives to prescribe efficiently, and it was not until the 1990s that some contracts with

[2] It is has also been estimated that the 6% of prescription drugs are dispensed without a prescription.

providers that took into account prescribing expenditure. Financial incentives were introduced in Navarre (1998) and in Catalonia (1999) to encourage primary care physicians to prescribe drugs "cost-effectively" and increase their prescribing of generics; GPs were also subjected to stricter control over both efficiency and quality. Furthermore, primary care pharmacists were established in 1995 to monitor prescribing patterns and to offer advice to consumers on suitable pharmaceutical treatments.[3]

Prescribing policies are based on practice guidelines developed at the regional level. Physicians –both GPs and specialists- are paid a salary partly determined by incentives linked to prescribing quality. Generics are being extensively promoted through a reference price system albeit penetration is less that 6% of total market volume. Proxy demand-side policies implemented in Spain mainly refer to the introduction of stricter prescribing controls, although there is still evidence of significant clinical variability, the introduction of de-listing policies in the form of "negative lists" for drugs for minor ailments, and the establishment of fixed budgets for pharmaceutical spending. Despite the proliferation of policies on the proxy-demand, the robustness with which they have been implemented and their effectiveness in containing pharmaceutical costs have been disputed in the literature (Lopez and Mossialos, 2000).

Although the statutory nominal co-payment rate for pharmaceuticals has been 40% for most drugs since the early 1980s, the *effective co-payment rate* (i.e. the rate taking into account exemptions and log-term illnesses) has declined from 15% in 1985 to 7% in 2002, and this was deemed responsible for an increase by 0.4% annually in the share of pharmaceuticals in total public health care expenditure during that period (Costa-Font and Puig, 2004). As a result, cost sharing levels in Spain are among the lowest in the EU. Simultaneously, the share of pharmaceutical spending of the retired population (who amount to around 15% of the total population and are exempt from co-payments) practically doubled (from 39% to 72%) between 1985 and 2002. As Table **1** shows, the share of retired consumers increased significantly from around 60% at the end of the 1980s to 72% in 2002. This partially reflects an increase in the number of retirees, who have significantly higher consumption patterns than non-retirees. Whilst expenditure per active individual was below €60 in 2000, expenditure per pensioner in 2003 amounted to €140 (Costa-Font and Puig-Junoy, 2004).

[3] The information system to be developed in the near future for a national prescription monitoring system – through the so-called Independent Prescription Identification Terminal – might be used to identify and warn physicians who are judged to be overprescribing.

3. Theoretical Background and Empirical Application

3.1 The model

Standard economic theory suggests that the demand for pharmaceuticals derives from the individual demand for health care following the Grossman tradition (Grossman, 1972). Agents employ time and health care inputs -both intangible (medical care) and tangible (pharmaceuticals) - to fulfil demand for health. Let us follow state-dependent demand analysis and assume that each household/individual *i* maximises a utility function subject to a budget constraint. As a result an indirect utility function can be isolated that will depend on the health status of the individual whether sick or not. If sick, the individual will consume a certain drug (*k)* depending on the percentage of individual income (y) it absorbs (which would be reduced or eliminated by means of existing co-payments), prices (p) of drugs and substitute treatments, and other characteristics (z). However, when the individual is healthy, the value of drugs is null and thus utility can be reduced to individual income as follows:

$$v_{hi} = \begin{cases} v_{ik}(x_i, p_k, z_i) \text{ if sick} \\ v_{ik}(x_i) \quad \text{if healthy} \end{cases} \qquad (1)$$

where y_i is the total expenditure per household that is assumed to be equal to disposable income, p_k refers to prices and z_i is a vector of household characteristics. Under the Roy's identity, following Alan et al (2002), a percentage increase in prices under the assumption of sickness leads to:

$$\frac{\partial v_{ik}}{\partial p_k} = -q_{ik} \frac{\partial v_k}{\partial y_i} \qquad (2)$$

where q_{ik} is the quantity consumed of drug k by the household i, so that a rise in prices will reduce welfare proportionally to the income reduction from facing the drug prices times the quantity of drugs consumed. Accordingly, the demand for drugs will be constrained by the following explanatory variables: health status (h_i) as determining need and sickness, income (y_i) which influences the capacity to cope with larger cost-sharing and prices of drugs, and

the prices for pharmaceuticals (and thus the individual –specific cost-sharing characteristics) (p_{ik}) which can be approximated by the influence of proxy variables such as 'age' and 'disability' although part of the effects might be associated with health deterioration. Finally, our model includes a number of specific variables affecting the consumption of medical and pharmaceutical products (z_i). Those variables include education attainment, (Kenkel, 1991), and self-medication, the latter determining the extent to which an individual might pay for medicines out-of-pocket. Therefore, we can model the demand for drugs (q_{ik}) as dependent on those variables as follows:

$$q_{ik} = q(h_i, p_{ik}, y_i, z_i) \qquad (3)$$

where the expected marginal effects would be $\frac{\partial q_{ik}}{\partial h_i} \geq 0, \frac{\partial q_{ik}}{\partial p_{ik}} \leq 0, \frac{\partial q_{ik}}{\partial y_i} \geq 0$ while the effect of specific determinants might exhibit different signs.

3.2 Household determinants of pharmaceutical expenditure

Given (3), demand analysis under price heterogeneity[4] leads to examining out-of-pocket pharmaceutical expenditure ($Q^*_{ik} = p_{ik} x q_{ik}$) measured in logs, the set of determinants (such as cost-sharing characteristics [p], changes in income [y], health status [h], as well as other specific characteristics [z]) and the error term (μ). Furthermore, given the co-payment structure we just observe the out-of-pocket expenditure rather than total expenditure. Therefore, we proceed by formulating a two-stage model that takes into account the censored nature of the data as follows:

$$\begin{aligned} Q^* &= X\beta_i + \mu \\ Q &= 0 \text{ if } Q^* \leq 0 \\ Q &= Q^* \text{if } Q^* > 0 \end{aligned} \qquad (4)$$

[4] Drugs are products subject to substantial product and price differentiation; therefore it is impossible to estimate adequate household specific price index.

This specification allows accounting for a number of zero responses appearing due to the existence of the cost sharing policies (not paying the co-payment versus paying the co-payment) and X refers to all explanatory variables. In a first stage we examine the determinants of some drug consumption using a probit model $pr(Q > 0 / X)$ and in a second stage we examine $E(Q / Q > 0 / X)$. If Q measures household out-of-pocket expenditure on pharmaceuticals, the coefficient in logs is interpreted as elasticities[5]. Because information on the controlling variable (health status) is at the individual level we have excluded this variable from the expenditure function, which will serve, jointly with self-medication, as an identification variable. Furthermore, because drugs are not consumed on a day-to-day basis, one might expect to find a censoring problem. Therefore, we employed a two-part model where in a first stage we examine the determinants of any pharmaceutical expenditure and in a second stage we examine the determinants of pharmaceutical expenditure given that the household has undertaken some expenditure. Finally, to test for the potential existence of sample selection we employed the Heckman correction (Heckman, 1979).

3.3 The determinants of the pharmaceutical consumption

A further question that arises refers to the determinants of access to drugs. Because the access to drugs might depend on previous referral from a GP, we model and estimate a joint process involving the choice of consuming a particular drug and whether or not this arose from a visit to a GP in order to obtain a prescription for it.. Let D* denote the demand for drugs, let V* be the benefits from visiting the physician and let W and K be vectors of explanatory variables for the valuation and participation equations respectively which contain the same explanatory variables as in (3). Then we can write:

$$D^* = \gamma' W + \eta_i \qquad (5)$$

and

$$V^* = K' \delta + \varepsilon_i \qquad (6)$$

We cannot observe both D* and V*, but we can observe D and V taking a value of 1 if there is respectively some drug consumption and whether there is a visit to a GP. Therefore, from (5) and (6) we can write the bivariate normal distribution as $BivN \sim$

[5] Examining elasticities is important because I might be informative on the effects of subsidies on drugs. Indeed, subsidising more those commodities whose consumption tends to fall with income. Thus, income elasticity

$(z_i'\delta, x_i'\beta, \rho)$ with zero means, variances equal to 1 and ρ denoting the correlation matrix of the error terms of the two processes underlined in (5) and (6).

4. Data and variables

4.1 The data

In order to estimate the determinants of the demand for pharmaceuticals, we used data from the 1994 Catalan Health Survey, which is the latest available. This is a general health survey that contains detailed data on pharmaceutical expenditure and use and is representative of the Catalan population All policies mentioned above regarding pricing, reimbursement, and other cost containment measures for pharmaceuticals within Spain, also apply to the case of Catalonia. The survey also contains information on medical utilisation and expenditure and has 15,000 observations in individual and household format. Although the survey does not contain explicitly the co-payment rate for pharmaceuticals, this information has been approximated by two main variables: age (if the individuals is over 65, then the co-payment is zero) and disability (co-payment is reduced to a 10% if individual is disabled). In all other cases, the co-payment should be 40% per prescription item. The mean individual age is approximately 40 and about 3% of the population has some disability, which entitles them to a low co-payment rate. Furthermore, the survey contains information on the individual's family income and education, which provide an indication of the role of socio-economic position as influencing the demand for drugs. Household size can reveal preferences about lifestyle as well as potential household-specific disease patterns. For identification purposes, we include whether the individual 'smokes' or not to control for potential individual-specific health care need. The same applies to private health insurance entitlement (PHI) which might be an important determinant of access to private health care (Vera, 1999) and accordingly to the consumption of drugs on an out-of-pocket basis, since PHI does not cover drugs. The survey allows identifying individual self-medication through a set of questions on whether the household has purchased drugs without obtaining a physician prescription that points out the presence of self-medication. Finally, we have included other relevant characteristics such as the pharmacy density and doctor's density in the specific sub-regions in Catalonia, which is informative on potential access effects on pharmaceutical consumption.

provides come information on whether or not to subsidize certain goods.

4.2 The variables

Table 2 contains the description of the variables employed in the study. We separate the dependent variables (out-of-pocket expenditure [Q], drug use [D] and GP visits [V]) from the explanatory variables (household size, gender, age, disability, education, smoking, private health insurance, self-medication, doctor density in region and pharmacy density in region). Out-of-pocket expenditure refers to the declared household pharmaceutical expenditure in the last 30 days and drug use refers to the consumption of drugs in the last 30 days. Health status is measured by a self-reported assessment of health (where 4 refers to excellent health and 1 refers to bad health). We have also included household size for two reasons. First, out-of-pocket pharmaceutical expenditure might reduce total household expenditure. Second, the larger the number of family members the more likely it is that drug consumption may be the result of intra-household health effects of specific illnesses (especially for minor conditions). Female gender is commonly associated with higher consumption of health care goods and services and male gender is more closely associated with smoking than female gender. Education influences health related information which, in given the assumptions of Grossman (1972) is envisaged as increasing the productivity of health production. Disability and age are variables, which are linked to specific cost sharing structures. In our model we have included age squared in order to distinguish between the specific effect of age in general, and that of an advanced age where the individual is likely to be entitled to free prescribed medicines. Income and private health insurance are variables associated with the individual's capacity to bear the costs of out-of –pocket pharmaceutical expenditure as well as the likelihood of obtaining private prescriptions, which might lead to out-of pocket consumption. Finally, pharmacy density and doctors' density are variables, which are associated with access to drugs.

[TABLE 2 ABOUT HERE]

5. Results

The results of the econometric approach followed are summarised in Table 3 and are grouped under Model (1) and Model (2). All models were estimated using conventional OLS when estimating expenditure and using probit analysis when the data was dichotomous. Model (1), reports the results of the two-part model for the determinants of out-of-pocket pharmaceutical expenditure [Q] and pharmaceutical use [D]. Model (2) contains a Heckman selection model examining the determinants of drug use [D] accounting for the likely effects

of visiting a physician (GP) and obtaining a prescription [V]. Before proceeding with running the models, we first tested for selectivity in each of them. We found no evidence of selectivity in Model (1) using the conventional Mills Lambda whereas there is selectivity in Model (2) as the ρ is significantly different from zero and has a positive coefficient (Table 3). The latter indicates that a joint estimation, as employed in this case, is necessary and that a one-equation estimation would produce biased estimates. Furthermore, the difference in the coefficients of drug use [D] would result from heterogeneity since drug use can be the outcome of GP prescribing behaviour. This is a unique feature of pharmaceutical consumption, at least in what concerns prescription medicines, and is very often the consequence of a prior decision to visit a doctor from which a prescription isissued. Conventional specification tests are reported and indicate acceptable explanatory power and a joint significance for the estimated models.

With regards to the results of Model (2), examining those variables that account for the effect of cost sharing we find that although age determines drug use [D] disability does not (Table 2, model (2) – left panel. Thus, having a 0% co-payment rate for the retired elderly increases significantly the demand for pharmaceuticals as expected. By contrast, in Model (1), expenditure [Q] is determined by disability rather than age (Table 3, Model (1) – left panel). This affects results from the fact that the elderly are excluded from co-payments and therefore they undertake very limited out-of-pocket expenditure on pharmaceuticals. In addition, elderly patients have an incentive to contact their GPs and receive prescriptions which can be filled free of charge, and which might otherwise be considered OTC and payable fully out-of-pocket. On the other hand, individuals suffering from some chronic disability may incur expenditure both through filling prescriptions as well as paying out-of-pocket for drugs. When correcting by potential sample selection (Model (2)) for those visiting a GP then age is not significant, suggesting that potential barriers in accessing drugs might be influenced by a previous visit to a GP. Gender does exert some effect on drug consumption. Males are less likely to use drugs and more likely to consume out-of-pocket than females (Model (1)). However, when we turn into the selectivity corrected in Model (2) we find that males are less likely to visit the GP and accounting for this feature, are more likely to use drugs than females. Again, this result confirms that the potential heterogeneity resulting from GP visits might exert significant influence on the results. Other relevant control variables are household size and health status, both of which are statistically significant and positively associated with drug use and expenditure, and in accordance with the Grossman tradition

(Grossman, 1972). Furthermore, smoking is found to be positively associated with higher out-of-pocket pharmaceutical expenditure and a higher drug use. However, when drug used is corrected by potential visits to the GP we find that smoking was not significant anymore and it turns to be determining a reduced access to the GP.

Possibly one of the most interesting results from the study is the lack of significance of income in predicting out-of-pocket expenditure on drugs while helps predict a significant effect on drug use even when correcting for the estimated parameter by the potential sample selection. This result is in line with Stuart et al (2000) and suggests a small elasticity of demand for drugs. The fact that income explains drug use but not expenditure might suggest that due to the co-payment structure, some individuals might refrain from consuming drugs and might instead consume alternative health care free-of-charge. On the other hand, pharmaceuticals as an input to the health production process are not demanded unless the individual is ill, and thus income plays a small role here once having controlled for health status. Education has some effect on out-of-pocket expenditure suggesting a limited, although potentially important, role of information in drug expenditure. In addition, education is inversely related to the degree of access to the system. This indicates that the lower the education attainment the higher is the access to the GP, most likely to obtain valuable health information.

Finally, two interesting findings point to the importance of access to medicines and the importance of self-medication. Self-medication is estimated as a control variable for out-of-pocket health expenditure and displays a positive coefficient as expected.The positive and significant effect of pharmacy density even when accounting for potential sample selection indicates that there is an access motive in the demand for medicines which influences both drug use and out-of pocket expenditures. Finally, those individuals that have private health insurance (PHI) are more likely to report some drug use although that does not significantly influence out-of-pocket expenditure. This could be because private health insurance in Spain provides a faster access to the GP compared with statutory health insurance provided by the NHS. On the other hand, PHI might be correlated with some of the unobserved variables associated with drug access such as income, risk aversion and health information among other determinants.

5. Discussion

This paper has sought to analyse the determinants of the demand for pharmaceuticals and out-of-pocket expenditures in Catalonia (Spain). Consistently with previous literature, the paper has specifically dealt with individual characteristics of the demand for pharmaceuticals (Stuart, 2000; Poisal et al, 2000). However, in examining the results, one important distinction may be drawn between individual and economic determinants. This distinction is important because although individuals may need to consume specific drugs with or without a prescription, out-of-pocket expenditures may be associated with specific economic determinants (eg. income or having private health insurance). Indeed, consistently with the existing literature, individual characteristics such as ill health and gender appear to be important determinants of the demand for drugs. Empirical evidence from the US suggests that a large proportion of prescriptions for Medicare beneficiaries is associated with individuals reporting several co-morbid illnesses (Stuart et al, 2000). Gender is also a relevant determinant and women were shown to spend more out-of-pocket for drugs than men. This can be partly explained by the prevalence of conditions primarily affecting women after age 55. Age and disability are also important in determining access to drugs and in explaining out-of-pocket pharmaceutical expenditure. Our evidence suggests that due to the prevailing cost-sharing structure in Spain and Catalonia variables such as age and disability might have different effects on pharmaceutical expenditure and use compared with other studies. As expected from the prevailing cost sharing structure in Catalonia, age appears to be a significant determinant of drug access but not of out-of-pocket expenditure while disability is the other way around. The literature also identifies disability at young age as a relevant determinant of pharmaceutical expenditure. Poisal et al (2000) find that disabled beneficiaries under the age of 65 spend almost twice as much as those over the age of 65. However, the relevance of age is not entirely clear in that although age and health status are associated with expenditure, personal drug costs for chronically ill patients appear to be lower than for other age groups due to cost sharing exemptions (Stuart, 2000). Brendt et al (1998) show that there is no clear evidence of the direction of age-related effects and, if they exist, they really depend on the type of drug analysed and whether it treats chronic or age-related conditions or not. Thus, a distinction may be set between medicines that are subsidized by the NHS and those that are not. When drugs are not rationed or co-payments are small we may expect pharmaceutical expenditure to rise. However, when estimating the effect of cost sharing on demand, we should take into account that co-payments are set according to individual

characteristics that result from higher need of pharmaceutical consumption due to a fragile health status.

Turning to the economic determinants of drug expenditure and use, private health insurance coverage together with income provides some evidence of a higher likelihood of drug use among the most affluent consumers, although both variables were not significant predictors of out-of pocket expenditures. This results from the fact that OTCs are normally low priced drugs whereas the co-payment that less affluent individuals might have to pay for drugs is significant. On the other hand, this results from the fact that the cost sharing structure in Spain is based on age rather than on income, and the elderly, who do not pay for drugs, often is more affluent than households or individuals of younger average age. Finally, both income and PHI appear to be strong determinants of drug use, which implies that there might be socio –socio-economic barrier to the access for drugs (once controlling for health status). The current cost sharing structures (40% of the cost of medicines if the full rate applies) or the cost of obtaining medicines on an out-of-pocket basis may deter consumers from accessing drugs in certain circumstances.

Recent work on the influence of insurance on the demand for prescription drugs finds that private insurance coverage leads to increased demand for drugs (Coulson et al, 1995). Interestingly, the influence of income remains once correcting for sample selection to account for the physician influence on prescribing and dispensing. Physicians, as agents acting on behalf of patients, are key in determining demand for medicines through their clinical practice and prescribing behaviour. The significance of self-medication in increasing pharmaceutical out-of-pocket expenditure indicates that a part of the population might not consume drugs on the basis of doctor's prescription but based on their own perceptions and available health information. Finally, once controlling for the influence of self-medication we find that improved access to pharmacies increases both drug use and out-of-pocket expenditure.

In examining drug use, we find that results change significantly when drug use is jointly estimated with the access to GPs, indicating that the model has captured part of the unobserved heterogeneity resulting from the potential drug use with without a prescription. Furthermore, the decision to demand drugs available only on prescription is taken by the physician rather than the patient. In Catalonia GPs act as gatekeepers and all prescriptions covered by the NHS originate from them or from specialists (López and Mossialos, 2000). Therefore, the decision to consume prescribed pharmaceuticals cannot be separated from the decision to consume health care since the latter is in part the expected result of visiting a

physician. Evidence from Catalonia (Vera-Hernandez, 1999) suggests that whereas people that purchase PHI tend to visit specialists more often, this is not the case with GP visits, typically prescribing drugs subsidised by the NHS.

This paper also shows that income does not influence out-of-pocket expenditure but other variables, such as access to pharmacies; self-medication and household size have a significant influence over such expenditure. On the other hand though, income does influence drug use; this finding indicates that certain cost-sharing structures, which are not associated with individual income might have an impact on access to medicines. Whereas higher income and education were associated at individual level with a higher demand for pharmaceuticals, neither determines out-of-pocket expenditure at family level. As the utility of medicines is zero if the individual is not ill, our finding implies that medicines consumed by individuals when ill, are independent of income and education, even though more educated and wealthier individuals are more likely to demand and consume them.Education may also be a proxy for an individual's ability to act in order to prevent illness rather than underline individual demand for a health related input.

Finally, this paper shows the difficulties that may appear when using general health surveys based on individual data in estimating the demand for pharmaceuticals. Our results suggest that estimating the demand for pharmaceuticals with survey data is complex for many reasons. Available surveys just show the amount of pharmaceutical expenditure that the individual (or the family) has undertaken. However, pharmaceutical expenditure includes out-of-pocket expenditure (for OTC products and, potentially, prescription-only medicines available on a private prescription, or, simply, available at the pharmacy without a prescription), and co-payments (most notably for publicly covered prescription medicines); the indivisibility between the two types of out-of-pocket expenditure limits empirical research. In this study we estimated that 13% of the Catalan population has consumed a drug without any prescription, from where a half of them were drugs for illnesses that would require a prescription. As a result, more work should be undertaken in improving available databases to test hypotheses on the individual demand for pharmaceuticals. This paper is also a first attempt to account for a reduced form of an individual demand where the role of co-payments is determined indirectly. Although the two-part model employed accounts for a possible two-stage decision making-process, it is likely that other health related characteristics and more complex models would provide us with more accurate results. Empirical problems emerge when using health surveys that contain information on health expenditure. Unobserved patient heterogeneity may be significant due to the heterogeneity of

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pharmaceuticals as consumer products. Information on prices for all medicines is not always available easily and when it is, it is surrounded by controversy. Being in a position to know with precision cost-sharing policies affecting different segments of the population, has enabled this research to instrument the price effect by using age and disability information. Consequently, a censuring problem appears when estimating the demand for pharmaceuticals. When examining individual data on pharmaceutical expenditure we may encounter zero observations that may be due to different reasons. First, there may be an infrequency problem when using data from only one year. Second, healthy individuals do not consume pharmaceuticals as its unnecessary for them. Third, as previously noted, elderly individuals may be ill and most likely consume pharmaceuticals, but pay nothing for pharmaceutical consumption because of their health insurance coverage, therefore, zero expenditure arises. Fourth, even though some people should consume pharmaceuticals, it may be the case that some may not be able to afford the high co-payments for some drugs (due to the high prices for the latter), however this is less likely (corner solution) to happen due to the increased possibility of consuming a substitute drug (generic).

6. Conclusions

Examining the determinants of the demand for pharmaceuticals and of out-of-pocket expenditures is key in understanding the potential impact of changes in drug regulation in a country. In particular, this paper has found that out-of-pocket expenditure on pharmaceuticals in the Spanish Autonomous Region of Catalonia is sensitive to the effect of the statutory co-payment, but is also influenced by individual patterns of self-medication and geographical access to drugs. On the other hand, drug use is determined by income, private health insurance, the statutory co-payment and health status. From a methodological perspective we have found that the demand for pharmaceuticals could be affected by previous consultation with a general practitioner.

Our research has several policy implications both for Spain and other jurisdictions. First, we confirm that self-medication explains a remarkable share of out-of-pocket expenditure. Therefore, the regulation of the market for OTC products should bear in mind this feature. Deregulation of pricing and competition in the OTC market, should enable consumers to obtain better deals on their medications. Second, the importance of income and private health insurance in determining drug use suggests that there might be a socio-economic vector explaining the access to drugs. Indeed, because co-payments in Spain are not associated with individual's income, but depend on age and disability, there may be

inequality in the access to medicines, such that poorer patients who do not meet age and disability eligibility criteria, may still be having to pay 40% of the cost of their medicines. To date there is still no study examining inequalities in accessing medicines in Spain and therefore future research further investigate this issue. However, in light of the evidence presented in this paper, it would be sensible to introduce a reform of cost-sharing to include means-tested (income-based) co-payments. Finally, the effect of pharmacy density in explaining drug use indicates that the increasing density of pharmacies in Spain might not be neutral in influencing the demand for drugs. Therefore, some additional emphasis should be placed in controlling pharmacy growth, with stricter criteria for new pharmacies to open.

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Table 1. Number of prescriptions, expenditure, share of retired consumers and effective co-payments in Spain, 1986-2002

	Number of prescriptions (thousands)	Real expenditure per capita (€)	% Retired consumers	Effective co-payment rate*
1986	460,866	52.68	56.6	14%
1987	470,390	58.09	57.8	13%
1988	491,249	64.59	59.2	13%
1989	509,875	69.87	60.3	12%
1990	532,231	74.93	61.5	10%
1991	541,057	81.77	62.7	10%
1992	548,646	85.85	64.1	9%
1993	534,559	90.01	65.4	9%
1994	520,463	88.57	67.4	9%
1995	553,788	93.58	68.3	8%
1996	581,561	99.67	68.9	8%
1997	593,046	103.83	69.3	8%
1998	592,330	111.76	70.1	7%
2002	na	Na	72	7%

Note: * Cost-sharing expenditure divided by total expenditure
Source: Consejo del Colegio de Farmaceuticos, 2003.

Table 2. Descriptive statistics of the variables employed (N=15,000)

Variable	Description	Mean	s.e
	Dependent		
Q	Household expenditure on drugs in the last 30 days (logs)	5.511	0.0317
D	Some pharmaceutical consumption in the last 30 days	0.690	0.0038
V	The patient has visited the general practitioner in the last two weeks	0.215	0.0034
	Explanatory		
Nmemfam	Household size	3.680	0.0117
Sexe	Male=1	0.476	0.0041
Age	Age in years	39.614	0.1873
Lincome	Log monthly household income	14.327	0.0063
Incap	Chronic illness=1	0.026	0.0013
Educ1	No education	0.211	0.0033
Educ2	Primary Education	0.548	0.0041
Educ3	Secondary education	0.130	0.0027
Health	Perceived health status (4=excellent, 3=good, 2=fair, 1=bad)	2.96	0.078
Smoke	Smoker=1	0.225	0.0034
Phi	Private health insurance	0.189	0.0032
Self	Self-medication =1	0.132	0.0021
Phar_des	10,000 Inhabitants per pharmacy in each region	0.290	0.0043
Doctor_dens	10,000 Inhabitants per doctor in each region	0.217	0.0013

Source: The authors, from the Catalan Health Survey, 1994

Table 3. The demand for pharmaceuticals and pharmaceutical expenditure: results from the Catalan Health Survey (1994) of a two-part model of pharmaceutical expenditure and pharmaceutical use [Model (1)] and a two-part model of pharmaceutical use and physician visit [Model (2)]

Variables	Model (1)				Model (2)			
	Pharmaceutical expenditure (Q)		Pharmaceutical use (D)		Pharmaceutical use (D)		Physician visit (V)	
	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff.	S.E.
Nmemfam	0.089*	(0.039)	0.125*	(0.011)	0.082*	(0.017)	-0.007	(0.011)
Sex	0.1428*	(0.041)	-0.094*	(0.027)	0.056*	(0.041)	-0.136*	(0.028)
Incap	0.346*	(0.117)	0.011	(0.082)	-0.033	(0.096)	0.159*	(0.082)
Age	-1.9×10^{-4}	(4.6×10^{-4})	0.006*	(0.002)	-0.006*	(0.004)	0.002*	(0.001)
Age^2	1.34×10^{-4}	(1.1×10^{-4})	1.9×10^{4}*	(3×10^{-5})	1.9×10^{-4}*	(5×10^{-4})	4.18×10^{-4}	(3.2×10^{-4})
Lincome	0.031	(0.083)	0.253*	(0.024)	0.192*	(0.040)	-0.014	(0.025)
Educ1	0.027	(0.068)	-0.093	(0.059)	-0.282	(0.102)	0.333*	(0.061)
Educ2	-0.150*	(0.054)	-0.072	(0.050)	-0.144	(0.093)	0.111*	(0.053)
Educ3	-0.025	(0.061)	-9×10^{-4}	(0.059)	-0.146	(0.106)	0.109*	(0.061)
Smoke	0.089*	(0.045)	-0.071*	(0.034)	0.034	(0.025)	-0.124*	(0.036)
Phi	0.973	(2.357)	0.124*	(0.005)	0.135*	(0.051)	-	-
Health	-	-	0.152*	(0.012)	0.137*	(0.012)	0.281*	(0.013)
Self	0.033*	(0.011)	-	-	-	-	-	-
Phar_des	0.230*	(0.065)	0.627*	(0.166)	0.594*	(0.168)	0.987	(0.678)
Doctor_dens	-1.39	(1.310)	2.534	(1.683)	-2.045	(1.678)	0.40	(0.467)
Intercept	7.30*	(1.580)	-3.253*	(0.369)	-0.870	(0.619)	0.79*	(0.345)
ρ							0.69	0.023
λ	-0.583	0.637						
Wald (χ^2)	1238.5						394.98	
R^2	0.25							
Pseudo-R^2			0.23					
LR[a] (All $\beta = 0$)			1199.55					
Log-Likelihood	-4567.9						-6530.24	
LR[a] (ρ=0)							3.89	

- Significant at 5% of lower level.
- [a]Likelihood Ratio Test.