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Why Does the Utilization of Pharmaceuticals Vary So Much Across Europe? Evidence from Micro Data on Older Europeans

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ABSTRACT
We analyze the relative importance of population versus institutional factors in explaining cross-country variation in the utilization of pharmaceuticals among older Europeans. Use of medication is examined among all individuals aged 50+ in eleven European countries and, to better control for need, among those diagnosed with medical conditions for which effective drug therapies exist. Organizational factors include the density of pharmacies and physicians, retail prices, reimbursement rates, restrictions on retailing of pharmaceuticals and incentives designed to influence prescribing behaviour. Differences in population health and demographics account for 75% of the cross-country variation in the propensity to use pharmaceuticals among all older Europeans but this fraction falls to only 12% among those with a diagnosed condition, while, for this group, differences in the organization of the pharmaceutical and health sectors explain 32-54% of the cross-European variation in utilization of medicines. Organizational differences are more important in explaining variation in receipt of medication for serious conditions, such as asthma, arthritis, diabetes, heart attack and stroke, for which 60-80% of the cross-country variation can be explained by population and organizational factors, and less important for asymptomatic conditions, such as high cholesterol and hypertension, for which less than 35% of the variation is explained.

Keywords: Pharmaceuticals, heath care, elderly, Europe
JEL: I11, I18

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1. Introduction

Throughout Europe, spending on prescription medicines is a strong contributor to rising expenditures on health care, being the most rapidly growing component of total health expenditures (OECD Health Data, 2008). Besides this upward trend in pharmaceutical expenditures, there is also remarkable cross-country variation in the levels of spending. France and Italy spend more than twice as much per capita on medicines than Denmark, and around three-fifths more than the Netherlands (Figure 1). Pharmaceutical expenditures consume almost two percent of GDP in France, but less than one percent in Denmark (*ibid*). These differences do not simply reflect variation in levels of spending on health care in general. Pharmaceuticals account for almost 17% of total health expenditure in France, but less than 9% in Denmark (*ibid*). Nor are the spending differences simply attributable to variation in pharmaceutical prices. Denmark is among the most expensive countries in Europe, with price levels 20% higher than the EU-25 average, while in France prices are 10% lower than the average (Konijn, 2007). Differences in spending reflect cross-country variation in the utilization of medicines. The objective of this paper is to explain that variation.

Identification of the reasons for wide disparities in the utilization of pharmaceuticals is valuable at a time when policy makers are struggling to contain health care costs, while maintaining a commitment to universal and equitable access to medicines and other health services. At a very general level, there are three potential sources of the cross-country disparities. First, differences in demand will arise from variation in the demographic composition and health status of populations. While European populations are relatively homogenous, they do differ in the concentration of the elderly; with Italy, for example, being substantially more "grey" than Denmark or the Netherlands (EUROSTAT, 2008). Second, differences across

Europe in policies relating to insurance coverage, cost-sharing, generic substitution, reference pricing, and prescribing guidelines and incentives, as well as in the organization and financing of health care more generally, potentially result in cross-country variation in access to and the cost of medication. The balance of policies adopted in any one country may influence the extent to which there is adequate and equitable access to medication, appropriate adherence to prescribed treatments and cost-effective adoption of new medicines. Third, besides objective differences in the need for medication and in the organization and financing of their supply, pharmaceutical utilization may vary due to cultural differences in the inclination on the part of doctors to prescribe medicines and on the part of patients to use them. It has even been suggested that variation in the utilization of medicines is symptomatic of European differences in the existence of social capital, in the form of willingness to trust (The Economist, 2009). Put rather crudely, while a Dutchman is prepared to believe his doctor's advice that he will get better soon, his Belgian neighbour wants the reassurance of a prescription to be satisfied that his needs have been taken seriously.

The purpose of this paper is to identify the relative contribution of population, organizational and cultural factors in explaining cross-country variation in the utilization of prescribed pharmaceuticals in Europe. This will help gauge the extent to which differences in pharmaceutical expenditures are the result of policy choices, rather than in health needs, or less amenable cultural factors. This is done using data from the first wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) collected in 2004, which covers populations aged 50+ in eleven European countries - Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden and Switzerland. By using samples aged above 50, not

only do we focus on the highest users of pharmaceuticals but we partially control for variation in demographic composition and this is completed using the age and sex information in the data. A major advantage of these data is that they provide detailed information on health and on receipt of medication specific to diseases and risk factors for which effective drug regimes are established. This makes it possible to assess the extent to which older Europeans with the same needs for medication are treated differently and to relate these differences to incentives operating on the demand and supply sides of pharmaceutical markets. Differences in the organization of health care systems and in policies that are directly or indirectly related to drug utilization are documented and used to explain cross-country variation in rates of utilization among individuals suffering from the same diseases or risk factors. The variation that remains after controlling for need and organizational factors provides an upper bound on the contribution of cultural differences in the propensity to prescribe and use medicines.

Although there have been numerous studies of pharmaceutical use and expenditures (Noyce et al., 2000; Clemente et al., 2008; Thiebaud et al, 2008), there are very few cross-national comparisons of pharmaceutical consumption. All previous non-clinical studies that investigated cross-country differences in pharmaceutical consumption have relied on aggregate data on pharmaceutical sales or expenditures per capita, with overall, or disease-specific, mortality being used as a proxy measure of the disease burden (OECD, 1995; Dickson & Jacobzone, 2003; IMS, 2008). But mortality is only a very crude indicator of health care, in particular pharmaceutical, need. Aggregate comparisons cannot inform of the extent to which cross-country differences translate into individuals with homogenous conditions receiving differential drug therapies.

By using micro data, we are able to examine cross-country variation in pharmaceutical utilization after making detailed controls for need, such that the remaining variation can be largely attributed to organizational and cultural factors. By supplementing the micro data with indicators of the regulation and supply of pharmaceuticals, we are able to further identify variance that is explained by policy amenable determinants. The measured organizational characteristics include proxies for: i) the availability of pharmaceuticals in the form of the density of physicians and of pharmacies, and restrictions on the retailing of pharmaceuticals ii) incentives to control prescribing behaviour, e.g. prescribing budgets; and, iii) demand as determined by price, cost-sharing and protection of the chronically-ill from co-payments. The variance decomposition method follows that adopted by Bolin et al (2009) to explain cross-country differences in physician visits. To our knowledge, no previous analysis of this nature has been conducted in relation to pharmaceutical utilization.

The remainder of the paper is organized as follows: Section 2 provides detailed background information on the European pharmaceutical sector, particularly as it pertains to the availability and coverage of medication treatment of the chronically ill elderly. Section 3 explains the variance decomposition method and the data are described in section 4. The results are presented in section 5. The final section summarizes the main results, and discusses potential limitations and the most important policy implications.

[Figure 1 Here]

2. Pharmaceutical Policies across Europe

European differences in the organization of health care are perhaps most evident in the regulation of the pharmaceutical market. Although most European citizens have insurance cover, at least to some degree, for prescribed medication, the reimbursement policies, distribution policies, prescribing and dispensing of pharmaceuticals differ to a great extent.

2.1 Regulation of Pharmaceutical Distribution and Retailing

The pharmacy profession is organized on a licensing basis in all EU member states. On top of this, some countries have additional barriers to entry, justified by protection of patient safety and preventing oversupply in urban areas while guaranteeing availability in rural ones. In most of the EU countries covered by the SHARE data, ownership and establishment of pharmacies is restricted to qualified pharmacists. In the most heavily regulated countries (France, Italy, Greece, Spain), a pharmacist cannot own more than one pharmacy, chaining of pharmacies is forbidden and pharmacies hold a monopoly over the distribution of Prescription Only Medicines (POMs) and Over The Counter (OTC) medicines. In less regulated countries (Germany, Switzerland, the Netherlands, but also Denmark), some non-prescription medicines are sold in drug-stores and supermarkets. Sweden is an exception where all pharmaceutical products are sold via a state-monopoly. At the other extreme, pharmacy ownership is not restricted in Belgium and the Netherlands.

Diversification on the degree of regulation is more pronounced regarding the number of pharmacies and the location of new pharmacies. In less regulated countries like the Netherlands, Germany and Switzerland, and to a lesser degree in Denmark, there are no geographical or population criteria for the establishment of new

pharmacies. In other countries, the number of pharmacies is restricted relative to population and locality criteria. The permitted minimum distance between pharmacies varies from 200 meters in Italy to 1,000 in some autonomous communities in Spain (e.g. Cannarias, Baleares). A high density of pharmacies might be expected to have a positive 'availability effect' on consumption (Birch, 1988; Madden et al., 2005).

Direct-to-Consumer Advertising (DCTA) of PMOs is prohibited in all EU countries. Advertising of OTC medicines is, on the other hand, permitted in all countries, with the singular exception of Greece.

Table I summarizes the most important features of the regulation of the distribution and retailing of pharmaceuticals. To facilitate easier cross-country comparison of the degree of regulation, we have created a summary index of regulation. Each dimension of regulation is scored on a scale from 1 to 4, with 1 indicating a liberal setting and 4 a highly regulated one. To give an overall impression of the degree of regulation, we simply sum the scores. Of course, this index is subjective and rather crude, but it is nonetheless useful in distinguishing between highly regulated and liberal regimes. In addition to the state monopoly operating in Sweden, heavily regulated systems are found in the more southerly European countries (Greece, Italy, Spain and France) and in Austria. Systems with a middle degree of regulation are in Belgium, Denmark and Germany, while the most liberal regimes are in the Netherlands and Switzerland. In the empirical analysis, we group these latter two sets of countries and distinguish between them and the six highly regulated countries.

The number of pharmacies per 10.000 inhabitants ranges from 0.6 in Denmark to 8.5 in Greece (Figure 2). Comparing Figure 2 with Table I, it is apparent that, perhaps rather paradoxically, the countries with the most detailed entry

restrictions generally also have the greatest supply in pharmacies. At first sight, this appears inconsistent with the standard model of regulatory capture in which entry barriers are used to limit supply, raise price and extract rent. But one must bear in mind that, besides entry, mark-ups are also regulated. Liberalizing entry restrictions in combination with lowering regulated markups need not lead to reduced geographic coverage of pharmacies and may result in significant benefits to consumers (Schaumans & Verboven, 2006).

[Figure 2 and Table I Here]

2.2. Incentives to Control Prescribing Behaviour

Health professionals, through prescribing behavior, and pharmacists, through the dispensing of pharmaceuticals, both exercise a potentially important influence on pharmaceutical utilization and expenditures. Regulation of prescribing and dispensing behavior is summarized in Table II. The most direct measure acting on physicians is the restriction of prescription drugs that are entitled to reimbursement by the use of positive and/or negative lists. This measure applies in all countries, with the positive list being most popular[1]. A negative list is used in Germany, while in Spain a negative list is being used in conjunction with a positive list. The second measure is the issuing of guidelines and treatment protocols, aiming to encourage rational, appropriate and economic prescribing. The measure is widely used in all countries, with the exception of Greece and Switzerland. However, the success of prescribing guidelines in promoting rational and cost-effective prescribing is dependent upon effective dissemination and the mechanisms employed to ensure compliance with recommendations (Coleman & Nicholl, 2001; Watkins et al., 2003). In most

[1] A positive list was in operation in Greece at the time the wave 1 SHARE data were collected but was abolished in 2006.

countries, guidelines have no mandatory character and are not used in combination with incentives for adhering to them. However, in Germany, Austria, and, to a lesser degree, in Switzerland, Belgium, Denmark and the Netherlands, physicians' prescribing is monitored, and in some cases physicians receive feed-back on their prescribing patterns.

There is evidence that prescribing and practice budgets are effective in cutting drug expenditure, not only per item and per patient, but also through volumes (Sturm et al., 2007). Prescribing budgets and further pecuniary incentives have only been introduced in Germany, Italy and Spain, while since 2006 (post the 2004 data analyzed here) physicians in Belgium are obliged to prescribe a certain percentage of "cheaper medicines", which varies depending on the specialty. In Sweden, although there are no sanctions against doctors for not following prescribing guidelines, certain counties have established incentive agreements, where adherence of doctors to decentralized budgets and prescription targets results in reward. In the empirical analysis, we control for financial incentives operating on prescribing behaviour by distinguishing between the countries that have implemented prescribing budgets and those that have not.

[Table II Here]

2.3 Cost-sharing and Reimbursement Policies

Cost-sharing, particularly for pharmaceuticals, is increasingly being adopted in European health systems. Since co-payments are regressive (Wagstaff et al., 1999; Wagstaff & van Doorslaer, 1992), many countries implement them in conjunction with mechanisms to protect vulnerable groups. Of particular relevance to this study are exemptions granted to the elderly and individuals suffering from chronic

conditions. These groups, in addition to low income individuals, have been found to be particularly sensitive to drug charges. Lexchin and Grootendorst (2004), reviewing studies from the US and Canada, conclude that cost-sharing results in considerable decreases in use of drugs (both essential and discretionary) by the poor and chronically ill. Drug price elasticities among these groups were found to range from -0.34 to -0.50. Klick and Stratmann (2006) found that a one percentage point increase in the coinsurance rate implies a 1.01 percent decrease in the number of prescriptions filled and a 0.69 percent decrease in total drug expenditures of US pensioners, indicating that the elderly population is quite responsive to prescription drug price changes. The same broad conclusion was reached by Shang and Goldman (2007) and in studies that concentrated on chronically-ill populations (Mahoney, 2005; Cole et al., 2006; Gibson et al., 2006; Goldman et al., 2006; Lichtenberg & Sun, 2007). Lichtenberg & Sun (2007) estimated that the Medicare Part D reform, which extended prescription drug benefits to 43 million US pensioners, reduced user cost by 18.4% and increased utilization by 12.8% in 2006.

Western European studies (van Doorslaer, 1984; Lavers, 1989; O' Brien, 1989; Smith & Watson, 1990; Ryan & Birch, 1991; Carrin & Van Dael, 1991; Hughes & McGuire, 1995) also suggest that prescription cost-sharing reduces utilization, but there is some variation in estimates of price-elasticity. From a meta-analysis Gemmill et al. (2007) found estimates to vary significantly by the institutional setting, the extent of public financing, the aggregation of the data and the research methodologies employed and estimated a corrected elasticity of -0.209 with a standard error of 0.026. Elasticities were found to be lower in tax-based health insurance systems, which is to be expected given lower co-payments in such systems.

Table III summarizes pricing and reimbursement policies in the SHARE countries and differences in cost-sharing protection mechanisms. Only in Austria, Italy and the Netherlands are all pharmaceuticals 100% reimbursable. Co-payment rates not only vary between countries, but also within countries, depending most commonly on the category of the drug. Sweden, Denmark and Switzerland follow a consumption-based reimbursement, where the level of reimbursement depends on the patient's (annual) expenditure on pharmaceuticals, with the patient paying the full cost up to a threshold. In Switzerland, a general flat co-payment rate is applied after a deductible, while in Denmark and Sweden the co-payment rate decreases gradually, reaching 0% and 15% respectively.

In all countries under study, cost-sharing is implemented in conjunction with mechanisms to protect vulnerable groups of the population (the chronically ill, low income and pensions, and the elderly), such as reduced co-payment rates or out-of-pocket maximums. Generous protection mechanisms related to age are found in Spain, where pensioners are totally exempt from co-payments. Low-income groups and especially low-income pensioners are totally exempt from cost-sharing in France, Austria and Italy. In Greece, only low-income pensioners are entitled to a higher reimbursement rate, while in Belgium and Denmark[2] this is granted also to non-pensioners on low incomes.

Of particular relevance to the current study are the disease-specific protection mechanisms. The most generous disease-specific protection mechanisms can be found in Spain, France but also in Greece, where people suffering from specific chronic or life-threatening diseases are totally exempt from cost-sharing (or are subject to

[2] In Denmark pensioners expenditures may be covered up to 85% of the pensioner's out-of-pocket payments for reimbursable pharmaceuticals, depending on the pensioner's income and personal wealth. However such applications are evaluated and supplementary reimbursement is granted on a individual basis.

reduced co-payment rate for some specific diseases in Greece). A reduced maximum annual out-of-pocket amount applies for chronically-ill in Germany, while preferential reimbursements are only offered to disabled people in Belgium and to the chronically-ill on a personal basis in Denmark.

[Table III Here]

2.4 Indicators of organizational determinants

In Table 4 we present the summary indicators used in the empirical analysis to represent organizational factors potentially relevant to explaining cross-European variation in the utilization of pharmaceuticals. To capture any availability effect, we rely on the densities of pharmacists and physicians relative to the population. Further, we distinguish between the countries in which the retailing of pharmaceuticals is highly regulated (Austria, France, Greece, Italy, Spain, and Sweden) and others adopting a more liberal regime (Belgium, Denmark, Germany Netherlands and Switzerland), where the separation is based on the policies summarized in Table I. This allows us to test whether restrictions on who can sell prescription drugs appears to have any impact on the level of utilization.

With respect to policies acting on prescribing behavior, we distinguish the four countries (Germany, Italy, Spain, and Sweden) where doctors have prescribing budgets or other financial incentives to constrain prescribing. As noted above, there is evidence to support the effectiveness of such policies.

We control for the impact of cost-sharing on utilization using estimates from the European Federation of Pharmaceutical Industries and Associations (2007) of the average cost paid by a patient as a percentage of the total cost paid by the insurer and

the patient (EFPIA, 2007; OFT, 2007).[3] Cost-sharing is by far the highest in Denmark, where, on average, patients pay 40% of the cost of the reimbursed pharmaceuticals. In all other countries, cost-sharing is less than half of that rate. In Greece, Belgium, Austria and Sweden, the rate varies from 14-22%. In Switzerland, patients pay around 10%, and in Germany and Spain about 7%. In Italy, France and the Netherlands there is near full insurance of the cost of prescribed pharmaceuticals. Obviously, the price effect depends not only on the proportion of the cost for which the patient is liable but also on the level of the cost. To control for the latter, we use the average retail (gross of reimbursement) price of pharmaceuticals, expressed as a percentage of the EU-25 average (Konijn, 2007).[4] Prices are highest in Switzerland, Germany, Denmark and Italy and lowest in Greece, Spain and France.

A dummy indicates one for reduced cost-sharing for individuals reporting chronic conditions in Denmark, France, Germany, Greece, Italy and Spain.[5]

[Table IV Here]

3. Measurement and Explanation of Cross-Country Variation

Our aim is to measure and explain variation across Europe in the utilization of prescribed medicines, paying particular attention to the extent to which cross-country variation is attributable to differences in populations, policies or cultures. For this purpose, we adopt the method proposed by Bolin et al. (2009), which, using micro data, measures the total variation in utilization across countries and then identifies the

[3] For France, the cost paid by the insurer includes that covered by supplementary insurance (mutual or private).
[4] Retail prices of pharmaceuticals are based from the Price Level Index for pharmaceuticals produced by the Eurostat-OECD Purchasing Power Parity (PPP) programme.
[5] We experimented with a dummy for those on low income in countries granting exemptions to this group but it was always correlated with lower utilization. It is likely that this reflected an income effect, rather than the intended price effect and so we decided to omit the dummy. Income is controlled for.

proportion of this that remains unexplained after sequentially controlling for individual level determinants, in the form of health and socio-demographics, and country level determinants given by the policy variables identified in the previous section. The variation remaining after controlling for these determinants may be attributable to omitted individual level need/enabling factors and/or unmeasured policy differences, but also provides an upper bound on the variation that is attributable to cultural differences in attitudes to the prescription and use of medicines.

We adopt a disease-based approach to the analysis of variation in utilization as suggested by the OECD and others (Dickson & Jacobzone, 2003; Goldman & Smith, 2005; Maurer, 2008). This is feasible because SHARE asks about use of medication in direct relation to reported, diagnosed medical conditions. Hence, we can analyze the probability of receiving medication for a medical condition for which an effective drug therapy is known to exist. This provides much more precise evidence than is typically the case in studies of health care access. We are investigating variation in health care treatments that can be anticipated to have an impact on health outcomes. As individuals diagnosed with the same condition may still differ in their need for drug treatment the analysis controls for further predisposing characteristics such as age, gender and indicators of health status. Further, at the individual level we control for enabling, or non-need, factors, such as income, occupation and education that may affect access to health care and ability to manage health conditions (Andersen, 1968; 1995; Wagstaff & van Doorslaer, 2000)

Drug utilization is recorded as a dummy variable y_{ij} indicating whether an individual *i* residing in country *j* is using prescribed medicine or not. A probit model is used to analyze the probability of drug usage (y_{ij} =1), namely

$$P(y_{ij} \mid X_{ij}, H_{ij}, Z_j) = \Phi(X_{ij}\beta + H_{ij}\gamma + Z_j\delta) \quad (1)$$

where H_{ij} includes indicators of need (health and demographics), X_{ij} represents a vector of socioeconomic enabling factors, Z_j includes the country level indicators of policy and $\Phi(.)$ is the standard normal cumulative distribution function. From this, one obtains the average residual, for each country,

$$r_j^* = \frac{1}{N_j}\sum_{i=1}^{Nj}(y_{ij} - \hat{y}_{ij}) \quad (2)$$

where N_j is the number of respondents in country j and $\hat{y}_{ij}$ is the predicted probability of drug use. Following Bolin et al (2009), a measure of the unexplained cross-country variation is given by the mean of the squared deviations in these country-specific residuals:

$$MSD = \frac{1}{J}\sum_{j=1}^{J}(r_j^* - \bar{r})^2 = \frac{1}{J}\sum_{j=1}^{J}[(\bar{y}_j - \bar{y}) - (\bar{\hat{y}}_j - \bar{\hat{y}})]^2 \quad (3)$$

where J is the number of countries (J=11), $\bar{r} = \frac{1}{J}\sum_{j=1}^{J} r_j^*$, $\bar{y}_j = \frac{1}{N_j}\sum_{i=1}^{N_j} y_{ij}$ is the average rate of use in country j, $\bar{y} = \frac{1}{J}\sum_{j=1}^{J}\bar{y}_j$ the (simple) average rate of drug use over all countries, $\bar{\hat{y}}_j = \frac{1}{N_j}\sum_{i=1}^{N_j}\hat{y}_{ij}$ and $\bar{\hat{y}} = \frac{1}{J}\sum_{j=1}^{J}\bar{\hat{y}}_j$.[6]

Note, when no covariates are included in the probit, the second term in square brackets in equation (3) is zero. The first term is the deviation of a country's drug utilization rate from the simple average of these country-specific rates. Then, the average of the square of this first term is a measure of the total variability across countries in drug utilization rates that is to be explained.

[6] Bolin et al (2009) use the term mean squared error (MSE) for this measure. To avoid confusion with the MSE of the probit estimator or the sample MSE, we prefer the label mean squared deviation.

Once regressors are added, the second term in square brackets is non-zero and expresses the deviation of the predicted utilization rate in a country given covariates from the (simple) across country mean of these predictions. This corresponds to the cross-country variability that is explained by the covariates. If the model were able to predict utilization perfectly in each country, then the MSD would be zero. Larger values of the MSD indicate more of the cross-country variability that is left unexplained by covariates.

The probability of utilization is first modelled as function of a constant only (model 0) and a baseline measure of MSD computed. Health and demographic variables are then added to give model 1 and the MSD re-computed. The change in MSD indicates the proportion of cross-country variation that is explained by population differences in need factors. Socioeconomic characteristics are then added (model 2) and the process repeated to identify the proportion of the variance explained by differences in enabling factors. Finally, the country level policy variables are added (model 3) to identify the additional variance that can be explained by organizational differences in the supply and demand of pharmaceuticals between countries. The remaining unexplained cross-country variation is the upper bound on the contribution of cultural factors.

Note that the MSD is not necessarily decreasing as regressors are added to the model. For example, a country could have a greater than average utilization rate, while the model predicts it to have a lower that the average rate. If this happens for a sufficiently large number of countries, then the MSD of model 0 can be smaller than that of a model with covariates. This would indicate that differences in the distribution of covariates cannot explain the observed cross-country difference in utilization rates.

In fact, one would anticipate exactly the opposite direction of cross-country differences in utilization from the observed differences in covariates.

4. Data

4.1. Sample

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a cross-national survey of health and health care, amongst other topics, for representative samples of the 50+ population. We use data from the first wave, collected in 2004, which covers 31,115 individuals in 11 countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden and Switzerland). Israel is excluded due to incomplete data. The survey was conducted using consistent sampling frames and survey design across all participating countries resulting in a high degree of cross-national comparability. SHARE provides a sample of older individuals thus capturing the population with the greatest burden of degenerative diseases and with the highest consumption of pharmaceuticals.

4.2 Medication rates for specific conditions

The analysis investigates variation in utilization of medication conditional on medical need. Most previous studies of pharmaceutical utilization have relied on either aggregated need proxies, such as mortality rates and age composition (Dickson & Jacobzone, 2003), or subjective indicators of general health and functioning. Besides the potential problem of heterogeneity in the reporting of health (Groot, 2000; Sen, 2002; Jüerges, 2007a; Bago d'Uva et al., 2008), these indicators do not provide information on need for specific treatments. A major advantage of SHARE is that it

contains "quasi-objective" indicators of health in the form of reported doctor-diagnosed health conditions (Jüerges, 2007a; Maurer, 2007), and it asks directly about drug treatment for each of those specific conditions. This allows us to identify much more precisely individuals in need and to examine utilization of drugs specific to meeting that need. In addition, SHARE provides comparable data on a broad range of health indicators (see below), which allow detailed control for severity and co-morbidity beyond the need indicated by presence of a diagnosed condition.

We focus on reported doctor-diagnosed conditions, which warrant some form of medication treatment and for which drug treatment is generally regarded to be advantageous. The conditions are high blood pressure (hypertension), high cholesterol, diabetes, asthma, arthritis, heart attack (including myocardial infarction, coronary thrombosis, and other heart problems such as congestive heart failure) and stroke or cerebrovascular disease.

Pharmacological therapy for hypertension is strongly recommended and includes calcium-channel blockers, diuretics, angiotensin-converting enzyme (ACE) inhibitor and angiotensin-II receptor antagonist. More than one drug is often required to achieve blood pressure control (NICE , 2006a). Treatment of high blood cholesterol, which is an important contributor to cardiovascular disease, depends on various factors, including individual risk factors, age, general health and side effects. Common drug therapies include statins, cholesterol absorption inhibitors and bile-acid-binding resins (NICE, 2006b). Antihyperglycemic drugs or insulin replacement therapy is important for the control of both Type 1 and Type 2 diabetes[7]. Medication, such as bronchodilators and corticosteroids, is often indicated to control symptoms and prevent exacerbations of asthma (SIGN, 2008). Drug therapy for arthritis

[7] On top of medical treatment, patient education and support, sensible exercise, self glucose monitoring play an important role in maintaining blood glucose levels within acceptable bounds.

involves combinations of non-steroidal anti-inflammatory drugs (NSAIDS), slow-acting drugs, corticosteroids or disease-modifying antirheumatic drugs (DMARDs) (NICE, 2001; Kennedy et al., 2005). Depending on the aetiology and risk factors of heart attack and stroke, common medical modules include drugs for controlling high blood pressure, hypercholesterolemia and hyperlipidemia, antithrombotics and anticoagulants but also pharmaceutical treatment for further cardiac diseases (Smith et al., 2006; Sacco et al., 2006).

SHARE identifies whether the individual reports currently taking drugs, at least once a week, for each of the above mentioned conditions, however it does not contain information regarding quantities of drugs consumed. Table V presents pooled and country specific rates for the prevalence of conditions and medication received by those reporting a condition. Figures in bold indicate statistically significant differences in proportions relative to the country with the highest rate, which itself appears in italics.

[Table V Here]

Around 61% of the respondents across all countries report suffering from at least one doctor-diagnosed health condition, with prevalence varying from 46% in Switzerland to 66% in Belgium. Of those declaring a diagnosed condition, 83% report using medication for at least one of their conditions. There is considerable variation in the rate of medication across countries, varying from 75% in Denmark to 87% in France. Note that these countries correspond to those with the lowest and highest spending on pharmaceuticals identified in Figure 1, suggesting that our analysis of utilization may be directly relevant to explaining such differences in expenditures.

It is even more revealing to examine medication for each of the diagnosed conditions. One-third of older Europeans report a diagnosis of hypertension, a prevalence rate comparable with those reported in clinical studies (Brindel et al., 2006; Efstratopoulos et al., 2006). In France, 93% of those reporting hypertension receive medication, which is significantly higher than in all other countries except Switzerland. The rate is only 67% in Belgium. On average, one-fifth of older Europeans have high-blood cholesterol, but there is substantial variation in prevalence from 13% in Switzerland to 29% in Belgium[8]. Just over three-fifths of older Europeans with high cholesterol use cholesterol lowering drugs, but the rate in France is four-fifths, which is significantly higher than all other countries. Four-fifths of those diagnosed with diabetes report taking related medication, which accords with the high compliance rate for diabetes medication reported in the medical literature (Rozenfeld et al., 2003; Rubin et al., 2006). Yet, there are significant cross-country differences in compliance, the rate being highest in Austria (85%) and lowest in Denmark (70%) and Sweden (69%). Two European studies (Cerveri et al., 1999) found a median compliance of asthmatic patients with medical treatment of 67% and wide variations across countries. Our estimates are very close to those of the clinical studies, with two-thirds of the 4.5% with a diagnosis of asthma reporting use of related medication. Take-up of asthma medication is significantly lower in Italy (50%) and Spain (60%) than in the other countries.

The clinical literature demonstrates that adherence to medication for arthritis is relatively poor (50-82%), estimates varying with the method used to measure compliance (Hill, 2005; Tuncay et al., 2007; Elliott et al., 2007). We estimate that one-half of older Europeans diagnosed with arthritis are currently under weekly

[8] Although our estimates refer to an older age group, they are broadly consistent with those obtained by the WHO MONICA project (Tolonen et al., 2005) .

medication treatment. Use of medication is again higher in France, but also in Greece and Austria. Poor adherence to medication for rheumatoid arthritis has been found to be associated with serious adverse effects of the drugs, beliefs that the drugs are of poor effectiveness and the cost of the drugs (Elliott et al., 2007).

Since the aetiology of cardiovascular disease involves many interrelating factors, including hypertension and high-blood cholesterol, we examine whether individuals diagnosed as having suffered a heart attack or stroke, or those with a heart disease, report use of drugs for either high cholesterol, high blood pressure, coronary or cerebrovascular disease or other heart diseases. Heart attack and stroke are serious life threatening conditions and any cross-country variation in medication for their treatment is of great interest. With the exceptions of Sweden, the Netherlands and Denmark, medication rates for individuals that have suffered a heart attack or disease are above 90%. For stroke, the highest rate of medication use is observed in Italy (94%) with most of the other countries having statistically significant lower rates (with the exception of Spain, France and Switzerland).

To summarise, there are cross-country differences in medication for older Europeans with the same medical conditions. This variation is less marked for diabetes and much more distinct for asymptomatic conditions like hypertension and high blood cholesterol. Use of medication is consistently high in France and, albeit less consistently, lower in northern European countries such as Sweden, Denmark and the Netherlands, but also Switzerland.

4.3 Control Variables

We distinguish between three categories of control variables: health care need factors, enabling socioeconomic factors and organizational factors. Regarding the former we

include gender specific age dummies (50-59 and 60-69, with 70+ being the reference category). To account for the severity of the respondents health condition we include indicators of overweight and obese, current and past smoking status, presence of symptoms, cognitive functioning (numeric and orientation), mobility limitations, limitations with Instrumental Activities of Daily Living (IADL), depression, and dummies for self-perceived health status. Variable definitions and means are given in Table VI.

[Table VI Here]

Variables that have been shown in the literature to affect pharmaceutical utilization but are not direct indicators of health status include education level, economic activity, marital status and income (see Table VI for definitions). The latter is measured as equivalent gross annual household income, which includes income received from employment and self-employment, private non-labor income (investments, property and transfers) and pensions. Adjustments for household size and composition were made using the OECD-modified equivalence scale[9].

Table VI presents sample pooled and country-specific means for all control variables for both the full sample and the restricted sample of all those diagnosed with any of the selected conditions. The disease-specific sample is older, somewhat less educated, less economically active and have slightly lower income. Prevalence of symptoms, mobility and IADL limitations, cognitive difficulties, and obesity are all higher among individuals with a diagnosed condition. Depression, which is strongly associated with poor adherence to medication, is much more prevalent in the sample with a condition. Smoking is regarded as a main risk factor for many of the diseases

[9] The scale assigns a value of 1 to the household head, of 0.5 to each additional adult member and 0.3 to each child aged below 13 years.

under study, so it is perhaps not surprising that those with a condition are much more likely to have quit smoking.

There are also substantial cross-country differences in the health indicators. The mean number of symptoms ranges from 1 in Switzerland to 3.2 in Sweden. The proportion reporting very good health varies from 8% in Italy to 32% in Switzerland, while the proportion of those with depression ranges from 18% in Denmark to 36% in Spain. Differences are also observed in the socio-economic factors. For example, the proportion with tertiary education ranges from 8% in Italy to 33% in Denmark, while the proportion employed ranges from 20% in Italy to 40% in Switzerland.

5. Results

Using the full sample of SHARE respondents pooled across all countries, we first analyze variation in the probability of using medication for any of the conditions listed above across both those reporting a diagnosed condition and those reporting no such diagnosis[10]. While these might be characterized as appropriate and inappropriate use respectively, this is not entirely accurate since some medications might be used for other diseases or co-morbidities and there will be errors in the reporting of diagnosed conditions. Nevertheless, since variation in medication across individuals for whom drug treatment is appropriate given their pathology is of greater concern, we also conduct the analysis on the restricted sample of respondents who report a diagnosed condition. Further, we repeat the analysis for each specific condition.

[10] The questionnaire first asks whether the individual has a particular diagnosed condition. It then asks all respondents whether they take medication for this condition.

5.1 Total cross-country variation in utilization

Average country-specific residuals, and their bootstrapped confidence intervals, are presented in tables VII and VIII for the full and restricted (diagnosed condition) samples respectively. The first column in each table gives the residuals from a probit model of drug utilization including a constant only, thus showing the deviations from the average utilization rate across all individuals in the pooled sample. The respective MSD measures the total variation in utilization across countries.

The first column of table VII confirms substantial and significant variation between countries, with France and the Netherlands representing the extremes. A person in France has a 0.09 greater probability of using medication than the average across the pooled sample, while the probability for a Dutch person is 0.09 less than the average. Besides these two countries, utilization rates are significantly (5%) above the average in Belgium, France, Italy and Spain, and significantly below the average in Denmark, Sweden and Switzerland. Among those reporting a diagnosed condition (Table VIII), the probability of taking medication for such a condition is significantly above average in Austria, France, Germany and Greece, and significantly below average in Denmark, Italy, the Netherlands and Sweden. Note that all Italians are more likely than the average European to use medication, but among Italians with a diagnosed condition utilization is less than average. This indicates a very high level of utilization among Italians reporting no diagnosis.

[Table VII & VIII Here]

5.2 Variation explained by differences in population health

The probit partial effects presented in tables IX and X for the full and restricted sample respectively confirm a strong impact of health status and demographics on the probability of using medication. For the full sample (table IX), the presence of any

diagnosed condition raises the probability by 0.65. In both samples, those below 70, particularly those below 60, are less likely to receive medication. The presence of symptoms, mobility difficulties and obesity/overweight all significantly raise the likelihood of using medication. Those who have quit smoking are significantly more likely to take up medication compared to current smokers, which suggest health played a role in the decision to quit. Better self-assessed health reduces the probability of using medication. People with depression are less likely to use drugs, which is in line with medical literature suggesting this factor is associated with poor adherence to medication (Stilley et al., 2004; Osterberg & Blaschke, 2005). After restricting the sample to those with a diagnosed condition (table X), the magnitudes of the effects of the remaining health variables generally fall, but remain significant.

Differences in the health and demographic status of populations explain around three-quarters of the between-country variation in the probability of using pharmaceuticals in the full sample (Table VII, column 2). This is also reflected in the fact that the average country-specific residuals fall substantially in magnitude. Conditional on health, utilization remains significant greater in Belgium and France than the average, and France is still the country with the highest rate of utilization. Denmark and Sweden continue to have lower than average utilization, but this is no longer true for the Netherlands. Italy and Spain move from having above to below average utilization, indicating that the apparent above average propensity to use medication is entirely attributable to the fact that the populations in these countries are older and in poorer health. Switzerland moves in the opposite direction, such that, after allowing for the fact that its population is healthier, it has a higher than average utilization of pharmaceuticals.

Among those with a diagnosed health condition, the remaining health indicators explain much less of the between country variation in utilization rates – the explained variation being almost 12% of the total (Table VIII, column 2). This is to be expected since the presence of a diagnosed condition is the strongest determinant of the receipt of medication and there is less variation in health status across those with such a condition than in the full sample. After controlling for health and demographic status, the propensity to use medication remains above the average in France, Germany and Greece. France continues to have the highest rate of utilization and the magnitude of its residual actually rises, indicating that the good health status of its population obscures the true extent to which the utilization is greater than in other countries. The same is true of Switzerland, which moves above the average after controlling for health and demographics. Denmark and Italy remain below the average, with the magnitude of the residual rising in Italy, indicating that the age and relatively poor health of its population obscures the extent to which pharmaceuticals are underutilized relative to other European countries. Spain falls below the average after controlling for health and demographics for the same reason. On the other hand, the Netherlands and Sweden no longer lie significantly below the average once account is taken of the better health of their populations.

[Table IX and X Here]

5.3 Variation explained by socioeconomic characteristics

In both the full and restricted samples, employed individuals are less likely to use medication. There are no significant differences by education, which contrasts with US evidence showing that the more highly educated have better access to medication (Goldman & Smith, 2005; Cutler & Lleras-Muney, 2006). There is a positive and significant income effect in the full sample, which is no longer present once attention

is restricted to those with a diagnosed health condition. This suggests that it is higher income individuals without a diagnosis that are more likely than their lower income counterparts to use medication. We have tested for evidence of an income effect varying across countries, possibly due to differences in cost-sharing arrangements, but never rejected the null of no income-country interactions.

The modest impact of socioeconomic characteristics on the propensity to utilize drugs results in a negligible contribution to explanation of between-country differences. In the full sample, after controlling for health and demographics, socioeconomics add less than 1% to the explanation of cross-country variation. In the restricted sample, they add nothing. In both cases, controlling for socioeconomic characteristics has no noteworthy impact of the country-specific residuals. Socioeconomic characteristics of the populations do not explain the cross-European differences in the utilization of pharmaceuticals.

5.4 Variation explained by organizational factors

In the third column of tables IX and X we give partial effects from models including the policy amenable supply and demand side characteristics of the pharmaceutical sector that were described in table IV. For both samples, a higher density of pharmacies has a significant positive effect on the propensity to use medication. This is consistent with an availability effect, namely a positive association between supply and consumption. Physician supply, however, is negatively associated with drug utilization in both samples. This is consistent with doctor visits acting as a substitute for pharmaceuticals. Higher physician density might result in more time spent in consultations with patients, which has been found to be associated with less frivolous prescribing (Lundkvist, 2002). The propensity to use is greater in countries where the retailing of pharmaceuticals is highly regulated. Such regulation does not appear to be

motivated by a desire to constrain consumption, or, at least if it is, then there is no indication from these data that it is effective toward that end. The motivation for such regulation may derive more from the protection of professional interests than those of the patient.

The propensity to use pharmaceuticals is lower in countries that provide financial incentives to doctors to constrain their prescribing. In the full sample, the probability of receiving medication is 6.4 percentage points lower in such countries, and in the restricted sample it is 3.6 points lower. This is in accordance with the findings in the literature that financial incentives are not only effective in reducing prescribing costs but also the volume of drugs prescribed (Sturm et al., 2007).

Conditional on the average gross of reimbursement price, the average proportion of the cost incurred by patient is significantly negative correlated with drug utilization. This is consistent with a price effect, found in many studies of the demand for pharmaceuticals, that might stem from the patient choosing to forgo medication and/or the costs incurred by the patient impacting on the prescriber's behaviour (Atella et al., 2005; Hassell et al., 2003). Of course, we should be cautious in interpreting the effect as an estimate of the causal impact of patient cost on utilization since it is identified only from cross-country variation and average costs that overlook much of the complexity of reimbursement policies. Gross of reimbursement retail prices are positively correlated with the propensity to use pharmaceuticals. This is inconsistent with the expected negative price effect. This may derive from the difficulty of identifying the effect from country level variation alone, or it could be that the correlation is picking up not the impact of price on demand, but that of demand on price. This could materialise even in the absence of market determined prices. In countries where cultural and/or institutional factors propel a vigorous

demand for medicines, the pharmaceutical companies are in a stronger position to negotiate higher prices. Utilization rates are higher in countries that protect the chronically ill from cost-sharing, but the difference is not significant.

Pharmaceutical and healthcare system organizational characteristics explain an additional 18% of the between-country variation in the full sample, bringing the explained variation to 93% of the total (Table VII, column 3). The magnitudes of most of the country-specific residuals decline when control is made for organizational factors further indicating that system level characteristics are partly responsible for the differences in utilization rates. France and Belgium remain above the average, but the fall in the residual is very marked in France and it no longer remains the country with the highest rate of medication. This suggests that policies in operation in France have much to do with the high utilization of pharmaceuticals found there. Most important would appear to be the near full reimbursement of costs and the absence of incentives to constrain prescribing behaviour. Conditional on institutional factors, Sweden is the country with the highest rate of utilization and Germany also moves to having higher than average utilization. This is consistent with policies in these two countries helping to constrain utilization. It is notable that both countries operate systems of financial incentives linked to prescribing behaviour. Austria and Switzerland no longer have above average utilization rates, suggesting that polices may contribute to high rates of medication. After controlling for organizational factors, utilization rates remain below the average in Denmark, Italy, the Netherlands and Spain. The magnitudes of the residuals move closer to zero for the first three of these countries, consistent with policies being partly responsible for their low rates. Notable are the low densities of pharmacies in Denmark and the Netherlands, the very

high cost-sharing in Denmark and the financial incentives to constrain prescribing behaviour in Italy.

Restricting attention to medication received by those with a diagnosed condition, given that individual level health and demographic factors play less of a role in explaining cross-country variation in utilization, one would expect country level organizational factors to be relatively more important. This is confirmed, with the explained cross-country variation rising from around 12% to 66% when organizational factors are taken into account (Table VIII, column 3). France and Greece continue to have rates of use above the average although the excess falls in both cases, which for Greece is mostly attributable to the very high density of pharmacies. As for the full sample, Germany and Sweden move above the average after controlling for institutional factors, while Switzerland is no longest significantly above the average. As for the full sample, Denmark, Italy, the Netherlands and Spain all remain below the average with the deficit declining for the first three countries after taking account of the policies they have in place that appear to help constrain utilization.

Three of the country-level organizational variables—physician density, retailing restrictions and the gross of reimbursement price—take what are arguably the 'wrong' signs in the regressions. It is possible that these variables are picking up the effects of correlated omitted factors, and so we are less confident that they are capturing the effect of different policy environments. In order to avoid over attributing the cross-country variation to policy determined factors, we repeat the analysis dropping the three variables from the models. The results are given in the final columns of tables VII-X. The partial effects of the remaining institutional factors are generally robust to dropping the three variables, although pharmacy density

becomes insignificant and the dummy indicating that individuals with chronic conditions are exempt from co-payments increases in magnitude and becomes significant.

Excluding the three institutional factors results in the proportion of the cross-country variation that is explained falling from 93% to 85% with the full sample and from 66% to 44% in the restricted sample. The remaining four institutional factors explain 10% of the variation in the full sample and 32% in the sample restricted to those reporting a diagnosed condition. Even with this more conservative specification of proxies for differences in pharmaceutical policy instruments, it appears that around one-third of the cross-European variation in the receipt of medication among individuals with conditions known to respond to drug therapy can be explained by differences in the availability of pharmacies, the presence of incentives to constrain doctors' prescribing and levels of patient cost-sharing.

5.5 Variation in medication for specific diagnosed conditions

Results of the analysis of utilization of medication specific to each condition are summarised in Figure 3. For each of condition, the period since first diagnosis is controlled for along with a set of health variables selected according to Akaike/Bayesian Information Criteria. In the cases of Asthma and High Blood Cholesterol the MSD actually increases when health and demographic are entered into the model and for cholesterol this is also true for the addition of socioeconomic factors. This indicates that cross-country differences in the distributions of these covariates cannot explain the observed differences in utilization rates. For the rest of the diseases, differences in the health and demographic status of the populations with each condition explain between 10% (Hypertension) and 30% (Stroke) of the cross-

country variation in utilization. Pharmaceutical and healthcare system organizational characteristics play a relatively important role, explaining an additional 43% (Stroke)-57% (Diabetes) of the variation. When the analyses is repeated dropping the three country-level organizational variables that take the 'wrong' sign, namely physician density, retailing restrictions and retail price, the proportion of the cross-country variation that is explained falls by approximately half in the case of Arthritis (60% to 33%) and to around 40% for Asthma and Stroke, while it remains rather constant in the cases of Diabetes and Heart Attack. High blood Cholesterol and Hypertension are clear exceptions. For these two conditions, organizational characteristics are less important and more than two-thirds of cross-country variability in medication use remains unexplained. It is notable that these are the least symptomatic conditions and it is likely that individual, rather than institutional, factors play a greater role in determining utilization of medication through insight into the illness and beliefs about the benefit of treatment. Physicians' attitudes towards medication of these conditions, but also different methods used in the delivery of care may also play an important role (Fahey, et al. 2006).

6. Discussion

There are substantial differences in the utilization of pharmaceuticals across Europe that carry over into disparities in pharmaceutical expenditures. For example, while 86% of older French men and women with a diagnosed chronic condition are on medication, the equivalent figure in Denmark is only 75%. Differences are even greater across Europeans with the same diagnosis. The extent to which these disparities are attributable to organizational differences in pharmaceutical and health care sectors resulting from policy choices, as opposed to differences in the health of

populations or in cultural attitudes to the prescribing and consumption of medicines, must be established if there is to be cost-effective utilization of pharmaceuticals throughout the continent.

Our analysis reveals that differences in population health almost three-quarters of the cross-country variation in the utilization prescribed medicines among older Europeans. However, after restricting attention to individuals with a diagnosed chronic condition, differences in demographics and health (measured by a rich set of indicators) explain only 12% of the cross-country variation, leaving a lot that is attributable to other factors, including organizational differences. Cross-country differences in the distribution of enabling factors, e.g. education and income, appear to play no role in explaining the differences in pharmaceutical utilization. In addition, while there is a positive, significant income effect on utilization in the whole population of older individuals, there is no evidence of an effect among those with a diagnosed condition. Further, in contrast to the US, education is not associated with greater utilization of pharmaceuticals. Overall, there is little or no evidence of a socioeconomic gradient in need-adjusted medication use in Europe, which can be attributed to the near-universal coverage across all eleven countries studied.

After restricting attention to individuals with a diagnosed chronic condition and controlling for health, demographic and socioeconomic status, our proxies for organizational determinants of pharmaceutical utilization (i.e. density of pharmacies and of physicians, degree of regulation of retailing, incentives to influence prescribing behaviour, gross prices, reimbursement rates and protection of the chronically ill from co-payments) explain 54% of the cross-country variation in utilization. While we would not suggest that this provides an estimate of the causal effect of these organizational factors on the utilization of medicines, it is at least consistent with, and

suggestive of, a potentially large role for policy differences in explaining the cross-European variation. Most of the institutional variables showed the expected signs, with higher pharmacy density, higher patient reimbursement rates and protection of the chronically-ill from co-payments all being associated with higher probability of drug utilization, while utilization is lower in countries that offer physicians financial incentives to constrain their prescribing. The evidence of a positive correlation with pharmacy density is consistent with Kooiker & van der Wijst (2003), who argue that high density contributed toward a culture of a "pill for every ill". There is also abundant evidence, reviewed above, to support a negative price effect on pharmaceutical utilization. Our cross-country finding on the relationship between physicians' incentives and pharmaceutical utilization is consistent with the evidence showing that such incentives are effective in reducing prescriptions issued (Sturm et al., 2007).

On the other hand, we find that pharmaceutical consumption is not lower in countries that place greater restrictions on retailing and where gross of reimbursement average prices are higher. The former is not consistent with any substantial impact of regulation of who can sell medicines and of where they are sold on their rate of utilization. Consumption is actually greater in countries where gross prices are higher. It is possible that this reflects an effect of strong demand on prices. Utilization is lower in countries with a higher density of physicians. While this is inconsistent with an availability effect—more doctors writing more prescriptions—it could simply mean that physicians are substitutes for pharmaceuticals. Nonetheless, since the estimated effects of regulation, gross price and physicians may be considered counter-intuitive and attributable to correlated factors not influenced by policy, we repeated the analysis without controlling for these variables. The remaining organizational

proxies still account for 32% of the cross-country variation in utilization of medication by individuals with a diagnosed condition.

After accounting for population health, socioeconomics and organizational factors, 34% of the cross-country variation in pharmaceutical utilization among those diagnosed with a chronic condition remains unexplained (56% in the restricted specification—model 4). In the cases of hypertension and high blood cholesterol, two rather asymptomatic conditions, as much as two-thirds of variability is left unexplained. This unexplained variation could be due to uncontrolled differences in need—severity of disease or the existence of co-morbidities—and in organizational determinants. However, it will also be due to differences in norms and cultures regarding the prescribing and taking of medication, which may influence the effectiveness of given organizational structures. For example, in the Netherlands evidence based prescribing guidelines are known to be highly valued by health professionals and used in day-to-day practice while in France there is evidence that they are not adhered to (Durieux et al., 2000). A recent report on role of culture in the consumption of pharmaceuticals in Europe found that only in the Netherlands is lifestyle advice ranked as an equal therapy with medication for the treatment of hypertension, while in France and Switzerland doctors are likely to prescribe expensive pharmaceutical treatment from the first consultation and alternative options are rarely considered (Kooiker et al., 2003).

Patients' attitudes toward the use of pharmaceuticals, and adherence to medication, also differ. Kooiker et al (2003) found such attitudes range from strong pharmaco-centrism in France and Switzerland to drug-reluctance in the Netherlands. Cultural differences in attitudes toward medication may stem from deeper differences in conceptions of illness (Murray et al., 2003). One study found that Belgians with

upper respiratory symptoms are more likely to label their condition as bronchitis, whereas the Dutch most likely report cold or flu (Deschepper et al., 2002). The Belgians were more likely to visit a doctor, which most often led to a prescription, while the Dutch were more likely to adopt an attitude of "nursing one's illness". A study on upper respiratory tract infections in France and the Netherlands revealed that the threshold for consulting a GP is much lower in France due to a greater perceived need to consult for self-limiting diseases (Rosman et al., 2008). Even though antibiotic prescribing did not differ substantially between the two countries, the volume of prescriptions of symptomatic or analgesic medications was remarkably higher in France. These prescriptions are often thought to be offered as some sort of "consolation". People in the Netherlands are much more sceptical towards medication use, which is associated with the belief that drugs may have toxic effects on the body (Rosman et al., 2008). Jüerges (2007b), using the SHARE data, has separated cross-national differences in self-reported health into that part due to differences in "true" health, measured by diagnosed conditions, and the remainder due cross-cultural differences in response styles. He finds that Danish and Swedish respondents tend to overrate their health (relative to the average), while German, but also French, respondents tend to underrate their health. Interestingly, we find that the Swedes and Danes are less likely to use medication in almost all of the models estimated. Another predictor of poor adherence to medication is patients' lack of belief in the benefit of treatment (Lacro et al., 2002; Okumo et al., 2001; Murray et al., 2003). The recent Study of Heart Failure Awareness and Perception in Europe (SHAPE) revealed that only a minority of respondents from the Netherlands and Germany believe that drugs can prevent the development of heart failure (43% and 38% respectively), while a majority believes so in France (60%) and Spain (65%) (Remme et al. 2005).

Of course, it is difficult to isolate the effect of purely cultural determinants from attitudes that develop in response to information and institutionally fixed incentives. Patient education campaigns in the Netherlands have long advised individuals not to consult their doctor before it is absolutely necessary. Self-medication and the use of OTC drugs is widespread in France compared to the rest of Europe; around 36% of pharmaceutical sales are not on prescription.[11] This is due to the fact that almost 70% of the products that can be bought with or without prescription are on the positive list for reimbursement. In the Netherlands, the OTC market is limited as they are not reimbursed, while prescribed drugs are essentially free.

While we do not claim that this study provides conclusive evidence on the causal determinants of pharmaceutical utilization in Europe, together with other available evidence, it does suggest that organizational and cultural factors play an important role in explaining the substantial cross-country variation that exists. We contend that the evidence is sufficient to warrant the exertion of considerable effort by countries into learning how others manage to constrain the utilization of pharmaceuticals. This requires investigation not only of demand and supply side characteristics of the pharmaceutical and health care sectors that are directly amenable to policy in the short to medium term, but also attitudes towards the use and prescription of medicines that may be responsive to information and education campaigns over a longer time horizon.

[11] The data analysed in the present study do not cover OTC medicines.

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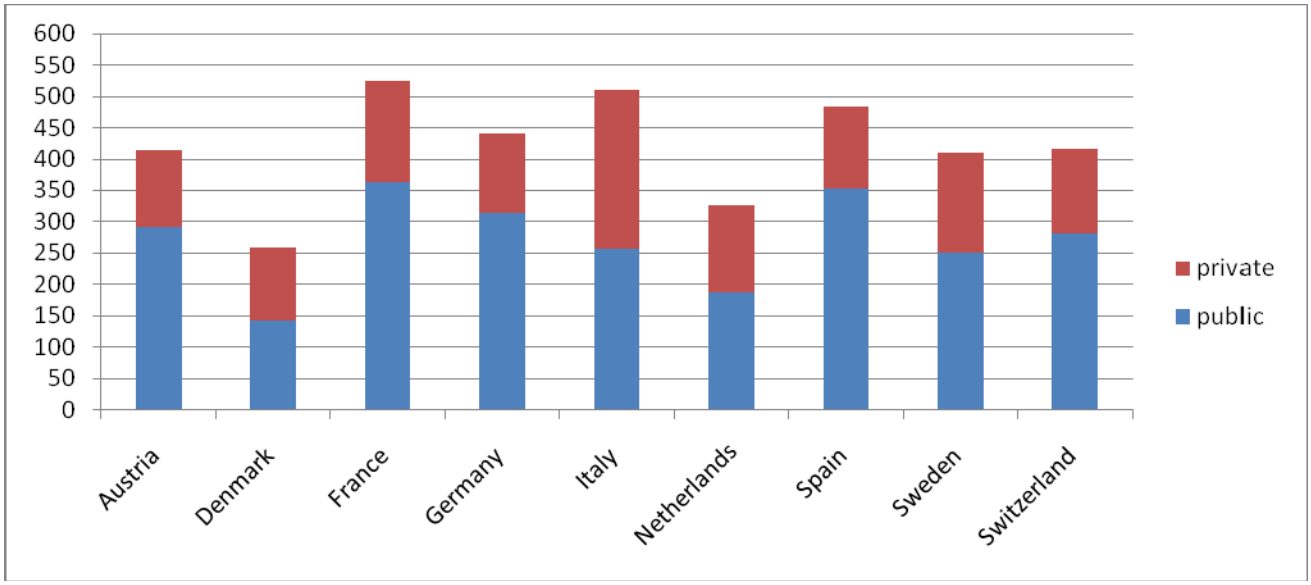
Figures and Tables

Figure 1: Total Pharmaceutical Expenditures per capita (US$, PPP), 2004



Source: OECD-Health Data -2007. The data for the Netherlands are the latest available for 2002; Belgium and Greece excluded due to non-available data.

Figure 2: Number of Pharmacies per 10,000 Inhabitants in Europe (SHARE countries)

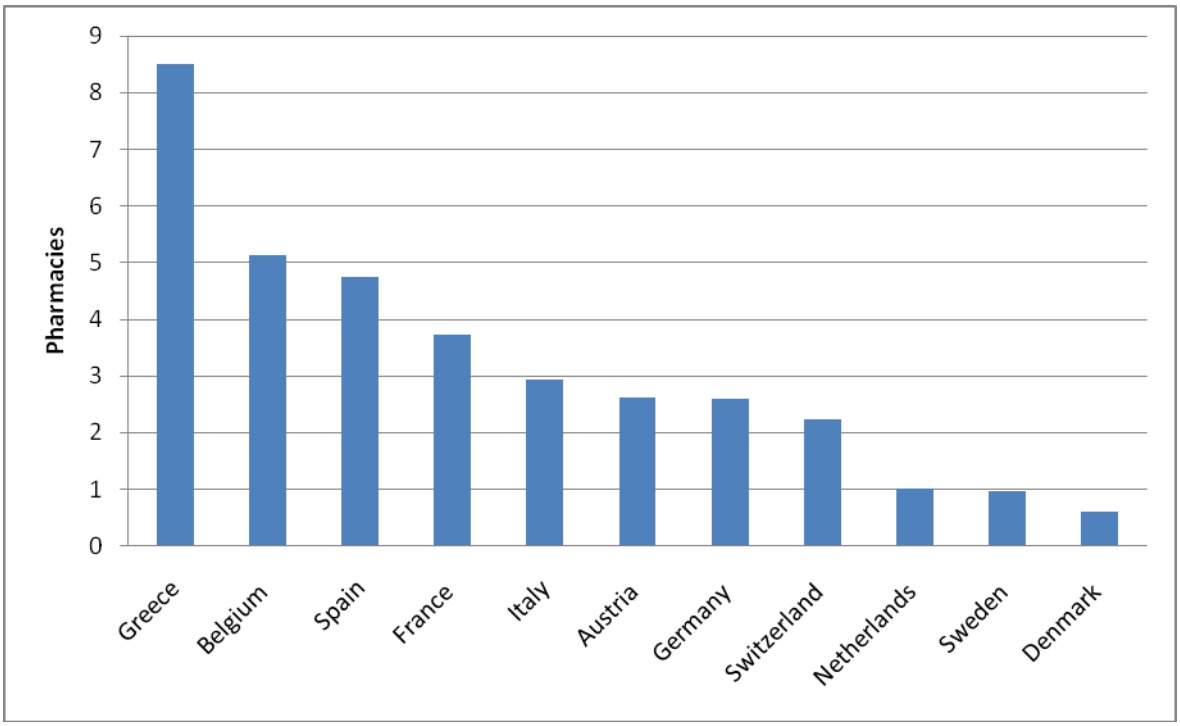
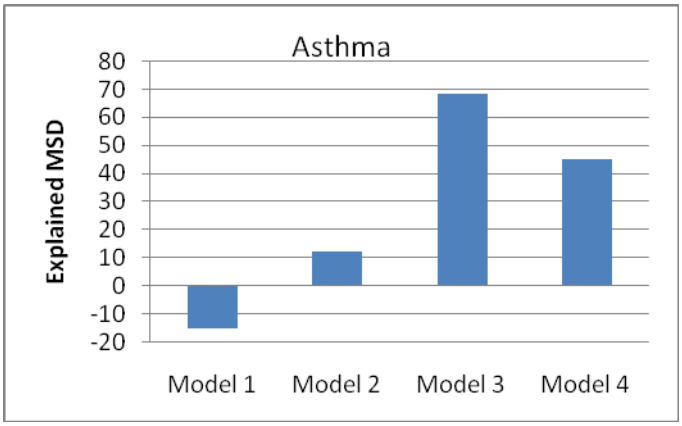
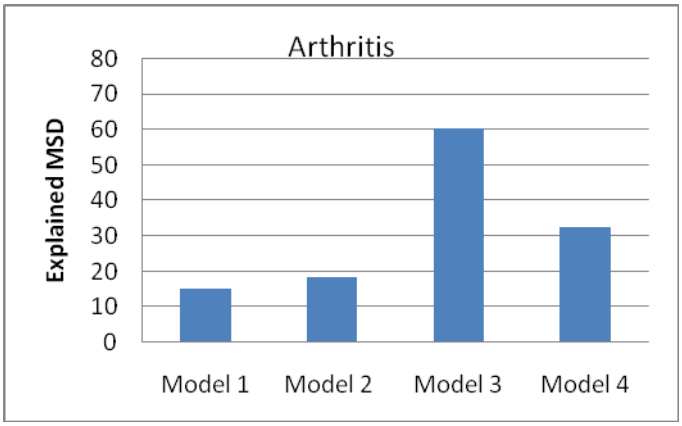
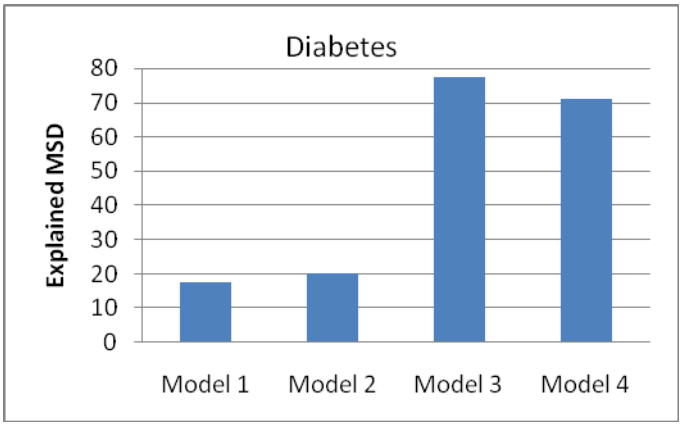
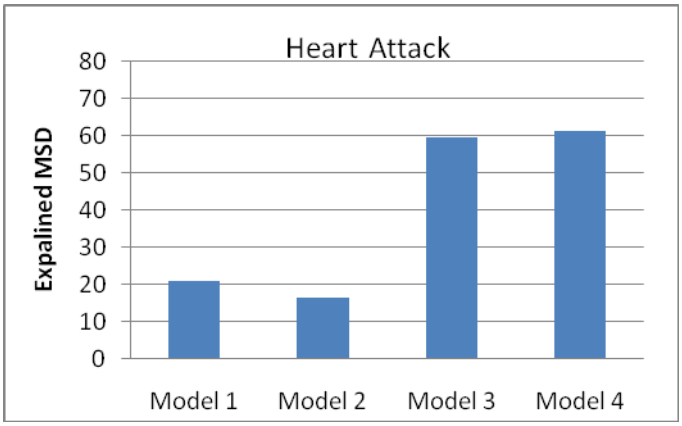


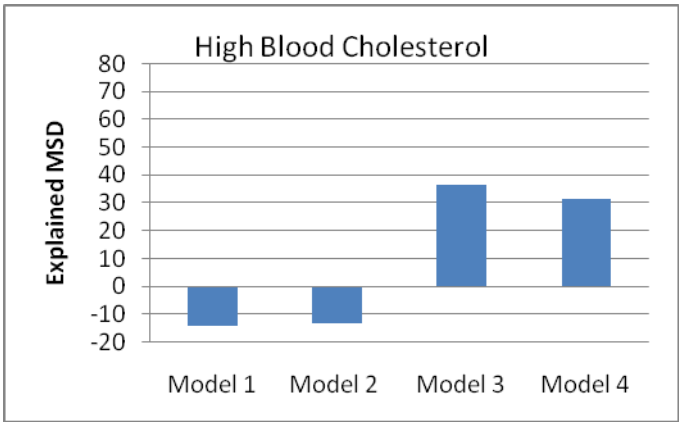
Figure 3: Explained percentage of cross-country variation (MSD) in the probability of taking medication for specific diseases

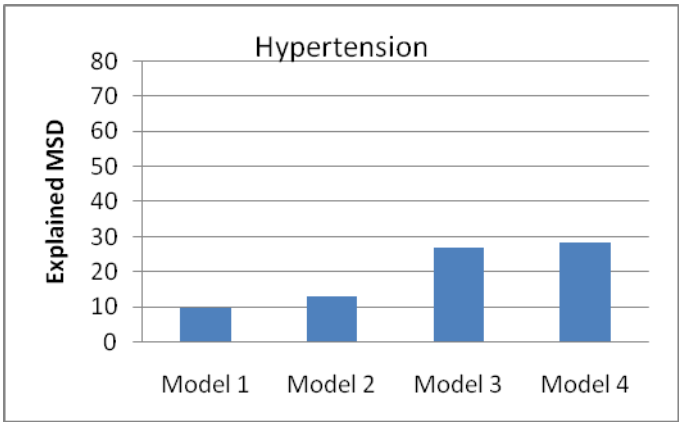


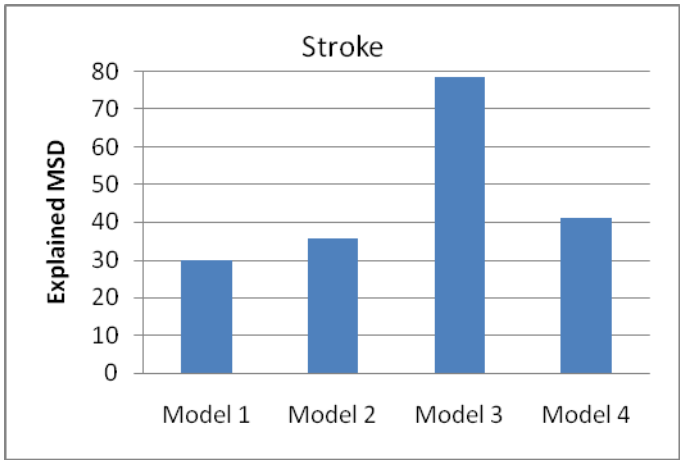












Model 1: Health & demographics
Model 2: Health, demographics & socioeconomics
Model 3: Health, demographics, socioeconomics & organizational
Model 4: is as Model 3 but with physician density, regulation of retailing and retail price omitted.

Table I: Regulation of Pharmaceutical Retailing in SHARE countries

Restrictions on:	Austria	Belgium	Denmark	France	Germany	Greece	Italy	Netherlands	Spain	Sweden	Switzerland
Ownership	4	1	3	4	3	4	4	1	3	4	2
Location	4	3	1	4	1	4	4	1	4	4	1
Diversification	4	1	3	4	1	4	4	1	4	4	1
Pharmacies Monopoly on Dispensing	4	4	2	3	2	4	4	2	4	3	1
Advertising	2	3	2	2	2	4	2	2	2	2	2
Total	18	12	11	17	9	20	18	7	17	17	7
Classification used in analysis	Restricted	Liberal	Liberal	Restricted	Liberal	Restricted	Restricted	Liberal	Restricted	Restricted	Liberal

Note: Subjective scores on a 1-4 scale with a higher score indicating a higher degree of regulation. Subjective classification of regulatory regime as "restricted" or "liberal" based on clustering of the total score.
Ownership restrictions: degree to which only pharmacists are entitled to own a pharmacy.
Location requirements: geographic and population restrictions on the establishment of new pharmacies.
Restrictions of Diversification: limitations to the number of pharmacies owned and formation of pharmacy chains.
Pharmacies monopoly on dispensing: degree to which pharmacies have a monopoly over dispensing of medicinal products or whether dispensing of particular products is allowed at doctors and/or other retail shops.
Advertising Restrictions: degree to which advertising is prohibited for all medicinal products or permitted for some products, e.g.. OTCs.

Table II: Policies influencing Prescribing Behaviour (2004)

Policy	Austria	Belgium	Denmark	France	Germany	Greece	Italy	Netherlands	Spain	Sweden	Switzerland
Prescribing Guidelines	√	√	√	√	√	X	√	√	√	√	X
Monitoring/ Individual audit on Prescribing	√	√	√	X	√	X	√	√	√	X	X
List	√	√	√	√	√	√	√	√	√	√	√
Prescribing Budgets/ Financial Incentives	X	X	X	X	√	X	√	X	√	√	X
Generic Prescribing	X	X	X	√	√	X	√	√	√	X	√
Generic Substitution	X	X	√	√	√	X	√	√	√	√	√

Prescribing Guidelines: evidence based guidelines issued by statutory bodies to promote an appropriate and economic prescribing of pharmaceuticals.
Monitoring and Individual Audit: of Prescribing: monitoring of doctors' prescribing habits (volumes/ costs/ quality) and physicians receiving personal feedback on their prescribing practices
List: refers to either positive or negative lists that guarantee or limit that include pharmaceutical for which reimbursement is guaranteed or limited.
Prescribing Budgets: budgets allocated to physicians or health authorities or areas to cover their prescribing over a given period
Financial Incentives: payments or fines for adherence or non-adherence to treatment guidelines or achieving targets that relate more to quality rather than financial targets only.
Generic Prescribing: allowing doctors to prescribe using non-proprietary name for a pharmaceutical preparation
Generic Substitution: allowing pharmacists to substitute the product written on the prescription by a generic equivalent.

Table III: Pricing, Reimbursement and Patients' Cost-Sharing in SHARE countries

	Pricing	Reimbursement	Co-Payments	Protection Mechanisms
Austria	price-contracting with price/volume agreements rebate on excess sales	No reference price system. All pharmaceuticals in the positive list are fully reimbursed. Pharmaceuticals not on the positive list are not reimbursed.	For reimbursable pharmaceuticals patients pay a fixed prescription fee amounting to € 4.60 (in 2006).	Exemption from prescription fee for low-income pensioners, patients with communicable diseases, (exemptions are valid for the whole family
Belgium	a) price comparisons with weights to R&D b) Price cuts/freezes for older drugs c) reference pricing for products with generic equivalents	Products on the positive list partly or fully reimbursed Products with generic equivalents are reimbursed at the generic price	co-insurance (25%-80%) up to max. amount (depending on family's net income) For serious/ chronic illness: 0%.	"preferential reimbursement" of 15% for widows, pensioners, disabled. Annual threshold for vulnerable groups & maximum copayment per prescription from €6.70 to €26.10 for certain reimbursement categories.
Denmark	Price agreement between the industry and the Ministry of Health	Reference pricing for reimbursement. Consumption-based reimbursement, i.e. the rate depends on patient's annual pharmaceutical expenditure for reimbursable medicines.	Depending on annual pharmaceutical expenditure copayment rate varies from 100% to 15%.	Exemptions for chronically-ill above an annual ceiling (3805 DKr). Total exemption for terminally ill.
France	Free pricing for non-reimbursable products. Price fixing (negotiation with manufacturers); ccomparisons with EU countries, recurrent price freezes/cuts for innovative products	Only drugs in the positive list are eligible for reimbursement. Four reimbursement rates: 100% (for highly effective drugs; 65%, 35% & 15% and 0% for drugs with limited therapeutic value	Fixed co-payment of €0.53 per pack plus a co-payment (difference between the retail price and the rate of reimbursement)	Total exemption: a list of 30 chronic/ costly diseases[1], conditions with >6 month duration. People with low incomes, disability/ work injury benefit.
Germany	Free pricing of stand-alone drugs	Reference prices for therapeutic substitutes and generics. All pharmaceuticals in the positive list are fully reimbursed. Lifestyle and OTC drugs are not reimbursed.	Cost-payment of 10%, with a min. of 5€ and a max. of 10€[12] Price differential between the reference and the market price.	Total exemptions for children <12years, children >12yrs with developmental/severe diseases. Annual total cost-sharing limited to 2% of annual gross income (1% for chronically ill)
Greece	Price Fixing for imported drugs (average of the 3 lowest prices of the EU-25) Basic cost formula for locally produced products	All medicines with approved price are eligible for reimbursement- standard rate 75%. OTC; 'life-style' products are not reimbursed	25% general co-payment rate	Low income pensioners; chronic/sever diseased reduced (10%) co-payment rate. Specific chronic/severe conditions totally exempt

[12] Pharmaceuticals priced 30% below the reference price are exempt from co-payments, which is the case for more than 12,000 medicines (Busse, 2008)

	Pricing	Reimbursement	Co-Payments	Protection Mechanisms
Italy	- Average European Price (AEP) for old products - Contractual model (negotiation) for new products Price cuts/ freezes	All pharmaceuticals in the positive list are fully reimbursed.	Prescription fee (€ 1 or 2) applied only in few Regions	Exemptions to chronically ill, people with rare diseases, disabled. For some regions use exemptions based on income and/or age.
Netherlands	For POM price fixing biannually (average price of comparable products in: Germany, France, Belgium, UK.	Reference pricing for interchangeable therapeutically products. All pharmaceuticals in the positive list are fully reimbursed.	No co-payment policy. (patient pays the full difference between medicine price and the reimbursement limit	Fiscal compensation arrangements for low income groups.
Spain	Price negotiations on cost-plus basis; EU price comparisons Price-Volume agreements for costly products	Reimbursement is based on the agreed price (reference pricing) Positive & Negative List	Based on the price of the drug. Generally 40% of the price, 30% for civil servants mutual companies.	Pensioners, handicapped and chronically ill are fully exempted from pharmaceutical co-payments
Sweden	Price control for reimbursable products (cost-effectiveness criteria) Free-pricing for non-reimbursable pharmaceuticals	Mandatory generic substitution since2002. Consumption-based reimbursement, i.e. the rate depends on patient's annual pharmaceutical expenditure for reimbursable medicines.	Depending on annual pharmaceutical private expenditures co-payment rates from 100% -10%, up to a max. annual co-payment of €194[13]	Maximum limit of €194 annual. Children <18 years within a family are considered as one beneficiary and their costs are pooled together.
Switzerland	Free-pricing of non-reimbursable products; negotiations with manufacturers for reimbursable products	Only products included in the positive list are being reimbursed	Payable deductible amount and a 10% co-insurance above the deductible. (20% for brand-name drugs with interchangeable generics available)	Cost-sharing is capped annually but there is no exemption for low-income people. Children <18 years exempt from deductibles.

1. Federation of Social Insurance Institutions (HVSV). 2. Economic Committee for Health Care Products (CEPS) 3. http://www.ameli.fr/229/DOC/2259/fiche.html?page=4
4. Pharmaceutical Benefits Board (Läkemedelsförmånsnämnden, LFN)

[13] In Sweden cost-sharing due to refusal of generic substitution, payments for not reimbursed medicines and OTC drugs are not included when calculating the 12-month co-payment ceiling of SEK 1,800/ €193.91

Table IV: Description and means for indicators of organizational determinants of pharmaceutical utilization used in empirical analysis

Variable	Description	Austria	Belgium	Denmark	France	Germany	Greece	Italy	Netherlands	Spain	Sweden	Switzerland
Quantity and regulation of suppliers												
Pharmacy density	Pharmacies per 10.000 persons	2.62	5.13	0.60	3.74	2.59	8.50	2.94	1.02	4.76	0.98	2.25
Physician density	Physician per 1.000	3.5	4.0	3.2	3.4	3.4	4.9	4.2	3.6	3.4	3.4	3.8
Retail restrictions	High degree of regulation of pharmaceutical retailing	1	0	0	1	0	1	1	0	1	1	0
Financial incentives on suppliers												
Incentives	Physicians have financial incentives to constrain prescribing	0	0	0	0	1	0	1	0	1	1	0
Price effects and cost-sharing												
Retail price	Price level index for pharmaceuticals (EU25=100)	106	105	120	91	127	73	117	109	77	94	185
Patient cost	Average cost paid by the patient as % of the total reimbursed pharmacy market value at retail prices	17%	15.90%	40.40%	1.00%	7.10%	13.60%	3.20%	0.50%	7.00%	22.40%	10.00%
Chronic exempt	Chronically-ill exempt from/pay reduced co-payments (mean)	0	0	1 (0.64)	1 (0.62)	1 (0.61)	1 (0.62)	1 (0.68)	0	1 (0.64)	0	0

Retail restrictions: 1 if the country is highly regulated in pharmaceutical retailing according to the classification presented in Table 1.
Incentives: 1 if the country operates prescribing budgets allocated to physicians/ health authorities or makes payments/fines for (non-)adherence to treatment guidelines that relate to quality of prescribing
Retail price: gross of patient reimbursement price relative to the EU-25 average for the year 2005. Source: Eurostat-OECD Purchasing Power Parity (PPP) programme (Konijn, 2007).
Patient cost: average cost paid by the patient as a percentage of the total cost paid by the insurer and patient in the total reimbursed pharmacy market (OTC products are not included if they are not reimbursed). For France the costs paid by the insurer includes that covered by supplementary insurance (mutual or private). Source: European Federation of Pharmaceutical Industries and Associations (EFPIA, 2007).
Chronic exemptions: 1 if the individual reports to have been diagnosed with a chronic conditions and lives in a country that exempts, or reduces, co-payments for the chronically ill. Figures in parenthesis are the relevant sample's mean.

Table V: Disease prevalence and pharmaceutical utilization rates (%).

	Pooled	Austria	Belgium	Denmark	France	Germany	Greece	Italy	Netherlands	Spain	Sweden	Switzerland
Any Condition	61.3	53.85	66.26	58.80	64.6	59.03	62.07	65.53	49.92	64.06	54.84	46.04
Drug Use if have any condition	83.2	84.32	**80.62**	**75.12**	*86.48*	85.93	86.17	**79.53**	79.28	**82.06**	**79.72**	83.47
Hypertension Diagnosed	33.2	30.75	31.53	29.14	28.90	36.06	36.20	37.09	25.47	32.79	28.55	26.30
Drug Use if hypertensive	86.3	**89.97**	**66.65**	**82.71**	*93.46*	**89.93**	**90.76**	**88.36**	**81.93**	**84.85**	**87.75**	92.93
Cholesterol Diagnosed	20	15.91	28.88	15.26	23.02	18.35	21.07	19.61	14.75	23.94	16.25	12.89
Drug Use if have high blood cholesterol	61.9	**56.05**	**57.09**	**62.09**	*80.12*	**55.94**	**61.83**	**54.41**	**67.47**	**58.76**	**59.05**	**63.39**
Diabetes Diagnosed	11.1	8.31	8.39	7.44	9.60	12.01	9.28	12.00	8.51	14.56	8.94	5.49
Drug Use if diabetic	80.9	*85.64*	81.56	**69.63**	81.17	83.49	79.96	81.34	82.47	**77.85**	**68.85**	77.69
Asthma Diagnosed	4.5	4.72	3.27	8.26	4.29	3.36	3.23	5.20	4.26	3.95	7.67	3.34
Drug Use if asthmatic	64.4	72.09	68.6	*74.51*	71.59	72.57	61.48	**49.98**	70.15	**60.00**	65.21	70.11
Arthritis Diagnosed	22.1	10.85	24.10	26.24	31.00	11.97	18.37	31.30	9.95	28.33	10.08	11.54
Drug Use if have Arthritis	49.2	56.09	**46.52**	**41.28**	57.48	53.36	*57.86*	**40.16**	**45.13**	**48.47**	52.65	**43.44**
Heart Attack Diagnosed	12.01	9.37	14.87	8.78	14.23	11.64	12.75	11.10	11.02	11.14	17.19	6.90
Drug Use if had a heart attack	91.7	90.63	94.27	89.20	94.55	93.67	*94.65*	93.82	**88.50**	91.07	**86.87**	92.64
Stroke Diagnosed	3.6	4.23	4.00	5.41	3.69	4.26	3.73	3.14	4.64	2.13	5.07	2.38
Drug Use if had a stroke	84.2	**84.05**	**84.38**	**75.70**	89.21	**79.49**	**80.78**	*94.03*	**78.30**	82.42	**80.60**	82.72

Note: italics indicate the country with the highest rate, bold indicate statistically significant differences (5%) relative to the country with the highest rate.

Table VI: Sample Means of Control Variables

Variables	Variable Description	ALL	At least one Condition	AU	BG	DK	FR	DE	GR	IT	NL	SP	SE	CH
Male 50-59	1 if male aged 50-59 years (ref: female aged 70+)	0.17	0.13	0.18	0.17	0.20	0.18	0.17	0.16	0.16	0.21	0.17	0.18	0.20
Female 50-59	1 if female aged 50-59 years	0.18	0.13	0.19	0.18	0.20	0.19	0.16	0.16	0.17	0.21	0.17	0.18	0.20
Male 60-69	1 if male aged 60-69 years	0.14	0.15	0.14	0.14	0.14	0.13	0.17	0.16	0.14	0.14	0.13	0.14	0.16
Female 60-69	1 if female aged 60-69 years	0.16	0.17	0.16	0.15	0.15	0.14	0.18	0.17	0.16	0.14	0.14	0.14	0.15
Male 70+	1 if male aged >70	0.21	0.16	0.12	0.15	0.12	0.14	0.12	0.15	0.14	0.12	0.16	0.15	0.13
symptoms	Number of symptoms [+]	2.05	2.03	1.33	1.92	2.03	2.60	1.58	1.61	2.57	1.53	1.89	3.21	1.01
numeracy	mathematical performance [++]	3.15	3.01	3.61	3.25	3.44	3.05	3.56	3.27	2.82	3.53	2.43	3.56	3.72
orientation	Orientation to date, month. year, day++	3.72	3.68	3.80	3.75	3.75	3.69	3.78	3.77	3.76	3.70	3.56	3.78	3.83
mobility	1 if ≥3 mobility limitations [+++]	0.25	0.34	0.24	0.24	0.19	0.24	0.24	0.28	0.27	0.19	0.34	0.20	0.13
depression	1 if depressed (EURO-D scale)	0.29	0.34	0.20	0.26	0.18	0.33	0.21	0.25	0.36	0.21	0.36	0.21	0.19
overweight	1 if overweight (BMI 25 – 29.9) (ref: normal/ underweight)	0.42	0.44	0.43	0.42	0.38	0.39	0.44	0.48	0.43	0.42	0.45	0.40	0.37
obese	1 if obese (BMI over 30)	0.18	0.21	0.19	0.18	0.14	0.15	0.17	0.19	0.17	0.15	0.23	0.14	0.13
Never smoked	1 if never smoked daily for at least one year (ref:smoker)	0.56	0.58	0.63	0.52	0.36	0.59	0.57	0.57	0.56	0.39	0.62	0.46	0.56
Former smoker	1 if former smoker	0.26	0.27	0.18	0.31	0.33	0.27	0.25	0.18	0.26	0.37	0.21	0.37	0.24
iadl	1 if ≥1 IADL limitations	0.17	0.22	0.17	0.19	0.17	0.18	0.15	0.19	0.16	0.16	0.24	0.17	0.08
VeryGoodHealth	1 if self-reported health very good (ref:bad/very bad)	0.13	0.06	0.17	0.18	0.24	0.13	0.11	0.22	0.08	0.18	0.10	0.27	0.32
Goodhealth	1 if self-reported health good	0.43	0.38	0.43	0.49	0.45	0.48	0.42	0.39	0.40	0.50	0.40	0.35	0.48
FairHealth	1 if self perceived health Fair	0.33	0.39	0.30	0.25	0.22	0.29	0.32	0.30	0.38	0.26	0.32	0.27	0.16
single	1 if live as single 0 if live with spouse/ partner	0.34	0.36	0.39	0.27	0.34	0.31	0.34	0.33	0.35	0.31	0.36	0.37	0.31
employed	1 if employed/self-employed (ref: retired)	0.26	0.19	0.21	0.22	0.38	0.27	0.28	0.25	0.20	0.30	0.23	0.39	0.41
inactive	1 if unemployed/permanently sick/disabled/homemaker	0.23	0.24	0.16	0.25	0.09	0.17	0.18	0.28	0.25	0.34	0.41	0.06	0.14
secondaryEduc	1 if highest level of education (ISCED-.3, 4) (ref: low education- ISCED 0,1,2)	0.47	0.45	0.76	0.48	0.67	0.35	0.73	0.30	0.35	0.61	0.26	0.34	0.51
tertiaryEduc	1 if highest level of education (ISCED 5-6)	0.18	0.16	0.24	0.23	0.33	0.19	0.26	0.15	0.08	0.20	0.08	0.29	0.28
Log income	logarithm of equivalent gross annual household income	9.67	9.64	9.80	9.82	10.33	9.94	9.90	9.00	9.37	10.05	8.94	10.19	10.37

+ Individuals were asked if they were bothered with symptoms in the past six months: 1) pain, knees, hips, joints, 2) heart trouble, angina, chest pain; 3) breathlessness; 4) persistent cough; 5) swollen legs; 6) sleeping problems; 7) falling down and fear of falling down; 8) dizziness faints or blackouts; 9) stomach or intestine problems; 10 incontinence.

++ A score of 1-5 was used.The higher the score the better

+++Individuals were asked if they had difficulties with: 1) walking 100 meters; 2) sitting for two hours; 3) getting up from a chair; 4) climbing one or several flights of stairs without resting; 5) stooping, kneeling or crouching; 6) reaching or extending arms above shoulder level; 7) pulling/pushing larges objects; 8) lifting weights over 10 pounds/5 kilos; 9) picking up a small coin from a table.

Table VII: Country-specific mean residuals and cross-country mean squared deviation (MSD) from probit model of pharmaceutical utilization- full sample

	Model 0: no covariates		Model 1: Health & demographics		Model 2: Health. demographics & socioeconomics		Model 3: Health, demographics, socioeconomics & organizational		Model 4: Model 3 with restricted specification of organizational factors	
	Mean	95 CI	Mean	95 CI	Mean	95 CI	Mean	95 CI	Mean	95 CI
Austria	0.00869	(-0.015 to 0.031)	0.01967*	(0.004 to 0.036)	0.01652*	(0.001 to 0.032)	-0.00188	(-0.015 to 0.010)	0.01548*	(0.002 to 0.030)
Belgium	0.04080*	(0.026 to 0.057)	0.01703*	(0.005 to 0.027)	0.01551*	(0.005 to 0.026)	0.01343	(0.007 to 0.018)	0.01186*	(0.004 to 0.021)
Denmark	-0.06412*	(-0.087 to -0.038)	-0.03967*	(-0.056 to -0.022)	-0.04081*	(-0.057 to -0.024)	-0.02353*	(-0.032 to -0.016)	-0.02767*	(-0.035 to -0.019)
France	0.08973*	(0.074 to 0.108)	0.05377*	(0.042 to 0.066)	0.05400*	(0.043 to 0.066)	0.01266*	(0.006 to 0.020)	0.02603*	(0.017 to 0.035)
Germany	0.00944	(-0.008 to 0.027)	0.00416	(-0.006 to 0.015)	0.00320	(-0.007 to 0.013)	0.00863*	(0.002 to 0.015)	0.00952*	(0.001 to 0.018)
Greece	-0.01868	(-0.038 to 0.000)	0.00339	(-0.008 to 0.015)	0.00677	(-0.005 to 0.018)	-0.00083	(-0.005 to 0.004)	-0.01209*	(-0.020 to -0.005)
Italy	0.03361*	(0.013 to 0.053)	-0.03139*	(-0.045 to -0.018)	-0.03074*	(-0.044 to -0.018)	-0.00941*	(-0.017 to -0.002)	-0.01461*	(-0.026 to -0.003)
Netherlands	-0.08868*	(-0.105 to -0.073)	-0.01095	(-0.023 to 0.000)	-0.01394*	(-0.025 to -0.003)	-0.00861*	(-0.013 to -0.004)	-0.03005*	(-0.038 to -0.021)
Spain	0.05569*	(0.034 to 0.075)	-0.02751*	(-0.042 to -0.014)	-0.02427*	(-0.038 to -0.011)	-0.02686*	(-0.036 to -0.017)	-0.01791*	(-0.029 to -0.005)
Sweden	-0.05759*	-0.074 to -0.038)	-0.01829*	(-0.030 to -0.007)	-0.01627*	(-0.027 to -0.005)	0.02315*	(0.016 to 0.031)	0.01973*	(0.011 to 0.027)
Switzerland	-0.07777*	(-0.106 to -0.048)	0.04221*	(0.022 to 0.062)	0.04142*	(0.022 to 0.061)	0.00047	(-0.011 to 0.012)	0.03347*	(0.011 to 0.053)
MSD	0.00321536		0.00083038		0.00080544		0.00021622		0.00045123	
Explained variation as % of model 0 MSD			74.0%		74.9%		93.3%		85.0%	

95 CI – 95% bootstrap confidence intervals; * significant at 5%. Model 4 is as model 3 but with physician density, regulation of retailing and retail price omitted.

Table VIII: Country-specific mean residuals and cross-country mean squared deviation (MSD) from probit model of pharmaceutical utilization- Individuals with a diagnosed chronic condition

	Model 0: no covariates		Model 1: Health & Demographics		Model 2: Health. demographics & Socioeconomics		Model 3: Health, demographic. socioeconomic & organizational		Model 4: Model 3 with restricted specification of organizational factors	
	Mean	95 CI	Mean	95 CI	Mean	95 CI	Mean	95 CI	Mean	95 CI
Austria	0.03107*	(0.010 to 0.052)	0.01527	(-0.006 to 0.036)	0.01309	(-0.008 to 0.032)	-0.00435	(-0.019 to 0.011)	0.01603	(-0.002 to 0.036)
Belgium	-0.01493	(-0.030 to 0.001)	-0.00058	(-0.0151 to 0.013)	-0.00179	(-0.017 to 0.012)	-0.00080	(-0.006 to 0.005)	-0.00361	(-0.014 to 0.007)
Denmark	-0.07566*	(-0.102 to -0.050)	-0.05020*	(-0.076 to -0.026)	-0.04763*	(-0.073 to -0.023)	-0.02988*	(-0.040 to -0.020)	-0.03536*	(-0.047 to -0.025)
France	0.04458*	(0.030 to 0.059)	0.05376*	(0.040 to 0.067)	0.05453*	(0.041 to 0.068)	0.01174*	(0.004 to 0.020)	0.02332*	(0.012 to 0.034)
Germany	0.03435*	(0.019 to 0.050)	0.01508*	(0.000 to 0.030)	0.01538	(-0.001 to 0.030)	0.02135*	(0.013 to 0.030)*	0.01718*	(0.005 to 0.028)
Greece	0.03053*	(0.014 to 0.047)	0.02871*	(0.013 to 0.045)	0.02904*	(0.013 to 0.045)	0.01208*	(0.006 to 0.018)*	0.00339	(-0.007 to 0.014)
Italy	-0.02717*	(-0.048 to -0.009)	-0.04275*	(-0.061 to -0.025)	-0.04399*	(-0.063 to -0.027)	-0.02417*	(-0.035 to -0.014)	-0.02504*	(-0.041 to -0.011)
Netherlands	-0.03086*	(-0.051 to -0.009)	-0.01612	(-0.035 to 0.004)	-0.01967*	(-0.037 to -0.000)	-0.00896*	(-0.016 to -0.002)	-0.03130*	(-0.044 to -0.018)
Spain	0.00441	(-0.016 to 0.024)	-0.02971*	(-0.049 to -0.013)	-0.02998*	(-0.050 to -0.014)	-0.03351*	(-0.045 to -0.022)	-0.02771*	(-0.043 to -0.014)
Sweden	-0.02407*	(-0.043 to -0.004)	-0.01419	(-0.031 to 0.005)	-0.01003	(-0.026 to 0.008)	0.03388*	(0.024 to 0.044)	0.03374*	(0.021 to 0.046)
Switzerland	0.01461	(-0.019 to 0.046)	0.04513*	(0.012 to 0.074)	0.04586*	(0.013 to 0.075)	0.00742	(-0.013 to 0.027)	0.04117*	(0.010 to 0.071)
MSE	0.00122726		0.00108193		0.0010836		0.00042012		0.00068784	
Explained	0		11.8%		11.7%		65.8%		44.0%	

95 CI – 95% bootstrap Confidence Intervals; * significant at 5%. Model 4 is as model 3 but with physician density, regulation of retailing and retail price omitted.

Table IX: Probit estimates of partial effects on probability of pharmaceutical utilization- Full sample

	Model 1	Model 2	Model 3	Model 4
Any condition	0.645*** (0.005)	0.645*** (0.005)	0.643*** (0.006)	0.639*** (0.006)
Male 50-59	-0.248*** (0.014)	-0.221*** (0.016)	-0.229*** (0.016)	-0.226*** (0.016)
Female 50-59	-0.244*** (0.013)	-0.225*** (0.015)	-0.229*** (0.015)	-0.227*** (0.015)
Male 60-69	-0.111*** (0.015)	-0.103*** (0.016)	-0.105*** (0.016)	-0.104*** (0.016)
Female 60-69	-0.118*** (0.014)	-0.116*** (0.014)	-0.114*** (0.014)	-0.113*** (0.014)
Male 70+	-0.004 (0.015)	-0.002 (0.016)	-0.005 (0.016)	-0.004 (0.016)
symptoms	0.021*** (0.003)	0.021*** (0.003)	0.022*** (0.003)	0.023*** (0.003)
numeracy	-0.005 (0.004)	-0.005 (0.004)	-0.004 (0.004)	-0.005 (0.004)
orientation	0.013* (0.007)	0.013* (0.007)	0.013 (0.008)	0.014* (0.008)
mobility	0.094*** (0.012)	0.094*** (0.012)	0.089*** (0.012)	0.091*** (0.012)
depression	-0.032*** (0.010)	-0.032***(0.010)	-0.040*** (0.010)	-0.038*** (0.010)
overweight	0.077*** (0.008)	0.078*** (0.009)	0.079*** (0.009)	0.078*** (0.009)
obese	0.152*** (0.011)	0.152*** (0.011)	0.151*** (0.011)	0.151*** (0.011)
Never smoked	0.014 (0.011)	0.015 (0.011)	0.010 (0.011)	0.016 (0.011)
Former smoker	0.033*** (0.011)	0.033*** (0.012)	0.036*** (0.012)	0.036*** (0.012)
iadl	-0.024* (0.013)	-0.026** (0.013)	-0.006 (0.006)	-0.027** (0.013)
VeryGoodHealth	-0.288*** (0.017)	-0.280*** (0.018)	-0.285*** (0.018)	-0.287*** (0.018)
Goodhealth	-0.157*** (0.017)	-0.151*** (0.017)	-0.160*** (0.017)	-0.162*** (0.017)
FairHealth	-0.044*** (0.017)	-0.041** (0.017)	-0.045*** (0.017)	-0.047*** (0.017)
Single		0.002 (0.010)	-0.004 (0.010)	-0.000 (0.010)
employed		-0.042*** (0.013)	-0.036*** (0.013)	-0.039*** (0.013)
inactive		0.006 (0.012)	0.005 (0.012)	-0.001 (0.012)
secondaryEduc		0.010 (0.010)	0.010 (0.010)	0.011 (0.010)
tertiaryEduc		-0.006 (0.013)	-0.005 (0.013)	-0.004 (0.013)
Log income		0.009** (0.004)	0.010***(0.004)	0.011*** (0.004)
Pharmacy density			0.018***(0.004)	0.002 (0.002)
Physician density			-0.071*** (0.015)	
Retail restrictions			0.042*** (0.011)	
Incentives			-0.064*** (0.009)	-0.055*** (0.009)
Retail price			0.001*** (0.000)	
Patient cost			-0.002*** (0.000)	-0.002*** (0.000)
Chronic exempt			0.013 (0.011)	0.030*** (0.009)
constant	-0.731*** (0.091)	-0.984*** (0.131)	-0.767 (0.190)***	-0.936 (0.140)
Sample Size	27021	27021	27021	27021
Log-Likelihood	-10489.135***	-10476.966***	-10418.593***	-10435.874***

Estimates are computed at the sample means. Standard errors in parentheses. ***, ** and * significant at 1%, 5% and 10%.

Table X: Probit estimates of partial effects on probability of pharmaceutical utilization for those diagnosed with at least one chronic condition

	Model 1	Model 2	Model 3	Model 4
Male 50-59	-0.205*** (0.017)	-0.185*** (0.019)	-0.193*** (0.019)	-0.190*** (0.019)
Female 50-59	-0.193*** (0.014)	-0.182*** (0.016)	-0.185*** (0.016)	-0.184*** (0.016)
Male 60-69	-0.062*** (0.014)	-0.056*** (0.014)	-0.059*** (0.014)	-0.057*** (0.014)
Female 60-69	-0.080***(0.012)	-0.079*** (0.013)	-0.078*** (0.013)	-0.077*** (0.013)
Male 70+	-0.005 (0.012)	-0.002 (0.012)	-0.003 (0.012)	-0.003 (0.012)
symptoms	0.005** (0.002)	0.005** (0.002)	0.006** (0.002)	0.006** (0.002)
numeracy	-0.001 (0.003)	0.000 (0.003)	0.001 (0.003)	0.000 (0.003)
orientation	0.007 (0.006)	0.007 (0.006)	0.007 (0.006)	0.007 (0.006)
mobility	0.040*** (0.008)	0.040*** (0.008)	0.038*** (0.008)	0.038*** (0.008)
depression	-0.026*** (0.008)	-0.026*** (0.008)	-0.031*** (0.008)	-0.030*** (0.008)
overweight	0.055*** (0.006)	0.054*** (0.007)	0.055*** (0.007)	0.054*** (0.007)
obese	0.101*** (0.007)	0.099*** (0.007)	0.098*** (0.007)	0.098*** (0.007)
Never smoked	0.004 (0.008)	0.005 (0.008)	0.002 (0.008)	0.005 (0.008)
Former smoker	0.019** (0.009)	0.021** (0.009)	0.022** (0.009)	0.022** (0.009)
iadl	-0.007 (0.010)	-0.008 (0.010)	-0.007 (0.010)	-0.008 (0.010)
VeryGoodHealth	-0.226*** (0.022)	-0.217*** (0.022)	-0.224***(0.023)	-0.222*** (0.023)
Goodhealth	-0.099*** (0.014)	-0.096*** (0.014)	-0.103*** (0.014)	-0.102*** (0.014)
FairHealth	-0.036*** (0.013)	-0.035*** (0.013)	-0.039*** (0.013)	-0.039*** (0.013)
single		0.002 (0.007)	-0.001 (0.008)	0.000 (0.008)
employed		-0.019* (0.010)	-0.016 (0.010)	-0.017* (0.010)
inactive		0.011 (0.009)	0.010 (0.009)	0.007 (0.009)
secondaryEduc		0.005 (0.008)	0.007 (0.008)	0.006 (0.008)
tertiaryEduc		-0.013 (0.010)	-0.010 (0.010)	-0.011 (0.010)
Log income		0.001 (0.003)	0.003 (0.003)	0.003 (0.003)
Pharmacy density			0.010*** (0.003)	0.002 (0.002)
Physician density			-0.034*** (0.012)	
Retail restrictions			0.028*** (0.009)	
Incentives			-0.036*** (0.007)	-0.030*** (0.007)
Retail price			0.001*** (0.000)	
Patient cost			-0.001*** (0.000)	-0.001*** (0.000)
Chronic exempt			0.011 (0.008)	0.019*** (0.006)
constant	1.187*** (0.110)	1.082*** (0.161)	1.150*** (0.243)	1.062*** (0.173)
Sample Size	15859	15859	15859	15859
Log-Likelihood	-6925.8998	-6918.2941	-6884.9076	-6892.9913

Estimates are computed at the sample means. Standard errors in parentheses. ***, ** and * significant at 1%, 5% and 10%