Prescription of generics and physician altruism: evidence from France

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Abstract

This work investigates how physician, patient and drug characteristics interact in the prescription decision between brand-name and generic drugs. In specific, it aims at verifying whether non-medical factors affect the outcome of the prescription process and whether physicians adjust the choice of the brand type to patient preferences and characteristics, a form of moral hazard a la Pauly (1968). The analysis uses CEGEDIM data on a representative sample of 327 French General Practitioners and 10627 patients, receiving prescriptions between 2000 and 2008 for drugs in five therapeutic classes (anti-ulcer, anti-diabetes, anti-hypertensive, anti-cholesterol and antidepressant drugs). Results suggest that physician and patient characteristics play a major role in explaining the decision on the brand type: patients that are fully reimbursed show a higher probability of receiving a brand-name prescription. Regulation matters as well: the introduction of reference pricing on some drugs is estimated to increase significantly the probability of generic prescription.

Keywords: empirical IO, prescriptions, generic drugs, regulation.
JEL Codes: I11, I18, L84
1 Introduction

During the past decade, more and more emphasis has been placed on generic drugs as a cost containment device for public health systems. The first generic drugs entered the market in the 1980s, but their diffusion was slow. After two decades, the use of generic versions of known molecules is more common, but high differences across countries exist. Some countries show very high penetration rates (US, Germany, UK), while others still lag behind (France, Italy, Spain, Japan), as Figure 1 shows (IMS Health, 2011). One of the explanations for such difference is to be found in the regulatory approach towards generic drugs use, with leading countries being those where generic usage was encouraged or made compulsory through various means (campaigns, obligation to reach certain thresholds of generic prescription/sale, generic substitution at the pharmacy, pricing and reimbursement measures linking branded and generic drugs). Most of these measures are now present in many countries, but those with little generic penetration have been slower in their introduction, often not providing the right incentives towards their application.

![Image](https://via.placeholder.com/150)

**Figure 1**: Generic share of total wholesale transactions of prescription drugs, 1997-2007 (own elaboration on IMS data)

France is a clear example. The recent regulatory reform started in 2003 has addressed these issues with a number of measures: broad campaigns towards generic use, emphasizing how generic are not inferior products to their brand-name versions; strengthening of financial incentives for pharmacists to substitute brand-name drugs with their generic versions; agreements with doctors to prescribe using the INN, the international non-proprietary name of the drug (the molecule), rather than the trademark; change in reimbursement and price setting rules, linking the price and reimbursement of the drugs to the availability of their generic versions (price decreases and reference pricing). Although the increase in the sale of generic drugs has been significant in recent years, making France one of the countries where the growth has been the highest (see Figure 1), the prescription of generic versions of the drug by the physician is still limited, with sale
of generics being mainly driven by generic substitution at the pharmacy (Paraponaris et al., 2004), which has reached 70% at the end of 2009 (GEMME, 2010). The rate of generic penetration in France has reached 79% in 2010, but only 12% of prescriptions written by French doctors in 2010 reported the INN rather than the brand-name of the drug; this figure was around 80% in Germany, 35% in UK and 18% in Spain (CNAM, Observatoire du medicament, 2011).

For many years, generic drugs were considered as inferior products, sometimes even dangerous, far from being perfect substitutes of their brand-name versions. Surveys carried out in the nineties and early 2000s (Naudin, 2003) have shown how patients opposed resistance to substitution and physicians often accommodated such behavior. While it is commonly thought that these approaches were mainly typical of the initial period of entry of generics, this may not be the case for France. Recently, several French doctors have been found to systematically forbid generic substitution at the pharmacy, by writing the claim non substitutable on all prescriptions issued (Assurance Maladie, 2012). Forbidding substitution is a right doctors can exert based on medical reasons: patients may be allergic to inert components and drugs with narrow therapeutic margins may experiment a decrease in their efficacy with small changes in excipients (it is the case of antiepileptics, for example). However, these are usually considered as rare instances.

If the generic is a perfect substitute for its branded version (as it is in the majority of cases), then the decision not to prescribe it cannot be justified on scientific grounds. This seems to suggest that the prescription process does not only take into account health or medical considerations: in the choice between two versions of the same molecule other factors may play a role. Some studies have shown how habits influence prescription, such that doctors tend to prescribe a drug they have prescribed for a long time (Crawford and Shum, 2005). Also, physicians may be little informed about the actual price of the drugs they prescribe (Danzon, 1997). Moreover, doctors may want to please the patients so as to retain them, and advertising and lobbying by pharmaceutical companies may encourage the prescription of newer drugs (Berndt, Kyle and Ling, 2003). Plausibly, the prescription process entails a number of considerations, with the doctor trying to find a match between the drug that is best in terms of medical benefit (healing the patient, treating the symptoms) and the characteristics of the patient. The health condition is only one of them. If the patient has a preference for a given drug (in terms of brand type, presentation, frequency of administration, etc.), the physician may try to accommodate it, hence embodying any patient constraints in the decision. For instance, a branded expensive drug can be prescribed instead of its generic counterpart, but only if the patient does not bear the (entire) cost: this situation is often referred to as a form of moral hazard (Pauly, 1968), as the physician favors the interest of the patient over that of the insurance, even in the absence of any medical reason.

This work explores the factors that affect the prescription process and can explain its outcome. The aim is to shed some light on the limited prescription of generics in France in the period between 2000 and 2008, using CEGEDIM data on a representative sample of General Practitioners (GP) and uses all prescriptions written by them to their patients in five therapeutic classes. To the best of my knowledge, this is the first work to use data for France, by combining the rich information provided by CEGEDIM data and additional information about drug characteristics and regulatory reforms available
from other sources. The results suggest that non-medical factors are also considered by the doctor when writing a prescription, which adjusts to patients preferences and characteristics: patients that are fully reimbursed show a higher probability of receiving a brand-name prescription. Thus, the prescription outcome is affected by the interplay of patient, physician and drug characteristics, and regulation seems to have played a role in increasing the acceptance of generics: the introduction of reference pricing on some drugs is estimated to increase by a significant amount the probability of generic prescription.

The paper is organized as follows. Section 2 briefly illustrates the approaches followed and results achieved by previous contributions on the topic; section 3 explains the regulatory setting in place at the time of analysis and section 4 describes the data used; some preliminary evidence is shown in section 5; the model used is presented in section 6 and the results in section 8. Finally, section 9 concludes.

2 Literature

The literature exploring the determinants of prescription behavior is not broad, though it has been growing recently, reflecting an increasing interest in the topic mainly for policy evaluations. So far, contributions have tackled the issue under different frameworks: some consider the physician as a perfect agent, acting in the interest of the patient; others model instead the physician as a double/imperfect agent, where the relative weight placed on own, patient and insurance utility may be affected by external factors (type of incentives, way the physician is compensated, etc.). Most of these contributions do not explicitly model the medical decision (i.e. the choice of the molecule), but focus on other characteristics of the drug (price, brand type) or the prescription process (persistence versus switch in the choice of the drug in subsequent episodes). Some articles, however, incorporate the medical decision, mainly addressing problems of imperfect information, learning, risk aversion and diffusion of new drugs in a context of experience goods.

Blomqvist (1991) is perhaps the first contribution in this strand of literature, the first to build on the concept of the physician as a double agent introduced by Pauly (1968). In his model, the doctor is the agent of two principals, whose interest may be conflicting: the patient and the insurance. If conflicts arise between the two interests, the doctor may favor one over the other, a behavior which is defined as moral hazard. In a context of both incomplete and asymmetric information, the first best where health is observable and contractible upon cannot be achieved and moral hazard may emerge. The physician may favor the patient or the insurance, depending on the incentives she is exposed to. Some corrections can be introduced with capitation schemes and ethical codes, to avoid that cost containment induced by capitation hurt the patient.

Some more recent papers have built on this theoretical setting, trying to find empirical evidence of such a behavior. Hellerstein (1998) shows the major role played by physician rather than patient characteristics in the branded versus generic prescription decision. She uses US data on around 33,000 patient visits during two weeks in 1989, finding evidence of brand loyalty but not of moral hazard. However, her single-visit data do not allow to study persistence and loyalty over time. Similarly, Lundin (2000) confirms the
role of the physician in the choice of the brand type, but also finds evidence that patient characteristics affect the outcome of the prescription. The analysis is based on data on actual purchases of drugs in 1992-1993 in a Swedish municipality. In a setting where the doctor is a double agent, he finds that physicians tend to prescribe generics to those patients having to pay mainly out-of-pocket. He interprets this result as moral hazard. Also, he finds some role played by regulation, namely reference pricing. Coscelli (2000) mainly focuses on brand loyalty and persistence in prescriptions. The author exploits the peculiar regulatory setting of Italy, where after patent expiration the drugs based on the same molecule must be priced equally, irrespective of the brand. In such a context, he finds that doctors show brand loyalty: the probability of switch among brands of the same molecule is low and affected by patient and physician characteristics.

Some works have pointed out how different financial incentives for the physician may lead to different outcomes in the prescription process, providing an explanation for moral hazard. Iizuka (2012) investigates the role of private benefits in the decision to prescribe branded or generic versions of a drug. In a peculiar context like the one of Japan (and other Asian countries like Taiwan, see Liu, Yang and Hsieh, 2009), where some doctors prescribe and dispense the drug, the possibility to gain a higher markup on unbranded medications explains the higher proportion of generic prescriptions written by vertically integrated doctors. Dickstein (2012a) also tests whether differences in the compensation scheme of the physician lead to different prescription behaviors. He finds that US GPs being paid by capitation have a higher probability to prescribe generic versions of a drug, as compared to doctors paid on a fee-for-service basis. Paraponaris et al. (2004) carry on a survey on 600 GPs in France, to explore the willingness to prescribe by INN. They find that, in the absence of incentives towards generic prescription, physicians play a major role in the decision, but some patient characteristics affect the outcome as well. For instance, GPs claim to be more willing to prescribe generics to patients with lower socio-economic status, anticipating that they may face budget constraints.

A handful of contributions have recently developed more sophisticated dynamic models to explore the evolution of prescriptions over time, in order to identify the factors explaining persistence versus experimentation. Coscelli and Shum (2004) investigate the evolution of prescriptions for a new anti-ulcer drug, omeprazole, in the Italian market between 1990 and 1992 (the data are the same as in Coscelli, 2000). They explain the gradual diffusion pattern of the new molecule by a learning model with spillovers: doctors, initially uncertain about the quality of omeprazole, update their beliefs after observing noisy signals from different type of patients (diagnosis). Crawford and Shum (2005) use the same data to analyze the persistence of prescriptions over time. As in Coscelli and Shum (2004), they find that initial uncertainty is crucial to slow down the diffusion process of new drugs; moreover, risk aversion hinders switch and experimentation and patient heterogeneity is strong. Uncertainty resolves after few periods, thanks to spillovers among patient experiences, which accelerate the updating of information for doctors. Ching (2010) also introduces risk aversion to explain the slow diffusion in generics in the late 1980s in the US. He uses aggregate data to estimate an empirical demand model with aggregate learning and consumer heterogeneity. He finds that patients have pessimistic priors on the quality of generics; also, brand-name firms set their prices sub-optimally, in order to slow down the learning process for generic qualities.
A very recent paper by Dickstein (2012b) explores similar issues in the prescriptions of anti-depressants in the US. He finds that uncertainty about the match between the drug and the patient is high upon the first prescription episode, making adherence to treatment a great challenge for physicians. Experimentation and spillovers play a major role in reducing it.

3 The regulatory setting

France has historically displayed high levels of pharmaceutical expenses. A reason for it is often found in a traditionally strong preference, by French patients and physicians, for branded drugs at the detriment of generic equivalents, considered for long as mere inferior or even unsafe substitutes. Such behavior was presumably encouraged by a welfare system, covering nearly the whole French population, which reimburses a large part of the price of prescription drugs. Moreover, more than 90% of the population has supplementary insurance, which used to cover the whole price (Nguyen-Kim, Oz, Paris and Sermet, 2005). In addition, the late introduction of generic substitution at the pharmacy (only in 1999) has encouraged the perpetuation of a strongly branded-oriented system of prescription and purchase. All of these factors are said to be the cause for a very low demand elasticity to price.

In the early 2000s, the level of pharmaceutical expenses in France doubled with respect to the previous decade (reaching 30 billion euros in 2004), increasing more rapidly than anywhere else in Europe (Nguyen-Kim et al., 2005). This situation accelerated the project of a reform of the pharmaceutical regulatory system, aimed at reducing public expenditures for drugs, which represented a fifth of total public expenditures on health. The reform entailed a number of measures including major changes to the regulation of pharmaceutical prices. The majority of these measures were related to the usage of generics, promoted by the reform not only as a tool to reduce public expenses, but also as a major goal in itself, in line with recommendations of the European Commission (2009). In 2003, reference pricing of branded drugs to generics was established (TFR - Tarif forfaitaire de responsabilité in French), linking the reimbursement of originator drugs to the price of their generic counterparts. Since 2006, the price of all drugs in a class must be reduced when generics become available. Several campaigns were launched, addressed to patients, to increase awareness and convey the idea that generics are perfect equivalents of branded drugs and there is no danger from their use. In addition, due to the limited application of generic substitution, introduced in 1999, some agreements were signed between doctors and the Statutory Health Insurance in order to increase prescription of generics. In 2001, a commitment to use the international chemical name of the medicine in prescriptions was introduced (INN, International Nonproprietary Name) in exchange for a revision of doctors salary. However, since only 8.5% of all prescriptions showed the INN (Grandfils and Sermet, 2006), another agreement was signed in 2006. Finally, in 2009 mandatory INN prescription for all reimbursed drugs was introduced.

The slow switch towards INN prescription was driven by the resistance of physicians and patients to change their habits. However, the agreements signed did not include any incentives to modify the prescription behavior (Paraponaris et al., 2004). Doctors
working for the public sector (both GPs and specialists) are mainly paid on a fee-for-service basis, with the price of each service (simple visit with or without prescription, home visit, urgent visit, etc.) being pre-determined by the Statutory Health Insurance, which reimburses 70% of the price to the patient. In addition, GPs receive some fixed amounts per year per patient, depending on the type of patient (46 euros for a standard patient and 86 euros for a chronic patient). Nothing in this retributive system concerns the type of prescription (brand-name or INN). This contrasts with the approach followed to encourage generic substitution. Pharmacists are granted strong financial incentives to implement generic substitution, with a margin system that favors generic over brand-name drugs and includes a fixed amount per box and a degressive margin. To compensate for the lower price of generics (at entry, they are priced 60% lower than their branded version), generic margins are computed on the price of the brand-name and, until 2008, pharmacists received an additional margin (the marge arrière), much higher for generics than for branded drugs (10.74% against 2.5%). These measures made generic substitution effective. In addition, since 2012 patients accepting generic substitution at the pharmacy benefit from tiers payant, such that they do not need to make any advance payment of the reimbursed part of the drug (usually the whole price is paid and part of it is later reimbursed by the Statutory Health Insurance).

In order to encourage INN prescription, the new medical convention signed in 2011 introduced some degree of pay-for-performance in the salary of physicians. In specific, doctors can be paid more if they reach some thresholds of generic prescriptions for some classes (90% for antibiotics, 85% for proton-pump inhibitors, 80% for anti-depressants, 70% for statins, 65% for anti-hypertension drugs). The convention maintains the right for the doctor to forbid substitution, by handwriting the claim non substitutable on the prescription.

4 Data

This work uses CEGEDIM data, comprising all prescriptions written by a representative sample of 386 French general practitioners to all of their patients during the years 2000-2008. The original dataset includes more than 600 thousand patients and an average 5 million prescriptions per year. The dataset provides information on the doctors (id, gender, age, area of France where they work), on the patients (id, age, gender, type of job, health status) and on the prescription (detailed reference to the drug prescribed, length of treatment, renewal). One observation in the dataset is a prescription on a specific date, written by one the physicians to one of their patient and shows the reason of the visit and the diagnosis, followed by the decision taken in terms of treatment.

The drugs are identified by their CIP code, which uniquely identifies their name, brand status (branded or generic), dosage and presentation (size of the box, type of format, i.e. tablets, capsules, powder, etc.). The dataset also provides the price and reimbursement level. Additional information on the drugs was collected concerning the date of entry of each drug (brand-name and its generic version) and some regulatory measures, such as the indices on the medical benefit (SMR and ASMR, referring to the absolute and relative innovativeness of each pharmaceutical approved for the French
market). For drugs subject to reference price, the date of introduction and the reference price itself are also included. This information was retrieved on the website www.theriaque.org.

The analysis focuses on patients who received at least one prescription every year in one of the following drug classes, defined by the ATC level 3: anti-ulcer drugs (A02B), anti-diabetics (A10B), ACE-inhibitors (C09A and C09B), lipid-modifying agents (C10A) and anti-depressants (N06A). Within these classes, only molecules for which generics were or became available during the sample period are chosen, i.e. one molecule enters the sample when its generic enters the market.

After this selection, the sample includes more than 323 thousand observations referring to 327 doctors, 10627 patients and 1382 unique drugs (465 are brand-name versions) based on 99 active ingredients.

<table>
<thead>
<tr>
<th>year</th>
<th>doctors</th>
<th>patients</th>
<th>total prescriptions</th>
<th>generic prescriptions</th>
<th>drugs</th>
<th>gen</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>327</td>
<td>10627</td>
<td>17168</td>
<td>4802</td>
<td>96</td>
<td>64</td>
</tr>
<tr>
<td>2001</td>
<td>327</td>
<td>10627</td>
<td>18994</td>
<td>5222</td>
<td>120</td>
<td>84</td>
</tr>
<tr>
<td>2002</td>
<td>327</td>
<td>10627</td>
<td>18111</td>
<td>5964</td>
<td>168</td>
<td>133</td>
</tr>
<tr>
<td>2003</td>
<td>327</td>
<td>10627</td>
<td>17490</td>
<td>7360</td>
<td>209</td>
<td>170</td>
</tr>
<tr>
<td>2004</td>
<td>327</td>
<td>10627</td>
<td>29943</td>
<td>10126</td>
<td>356</td>
<td>278</td>
</tr>
<tr>
<td>2005</td>
<td>327</td>
<td>10627</td>
<td>49501</td>
<td>15127</td>
<td>477</td>
<td>375</td>
</tr>
<tr>
<td>2006</td>
<td>327</td>
<td>10627</td>
<td>57436</td>
<td>20438</td>
<td>643</td>
<td>526</td>
</tr>
<tr>
<td>2007</td>
<td>327</td>
<td>10627</td>
<td>58194</td>
<td>23742</td>
<td>783</td>
<td>608</td>
</tr>
<tr>
<td>2008</td>
<td>327</td>
<td>10627</td>
<td>56852</td>
<td>24135</td>
<td>909</td>
<td>721</td>
</tr>
</tbody>
</table>

Table 1: The data at a glance

As shown in Table 1, the number of both total and generic prescriptions increases over time, such as the number of drugs prescribed. The average doctor is a man (82% of the sample), aged 45, residing in the western regions of France or in the Paris area. The average patient is a retired man, aged 61, with no chronic condition, receiving 9 prescriptions per year.

As Table 2 displays, most prescriptions are written for anti-cholesterol drugs (107,588), followed by anti-diabetes drugs (69,560). Therapeutic class C09A-B displays the highest number of brand-name drugs prescribed (307), while anti-cholesterol and anti-ulcer medications are prescribed under many different generic versions (more than 200). The vast majority of drugs are reimbursed at 65% level and show an important absolute medical benefit (SMR level II for 1100 drugs), but brought no improvement to it (950 have an ASMR level V, i.e. low innovativeness as compared to existing drugs). Only 15 brand-name drugs became subject to reference pricing (TFR), and most of them did not align their price to the the TFR.
Table 2: The drugs

<table>
<thead>
<tr>
<th>ATC</th>
<th>prescriptions</th>
<th>drugs</th>
<th>branded</th>
<th>generics</th>
</tr>
</thead>
<tbody>
<tr>
<td>A02B anti-ulcer</td>
<td>41601</td>
<td>309</td>
<td>106</td>
<td>203</td>
</tr>
<tr>
<td>A10B anti-diabetes</td>
<td>69560</td>
<td>253</td>
<td>85</td>
<td>168</td>
</tr>
<tr>
<td>C09A-B ACE inhibitors</td>
<td>56003</td>
<td>307</td>
<td>110</td>
<td>197</td>
</tr>
<tr>
<td>C10A anti-cholesterol</td>
<td>107588</td>
<td>296</td>
<td>92</td>
<td>204</td>
</tr>
<tr>
<td>N06A anti-depressants</td>
<td>48937</td>
<td>217</td>
<td>72</td>
<td>145</td>
</tr>
</tbody>
</table>

5 Some preliminary evidence

The rate of INN prescription in France remains low, though it grew significantly during the last decade, from 2% in 2002 to 12% in 2010; the figure is slightly higher, 14%, if one excludes specialists and only focuses on GPs (CNAM, Observatoire du Medicament, 2011). The rate of generic prescription in the CEGEDIM data is in line with the above numbers, though the 14% amount was reached already at the end of 2008, when the figure was 11% across all French GPs (see Figure 2). So, as compared to the whole population of French GPs, CEGEDIM doctors seem to be slightly more generic-friendly. This may be due to the fact that these physicians were provided a computer software to manage their prescription process and send the information to the firm: the possibility to retrieve more immediately the information about the drugs prescribed, including the price and the availability of generic versions, may have facilitated generic prescription. When focusing on the 5 therapeutic classes chosen for the analysis, the rate of generic prescription reaches 22% across all molecules and 42% for those with a generic available.

(a) All sample vs 5 ATC  (b) 5 ATC, generic available

Figure 2: Generic prescription in CEGEDIM data

Doctors are not homogeneous in their prescription behavior. The distribution of generic prescription rates in the sample is very skewed: very few doctors write more than half of their prescriptions for a generic and few continue to prescribe only the brand-name drugs. Physicians may have different unobserved preferences towards generic prescription and other factors may play a role: the knowledge that a generic exists and is available, the characteristics of the patient (resistance to generics, specific health conditions), habit in
prescribing the brand-name, etc. More plausibly, physicians tend to prescribe the generic versions of some drugs more often than others and to some patients more than to others.

The latter point is especially interesting. In particular, are there patients characteristics that make an individual more likely to receive a generic or a brand-name prescription? Table 3 displays some preliminary evidence on this. It shows the percentage of generic prescriptions in the sample by patient characteristic. Three characteristics are considered, two of them are socio-economic and the third is an indicator of health status: whether the patient is retired or unemployed and whether she has a chronic disease. The reason to focus on these refers to the special reimbursement treatment that unemployed and chronic patients receive, being reimbursed the whole medical expenses, including those for drugs. If one believes that generics are still perceived as inferior quality products to brand-name drugs, then physicians may want to please their patients by prescribing a branded version. However, the physician may not want the patient to pay a higher price for the drug: thus, brand-name prescription is likely to happen more often for those patients that do not bear the cost of the drug, like chronic and unemployed ones. The reason to include the retired status is instead suggested by common wisdom, further confirmed by some surveys (Naudin, 2003): retired people are more favorable to generics, as such and as a cost-containment device.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Branded</th>
<th>Generic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic</td>
<td>68%</td>
<td>32%</td>
</tr>
<tr>
<td>Non-Chronic</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>79%</td>
<td>21%</td>
</tr>
<tr>
<td>Non-Unemployed</td>
<td>64%</td>
<td>36%</td>
</tr>
<tr>
<td>Retired</td>
<td>62%</td>
<td>38%</td>
</tr>
<tr>
<td>Non-Retired</td>
<td>66%</td>
<td>34%</td>
</tr>
</tbody>
</table>

**Table 3:** Type of prescription and patient characteristics

The figures shown in Table 3 seem to go in the expected direction. Chronic patients receive a higher share of brand-name prescriptions than non-chronic patients (68% against 60%), but the figure is even more striking for unemployed individuals, who receive a generic prescription only 20% times, against 36% for non-unemployed. Conversely, retired patients are written more generic prescriptions than non-retired, though the difference is small (38% against 34%).

## 6 A model of physician behavior

When deciding about the version of the drug to prescribe, either brand-name or generic, the physician takes into account both her own benefit from the type of prescription and the utility of the patient. The relative weight associated to each of the two components determines the actual decision. Such weight depends on a number of factors, namely physician, patient and drug characteristics and their interplay, as well as on the role played by regulation.
6.1 The first prescription

Upon the first visit, the doctor does a diagnosis of the condition of the patient and proposes a treatment. The choice of the treatment (here: molecule) is not modeled in this work: based on her knowledge, the doctor picks the best medication in a class of drugs which treat a homogeneous set of conditions. Once a molecule is chosen among those available in a therapeutic class, the doctor must write a prescription either for the brand-name or for the generic, knowing that in any case generic substitution is available at the pharmacy. At this stage, the doctor chooses the version that maximizes her utility: she will prescribe the generic version only if the utility is higher than the utility from prescribing the brand-name drug.

The utility of the doctor can be split into two parts: the first is the benefit incurred by physician $j$ in the prescription of a given type of drug $k$ (where $k = \{branded, generic\}$); the second is the component embedding part of the utility of patient $i$ from such a prescription:

$$U_{ikt}^j = b_{ikt}^j + \gamma U_{ikt}$$  

(1)

The parameter $\gamma$ captures the share of the utility of patient $i$ which is included in the utility of physician $j$, a form of altruism: $\gamma$ is zero if the doctor only considers her cost/benefit $b_{ikt}^j$ when taking a decision, and is one if the whole utility of the patient is accounted for by the doctor.

The utility of the patient and the benefit of the doctor are affected by both common and specific factors. The private benefit $b_{ikt}^j$ for the doctor depends first of all on doctor individual characteristics and preferences for generic or brand-name drugs; age and gender may matter as well; they are summarized by the vector $Z_j$ of demographics. Also, the benefit from prescribing a version of a medication reflects its easiness of prescription, which is affected by drug characteristics $X_{kt}$, such as the brand type, the age of the drug, the fact that the doctor has prescribed the drug many times and can easily recall its name, indications, side effects and have a better idea of the quality of the drug and its match with the specific condition and characteristics of the patient (knowledge and prescription habits). Detailing may play a role in providing continuous information about the drug and encouraging its prescription. Moreover, the physician may have a preference for a specific brand, for instance because it was the first to market a certain treatment (loyalty to the innovator, Lundin, 2000). Regulation may interact with all previous factors in shaping the incentives for the doctor to prescribe the generic: for instance, several campaigns were addressed to physicians in the past years, to encourage INN prescription and inform them about the real quality of generics (i.e. decreasing the costs from prescribing generics).

Thus, the private benefit of the physician can be written as follows:

$$b_{ikt}^j = \alpha_1 Z_j + \alpha_2 X_{kt} + \epsilon_{jkt}$$  

(2)

where $\epsilon_{jkt}$ gathers all unobserved factors that affect $b_{ikt}^j$.

The utility of the patient from receiving a prescription for a given type of drug $U_{ikt}$, depends on both individual and drug characteristics. Individual characteristics $Z_i$ refer to
inherent preferences for brand-name or generics, which may be affected by gender and age (previous contributions have emphasized how older people may prefer branded drugs), as well as by the copayment the patient is subject to. While all patients in the sample are covered by the same statutory health insurance, some may benefit from a favorable treatment in terms of lower copayment for some prescription drugs, based on socio-economic or specific health conditions (in France unemployed people and chronic patients are fully reimbursed for their medical expenses). They are summarized by the vector $X_{kt}$ of drug-patient interactions. Patient utility is also affected by drug characteristics $X_{kt}$, such as the active ingredient, the brand, the price, the age; the patient might already know the drug or its brand, due to previous use or word of mouth, and show a preference for it. Also, the exposure of the patient to the campaigns encouraging the use of generics might influence patients attitude towards generics.

Including the shock $\eta_{ikt}$ to capture all unobserved factors affecting a patients utility, $U_{ikt}$ can be expressed as:

$$U_{ikt} = \beta_1 Z_i + \beta_2 X_{kt} + \beta_3 X_{kt}^i + \eta_{ikt}$$  (3)

The previous factors may be taken into account by the doctor when writing the prescription. The extent to which the physician includes them in the decision process (at all, entirely or partially) is captured by the parameter $\gamma$. The higher $\gamma$, the more the doctor will adapt the prescription to patient characteristics and preferences. Thus, altruistic doctors (i.e. higher $\gamma$) will probably prescribe the generic version of the drug to price-elastic and generic-friendly patients and the brand-name to price-inelastic and generic-averse patients. This situation, i.e. the dependence of the outcome of prescription on patients characteristics, is a form of moral hazard à la Pauly (1968).

The altruistic component itself, $\gamma$, may be modeled as being physician-specific (doctors may be inherently more or less altruistic) and potentially affected by external factors. The remuneration system of French General Practitioners, for instance, provides incentives for doctors to please their patients: physicians are paid on the basis of the number of patients they treat and prescriptions they write, so that retaining patients becomes crucial. The national guidelines for good prescription in place during the period of study, on the contrary, strongly encouraged INN prescription (now mandatory) regardless of patient preferences, though allowed doctors to forbid substitution in the presence of specific medical considerations against generic use. In this example regulation is likely to decrease $\gamma$. Conversely, the introduction of reference pricing (TFR) on some drugs is akin to an increase in $\gamma$: the doctor may fear that a branded prescription would result in a branded drug delivery at the pharmacy, which causes the patient to pay the difference between the price of the brand-name drug and the reference price. By delivering a generic prescription, the doctor includes this altruistic consideration in the decision process.

Once the molecule best suited to treat the patient is selected, upon the first visit the physician will choose the version $k$ of the drug that maximizes her utility:

$$k^* = \arg\max_{k \in \{br, gen\molecule\}} U(Z_j, Z_i, X_{kt}, X_{kt}^i; \xi; \vartheta)$$  (4)
where $\xi$ is the vector of the unobserved terms $\epsilon_{jkt}$ and $\eta_{ikt}$ and $\vartheta$ is the vector of parameters.

6.2 Subsequent prescriptions

After the first prescription, the patient comes back for further visits if she is not healed yet or if the health condition or the drug require follow-up prescriptions (for example, chronic diseases or drugs requiring several rounds of treatment). At each visit, the doctor re-evaluates the initial diagnosis and the choice of the drug. Following the assumption made above, the choice of the molecule remains the best one all along the treatment process, thus it will not change. However, the choice of the brand type may change if the patient is not satisfied or reports any problems related to it. For example, the patient may be allergic to one of the inert components of the drug (either branded or generic).

The reasons to switch from the branded to the generic version of the drug may be driven by price considerations, as generic drugs are less expensive, by an increased trust towards generics, by a positive experience with generic substitution at the pharmacy. Conversely, the physician may decide to switch to a branded prescription if the patient has experienced problems in finding the generic available at the pharmacy or has reported any dissatisfaction with the taste, shape or color of the drug. The probability of switch may increase as a consequence of a change in the insurance status of the patient (higher or lower copayment as compared to the previous prescription occasion), or of a change in the reimbursement level of the drug, such as the introduction of reference pricing, which makes the brand-name de facto more expensive. Patient and physician characteristics are also likely to affect the probability of switch. In specific, the attitude towards risk is a determinant of the decision to change: risk averse patients (and doctors) prefer to stay with a drug version already tried, while others may be willing to experiment with a different version. Following the reasoning developed in the literature, the decision to switch towards the generic entails a higher level of risk, and hence is less likely to occur for risk-averse patients: as the brand-name drug has been on the market for at least a decade, its effectiveness and side effects are known by patients and doctors and is thus perceived as less risky (Ching, 2010).

Therefore, the physician considers any evidence occurred between prescription occasion $t-1$ and $t$ and decides whether to prescribe the same drug version or to switch, choosing the brand type that maximizes her utility for period $t$, given the choice made in the previous prescription occasion:

$$k^* = \arg\max_{k \in \{br, gen\}} U(Z_j, Z_i, X_{kt}, X_{ikt}, I_{ikt-1}, \xi; \vartheta)$$ (5)

where the utility of the doctor $U_{ikt}^j$ includes $I_{ikt-1}$ through the utility of the patient $U_{ikt}$: $I_{ikt-1}$ indicates whether drug version $k$ was chosen as well in period $t-1$ and captures persistence of choices:

$$U_{ikt}^j = b_{ikt}^j + \gamma U_{ikt} + \zeta_{ikt}$$
$$= [\alpha_1 Z_j + \alpha_2 X_{kt} + \epsilon_{jkt}] + \gamma [\beta_1 Z_i + \beta_2 X_{kt} + \beta_3 X_{ikt} + \beta_4 I_{ikt-1} + \eta_{ikt}] + \zeta_{ikt}$$
\( \beta_4 \) can be interpreted as the effect exerted by the past choice on the current period utility of the patient: if \( \beta_4 > 0 \), it is akin to a switching cost and doctors and patients will prefer prescribing the same brand type as in the previous period.

7 Empirical strategy

Following the theoretical model described above, the specification of the physician utility to be estimated (see equation 1) includes the private benefit of the doctor \( b_{jt}^k \) and a share of the utility of the patient \( \gamma U_{ikt} \), where \( k = \{\text{branded, generic}\} \) refers to the brand type the doctor writes on the prescription and is the actual decision dimension: after selecting the most appropriate molecule to treat patient \( i \), the physician considers her own benefit and weighs the utility of the patient through the altruistic component \( \gamma \) when choosing a brand-name or a generic drug.

Common factors that affect both patient and physician utility are drug characteristics, \( X_{jt} \), which enter both \( b_{jt}^k \) and \( U_{ikt} \). They are proxied by therapeutic class dummies to control for different health conditions (5 ATC markets), SMR and ASMR indices that identify quality (medical benefit and innovativeness), the age of the molecule to capture knowledge and perceived riskiness, the reimbursement level and two variables related to reference pricing: a dummy indicating whether TFR is in place and the difference between the price of the drug and its reference price. The latter terms account for the role played by regulation and are potentially time-varying.

Physician demographic characteristics \( Z_j \) that enter \( b_{jt}^k \) include age and gender, as well as some average measures of the whole patient base of the doctor (number of patients visited, health and socio-economic characteristics of them): these serve as a proxy for the environment the doctor is exposed to, her knowledge, the dispersion in the type of patients she deals with, and potential spillovers in the prescription behavior (see, for instance, Hellerstein, 1998 and Coscelli, 2000).

\( U_{ikt} \), the utility of patient \( i \), depends on the drug characteristics explained above (both time-unvarying and varying) and on patient characteristics \( Z_i \). These include age and gender, which are likely to affect the health condition, the type of disease and the attitude towards different type of drugs: women and elderly people have been found by previous works to have a preference for brand-name drugs (Hellerstein, 1998 and Coscelli, 2000). This is usually justified on medical grounds on the basis of higher intolerance to inert components for this group of people or adverse interactions with ongoing treatment; also, elderly patients tend to attach a great importance to the color, shape or taste of the medication, as an identification device among several drugs taken at the same time. For these patients, brand-name and generic drugs are less close substitutes. Socio-economic characteristics that may affect the brand-type choice are summarized by two indicator variables, the unemployed and the retired dummy. The former captures the 100% reimbursement granted to unemployed patients, which makes these patients less price-sensitive; the latter is included to test some evidence on the generic-friendliness of retired people in France (Naudin, 2003). Finally, a patient-drug-specific variable \( X_{ikt}^l \) is introduced by the chronic indicator: it is one if the patient suffers from one of 30 chronic diseases (ALD, affections de longue duree in French) included in an official list.
created by the Ministry of Health and revised periodically. Such status, which must be officially certified by the family doctor through a standard procedure, gives the right to 100% reimbursement for all drugs related to the chronic disease; for other drugs, the reimbursement treatment is the same as for all other patients.

After the first prescription, the version prescribed in the previous occasion is likely to affect utility of the patient as well, as captured by the term $I_{ik,t-1}$, which indicates whether there is persistence of choices: $I_{ik,t-1} = 1$ if version $k$ was the one prescribed in $t-1$.

Including an additive error $\zeta_{ijkt}$, as well as two patient- and physician-specific terms $\epsilon_{jkt}$ and $\eta_{ikt}$ to capture unobserved characteristics, the expression of physician utility becomes:

$$U_{jikt} = b_{kt}^j + \gamma U_{ikt} + \zeta_{ijkt} = [\alpha_1 Z_j + \alpha_2 X_{kt} + \epsilon_{jkt}] + \gamma [\beta_1 Z_i + \beta_2 X_{kt} + \beta_3 X_{kt}^i + \beta_4 I_{ik,t-1} + \eta_{ikt}] + \zeta_{ijkt}$$

$$= \alpha_1 Z_j + (\alpha_2 + \gamma \beta_2) X_{kt} + \gamma [\beta_1 Z_i + \beta_3 X_{kt}^i + \beta_4 I_{ik,t-1}] + \epsilon_{jkt} + \nu_j + \zeta_{ijkt}$$

The terms $\epsilon_{jkt}$ and $\eta_{ikt}$ proxy for elements that are not observed by the econometrician but are observed by the doctor and patient when taking a decision and are likely to affect it: detailing exposure of physicians, generic information campaigns aimed at both doctors and patients, specific characteristics that make a brand-type decision more likely and are not available in the data (allergies to excipients, adverse interactions, attention to cost-containment for the statutory insurance and the patient, preference for some brands, etc.).

The variables used as regressors are listed in Table 4.

### 7.1 The estimation procedure

The doctor chooses the drug version $k$ that maximizes her own utility, which includes the utility of the patient. Thus, in each period $t$, she will choose the generic version if $U_{t,k=generic}^j > U_{t,k=branded}^j$.

In a static context, this translates into the physician taking independent decisions at every prescription occasion; in a dynamic context, the doctor considers the choice made in $t-1$ and decides whether to stay with the previously prescribed drug version $k$ or switch to type $-k$.

The variable of interest is then the indication that physician $j$ prescribes the generic or brand-name to patient $i$. If the generic is prescribed, it could be inferred that the utility from prescribing the generic is strictly higher than the utility from brand-name prescription:

$$Prob(k_{it}^j = generic | Z_j, Z_i, X_{kt}, X_{kt}^i; \theta) =$$

$$= Prob(U_{it,gen}^j > U_{it,br}^j, \forall k, -k \in \{br, gen\})$$

$$= Prob(\alpha_1 Z_j + (\alpha_2 + \gamma \beta_2) X_{kt} + \gamma [\beta_1 Z_i + \beta_3 X_{kt}^i] + \nu_j + \zeta_{ijt} > 0)$$
Depending on the specific assumptions made on the form of the unobserved terms $\nu_j$ and $\zeta_{ijt}$ in the specification of the utility, the above equation can be estimated through different methods.

If the $\nu_j$ and $\zeta_{ijt}$ are assumed to be random iid with a normal distribution, a Random-Effect Probit can be implemented:

$$Pr(k_{it}^j = gen|X) = \Phi(\alpha_1Z_j + (\alpha_2 + \gamma\beta_2)X_{kt} + \gamma[\beta_1Z_i + \beta_3X_{i}^t] + \nu_j + \zeta_{ijt} > 0) \quad (7)$$

where $\Phi$ is the cdf of the standard normal distribution. This approach assumes that $\nu_j \sim N(0, \sigma^2_{\nu_j})$ and is independent of the vector of exogenous regressors $|X$. That is, the unobserved characteristics of the physician are independent of the observables, a strong assumption that can be questioned in this setting.

In order to relax this assumption, a Conditional Logit model can be instead used. In this case, the $\nu_j$ is a physician fixed effect and no distributional or independence assumptions are made on it; $\zeta_{ijt}$ is the logistic error and $\Lambda$ is the logistic distribution:

$$Pr(k_{it}^j = gen|X) = \Lambda((\alpha_2 + \gamma\beta_2)X_{kt} + \gamma[\beta_1Z_i + \beta_3X_{i}^t] + \nu_j + \zeta_{ijt} > 0) \quad (8)$$

All time-invariant physician characteristics are dropped (they are subsumed in the fixed effect). This approach, though appealing for the analysis of this work, becomes computational burdensome and must be estimated on a restricted sample.

For this reason, both models will be estimated to compare the results obtained.
Dynamic model

In subsequent prescriptions, the decision of the physician takes into account the choice made in $t-1$:

$$
Prob(k_{jt} = \text{generic}|Z_j, Z_i, X_{kt}, X_{kt}^i, I_{ik,t-1}; \vartheta) = F(\alpha_1 Z_j + (\alpha_2 + \gamma \beta_2) X_{kt} + \gamma [\beta_1 Z_i + \beta_3 X_{kt}^i + \beta_4 I_{ik,t-1}] + \nu_j + \zeta_{ijt} > 0)
$$

The same models used in a static context could be used in the case where the one-period lagged choice is included: replacing $F$ by the standard normal ($\Phi$) or by the logistic ($\Lambda$) distribution, and imposing the assumptions seen above, respectively the Random Effect Probit or the Conditional Logit can be estimated. However, using the past choice as an additional regressor complicates the estimation.

When the Random Effect Probit is used, an additional assumption must be made on the initial choice $k_{j0}$, which must be exogenous. The exogeneity assumption is likely to be wrong in this case, where the initial choice of drug version is modeled to depend on observed and unobserved physician, patient and drug characteristics. In addition, pooled models have been found to overestimate the importance of persistence, i.e. $\beta_4$. In the Conditional Logit model, no such exogeneity assumption is needed, but results are likely to be inconsistent (Chintagunta, Kyriazidou and Perktold, 2001).

There is no agreement on which models can best overcome such problems when unobserved individual characteristics and state dependence co-exist, making it difficult to disentangle the true effect of persistence (Heckman, 1981; Erdem and Sun, 2001). Some authors have proposed to put a structure on the unobserved heterogeneity (the fixed effect) conditional on the initial choice and the exogenous regressors (Wooldridge, 2005), but modeling the unobserved heterogeneity requires assumptions that may be incorrect. Honor´e and Kyriazidou (2000) suggest a fixed T consistent estimator, which is consistent with a dynamic utility maximization model with habit formation. Although Chintagunta et al. (2001) show that this estimator outperforms both pooled methods and conditional likelihood procedures, this approach imposes strong assumptions on structure of the exogenous regressors and becomes intractable when the number of regressors increases (Carro, 2007).

8 Results

8.1 First prescription

Table 6 reports the results obtained under the two different methods (Random Effect (RE) Probit and Conditional Logit) on the first prescription for all patients. The factors that seem to mostly affect the outcome of the first prescription are some characteristics of the drug and the patient. Drugs with a higher SMR are more likely to be prescribed as generic, as well as more recent and innovative drugs. Also, chronic patients have a higher probability of receiving a brand-name on the first prescription. The most striking result is the high and significant coefficient of the variable TFR: being subject to reference
price increases the probability that the doctor writes a generic prescription for that drug. Moreover, it seems to be the TFR in itself to be driving the results and not the potential price difference that the patients might pay: the negative sign associated to the price difference between the drug and the TFR suggests that the segment of price-inelastic loyal customers continues to buy the brand-name drug even if it is now more expensive. Most of the drugs subject to TFR do not align their price to the reference price but instead maintain it at the pre-TFR level: this is a form of segmentation/harvesting strategy implemented by brand-name manufacturers, often observed at the entry of generics: it is aimed at retaining a segment of loyal customers that are willing to pay a higher price and never switch to the generic.

### 8.2 All prescriptions

Results presented in Table 7 are mainly in line with expectations, though some are worth commenting. A closer inspection of marginal effects (not reported) provides an idea of the variables that are more likely to affect the outcome.

Concerning physician characteristics, older GPs are less likely to prescribe a generic version and the effect is relevant: an additional year implies 0.2% decreased probability of prescribing the generic. This is suggestive of the role played by habits in the prescription process: older doctors have prescribed using the brand-name for a long time, while younger ones may have been encouraged to use the INN. Conversely, there seem to be no significant effect of gender, though male doctors seem to be more favorable to generics.
### Table 6: First prescription

<table>
<thead>
<tr>
<th></th>
<th>RE Probit</th>
<th>Cond. Logit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Z_j$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>age phys</td>
<td>0.02 (0.007)</td>
<td>-</td>
</tr>
<tr>
<td>sex phys</td>
<td>0.06 (0.13)</td>
<td>-</td>
</tr>
<tr>
<td>$Z_i$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>age pat</td>
<td>-0.002 (0.003)</td>
<td>0.00 (0.005)</td>
</tr>
<tr>
<td>sex pat</td>
<td>0.05 (0.05)</td>
<td>0.05 (0.07)</td>
</tr>
<tr>
<td>unemployed</td>
<td>-0.05 (0.28)</td>
<td>0.29 (0.50)</td>
</tr>
<tr>
<td>retired</td>
<td>0.02 (0.07)</td>
<td>0.03 (0.10)</td>
</tr>
<tr>
<td>$X_{kt}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chronic</td>
<td>-0.41 (0.06)</td>
<td>-0.53 (0.09)</td>
</tr>
<tr>
<td>SMR</td>
<td>1.49 (0.08)</td>
<td>1.63 (0.12)</td>
</tr>
<tr>
<td>ASMR</td>
<td>-0.11 (0.05)</td>
<td>-0.30 (0.07)</td>
</tr>
<tr>
<td>reimb rate</td>
<td>0.04 (0.005)</td>
<td>0.01 (0.01)</td>
</tr>
<tr>
<td>age drug</td>
<td>-0.03 (0.003)</td>
<td>-0.07 (0.001)</td>
</tr>
<tr>
<td>TFR</td>
<td>3.98 (0.74)</td>
<td>2.57 (0.57)</td>
</tr>
<tr>
<td>TFR pricediff</td>
<td>-2.07 (0.40)</td>
<td>-0.97 (0.31)</td>
</tr>
</tbody>
</table>

**year FE, ATC FE** | yes | yes |
**Observations**     | 13895 | 13895 |

### Table 7: RE Probit: probability of receiving the generic

<table>
<thead>
<tr>
<th></th>
<th>RE Probit</th>
<th>Cond. Logit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Z_j$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>age phys</td>
<td>-0.02 (0.008)</td>
<td>-0.02 (0.008)</td>
</tr>
<tr>
<td>male phys</td>
<td>0.07 (0.14)</td>
<td>0.13 (0.15)</td>
</tr>
<tr>
<td>share men</td>
<td>0.80 (0.31)</td>
<td>-</td>
</tr>
<tr>
<td>avg age</td>
<td>-0.03 (0.02)</td>
<td>-</td>
</tr>
<tr>
<td>share unempl</td>
<td>-1.07 (0.76)</td>
<td>-</td>
</tr>
<tr>
<td>share chronic</td>
<td>-0.06 (0.33)</td>
<td>-</td>
</tr>
<tr>
<td>share retired</td>
<td>0.94 (0.35)</td>
<td>-</td>
</tr>
<tr>
<td>$Z_i$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>age pat</td>
<td>0.01 (0.001)</td>
<td>0.01 (0.001)</td>
</tr>
<tr>
<td>male pat</td>
<td>0.05 (0.01)</td>
<td>0.06 (0.01)</td>
</tr>
<tr>
<td>unemployed</td>
<td>-0.10 (0.07)</td>
<td>-0.11 0.07</td>
</tr>
<tr>
<td>retired</td>
<td>-0.08 (0.01)</td>
<td>0.06 (0.01)</td>
</tr>
<tr>
<td>$X_{kt}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chronic</td>
<td>-0.25 (0.01)</td>
<td>-0.25 (0.01)</td>
</tr>
<tr>
<td>SMR</td>
<td>1.27 (0.22)</td>
<td>1.27 (0.02)</td>
</tr>
<tr>
<td>ASMR</td>
<td>0.27 (0.01)</td>
<td>0.27 (0.01)</td>
</tr>
<tr>
<td>reimb rate</td>
<td>0.01 (0.001)</td>
<td>0.01 (0.001)</td>
</tr>
<tr>
<td>age drug</td>
<td>0.003 (0.001)</td>
<td>0.003 (0.001)</td>
</tr>
<tr>
<td>age drug^2</td>
<td>-0.0002 (0.000)</td>
<td>-0.0002 (0.000)</td>
</tr>
<tr>
<td>TFR</td>
<td>2.41 (0.05)</td>
<td>2.41 (0.08)</td>
</tr>
<tr>
<td>TFR pricediff</td>
<td>-0.65 (0.02)</td>
<td>-0.65 (0.03)</td>
</tr>
</tbody>
</table>

**year FE, ATC FE** | yes | yes |
**Observations**     | 213519 | 213519 |
Gender seems instead to matter on the patient side. As suggested by previous works, women are less likely to receive a generic prescription. When it comes to age, older patients show a slightly higher probability of receiving a generic prescription: this contrasts with previous evidence, but can be explained by a higher price sensitivity of these patients and by the fact that average age in the sample is high. Moreover, the coefficient associated to the retired indicator is positive, and the two variables are correlated: French retirees show a 6% higher probability of receiving the generic prescription, confirming the results emphasized by some surveys conducted in the past (Naudin, 2003). Chronic patients, as explained above, benefit from a special treatment in terms of reimbursement, which makes them price-inelastic (full reimbursement); at the same time, the medical condition related to their chronic disease requires continuous treatment, making the patient more sensitive to potential interactions and to non-medical aspects of the drug, such as the shape or color of the pill. This is reflected in the estimated negative coefficient of the variable chronic: patients under the ALD regime are 4% less likely to get a generic prescription as compared to non-chronic ones. The full reimbursement granted to unemployed patients may explain why losing their job decreases the probability of receiving a generic prescription by 2%, though the effect is only significant at the 10% level: patients that should be more price-sensitive become, thanks to this regulatory regime, price inelastic and this is reflected by the prescription outcome.

Controlling for the average composition of the patient base of the doctors mainly leaves the results unaffected, suggesting that spillover effects are not very important.

Interestingly, drugs do not seem to be all alike. The coefficients on ATC classes (not reported) differ and show how anti-cholesterol drugs are the most likely to be prescribed under the generic version, while the opposite is true for anti-hypertensives. Older drugs are more likely to be prescribed as generics, as well as lower quality drugs, as suggested by the positive sign associated to the indices SMR and ASMR: the higher the indices (between 1 and 5), the lower the medical benefit and the innovativeness of the drug, the higher the probability that the doctor will write a generic prescription. The unexpected positive coefficient on the reimbursement rate may originate from the fact that most of the drugs are reimbursed at the highest level (65%), rather than from a different prescription behavior: drugs in the same class usually share the same reimbursement level, which is mainly driven by disease specificities rather than individual molecule characteristics. As for the first prescription, reference pricing matters: being subject to TFR accounts for a 35% increased probability that the doctor writes a generic prescription for that drug. Again, the potential price difference that the patients might pay is not instead discouraging brand-name prescription.

All in all, the regression on the pooled sample uncovers some evidence of altruism and the importance of physician and patient characteristics. Doctors seem to adjust their prescription behavior to the characteristics of the patient and presumably accommodate their requests and preferences. This may indicate altruism: the parameter γ in the theoretical model cannot be identified directly, but these results are suggestive of a prescription process that does not only entail medical considerations. Preferences, special needs, budget constraints seem to be considered by the doctor when deciding on the brand type. Also, this may reflect the remuneration scheme of French GPs (see section 3
above): doctors are paid on a fee-for-service basis and receive a fixed fee per patient/year; thus, they are interested in pleasing the patients in order to retain them. Hence, in order to better control for unobserved doctor characteristics, the model is estimated via a Conditional Logit with physician fixed effects. Results in Table 8 are in line with previous ones and confirm the role of patient characteristics in driving prescription outcome. Again, there is some evidence of altruism, though the unemployed dummy has a positive and non-significant coefficient. The result on reference pricing is robust to the change in specification.

\[
\begin{array}{l|l|l|l}
 Z_i & \text{age pat} & 0.02 & (0.02) \\
 & \text{male pat} & 0.001 & (0.001) \\
 & \text{unemployed} & 0.01 & (0.08) \\
 & \text{retired} & 0.04 & (0.02) \\
 X_{kt} & \text{chronic} & -0.08 & (0.002) \\
 & \text{SMR} & 0.21 & (0.03) \\
 & \text{ASMR} & 0.02 & (0.02) \\
 & \text{reimb rate} & -0.001 & (0.002) \\
 & \text{age drug} & -0.01 & (0.001) \\
 & \text{TFR} & 0.47 & (0.08) \\
 & \text{TFR pricediff} & -0.08 & (0.02) \\
 & \text{ATC FE} & \text{yes} \\
 Z_j & \text{physician FE} & \text{yes} \\
 \text{year} & \text{yes} \\
\end{array}
\]

950 prescriptions per physician, 165568 obs.

Table 8: Conditional Logit

8.3 All prescriptions: persistence through the lagged choice

To be written.

9 Conclusion

The aim of the work is to explore whether the prescription process includes non-medical considerations in the decision to prescribe the brand-name or the generic version of a drug. In the past decade, there has been a strong pressure to use cheaper and bio-equivalent generic versions of brand-name drugs and the consumption of generics has increased even in those countries that have traditionally shown resistance to generic usage, such as France. However, the result has been mainly achieved through generic substitution at the pharmacy, while the rates of INN (International Non-proprietary Name) prescription have remained low. A reason may be found in the different incentives towards generic usage provided at the prescription and delivery stages: pharmacists have been strongly incentivized to apply generic substitution, through a system of margins
that favors generic over branded drugs; on the contrary, physicians have been encouraged
to shift their habits towards INN prescriptions, but their remuneration schemes have
not been changed accordingly. Doctors often oppose the idea that, despite being bio-
equivalents, the branded and the generic are perfect substitutes, at least for some patients
(potential interactions with other drugs, intolerance to inert components, importance of
appearance or taste of the medication). This seems to suggest that the writing of a
prescription is not a one-size-fits-all process, but is affected by the characteristics of the
patient and by the way physician takes account of them.

In a context where the physician embeds a part of the utility of the patient in her
own utility maximization, patient preferences are likely to affect the choice of the brand
type, while the decision about the molecule remains a doctor prerogative and is assumed
to be the best possible. Thus, doctor, patient and drug characteristics interact in the
prescription process.

Within such a framework, this article analyzes a subset of the rich CEGEDIM data
for France: it focuses on more than 323 thousand prescriptions written by a representa-
tive sample of 327 French General Practitioners to 10627 patients. The prescriptions
include drugs in five therapeutic classes (anti-ulcer, anti-diabetes, anti-hypertensive, anti-
cholesterol and antidepressant drugs) and refer to the period between 2000 and 2008.

Results suggest that physician and patient characteristics play a major role in ex-
plaining the decision on the brand type and some patients show a significantly higher
probability of receiving a prescription for brand-name drug. These are mainly female,
unemployed and chronic patients. The explanation for this result is twofold. On the
one hand, some of these patients might be more sensitive to specific drug characteristics,
which may change across brand types: it is the case of chronic patients and, to a lesser
extent, women, as suggested by previous evidence (Hellerstein, 1998; Coscelli, 2000).
On the other hand, branded prescription is estimated to be higher for price-insensitive
patients, like unemployed and, again, chronic patients, who are fully reimbursed for their
medical expenses, including those for drugs. Conversely, retirees, potentially more price
elastic, are more likely to receive a generic prescription. Drug characteristics also af-
fect the prescription outcome: prescription of the brand-name version is more likely for
higher quality drugs, where quality is measured by SMR and ASMR indices, which refer
respectively to the absolute medical benefit and the relative innovativeness of the drug.

Interestingly, regulation matters as well: the introduction of reference pricing on
some drugs is estimated to increase significantly the probability that the prescriptions
for them is written in the generic form. Thus, a regulatory measure introduced to encour-
age generic substitution at the pharmacy seems to have stimulated generic prescription
as well. One explanation for this result could be that the physician fears that the pa-
tient will be obliged to pay the difference between the actual price of the drug and the
TFR and writes a generic prescription in the first place. This would confirm that physi-
cians are responsive to patient budget constraints and price sensitivity, by adjusting the
prescription accordingly.

However, one must be careful on the interpretation of these results. They are obtained
on the pooled sample, controlling for unobserved correlation across patients of the same
doctor, but not accounting for the identity of the patient: each prescription is treated as
independent of any other, even if the patient is the same. Also, the dynamic dimension
of the prescription history is not exploited at all. Each patient is observed across several years and how prescriptions evolve over time may provide a better understanding of the factors involved in the process. A model including time dependence would be more appropriate to explain why persistence or switches across brand types occur. Future work will address these issues and improve the model and the results.
References


Dickstein, M. (2012a) “Physician vs. patient incentives in prescription drug choice”, working paper


