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Determinants of generic vs. brand drug choice: Evidence from population-wide Danish data

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ABSTRACT

We investigate if demand for branded prescription medications in post-patent markets is patient- or doctor driven. When drugs go off-patent the brand medication often maintains non-negligible market shares. We use population-wide Danish data including all prescriptions for seven blockbuster drugs from 1998 to 2008, which amounts to 13,415,012 prescriptions. At the outset, descriptive statistics suggest large variation in drug choice over doctors. Nonetheless, using a two-way fixed effects model we find that the primary determinants of brand drug use are unobserved patient characteristics and price effects.

1. Introduction

Increasing prescription drug expenditures is an important policy issue in most developed countries. During 1998–2007, real pharmaceutical spending within the OECD went up almost 50%, reaching more than US $ 650 billion in 2007. One of the contributors to elevated expenditures is brand-name drugs that are sold at high prices while the drug is under patent protection. As a consequence, third party payers (government and private) encourage generic substitution when these drugs go off-patent. Despite the fact that generic alternatives are often vastly cheaper than the original brand, brand-versions of a drug typically maintain a non-negligible market share after patent expiry. A recent study by Iizuka (2012) shows strong inertia in the take-up of generic drugs in the Japanese market, but this fact also pertains to other countries like e.g. Italy, France and Spain. For example, the drug Zocor (cholesterol lowering) went off-patent in Japan in July 2003 and in Denmark in September 2002. Two years after patent expirations the brand share was approximately 70% in Japan compared to only 1.5% in Denmark. Holding everything else constant, imposing the Japanese market share to Denmark for this given drug would increase total expenditures by DKK 430 million in 2005 alone (around US $ 80 million or US $ 15/capita). Hence, there is a huge potential to limit drug expenditures if patients switch from brand drugs to generics. Despite the potential for significant cost savings, little is known about the determinants of the choice between brand-name versus generic drugs.

The goal of this paper is to empirically assess the determinants of drug choice using population-wide register data from Denmark. To our knowledge, this is one of first papers to use an entire population of patients and doctors to study this question (see Dalen et al. (2011) for another example). We also believe the paper to be the first to simultaneously quantify the relative contribution of doctor- and patient level characteristics to the overall variation in drug choice. We estimate a linear probability model for drug choice with two-way error components in the spirit of Abowd et al. (1999) that allows for identification of time-invariant unobserved heterogeneity on both the patient and doctor side simultaneously. This estimator has been widely used in the labor literature on matched employer-employee data. Due to data availability few large-scale studies with matched doctor-patient data exist; see Koulayev et al. (2013), Bennett et al. (2011) and Dickstein (2014) for recent examples. The estimation strategy is very demanding, as it requires population-wide data in order to separately identify the two types of fixed effects. For this purpose, we use a unique data set covering the entire Danish population (5.5 mill. individuals) and *all* prescription drug purchases for a period of 11 years. For each prescription redeemed, we observe IDs of both the patient and the doctor. This allows us to study the relative importance of both patient and doctor characteristics in explaining the variation of brand drug use. We study seven blockbuster drugs that went off-patent in the period 2001 to 2005, e.g. Zocor and Losec. We show that the propensity to prescribe brand drugs varies considerably over doctors in Denmark with the bottom 5% prescribing brand-

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drugs on 27% of their prescriptions, compared to 81% for the top 5%. We find that unobserved patient characteristics, such as underlying preferences, unobserved socio-demographics or even drug-patient match quality (cf. Crawford and Shum (2005), Dickstein (2014), Saxell (2014)), explain around 28% of the variation in drug choice, whereas unobserved doctor characteristics explain 0.7% of the variation in drug choice. Furthermore, observed patient and doctor characteristics are very poor predictors of drug choice. Still, the choice of brand-name versions is positively correlated with both doctor and patient income and age of the prescribing doctor. We also demonstrate that not having access to population data can easily lead the researcher to overestimate the effect of doctors' contributions to drug choice.

The results of the paper are obtained within an institutional framework where physicians do not have monetary incentives in the prescribing decision, which is also the case in e.g. the US and many other countries. In for example Japan (Iizuka (2012)), Korea (Kwon (2003)), Switzerland (Rischatsch et al. (2013)) and Taiwan (Liu et al. (2009)), physicians face financial incentives in the prescribing decision.

Under this regime we find that the choice of more expensive brand-name drugs is almost entirely patient driven (relative to doctors). This is suggestive evidence that unless incentives schemes for doctors to sell brand drugs or more expensive drugs exist then doctors do not significantly push these items.

The paper is organized as follows. Section 2 reviews the existing literature, Section 3 describes the institutional setting, Section 4 presents the data, Section 5 provides the empirical methods followed by the results in Section 6. Section 7 concludes.

2. Related literature

When drugs go off-patent, the average price of treatment with the chemical compound often falls drastically. The patent for Zocor expired in Denmark in 2002, and within one year, the price of a day's supply of the drug fell almost 90%. Although the efficacy of generics is believed to be on pair with that of brand drugs (see e.g. Kesselheim et al. (2008)), the prices of brand drugs often remain at the pre-patent level – or they may even go up. One strand of the literature on generic drug use focuses on the so-called 'generic competition paradox' coined after Scherer (1993). The paradox is based on the observation that the price of the branded version of a drug increases when the patent expires (Regan (2008)). One explanation for this paradox, as offered by Frank and Salkever (1992), is that the price-insensitive brand-loyal customers stick to the brand-name drug, losing the price sensitive segment to the generics.

Others, including Coscelli (2000) and Hellerstein (1998), argue that state dependence on both the patient and physician side can account for brand-versions to have positive market shares. With focus on the anti-ulcer market, Coscelli (2000) uses a 10% random sample of citizens aged 15–85 in the Rome-area and finds a considerable degree of state dependence in the drug choice (generic vs. brand) for both patients and doctors. Hellerstein (1998) uses survey data on physicians and their patients in the US to examine the factors related to generic substitution. She finds considerable variation in the likelihood of prescribing generics over physicians, and that physicians are the key decision makers in the prescribing decision. However, why some physicians are more likely to prescribe the branded version of a drug is left unexplained.

Mott and Cline (2002), looking at a somewhat different outcome than we do, use data on a sample of pharmacies in a Midwestern state in the US, and run random effects logistic regressions to analyze characteristics associated with getting a drug that has a generic substitute available. They find that unobserved doctor characteristics account for 23% of the variance in the opportunity for generic drug use, i.e. in contrast to our paper, Mott and Cline (2002) observe if a given prescription allowed for substitution or not. Similarly, unobserved characteristics of pharmacists accounted for 44% of the variance in the occurrence of generic substitution.

Granlund (2009) uses register data from the Swedish county of Västerbotten to investigate whether private sector physicians are more likely to veto generic substitution relative to publicly employed physicians. He finds that private physicians are 50–80 % more likely to veto generic substitution, and that the probability of the doctor vetoing generic substitution is increasing in the patients' co-payment. Also using Swedish data, Lundin (2000) finds that doctors in Sweden internalize the out of pocket price in the brand/generic decision.

Using US data, Carrera et al. (2013) find that some doctors recognize that a subgroup of their patients are more price sensitive, only initiating treatment with those individuals after patent expirations where cheaper generics are available.

Bronnenberg et al. (2013) show that health professionals (pharmacist) are more likely to choose a generic headache remedy, suggesting that more product knowledge would reduce the willingness to pay for brands.

More recently, Iizuka (2012) uses micro data from Japan to show that doctors react to financial incentives in the prescribing decision, favoring brand drugs when this is financially attractive.

We add to the literature by allowing for both patient and doctor fixed effects simultaneously (in contrast to e.g. Mott and Cline (2002)). Our estimation strategy is tractable in the sense that both effects can have arbitrary correlation with observables with no distributional assumptions made about them. Furthermore, as far as we know we are among the first to study this question using panel micro data for an entire nation. Besides being more representative compared to other data sets used in the literature, it also has the technical advantage that observing *all* patients and *all* doctors allows us to identify all patients switching doctors, which provides identification of the fixed effects. We do not offer any economic model for drug choice per se, but we think of the fixed effects as capturing – among other things – drug preferences on both the patient and doctor side.

3. Institutional setting

We now provide an overview of the institutional setting relevant for the study. Denmark has universal and tax financed health insurance run by the government. This includes paid hospital treatments and GP visits. Prescription drug coverage is also part of the public health insurance plan, though with substantial co-payments. Co-payments are a function of yearly accumulated expenditures; consumers have to pay the full cost of prescription drugs if the yearly expenditures are below DKK 500, i.e., a DKK 500 deductible (DKK 500 is approximately US$ 100). When reaching the DKK 500, co-payments are reduced to 50%. Reaching DKK 1,200, co-payments will reduce to 25%, and 15% at DKK 2800. Expenditures and co-payments are calculated on the basis of a *reference pricing* scheme. For drugs still under patent protection, the above co-payments will apply to the full price of a given product. For off-patent drugs however, subsidies are only given on the basis of the cheapest generic substitute. This clearly gives the consumer an incentive to move to generic alternatives once a patent expires.

The Danish market for prescription drugs is highly regulated to secure uniform prices across pharmacies. Pharmacies earn a fixed amount (approximately DKK 17) on each prescription processed, no matter the price or other attributes of the product dispensed (i.e. brand or generic). Note that this is in contrast to e.g. Brekke et al. (2013) who show that pharmacies in Norway have incentives to