Prescription behaviour of physicians in the public and private sector*

Elina Jussila[a], Kaisa Kotakorpi[b], and Jouko Verho[c]

July 2021

PRELIMINARY - PLEASE DO NOT CITE OR CIRCULATE WITHOUT PERMISSION

Abstract

We analyse differences in the prescription behaviour of physicians in the public and private sector. We conduct the analysis in the context of two case studies, treatment of high cholesterol and type 2 diabetes, which are both very important for public health as well as healthcare costs. Both cases are characterised by the availability of an effective, widely accepted low-cost treatment and alternative, more expensive treatments for the same condition. We find that in both cases, physicians are significantly more likely to prescribe the expensive alternative in the private sector. The result holds also after controlling for a wide variety of individual-level factors such as income and health indicators, as well as some physician-level factors.

Keywords: healthcare, prescription behaviour, public sector, private sector
JEL-codes: I11, H42, I18

* Funding from the Academy of Finland (grant no. 325111) is gratefully acknowledged.
[a] Tampere University; e-mail: elina.jussila@tuni.fi.
[b] Tampere University, VATT and CESifo; e-mail: kaisa.kotakorpi@tuni.fi.
[c] VATT; email: jouko.verho@vatt.fi.

1. Introduction

The purpose of this paper is to study the determinants of physicians' prescription behaviour. In particular, we are interested in whether prescription behaviour differs according to whether the physician operates in the private or the public sector. More specifically, we examine whether physicians in either sector are more likely to prescribe a high-cost medicine, when an effective, widely accepted low-cost alternative treatment for the same condition is also available. Studying the determinants of prescription behaviour is important from an economic point of view: Drug expenditures amount on average to 1.4% of GDP across OECD countries (OECD 2018).

In most advanced countries, the public sector has a large role in healthcare financing and provision, but the extent of this involvement differs across countries. The case for public sector involvement in healthcare markets is quite firmly established in the literature, starting with Arrow's (1963) seminal contribution. In practice, a prominent recent trend has been that many countries are moving towards a larger degree of private provision, with the goal of improving efficiency and/or the quality of services. A prominent example is the U.K. (see e.g. Propper 2018), and more closely related to our context, Sweden (e.g. Dietrichson et al. 2020). There is mixed evidence overall on performance differences between sectors (for reviews see e.g. Pita Barros & Siciliani (2012), Tynkkynen & Vrangbaek (2018)).

An important and interesting next step in this literature is to examine the differences and determinants of behaviour in each sector at the level of individual practitioners, whose choices ultimately play a key role in determining patient outcomes and costs. We focus on an important aspect of behaviour with potentially significant implications for both health outcomes and healthcare costs, namely prescription behaviour of physicians. Literature on this issue is relatively scarce. Ohlsson et al. (2010) examine the association between patient socio-economic status and medication choices for high cholesterol, separately for public and private healthcare in Sweden. Das et al. (2016) analyse the behaviour of physicians working in public vs. private sector in rural India, using panel data on physicians, and (fake) patients randomized to different physicians in an audit study.

We expand on the analysis of Ohlsson et al. (2010) by directly comparing treatment decisions in private and public sector, by controlling for a wider range of patient- and physician-level factors (e.g. patients' health status), and by moving beyond analysing the treatment of a single condition (high cholesterol) by documenting a similar pattern in the treatment of type-2-diabetes (T2D), which is one of the most important single diseases from the point of view of healthcare costs in advanced countries. Further, we complement the analysis of Das et al. (2016) by examining physicians in a developed country. Compared to both of these studies, we have exceptionally rich and extensive register data on physicians and patients.

We use data on a random sample of 2/3 of physicians operating in Finland in year 2017, all their patients, and all prescriptions received by these patients. We find that in both cases that we study, physicians are less likely to prescribe the low-cost treatment in the private sector. This result holds also after controlling for a wide variety of individual-level factors such as income and health indicators, as well as some physician-level

factors. The fraction of low-cost prescriptions is between 5 – 12 % lower in the private sector, depending on specification.

The paper proceeds as follows. The institutional setting and potential mechanisms that may cause differences in prescription behaviour between sectors are described in Section 2. Our data is described in Section 3 and the medication guidelines that are relevant for our case studies (T2D, cholesterol) in Section 4. Section 5 presents our empirical approach and results. Section 6 discusses our findings and lastly, Section 7 concludes.

2. Background

2.1 Institutional setting

In Finland, the share of the private sector in healthcare provision has been steadily increasing in recent years and was just over 30 % in 2016 (measured by the share of net value added in social and healthcare services; Kotakorpi & Seuri 2019). All Finns have mandatory public health insurance coverage and can visit a public primary healthcare centre. In addition, numerous private clinics also provide primary healthcare services.

Public health insurance is provided by the Social Insurance Institution (SII) of Finland. The SII administers a large number of social benefits and reimburses the use of private healthcare services and prescription drugs. The reimbursement for healthcare visits is generally low and based on fixed fees. In effect, public health insurance provides a small public subsidy (on average 16% of costs, SII 2021a) and private top-up insurance is common (16% of the Finnish adult population, Finance Finland 2019).

Prescription drug purchases are reimbursed typically directly at the pharmacy, and the insurance covers 40–100% of the drug costs after an annual 50€ deductible. While the basic reimbursement rate is 40%, diabetes and chronically ill high cholesterol patients are entitled to a special reimbursement rate of 65% after submitting a medical certificate to the SII.

Public healthcare is organised by municipalities. Outpatient care is provided in municipal health centres where a 20.6€ patient fee can be charged. Private healthcare visits are either covered by private top-up insurance or paid out-of-pocket. In addition, employed patients can visit occupational health services free of charge with improved access compared to the municipal health centres. Occupational healthcare can be operated either by public or private providers and it is classified in our analysis as public or private according to the sector of the provider.

Importantly, for prescriptions written in either sector, the cost of the medicine is subject to similar public (and possible private top-up) insurance: that is, the costs of drug purchases to the patient do not depend on the sector in which they are prescribed.

Patients in the private sector are typically wealthier and healthier than in the public sector. Further, there are fairly large socio-economic differences in health in Finland (Tarkiainen et al. 2012). Together, these stylized facts underline the importance of understanding the determinants of the type of care received in each sector.

Interestingly for our analysis, many physicians in Finland operate in both sectors. For example, physicians who hold a position in a public healthcare centre or hospital, may also have a private practice. In Section 3, we describe how these institutional features – patient characteristics in the two sectors, and the distribution of physicians between the sectors – are manifested in our data.

2.2 Potential mechanisms

Differences in prescription behaviour – that is, differences in which drug is prescribed for a given diagnosis – may arise for several reasons: Differences may originate on the demand side (patients), or on the supply side (physicians). We are mainly interested in (a subset of) the latter, but need to account also for other potential mechanisms in the analysis. For a model of treatment choice incorporating these features, see e.g. Chandra et al. (2012).

Demand side factors. Even for the same diagnosis, patient needs may differ for several reasons related to their health status. For example, different drugs may be optimal for different degrees of severity of the same condition. If patients have comorbidities, some drugs may not be suitable. Patients may have a preference for a particular drug also for idiosyncratic reasons, e.g. if a higher price or brand carries the impression of better quality (even in the absence of actual quality differences). The willingness to pay for perceived quality may depend e.g. on income. Further, if patients are insured – as they are in the cases that we study – there may be demand for overtreatment (moral hazard).

Supply side factors. Supply side factors may relate to physicians' characteristics, and institutional factors. Relevant factors that relate to physician characteristics include physicians' preferences (e.g. degree of altruism) and skill. These may affect how closely a physician's choice of treatment will match what is optimal for the patient.

Relevant institutional factors may include e.g. reimbursement schemes and other factors that influence physicians' incentives; these may be sector-specific. Again, insurance may give rise to so called 2nd degree moral hazard, where the physician accommodates the patient's demand for overtreatment (see e.g. Dulleck et al. 2011). Even though incentives for moral hazard on the patient side should be similar for both sectors in our setting (the reimbursement scheme for prescriptions does not depend on the sector), incentives for 2nd degree moral hazard may be stronger in the private sector: in the private sector the physician stands to make a profit that may depend e.g. on the value of treatments prescribed, and competitive pressure may increase the likelihood that the physician accommodates potential moral hazard arising on the patients' side.

In our analysis, we aim to control for demand side factors by controlling for a wide variety of patient characteristics, including rich information on socio-demographic characteristics, income, and importantly, health status including e.g. information on comorbidities that may render certain drugs unsuitable for that patient. Regarding supply side factors, we aim to control for some features of physician selection into different sectors; see the empirical section for details. If we manage to successfully control for factors that relate to patient and physician selection into each sector, any

remaining differences in prescription behaviour between sectors should be informative about other sector-specific factors that influence treatment decisions.

3. Data

Our analysis data is based on a two-thirds random sample of physicians working in Finnish out-patient care. For these physicians, we observe every patient with a medical drug prescription. The data include detailed background characteristics of the patients and all their prescriptions in 2016–17. Thus, the patient data includes prescriptions also from physicians who are not in the initial sample. The observed physician characteristics include the field of specialization, place of employment and patient mix.

We construct the analysis data by combining different administrative registers. The main data source is the Kanta e-prescription register which has information on drug prescriptions and purchases covering the entire Finnish population. The sampling is based on a population of physicians with any prescriptions in the register between 2015 and 2017. Then, all patients with prescriptions by the sampled physicians were included in the dataset. In total, the analysis sample includes about 15.7 million patient visits.

Patient characteristics are linked to these data from the so-called Folk datasets of Statistics Finland. The demographic variables used in the analysis include age, education, gender, and information on spouse and immigrant background. In addition, we use information on disposable income of the patients. All background characteristics are observed in 2016.

Let us first briefly describe the division of both physicians and patients between sectors. Figure 1 shows the number of physicians by their sector of employment. A majority of the physicians work in the public sector alone. The number of those employed in the private sector only is smaller. However, also a significant share of physicians has patient visits from both sectors implying they had employment contracts from both sectors.

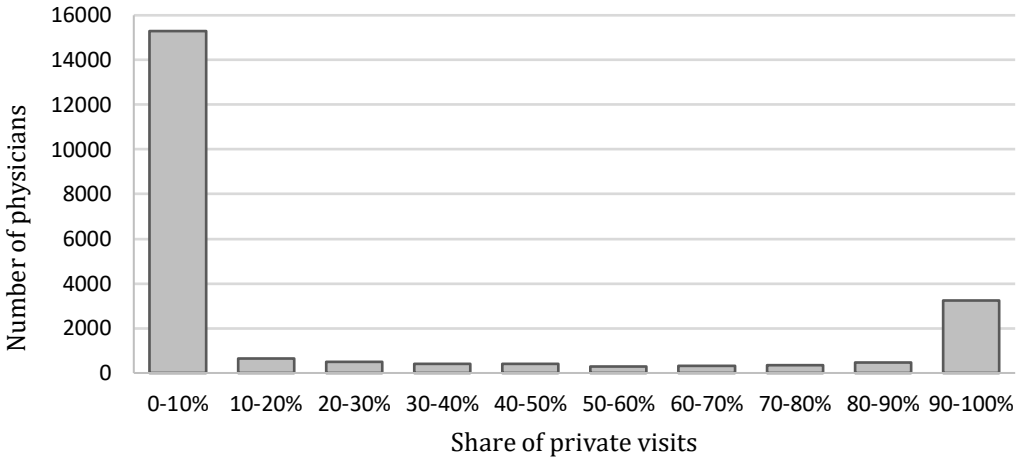

Figure 1. Distribution of physicians by their share of private receptions. Many physicians working in private clinics are also employed in the public sector.

In the following analysis, we define physicians with 0-20% of private visits as those mainly employed in the public sector. Physicians with 20-80% private visits are defined as those with mixed employment and, physicians with over 80% of private visits are defined as those mainly employed in the private sector. The number of public, mixed and private physicians is 15 901, 2 269 and 3 751, respectively.

On average, private sector physicians are more commonly specialized in occupational healthcare or have some other field of specialization. On the other hand, public sector physicians are more commonly junior professionals without any field of specialization. The mixed physicians are mainly specialists but rarely in the field of occupational healthcare.

A key difference in the patient characteristics between private and public sector clinics is illustrated in Figure 2. The private sector patients belong to the top end of the income distribution more often than public sector patients. The public sector patients are more likely to have below median income and they include a much larger share of elderly patients. However, those in the first income decile are quite evenly distributed and include a large share of students. More detailed descriptives pertaining to our empirical analysis are relegated to Section 5.1.

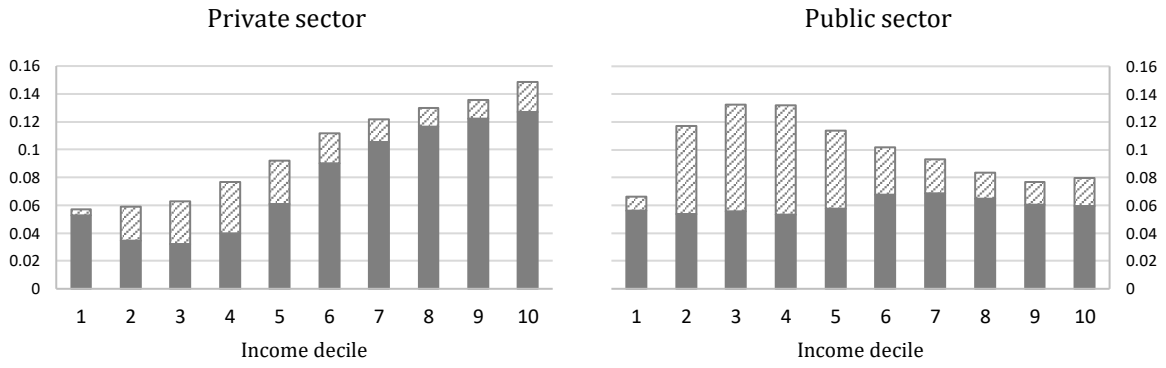

Figure 2. Income distribution of patients by the sector of physician visits. The shaded area represents patients over 65 and the dark grey area represents patients below 65.

4. Medication guidelines

We focus on prescription behaviour in the context of two diseases, that are both characterised by the availability of an effective, widely accepted low-cost treatment and alternative, more expensive treatments for the same condition. Both cases are also very important from the point of view of public health and healthcare costs in advanced countries.

Type 2 diabetes. Diabetes is one of the most important chronic conditions that causes increasing costs to the healthcare systems globally (Seuring et al. 2015). Diabetes is closely linked to the obesity epidemic, which highlights its importance also in the future. An increase in the costs related to the treatment of diabetes is also evident in Finland. For example, the treatment costs increased by 83 % over the period 1998–2007 (Jarvala et al. 2010). There are approximately 250 000 individuals diagnosed with type 2

diabetes in Finland and there are about 24 000 new cases of diabetes (defined as individuals receiving drug treatment for diabetes) per year; note that this latter number includes both type 1 and type 2 diabetics. It has been estimated that approximately 15% of total healthcare costs in Finland are related to the treatment of diabetes.

The basic recommendation for pharmacological therapy for type 2 diabetes is clear, namely that "metformin, if not contraindicated and if tolerated, is the preferred initial pharmacological agent for type 2 diabetes" and the treatment should be started at or soon after diagnosis if lifestyle changes alone are not sufficient to achieve glycemic goals. The grounds for this recommendation are that "metformin has a longstanding evidence base for efficacy and safety, is inexpensive, and may reduce risk of cardiovascular events and death". Further, if the target levels of blood glucose are not achieved within approximately 3 months, a combination of metformin and other treatment options should be considered. (American Diabetes Association 2016, S53-S54.) The Finnish guidelines on the treatment of type 2 diabetes are essentially similar to these guidelines, with lifestyle changes and metformin treatment being the primary forms of care that should be started as soon as a diagnosis is made, and the need for additional treatments should be considered if target blood sugar levels are not reached 3-6 months after diagnosis.

One criterion for metformin being the primary treatment is its relatively low cost, as stated in the treatment guidelines. In 2017, the price per 100 tablets was 4.11 € in Finland, compared to e.g. 128 € for one of the main alternative medicines, gliptin. Taking into account differences in dosage (2– 3 tablets of metformin vs. 1 of gliptin), the alternative treatment appears to be at least 16 times more expensive than the recommended treatment. (Pharmaceuticals Pricing Board 2020)

Cholesterol. Statins, i.e. HMG-CoA reductase inhibitors, are the most important class of cholesterol-lowering drugs. Satatins are used in the treatment of dyslipidemia which aims both to prevent and to treat atherosclerotic cardiovascular diseases. In Finland, statins are prescribed for over 700 000 individuals and the annual costs related to statins exceed 80 million euros (SSI 2020b). On the Finnish market, there are six different statins available of which simvastatin is the most common one. Historically, simvastatin has clearly been the low-cost treatment for high cholesterol, although the price for atorvastatin has been declining, and at the end of the year 2017, approached the same level as simvastatin. For example, at the beginning of the year 2017, the price per 100 tablets of simvastatin (30mg) was around 35 €, whereas the prices for atorvastatin (20mg) and rosuvastatin (10mg) were 41.4 € and 61.7 €, respectively. (Pharmaceuticals Pricing Board 2020) The comparison takes into account the defined daily doses which differs across statins.

5. Empirical analysis

The objective in this analysis is to study how the prescription behaviour of physicians differs between private and public sector practitioners and whether these differences can be explained by the observed patient selection. In the analysis, we focus on two different analysis populations: patients who have received either diabetes or statin (cholesterol) medication in 2017. The sample sizes are around 475 000 and 705 000 patient visits, respectively.

5.1 Descriptive statistics

Table 1 shows how patients differ in their characteristics between public and private visits. Patients with a prescription from a private physician are younger, more often men and living with a spouse compared to patients who visited a public health centre. The financial resources available to the private patients are also substantially larger as they have over 50% higher disposable income on average.

Patients in the public and private sector also differ markedly in their health status. The ability to control for a rich set of health indicators is a particularly attractive feature of our analysis. The health indicators are chosen so as to match the relevant mechanisms identified in Section 2.2 above. First, we use information on individuals' total reimbursed drug expenditures (for all drugs) in the previous year. This is a good indicator for the individual's general health status. Individuals with a lot of medical expenditures are more likely to have multiple health problems and may require different type of treatment for this reason. Table 1 shows that public sector patients have over 30 % higher overall prescription drug expenditures.

Second, we use an indicator for whether the patient had a so-called special reimbursement entitlement for the treatment of the specific disease that we are interested in, already in the year preceding the analysis. Having such an entitlement means that medication for the given condition will be covered by more generous public insurance. All patients with the relevant diagnosis should receive the entitlement directly upon diagnosis. In practice, this variable therefore measures whether the patient suffered from the disease already in the year prior to our analysis. Such "old" cases should be more likely to be prescribed the high-cost alternative, as all newly diagnosed patients should, according to treatment guidelines, receive the low-cost treatment as a default. Public sector patients are nearly twice more likely to be eligible for special reimbursement.

Third, we use an indicator for whether the patient has a prescription for a medicine that has been found to have harmful medical interactions with the low-cost treatment of interest; in this case prescribing the low-cost alternative should clearly be less likely. The average value of this indicator does not differ significantly between public and private sector patients.

The patient populations receiving statins and diabetes medication are relatively similar with respect to their socio-economic characteristics. The main differences are that the patients with a prescription for statins are slightly older and more often women. However, health indicators point to interesting differences as the patients receiving statins have lower medical costs and they are also less likely to have a special reimbursement eligibility. On the other hand, medical interactions appear to be relevant in the case of statin prescriptions (cholesterol medication), but not for diabetes medication.

Table 1. Descriptive statistics. The characteristics of patients using medication for type 2 diabetes or statins by physicians' sector of employment in 2016.

	Diabetes medication		Statins	
	Public	Private	Public	Private
Age	66.7	58.3	69.1	59.5
	(12.1)	(10.9)	(11.0)	(10.7)
Men (%)	54	63	50	62
Spouse (%)	57	68	60	72
Immigrant background (%)	4	3	3	3
Basic education (%)	43	20	42	18
Secondary education (%)	37	39	35	37
Tertiary education (%)	20	41	23	45
Disposable income (eur)	20 128	33 890	20 624	35 179
	(10 944)	(19 164)	(11 370)	(20 535)
Prescription drug costs (eur)	1 486	1 134	1 032	660
	(2 365)	(2 165)	(2 595)	(1 352)
Special reimbursement (%)	82	67	21	12
Medication interaction (%)	0.01	0	11	12
Number of patients	255 301	35 294	517 447	86 563
Number of prescriptions	415 061	60 250	602 883	102 190

5.2 Empirical model

To control for the observed differences in patient characteristics, we estimate linear probability models using OLS where the dependent variable is a dummy for whether the low-cost treatment was prescribed for each condition – that is, metformin in the case of treatment of type 2 diabetes and simvastatin in the case of treatment for high cholesterol. The main explanatory variable of interest is a dummy for prescriptions written in the private sector. Our model is specified as:

$$y_i = \alpha + \beta\, private_i + \gamma\, X_i + \varepsilon_i,$$

where *y* is an outcome variable taking value 1 when the low-cost treatment was prescribed in a patient visit *i* and 0 otherwise. The variable *private* indicates whether a physician gives the prescription in a private clinic. The set of control variables are denoted by *X*, and they include the background characteristics of the visiting patient.

We estimate the model using five different sets of control variables. Model (1) includes no controls and gives the raw difference in the likelihood of receiving the low-cost

treatment in a private visit. Model (2) adds the set of demographic controls including age, gender, education, and indicators for having a spouse and immigrant background. Model (3) is extended by including income deciles of the patients. Models (4) and (5) add health indicators: the deciles of drug expenditures and indicators for special reimbursement entitlement. All control variables are observed in 2016.

5.3 Results for diabetes medication

The results for the treatment of type 2 diabetes are presented in the top panel of Table 2. Model (1) documents the difference in the rate of prescribing the low-cost medication between physicians working in the private and public sectors before adjusting for patient characteristics. The estimate shows a statistically significant 1.5pp lower share of patients receiving the low-cost treatment in private clinics.

In the subsequent columns, we successively add controls to account for patient selection. Models (2) and (3) include controls for demographic characteristics and income deciles of the patients. Although public sector patients are nearly ten years older and have substantially lower incomes on average, the estimated difference in the likelihood of receiving low-cost medication changes only little.

Adding controls for the health status of the patients has a stronger impact on the estimate. Model (4) adds the individual's previous year drug expenditures as controls. The drug expenditures can be interpreted as a general proxy for patients' health. This increases the magnitude of the estimate notably from -1.5pp to -5.0pp.

Model (5) includes an indicator for the entitlement of special reimbursement. The entitlement increases the reimbursement rate of diabetes medication, and it is measured in the year preceding the analysis year. Controlling for the entitlement changes the estimate further to -6.7pp.

A full set of controls is included in model (6). The final control variable is an indicator for medication interaction which does not have any impact because it is very rare in the case of type 2 diabetes. When comparing the estimated difference to the mean of 54.3% for public sector patients, the results imply a 12% lower rate of prescribing the low-cost medication in the private clinics.

Table 2. Differences in prescriptions for type 2 diabetes medication and statins between private and public sector physicians.

	Public mean	(1)	(2)	(3)	(4)	(5)	(6)
Diabetes medication							
Estimate	0.543	-0.015***	-0.019***	-0.015***	-0.050***	-0.067***	-0.067***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
N	475 311						
Statins							
Estimate	0.430	-0.089***	-0.060***	-0.045***	-0.048***	-0.051***	-0.050***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
N	705 073						
Control variables							
Demographic characteristics			x	x	x	x	x
Income deciles				x	x	x	x
Drug expenditure deciles					x	x	x
Special reimbursement						x	x
Medication interaction							x

Notes: Estimates from a linear probability model for prescriptions in 2017. Standard errors (in parenthesis) are robust and clustered at patient level. *** denotes significance at a 1% level.

5.4 Results for statins

The middle panel of Table 2 reports the estimated difference between private and public sector prescriptions for statin medication. The pattern of estimates deviates from the case of diabetes in that including more controls reduces the difference between sectors.

The estimated raw difference between sectors shows a substantial 8.9pp lower share of low-cost medication in the private sector. Adjusting for demographic differences in model (2) reduces the difference to 6.0pp, and then adjusting for the income differences in model (3) reduces the difference further to 4.5pp. Thus, the impact of controlling for socio-economic factors nearly halves the difference between sectors for statin prescriptions whereas it had only a minor impact in the case of diabetes even though the differences in the patient mix between the sectors are fairly similar.

Models (4) and (5) add controls for patients' health indicators. They increase the estimated difference slightly to 5.1pp. Then the final model (6) adds an indicator for medication interaction. While the interaction affects every tenth patient with statin prescription, the estimate changes only a little. The 5.0pp estimated difference between sectors implies, relative to the public sector mean, a similar 12% lower rate of prescribing the low-cost medication in the private clinics as in the case of diabetes medication.

5.5 Subgroup analysis of mixed sector physicians

To account for sorting of physicians to different sectors, we conduct a subgroup analysis using mixed sector physicians, i.e. those with at least 20% employment in both public and private clinics. The number of observations drops substantially because most of the physicians work in the public sector alone in our data. In the subgroup of mixed sector physicians, we observe around 14 000 and 23 000 patient visits with prescriptions for diabetes and statin medication, respectively.

Table 3 presents the results for the subgroup analysis replicating the analysis conducted above using the full sample. For diabetes medication, the estimated differences between patients visiting private and public sector clinics remain broadly similar to those for the full sample. The main change is that the difference in the raw means is larger for the subgroup. This is balanced by the smaller impact of the socio-economic characteristics, and after controlling for health indicators, the estimated difference is 5.1pp. In relative terms, this implies a 9.3% lower rate of prescribing the low-cost medication in the private clinics.

Table 3. Analysis of physicians working in both sectors. The differences in prescriptions for type 2 diabetes medication and statins between private and public sector prescriptions.

	Public mean	(1)	(2)	(3)	(4)	(5)	(6)
Diabetes medication							
Estimate	0.551	-0.042***	-0.035***	-0.031***	-0.040***	-0.051***	-0.051***
		(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
N	13 599						
Statins							
Estimate	0.388	-0.052***	-0.029***	-0.019***	-0.020***	-0.019***	-0.018***
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
N	22 601						
Control variables							
Demographic characteristics			x	x	x	x	x
Income deciles				x	x	x	x
Drug cost deciles					x	x	x
Special reimbursement						x	x
Medication interaction							x

Notes: Estimates from a linear probability model for prescriptions in 2017. Standard errors (in parenthesis) are robust and clustered at patient level. *** denotes significance at 1% level.

For statin medication, the estimated differences become smaller in the subgroup when compared to the full sample. Both the raw difference and the estimate for the full model are roughly 3pp smaller. However, the estimated difference between the private and public clinics remains statistically significant at 1.8pp. In relative terms this implies a 4.7% lower rate of prescribing the low-cost medication in the private clinics even for the subgroup of doctors who work in both sectors.

6. Discussion

In both cases that we analysed – treatment for type 2 diabetes and high cholesterol – we found a significant raw difference in the rate of prescribing the low-cost treatment between the private and public sector: patients in the public sector are more likely to receive the low-cost treatment.

Given patient characteristics in the two sectors, the direction of the difference is a priori surprising. First, public sector patients are in general less healthy, and to the extent that less healthy patients should be more likely to benefit from the high-cost medication, the pattern that we find is exactly opposite to what we should expect to see if the result were due to patient selection according to health status. On the other hand, however, income differences may pull in the other direction: more wealthy and more highly educated private sector patients may be more likely to demand high-cost treatments; those treatments are subject to generous, but still only partial public insurance. Given the sign of the estimated difference between the sectors, it appears that the latter effect dominates. This pattern is consistent with a story of (2nd degree) moral hazard, where treatment choices are not determined solely by health factors.

The difference in the likelihood of prescribing the low-cost alternative remains at around 12 % in both cases even after all patient controls are added. Controlling for patient selection in this way is therefore not sufficient to explain the difference in prescription behaviour. In the case of diabetes, the difference between the sectors even increases when patient health is controlled for.

Similar patients in the two sectors therefore receive different treatment on average. From the point of view of the patient, the precise mechanism behind this remaining difference is inconsequential. The difference may arise for example because of selection of physicians into the two sectors, or because of differences in incentive mechanisms. We go one step towards controlling for the former factor by focusing on a subgroup of physicians who work in both sectors. To the extent that physicians have different preferences that affect the likelihood of working in each sector, physicians have endogenously revealed their "type" by choosing which sector to work in. The mixed sector physicians can be considered unlikely to have a strong intrinsic preference for either sector. The gap in prescription behaviour between the sectors is smaller in this subgroup, but nevertheless remains economically and statistically significant.

7. Conclusions

In this paper, we have documented a pattern indicating that physicians are more likely to prescribe high-cost medication instead of an effective low-cost alternative, when they

work in the private sector. We have shown a similar pattern for the treatment of two conditions that are important for public health and healthcare costs, namely high cholesterol and type 2 diabetes. The difference in prescription behaviour does not appear to be explained by patient selection (according to income and health status), nor by selection of physicians into the two sectors.

Finding such a consistent pattern in these two highly important cases appears to us quite striking. However, there is good reason for exercising proper caution in drawing precise conclusions about mechanisms. More detailed analysis of the precise causes – and very importantly, implications – of the pattern that we have documented is an interesting issue for further research. For example, analysing whether the treatment differences in the two sectors are later associated with differences in patient outcomes could be informative about whether there is after all a legitimate, treatment-related explanation for our findings, or whether the differences arise for example due to differential degrees of moral hazard in either sector. The implications of either of these interpretations for policy are obviously very different.

Examining the implications for healthcare costs – at least the direct costs of medication – would be more straightforward. In future work we can, for example, carry out simple counterfactual calculations of what would happen to medication costs if all physicians in the public sector behaved like private sector physicians, or vice versa. However, again, obtaining overall cost estimates that would take into account the full cost of treatment, also accounting for potential differences in patient outcomes referred to above, would be a much more complicated exercise.

References

American Diabetes Association (2016). Approaches to glycemic treatment. In Standards of Medical Care in Diabetes 2016. *Diabetes Care*, 39 (Supplement 1), S52–S59.

Arrow, K.J. (1963). Uncertainty and the Welfare Economics of Medical Care. *American Economic Review*, 53(5), 941-973.

Chandra, A., Cutler, D. and Song, Z. (2012). Who ordered that? The economics of treatment choices in medical care. *Handbook of Health Economics*, vol. 2, 398 – 432.

Das, J., Holla, A., Mohpal, A., and Muralidharan, K. (2016). Quality and accountability in health care delivery: Audit-study evidence from primary care in India. *American Economic Review* 106, 3765-99.

Dietrichson, J., Ellegård, L.M., and Kjellsson, G. (2020). Patient choice, entry, and the quality of primary care: Evidence from Swedish reforms. *Health Economics*, 29, 716-730.

Dulleck, U., Kerschbamer, R. and Sutter, M. (2011). The economics of credence goods: On the role of liability, verifiability, reputation and competition. *American Economic Review*, 101, 526-555.

Finance Finland (2019). Tilasto sairauskuluvakuutus 2009–2017. [In Finnish.]

Jarvala, T., Raitanen, J., and Rissanen, P. (2010). Diabeteksen kustannukset Suomessa 1998–2007. Tampere: Finnish Diabetes Association and University of Tampere. [In Finnish.]

Kotakorpi, K. and Seuri, A. (2019). Yksityisen ja julkisen sektorin työnjako sosiaali- ja terveydenhuollossa. Talous & Yhteiskunta, 1/2019. [In Finnish.]

OECD 2018. Pharmaceutical spending (indicator). doi: 10.1787/998febf6-en (accessed on 28 September 2018).

Ohlsson, H., Lynch, K., and Merlo, J. (2010). Is the physician's adherence to prescription guidelines associated with the patient's socioeconomic position? - An analysis of statin prescription in South Sweden. *Journal of Epidemiology and Community Health*, *64*(8), 678-683.

Pharmaceuticals Pricing Board (2020). Viitehintajärjestelmä. Viitehintaryhmät ja viitehinnat – päätökset. 2017. [In Finnish.]

Pita Barros, P. and Siciliani, L. (2012). Public and Private Sector Interface. *Handbook of Health Economics*, vol. 2, 928-1001.

Propper, C. (2018), Competition in Health Care: Lessons from the English Experience. *Health Economics, Policy, and Law*, 13, 492–508.

Seuring, T., Archangelidi, O., and Suhrcke, M. (2015). The economic costs of type 2 diabetes: A global systematic review. *Pharmacoeconomics*, 33(8), 811-831.

Social Insurance Institution, SII (2020a). Statistical database Kelasto. Reimbursements of medical expenses: Number of recipients and reimbursements paid out.

Social Insurance Institution, SII (2020b). Statistical database Kelasto. Reimbursements of medicine expenses: Number of recipients and prescription data.

Tarkiainen, L., Martikainen, P., Laaksonen, M. and Valkonen, T. (2012). Trends in Life Expectancy by Income from 1988 to 2007: Decomposition by Age and Cause of Death. *Journal of Epidemiology and Community Health* 66 (7), 573–78.

Tynkkynen, L. K. and Vrangaek, K. (2018). Comparing public and private providers: a scoping review of hospital services in Europe. *BMC health services research 18(1)*, 1-14.