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Type of contract and supplier-induced demand for primary physicians in Norway

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Abstract

The focus of the present study is to examine whether supplier-induced demand exists for primary care physician services in Norway. We compare how two groups of physicians, with and without incentives to induce, respond to increased competition. Contract physicians receive their income from fee-for-item payments. They have an incentive to compensate for a lack of patients by inducing demand for services. Salaried physicians receive a salary which is independent of output. Even though increased competition for patients reduces the availability of patients, they have no financial incentive to induce. Neither of the two groups of physicians increased their output as a response to an increase in physician density. This result could be expected for salaried physicians, while it provides evidence against the inducement hypothesis for contract physicians. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

The theory of supplier-induced demand (SID) has been one of the main research topics in the health economics literature (Feldman and Sloan, 1988; Rice and Labelle, 1989). The background for the hypothesis on SID is the assumption of asymmetric information between the physician and the patient. The patient does not have sufficient expertise to evaluate the extent and quality of the services supplied. Therefore, the physician has two roles: to act as the patient's advisor and to offer medical care. In his role as advisor, the physician has a considerable influence on the type and quality of services offered. Ideally physicians should

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supply services based on medical evaluation, and social and patient costs, without regard to their private economic interests. But, because the patient is poorly informed, the physician has the possibility to influence both the type of diagnosis and the amount of treatment provided, and possibly also the extent and number of consultations.

If physicians are financed on a fee-for-item basis, greater competition provides an incentive to exploit the information advantage. An increase in the number of physicians per capita is claimed to reduce the availability of patients, which can lead physicians to induce demand for health care services (Feldman and Sloan, 1988; Rice and Labelle, 1989). They do this in order to maintain their income. Conversely, if physicians' income is independent of output, there is no incentive for inducement. Even though increased competition for patients reduces the availability of patients, this does not lead to a reduction in income.

The focus of the present study is to examine whether SID exists for primary physician services in Norway. In Norway, there are two types of primary care physician: contract physicians and salaried physicians. Contract physicians' income is dependent on the number of patients seen. They are self-employed and receive a fixed grant from the municipality in addition to patient fees per visit and revenue from the National Insurance Administration for provision of items of medical treatment. The level of patient fees and revenues from the National Insurance Administration are determined centrally. Salaried physicians receive a salary. Their income is independent of the number of patients seen. About 75% of all primary care physicians are contract physicians, while about 25% are salaried physicians (Statistics Norway, 1998). If SID exists, contract physicians would respond to increased competition by provision of more services. Conversely, salaried physicians would not increase provision of services as physician density increases. Our test of SID is new. There are no previous studies where inducement has been examined between groups of physicians with and without incentives for inducement.

2. Theory and empirical implementation

2.1. Model

The underlying theoretical model for contract physicians' behavior is based on the early work of Evans (1974), which has been followed up by researchers such as Rossiter and Wilensky (1984) and Rice (1984). In their models, the physician is assumed to maximize utility (U) with respect to income (Y) and leisure (L), and with respect to the disutility which arises from inducing demand (D). The utility function $U = U(Y, L, D)$ is maximized due to a budget restraint (Y) and a time constraint (T). Total time (T) is allocated for working and leisure. Physicians' income (Y) is determined by physicians' fees, market demand for physicians' services and the costs of running the practice. Increased competition for patients lowers income through lower demand directed towards the individual physician's practice. Contract physicians have an incentive to induce demand if the marginal disutility of inducement is sufficiently small. If patient demand is lower than required to achieve the optimal income–leisure trade off, inducement will take place until the disutility (higher D and less L) of inducement balances the gains of the extra income. Salaried physicians, on the other hand, have no economic incentives to induce demand. Inducement would lead to additional work load, possibly less leisure-time and disutility caused by divergence from correct medical treatment.

2.2. Services which can be induced

Contract physicians can induce demand in four ways: (1) by increasing the number of recall visits; (2) by increasing the mean number of laboratory tests per consultation; (3) by increasing the number of consultations lasting for more than 20 min and (4) by increasing the mean number of specific procedures per consultation [1] (Skau, 1998). Contract physicians receive an extra fee of NOK64, in addition to the consultation fee of NOK108 for consultations lasting more than 20 min. This is given as an incentive to encourage physicians to see patients who are time-consuming to diagnose and to treat (for example chronically-ill patients). A potential problem with this fee is that it might encourage inducement. Contract physicians who have too few patients may prolong the duration of a consultation in order to increase their income.

Inducement with respect to recall visits has been analyzed using other data sets from Norway (Grytten et al., 1995; Carlsen and Grytten, 1998; Sørensen and Grytten, 1999). These studies did not find that contract physicians-induced recall visits. However, this does not exclude the possibility that inducement could occur for other types of services. In the present study, we focus on inducement with respect to the mean number of laboratory tests per consultation, the proportion of consultations lasting more than 20 min and the mean number of specific procedures per consultation. Thus, the present analyses provide a more comprehensive investigation of the inducement hypothesis.

2.3. Data

Our main analyses were performed on a set of data which were collected using a questionnaire sent to a sample of contract and salaried physicians in 1998. From that set of data, the effect that SID might have on the mean number of laboratory tests per consultation and the proportion of consultations lasting more than 20 min was examined. The population from which the sample was drawn encompassed all contract physicians ($n = 1818$) and salaried physicians ($n = 564$) on the register kept by the Norwegian Medical Association. This register is considered to include nearly all physicians in Norway. The response rate for contract physicians was 68%, and for salaried physicians 57%. The non-responders were evenly distributed according to gender, age and place of residence (for further details see: Grytten et al., 1999).

The effect that SID might have on the mean number of specific procedures per consultation was examined on a set of data from the National Insurance Administration. The data contained information on the revenue from all specific procedures for all contract physicians in Norway for 1 month in 1995. Since fees are identical for all contract physicians, revenue is proportional to the total number of specific procedures (for further description of the data see: Carlsen and Grytten, 1998).

[1] Surgical procedures constitute a large proportion of all specific procedures.

2.4. Hypotheses

From the data collected from the questionnaire, specific hypotheses about the effect of SID on the mean number of laboratory tests per consultation (LAB), and on the proportion of consultations lasting more than 20 min (TIME) could be tested. We formulated the following hypotheses:

- H_1: contract physicians induce demand relative to salaried physicians. We estimated the following regressions:

$$\log(\text{LAB}) = \alpha_1 + \beta_1\,\text{CONTRACT} + \text{control variables} \tag{1}$$

$$\log\left(\frac{\pi_k}{1-\pi_k}\right) = \alpha_k + \beta_1\,\text{CONTRACT} + \text{control variables},\ \ k = 1, 2 \tag{2}$$

Our dependent variable measuring laboratory tests was obtained in the following way: the physicians registered the number of laboratory tests during a normal working week. They also reported the number of consultations during the same week. The mean number of laboratory tests per consultation was then obtained by dividing the number of laboratory tests by the number of consultations. Since LAB takes on positive values only, a log transformation was applied in order to generate a symmetrical distribution. LAB was skewed to the right, log(LAB) was symmetrical. TIME is an ordinal response variable with three levels: the proportion of consultations lasting more than 20 min during a normal working week: 0–20; 21–50 and more than 50%. We applied an ordinal logistic regression model to estimate Eq. (2). P_0 denotes the probability that the physician has 0–20% of consultations lasting more than 20 min, P_1 denotes the probability that the physician has 21–50% of consultations lasting more than 20 min, and P_3 denotes the probability that more than 50% of consultations last more than 20 min. The ordinal logit model uses cumulative probabilities (Clogg and Shihadeh, 1994), and we define $\pi_1 = P_1$ and $\pi_2 = P_1 + P_2$. The three response levels of TIME imply that two intercepts (α_1 and α_2) are estimated.

CONTRACT is a dummy variable that takes the value 1 for contract physicians. A significant effect of CONTRACT indicates that SID manifests itself as a higher level of output for contract physicians as opposed to for salaried physicians. The absence of an effect is not sufficient evidence against the SID hypothesis. Contract physicians may induce demand only when competition for patients is high. Therefore, we formulated the following hypothesis:

- H_2: contract physicians increase the mean number of laboratory tests per consultation, and have more consultations lasting for more than 20 min as physician density increases. This effect is particularly strong in municipalities where competition is high. Salaried physicians do not respond to increased competition by increasing their activity level. For each group of physician, we formulated the following regression models, models (3) and (5) where physician density (R) was entered as a linear variable, and models (4) and (6) with "cut-off" values for R.

$$\log(\text{LAB}) = \alpha_1 + \beta_1 \log R + \text{control variables} \tag{3}$$

$$\log(\text{LAB}) = \alpha_1 + \alpha_2\,\text{DUM}_\alpha + \beta_1 \log R^*(1 - \text{DUM}_\alpha) + \beta_2 \log R^*\text{DUM}_\alpha + \text{control variables} \quad (4)$$

$$\log\left(\frac{\pi_k}{1-\pi_k}\right) = \alpha_k + \beta_1 \log R + \text{control variables},\ k = 1, 2 \quad (5)$$

$$\log\left(\frac{\pi_k}{1-\pi_k}\right) = \alpha_k + \beta_0\,\text{DUM}_\alpha + \beta_1 \log R^*(1 - \text{DUM}_\alpha) + \beta_2 \log R^*\text{DUM}_\alpha + \text{control variables},\ k = 1, 2 \quad (6)$$

DUM_α is a dummy variable with the value 1 when R for the physician's municipality exceeds the cut-off point R_α or else is 0. R_α is the value which cuts α% of the lowest values for physician density in the municipality. That is to say that α% of municipalities in the sample have a physician density $R < R_\alpha$. If $\alpha = 60$, then $\text{DUM}_\alpha = 1$ for 40% of the municipalities. The model was specified such that β_1 is the regression coefficient in municipalities with low physician density and β_2 is the regression coefficient in municipalities with high physician density. Regression analyses with the two output measures were run separately for each type of physician. The continuous right-hand side variables in Eqs. (3)–(6) were log transformed. Their parameters could then be interpreted as elasticities. In Eqs. (5) and (6), the elasticities measure the percentage change in the odds-ratio produced by a 1% increase in the explanatory variable.

From the data collected from the National Insurance Administration the following hypothesis could be tested:

- H_3: contract physicians increase the mean number of specific procedures per consultation (SPEC) as physician density increases. Since the data from the National Insurance Administration did not include salaried physicians, a comparison of the mean number of specific procedures per consultation between the two types of physicians could not be performed. This is a limitation of the study. We estimated the following regression model [2]

$$\log(\text{SPEC}) = \alpha_1 + \beta_1 \log R + \text{control variables} \quad (7)$$

2.5. *Control variables*

The following characteristics of physicians were included as control variables: gender, age, whether the physician had a specialist degree in community medicine or not, work experience (years) in the present practice, and whether the physician worked in a group practice or not. [3] To control for variations in demand for primary physician services, several variables that measured the health status of the patients were included: the proportion of patients aged 6 years and younger, whether more than 50% of the patients in the practice

[2] We also estimated a model with "cut-off" values similar to the model specified in Eq. (4). The results from these analyses are not reported, as they did not differ from the results obtained from estimating model (7).

[3] Data were not available from the National Insurance Administration on work experience and whether the physician worked in a group practice or not.

were 60 years and older, and whether 75% or more of the patients in the practice were women.

2.6. Selection effect

If an inducement effect is found, this could be the result of either an effect of the payment system, an effect of selection of physicians to different types of contract, or both. Different types of physician will have different preferences with respect to income. It could be expected that physicians who are most likely to induce demand for their services are those who have preferences for a high income.

In the questionnaire, the physicians were asked about income considerations in choosing type of contract. From the answers, we constructed one index which measured the priority physicians give to family and leisure-time compared with income considerations (INCLEISURE). The index ranged from -1 (priority given to high income) to $+1$ (priority given to family/leisure activities). Priority given to income in relation to community medicine considerations was measured using a corresponding index (INCCOM). This index ranged from -1 (priority given to high income) to $+1$ (priority given to community medicine duties). We expect physicians who give priority to family, leisure-time and community medicine duties to prefer a salary contract. Accordingly, we estimated the following regression:

$$\log\left(\frac{P_{\mathrm{C}}}{1-P_{\mathrm{C}}}\right) = \alpha + \beta_1\,\mathrm{INCLEISURE} + \beta_2\,\mathrm{INCCOM} + \text{control variables} \qquad (8)$$

where P_{C} denotes the probability of choosing to be a contract physician, and $1 - P_{\mathrm{C}}$ the probability of choosing to have a salary contract. Choice of contract is also influenced by factors other than physicians' preferences for income. This is taken into account in the analysis by including variables which reflect characteristics of the physician (gender, age and work experience), and characteristics of the municipalities (centrality, municipal income and party composition).

We estimated Eqs. (1) and (2) by taking the selection effect into account. This was done by including the predicted values (the hazard rate) from Eq. (8) into Eqs. (1) and (2). A large and significant regression coefficient β_1 in Eq. (1) indicates that SID exists. A selection effect is identified if that coefficient is reduced in size after inclusion of the predicted values from Eq. (8). In that case, SID is not only a result of the payment system per se, but also a result of the fact that physicians have different preferences with respect to inducement.

2.7. Analyses

Eqs. (1), (3), (4) and (7) were analyzed using ordinary least squares (OLS) regression, while Eqs. (2), (5), (6) and (8) were analyzed using logistic regression. A potential problem with our variable measuring supply (R) is that it may be endogenous in the long run. If unmeasured demand factors influence both physician density and physician behavior, then the elasticities are potentially biased towards zero (Dranove and Wehner, 1994). A long run equilibrium is characterized by local governments increasing physician supply to meet an increase in demand. Therefore, to capture the effect of long-term adjustments of local governments, the data were also analyzed using instrument variables for physician density. The instruments are the population size and per capita revenue of the municipality. The Norwegian municipalities are covered by a national minimum revenue guarantee for the local public sector, and their revenues are effectively determined by the government. Per capita revenue of the municipalities is, therefore, unlikely to be related to determinants of demand for primary physician services. Following Dranove and Wehner (1994), we tested the validity of our instruments by computing correlations between the residuals from the OLS estimates and our instruments. We found that the correlations were low and not statistically significant at conventional levels. This suggested that our instruments were valid; i.e. they could be excluded from the demand equations.

3. Results and discussion

The use of laboratory tests is an important and well-integrated part of primary physician services in Norway. Test results are important in diagnosing medical conditions, in monitoring diseases and in assessing the effectiveness of treatment. Tests are also used for other reasons such as reassuring patients about their medical condition and for improving patient satisfaction (Wertman et al., 1980). An important question is how to remunerate physicians so that an optimal number of tests are provided. Fee-for-item payments encourage physicians to provide high quality services. An argument against fee-for-item payments is that they may lead to SID.

There was no difference in the mean number of laboratory tests per consultation between contract and salaried physicians (Table 1). This was the case both with and without controlling for selection of physicians according to type of contract. The analyses of physicians' choice of contract showed the expected results (Table 2). Those physicians who give priority to family, leisure-time and community medicine duties preferred a salary contract. Contrary to our predictions in hypothesis 1, contract physicians did not have more consultations lasting for more than 20 min than salaried physicians (Table 1). Before controlling for selection, contract physicians actually had fewer consultations lasting for more than 20 min. This effect disappeared after controlling for selection. When physician's preferences and their characteristics were controlled for there was no difference between the two types of physician in the proportion of consultations lasting for more than 20 min (Table 1).

Further tests of the inducement hypothesis are given in Tables 3–6. The results from the analyses without cut-off points are shown in Tables 3 and 4. The mean number of laboratory tests per consultation, the proportion of consultations lasting for more than 20 min and the mean number of specific procedures per consultation did not increase with increased competition for both types of physician. The elasticities of physician density were small, and not statistically significant at conventional levels ($P < 0.05$). This was the case both when estimated with and without instrument variables.

The analyses in Tables 3 and 4 do not take into account that SID is most likely to occur in municipalities where competition for patients is high. This was examined by estimating models (4) and (6). In these analyses, the sample was split according to physician density. There was no statistically significant ($P < 0.05$) relationship between physician density and the mean number of laboratory tests per consultation and the proportion of consultations

Table 1
Effects of type of contract[a]

Independent variables	Mean number of laboratory tests per consultation per physician[b]		Proportion of consultations lasting more than 20 min during a normal week per physician[c]	
	Without control for selection (1)	With control for selection (2)	Without control for selection (3)	With control for selection (4)
Constant	−0.83 (1.47)	1.03* (2.26)		
Constant 1			−3.53* (6.56)	−2.54 (2.52)
Constant 2			−0.63 (0.21)	0.46 (0.08)
Contract physician = 1	0.08 (1.17)	0.04 (0.68)	−0.35* (4.47)	−0.25 (1.40)
Predictive values for choice of contract[d]		0.09 (0.74)		−0.04 (0.01)
Male = 1	0.13 (1.76)	0.15* (2.41)	−0.20 (1.22)	−0.18 (0.81)
Age: 35–50 years = 1	0.08 (0.74)	0.01 (0.10)	0.33 (1.82)	0.47 (2.66)
Age: >50 years = 1	0.07 (0.58)	−0.01 (0.11)	0.42 (2.36)	0.54 (2.77)
Specialist in community medicine = 1	−0.06 (0.99)	−0.07 (1.31)	−0.35* (5.84)	−0.47* (7.96)
Number of years in present practice	−0.01 (0.46)	−0.02 (0.97)	−0.24* (16.07)	−0.23* (10.98)
Group practice = 1	0.11 (1.59)	0.09 (1.71)	−0.19 (1.42)	−0.20 (1.19)
Number of sessions of emergency services per month (log)	−0.01 (1.10)	−0.01 (1.37)	−0.01 (0.26)	−0.02 (0.33)
Proportion of patients 6 years and younger (log)	−0.06 (0.23)	0.09 (0.47)	−1.35* (5.60)	−0.81 (1.54)
More than 50% of the patients aged 60 years and older = 1	0.03 (0.49)	−0.01 (0.14)	0.74* (20.77)	0.77* (18.09)
More than 75% of the patients are women = 1	0.09 (0.98)	0.06 (0.75)	0.03 (0.01)	−0.08 (0.10)
Number of man-labor years of physicians per 10 000 inhabitants (log)	−0.08 (0.48)	−0.15 (1.09)	−0.40 (0.84)	−0.38 (0.56)
R^2	0.02	0.02		
Concordant value			0.62	0.61

[a] With and without control for selection of physicians to different types of contract.
[b] Regression coefficients with t-value in brackets.
[c] Logit coefficients with Wald chi-square test statistics in brackets.
[d] Estimated from Eq. (8).
* $P \leq 0.05$.

Table 2
Physicians' choice of type of contract (Contract physician = 1)

Independent variables	Logit coefficient (Wald chi-square test statistics)
Constant	0.44 (0.34)
Index: priority of income (= −1) as opposed to family/leisure (= 1)	−0.92* (9.69)
Index: priority of income (= −1) as opposed to community medical duties (= 1)	−2.42* (58.66)
Male = 1	−0.37 (2.38)
Age: 35–50 years = 1	0.52 (2.36)
Age: >50 years = 1	0.19 (0.21)
Specialist in community medicine = 1	0.90* (14.38)
Number of years in present practice	0.09* (27.80)
Central municipality = 1[a]	1.29* (23.24)
Municipal income per capita (log)	−0.11 (2.61)
Party composition of local governments (= 1 if socialist majority)	0.38 (1.49)
Concordant value	0.88

[a] Municipalities are classified as central as opposed to not being central by Statistics Norway. The classification criteria include population density and traveling distance to the center within each municipality.

* $P < 0.05$.

lasting for more than 20 min (Tables 5 and 6). This was the case for both contract and salaried physicians. Regression coefficients are not reported for the control variables, as the effects of the control variables did not differ from those reported in Table 3. We interpret the results as evidence against the inducement hypothesis. In municipalities with a high physician density, there is high competition for patients. Contract physicians in these municipalities did not increase provision of services in order to maintain their income.[4]

Our findings can be explained in two ways: the first explanation is that contract physicians are motivated by factors other than pure economic incentives. In a recent paper, Hausman and LeGrand (1999) argued that primary care physicians' behavior to a large extent is influenced by professional norms and caring concerns about their patients. Financial incentives are important, but these incentives are constrained by norms other than self-interest. Our findings support such a view. Even though contract physicians have the possibility to induce demand for their services, they do not behave in that way. Within the profession, there are strong norms governing the proper conduct of a primary care physician. Following Hausman and LeGrand (1999), it can be argued that our findings show that professional standards play an important role. The second explanation is that the National Insurance Administration performs regular controls of contract physicians' practice (Malde et al., 1999). Following

[4] It can be argued that the proportion of long consultations is a crude measure, since it will only pick up inducement sufficient to tip the proportion of long consultations over the two cut-off points. Contract physicians may, therefore, increase long consultations from 1% of all consultations to 19% in response to increased competition without appearing to do so on the measure used in the analyses. In particular, this is the case if the distribution of the variable is skewed. For contract (salaried) physicians, 33% (28%) reported that 0–20% of their consultations lasted for more than 20 min, 57% (53%) reported that 21–50% of the consultations lasted for more than 20 min, and 10% (19%) reported that more than 50% of the consultations lasted for more than 20 min. Even though these distributions are not particularly skewed, the possibility cannot be completely excluded that SID exists for the proportion of long consultations.

Table 3
Effects of physician density[a]

Independent variables	Mean number of laboratory tests per consultation per physician[b]				Proportion of consultations lasting more than 20 minutes during a normal week per physician[c]			
	Contract physicians		Salaried physicians		Contract physicians		Salaried physicians	
	Without instruments (1)	With instruments (2)	Without instruments (3)	With instruments (4)	Without instruments (5)	With instruments (6)	Without instruments (7)	With instruments (8)
Constant	−1.21 (1.92)	−1.43 (1.52)	−1.80 (1.37)	−1.25 (0.66)				
Constant 1					−5.42* (13.11)	−5.40* (4.67)	−2.47 (0.66)	−4.61 (0.69)
Constant 2					−2.40 (2.61)	−2.39 (0.91)	0.06 (0.0004)	−1.93 (0.12)
Male = 1	0.10 (1.13)	0.12 (1.34)	0.16 (1.06)	0.10 (0.71)	−0.07 (0.11)	−0.09 (0.17)	−0.36 (1.30)	−0.40 (0.80)
Age: 35–50 years = 1	0.08 (0.55)	0.10 (0.73)	0.12 (0.74)	0.05 (0.31)	0.39 (1.40)	0.34 (1.08)	0.34 (0.82)	0.36 (0.60)
Age: >50 years = 1	0.11 (0.71)	0.14 (0.88)	−0.09 (0.46)	−0.21 (1.03)	0.41 (1.25)	0.37 (1.01)	0.62 (1.74)	0.06 (0.01)
Specialist in community medicine = 1	−0.10 (1.55)	−0.12 (1.85)	0.05 (0.36)	0.10 (0.68)	−0.45* (7.79)	−0.45* (7.84)	−0.14 (0.20)	−0.07 (0.02)
Number of years in present practice	−0.01 (0.29)	−0.02 (0.67)	−0.03 (0.68)	0.0008 (0.02)	−0.22* (10.08)	−0.22* (10.02)	−0.28* (5.11)	−0.21 (1.71)
Group practice = 1	0.13 (1.75)	0.10 (1.46)	0.33 (1.48)	0.31 (1.38)	−0.07 (0.15)	−0.06 (0.13)	−1.01* (3.89)	−1.49* (4.61)
Number of sessions of emergency services per month (log)	−0.004 (0.34)	−0.01 (0.75)	−0.04 (1.13)	−0.04 (1.12)	−0.05 (2.28)	−0.04 (2.10)	0.09 (1.61)	−0.18* (4.05)
Proportion of patients 6 years and younger (log)	−0.12 (0.43)	−0.20 (0.78)	−0.15 (0.28)	−0.11 (0.21)	−1.25 (3.78)	−1.32* (4.62)	−0.61 (0.26)	−1.71 (1.37)
More than 50% of the patients aged 60 years and older = 1	−0.03 (0.40)	−0.06 (0.81)	0.40* (2.51)	0.42* (2.69)	0.73* (15.94)	0.73* (15.58)	0.82* (5.74)	1.42* (8.12)
More than 75% of the patients are women = 1	0.05 (0.49)	0.04 (0.38)	0.24 (1.12)	0.22 (1.05)	0.33 (1.69)	0.31 (1.46)	−0.73 (2.46)	−1.07 (2.84)
Number of man-labor years of physicians per 10 000 inhabitants (log)	0.10 (0.49)	0.14 (0.32)	0.12 (0.34)	−0.08 (0.09)	0.27 (0.30)	0.20 (0.03)	0.40 (0.25)	0.47 (0.04)
R^2	0.02	0.02	0.02	0.08				
Concordant value					0.61	0.61	0.65	0.67

[a] Contract and salaried physicians.
[b] Regression coefficients with *t*-value in brackets.
[c] Logit coefficients with Wald chi-square test statistics in brackets.
* $P \leq 0.05$.

Table 4
The effect of physicians' density on contract physician revenue from specific procedures

Independent variables	Without instruments[a]	With instruments[a]
Constant	0.10 (0.12)	0.36 (0.38)
Male = 1	0.30* (6.37)	0.30* (6.21)
Age: 35–50 years = 1	0.02 (0.35)	0.02 (0.40)
Age: >50 years = 1	−0.06 (1.23)	−0.06 (1.08)
Specialist in community medicine = 1	1.37* (42.93)	1.36* (42.64)
Proportion of the population 6 years and younger (log)	−0.38 (1.76)	−0.37 (1.72)
Proportion of the population 60 years and older (log)	−0.08 (0.72)	−0.06 (0.55)
Proportion of women in the population (log)	−1.38 (1.69)	−1.60 (1.90)
Number of man-labor years of physicians per 10 000 inhabitants (log)	−0.09 (0.98)	−0.26 (1.13)
R^2	0.67	0.67

[a] Regression coefficients with *t*-value in brackets.
* $P \leq 0.05$.

certain criteria, the National Insurance Administration identifies contract physicians who misuse the system. These controls are effective in restraining inducement. Very few contract physicians have been identified as having misused the system (Malde et al., 1999).

The variables measuring characteristics of the physician had no or only a small effect on the mean number of laboratory tests per consultation, and on the proportion of consultations lasting for more than 20 min (Table 3). This is a reasonable result. Variables which reflect characteristics of the physicians are most likely to affect the mean number of consultations per physician, and not the amount of services provided in each consultation. Previous studies from Norway have shown that physicians' gender and age have a strong effect on the number of consultations per physician (Sørensen and Grytten, 1999). For example, female physicians have fewer consultations than male physicians. Once a patient is in the office, the amount of services provided should primarily be determined by his health care needs, and not by physician characteristics. One of our variables measuring health care needs, whether more than 50% of the patients in the practice are 60 years and older, had a significant effect on the mean number of laboratory tests per consultation, and on the proportion of consultations lasting for more than 20 min (Table 3). This is a reasonable result. Older people are more often sick than younger people. Therefore, they receive more services.

The R^2 values are low (Tables 1 and 3). Most likely, this is due to random measurement error in the dependent variable (the mean number of laboratory tests per consultation). This random error is absorbed in the error term in the regression and leads to a low R^2. The regression coefficient will be unbiased, but less efficient (Berry and Feldman, 1985). Random measurement error in the independent variables is more serious because it will lead to biased coefficients. In our study, it is unlikely that there is a significant amount of random error in the variables measuring type of contract and physician density. Therefore, it is unlikely that our regression coefficients are biased due to measurement error. The test statistics of the coefficients may be less efficient due to random measurement error in the dependent variable. But that is not likely to influence the interpretation of the results. The

Table 5
Regression with cut-off points for contract physicians[a]

	Percentage of municipalities which belong to the sub-sample with high physician density											
	70		60		50		40		30		20	
	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME
Upper sub-sample (high physician density)	−0.004 (0.13)	−0.001 (0.0001)	−0.01 (0.37)	−0.02 (0.02)	−0.02 (0.52)	−0.02 (0.02)	−0.004 (0.09)	0.03 (0.04)	−0.07 (0.15)	0.05 (0.10)	−0.03 (0.57)	−0.01 (0.002)
	Percentage of municipalities which belong to the sub-sample with low physician density											
	30		40		50		60		70		80	
	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME
Lower sub-sample (low physician density)	0.22* (2.00)	0.12 (0.23)	0.13 (1.48)	0.08 (0.15)	0.07 (1.01)	0.10 (0.40)	0.08 (1.44)	0.10 (0.52)	0.05 (1.06)	0.10 (0.71)	0.02 (0.51)	0.04 (0.25)

[a] LAB = mean number of laboratory tests per consultation per physician; TIME = proportion of consultations lasting more than 20 min during a normal week per physician. Control variables are included, but not reported. Regression coefficients with *t*-value in brackets. Logit coefficients with Wald chi-square test statistics in brackets.

* $P < 0.05$.

Table 6
Regression with cut-off points for salaried physicians[a]

	Percentage of municipalities which belong to the sub-sample with high physician density											
	70		60		50		40		30		20	
	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME
Upper sub-sample	−0.28	−0.07	−0.05	−0.07	−0.18	−0.09	−0.12	−0.07	−0.27	0.008	−0.007	0.009
(high physician density)	(0.64)	(0.27)	(0.09)	(0.23)	(0.35)	(0.33)	(0.23)	(0.18)	(0.33)	(0.002)	(0.007)	(0.003)
	Percentage of municipalities which belong to the sub-sample with low physician density											
	30		40		50		60		70		80	
	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME	LAB	TIME
Lower sub-sample	−0.14	−0.65	0.75	−0.20	0.61	0.001	0.78	0.14	0.78*	0.30	0.80*	0.28
(low physician density)	(0.20)	(2.23)	(1.17)	(0.32)	(1.10)	(0.01)	(1.66)	(0.36)	(2.24)	(1.85)	(2.36)	(1.72)

[a] LAB = mean number of laboratory tests per consultation per physician; TIME = proportion of consultations lasting more than 20 min during a normal week per physician. Control variables are included, but not reported. Regression coefficients with *t*-value in brackets. Logit coefficients with Wald chi-square test statistics in brackets.

* $P < 0.05$.

reason is that the size of the coefficients is small. Another source of bias occurs if relevant variables have been omitted in the logistic regression. However, this is unlikely to be the case because in the analyses we have controlled for characteristics of both the patients and the physicians.

In conclusion, we did not find SID for primary physician services in Norway. This finding is consistent with some of the more recent literature within this field (for example see: Stano, 1985; Escarce, 1992; Dranove and Wehner, 1994; Davis et al., 2000; Grytten et al., 2001). Most of the previous studies where SID has been found have used aggregated data (for example see: Evans, 1974; Fuchs, 1978; Cromwell and Mitchell, 1986; Birch, 1988). However, aggregated data from geographical units have weaknesses, particularly because the theoretical inducement model describes factors associated with the physician's behavior rather than variation in consumption of physician services per capita (for a discussion see: Stano, 1985; Sørensen and Grytten, 1999). By using data from the individual physician practice most of the weaknesses of using aggregated data can be overcome. Our results also indicate that physicians are motivated by factors other than pure economic incentives. Recently, some health services researchers have argued that professional norms play an important role in governing the proper conduct of a physician (Hausman and LeGrand, 1999; Iglehart, 1998; Fuchs, 2000). Our findings support such a view.

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