Hiltunen *Health Economics Review* (2026) 16:4
https://doi.org/10.1186/s13561-025-00691-y

Health Economics Review

RESEARCH **Open Access**

Does price disclosure promote competition in private MRI markets? A difference-in-differences analysis

Riina Hiltunen[1*]

Abstract

Background In Finland's private health care markets, a lack of price transparency has made price shopping difficult for consumers in the past. To address this issue, two distinct online price comparison tools were introduced. Economic theory and empirical research suggest that increasing price transparency can lower prices, but the impact depends on market conditions and the design of price disclosure. This paper examines the effect of these two distinct price disclosures on the prices of private magnetic resonance imaging (MRI) in Finland.

Methods We utilize comprehensive administrative data from the National Health Insurance of Finland, which include all reimbursed procedures and prices in the private sector from 2008 to 2017. We employ a difference-in-differences approach to estimate the causal effects of price disclosures. Additionally, we use a market concentration index to control for the *ex ante* level of competition and explore whether market concentration is associated with the price effects.

Results We found that only the second price disclosure reduced MRI prices, with provider prices lowering by 5.2% and market prices by 10.6% relative to those of the control group. The effects varied across regions and time: the provider price effect became statistically insignificant after a year, whereas market prices reached a statistically significant reduction of 12% until the end of the study period. The effect was also stronger for concentrated markets, suggesting that price transparency inhibits companies' ability to exert monopoly power.

Conclusions The results align with those of previous studies, indicating that competition can be promoted through price transparency and that information disclosure is more effective when baseline market performance is low. As MRI services are highly standardized, it is unlikely that providers lower prices by compromising quality. However, a definitive conclusion on consumer welfare gains cannot be drawn.
The different effects of the two price disclosures highlight the importance of design and market conditions in promoting competition and gaining savings. The first price disclosure failed, as it did not reveal the relevant price information sufficiently, and *ex ante* market conditions lowered the price sensitivity of both the consumers and providers.

*Correspondence:
Riina Hiltunen
riina.hiltunen@kela.fi
Full list of author information is available at the end of the article

© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

Keywords Price transparency, Private health care markets, Price comparison tools, Market competition, Magnetic resonance imaging (MRI), Price disclosure effects

Background

Introduction

Both economic theory and empirical research in several markets suggest that increasing price transparency reduces prices [1–5], as market power is often derived from informational frictions. Additionally, in health care markets, price transparency is commonly viewed as a way to promote competition and contain health care expenditures [6, 7]. To promote price transparency and competition, price comparison tools have been launched in several countries, and public initiatives have been adopted, for example, in the USA and the Netherlands [5, 8, 9].

In Finnish private health care markets, price transparency has increased with the release of new online price transparency tools. Especially in the markets for private MRIs, prices are high relative to those of other services, and MRI price variation has traditionally been considerable even for procedures with little variation in their contents, suggesting an opportunity for savings and consumer welfare gains through increased price transparency [10, 11]. However, the effects of exogenous price information shocks have not been studied previously in Finland.

Most empirical findings support the view that price transparency leads to consumer savings, which might come from sources on the demand or supply side. Patients might search for price information and switch the service provider or adjust their consumption on the basis of the new information, and providers might alter their prices in reaction to the payers' increased bargaining power. For example, Lieber [6] reported that access to and searching for new price information leads consumers to pay considerably less for care in the USA, as searching reduces prices by 10–17%. They also find that access to new information increases the probability of switching to a new provider. Using a similar study design, Whaley et al. [12] reported a 13–14% reduction in diagnostic laboratory and imaging procedure prices for searchers. Likewise, Wu et al. [13] find a reduction of 18% in MRI prices as a result of a price transparency program. Whaley [14] again studies the effect of an internet-based price transparency platform on provider prices and finds a 1–4% reduction for standardized laboratory tests but no effect for differentiated office visits. They conclude that different price responses are driven by the activity of consumer use of price information.

Most empirical studies indicate that price transparency leads consumers to pay less for care; at the same time, several economic concepts argue that price disclosure may increase firms' bargaining power against payers and cause collusion, especially in markets with a small number of firms and inelastic consumer demand [15, 16]. Schultz [17] theoretically proved that whether price transparency has pro- or anti-competitive effects depends crucially on consumer price elasticities and product differentiation, both of which are relevant to health care markets with low price elasticity and product differentiation [14].

As an exhibit of low price elasticity, several studies find very low utilization rates for online price transparency tools for medical services [6, 18, 19]. In particular, insurance coverage inhibits the use of price information and searches for it, thus increasing the potential for price collusion, while deductibles are imposed to alleviate this problem. For example, Lieber [6] reported that patients who met their deductibles and faced 50% lower marginal prices were 90% less likely to search for price information and concluded that price disclosure influences consumer behavior only if they have strong financial incentives to care about prices. This finding indicates that moral hazard plays an important role in search behavior. Additionally, habits are persistent, and patients face uncertainty and transaction costs when switching from a familiar provider to a new provider, decreasing their willingness to switch [20].

Additionally, Montag et al. [8] show that price disclosure might promote anti-competitive behavior if providers are prone to collusion. They theoretically prove that the share of price-informed producers and consumers before price disclosure and the intensity of the treatment are important determinants of the effect of price disclosure. Empirically, they find that if producers are well informed about prices before price disclosure, it is less likely that the effect of price disclosure is anti-competitive. Additionally, in some cases, a marginal increase in consumer transparency can be anti-competitive, whereas a large increase is pro-competitive [8]. This indicates that the competitive environment where prices are disclosed and the design of price disclosure, i.e., the way information is presented and adopted by consumers, have an effect on the outcome [8, 21].

In this paper, we contribute to the empirical literature on the effects of price transparency tools in health care markets by analyzing whether two differently performed price disclosures had a pro- or anti-competitive effect in Finnish private market for magnetic resonance imaging (MRI). While most of the previous research comes from the U.S [22], there is little evidence from countries with universal healthcare systems like Finland. We use

a difference-in-differences (DiD) design to estimate the effect of price disclosure on MRI prices, utilizing policy variation in the disclosure of prices between different MRI procedures. Comparing two differently performed price disclosures in the same MRI markets, but at different times and for different procedures, also allows us to contribute to the discussion on the role of disclosure design in promoting competition. In addition, we study the association between *ex ante* competition and the price response to price disclosure as well as heterogeneity among markets and the dynamics of the effect.

The analysis is based on comprehensive procedure-level administrative data from the reimbursements of the Finnish National Health Insurance (NHI) for private health care consumption, covering the entire private market under the NHI scheme in Finland. This market is rare among healthcare systems, as it combines patient-driven competition and low regulation with very comprehensive register data from the NHI. This is the first nationwide study utilizing these data to examine the effects of online price transparency tools on prices, and the first evidence on the association of market structure with provider responses to price disclosure in health care markets. This paper also contributes to the literature by comparing two different tools within the same market.

Price negotiation in the private MRI markets of Finland

In Finland, private health care services complement and supplement public tax-funded services in several health care segments. Private customers usually use private health care services to avoid public sector queues and to access higher subjective quality [23]. The NHI covers a small proportion of the costs, 17% on average, and the exceeding costs are covered by customers themselves or by private insurance [24, 25]. The private health care sector plays a significant role in the Finnish MRI market, as approximately every fifth MRI examination is reimbursed by the NHI in the private sector [26]. MRI is also a sizable business area within the private health care market, accounting for 4.7% of private health care expenditures and 6.9% of NHI reimbursements in 2008–2017.

MRI referrals give patients the freedom to choose among MRI providers. MRI is an expensive nonemergency diagnostic service, suggesting that payers should have strong incentives to compare prices and sufficient time to make informed choices. MRI also has little variation in the contents of the service, indicating that quality differences across providers are less important than for other types of procedures. Despite the high level of standardization, private MRI prices vary considerably. For example, in 2017, the overall median price for the most common MRI examination of the lumbar spine (1.5T) was €331, and the interquartile range varied between €18 and €115 across Finnish regions. One explanation is that prices are not always easy for patients to observe, which makes it difficult for them to take advantage of the variation and find the best bargains.

Private health insurance also inhibits patient responsiveness to prices, but deductibles are imposed to create incentives to avoid unnecessary health care use and compare prices [6, 27]. Insurance companies might also influence patient choice, as most companies have collaboration agreements with private health care providers. On the other hand, increased price transparency might increase insurers' bargaining power, but this is unlikely since insurance companies, as mass payers of private health care use, are more price conscious than patients are.

Physicians play an important role in patient choice for MRI, first, as gatekeepers deciding whether an MRI examination is referred and, second, as possible consultants advising patients on the choice of MRI provider. Private physicians usually work as independent entrepreneurs even within nationwide companies, and physicians' earnings do not depend on the number or value of their referrals within the company. Therefore, we expect that most MRI referring physicians act altruistically on their patients' behalf and advise them transparently on their options. However, some physicians might have implicit or explicit collusive contracts with companies or practices to refer patients to.

MRI providers, on the other hand, independently set their range of services and prices on a market basis. MRI is a relatively standardized service that varies little with patient characteristics or among providers. As a technology-intensive service, considerable scale advantages and welfare gains can be achieved with efficient market performance. The statistics of Organization for Economic Co-operation and Development (OECD) indicate that in 2016, the number of imaging exams (39/1000 population) was below the OECD median (61.4) [28]. Meanwhile Finland had the sixth highest number of MRI units per capita, 25 per million inhabitants, as the OECD median was 13.6 [29]. This indicates that the capacity of MRI units has been underutilized in Finland.

Price information in private MRI markets

In recent years, online tools that give patients easy access to aggregated price information have been developed in Finland to ease consumer price shopping. There are two different online tools that provide information on MRI prices, both of which caused an exogenous price information shock at the time of release. The first price disclosure (shock 1) took place on April 2, 2012, when the Social Insurance Institution of Finland (SII) released a free-of-charge online price comparison tool called "Average fees charged for private-sector medical services" [30, 31]. The tool covers yearly average prices for 55 common

private sector procedures, including lumbar spine and knee or lower leg MRI examinations, aggregated at the municipality level. These average prices are calculated from the NHI reimbursement registers and reported per municipality and calendar year (Figure 5 in Appendix), and prices are updated once a year. At the time of the release, the website included municipality-level average prices for the years 2010 and 2011. The tool was also promoted rather passively.[1]

The second price disclosure (shock 2) took place at Christmas 2015, when a start-up company founded by medical students released an online tool called "lääkärihinta.fi". While the first tool showed the average price of a procedure within a given municipality, this tool provided the same information for individual providers. The site included filtering tools for a specific area, procedure and symptom, and then provided a list of individual practices and their average prices. The search was free of charge, and profits were gathered from the sales of additional features for health care providers. At disclosure, provider and price information was retrieved from the NHI registries, providing high coverage of providers and procedures. Later, prices were updated manually either by the start-up or the health care providers themselves. The website was actively promoted, and it became well known rather quickly. NHI reimbursement for MRI also decreased substantially from €145 to €73 at the beginning of 2016, which most likely increased interest in comparing prices among consumers and providers. In the summer of 2016, Lääkärihinta.fi reported that nearly 100 of the more than 400 health care companies updated their prices by themselves [32], meaning that a substantial share of providers used the site. The website was closed by the end of 2023.

Our main interest is whether price disclosure has decreased prices in Finnish private MRI markets, as the bulk of the literature suggests. However, the two information shocks differ in a few fundamental ways that have an impact on their expected effects. First, the level of aggregation affects how well price information can be applied in consumer decision making. In contrast to Lääkärihinta.fi, SII's website may not facilitate consumer search or provider benchmarking, as alternative providers and their prices still have to be screened one by one to make comparisons. Second, the two information providers are driven by fundamentally different motives. SII is a publicly financed institution, whereas Lääkärihinta.fi is a company whose future profit depends on increasing people's and providers' awareness of the website. Consequently, the level of awareness and utilization of the websites were likely very different at the time of disclosure.[2]

Additionally, the market conditions differed at least by the level of *ex ante* price transparency, market structure and NHI reimbursement policies, which might affect consumer and provider responsiveness to the shocks. Montag et al. [8] conclude that if *ex ante* price transparency is very low and providers are prone to collusion, the effect of price disclosure might even be anti-competitive. Especially in the first price disclosure, poor *ex ante* price transparency is a valid concern since the trend of using the internet for searching and publishing prices was only developing[3]. In addition, pricing was probably collusive at that time. This is illustrated by a dramatic shift in the markets in 2014–2015, when a new company entered the MRI market with an innovative business model and prices 45% below the market average. The entry forced incumbent companies to lower their prices to the level of the new price leader (see Fig. 1). The price decline did not lead providers to shut down their MRI operations as unprofitable either, which is an indication of considerably high profit margins and collusive prices prior to the entry [26]. As a result of the market entry, the competitive environment changed dramatically by the time of the 2nd price disclosure, and MRI prices were considerably lower (Table 1). On the other hand, a strong price leader might cause a new tacit collusion if competitors simply follow the price leader.

Additionally, the NHI reimbursement policies for MRI changed three times during the study periods of shocks 1 and 2. In 2011, the reimbursement limit was lowered from €400 to €350, reducing the reimbursement from around €290 to €253. In 2013 the calculation method was changed and the reimbursement was further reduced to €145. Finally, in 2016, the reimbursement was halved to €73. These reductions increased the financial incentives of patients, particularly for those without private insurance covering the exceeding costs.

Methods

Data and method

To analyze MRI prices, we utilize administrative data from the NHI reimbursement system covering years 2008–2017. The data contain the universe of private health care use under the NHI scheme, as all Finnish citizens are entitled to NHI reimbursement. The data

[1] Only on SII's website and with a press release, which resulted in some news in other media. During 2016–2018 the average number of monthly views was 117 and the average number of monthly distinct visitors was 73 based on communications with SII's statistical department. Similar statistics from the time of the disclosure are not available.

[2] We do not know the number of visits on the websites after the disclosures, but for perspective, the number of Google search results is nearly 18 times higher for Lääkärihinta.fi than for the SII's website.

[3] A private health care provider interviewed in 2012 declared, that it was not long ago, when companies still reported their prices only in paper files at the reception, making price shopping practically impossible for the patients (interview of a private health care company in 2012).

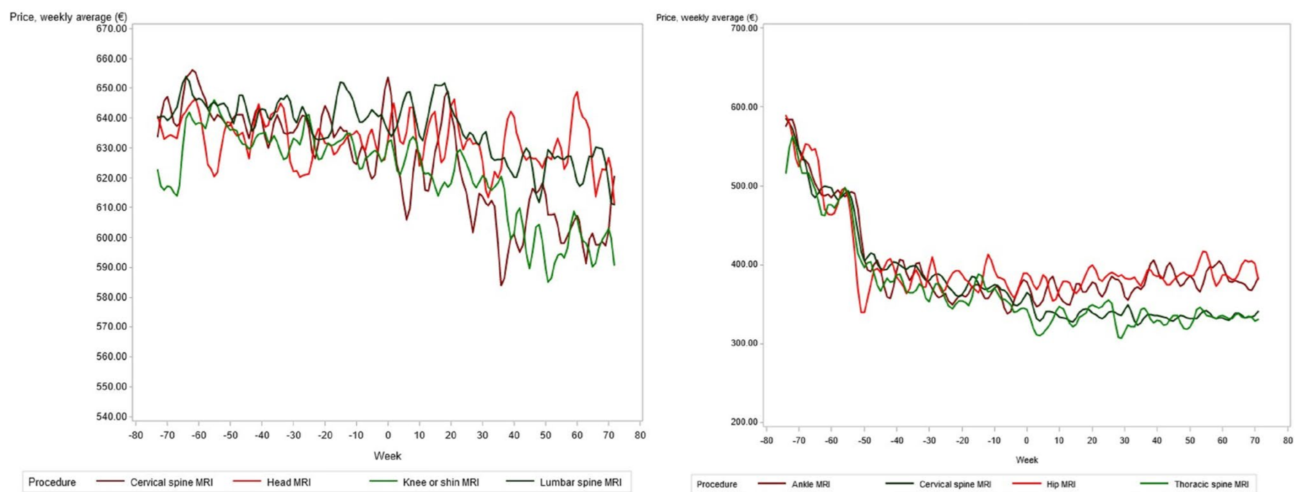

Fig. 1 Price trends of the exposed (green) and nonexposed (red) MRI procedures for shocks 1 (left) and 2 (right). Price disclosure occurs at week 0. To smoothen the fitted curves, we use an interpolation method, which provides a cubic spline minimizing the linear combination of the sum of squares of the residuals of fit (smoothing value 10)

Table 1 Basic patient, physician and provider characteristics of the exposed and nonexposed groups in the 72-week pre-period for shocks 1 and 2

	Shock 1				**Shock 2**			
	Exposed		Non-exposed		Exposed		Non-exposed	
N procedures	21,229		9571		7531		5345	
N patients	20,403		9103		6962		5090	
of them female	9816		5121		3828		2748	
N physicians referring to MRI	1621		1563		1449		938	
of them female	510		519		502		265	
N physician specialties	45		45		48		43	
N practices	100		93		112		89	
N companies	23		23		28		17	
N regions	18		18		18		18	
	Median	QRange	Median	QRange	Median	QRange	Median	QRange
Procedure								
Price	664	127	655	159	365	227	375	207
Reimbursement	252	0	252	5	145	0	145	0
Patient								
Age	47	27	56	27	51	21	43	31
Earned income	30,481	29,088	29,032	27,161	33,488	26,787	31,692	33,996
Physician								
Age	55	10	55	11	55	11	54	13
Provider								
Distance	16,042	40,783	16,037	42,918	19,361	51,262	13,938	39,255
FTHHI	0.47	0.15	0.40	0.15	0.30	0.05	0.30	0.03

Prices within the range €50–1500 are selected in the 72 weeks pre-period. Unidentified and foreign providers are excluded.

contain information on five levels: time, procedure, patient, physician and practice. They include all reimbursed procedures with their codes, names, total costs, reimbursements and dates. Patient characteristics include decoded identifiers, gender, income and residence at the zip code level. Physician characteristics include decoded identifiers, gender, age, year of graduation from medical university and specialty of the referring physician. Practice characteristics include decoded identifiers, name and location at the zip code level. Practices providing MRI

are grouped to companies on the basis of publicly available information and company registers (ytj.fi). Our main outcome is the logarithmic MRI consumer price, which is observed directly from the data.

On the basis of travel distances, we also construct a Fixed Traveltime Herfindahl–Hirschman Index (FTHHI) [33] for each company to account for differences in the market structure before each shock. We define for the calculation substitutable MRI procedures on the provider side, meaning that all MRI procedures are included in the index. On the demand side, we define a 150 km radius for potential markets, including 95% of the observed travel distances in our data. Finally, we assume that the relevant competition occurs at the company level. To estimate the distance traveled, we used information on patients' residences and MRI practice locations and calculated the distance between the geographical centroids of the zip codes. Using these distances and assuming that each additional kilometer traveled is equally costly for the patient, we estimate the patients' willingness to travel to alternative providers within a 150 km radius for each patient zip code location. Finally, the concentration index is constructed for each company as the volume-weighted sum of the squared willingness to travel to them from each patient zip code location within the 150 km radius. The FTHHI mitigates the common endogeneity problem of the traditional Herfindahl–Hirschman index (HHI), as it is constructed from estimated market shares rather than observed ones [33].

To evaluate the effect of MRI price disclosure on prices paid, we estimate a difference-in-differences (DiD) model that exploits variation in the disclosure across procedures. The analysis is conducted separately for the two information shocks. For the first shock, on April 2, 2012, municipal-level average prices were disclosed for lumbar spine MRI and knee or skin MRI, forming the exposed group. In the nonexposed group, we include cervical spine MRI and head MRI. For the second shock, on December 24, 2015, practice-level prices were disclosed for several MRI procedures. To keep the two shocks separate, we include only procedures that were not exposed to the first price disclosure. The exposed group consists of high-volume cervical spine MRI and thoracic spine MRI, while the nonexposed group includes ankle (or foot) MRI and hip (or femur) MRI. In addition, we control for patient, physician and provider differences with control variables and fixed effects, and estimate separate effects for relevant subgroups of interest to explore possible mechanisms.

The key underlying assumption behind the DiD method is that without any access to price information, the prices of all MRI procedures would have followed the same trend. To test the parallel trend assumption, we describe the characteristics of the exposed and nonexposed groups and run pre-trend analysis to evaluate whether the groups were on similar price trends prior to the disclosure, as we assume. Finally, for our estimation strategy to identify the causal effect, there should be no spillovers from the exposed to the nonexposed group, meaning that the disclosure of prices in one group should not affect prices in the other group. Moreover, no other contemporaneous shocks should differentially affect the exposed and nonexposed groups apart from the price disclosure itself [8]. We conduct robustness analyses to assess these identification assumptions and address them further in the Discussion.

Empirical models

In our difference-in-differences Model (1), we utilize the difference in access to price information between closely similar procedures to estimate the effect of two different price disclosures on prices. We estimate a two-way fixed effects (TWFE) regression:

$$\log\left(price_{ijmt}\right) = \beta_0 + \beta_1\left(post_t \times exposure_j\right) + \lambda_w + \lambda_{jm} + \lambda_p + \epsilon_{i(k)} \tag{1}$$

where $price_{ijmt}$ is the price paid for a single MRI i of procedure code j, provided in practice k of company l located in regional market m at time t. $Post_t$ and $exposure_j$ are dummy variables that turn on after the price disclosure and for procedures whose prices were disclosed, respectively, and their interaction term $(post_t \times exposure_j)$ captures the difference-in-differences (DiD) effect on prices. For brevity, this interaction term is referred to as DiD in the results tables. Hence, β_1 is the parameter of interest for the effect of price disclosure on prices. Any seasonality or trend in prices is adjusted with week-by-year fixed effects λ_w, and market-specific differences are adjusted with procedure-by-region fixed effects λ_{jm}. Fixed effects for physician specialties, λ_p, adjust for specialty-specific patient needs and referring standards or habits to MRI. Possible within-practice dependencies, which could be caused by shared characteristics and unobserved heterogeneity at the practice level, are accounted for by using clustered standard errors. We restrict our analysis to the time period of 72 weeks before and after the shocks. Unidentified or foreign providers are excluded from the model (14% of observations for shock 1 and 6% for shock 2[4]), as are outlying prices[5], leaving a dataset of 58,201 observations for

[4] "Unidentified and foreign providers" is a statistical class, of which we cannot separate which MRI is provided by an unidentified or a foreign provider. However, MRI is rarely purchased from abroad and therefore it is likely, that most of the observations in the class are of unidentified providers. Providers remain unidentified in the data for example if the provider does not have an agreement for electric reimbursement with SII and patients apply for reimbursement manually.

[5] below €50 and above €1500, excluding less than 0.1% of observations for both shocks.

Table 2 Specifications of model (1) for information shocks 1 and 2. Standard errors are clustered at the practice level

Dependent variable: ln (price)			**Model (1) Baseline**	**+Patient and physician characteristics**	**+Practice fixed effect**	**+Practice fixed effect +Patient and physician characteristics**	**Model (3): FTHHI**
			Col 1	**Col 2**	**Col 3**	**Col 4**	**Col 5**
Shock 1	Model period		± 72 w	± 72 w	± 72 w	± 72 w	± 72 w
	N		58,201	55,348	58,201	55,348	55,557
	DiD	β_1	−0.004	−0.002	−0.006	−0.005	−0.013
		Std. E.	0.012	0.0117	0.008	0.007	0.017
		P-value	0.762	0.855	0.420	0.473	0.474
	FTHHI x DiD	β_2					0.017
		Std. E.					0.040
		P-value					0.679
Shock 2	Model period		± 72 w	± 72 w	± 72 w	± 72 w	± 72 w
	N		24,573	23,088	24,573	23,088	24,219
	DiD	β_1	−0.106***	−0.107***	−0.052**	−0.053***	0.213***
		Std. E.	0.018	0.018	0.020	0.020	0.047
		P-value	< 0.001	< 0.001	0.010	0.008	< 0.001
	FTHHI x DiD	β_2					−0.859***
		Std. E.					0.149
		P-value					< 0.001
Time FE			x	x	x	x	x
Market FE			x	x	x*	x*	x*
Specialty FE			x	x	x	x	x
Practice FE					x	x	x
Patient & Physician characteristics				x		x	

*Procedure-by-region market fixed effects are replaced with procedure fixed effects, when practice fixed effects are included.

**$p < 0.05$

***$p < 0.01$

shock 1 and 24,573 for shock 2. We provide robustness analysis using a ± 52-week time window, separate fixed effects for procedure and region, and narrower trimming thresholds for outlying prices.

The results for Model (1) are presented in Table 2, Column (1) To allow for heterogeneity in patient and physician composition between groups, we fit patient and physician characteristics in the model in Table 2, Column (2) We include patient age, sex and logarithmic income and physician age and sex. The NHI reimbursement is excluded from the equation because it, by definition, is determined endogenously as a function of the MRI price and the current reimbursement policies of the NHI scheme. The time-variant policies are uniform for all MRI procedures and are therefore captured by the week-year fixed effects in all models[6].

Additionally, to control for any unobserved provider differences that might affect responsiveness to the price disclosure, we add fixed effects for practices, λ_k, in Column 3. Thus, the identification of β_1 utilizes only the within-practice variation in prices and captures the average provider price response to price disclosure. This also removes the possibility that practices which exit the market before, or enter the market after, the price disclosure are more or less likely to compete for patients with low prices, among other unobserved differences between practices. While adding fixed effects for practices, we replace the procedure-by-region fixed effects λ_{jm} with procedure fixed effects λ_j, as each practice is located in one region uniquely. In Column 4, we add practice fixed effects and patient and physician characteristics. For simplicity, we use the terms market price and provider price, depending on whether results are generated using a model with market fixed effects (Columns 1 and 2) or practice fixed effects (Columns 3 and 4). Finally, we decompose the estimated effects into intensive and extensive margins by subtracting the estimated provider price response (intensive margin) from the overall market

[6] For shock 1, 99.8% of MRI prices exceed the maximum price reimbursed by NHI policies. For these procedures the reimbursement is a constant lump-sum varying only in time with the changes in the NHI reimbursement policies. For shock 2, all reimbursements were constant after excluding outlying prices. This timely variation in the reimbursement policies is captured by the week-year-fixed effect.

price response, leaving the residual component that reflects the demand-side response (extensive margin).

Additionally, the effects of price disclosure might not be instantaneous because information diffuses slowly and there is a time lag between deciding to purchase and actually consuming the MRI service. To investigate the dynamics of the price effects, we separate the price disclosure dummy by quarter years, indicated by $Quarter$ -dummies for each 12 quarters of the study period. We drop the last quarter preceding the shock ($Quarter_{(-1)}$) out of the model to provide the relative event-study estimates.

$$\begin{aligned}\log\left(price_{ijmt}\right) =&; \beta_0 + \sum{}_{n=(-6)}^{5} \beta_n Quarter_n \\ &; \left(post_t \times exposure_j\right) \\ &; + \lambda_w + \lambda_{jm} + \lambda_p + \epsilon_{i(k)}\end{aligned} \tag{2}$$

Similarly, we fit DiD interaction terms for different exposed procedures and regions to analyze the heterogeneity and whether particular procedures or regions drive the effect. We also analyze heterogeneity of the effect across patient income groups, which are constructed for the lowest 25%, median 50% and highest 25% of the income distribution. These DiD interactions are analyzed with and without the practice fixed effects, and results are presented in Tables A4 – A7. Finally, we analyze heterogeneity of the provider price effect across companies by estimating separate effects for each company, and analyze whether the price effect is associated with competitive market structure by adding the DiD interaction term for the market concentration index $FTHHI_l$ to Model (1). The main effect for $FTHHI_l$ is dropped from the model, as it is not separately identifiable with practice fixed effects[7]. For robustness, we analyze the effect via both continuous and binned $FTHHI_l$ variables[8].

Finally, we run several robustness analyses. To test the parallel trends assumption and the validity of our identification strategy, we estimate whether the linear price trend differentiates between the exposed and nonexposed MRI procedures prior to the price disclosure. To provide a reference point, we first interact exposure for price disclosure and time in weeks and include this term for a linear price trend for the exposed procedures to Model (1). Second, we test whether exposed and nonexposed procedures were on similar trends prior to the price disclosure by interacting the linear price trend with a dummy variable, which turns on only for the pre-period. Finally, our event study analysis tests the parallel trends assumption for each quarter by interacting the DiD variable with quarter-year dummies (Model (2)). The results of the pretrend and event study analyses are presented in Table 3 and 4 in Appendix.

To evaluate possible spillover effect resulting from providers compensating for price reductions in exposed procedures by increasing the prices for nonexposed procedures, we run interrupted time series regression models for the nonexposed group and examine whether the prices or price trends of the nonexposed procedures increase after the price disclosure[9]. We run the same analysis for the exposed group for comparison and report both results in Table 8 in Appendix.

Additionally, to address concerns that the 2016 reimbursement reform may bias our estimates for shock 2, we use two strategies. First, while we cannot directly test whether exposed and non-exposed procedures responded similarly to the policy reform due to the overlap with price disclosure, we draw on evidence from a comparable 2013 reform. More precisely, we run Model (1), but replace the price disclosure date with the 2013 policy change placebo date and estimate whether price responses to 2013 policy reform differ between the exposed and nonexposed groups of shock 1. To isolate the effect of the 2013 reform, we restrict the analysis to the final two years of the 144-week study period, thereby excluding the previous 2011 policy reform. Second, we estimate interrupted time series models to assess whether the 2016 reform is associated with a shift in the price level or trend of non-exposed procedures (N = 9,970)[10]. We estimate the models with both market and practice fixed effects, as in the main specification and report results in Tables A9 and A10. We also estimate a donut specification that omits the immediate post-reform weeks (weeks 0–3) to further support the causal interpretation.

All models are estimated using generalized least squares in SAS 9.4. Standard errors are clustered at the practice level, and statistical significance is evaluated using two-sided t-tests with a 5% threshold.

[7] The estimated Model (3) is
$$\log\left(price_{ijmt}\right) = \beta_0 + \beta_1\left(post_t \times exposure_j\right) + \beta_2\left(post_t \times exposure_j\right) FTHHI_l + \lambda_w + \lambda_j + \lambda_p + \lambda_k + \epsilon_{i(k)}.$$

[8] We run the FTHHI-interaction models additionally with FTHHI binned to 2 classes using a "high concentration" -dummy for FTHHI above 2500 and to 3 classes by adding dummies "low concentration" for FTHHI below 1500 and "moderate concentration" between 1500 and 2500, as well.

[9] The Model (4) is: $\log\left(price_{ijmt}\right) = \beta_0 + \beta_1(POST) + \beta_2(POST * week) + \lambda_w + \lambda_{jm} + \lambda_p + \epsilon_{i(k)}$.

[10] The Model (5) is: $\log\left(price_{ijmt}\right) = \beta_0 + \beta_1(New_policy) + \beta_2(New_policy * week) + \lambda_w + \lambda_{jm} + \lambda_p + \epsilon_{i(k)}$. Here, New_policy is a dummy variable, equal to 1 starting from January 1, 2016, when the new reimbursement policies came into force, and 0 before that. $Week$ is a continuous time variable for a linear price trend.

Table 3 Pre-trend analysis for possible differential price trends prior to the price disclosure

Dependent variable: ln (price)			**Model (1)**	**Linear trend**	**Pre-period linear trend**
			Col 1	**Col 2**	**Col 3**
Shock 1	Model period		± 72 w	± 72 w	± 72 w
	N		58,157	58,210	58,210
	DiD	β_1	−0.004	0.002	0.000
		Std. E.	0.012	0.011	0.018
		P-value	0.762	0.884	0.999
	Linear trend x exposed	β_1		0.000	
		Std. E.		0.000	
		P-value		0.582	
	Linear pre-trend x exposed	β_1			0.000
		Std. E.			0.000
		P-value			0.683
Shock 2	Model period		± 72 w	± 72 w	± 72 w
	N		24,573	24,573	24,573
	DiD	β_1	−0.106***	−0.043	−0.126***
		Std. E.	0.018	0.027	0.037
		P-value	< 0.001	0.109	0.001
	Linear trend x exposed	β_1		−0.001	
		Std. E.		0.000	
		P-value		0.057	
	Linear pre-trend x exposed	β_1			0.000
		Std. E.			0.001
		P-value			0.422
Time FE			x	x	x
Market FE			x	x	x
Specialty FE			x	x	x
Practice FE					
Patient & Physician characteristics					

**$p < 0.05$

***$p < 0.01$

Results

Descriptive statistics

Figure 1 shows that the pre-trends of prices seem to be relatively similar between the exposed and nonexposed procedures for shocks 1 and 2. The prices of each procedure also react similarly to a change in the market conditions, illustrated by an extreme drop in all prices in the pre-period of shock 2.4[11] The treatment effect is unclear for shock 1, but after shock 2, the price trends of the exposed and nonexposed procedures diverge, suggesting that there might be a treatment effect. The seasonality of demand is also similar to exposed and nonexposed groups (Figure 6 in Appendix).

Additionally, the price distributions are similar between the exposed and nonexposed groups for both shocks in the pre-period (Fig. 2). To analyze this, we regressed logarithmic prices against region fixed effects and plotted the residuals in kernel density plots.

[11] This drop is the market price reaction to a disruptive competitor entering the MRI markets with an innovative business model and substantially lower prices relative to incumbent companies [26].

The basic characteristics of the exposed and nonexposed MRIs are compared in Table 1 for the pre-period. For both shocks, the number of exposed MRI procedures is considerably greater than the number of nonexposed procedures. The median prices (€664 and €655 for shock 1; €365 and €375 for shock 2) are very similar, and the reimbursement paid for them is the same (€252; €145) across the groups (Table 1). Changes in NHI reimbursement policies affect all MRI procedures similarly.

For both shocks and groups, 92–96% of patients appear only once in the pre-period sample, indicating that MRI is rarely repeated for the same patient. For shock 1, the share of female patients is 8% points greater, and the median age of patients is 9 years greater for the nonexposed group. This difference is explained by a greater probability of knee injury requiring knee MRI for young men (44% female, median age 40), whereas head MRI is more common for elderly women (59%, 57). For shock 2, the sex distribution is similar between the groups, but the patients in the exposed group are 8 years older by median. Patients' earned income is similar across the groups for both shocks.

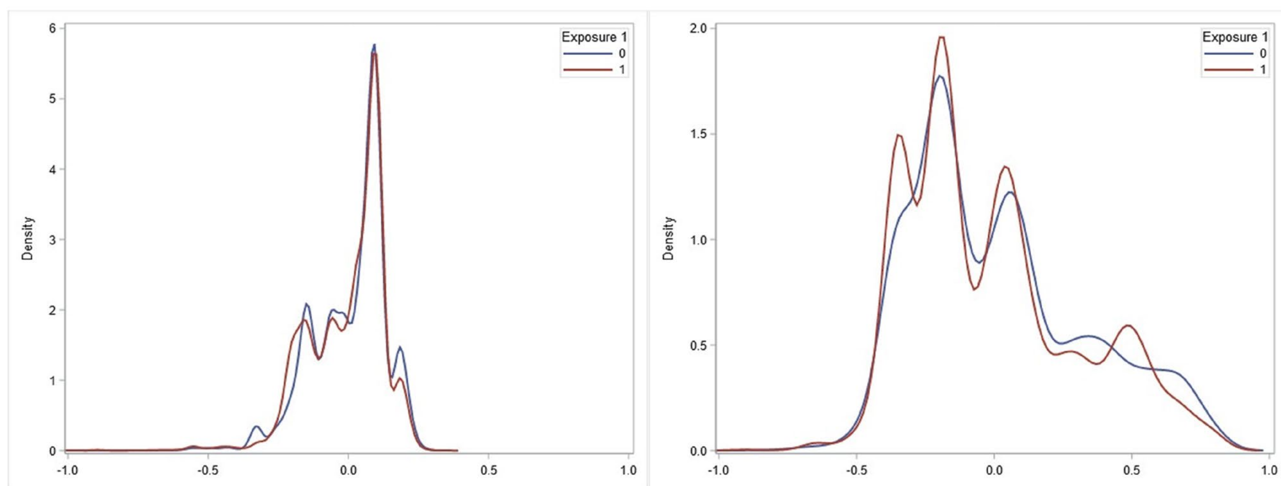

Fig. 2 Kernel density plots for region-adjusted price distributions of exposed (red) and nonexposed (blue) MRIs in the pre-periods of shocks 1 (left) and 2 (right)

For shock 1, the average number of MRIs referred per physician is 13 in the exposed group, which is more than twice that in the nonexposed group. This difference is explained by the high volume of knee and lumbar spine MRI referrals from orthopedics in the exposed group. For shock 2, such a difference is not observed. The sex distribution of physicians is quite similar, and the median age is approximately 55 years across all groups and shocks.

For shock 1, the exposed MRI procedures are provided in 100 different practices, and nonexposed MRI procedures are provided in 93 practices. All practices belong to the same 23 companies, and 24 of the practices provide MRIs to one group uniquely. For shock 2, the exposed MRI procedures are provided in 112 practices of 28 companies and nonexposed in 89 practices of 17 companies. Of these, 40 practices and 14 companies provide services exclusively in one of the groups. Exposed and nonexposed procedures are provided for all 18 regions in continental Finland[12] for both shocks. For shock 1, the average distance traveled to the MRI scan is 16 km for both groups, and for shock 2, the distance was 5.3 km greater for the exposed group than for the nonexposed group (14.0 km).

The provider market structure is slightly more concentrated for the exposed group, with a median FTHHI of 0.47, than for the nonexposed group, with a median FTHHI of 0.40 for shock 1. For shock 2, the market concentration is the same (0.30) for both groups. Overall, MRI scans are provided on more concentrated markets before shock 1 than before shock 2, and the interquartile range of the FTHHI is considerably smaller for shock 2 (Table 1).[13]

The mean FTHHI also varies considerably across regions before shock 1 (Fig. 3). The average market concentration declines in every region, and the decline is the most considerable in the most concentrated areas (Fig. 3). The decline in market structure indicates that the probability of monopolistic competitors utilizing location-based market power in their pricing has diminished. Across the entire ± 72-week study period, the mean value of FTHHI is 0.39 for shock 1 and 0.30 for shock 2.

Effect on MRI prices

The results for Model (1) are presented in Table 2. Column 1 is the baseline estimation of Model 1, including fixed effects for time, procedure-by-region markets and physician specialty. In Column 2, we include patient and physician characteristics; in Column 3, we include practice fixed effects; and in Column 4, we include patient and physician characteristics and practice fixed effects. For shock 1, the effect of price disclosure on MRI prices cannot be distinguished from zero, as DiD coefficients are close to zero ($-0.006 < \beta_1 < -0.002$) and are consistently statistically insignificant for all model specifications (Columns 1–4, Table 2).

For Shock 2, Columns 1 to 4 suggest that price disclosure decreases MRI prices by 5.2–10.7% depending

[12] Åland did not have any private MRI providers.

[13] FTHHI includes all MRI procedures and is therefore comparable across shocks despite different procedures in the exposed and nonexposed groups.

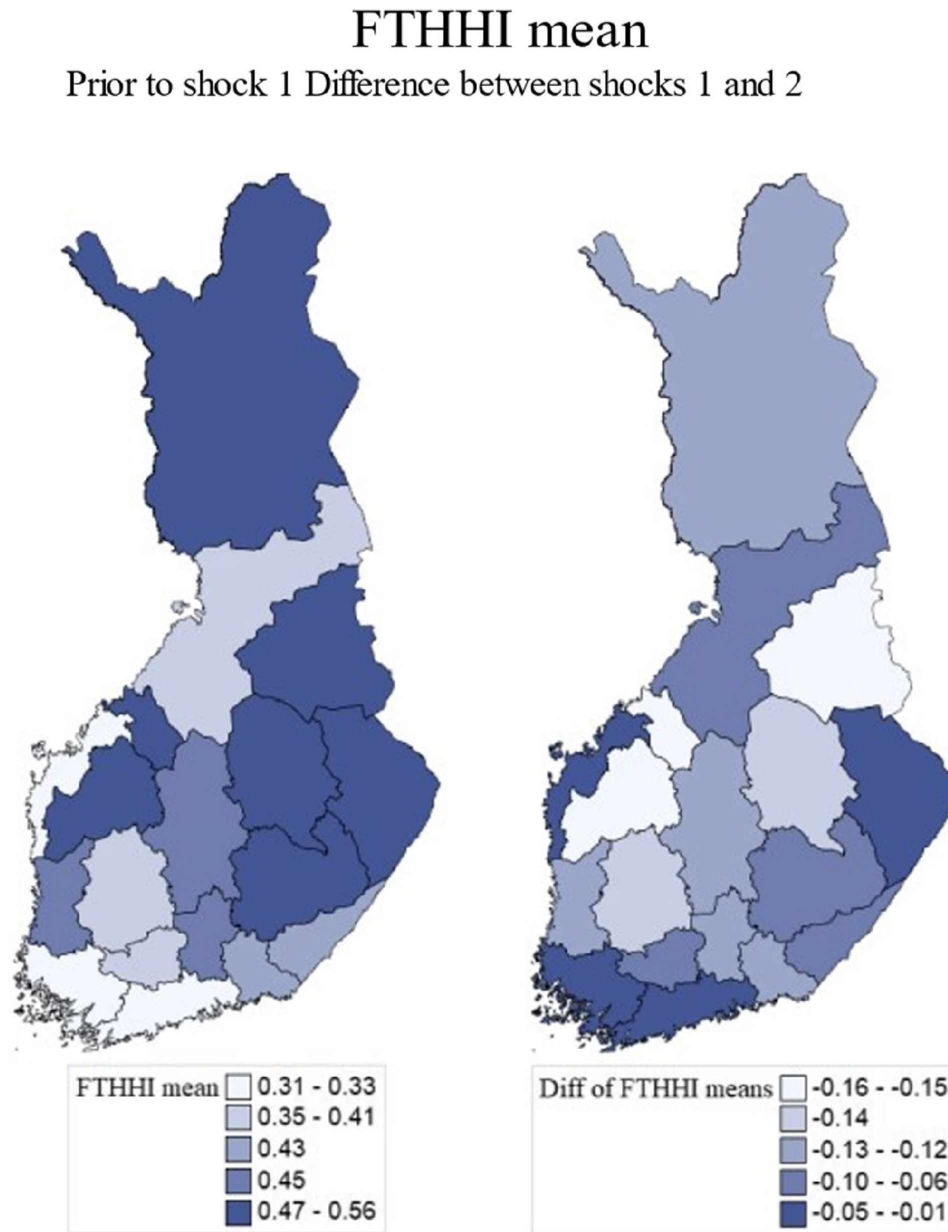

Fig. 3 The mean of FTHHI by region before shock 1 (left) and the difference in the regional FTHHI means between shocks 1 and 2 (right)

on the model (Table 2). In Column 1, β_1 is –0.106 and highly statistically significant. In Column 3, the estimation of β_1 comes from the within-practice variation, leading to a decrease in the point estimate to 5.2% (Column 3). Both estimated effects are rather insensitive to the inclusion of patient and physician characteristics, as the estimate decreases by only 0.01 and remains statistically significant (Columns 2 and 4). Running the analysis with a shorter ± 52-week time period around the disclosure yields slightly smaller within-market effects (Columns 1 and 2) and slightly greater within-practice effects for (Columns 3 and 4). Using separate fixed effects for procedure and region or altering the trimming values for outlying prices provides similar results.[14]

Separate price effects for quarters, procedures and regions are presented in Tables A4–A6. For shock 1, the

[14] For shock 1, all DID estimates remain statistically insignificant. For shock 2, the ± 52-week time window yields β_1 estimates of -0.082 ($p < 0.0001$) for Column 1, -0.085 ($p < 0.0001$) for Column 2, -0.058 ($p < 0.01$) for Column 3 and − 0.060 ($p < 0.01$) for Column 4. With separate fixed effects for procedure and region, β_1 is -0.107 ($p < 0.0001$) for Column 1 and − 0.108 ($p < 0.0001$) for Column 2. This estimation for Column 1 is later used to decompose the estimated effects to intensive and extensive margins. Narrowing the trimming values from €50–1500 to €50–800 excludes 5 high priced MRI's and yields β_1 estimates of -0.106 ($p < 0.0001$) for Column 1, and − 0.052 ($p < 0.05$) for Column 3.

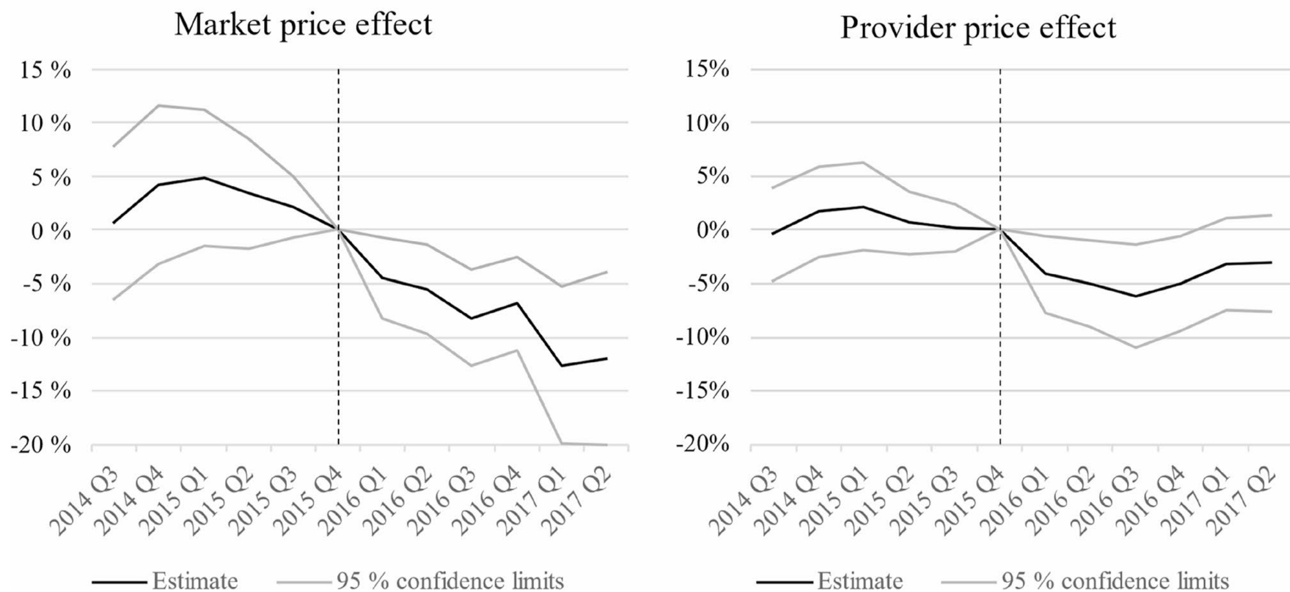

Fig. 4 Event study plots for market (left) and provider (right) price effects by quarter-years[22] for shock 2. Shock is marked with the dashed vertical line

[22] The estimated Model (2) includes time, specialty and procedure-by-region fixed effects (left plot) and time, specialty, procedure and practice fixed effects (right plot), and standard errors are clustered at the practice level. 2015 Q4 is the last quarter before the price disclosure and it is used as the reference point.

separate effects for quarters and procedures are statistically insignificant (Tables A4 and A5), but for regions, we find mixed results. The DiD estimator β_1 is statistically nonsignificant for 12 regions, significant and negative for 3 regions and positive for 3 regions (Table 6 in Appendix).

For shock 2, the price decline takes effect in the first full quarter[15] after the price disclosure, with a 4.6% decrease in price ($p=0.018$). The price reduction increases to −12% until the 6th quarter after the price disclosure, and it remains statistically significant throughout the study period (Fig. 4: Panel A, Table 4 in Appendix). The price effect is statistically significant for both exposed procedures and it is only slightly greater for thoracic spine MRI ($\beta_1 = -10.8\%$) than for cervical spine MRI ($\beta_1 = -10.0\%$, Table 5 in Appendix). Separate analyses for regions show a statistically significant price decrease in 9 regions and an increase in one region (Table 6 in Appendix).

The estimation of separate effects with practice fixed effects yields similar results for shock 1[16]. For shock 2, we find that providers decrease prices by 4.1% immediately after the price disclosure and that the price gap increases slightly to 4.9–6.1% during the following three quarters. For the last two quarters, contrary to the model without practice fixed effects, the effect diminishes to −3.2% and −3.1% and becomes statistically insignificant (Fig. 4: Panel B, Table 4 in Appendix). This finding indicates that the increasing price gap between exposed and non-exposed MRIs is explained by between-practice variation rather than within-practice variation in the longer term. The separate effects for regions and procedures are also weaker than those for market prices, and for some regions, the effect becomes statistically insignificant when practice fixed effects are included (Tables 5 in Appendix and 6 in Appendix)[17].

We also examined heterogeneous effects of price disclosure by patient income groups, where patients were classified into three groups: low income (bottom 25%), median income (middle 50%), and high income (top 25%). For shock 2, the largest price reduction at the market level was observed for the median income group ($\beta_1 = -0.117$), whereas the effect was more modest for both the high- ($\beta_1 = -0.092$) and low-income groups ($\beta_1 = -0.101$). Using practice fixed effects, the median income group again gained the largest effect ($\beta_1 = -0.057$), but the ranking for high- and low-income groups differs slightly (−0.051 and −0.046, respectively). For shock 1, income-group specific effects were not statistically significant.

[15] The 4th quarter of 2015 includes only 4 business days after the price disclosure (Dec 28–31, 2015). These 4 days are included in the 1 st post quarter, i.e. 2016 Q1.

[16] For shock 1, separate effects for procedures and quarters are statistically insignificant. For regions we find 10 statistically insignificant, 4 positive and 4 negative statistically significant DiD-coefficients.

[17] For shock 2 separate price effect for cervical spine MRI is, correspondingly, slightly smaller (-0.049, $p<0.05$) than it is for thoracic spine MRI (-0.061, $p<0.01$). Separate effects for regions are statistically significant and negative for 6 regions and positive for 1 region, as for other 11 regions the effect is statistically insignificant.

As a competitive environment is likely to have an effect on how providers respond to price transparency, we finally add the DiD interaction term for the market concentration index FTHHI in Model 3 (Table 2, Column 5). For shock 1, the effects are consistently insignificant for both the DiD and DiD-FTHHI interactions. For shock 2, the DiD coefficient β_1 is positive (0.213), whereas β_2 for the DiD-FTHHI interaction is negative (−0.859), both being statistically significant. This finding indicates that a concentrated market structure is associated with providers declining prices more in response to the price disclosure. The net price effect is negative for market concentration above 0.248, covering 78% of the observations. With the FTHHI varying between 0.072 and 0.640, the estimated price effect varies between + 15.1% and − 33.5%. The effect was also tested using FTHHI classification variables, which produced very similar results[18]. Finally, we find considerable heterogeneity in provider responses across companies, while most responses are negative: The estimated effects are statistically significant ($p < 0.001$) and negative ($-0.534 < \beta_1 < -0.049$) for 17 companies, positive ($0.090 < \beta_1 < 0.351$) for 5 companies, non-significant for 3 companies and not identifiable for 6 companies[19]. This suggests that the aggregate provider response is not driven by a single dominant company but rather reflects a range of company-specific strategic responses.

Robustness analyses

The results of the pre-trend analysis suggest that the pre-trend assumption is supported (Table 3). The differential common linear trend for the exposed group (Column 2) is not statistically significant, and most importantly, the exposed procedures are not on a differential linear trend prior to the price disclosure (Column 3). Additionally, the quarter dummies for the differentiating pre-trends are statistically insignificant[20] for both shocks in the event study (Fig. 3, Table 4 in Appendix). This also indicates that there is no anticipation of price disclosure.

The robustness analysis evaluating the spillover effects onto the nonexposed group, arising from possible compensating behavior by providers (Table A8) found no statistically significant effect, suggesting that the disclosure did not affect prices of nonexposed procedures. For comparison, the same model applied to the exposed group produced a statistically significant negative effect, confirming that the method is capable of detecting price changes when they occur.

The robustness analysis addressing the potential bias from the overlap between the 2016 reimbursement reform and shock 2 is reported in Tables A9 and A10. For the 2013 reform, estimated DiD effects (β_1) did not differ statistically significantly between the disclosed (high-volume) and non-disclosed (low-volume) procedures. However, for market-fixed effect model, the estimated 1.7% greater decline in high-volume procedure prices was close to statistical significance ($p = 0.050$), whereas within practices the corresponding estimate was − 1% ($p = 0.078$) (Table 9 in Appendix). For the 2016 reform, neither the change in price level (β_1) nor trend (β_2) was statistically significant for the control group of shock 2 (Table 10 in Appendix). Finally, the donut specification that omitted post-reform weeks 0–3 produced results similar to those of the main specifications in Model (1)[21].

Discussion

Main findings

The aim of this study was to estimate the effects of two distinct price disclosures on private MRI prices in Finland and to evaluate their association with the competitive market structure. Our difference-in-differences (DiD) approach reveals that the disclosure of municipality average prices by the SII did not reduce MRI prices, suggesting that it failed to promote competition or gain savings. In contrast, the disclosure of provider average prices by Lääkärihinta.fi resulted in a statistically significant price reduction of 10.6% within markets and 5.2% within practices. The total within-market effect can be decomposed into the 5.2% intensive margin, capturing average price adjustments by incumbent providers, and the 5.5% extensive margin, reflecting changes in provider volumes due to patient switching and provider entry and exit.

While some of the previous studies on the introduction of price transparency tools find no effect on prices [18], others report substantial reductions. For example, Wu et al. [13] find an 18% price decrease, and Whaley et al. [12] report a 13% reduction in MRI prices among searchers. The estimated effects are larger in magnitude than ours, as Wu et al. [13] and Whaley et al. [12] estimated the effects directly for searchers, whereas our estimates reflect the intention-to-treatment effect in the population, of which only a proportion is likely to search and utilize the information [18, 19]. Our alternative model specifications,

[18] These models provide similar results as Model (3) with continuous FTHHI. For shock 1 and 2 the main effect for binned FTHHI is statistically significant and suggests higher prices for more concentrated markets. For shock 2 the interaction of DiD and FTHHI are mainly significant and suggest that prices decline more for concentrated market structure.

[19] The company-specific estimates are not reported separately due to confidentiality restrictions.

[20] The analysis is run also using months instead of quarters, and using the last 3 months preceding the shock as the reference point. For shock 1, the prices of the exposed procedures were not statistically significantly different for any of the months in the pre period, and for shock 2 for two months, 2015 January and June. This too indicates that prices were not on differential price trends prior to the shocks.

[21] Omitting weeks 0–3 declines the estimate β_1 from − 0.106 ($p < 0.0001$) to -0.105($p < 0.0001$) for Column 1, and the estimate remains the same for Column 3.

pre-trend analyses and robustness analysis, including checks for spillover effects and overlapping policy reforms, generally support the credibility of the DiD estimates.

Differences between disclosures

The difference in price effects of the two price disclosures can be attributed to differences in both the design of the price transparency tools and the competitive environment at the time of their introduction. First, the design of the price transparency tool might play a decisive role. The SII disclosure provided only municipality-level average prices. Such aggregated information is difficult for consumers to use in price shopping because patients still need to search for provider-specific MRI prices manually. Similarly, competitors cannot easily benchmark against an average price. In contrast, the Lääkärihinta.fi tool displayed provider-level prices in a single, easily comparable list. This design makes price comparison of alternative providers straightforward for patients and allows providers to directly benchmark and adjust their prices. Previous studies have shown that the amount of information disclosed and the way it is presented substantially influence how consumers and providers respond [8].

We also know from the previous literature that price transparency tools are often utilized by only a small proportion of consumers [19, 20, 34]. Desai et al. [18] conclude that an important reason why a transparency tool failed to reduce health care spending was its low uptake among eligible users. In our study, different levels of awareness and utilization might explain the differential effects between the two price disclosures examined. The lack of data on consumer search, however, limits our ability to draw conclusions about the mechanisms from search to the price effect.

Despite poor design and lack of marketing, even the release of local average prices by SII may increase consumer and provider awareness of the local price level. Previous studies for example suggest that for markets where *ex ante* price transparency is very low and providers are prone to collusion, the effect of price disclosure might even be anticompetitive [8]. If pricing is collusive, providers might take the disclosed average price as the new collusive price and simply increase or lower their prices to match this level. Indeed, we did find regional effects for the SII's price disclosure varying in both the pro- and anti-competitive directions in nearly half of the regions. This suggests that even the disclosure of aggregated prices might have motivated the providers to adjust their prices—either to increase their prices to take more advantage of their monopoly power or to lower their prices to compete with other providers.

For the second price disclosure, both the common and regional price effects were more consistently pro-competitive, but there was still notable variation in the magnitude of the regional effects. We also found that prices decline more when providers have more monopoly power prior to price disclosure. This result is in line with the previous literature stating that information disclosure is more effective in promoting competition if baseline market performance is low [8]. For the first price shock, we found no association between market structure and the price effect, suggesting collusive pricing, which is not sensitive to competition by definition. Indeed, the second prominent explanation for the different effects of the two price disclosures is the different competitive environments at the times of the two price disclosures. Pricing was probably collusive at the first price disclosure, protected by a poor *ex ante* level of price transparency. Even though the first price disclosure did not increase price information enough to break the collusion, the disruptive entrant possibly did and increased the providers' responsiveness to price information by the time of the second price disclosure [26].

Dynamics and mechanisms

The analysis of the price dynamics revealed that the market prices of disclosed MRIs continued to decline, ultimately reaching a 12% difference from those of non-disclosed procedures by the end of the study period. This market price effect captures the total effect of the price disclosure, combining both provider responses and patient switching. However, the estimates may be biased by unobserved provider differences. For example, medical quality MRI is fairly standardized, but brand, reputation or endorsement of an insurance company or referring physician could confound the effect. For example, Chernew et al. [19] find that more than half of MRI price variation is explained by the referring physician.

When controlling for provider heterogeneity with practice fixed effects, the estimated provider-level effect, the intensive margin, was only 4.1–6.1% and became statistically insignificant toward the end of the study period. This estimate captures the average price adjustment among incumbent providers, as the approach ignores the shifts in market shares between providers and includes only providers that supplied services both before and after the disclosure. Compared with new entrants, incumbents may retain monopoly power due to persistent consumer habits and other switching costs. Consequently, the estimates likely understate the true provider response. The fading significance toward the end of the study period may also reflect patient loyalty and switching costs. Patients may initially react strongly to new price information by switching to lower-priced providers, motivating incumbent providers to reduce the disclosed prices relative to undisclosed ones. Over time, however, as new consumer habits are established, the incentive for differential pricing diminishes. The heterogeneous but predominantly negative within-provider responses across companies also suggest that the aggregate provider

response is not driven by a single dominant company but rather reflects a range of company-specific strategies.

The remaining extensive margin effect captures the impact of changes in provider volumes due to patient switching and provider entry and exit. This mechanism appears central to the observed longer-term market-level price reductions, however, growing uncertainty from potential confounding mechanisms toward the end of the study period increases the risk of bias for these estimates.

The heterogeneous effects across income groups suggested that middle-income patients benefited most from price disclosure. Those with high incomes were probably less price sensitive and low-income patients might have been choosing lower-cost providers even before the disclosure. Differences in insurance coverage and bargaining power likely also contribute to the observed heterogeneity, as private insurance is more common among higher-income patients. This interpretation is supported by the within-practice effects as well: the results indicated there was income-related price discrimination, which is plausible given the role of private insurers, more prevalent among higher-income patients in negotiating prices. Compared with the market-level analysis, the practice fixed effect analysis highlighted that these differences arise not only from patient behavior but also from provider pricing strategies.

Finally, the estimated price effect may stem from the demand side or supply side or from lower quality. Because of the high level of standardization in MRI services, it is unlikely that the price decline is achieved by lowering medical quality. However, quality could not be observed from the data, and conclusions on absolute consumer welfare gains cannot be drawn. The lack of combined price and quality information is a common limitation of price transparency tools [35], as it would help patients make better informed decisions and prevent providers from lowering the disclosed prices at the expense of quality. Another limitation of price transparency tools is that they often provide prices for only a fraction of the care episode, allowing providers to compete with the disclosed prices and increase profit margins where prices are hidden [35]. We did not find evidence on providers compensating their losses by increasing the prices of undisclosed control procedures, but it remains unclear whether providers increase the margins for some other services.

Contributions and limitations

Previous studies are often based on study designs that take advantage of the difference between patient groups [6, 13] in the given access to price information. Our study contributes to the literature with a different approach that takes advantage of the difference in the disclosure of prices between closely similar procedures. The advantages of our study design are the similarity of patients and providers between the exposed and nonexposed groups and the ability to include the whole population of patients and providers under the NHI scheme in our analysis. On the other hand, a limitation of our identification strategy is the possible spillover effects between the exposed and nonexposed MRI procedures arising either from providers compensating their losses or from patients switching to exposed and nonexposed MRI examinations based on the same price information. Our robustness analysis found no evidence of spillover effects on to the control group, validating our methodology. Although the difference-in-differences design with a control group provides a robust quasi-experimental setting, it cannot fully eliminate the risk of bias from unobserved confounding factors. Robustness analyses indicate that the overlapping 2016 reimbursement reform is unlikely to have caused substantial bias in the estimates of shock 2. Nevertheless, other unmeasured demand- or supply-side changes, that coincided with the price disclosure, may have influenced the results.

The data used in our analysis are comprehensive and cover the universe of private MRI markets under the NHI scheme, but they also have some limitations. First, we lacked data on whether patients had supplementary private insurance, while we know from previous studies that insurance substantially lowers consumers' incentives for price shopping [6, 36]. For example, Lieber [6] concluded that moral hazard decreased patient searches for prices by 90% when patients met their deductibles. Insurance companies often negotiate lower prices for their customers, yet patients may deviate from insurers' recommendations, and deductibles may create incentives both to avoid unnecessary health care use and to compare prices [27]. However, observed heterogeneity across patient income suggests that unobserved private insurance is likely to reduces the price responsiveness of both consumers and providers in Finnish markets. Due to this limitation, we are not able to assess the extent to which our results would generalize to markets with different co-payment structures. This implies that our findings may be more representative of systems like the Finnish one, where consumers include both insured and uninsured patients. For example, in markets with more widespread insurance coverage, consumer search and provider competition could be weaker.

We also lacked data on MRIs provided in public hospitals, which would overestimate the market concentration if public and private MRIs were substitutes. However, the Finnish Competition and Consumer Institution (FCCA) has found that only 10% of users of private physician services report that they would change to a public health care provider if their private provider was not available [37]. The low level of substitution between the sectors rationalizes the exclusion of the public sector from the relevant MRI product markets.

Finally, the study was conducted in the Finnish private healthcare market, which is characterized by partial

public reimbursement, relatively high market concentration and a universal, tax-funded public healthcare system operating alongside. These institutional features may limit the external validity of the results for countries with different healthcare financing and competitive structures. Demand response to price disclosure may be smaller in Finland, compared to, for example, U.S. insurance funded system, as patients face lower out-of-pocket costs and often have access to public alternatives. Conversely, the U.S. system's higher cost exposure and more fragmented markets might amplify the impact of transparency initiatives. Despite these differences, our findings are quite consistent with U.S.-based evidence in showing that price transparency can lead to modest price reductions, suggesting that the underlying mechanisms—such as increased patient price awareness and competitive pressure—may operate across different institutional settings.

Conclusions

Market power is often derived from informational frictions, especially in health care markets, where asymmetric information makes it difficult for patients to compare their options. Our study aligns with the bulk of the literature on the effects of price transparency tools and concludes that in Finnish private health care markets, where competition is patient driven, price transparency is a prominent way to promote competition and contain health care expenditures. We find that the disclosure of practice-level MRI prices is causally associated with a short-term decrease of 5.2% in provider prices. In addition, providers decline their prices more in concentrated markets, where competitors hold more market power prior to the disclosure. This emphasizes the potential of price transparency in inhibiting companies' ability to exert monopoly power in their pricing.

Furthermore, our study indicates that the price disclosure could be associated with a long-term market price decline of 10.6%, which results from both provider and patient responses to the new price information. Unobserved confounding factors might, however, cause bias in these estimates, and more studies on the role of patient choices and provider incentives are needed. In particular, new market entrants could be more sensitive to the price information available than incumbent firms are, causing bias in the estimation. We also found the largest effects for median-income patient – including within practices – suggesting both behavioral differences in patient price sensitivity and income-related price discrimination by providers, most likely explained by private insurance. Although the magnitude of the differences is modest, the findings highlight that the impact of price transparency policies may vary across patient subgroups, reflecting differences in price sensitivity and insurance coverage.

A comparison of two differently performed price transparency tools reveals that the effects are not unambiguous, as for the previously introduced tool, we found no overall effect on savings and even an indication of regional anti-competitive effects. In our analysis, we concluded that the failure of the first price disclosure was related to two main aspects. First, the aggregation of prices disclosed and low awareness of the information provided probably led only to a small or frictional increase in the relevant price information. Second, the poor level of *ex ante* price information and collusive pricing might have caused weak price sensitivity on both the consumer and provider sides. Our findings highlight the importance of a well-performed design of the tool and execution of the disclosure, as well as an analysis of the market conditions and environment where the tool is implemented, to achieve savings. In our analysis, we use comprehensive data on private MRI markets, including the whole population of private MRI users under the NHI scheme. Our estimation strategy takes advantage of the difference in the disclosure of price information between closely similar MRI procedures, deviating from the bulk of the literature using differences among population groups. We show that the populations and service providers are very similar and use precautionary adjustments to take any differences into account between the comparison groups. Consequently, we provide robust results with pre-trend analysis and robustness checks to validate the critical assumptions behind our method. The possible risk of unobserved confounding factors might still cause bias in our estimates.

Although the internal validity of our results seems to be strong, the external validity is limited, as in most quasi-experimental settings. Our findings may be more representative of systems like the Finnish one, where private healthcare market operates alongside the public healthcare system and consumers include both insured and uninsured patients. Furthermore, the results do not generalize across all health services since price elasticities vary for different types of procedures. For example, Brown et al. [38] conclude that only 30–40% of health care spending is shoppable in the U.S., meaning that price transparency tools may be effective only for this proportion of the whole health care market. Despite this, the study provides important insight into the effects of price information tools in health care markets, where competition is patient-driven. This study contributes to the literature by further analyzing the association of market structure with provider responses and by evaluating the factors behind the different outcomes of two different price transparency tools within the same market.

These findings have important implications for health care policymakers. Overall, the evidence indicates that competitive pressure from price transparency can influence pricing strategies, particularly in more competitive

markets. Furthermore, our results suggest that price transparency tools should provide provider-level, easily comparable information to effectively promote competition and contain healthcare costs. Aggregated or poorly communicated price information may fail to incentivize price reductions. Overall, careful design and implementation of price transparency policies are crucial to achieve cost savings while maintaining service quality.

Appendix

Average fees charged for private-sector medical services

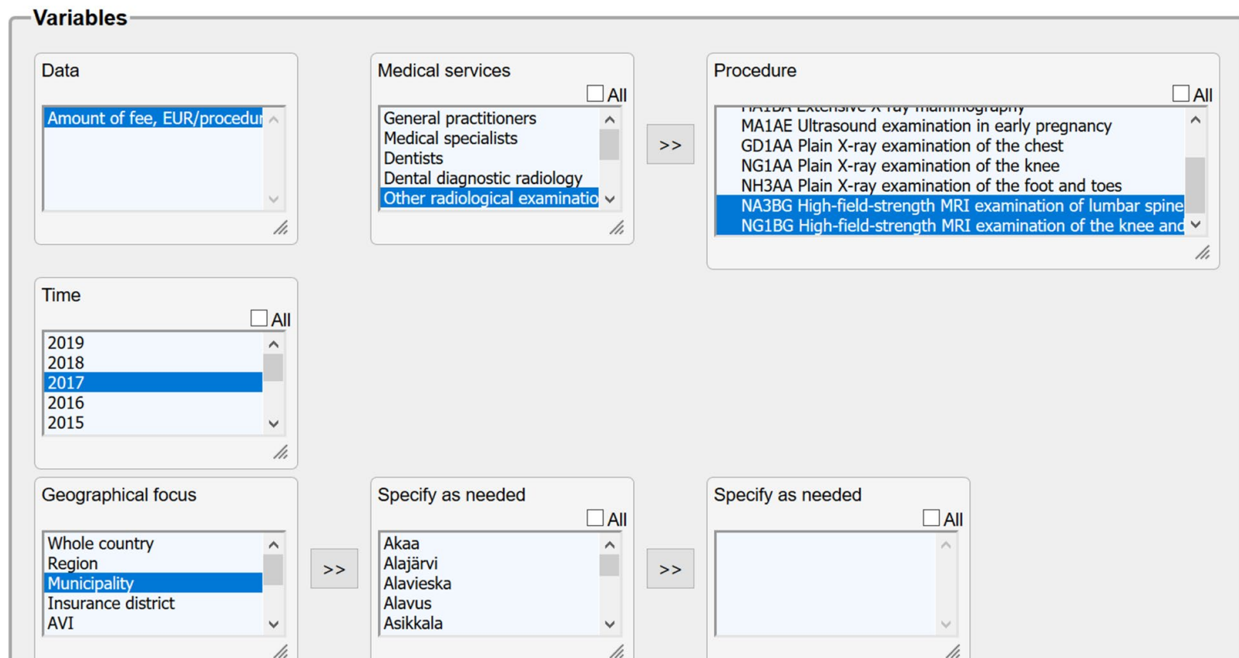

Fig. 5 The price comparison tool of SII "Average fees charged for private-sector medical services" (SII 2024)

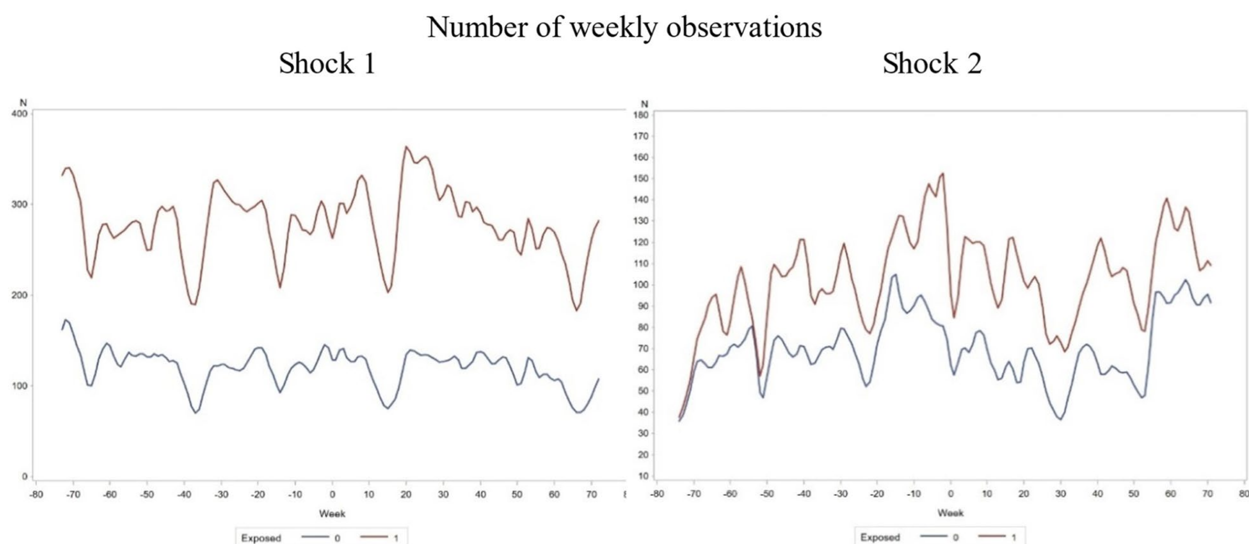

Fig. 6 Seasonality of demand of the exposed (red) and nonexposed (blue) groups for shocks 1 (left) and 2 (right). Price disclosure occurs at week 0. To smoothen the fitted curves, we use an interpolation method, which provides a cubic spline minimizing the linear combination of the sum of squares of the residuals of fit (smoothing value 10)

Table 4 Separate effects for quarters

Model (2): Separate DiD effects for quarters; Dependent variable: ln(price), ± 72-week study period						
Shock 1						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x Q-6	−0.013	0.017	0.445	0.005	0.007	0.483
DiD x Q-5	0.003	0.013	0.811	0.013***	0.004	0.002
DiD x Q-4	−0.002	0.006	0.683	0.007	0.004	0.098
DiD x Q-3	−0.001	0.006	0.856	0.005	0.004	0.189
DiD x Q-2	0.001	0.006	0.850	0.004	0.005	0.428
DiD x Q-1	0.000	0.000		0.000	0.000	
DiD x Q0	0.001	0.012	0.918	0.001	0.009	0.912
DiD x Q1	−0.004	0.009	0.637	0.003	0.007	0.690
DiD x Q2	0.010	0.013	0.445	0.009	0.010	0.384
DiD x Q3	−0.018	0.014	0.212	−0.009	0.010	0.354
DiD x Q4	−0.014	0.014	0.330	−0.007	0.009	0.459
DiD x Q5	−0.009	0.013	0.4754	0.001	0.011	0.9313
Shock 2						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x Q-6	0.006	0.036	0.868	−0.004	0.022	0.863
DiD x Q-5	0.041	0.037	0.273	0.017	0.021	0.430
DiD x Q-4	0.047	0.032	0.143	0.022	0.021	0.294
DiD x Q-3	0.033	0.026	0.210	0.007	0.015	0.658
DiD x Q-2	0.020	0.014	0.169	0.002	0.011	0.855
DiD x Q-1	0.000	0.000		0.000	0.000	
DiD x Q0	−0.046**	0.019	0.018	−0.041**	0.018	0.023
DiD x Q1	−0.056***	0.021	0.008	−0.050**	0.020	0.016
DiD x Q2	−0.083***	0.023	< 0.001	−0.061**	0.024	0.013
DiD x Q3	−0.069***	0.022	0.002	−0.049**	0.022	0.028
DiD x Q4	−0.127***	0.037	< 0.001	−0.032	0.022	0.140
DiD x Q5	−0.121***	0.041	0.003	−0.031	0.022	0.171
Time FE	x			x		
Market FE*	x			x*		
Specialty FE	x			x		
Practice FE				x		

Standard errors are clustered at practice level for all models

*Procedure-by-region market fixed effects, are replaced with procedure fixed effects, when practice fixed effects are included

** $p < 0.05$

*** $p < 0.01$

Table 5 Separate effects for procedures

Separate DiD effects for procedures; Dependent variable: ln(price), ± 72-week study period						
Shock 1						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x Knee or shin MRI	−0.011	0.012	0.359	−0.011	0.010	0.286
DiD x Lumbar spine MRI	0.002	0.014	0.895	−0.003	0.006	0.698
Shock 2						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x Cervical spine MRI	−0.108***	0.018	< 0.001	−0.049***	0.021	0.019
DiD x Thoracic spine MRI	−0.100***	0.021	< 0.001	−0.061***	0.019	0.002
Time FE	x			x		
Market FE*	x			x*		
Specialty FE	x			x		
Practice FE				x		

Standard errors are clustered at practice level for all models

*Procedure-by-region market fixed effects, are replaced with procedure fixed effects, when practice fixed effects are included

** $p < 0.05$

*** $p < 0.01$

Table 6 Separate effects for regions

Separate DiD effects for regions; Dependent variable: ln(price), ± 72-week study period						
Shock 1						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x South Karelia	−0.125**	0.055	0.025	−0.052***	0.012	< 0.001
DiD x South Ostrobothnia	0.020	0.025	0.422	−0.002	0.010	0.846
DiD x South Savo	−0.046**	0.019	0.018	−0.034***	0.010	< 0.001
DiD x Kainuu	0.021**	0.011	0.049	0.020**	0.009	0.035
DiD x Kanta-Häme	−0.026**	0.013	0.047	0.014	0.008	0.094
DiD x Central Ostrobothnia	0.011	0.022	0.625	−0.002	0.013	0.908
DiD x Central Finland	−0.012	0.018	0.485	−0.017	0.013	0.201
DiD x Kymenlaakso	0.019	0.015	0.215	0.030**	0.012	0.016
DiD x Lapland	0.018	0.017	0.289	0.020	0.013	0.134
DiD x Pirkanmaa	−0.003	0.014	0.838	−0.008	0.015	0.603
DiD x Ostrobothnia	0.056***	0.013	< 0.001	0.041***	0.010	< 0.001
DiD x North Karelia	−0.019	0.012	0.119	−0.011	0.010	0.270
DiD x North Ostrobothnia	0.018	0.014	0.176	0.001	0.007	0.945
DiD x North Savo	−0.041	0.021	0.053	−0.028**	0.011	0.011
DiD x Päijät-Häme	−0.052	0.035	0.147	−0.028***	0.010	0.004
DiD x Satakunta	0.035***	0.013	0.007	0.034***	0.009	< 0.001
DiD x Uusimaa	0.017	0.027	0.530	−0.008	0.009	0.389
DiD x Southwest Finland	−0.021	0.013	0.120	−0.009	0.008	0.247
Shock 2						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x South Karelia	−0.275***	0.065	< 0.001	−0.128***	0.033	< 0.001
DiD x South Ostrobothnia	−0.158***	0.044	< 0.001	−0.143***	0.035	< 0.001
DiD x South Savo	−0.258***	0.039	< 0.001	−0.183***	0.017	< 0.001
DiD x Kainuu	−0.177	0.138	0.200	−0.033	0.091	0.720
DiD x Kanta-Häme	−0.063	0.058	0.280	−0.015	0.053	0.771
DiD x Central Ostrobothnia	−0.246***	0.051	< 0.001	−0.150***	0.024	< 0.001
DiD x Central Finland	−0.151	0.111	0.1745	−0.078	0.096	0.417
DiD x Kymenlaakso	−0.041	0.075	0.584	0.012	0.058	0.841
DiD x Lapland	−0.465***	0.113	< 0.001	−0.179	0.093	0.056
DiD x Pirkanmaa	0.054	0.061	0.379	−0.008	0.083	0.921
DiD x Ostrobothnia	0.101***	0.042	0.017	0.112**	0.043	0.011

Table 6 Separate effects for regions

Separate DiD effects for regions; Dependent variable: ln(price), ± 72-week study period						
DiD x North Karelia	−0.238***	0.042	< 0.001	−0.133***	0.021	< 0.001
DiD x North Ostrobothnia	−0.143	0.073	0.054	−0.054	0.067	0.4288
DiD x North Savo	−0.366***	0.055	< 0.001	−0.150***	0.030	< 0.001
DiD x Päijät-Häme	−0.161	0.083	0.054	−0.092	0.073	0.211
DiD x Satakunta	−0.128**	0.049	0.010	−0.012	0.054	0.822
DiD x Uusimaa	−0.034	0.039	0.378	−0.008	0.045	0.856
DiD x Southwest Finland	−0.234***	0.039	< 0.001	−0.087	0.046	0.062
Time FE	x			x		
Market FE*	x			x*		
Specialty FE	x			x		
Practice FE				x		

Standard errors are clustered at practice level for all models

*Procedure-by-region market fixed effects, are replaced with procedure fixed effects, when practice fixed effects are included

** $p < 0.05$

*** $p < 0.01$

Table 7 Separate effects for income groups

Separate DiD effects for income groups; Dependent variable: ln(price), ± 72-week study period						
Shock 1						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x Low income	0.001	0.012	0.881	−0.003	0.008	0.752
DiD x Median income	−0.010	0.012	0.362	−0.010	0.008	0.195
DiD x High income	0.010	0.013	0.433	0.001	0.007	0.940
Shock 2						
	β_1	**Std. E**	**P-value**	β_1	**Std. E**	**P-value**
DiD x Low income	−0.101***	0.019	< 0.001	−0.046***	0.020	< 0.001
DiD x Median income	−0.117***	0.018	< 0.001	−0.057***	0.020	0.005
DiD x High income	−0.092***	0.020	< 0.001	−0.051***	0.022	0.019
Time FE	x			x		
Market FE*	x			x*		
Specialty FE	x			x		
Practice FE				x		
Patient & Physician characteristics	x			x		

Standard errors are clustered at practice level for all models

*Procedure-by-region market fixed effects, are replaced with procedure fixed effects, when practice fixed effects are included

** $p < 0.05$

*** $p < 0.01$

Table 8 Robustness analysis: spillover effects on the nonexposed group after shock 2

Model (4): Spillover effects on the nonexposed group; Dependent variable: ln(price)					
Shock 2		Nonexposed group		Exposed group	
Model period		± 72 w	± 72 w	± 72 w	± 72 w
N		9970	9970	14,603	14,603
POST	β_1	0.057	–0.093	–0.023	–0.232**
	Std. E.	0.161	0.131	0.135	0.103
	P-value	0.727	0.481	0.866	0.026
POST*week	β_2	–0.001		–0.002**	
	Std. E.	0.001		0.001	
	P-value	0.401		0.046	
Time FE		x	x	x	x
Market FE		x	x	x	x
Specialty FE		x	x	x	x
Practice FE					
Patient & Physician characteristics					

Standard errors are clustered at practice level for all models

**$p < 0.05$

***$p < 0.01$

Table 9 Robustness analysis: potential bias from the 2016 reform overlap. Placebo date of 2013 reform

Model (1) with reform placebo date; Dependent variable: ln(price)						
Shock 1						
Model period	–72 w, + 32 w			–72 w, + 32 w		
N	42,007			42,007		
	β_1	Std. E	P-value	β_1	Std. E	P-value
DiD (reform placebo)	–0.017	0.009	0.050	–0.010	0.005	0.078
Time FE	x			x		
Market FE*	x			x*		
Specialty FE	x			x		
Practice FE				x		
Patient & Physician characteristics						

Standard errors are clustered at practice level for all models

Time period is restricted to a two-year time window of 72 weeks before and 32 weeks after the policy reform

*Procedure-by-region market fixed effects, are replaced with procedure fixed effects, when practice fixed effects are included.

** $p < 0.05$

*** $p < 0.01$

Table 10 Robustness analysis: potential bias from the 2016 reform overlap. Interrupted time series approach

Dependent variable: ln(price)			**Model (5): Baseline**	**+ practice fixed effects**
Shock 2		Model period	± 72 w	± 72 w
		N	9970	9970
	New_policy	β_1	−4.011	−7.707
		Std. E.	7.962	6.700
		P-value	0.615	0.253
	New_policy*week	β_2	0.031	0.060
		Std. E.	0.063	0.053
		P-value	0.623	0.261
Time FE			x	x
Market FE*			x	x*
Specialty FE			x	x
Practice FE				
Patient & Physician characteristics				x

Standard errors are clustered at practice level for all models.

*Procedure-by-region market fixed effects, are replaced with procedure fixed effects, when practice fixed effects are included.

** $p < 0.05$

*** $p < 0.01$

Abbreviations

DiD Difference-in-differences
FCCA Finnish Competition and Consumer Authority
FTHHI Fixed Traveltime Herfindahl–Hirschman Index
MRI Magnetic Resonance Imaging
NHI National Health Insurance
OECD Organization for Economic Co-operation and Development
SII Social Insurance Institution
TWFE Two-way fixed effects

Acknowledgements
I appreciate the comments from Mika Kortelainen, University of Turku; Hennamari Mikkola and Mikko Nurminen, Social Insurance Institution; Visa Pitkänen, FCCA and Tanja Saxell, VATT.

Authors' contributions
The corresponding author Riina Hiltunen takes full responsibility for the contents of this manuscript.

Funding
This research is funded by the Social Insurance Institution of Finland (Grant number 49/26/2016). The funding body had no role in the design of the study, the analysis or interpretation of the data or the writing of the manuscript.

Data availability
The data that support the findings of this study are available from the Social Insurance Institution of Finland, but restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. However, the data are available from the authors upon reasonable request and with the permission of the Social Insurance Institution of Finland and the Finnish Social and Health Data Permit Authority Findata.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Social Insurance Institution, Helsinki, Finland

Received: 11 March 2025 / Accepted: 27 October 2025
Published online: 22 November 2025

References

1. Brown JR, Goolsbee A. Does the internet make markets more competitive? Evidence from the life insurance industry. J Polit Econ. 2002;110(3):481–507.
2. Goldmanis M, Hortaçsu A, Syverson C, Emre Ö. E-commerce and the market structure of retail industries. Econ J. 2010;120(545):651–82.
3. Mehrotra A, Dean KM, Sinaiko AD, Sood N. Americans support price shopping for health care, but few actually seek out price information. Health Aff. 2017;36(8):1392–400.
4. Hibbard JH, Greene J, Sofaer S, Firminger K, Hirsh J. An experiment shows that a well-designed report on costs and quality can help consumers choose high-value health care. Health Aff. 2012;31(3):560–8.
5. Volpp KG. Price transparency: not a panacea for high health care costs. JAMA. 2016;315(17):1842–3.
6. Lieber EM. Does it pay to know prices in health care? Am Econ J Econ Policy. 2017;9(1):154–79.
7. Husiatynski M, Klein TJ, Mikkers M. Increasing price transparency in the Dutch health care market does not affect provider choice. In: Husiatyński M. Three essays on individual behavior and new technologies. Doctoral dissertation. Tilburg: Tilburg University, School of Economics and Management; 2021.
8. Montag F, Winter C. Price transparency against market power. 2020. SSRN: i https://doi.org/10.2139/ssrn.3256476.
9. Cacace M, Ettelt S, Brereton L, Pedersen J, Nolte E. How health systems make available information on service providers: experience in seven countries. Rand Health Q; 2011;1(1):11.
10. Franzini L, White C, Taychakhoonavudh S, Parikh R, Zezza M, Mikhail O. Variation in inpatient hospital prices and outpatient service quantities drive geographic differences in private spending in Texas. Health Serv Res. 2014;49(6):1944–63. https://doi.org/10.1111/1475-6773.12192.
11. Cooper Z, Craig SV, Gaynor M, Van Reenen J. The price ain't right? Hospital prices and health spending on the privately insured. Q J Econ. 2019;134(1):51–107. https://doi.org/10.1093/qje/qjy020.
12. Whaley C, Chafen JS, Pinkard S, Kellerman G, Bravata D, Kocher R, et al. Association between availability of health service prices and payments for these services. JAMA. 2014;312(16):1670–6.

13. Wu S-j, Sylwestrzak G, Shah C, DeVries A. Price transparency for MRIs increased use of less costly providers and triggered provider competition. Health Aff. 2014;33(8):1391–8.
14. Whaley CM. Provider responses to online price transparency. J Health Econ. 2019;66:241–59.
15. Stigler GJ. Public regulation of the securities markets. Bus Law. 1963;19:721.
16. Asker J, Nocke V. Collusion, mergers, and related antitrust issues. In: Ho K, Hortaçsu A, Lizzeri A, editors. Handbook of industrial organization. Volume 5. Elsevier; 2021. p 177–279. https://doi.org/10.1016/bs.hesind.2021.11.012.
17. Schultz C. Transparency and product variety. Econ Lett. 2009;102(3):165–8.
18. Desai S, Hatfield LA, Hicks AL, Chernew ME, Mehrotra A. Association between availability of a price transparency tool and outpatient spending. JAMA. 2016;315(17):1874–81.
19. Chernew M, Cooper Z, Larsen-Hallock E, Morton FS. Are health care services shoppable? Evidence from the consumption of lower-limb MRI scans. National Bureau of Economic Research; 2018. Report No.: w24869. https://www.nber.org/papers/w24869.
20. Nilssen T. Two kinds of consumer switching costs. RAND J Econ. 1992;23(4):579–88.
21. Wu B. Information presentation and consumer choice: evidence from assisted reproductive technology (ART) success rate reports. Health Econ. 2019;28(8):1056–69.
22. Chen J, Miraldo M. The impact of hospital price and quality transparency tools on healthcare spending: a systematic review. Health Econ Rev. 2022;12(1):62. https://doi.org/10.1186/s13561-022-00409-4.
23. Jäntti S. Kansalainen terveyspalveluja valitsemassa Kolmivaiheinen valintamalli julkisissa ja yksityisissä lääkäripalveluissa. Doctoral dissertation.Kuopio University Publications E. Social Sciences 154, Kuopio: Kuopion yliopisto; 2008. https://erepo.uef.fi/server/api/core/bitstreams/469fd359-d195-4646-bd57-c284fe26e099/content
24. Valtonen H, Kempers J, Karttunen A. Supplementary health insurance in Finland. Consumer preferences and behavior. Kela Working Papers 65/2014; 2014.
25. Valtonen H, Kempers J, Karttunen A. Terveystaloustiede 2015. In: Mäklin S, editor. 2015. https://www.julkari.fi/bitstream/handle/10024/125602/URN_ISBN_978-952-302-431-1.pdf?sequence=1
26. Hiltunen R. Yksityisten magneettikuvausmarkkinoiden muutos kilpailun näkökulmasta vuosina 2008–2017. Terveystaloustiede 2019: Terveystaloustieteen päivä 1.2.2019.
27. Tynkkynen L-K, Alexandersen N, Kaarbøe O, Anell A, Lehto J, Vrangbæk K. Development of voluntary private health insurance in Nordic countries – an exploratory study on country-specific contextual factors. Health Policy. 2018;122:485–92.
28. OECD. OECD Data Explorer. Medical technology: Magnetic Resonance Imaging (MRI). https://data-explorer.oecd.org/
29. OECD. OECD Data Explorer. Medical technology: Magnetic Resonance Imaging (MRI) units. 2025. https://data-explorer.oecd.org
30. SII. Yksityisten sairaanhoitopalvelujen hinnat vertailtavissa. 2012. https://www.kela.fi/-/yksityisten-sairaanhoitopalvelujen-hinnat-vertailtavissa. Accessed 20 Sept 2021.
31. SII. Average fees charged for private-sector medical services. 2021. http://raportit.kela.fi/ibi_apps/WFServlet?IBIF_ex=NIT236AL&YKIELI=E. Accessed 25 Oct 2021.
32. MTV. THL:n verkkopalvelu maksanut jo 1,4 miljoonaa euroa – Startup-yritys teki saman 60 000 eurolla. 2016. https://www.mtvuutiset.fi/artikkeli/thl-n-verkkopalvelu-maksanut-jo-1-4-miljoonaa-euroa-startup-yritys-teki-saman-60-000-eurolla/5922238#gs.arsm9x
33. Dunn A, Shapiro AH, Liebman E. Developing a framework for decomposing medical-care expenditures: exploring issues of representativeness. J Health Econ. 2014;33:58–73.
34. Kumpunen S, Trigg L, Rodrigues R. Public reporting in health and long-term care to facilitate provider choice. Geneva, Switzerland: World Health Organization; 2014.
35. Anzai Y, Delis K, Pendleton RC. Price transparency in radiology—a model for the future. J Am Coll Radiol. 2020;17(1):194–9.
36. Arrow K. Uncertainty and the welfare economics of medical care. Am Econ Rev. 1963;53:5.
37. FCCA, Finnish Competition and Consumer Authority. KKV:n Esitys markkinaoikeudelle. Esitys Dnro KKV/1233/14.00.10/2019. 29.9.2020. https://www.kkv.fi/uploads/sites/2/2022/04/r-2019-10-1233.pdf, haettu 14.6.2024. 2020.
38. Brown ZY. Equilibrium effects of health care price information. Rev Econ Stat. 2019;101(4):699–712. http://www-personal.umich.edu/zachb/zbrown_eqm_effects_price_transparency.pdf

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.