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Physician responses to insurance benefit restrictions: The case of ophthalmology

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Abstract

This study examines the impact of social insurance benefit restrictions on physician behaviour, using ophthalmologists as a case study. We examine whether ophthalmologists use their market power to alter their fees and rebates across services to compensate for potential policy-induced income losses. The results show that ophthalmologists substantially reduced their fees and rebates for services directly targeted by the benefit restriction compared to other medical specialists' fees and rebates. There is also some evidence that they increased their fees for services that were not targeted. High-fee charging ophthalmologists exhibited larger fee and rebate responses while the low-fee charging group raise their rebates to match the reference price provided by the policy environment.

KEYWORDS
health insurance, ophthalmology, physician fees, policy evaluation, reference prices

JEL CLASSIFICATION
G18, H51, H53, I11, I13, I18, I38

1 | INTRODUCTION

The impact of health insurance on consumer behavior is well documented (Aouad et al., 2019; Chandra et al., 2014; Dague, 2014; Fu et al., 2018; Higuera & Prada, 2016; Miller et al., 2013). More recently, there has been a growing number of studies evaluating how health care providers respond to changes in insurance arrangements (Whaley & Brown, 2018). Our contribution is to explore physician responses to insurance reforms that only partially affect the services they provide.

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Targeted reforms of social health insurance programs are commonplace in high-income countries, and many health systems have adopted diverse cost-sharing strategies to control the pressure on health care expenditure (Lai et al., 2013; van Gool and Pearson, 2014). Of relevance to this paper are the Australian reforms that placed restrictions on the public contribution for a specific set of out-of-hospital (OOH) services (van Gool et al., 2011). Such reforms are squarely aimed at reducing public expenditure by lowering both the demand for services and the price paid by public insurance.

The Australian reforms, introduced in 2010, provide an opportunity to examine physician responses to social insurance benefit restrictions. For a small set of OOH medical services, Australian patients now have to pay the part of the physician's fee that is higher than a government-determined reference price. For the part of the physician's fee that is below the reference price, patients are reimbursed through public insurance.

As a result of the reform, patients have an incentive to find physicians who charge fees below the reference price, noting that Australian doctor fees are unregulated. Due to this feature, the Australian health care system provides a unique 'laboratory' setting to examine behavioural responses relating to the fees charged by physicians.

Our analysis is focused on one of the medical services that was part of the 2010 reforms: cataract surgery fees. Specifically, we examine the effect of implementing a reference price (cap) on the fees charged by ophthalmologists for cataract surgery provided in the OOH sector; noting that many other types of services performed by ophthalmologists are not directly affected by the reforms. Even cataract surgery performed in the in-hospital (IH) setting was not directly impacted by the reform.

The Australian reforms not only allow us to examine what happens to physician fees for services that are directly affected by benefit restrictions, but also what happens to services that may be indirectly affected. Such indirect effects may occur, for example, if an ophthalmologist alters their fees for services that are unaffected by the reforms to compensate for potential fee reductions for services that are directly affected by reforms (i.e., cataract surgery i.e., performed OOH).

Compared to other medical specialists' fees, our findings show that ophthalmologists reduced their fees by around 28% for those cataract surgeries that are directly targeted by the insurance reform. Ophthalmologists who, prior to the reform, charged very high fees for these services reduced their fees to an even greater extent (approximately 50%) following the reform.

In terms of the rebates paid by government,[1] we find that for physicians who charged very low fees, their rebates increased by 34%; whereas for those physicians who charged very high fees, their rebates declined by 80%. The main driver underlying these results is the competitive market nature of the Australian healthcare system. It is important to note that fees charged by the different physicians for the various procedures are common knowledge in Australia and patients are free to choose the physician they consult with this information.

The indirect effect on ophthalmology items that were unaffected by the reforms indicates a small but statistically insignificant increase in average fees (5%) whereas changes to rebates are statistically significant at an average of 11%. However, ophthalmologists who charged high average fees prior to the reform significantly increased their fees by 9% for items not directly affected by the reforms. In terms of the indirect effect of the reforms on government rebates, we find that for unaffected ophthalmology services, physicians in the lower fee quartile have a larger response compared to high-charging ones.

Our results demonstrate that ophthalmologists are able to alter their fee structure across services to compensate for policy-induced income losses from one part of their income stream. High-charging specialists are more likely to respond to policy-induced changes compared to low-charging specialists.

Our paper provides evidence of the potential unintended consequences of targeted insurance reform. These unintended consequences show that policy makers need to be cautious when seeking to reduce expenditure through co-payment reforms. Provider behavioural changes turn out to be an important factor in determining the overall impact of reforms.

2 | LITERATURE REVIEW

Seminal papers such as those by Sloan (1982) found that more generous insurance programs were associated with higher physician fees and, as a result, medical inflation. Subsequent research has explored the impact that insurance reforms have on physician behaviours (Baicker et al., 2015; Cardon & Hendel, 2001). The types of reforms examined in this supply-side framework include changes to cost-sharing arrangements, fee regulations, fee transparency, and changes to deductibles and benefit eligibility.

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A number of papers examine the impact of such policy changes on fees charged by physicians for health care services (Dafny, 2005; Dranove, 1988). Yu et al. (2019), for example, examine the impact of reforms that increased the threshold amount (deductible) needed for patients to qualify for additional insurance coverage in Australia. They find that fees increased for patients who physicians knew were close to the qualifying threshold amount.

Whaley and Brown (2018) examine the impact of introducing a reference price for a number of common procedures. In this instance the reference price was introduced in one setting but not another, giving patients a greater incentive to shop around for lower charging physicians. Counterintuitively, the authors find evidence of fee reductions in the sector with no reference price but no change in fees with the reference price. Whaley and Brown (2018) suggest that this result may be explained through further consumer market segmentation induced by the introduction of the reference price. Accordingly, the introduction of the reference price made price-sensitive patients switch to the other sector – leaving less price-sensitive patients in the sector with reference prices.

Robinson and Brown (2013) investigate the fee-charging patterns of physicians following the implementation of a benefit restriction (from an employer-sponsored insurance scheme) leading to rising out-of-pocket cost for employees. The paper evaluates the impact of the reference-price policy on fees for knee and hip replacement surgeries. Heterogenous results show that volumes of surgical operations decreased in the high-price facilities and increased in the low-price ones. In contrast, there is evidence of fee reduction in both categories, with greater reduction documented in the high-price facilities relative to the low-price ones.

Collectively, these papers show that the regulatory changes aimed at curbing expenditure growth have, in all instances, led to unintended consequences. The studies indicate that physicians have the capacity to offset policy-induced revenue losses through a variety of means: increase in volume, increase in fees, increase in the volume of complex and higher fee services. This reflects the many idiosyncrasies of the health care market, including asymmetric information, imperfect agency, moral hazard, non-market-based pricing mechanisms and non-competitive market structures (Dafny, 2005; Dranove, 1988).

In this paper, we explore such unintended consequences further. We evaluate the impact on individual physician fees when insurance benefit restrictions are imposed on only part of that physician's revenue stream. Our contribution is to examine what happens in response to such a change in the context of unregulated physician fees.

3 | EMPIRICAL CONTEXT – AUSTRALIAN FUNDING ARRANGEMENTS AND THE CAPPING REFORM

The Australian health care system is a patchwork of insurance programs funded through federal and state governments, private health insurers and patient co-payments. For the purposes of this paper the most salient feature of the system is the Medicare Benefits Scheme (MBS). This program offers rebates for over 5700 different types of medical services. Each of these services is described in the MBS alongside a fixed, government-determined, benefit that patients are entitled to. The MBS is a federal government health insurance program that covers services delivered in the OOH sector as well as IH for private inpatients.

Under MBS arrangements, physicians have complete freedom over their fees. Physicians can choose to charge different fees to different patients at their discretion. In the OOH sector, patients must pay the gap between the physician's fee and the Medicare benefit. It is important to note that private health insurance cannot cover care received within the OOH sector. For most specialists' services, including ophthalmologists, the fee charged by physicians is well above the Medicare benefit, leaving patients with a co-payment.

Since 2004, these Medicare arrangements have been supplemented by the Extended Medicare Safety Net (EMSN). To qualify for EMSN benefits, families must reach a threshold in out-of-pocket costs for services that are delivered OOH. Patients accumulate out-of-pocket costs by paying the gap between the physician's fee and the Medicare benefit.

Since the EMSN's introduction, there has been a lower threshold for concession cardholders, and a higher threshold for the general population, and both are indexed by the Consumer Price Index (CPI) annually. Concession cardholders include those who receive government welfare payments (including the aged pension, unemployment benefits, carer payments and disability pension), or have low incomes. Around one million Australians qualify for the EMSN each year (around 1 in 20 individuals).

Once a family reaches their threshold, the EMSN will cover 80% of any gap payment for the remainder of the calendar year, but only for services that are provided in the OOH sector. The gap is defined as the difference between the physician's fee and the fixed Medicare rebate. The EMSN does not cover services that are delivered in the inpatient

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setting. By contrast, private health insurance complements MBS coverage of inpatient services, noting that there is no private health insurance cover for OOH services covered by the MBS.

Between 2004 and 2010, government EMSN expenditures increased, on average, by 20% per year, and gave rise to high levels of fee inflation for certain medical services (van Gool et al., 2009). As a result, the government introduced a new set of reforms in 2010 that placed limits (also called caps) on the amount of EMSN benefit that could be paid for a small number of MBS services.

In all, 71 caps were placed on MBS items in 2010. Although there are over 5700 MBS items, these 71 items were selected by the government because they explained the vast majority of EMSN expenditure and exhibited the highest growth in fees. The 71 capped items comprised all 11 assisted reproductive technology (ART) services and 57 private obstetric services, as well as one capped item relating to varicose veins treatment, one item on hair transplantation for alopecia and one item on cataract surgery (Department of Health and Ageing, 2009a; van Gool et al., 2011). In effect, the caps restrict the amount of EMSN benefit that patients are entitled to for each claim. Once the maximum amount of EMSN benefit is reached for a service that is capped, the patient must cover 100% of any physician fee beyond the capped amount. Hence, the Medicare rebate plus the EMSN cap can be regarded as a reference price (More details on the mechanics of how caps work are provided in Appendix A).

Capping EMSN benefits for cataract surgery provides an interesting case study in physician behavior. This is because: (i) only one specific cataract surgery item is capped from a group of 168 MBS items that are commonly billed by ophthalmologists; (ii) cataract surgery can be billed either in the IH or OOH setting, which allows physicians to switch between settings and, in effect, determine whether they are bound by the reference price; (iii) there is substantial variation in the fees charged by ophthalmologists for cataract surgery (van Gool et al., 2011). In this context, there is not only the potential for several different types of behavioural responses but also considerable response heterogeneity across ophthalmologists.

4 | CONCEPTUAL FRAMEWORK

Our conceptual framework is based on provider behaviour models such as those outlined by Godager and Wiesen (2013) and Chen and Lakdawalla (2016). Their insights identify the factors and trade-offs that motivate physicians that, in turn, drive our empirical strategy and interpretation of results. The conceptual framework starts by considering a physician's utility function that captures both selfish and altruistic behavioural motivations. Selfish motivations comprise a physician's personal income and altruistic considerations include the satisfaction and health benefits of the patient as well as the patient's financial position. We assume that ophthalmologists operate in a monopolistic competitive market with considerable discretion over the fees they charge. We also assume that both patients and physicians believe that greater health care bestows greater health benefits.

Equation (1) illustrates a simple utility function of physician, i, that incorporates both selfish and altruistic motivations. In this framework, the physician seeks to maximise a weighted average of patient well-being and physician income.

$$U_i = (1 - \alpha_i)\left[\sum_{j=1}^{n}(P_X - C_X)_j\right] + \alpha_i\left[\sum_{j=1}^{n}(\nu F(X) - P_X X)_j\right] \tag{1}$$

where P_X is the fee charged by a physician and C_X; the associated cost of healthcare delivery. Hence, the sum of unit level profits is weighted by parameter ($1–\alpha_i$) to reflect a physician's index for each patient.[2] In the equation, the parameter α_i is an index of the how important the physician regards their patient wellbeing in their own utility. Suppose health, F(.), is produced using a good or procedure X. The physician cares about the patient's – j's – health status as a result of X as well as the patient's financial implications of purchasing X with prices P_X. Note that the framework can be extended to incorporate insurance premiums but in our public insurance context we will ignore such factors. The physician income is derived from all the services provided to $j = 1, ..., n$ patients as is the altruistic part of the physician's utility function. This recognises that patients receive different services from the provider at different prices.

The framework allows for heterogeneity in provider motivations by placing different weights on selfish and altruistic considerations. For example, some physicians may place greater weight on the utility derived from their own personal income, whereas others may be more concerned about their patient's health status or financial welfare. Accordingly, the

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framework (and the empirical specification) should allow for such potential variation between physicians' motivations and consequent impact on behaviour.

There are two aspects of provider behaviour that are of interest in this paper. The first is a price response and the second is the decision to bill services in the in-hospital or out-of-hospital sector. This focus is partly driven by data availability but also because the Australian health care system provides a unique 'laboratory' setting to examine these potential behavioural responses. As noted, under MBS arrangements, physicians have complete freedom over the fees they charge and have the ability to switch the billing of their services from the IH to the OOH sectors, and vice versa.

The framework also needs to account for the interconnectedness between the physician's own financial position and that of the patient. For example, if patients face higher co-payments then this not only affects the patient's utility but can also reduce the demand for the provider's services which, in turn, affects the provider's own financial position. In other words, higher (lower) co-payments can negatively (positively) impact the selfish and altruistic aspects of the provider's utility function simultaneously. The more price responsive the demand for a particular medical service, the bigger the impact of a change in co-payments on provider utility through both altruistic and selfish aspects of the provider utility function.

In our conceptual framework, the impact of insurance is gauged through its effect on the price elasticity of the demand. In the event a patient qualifies for the EMSN, for example, the demand schedule pivots to become more price inelastic as patients pay less than 20% of the fee charged by physicians. The impact of EMSN capping arrangements, on the other hand, has the opposite effect. Caps will make patients more price sensitive but only under two very specific circumstances: (i) caps were imposed on a small number of medical services that were selected by the government; and (ii) impact was only felt by physicians/patients who faced prices greater than the reference price. Hence, we view the EMSN capping arrangements to have made demand more price elastic for (i) capped services and (ii) physicians that charged above the reference price. Due to both altruistic and self-interest motivations, we therefore expect to observe that provider fees for capped services that are above the reference price would fall once capping arrangements come into place. It is highly plausible that physicians who were charging very high fees prior to capping arrangements (compared to their peers) may reduce their charges by more than others but it is unclear if those charging very low fees will raise their prices.

Aside from the direct impact on pricing for capped items, physicians could also choose to alter the prices charged for uncapped items. This is particularly true in the case of ophthalmology, where capping arrangements only affected one out of 168 ophthalmology services that are listed on the MBS at the time of the policy. It is plausible therefore that physicians may increase prices for services that are unaffected by capping arrangement. In our framework, this would be an anticipated behavioural response for those physicians where selfish motivations dominate and who are attempting to offset potential revenue losses resulting from the capped item.

Unfortunately, the empirical context makes it more difficult to anticipate the direction of OOH billing behaviours following the introduction of caps. Certainly, with the introduction of the EMSN in 2004, there were both selfish and altruistic reasons for services to be billed in the OOH sector for those patients who did not have private health insurance. The narrative is different for the imposition of caps – but the financial advantages of being billed in the OOH sector have reduced substantially. Given that cataract surgery is most commonly billed in the IH sector, the lack of a financial incentive to do otherwise may induce physicians to revert to the norm.

5 | DATA

The analysis uses the Sax Institute's 45 and Up Study. Prospective participants were randomly sampled from the Government's Services Australia enrolment database. A total of 267,153[3] participants joined the study by completing a baseline questionnaire (between January 2006 and December 2009) and giving signed consent for follow-up and linkage of their information to routine health databases. About 18% of those invited participated. The 45 and Up Study sample equates to approximately one-tenth of the NSW population aged 45 and over and oversamples people above age 80 and residents of rural and remote areas (Banks et al., 2008). The 45 and Up survey is a representative sample (Johar et al., 2012) and provides a rich picture on patient demographic characteristics, socio-economic status and health status.

Importantly, the 45 and Up Study links a range of administrative claims datasets including MBS data for private inpatient and OOH services. MBS data are the gold standard in Australia when it comes to accuracy on service utilisation across a wide range of medical services, fees charged by physicians, co-payments and government benefits. The MBS dataset also contains a unique de-identified number for each physician, including details of their specialty group.

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This allows us to extract physician information for all MBS claims and establish a panel dataset of physician fees over time and across numerous patients who participate in the 45 and Up Study. Among ophthalmology specialists, we identify a subset of physicians with at least one claim of the capped item (item 42702) and exclude those who have never claimed this item.

The pre-policy observation period starts in January 2008, as this timeframe closely aligns to the 45 and Up Study participants completing their survey. We restrict our observation period to the end of December 2011 because the government introduced additional caps in January 2012.

We use a balanced panel of MBS items for ophthalmology as well as the comparison specialty groups of dermatology and gastroenterology. The balanced panel refers to a set of items that appear in each year of the observation period and excludes those that only appear in some years. The reason for doing so is to avoid the influence that the introduction of new services or technologies, over the course of the observation period, may have on the main results.

6 | EMPIRICAL STRATEGY

The introduction of EMSN caps in January 2010 presents a natural experiment that enables estimation of causal impacts. The introduction of caps on OOH cataract surgeries allows us to compare physician fee changes for items that are capped with those that are not capped. Such uncapped items include IH cataract surgery, all other ophthalmology items in both the OOH and IH settings, as well other types of specialist physicians' items that did not have EMSN caps imposed in 2010.

We contrast fee changes among ophthalmologists to those in the dermatology and gastroenterology specialist groups. The selection of the comparison groups is justified on the basis of four fundamental features: (i) no dermatology or gastroenterology item is capped during the observation period; (ii) there is large within-specialty variation in reported claims for MBS items; (iii) there is a flexibility for physicians to switch service provision between IH and OOH settings; (iv) the specialty comprises both consultations and procedures and are highly renumerated in Australia (v) they are all relatively small specialties (all less than 1000 practitioners) across Australia with long training periods and a high degree of urbanisation, and (vi) provide the majority of practice in private hospitals (58% in 2016 for gastroenterologists, 90% for ophthalmologists and 94% for dermatologists). Dermatologists and ophthalmologist have their own colleges for accreditation, whereas gastroenterologists are part of a larger group for accreditation, the Royal Australasian College of Physicians. Because of the greater similarities in private practice and accreditation structure between dermatologists and ophthalmologists, dermatologists are our default comparison group, but gastroenterologists are used as a robustness check. Alternatives discarded included otolaryngology (less than 500 across Australia and part of a larger craft group – the Royal Australasian College of Surgeons). Our strategy of using an alternative specialist group has been employed previously (Robinson & Brown, 2013).

Compliance with both first and second features supports the identification strategy for a causal interpretation of results. The third and fourth features demonstrate that ophthalmologists and dermatologists are comparable in the sense that they divide their time between consultations and procedures performed in both the IH and OOH settings. Fifth and sixth features provide a background for similar training and operational contexts across ophthalmologists and the control groups.

We use the difference-in-difference (DiD) methodology. Our strategy captures within-physician impacts by adding physician fixed-effects in all econometric specifications. We explore pre-policy and post-policy claims of MBS items to identify the causal impacts using the triple DiD method. The triple DiD strategy compares pre-policy to post-policy outcomes of the treatment group with those in comparison groups across IH and OOH settings. Table A1 summarises the identification design underlying the methodology.

Our main measure of outcome is to examine what happened to specialists' fees and rebates following the introduction of EMSN cap restrictions. The following regression model specification is used[4]:

$$\begin{aligned}\ln\left(\text{fee}_{\text{eipt}}\right) &= \boldsymbol{\beta_0} + \boldsymbol{\beta_2}(\text{policy}_e) + \boldsymbol{\beta_3}(\text{OOH}_e) + \boldsymbol{\beta_4}(\text{post}_t \times \text{policy}_e) + \boldsymbol{\beta_5}(\text{post}_t \times \text{OOH}_e) \\ &+ \boldsymbol{\beta_6}(\text{policy}_e \times OOH_e) + \tau_{\text{DiDiD}}(\text{policy}_e \times \text{post}_t \times \text{OOH}_e) + \delta_t + \alpha_p + X'_{\text{it}}\boldsymbol{\beta_7} + Z'_{\text{ip}}\boldsymbol{\beta_8} + \varepsilon_{\text{eipt}}\end{aligned} \tag{2}$$

where the dependent variable – $\ln(\text{fee}_{\text{eipt}})$ – represents the natural log of real specialist fees charged for a claim e to a patient i by specialist p at time t. We repeat this process for specialist rebate claims. The dependent variable is measured

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for each service provided by the specialist and correspondents to an MBS claim. We estimate Equation (2) separately for (i) direct treatment, which focuses on the capped cataract surgery item for an *intended impact* of the policy and (ii) indirect treatment, which focuses on the uncapped items for an *unintended impact* of the policy. We separate the estimation of Equation (2) for each sample structure of the MBS items required to estimate direct and indirect treatment effects. However, the sample consists of the same composition of treated ophthalmologists – respectively for the capped and uncapped MBS items – and the comparison group.

For the direct treatment regression, the policy_e variable is used to characterise the treatment for cataract surgery. We implement this by assigning 1 to the cataract surgery (item 42702) and 0 to the comparison items. For the indirect treatment regression, we repeat the same process for the indirect treatment where we assign 1 to all uncapped items within ophthalmology and 0 to the comparison items. Note that the comparison group for the baseline results is dermatology.

The regression model includes year fixed-effects, δ_t, which captures yearly variation in the prices of commodities that are not related to the introduction of the cap. OOH_e is an indicator variable assigned 1 if the delivery of the service is reported to have taken place within the OOH setting, and 0 for IH delivery of the service. Also, we include physician fixed-effects (α_p) in all models to capture stable unobserved characteristics of the specialists for within-physician responsive changes to the medical charges of patients resulting from policy introduction (Whaley and Brown (2018)). $\boldsymbol{\beta}_2$ captures the trend in fees for cataract surgery relative to the MBS items within the comparison group. $\text{post}_t \times \text{policy}_e$ is the interaction term for policy and timeline indicators. The estimate for $\boldsymbol{\beta}_4$ provides us with the causal impact of the cap restriction policy on charging patterns without accounting for the in or out of hospital setting. $\text{policy}_e \times \text{post}_t \times \text{OOH}_e$ is the triple interaction term which accounts for the fact that the EMSN does not apply to the IH setting. The$\boldsymbol{\tau}_{\text{DiDiD}}$, which is the parameter of interest in our model, refers to the differential DiD effects on patients across the setting of services (i.e., differential impact between OOH and IH services). Within the context of Equation (2), this implies the impact of the policy net of the IH component represented by $\boldsymbol{\beta}_4$. To address concern that OOH or IH is not independent of the policy changes (given that specialists can alter this aspect of their billing behaviour), we also estimate a standard two-way DiD model (described below). To control for time-varying patient and physician characteristics, and to increase the precision of our estimates, we include patient/household-level characteristics (X_{it}) and physician-level indicators (Z_{ip}) as covariates. Patient covariates include age and binary indicator variables for gender, marital status, concession card ownership, non-English speaking background and private health insurance ownership. Additional patient controls are indicators for educational qualification, labour force participation and household income levels. Physician covariates include five categories of Socio-economic Indexes for Areas (SEIFA) and Accessibility/Remoteness Index of Australia (ARIA) respectively from the postcode location of physicians. $\varepsilon_{\text{eipt}}$ denotes an error term. We base our selection of covariates on previous studies showing evidence of underlying price discrimination tendencies for physician behaviour on the basis of patient characteristics in Australia (Johar et al., 2017). We cluster standard errors at the physician level to account for correlation of variation in procedures performed by a specialist. As a robustness check, we also cluster standard errors at the postcode level to account for spatial correlation of physician charging behaviour across geographical areas.

For a causal interpretation of $\boldsymbol{\tau}_{\text{DiDiD}}$, the parallel trend assumption implies that the relative fee structure would have continued on their pre-policy trends had it not been for the policy change that affected ophthalmologists and not dermatologists. That is, our framework requires the relative fees of ophthalmologists and dermatologists OOH to trend the same way as the relative fees of ophthalmologists and dermatologists IH. Figures A3 and A4 plot quarterly average trend data, and shows support for parallel trends between relative fees between cataract surgery, uncapped ophthalmology items, and dermatology items. Where a steep rise in OOH ophthalmology fees is observed in Figure A3, this occurs after the announcement date of EMSN caps, and we explore these announcement effects later in our results. We further provide support for our empirical approach in three additional ways. First, we compare baseline characteristics for the dual treatments and the control group. We report normalised z-values for patient covariates between the ophthalmology treatment group and dermatology control group in Table A2. The normalised z-values are all below a quarter (except two) which is the rule of thumb suggested by Imbens and Wooldridge (2009) – indicating that there is no difference in the baseline characteristics of the treatment and comparison groups.[5] Second, we provide an alternative comparison group, using services provided by gastroenterologists as a robustness test. Third, we offer an additional falsification test, using a placebo model whereby we re-estimate our model during a time period where there were no policy changes.

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Finally, we address concerns over the endogeneity of hospital setting by removing the 'third difference' (comparison between OOH and IH) – using a linear two-way DiD model (Equation (3)) separately for OOH and IH outcomes.

$$\ln\left(\text{fee}_{\text{eipt}}\right) = \boldsymbol{\beta_9} + \boldsymbol{\beta_{10}}\left(\text{policy}_e\right) + \tau_{\text{DiD}}\left(\text{post}_t \times \text{policy}_e\right) + \delta_t + \alpha_p + X'_t\boldsymbol{\beta}_{11} + Z'_p\boldsymbol{\beta_{12}} + \mu_{\text{eipt}} \tag{3}$$

$\boldsymbol{\beta}_9$ is the constant term while $\boldsymbol{\beta}_{10}$ captures the trend in fees for cataract surgery relative to the MBS items within the comparison group. The estimate for τ_{DiD} provides us with the causal impact of the cap restriction policy on charging patterns in a similar manner with $\boldsymbol{\beta}_4$ without the assumption that hospital setting was independent of EMSN changes. τ_{DiD} presents sectoral DiD estimates for OOH and IH separately (DiD_OOH and DiD_IH). This approach helps demonstrate the pathway for achieving final treatment effect from DiDiD, as the setting is now defined as part of the outcome (e.g., fees for OOH capped cataract surgeries). Using the decomposition approach above is useful in that it facilitates the interpretation of the DiDiD treatment as follows: overall treatment effect (τ_{DiDiD}) = treatment effect OOH ($\tau_{\text{DiD\_OOH}}$) – treatment effect IH ($\tau_{\text{DiD\_IH}}$). Other variables are as per Equation (2).

7 | ESTIMATION RESULTS

7.1 | Summary statistics

Summary statistics of physician fees and claims patterns in Table 1, Column 3 show that the capped cataract surgery has an average fee per service of $1,393, which is more than the average fee for all other categories combined (including uncapped items for affected ophthalmologists). As expected, average rebate per claim (Column 4) demonstrate the same pattern. In contrast, the summary of average claims in Column 5 shows that cataract surgery has the smallest physician average claims of 77 while dermatologists and uncapped items share considerably large physician average claims of 1126 and 1,173, respectively. While the number of claims for the cataract surgery is small compared to other uncapped items, affected ophthalmologists may be more impacted by small movements in the cataract surgery charges than by uncapped items due to the disproportionate mean fee per service. The sample of specialist observations used in this research somewhat closely matches the population of specialists across NSW as reported in recent documents.[6] For example, our sample consists of 252 ophthalmologists offering cataract surgeries while the total sample of NSW practicing ophthalmologists are 304. The difference here may be explained by those not providing cataract surgeries among other factors such as year lag in reporting for both numbers. This gives credence to the representativeness of the sample of observations used in this research.

7.2 | Main results

Panels A and B of Table 2 present the estimates of the direct and the indirect treatment effects from Equation (2). All specifications in Table 2 include controls, physician fixed-effects and year dummies using dermatology items as the comparison group. Standard errors of reported coefficients are clustered at the physician level.[7]

TABLE 1 Summary statistics.

Specialist group	Specialist sub-group (1)	# Physicians (2)	Mean fee ($) (3)	Mean rebate ($) (4)	Mean claims (#) (5)	Physician claims minimum (#) (6)	Physician claims maximum (#) (7)
Affected ophthalmologists	Item 42702	252	1392.55	598.93	77.17	1	615
	Uncapped items	252	129.14	80.65	1173.1	2	7935
Dermatology	NA	239	106.7	62.42	1126.15	1	7799
Gastroenterology	NA	288	195.64	130.28	460.89	1	2148

Note: Affected ophthalmologists are considered as those who have reportedly claimed at least one cataract surgery (the capped item – MBS item 42702) between 2008 and 2011. NA indicates not applicable.

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TABLE 2 Physician fixed-effect impact of safety net restriction policy on cataract surgery and uncapped items – Dermatology comparison group.

Variables	Dependent variables: Natural log of real fees (1)	Dependent variables: Natural log of real rebates (2)
Panel A: Direct treatment		
Treatment effect (DiDiD) – τ_{DiDiD}	**−0.2818*** **	**−0.3500*** **
	(0.0943)	**(0.0941)**
R-squared	0.6471	0.5960
Observations	288,591	288,591
No. of physicians	491	491
Mean lnfees/lnrebates	**4.4466**	**4.0496**
Mean fees/rebates	**176.96**	**93.89**
Panel B: Indirect treatment		
Treatment effect (DiDiD) – τ_{DiDiD}	**0.0457**	**0.1117***
	(0.0611)	**(0.0580)**
R-squared	0.2571	0.1452
Observations	564,770	564,770
No. of physicians	491	491
Mean lnfees/lnrebates	**4.3943**	**3.9912**
Mean fees/rebates	**111.55**	**71.45**
Physician fixed-effect	Yes	Yes
Year fixed-effect	Yes	Yes
Controls	Yes	Yes

Note: Table 2 presents coefficient estimates of the triple interaction term for cap policy, year and OOH indicators on the natural logarithm of real fees and rebates using the triple DiD estimation approach specified in Equation (2) for Panels A and B. Panel A reports direct treatment results for fees and rebates; while Panel B reports indirect treatment results for the same outcomes. Sample observations in Panels A compare average natural logarithm of real fees (lnfees) and real rebates (lnrebates) for 19,448 capped cataract surgery (item no. 42702) – the direct treatment – to 269,149 observations for dermatology – the comparison items, respectively; while sample observations in Panel B compares average real fees for 295,621 uncapped items – the indirect treatment – to 269,149 observations for dermatology – the comparison items. Note that 6 singleton observations are dropped in the direct treatment regressions. Fees and rebates are adjusted using the *combined seasonal adjustment factors for medical and hospital services* obtained from the consumer price index (CPI) archive of the Australian Bureau of Statistics (ABS). Policy indicator is assigned 1 for item 42702 (direct treatment) or uncapped items (indirect treatment) and 0 for comparison items using the dermatology group; time indicator is assigned 0 for the pre-policy period (2008–09) and 1 for the post-policy period (2010–11); while OOH indicator is assigned 1 for OOH services and 0 for IH services. OOH services and IH services are flagged as mutually exclusive events in the MBS data. All regression models include each indicator variable and all possible (dual and triple) interaction terms. Each panel (and column) is a separate regression including physician fixed-effect, year fixed-effect and controls with robust standard error clustered at the physician level. Controls include both patient-level and physician-level covariates. Patient covariates are age and binary indicator variables for gender, marital status, concession card ownership, non-English speaking background, private health insurance ownership and any additional health insurance policy. Additional patient controls are indicators for educational qualification, labour force participation and household income levels. Physician covariates are five categories of Socio-economic Indexes for Areas (SEIFA) and Accessibility/Remoteness Index of Australia (ARIA), respectively, from the postcode location of physicians. Observations refers to claims level data used in the regression.

***, ** and * represent significance at 1%, 5% and 10%, respectively.

Panel A of Table 2 reports net policy impacts of cap restriction on cataract surgery fees and rebates. The estimated OOH net impact (τ_{DiDiD}) is a decrease of approximately 28.2% in the average fee charged for capped cataract surgeries and is significant at the 1% level. Table 2, Panel B shows the indirect effect of an approximate 5% increase for uncapped ophthalmology items charged in the OOH sector (not statistically significant). Column 2 shows a similar pattern in the impacts of policy implementation on rebates. The impact of policy for the OOH cataract surgeries rebate suggests a decline of 35% and statistically significant at 1%. More importantly, Panel B shows a marginally statistically significant

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increase in average uncapped ophthalmology items' rebates of 11%. The estimated effects from the regressions remain largely stable between specifications with or without covariates.

We perform a series of robustness checks on the baseline results reported in Table 2. Table A4 presents results for alternative comparison group that comprise of gastroenterologists.[8] The results reported in this Table reveal comparable pattern for estimated coefficients across treatment effects between fees and rebates similar to those presented in Table 2. We extend the robustness check on item-level price variation by including item fixed effects in the baseline specification (Table 3) and using a single MBS item as a control in comparison to the one capped cataract surgery item[9] (Table 4)

TABLE 3 Robustness check for direct treatment effects from the baseline regressions using MBS items fixed-effects.

Variables	Dependent variables Natural log of real fees (1)	 Natural log of real rebates (2)
Treatment effect (DiDiD) – τ_{DiDiD}	**−0.2963*** **	**−0.3609*** **
	(0.0943)	**(0.0895)**
R-squared	0.8469	0.8686
Observations	288,591	288,591
No. of physicians	491	491
Mean lnfees/lnrebates	**4.4466**	**4.0496**
Mean fees/rebates	**176.96**	**93.89**
MBS items fixed-effects	*Yes*	*Yes*
Physician fixed-effect	Yes	Yes
Year fixed-effect	Yes	Yes
Controls	Yes	Yes

Note: Table 3 replicates Table 2 Panel A regressions with MBS items fixed effects. See Table 2 for comprehensive set of notes.

***, ** and * represent significance at 1%, 5% and 10%, respectively.

TABLE 4 Robustness check for using identical control item for direct treatment effect.

Variables	Dependent variables Natural log of real fees (1)	 Natural log of real rebates (2)
Treatment effect (DiDiD) – τ_{DiDiD}	**−0.2706*** **	**−0.3961*** **
	(0.0054)	**(0.0866)**
R-squared	0.2080	0.3557
Observations	35,645	35,645
No. of physicians	503	503
Mean lnfees/lnrebates	**6.6239**	**5.9524**
Mean fees/rebates	**926.82**	**430.23**
Physician fixed-effect	Yes	Yes
Year fixed-effect	Yes	Yes
Controls	Yes	Yes

Note: Table 4 replicates Table 2 Panel A regressions using gastroenterology item 32090 in addition to baseline fixed effects on Table 2. See Table 2 for comprehensive notes.

***, ** and * represent significance at 1%, 5% and 10%, respectively.

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both for direct treatment effect models. The estimated impact on the average fee and rebates are identical to the result reported for the baseline specification (Table 2).

We also perform robustness tests relating to the sample composition. In these tests, we relax the restriction of a balanced panel of items and physicians. In each case, we re-estimate the direct and indirect treatment effects using dermatology and gastroenterology comparison groups. These results are not reported here but we can confirm that the magnitudes and patterns of the estimated coefficients are similar to the baseline results reported in Table 2.

A key concern with our DiDiD approach is that the IH an OOH setting is not independent of the policy changes. We observe for example, that while the proportion of IH services for dermatologists was stable at around 1.5%, for ophthalmologists this increased slightly from 93.1% to 94.6% after the policy change. In Table A3, we remove the 'third difference' (differencing between IH and OOH outcomes) and present separately estimated coefficients for treatment effects of OOH and IH services (for fees and rebates).[10] The results show that significant movement in fees especially was predominantly in the OOH sector. For example, fees for OOH capped cataract surgeries fell 32.8%, whereas in the IH setting, there was a statistically insignificant decrease of 4.7%. By decomposing our result into OOH and IH effects, we see that our DiDiD effect is broadly similar to the difference between the OOH and IH effects (columns 1 and 5 in Table A3). This alignment mitigates concern about the endogeneity of the OOH versus IH billing behaviour of specialists following the policy change, and provides support for our DiDiD approach.

7.3 | Distribution of policy impact

7.3.1 | Physician exposure to income shock

We now turn to an investigation of the heterogeneity in the policy impact across different groups of physicians. We examine physician responses according to their levels of fees charged prior to the policy change. Specifically, we calculate the average fees charged in the first six months of 2009, which is the immediate lead-up period to the announcement of the policy. We partition physicians into four quartiles for both the treatments and comparison groups. Ophthalmologists are allocated to a quartile based on the average fee they charged for cataract surgery during this six-month period. Dermatologists are partitioned based on their fees for all services within this period. To estimate the indirect effect, ophthalmologists are also categorised on the basis of their cataract surgery fees. We use Equation (2) to estimate direct and indirect effect across quartiles.

Table 5 presents results of the quartile triple DiD. Coefficient estimates in Table 3, Panel A reveal that the policy impact is significantly larger for physicians who, prior to the policy, were in the top quartile of fees charged. Among these high-charging physicians, fees for cataract surgery fell by approximately 50% after the introduction of EMSN caps. In fact, the overall decrease obtained for the baseline fee results (Table 2, Panel A) is largely driven by this group of physicians. The positive (an approximate 2.85% increase) but insignificant effect found for the physicians in the bottom quartile fee-charge category may seem somewhat unexpected but not necessarily illogical.[11] An alternative explanation for the positive coefficient estimated in the bottom quartile is recognition of reference prices for this group only after policy implementation.[12] However, the results across other quartile groups all indicate fee decreases that are broadly consistent with monotonically increasing magnitudes moving from second lowest to intermediate and highest percentile groups. This implies that, for the vast majority of claims from these physicians, the reference price is still binding, and their patients face the full marginal costs of the fees.

In Table A5, we present heterogenous impacts of the cap restriction policy on rebates. We use the same distribution of specialist groups discussed above to examine differential impacts of the policy on rebates. The composition of heterogenous impacts differ significantly from the fee structure patterns in Table 5. Table A5 shows asymmetric patterns across low- to high-end charging physicians due to differential charging patterns. These are prominent and statistically significant for the lowest- and highest-charging groups, respectively. Precisely, lowest-charging ophthalmologists increase the rebates for cataract surgeries by 34.3% while the highest-charging group decreased it by 80%. There is also a notable transition from positive to negative impact within intermediate groups – between the second and third quartiles – but not statistically significant. These results paint a counterbalancing picture in rebate responses between low- and high-charging specialists to level up with the reference pricing structure. The pattern showcased by quartile distribution of rebates for items not affected defies the self-interest argument behind physicians' drive to maintain their income. One explanation for the seemingly counterintuitive pattern in this Table is the need for low-charging physicians to increase the rebate claims for other items by higher factors compared to the high-charging ones

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TABLE 5 Distribution of direct and indirect fee impacts of cap restriction policy across quartiles of fee distribution.

Variables	Dependent variable: Natural log of real fees Below 25th (1)	25th–50th (2)	50th–75th (3)	Above 75th (4)
Panel A: Direct treatment				
Treatment effect (DiDiD) – τ_{DiDiD}	**0.0285**	**−0.0606**	**−0.2193**	**−0.5036*****
	(0.1646)	**(0.1441)**	**(0.2253)**	**(0.1909)**
R-squared	0.6961	0.6234	0.5879	0.6100
Observations	74,357	64,990	75,745	73,499
Number of physicians	119	77	126	169
Mean lnfees	**4.1271**	**4.3408**	**4.5475**	**4.7593**
Mean fees	**129.19**	**154.17**	**180.59**	**241.71**
Panel B: Indirect treatment				
Treatment effect (DiDiD) – τ_{DiDiD}	**0.1547**	**0.0505**	**−0.1040**	**0.0930***
	(0.1700)	**(0.1116)**	**(0.2286)**	**(0.0482)**
R-squared	0.3123	0.1877	0.1455	0.2561
Observations	143,627	126,407	146,790	147,946
Number of physicians	119	77	126	169
Mean lnfees	**4.2187**	**4.3097**	**4.4245**	**4.6069**
Mean fees	**93.03**	**99.31**	**110.50**	**141.04**
Physician fixed-effect	Yes	Yes	Yes	Yes
Year fixed-effect	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Note: Table 5 presents the distribution of baseline results from Column 1 Table 2 (Panels A and B). Distribution coefficient estimates in Table 3, Panels A and B represent heterogenous direct and indirect fee impacts using quartile triple DiD to redistribute observations. Quartile distribution for the treatment group comprise average fee for the capped cataract surgery in the first half of year 2009 across ophthalmologists while quartile distribution for the comparison group comprise average fee for dermatology items in the first half of year 2009 across dermatologists. The distribution refers to baseline coefficients respectively for direct and indirect baseline treatment effects presented in Panels A and B of Table 2. Table 3 Columns 1–4 present estimated coefficients from the lowest to highest physician average-charge quartiles referenced by the capped cataract surgery. Each column is a separate regression including physician fixed-effect, year fixed-effect and controls with robust standard error. See Table 2 for a list of covariates and additional notes. Observations refers to claims-level data used in each regression. ***, ** and * represent significance at 1%, 5% and 10%, respectively.

for parity. It seems this group have used the reference price dynamics of the cataract surgery to update claims submitted for rebates across items. We interpret this as leveraging spill over effect of the reference price introduced by the reform.

Table 5, Panel B presents results for indirect treatment fee effects for the same categories of physicians. Here we do not find any evidence of monotonicity in the estimates across quartiles and the third quartile estimate indicates a decline in charges, which is contrary to expectation. However, each of the estimates for the three lowest quartiles are statistically insignificant at the traditional levels. In contrast, the estimate for the highest-charging physicians – quartile 4 – represents a very large increase in fees (approximately 9.3%), which is statistically significant at the 10% level. The estimated effect is approximately double that of the baseline indirect treatment coefficient in Table 2, Panel B. For these high-charging physicians, the result signals cross-subsidisation of fees between capped and uncapped items. Notwithstanding, the estimated coefficient for the first quartile is almost twice that of quartile 4. Although this is not statistically significant, it is suggestive of responsive movement in prices towards certain threshold. These findings shed

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light on the factors underpinning physicians' behavioural pattern as a result of the cap policy. In Table A5 Panel B, the results show largely backward increase in estimated impacts of policy for rebates with the exception of quartile 3. The lowest charging group have an increase of 40.8% followed by 18.4% in quartile 2 while quartile 4 increases rebates by 12.5% – all significant between 5% and 10% levels. These increases in rebates patterns across high- to low-charging groups suggests there may be a spillover effect of normal fee recognition regime to rebates and across all acts for affected ophthalmologists (Table 5 and Table A5).

7.3.2 | Patient income categories

Next, we investigate distribution of impacts across patients' ability to pay. This detail may be indirectly retrieved by physicians using the information on the location of patients' residential areas. We use details on household income range provided during the survey to investigate heterogeneous impacts of the cap restriction policy on fees and rebates.[13] This component of our analysis sheds light on the role of the policy on access to care across different levels of affordability. Specifically, we aim to answer the question regarding potential physicians' changing fee patterns for individuals with lower or higher income levels. To achieve this, we divide observations by household income level of each patient using three broad categories namely low, middle and high income. The low-income group represents patients from households with less than $ 30,000 annual income; the middle-income group for households between $ 30,000 and $ 70,000; while the high-income group earns above $ 70,000.

Results reported in Table A6 show that there is no significant difference in the patterns for OOH cataract surgery fee and rebate across the income categories (Table A6 Panel A). However, the patterns of estimated impacts on these outcomes for uncapped items differ across income groups. Estimated coefficients for treatment effects in Table A6 Panel B show that low- and middle-income groups are not affected by the increase in fees and rebates of uncapped items, while coefficients for the high-income group are considerably high and statistically significant. These estimates are also up to three times the estimated coefficients for baseline results in Table 2. These results suggest elements of price discrimination and strategic pricing patterns by the physicians. This can also be interpreted as targeting an increase in fees or rebates for the uncapped items for high-income patients.

7.4 | Announcement effects

Previous research has shown evidence of an announcement effect which could trigger strategic payment and fee-charging behaviours (Dunn & Shapiro, 2015). Van Gool et al. (2011) found a spike in average fees immediately before the introduction of caps, and then a sharp decline in average fees immediately after the introduction of caps.

Such potential announcement effect motivates a further analysis of our results. The EMSN caps were first announced in May 2009, seven months prior to the implementation period, and were fully legislated on October 7, 2009. We check whether our results are sensitive to such announcement effects in two ways. First, we include a linear month-year trend to capture month-year specific behavioural patterns in specialist fees. Inclusion of the time trend absorbs month-specific charging patterns over the years. Secondly, we exclude the periods associated with the spike and sharp decline in cataract surgery. That is, we exclude data from the 3 months prior to and 3 months after the policy implementation to remove potential announcement effects from the analysis.

Columns 1 and 2 of Table A7 present results from the inclusion of a time trend and exclusion of potential announcement effect. The stable (and significant) coefficient estimate in Table A7, Column 1 suggests that including a month-year trend does not make any difference to baseline direct treatment results in Table 2, Panel A. Exclusion of the before and after implementation data shows that the estimated effect is no different to the main result. However, the significant loss in sample size suggests that surgical operations were brought forward from the implementation date to ensure that higher EMSN benefits could be claimed. The results presented in Table A7 are similar to the coefficients in Table 2, Panel A, further supporting the finding that policy anticipation responses do not distort our main results for direct treatment effects.

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TABLE 6 Placebo tests for fees and rebates results.

Variables	Dependent variables: Natural log of real fees (1)	Natural log of real rebates (2)
Panel A: Direct treatment		
Treatment effect (DiDiD) – τ_{DiDiD}	0.1190	0.0772
	(0.0869)	(0.0776)
R-squared	0.6369	0.5942
Observations	235,743	235,743
No. of physicians	690	690
Panel B: Indirect treatment		
Treatment effect (DiDiD) – τ_{DiDiD}	0.0979	0.0651
	(0.0753)	(0.0659)
R-squared	0.2724	0.1471
Observations	465,386	465,386
No. of physicians	771	771
Physician fixed-effect	Yes	Yes
Year fixed-effect	Yes	Yes
Controls	Yes	Yes

Note: Table 5 presents placebo estimates for direct treatment and indirect treatment baseline results presented for fees and rebates in Table 2 Panels A and B, respectively. The process involves hypothesising pre- and post-placebo policy implementation timeline; all embedded within the actual pre-policy period. We design a pre-policy timeline indicator by assigning '0' to sample of observations within years 2005–2006 as a placebo pre-policy period and '1' to those within years 2007–2008 as a placebo post-policy period. Table 5 Column 1 presents placebo result for the baseline direct and indirect treatment effects for fees reported in Table 2 Column 1 while Column 2 presents placebo result for the baseline direct and indirect treatment effects for rebates reported in Table 2 Column 2. Each column is a separate regression including physician fixed-effect, year fixed-effect and controls with robust standard error. See Table 2 for a list of covariates and additional notes. Observations refers to claims-level sample used in each regression.

***, ** and * represent significance at 1%, 5% and 10%, respectively.

7.5 | Placebo tests

A key assumption of our DiD approach is that there are parallel trends in average fees charged by ophthalmologists and specialists in our comparison group. To test this assumption, we perform a placebo test by re-estimating our model for the pre-policy periods using the periods between 2005 and 2008. We revise the timeline indicator in our benchmark econometric models in Equation (2) by assigning 0 to years 2005–06 and 1 to years 2007–08 as there were no relevant policy changes in these periods.

Table 6 presents the placebo test results for the direct and indirect treatments compared to the dermatology comparison group. The estimated coefficients are small and statistically insignificant for fees (columns 1) and rebates (column 2). Results are the same for robustness results from gastroenterology comparison group. These results show there is no evidence of statistically significant convergence or divergence in average fees and rebates between the ophthalmology and comparison groups before the policy implementation.[14]

8 | DISCUSSION AND CONCLUSION

This paper investigates the impact of policy reforms, in the form of insurance benefit restrictions on physician behaviour, using ophthalmologists as a case study. The reforms provide a natural experiment to examine the consequences of an insurance benefit restrictions on one aspect of an ophthalmologist's income stream; namely cataract surgeries billed in the OOH sector. All other ophthalmology services, including cataract surgery when performed in hospital, were not targeted by the policy reform. We examine whether ophthalmologists use their market power to alter

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their fees and rebates claimed across services to compensate for potential policy-induced income losses. We measure both the direct effect on the ophthalmology services targeted by the policy change and the indirect effect on ophthalmology services that were not targeted by the reforms.

In general, our results demonstrate evidence showing that physicians possess higher market power to alter rebates relative to fees, especially with other procedures not directly impacted by the reform. The impact of the reform on fees is restricted to direct treatment while that of rebates cuts across both direct and indirect treatments. This shows that physicians may be trying to offset losses in income from cataract surgery fees with higher claims from uncapped items. This pattern becomes even more prominent when results are evaluated across the distribution of fee spectrum for physicians as well as household income groups. One explanation for this selective behaviour is that physicians may anticipate patients' sensitivity to increase in fees for services not affected thereby opting for competitive prices for the service elsewhere. This is because direct increase in fees may impact patients' out-of-pocket costs. This paper makes a unique contribution to the responsive behaviour of physicians by disentangling the impacts of reform on rebates from fees in this manner.

Our analysis is based on administrative data that captures the activities of physicians for patients that are part of the study sample. However, we cannot observe physicians' total activity and total income thereby limiting the interpretation of our results. The implication of this is that a reduction in fees could be compensated by an increase in the number of cataract surgeries or an increase in the other acts not concerned by the reform. In other words, our results reflect a local effect of the policy reform rather than a global effect (impact of the reform on overall volume and fees) which would be the preferred model. Notwithstanding, the findings of the paper can be used to simulate a global model for compensating impacts of subsidy restriction on physician incomes – as there is evidence that physicians may be responding to protect their financial interests from the local effects.

Ideally, we would examine the impact of these fee changes on overall revenues by also looking at the change in the volume of services pre and post reforms. Unfortunately, one limitation of the 45 and Up study is that we do not have a full count of the physicians' activities. We can only observe the claims made by patients who participated in the study. However, we can utilise aggregate-level national utilisation data obtained from Services Australia and combine this with the results in this paper to provide some back-of-the-envelope aggregate revenue impacts. Based on these national volume data and our estimated price effect, we estimate that the drop in revenue for OOH cataract surgery is $11 million. However, this loss is offset by increases in IH cataract surgery that amounts to $17 million as well as increases in revenue from uncapped items of approximately $34 million. It should be noted that a large component of these revenue changes was due to volume changes. When we hold volumes constant and just estimate the price effect we find that the drop in revenue for OOH cataract surgery has now reduced to $6 million, while increases in the IH cataract and uncapped items have also reduced to $6 million each. This back of the envelope analysis suggests a gain in the overall physician revenue of around $40 million for the price and volume changes while we estimate a $6 million revenue gain attributable to price changes only.

Several checks and alternative specifications confirm that our results are robust. Among others, these checks indicate that the main conclusions of this paper do not alter when: (i) using alternative specialist comparison groups (specific comparison item and gastroenterology control group); (ii) dealing with potential anticipatory behaviours; (iii) implementing a placebo test that confirms the parallel trend assumption required for DiD estimates.

Whilst it is feasible that a reduction in fees will have a negative impact on quality of care, our data is limited in its ability to analyse well defined clinical standards (ACSQHC, 2019). However, the 45 and Up Study does contain information on self-reported rating of eyesight. This information was collected between 2012 and 2015. As a check, we examined whether the self-reported eyesight rating, following the surgery, was different for the cohort of patients who received cataract surgery in the pre-policy period (2009) compared to those in the post-policy period. We found no difference between the two groups at traditional statistical levels. This result is only an indication that the policy has not had a detrimental effect on quality; however, this is consistent with the notion that the variation in cataract surgery fees is driven by policy and funding mechanisms rather than quality factors.

Our findings are consistent with the patterns reported in the literature in terms of direction of estimated effects and coefficients. For example, Fu et al. (2018) documents a reduction in drug expenditures following the removal of drug mark-up level for hospital dispensations on one hand but a rise in expenditures for medical services for the same policy in China. Coefficient estimates of direct treatment effect are similar to results for Robinson and Brown (2013) which reports a stronger decline for providers in high-price facilities relative to low-price ones following regulations of employer's contribution. Our findings of the unintended impacts align with price component results of strategic-mitigation methods adopted by China hospital departments after cost-control regulations as documented by Chan and Zeng (2018).

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Our results for direct treatment effects are somewhat ambitious compared to the estimated coefficients reported in the literature. The differences may be related to different sampling frame and policy context across studies. Chandra et al. (2014) reports an estimated elasticity of −0.16 as a response of low-income population to emergence of cost-sharing arrangement in the US. On the other hand, results from Yu et al. (2019) report an increase of 12% fee for patients whose physicians identify are close to the threshold. This unintended consequence is similar to an increase of 11% estimated for fees for health insurance regulation in the US (Dunn & Shapiro, 2015) which is the same estimated coefficient for rebate in response to the cap restriction policy investigated in our paper.

Our results have important implications on the wider issue of unintended consequences of reforms. In particular, reforms aimed at reducing expenditure may be rendered ineffective. For example, policy makers may target a particular medical service through higher co-payments, restrictions on benefits, or removal from the benefit package all together. Such targeting may occur if policy makers are concerned by the overall expenditure on a particular service, or if there are concerns over the value for money of a service. However, reform targeting of one particular service may be misguided as the (unintended) response from physicians may offset any potential direct benefit of the reform. The findings from this paper provide clear evidence of supply-side response to such reforms. This highlights that the unit of analysis for policy makers (and evaluators alike) should not just be on what happens to an item that has been targeted, or what happens to the patients affected. Analysis is also needed on the physicians' response and its subsequent direct and indirect impacts on important health care issues such as fees, rebates, expenditure and access.

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CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

Data subject to third party restrictions: The data that support the findings of this study are available from Sax Institute (https://www.saxinstitute.org.au/). Restrictions apply to the availability of these data, which were used under the license for this study. Datasets are not directly available from the authors. Interested researchers can contact Sax Institute at sure-admin@saxinstitute.org.au for access to 45 and Up survey and administrative linkage datasets.

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ENDNOTES

[1] Note that while physicians have the freedom to fix prices, the rebate component is fixed and regularly revised by the regulatory body to be reimbursed by the government.

[2] In essence, 1-α_i reflects the importance a physician places on the income they derive from patient *j*.

[3] The underlying number of 45 and Up Study participants captured in the analysis may have depleted due to exclusion conditions relating to missing data, etc.

[4] The standard estimation approach for DID in the literature requires inclusion of a variable for the timeline of policy implementation (post$_t$), where we assign 0 to the pre-policy period (years 2008 and 2009) and 1 to the post-policy period (years 2010 and 2011). However, this has been excluded in our models due to collinearity with the year fixed-effects. The collinearity means that an alternative regression that includes the policy time indicator, post$_t$ associated with parameter (β_1) drops off during the estimation process. The year fixed-effects precludes the inclusion of the policy time indicator post$_t$separately (as commonly used in difference-in-difference methodology) due to collinearity with the year fixed-effects.

[5] Similar patterns are available when gastroenterology comparison group is used for robustness test of the baseline results.

[6] https://www.health.nsw.gov.au/careers/Factsheets/ophthalmology.pdf
https://www.health.nsw.gov.au/careers/Factsheets/dermatology.pdf
https://www.health.nsw.gov.au/careers/Factsheets/gastroenterology-and-hepatology.pdf.

[7] Results remain the same for postcode-clustered standard errors.

[8] This includes methodology sensitivity tests estimating the baseline specification using DiD which ignores the sector of services. In general, results from this estimation are consistent with a priori theoretical expectation. However, we observe a downward bias in the coefficient estimates of the treatment effect (Results available upon request). The source of this bias may be related to lack of adjustment of the specification with important policy details such as sector of reference. Thus, we focus the interpretation of results on the triple DiD models.

[9] We use one gastroenterology MBS item (MBS item 32090) that has comparable features with the capped cataract surgery. We choose MBS item 32090, a renowned colonoscopy beyond the hepatic flexure (with or without biopsy) from the gastroenterology group, with comparable surgical procedure to the cataract surgery – MBS item 42702. This is considered as the preferred comparison item also due to underlying equivalent distribution of IH and OOH patient services for participating specialists between 2008 and 2011.

[10] Estimated coefficients of the decomposed models for IH are moderated with an adjustment factor in the extended model – Equation (2). The inclusion of the OOH indicator in the triple interaction term signifies this approach.

[11] This pattern is reinforced by consistent trends in Figure A1 where there is higher OOH cataract surgery fee for low-end physicians but lower post-policy fee for high-end physicians compared to the pre-policy trends. Fee pattern for IH cataract surgery at the extremes are evenly distributed across periods (Figure A2).

[12] This implies that the heterogeneous impact of the reform reported in Table 5 Panel A for the group whose fees are below the 25th percentile is for physicians who, before the reform, priced their cataract surgery lower than the cap. The implication of the positive impact of the treatment suggests that the introduction of the cap may have signalled the right pricing scheme for this group by giving them information about normal fees for a cataract surgery. This information leads physicians in this group to increase fees – not statistically significant – (Table 5) and rebates (Table A5).

[13] Although we have provided evidence to support robustness of our baseline results to exclusion of controls in general, this analysis provides a unique assessment of whether there is physician-specific sensitivity to patient background.

[14] We also conduct falsification test for the distribution of impacts across fee charging spectrum of specialists within the placebo period to further establish the estimated pattern for fees and rebates in the main results. The estimated coefficients are not statistically significant as expected (Results are available from the authors upon request).

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