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20 October 2020

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October 20, 2020

Abstract

This paper analyzes the welfare impact of a cap on commissions paid by product providers to intermediaries who advise consumers. In contrast to the extant literature, with a downward sloping demand capped commissions have a direct impact on product providers' margins and consumers' prices. I show that a general ban is not welfare optimal as higher commissions do not necessarily lead to higher consumer prices. Starting from a general ban, allowing (marginally) higher commissions leads to lower prices as positive commissions make intermediaries wary to recommend more expensive products to consumers, thus making demand more elastic with respect to price.

Keywords: Advice, Cheap Talk, Commissions, Regulation
JEL Classification: D21, D82, D83, L15

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†I thank my advisors Roman Inderst and Heiko Karle for valuable comments and continuous guidance. This paper has benefited from discussions with Michael Blonski, Steffen Eibelshäuser, Pantelis Karapanagiotis, Sergey Turlo, Julian Wright, and Shiwei Yu. Further, I thank participants of the management and microeconomics brown bag seminar at Goethe University. Any errors are my own. You can find the most recent version of the paper here: `https://drive.google.com/open?id=1diHXazZ5DVSEKcNi2U3Jl08NPciEYOcs`.

1 Introduction

In many industries consumers are uninformed about the suitability of available products and thus rely on information intermediaries for advice. Such industries include brokers for insurance and financial products, physicians who advise on treatments or drugs, and comparison platforms which provide consumers with a ranking of products. In these markets, it is common practice that consumers do not pay directly for advice, but rather that intermediaries receive compensation from product providers in the form of commissions, gifts or discounts among others.[1] In the presence of such compensation structures intermediaries are tempted to recommend a more profitable in favor of a more suitable product. This behavior is called "steering" and may lead to distorted advice.[2]

This issue is compounded by the fact that consumers have generally high trust in intermediaries or for other reasons do not anticipate this behavior. In a report to the European Commission, Chater et al. (2010) conduct an online survey of 6,000 consumers from eight EU Member states and find that the majority of consumers either trust advice completely or mostly, and they do not view the advisor as biased.[3]

[1]See Cummins and Doherty (2006) for a study on the role and the shape of compensation structures for intermediation in the commercial insurance industry.

[2]Several studies find that intermediaries recommend more profitable (for intermediaries) and sometimes inferior products in the presence of commissions. In the industry of mutual funds, Bergstresser et al. (2008) and Zhao (2003) find that broker-sold mutual funds underperform direct-sold funds (before costs). For the life-insurance industry Anagol et al. (2017) conduct field experiments in India and find that advisors recommend the products with the highest commissions even when they are strictly dominated. In the area of specialist health-care services Shafrin (2010) analyzes the effect of different compensation structures on surgery rates and finds that surgeries performed by specialist physicians increase by eighty percent when they are paid on a per-procedure basis.

[3]Many other studies echo these findings such as Malmendier and Shanthikumar (2007, 2014) who find that small investors are naive and take stock recommendations at face value while security analysts deliberately steer these naive investors. Bergstresser and Beshears (2010) find that in the years prior to the financial crisis, adjustable-rate mortgages were sold more often to consumers who were less suspicious or had low financial knowledge and thus struggled to understand the features of this type of mortgage. In an audit study, Mullainathan et al. (2012) find that intermediaries fail to debias their clients and in many cases reinforce biases when they serve their interests such as return-chasing behavior.

Taken together, the intermediaries' incentive to steer and consumers' naivety or lack of awareness of the conflict of interest potentially lead to unsatisfactory market outcomes.

Usually, the focus of regulation lies on the effect on the quality of advice (bias). However, there is also another aspect to be considered, namely the effect of regulation on consumer welfare through product prices.In this study I focus on this second aspect and answer the following questions: (i) How does steering affect the product providers' pricing decision? (ii) How does a cap on commissions affect pricing and, (iii) What is the optimal level of such a regulation from a consumer and overall welfare standard?

In order to answer these questions, I extend the framework in Inderst and Ottaviani (2012a) with heterogeneous consumers. This, crucially, allows me to analyze the interplay between prices and commissions. I consider a model with two firms that sell horizontally differentiated goods and a single information intermediary who receives commissions from these firms for each recommended purchase consumers make. The intermediary has noisy private information about the suitability of a particular product for the consumer, while a consumer has an overall valuation vis-à-vis his outside option as his private information. Thus, the intermediary has to take into account the probability of a purchase conditional on a recommendation. Furthermore, the intermediary has to trade-off the commission he receives for a recommendation with the expected cost when he missells. I then analyze the interaction of commissions and prices in steering advice. This interaction arises due to the heterogeneity of consumers, which introduces a downward sloping demand to the model.

Downward sloping demand represents a key departure from the literature and allows for the aforementioned interaction. Thus, when the intermediary recommends a more expensive product, he risks with a higher probability that the consumer does not purchase at all after a recommendation. It is through this channel, that a firm's demand becomes more elastic to changes in the price when commissions are positive. Judged by this effect alone, positive commissions can thus make firms more wary to raise prices and may ultimately lead to lower prices. This effect must however be weighted up against a more immediate, direct effect, namely that higher commissions reduce product providers' margins and thus induce them to increase prices.

I find that in equilibrium, when consumers hold naive beliefs and commissions are not regulated, there is no pass-on of commissions to consumers and firms alone bear the additional marginal costs represented by commissions.

When turning to regulation, the lack of pass-on of commissions means that increasing the intermediary's liability or concern for good advice does not affect prices, but only the distribution of profits. However, when firms are symmetric and commissions are regulated through a cap, prices are affected by commissions. And, while the trade-off between a higher price elasticity and a smaller margin is generally ambiguous, I still obtain the following clear-cut insight: A complete ban of commissions is, judged from the effect on consumer welfare, not optimal, as allowing (sufficiently small) positive commissions would lead to lower rather than higher prices. When such commissions do not bias advice, which is always the case when firms are symmetric in all relevant aspects, notably costs, such lower prices then translate into higher welfare, which is achieved by positive and not by zero commissions. Furthermore, there exists some positive, optimal cap on commissions which maximizes consumer welfare. This obtains, since, with a complete ban of commissions, prices are the same as when there is no pass-on, and for small caps on commissions the increased price elasticity of demand outweighs the (slightly) reduced margin.

This work complements recent studies such as Inderst and Ottaviani (2012a,b), Teh and Wright (2018), Armstrong and Zhou (2011), de Cornière and Taylor (2019), Hagiu and Jullien (2011), and Murooka (2014) in analyzing intermediaries' influence on product choice.[4] Except for Inderst and Ottaviani (2012a,b) and Teh and Wright (2018), typically

[4]Other studies include Biglaiser (1993) and Lizzeri (1999) where the intermediary provides vertical information about quality, and Lewis and Sappington (1994), Moscarini and Ottaviani (2001), Johnson and Myatt (2006), Ganuza and Penalva (2010), Bar-Isaac et al. (2012), and Bolton et al. (2007) where a seller directly informs a buyer about his match value. Inderst and Ottaviani (2009) investigates the principal-agent conflict between a firm and its sales force.

consumers are assumed to simply follow the advice of the intermediary. In line with the latter papers, I allow consumers to rationally decide whether to follow the intermediary's advice. My model incorporates both prices and commissions since I am interested in the interplay between these two choices, which is in contrast to the works of Inderst and Ottaviani, who consider either only a single strategic firm (c.f. Inderst and Ottaviani (2012b)) or ex-ante homogeneous consumers (c.f. Inderst and Ottaviani (2012a)) and thus, do not allow to investigate the effect of competition on prices. In Teh and Wright (2018) prices and commissions affect the intermediary's decision, however they consider search products such that consumers know a product's match value before a purchase. In contrast, I consider experience goods such that consumers do not know their match value until after the purchase.

The rest of the paper proceeds as follows. Section 2 lays out the model which is analyzed in Section 3. In Section 4, I analyze the effect of regulated commissions and determine the optimal level of regulated commissions from a consumer welfare standard. Finally, Section 5 concludes.

2 Model

Setup I consider a market situation where two firms $n = A, B$ compete for market share through prices, which are aimed directly at consumers, and through commissions, which are paid to a single intermediary. I assume that firm A is more cost-efficient than firm B, i.e. $c_A \leq c_B$.

Valuation, information and advice A consumer's valuation from purchasing either product depends on a binary state variable $\theta = A, B$. He derives a higher utility when the realization of the state variable matches the product. I stipulate that when the product matches the realized state, utility $z + v_h$ is realized and $z + v_l$ otherwise, where $0 < v_l < v_h$.

The parameter z is an idiosyncratic shift in a consumer's valuation for either product, which generates a downward sloping demand curve, as I discuss in further detail below. [5] When the consumer chooses the outside option, he derives utility v_0, which I normalize to zero.

Ex-ante, I assume that for each consumer both products are equally likely to be suitable, so that without advice the expected valuation is $z + E[v] = z + (v_l + v_h)/2$. When the intermediary interacts with a consumer, he obtains private information about which of the products is more suitable for this consumer. This private information is represented by a (posterior) belief that product A is more suitable, $q = \Pr(\theta = A)$. Conditional on q, a consumer's expected utility from either product is thus $z + E[v_A \mid q]$ or $z + E[v_B \mid q]$, where $E[v_A \mid q] = v_l + q(v_h - v_l) = v_h + q\Delta_v$ and $E[v_B \mid q] = v_h - q\Delta_v$. A priori, q is distributed according to the continuous distribution $G(q)$ with density $g(q) > 0$ over $q \in [0, 1]$. Moreover, I stipulate that this distribution is symmetric, i.e. $G(q) = 1 - G(1-q)$. For a given consumer, the parameter z is randomly drawn from the distribution $H(z)$ with density $h(z) > 0$ over some interval $[\underline{z}, \overline{z}]$. It is privately observed by the respective consumer. To guarantee that the firms' maximization problems are well-behaved, I assume

$$\frac{d}{dq}\frac{g(q)}{1 - G(q)} > 0, \tag{1}$$

$$\frac{d}{dz}\frac{h(z)}{1 - H(z)} > 0. \tag{2}$$

Note that then

$$\frac{d}{dq}\frac{g(q)}{G(q)} < 0 \tag{3}$$

[5] The private valuation z can be the interpreted as the part of a consumer's match value the intermediary cannot observe or elicit. Alternatively, the model could be set up such that the consumer's reservation value is his private information.

follows from the symmetry of $G(q)$. Also assume that

$$E[v_A] + \overline{z} = E[v_B] + \overline{z} = \frac{v_l + v_h}{2} + \overline{z} < c_n, \tag{4}$$

so that advice is essential for selling either product. This assumption guarantees that firms cannot circumvent the intermediary and sell directly to uniformed consumers. To ensure that either product can be sold with good advice, I further stipulate that

$$E[v_A \mid q \geq 1/2] + \overline{z} = E[v_B \mid q < 1/2] + \overline{z} > c_n. \tag{5}$$

Consequently, if the intermediary recommends the most suitable product based on the information in the posterior belief, the expected conditional valuation for some consumers exceeds costs.

Contracts I restrict contracts to simple price contracts, p_n. Assuming the final outcome v is not verifiable, firms cannot offer contracts contingent on the final outcome such as warranties or more sophisticated contingent payment schemes. Similarly, firms cannot condition the intermediary's compensation scheme on the final outcome. However, they can condition on whether a product was sold or not, but not whether a competitor's product was sold. Therefore, compensation schemes take the form of a fixed wage F_n and a bonus for a sale f_n. Furthermore, I assume the intermediary has zero wealth and is protected by limited liability, thus $f_n, F_n \geq 0$. Below, I show that it is in the firms' interest to set $F_n = 0$.

Concern for suitability and (regulatory) supervision of advice For the intermediary, who cares directly about received commissions, I stipulate that supervision indirectly imposes a concern for suitable advice. Even when the final outcome v is not verifiable, supervisors have, however, the option to directly "test" the intermediary's advice, e.g., through so-called "mystery shopping" trips, consumer surveys, or consumer complaints. For simplicity, we stipulate that with probability φ a given recommendation is thus "tested" by the supervisory authority. Suppose that this rightly predicts a match with symmetric precision $\mu > 1/2$: When the true state is θ, then the regulator receives the true signal $s = \theta$ with probability μ and the wrong signal $s \neq \theta$ with probability $1-\mu$. Even when this would not constitute proof of an unsuitable recommendation before court, a supervisor may be in a position to impose penalties on a supposedly misbehaving intermediary or to interfere with his business in a more discretionary way. We capture this by a "loss" $L > 0$ for the intermediary. In sum, when given some posterior belief q product A was recommended to the "mystery shopper", the *expected* loss to the advisor is $l_A(q) = L[(1-q)\mu + q(1-\mu)]$. When product B was recommended, the *expected* loss is $l_B(q) = L[q\mu + (1-q)(1-\mu)]$. In light of the following results it is convenient to define

$$\tau = L\varphi(2\mu - 1).$$

Furthermore, I stipulate that the intermediary derives a benefit $b > 0$ when he recommends purchasing either product. This captures the notion that the intermediary can, now or in the future, create sales from different products with the same consumer and effectively restricts consideration to the choice between A and B.[6] The binary nature of suitability also allows to restrict consideration to a game of advice where the intermediary sends at most two different messages m, which are denoted $m = A, B$.[7]

In the following I assume that consumers hold the naive belief that commissions for both firms are zero, or that they are unaware of such commissions and their influence

[6]This assumption does not affect the intermediary's cut-off rule since only the difference in the benefits from recommending A or B matters.

[7]The assumption that intermediaries derive a sufficiently large benefit $b > 0$ from recommending either product to a consumer implies that the intermediary never recommends the outside option. Customers anticipate this behavior and consequently interpret any message the intermediary sends in an informative equilibrium to be either in favor of product A or in favor of product B. Consequently it is without loss of generality to reduce the space of messages to $m = A, B$.

when making their decision. This implies that consumers expect the advisor not to steer them to a particular product, i.e. formally, that the cut-off probability q is $1/2$. This follows the analysis in Inderst and Ottaviani (2012c). Naive consumers expect that the quality of advice is unaffected by the presence and the size of payments from product providers. There is ample evidence which documents such beliefs, such as Chater et al. (2010), who show that many consumers are ignorant or unaware of a conflict of interest of the intermediary. Cain et al. (2005) show that participants in experiments follow advice more often than they should even when incentives are revealed.[8]

Timing of moves At $t = 1$ the two firms $n = A, B$ set prices p_n for consumers and contracts (F_n, f_n) for the intermediary. At $t = 2$ the intermediary interacts with a consumer: He observes private information about the suitability of either product for the respective consumer and sends a message m to the consumer. At $t = 3$ the consumer decides whether to buy either of the products or none. After purchase, the valuation v and all payoffs are realized at $t = 4$.

3 Baseline analysis

3.1 Demand derivation

I focus on equilibria where only pure strategies are played and in which advice is informative. I show that such equilibria always exist. From Assumptions (4) and (5), trade only takes place in those informative equilibria. In an informative equilibrium, both products are recommended with positive probability. Further, given a sufficiently large positive benefit $b > 0$ which the intermediary derives from recommending either product, I can restrict consideration to only two messages from the intermediary, which represent products

[8] For a more thorough survey of the evidence of naive beliefs and their exploitation see the introduction of Inderst and Ottaviani (2012c).

A and B, respectively. I can safely abstract from the case where the interpretation of the messages is swapped.

Lemma 1 *Under (4) a naive consumer either follows the intermediary's advice or does not buy at all.*

Proof of Lemma 1. Suppose the intermediary recommends product A. Then a naive consumer expects to receive a conditional expected utility of $E[v_A \mid q > 1/2]$. If he would deviate to buy product B he expects to receive conditional expected utility $E[v_B \mid q > 1/2]$. Since, $G(1/2)E[v_B \mid q \leq 1/2] + [1 - G(1/2)]\, E[v_B \mid q > 1/2] = E[v_B]$ and $E[v_B \mid q \leq 1/2] > E[v_B]$, it follows that $E[v_B \mid q > 1/2] < E[v_B]$. Due to Assumption (4), firm B cannot set a price to induce purchase and cover its costs. The case when product B is recommended is analogous. ■

Consumer problem Writing the consumer's expected valuation for product n when receiving the message $m = n$ as $E[v_n \mid m = n]$, the consumer will thus follow this recommendation when

$$z \geq z_n^* = p_n - E[v_n \mid m = n]. \tag{6}$$

Otherwise, i.e., for $z < z_n^*$, he chooses not to buy.

Intermediary problem When consumers behave in this way, i.e., when they apply the respective thresholds z_A^* and z_B^*, the intermediary faces the following optimization problem. If he recommends product n, then given his posterior belief q he expects to realize the payoff

$$F_n + F_{n'} + [1 - H(z_n^*)]\, f_n - \varphi l_n(q) + b,$$

where $n' \neq n$. Hence, the intermediary prefers to recommend A over B when

$$[1 - H(z_A^*)]\, f_A - \varphi l_A(q) \geq [1 - H(z_B^*)]\, f_B - \varphi l_B(q). \tag{7}$$

Note that $l_A(q)$ is strictly decreasing in q and $l_B(q)$ is strictly increasing. Furthermore, it is obvious that a firm cannot steer the intermediary's advice through a fixed wage F_n, which is thus set to zero. After substituting for $l_n(q)$, this yields immediately the following observation.

Lemma 2 *The intermediary prefers to recommend product A for all posterior beliefs when*

$$f_A \left[1 - H(z_A^*)\right] - f_B \left[1 - H(z_B^*)\right] \geq \tau. \tag{8}$$

He always prefers recommending product B when

$$f_B \left[1 - H(z_B^*)\right] - f_A \left[1 - H(z_A^*)\right] \geq \tau. \tag{9}$$

When (8) and (9) do not hold, then there exists a cut-off $0 < q^* < 1$*,*

$$q^* = \frac{1}{2} - \frac{1}{2\tau} \left[f_A \left[1 - H(z_A^*)\right] - f_B \left[1 - H(z_B^*)\right]\right], \tag{10}$$

so that the intermediary recommends product A when $q > q^*$ *and recommends product B when* $q < q^*$*. (He is indifferent at* $q = q^*$*.)*

To be brief, we refer to the cases where (8) or (9) apply, respectively, by setting $q^* = 0$ or $q^* = 1$. Also, when q^* is interior, we stipulate that the intermediary recommends A when $q = q^*$. Given that this is a zero-probability event, this is without loss of generality. Thus, τ captures the responsiveness of advice to commissions. Note, however, that in our present analysis it is not the size of f_n *per se* that matters, but the expected commission payment, taking into account the likelihood with which the consumer follows advice, $1 - H(z_n^*)$. As this depends on the prices p_n (cf. expression 6), prices will have a direct effect on market share, namely through z_n^*, and an indirect effect on market share, namely through q^*. I comment on this in detail below.

I obtain consumers' expected valuations (net of z) as follows:

$$E[v_A \mid m = A] = E[v_A \mid q \geq 1/2] = \int_{1/2}^{1} v_A(q) \frac{g(q)}{1 - G(1/2)} dq, \tag{11}$$
$$E[v_B \mid m = B] = E[v_B \mid q < 1/2] = \int_{0}^{1/2} v_B(q) \frac{g(q)}{G(1/2)} dq.$$

Taken together, I have thus arrived at the following demand for each firm.

Lemma 3 *The demand for firm A is given by*

$$\begin{aligned} D_A &= \Pr[q \geq q^*] \cdot \Pr[z \geq z_A^*] \\ &= [1 - G(q^*)]\,[1 - H(z_A^*)] \end{aligned}$$

and that for firm B by

$$\begin{aligned} D_B &= \Pr[q < 1 - q^*] \cdot \Pr[z \geq z_B^*] \\ &= G(q^*)\,[1 - H(z_B^*)]\,. \end{aligned}$$

3.2 Equilibrium

Recall that consumers purchase after a recommendation when their private valuation exceeds a certain threshold and that the intermediary, anticipating this behavior, applies a cut-off rule when advising according to Lemma 2. Further, since consumers hold naive beliefs, they do not internalize the effect of higher commissions or prices on the intermediary's cut-off rule. Firm A's maximization problem is then

$$\max_{f_A, p_A} \pi_A = [1 - G(q^*)]\,[1 - H(z_A^*)]\,(p_A - f_A - c_A) \tag{12}$$

and firm B's maximization problem is

$$\max_{f_B, p_B} \pi_B = G(q^*)\,[1 - H(z_B^*)]\,(p_B - f_B - c_B). \tag{13}$$

Before I consider the equilibrium behavior of firms, I first analyze a firm's optimal strategy for given choices of the competing firm. When the solution to the maximization problem is interior, the first-order conditions characterize optimal choices for firm n [9]:

$$\frac{\partial \pi_n}{\partial p_n} = \frac{\partial D_n}{\partial p_n}(p_n - f_n - c_n) + D_n = 0,$$
$$\frac{\partial \pi_n}{\partial f_n} = \frac{\partial D_n}{\partial f_n}(p_n - f_n - c_n) - D_n = 0,$$

where D_n is the demand for firm n's product. The optimality condition for the price is then

$$p_n^* = \frac{D_n}{\frac{\partial D_n}{\partial p_n}} + f_n + c_n \tag{14}$$

which is familiar from oligopoly pricing. Therefore, for given choices by its competitor, the optimal price consists of the marginal costs necessary to make each sale $f_n + c_n$ and the firm's markup resulting from the trade-off between a higher demand and a higher margin. Next, consider the optimality condition for commissions. Since the profit function is the product of demand and margin, in the optimum it must be that

$$\frac{\partial D_n}{\partial p_n} = -\frac{\partial D_n}{\partial f_n}. \tag{15}$$

To provide addtional intuition, suppose that for some choice of (p_n, f_n) demand responds more strongly to an increase in commission than to an increase in price. Then, the firm could increase commission and price by the same amount. This would leave the firm's margin $p_n - f_n - c_n$ unchanged, but by assumption of the considered cases it would overall increase demand for firm n's product since demand expands more due to the increase in commission than it decreases due to the price increase. Plugging the partial derivatives of

[9] See section A of the Appendix for the derivation of the partial derivatives.

demand evaluated at the optimum for a given choice of the competing firm into 15 yields

$$-g(q^*)\left[1 - H(z_n^*)\right]\frac{1}{2\tau}f_n^* h(z_n^*) - h(z_n^*)S_n(q^*) = -\left(\left[1 - H(z_n^*)\right]^2 g(q^*)\frac{1}{2\tau}\right).$$

Rearranging yields the optimal commission for firm n:

$$f_n^* = \frac{1 - H(z_n^*)}{h(z_n^*)} - \frac{2\tau}{1 - H(z_n^*)}\frac{S_n(q^*)}{g(q^*)}, \tag{16}$$

where $S_n(q^*)$ is the share of consumers the intermediary steers to firm n, i.e. $S_A(q^*) = 1 - G(q^*)$ and $S_B(q^*) = G(q^*)$. Then, plugging back the optimal commission into (14), this simplifies to

$$p_n^* = \frac{1 - H(z_n^*)}{h(z_n^*)} + c_n. \tag{17}$$

Note that z_n^* only depends on p_n^* and not on any other strategic variable. Furthermore, in the optimum firm n's margin is

$$p_n^* - f_n^* - c_n = \frac{2\tau}{1 - H(z_n^*)}\frac{S_n(q^*)}{g(q^*)}. \tag{18}$$

Lemma 4 *When the solution to the firm's maximization problem is interior, firm n optimally sets commissions and prices according to (16) and (17). The optimal commission depends on the optimal price as well as the competitor's choices (captured through q^*) and ceterus paribus, decreases with the concern for good advice τ. The optimal price neither depends on commissions nor the competitor's choices, and as such (higher) commissions are not passed on to consumers.*

Hence, even though the optimal margin (18) depends on optimal commissions f_n^* and consequently on the competitor's choices, the optimal price p_n^* does not.

Even though the price also affects advice and interacts with commissions in this way, at the optimum (interior) choice, it is as if the firm sets its price like a monopolist, ignoring its commission. Next, looking at the optimal commissions, we can make multiple observations. When the intermediary has a higher concern for suitability (large τ), commissions are lower. Further, the second term in (16) can be rewritten as $S_n(q^*)/\left(\partial S_n(q^*)/\partial f_n\right)$ and thus interpreted as the tradeoff between a higher share of consumers steered to the firm and higher marginal costs in the form of a higher commission. Next, I turn to the equilibrium. Since, I am interested in the effect of regulated commissions on prices, I first find sufficient conditions such that each firm has an incentive to set positive commissions in the absence of such regulation. From (16) we know that when the intermediary is too concerned about suitability, then firms would like to set zero commissions. If, on the other hand, the concern for suitability is below some upper bound, then it is optimal for firms to set positive commissions.

Lemma 5 *If the intermediary's concern for good advice, τ, is sufficiently small, then commissions are strictly positive in equilibrium, i.e. if $\tau < \overline{\tau}$ for some $\overline{\tau} > 0$, then $f^* > 0$.*

Proof of Lemma 5. Consider the equilibrium with commissions at $f_A^* = f_B^* = 0$. Then first consider the commission paid by firm A. The derivative of firm A's profit with respect to commissions evaluated at $f_A^* = f_B^* = 0$ and the corresponding equilibrium price $p_A^* = \frac{1-H(z_A^*)}{h(z_A^*)} + c_A$ (from 14) yields:

$$\frac{\partial \pi_A}{\partial f_A}\Big|_{p_A = p_A^*, f_A^* = f_B^* = 0} = \left[1 - H(z_A^*)\right]^2 g(1/2) \frac{1}{2\tau} \frac{1 - H(z_A^*)}{h(z_A^*)} - \left[1 - G(1/2)\right]\left[1 - H(z_A^*)\right].$$

Note here that, at $f_A^* = 0$, z_A^* does not depend on τ (as p_A^* does not depend on τ). A commission of $f_A^* = 0$ is thus surely not optimal for firm A if $\frac{\partial \pi_A}{\partial f_A}\Big|_{p_A = p_A^*, f_A^* = f_B^* = 0} > 0$. Using $1 - G(1/2) = 1/2$, this condition can be rearranged to

$$g(1/2)\frac{\left[1 - H(z_A^*)\right]^2}{h(z_A^*)} = \overline{\tau}_A > \tau.$$

Thus, when the intermediary's concern for good advice is smaller than $\overline{\tau}_A$, firm A can profitably deviate and sets strictly positive commissions. A similar reasoning applies to firm B where the corresponding upper bound is

$$g(1/2)\frac{[1-H(z_B^*)]^2}{h(z_B^*)} = \overline{\tau}_B > \tau.$$

Since the optimal price increases in marginal costs, z_n^* increases, and consequently the upper bound for the concern for suitability is higher for the more cost-efficient firm. Thus, with $c_A \leq c_B$, $\overline{\tau}_A \geq \overline{\tau}_B$. I define the minimum of these upper bounds as $\overline{\tau} \equiv \min\{\overline{\tau}_A, \overline{\tau}_B\}$. Consequently, when $\tau < \overline{\tau}$ both firms set positive commissions in equilibrium. ■

Given that commissions will be strictly positive in equilibrium when $\tau < \overline{\tau}$, I can determine equilibrium prices and commissions from the already obtained first-order conditions.

Proposition 1 *When the difference in cost-efficiencies is not too large, and the concern for good advice τ is sufficiently small ($\tau < \overline{\tau}$), then there is a unique equilibrium in pure strategies, in which firms set the following prices, commissions and fixed wages:*

$$\begin{aligned}
p_n^* &= \frac{1-H(z^*)}{h(z^*)} + c_n, \\
f_n^* &= \frac{1-H(z_n^*)}{h(z_n^*)} - \frac{2\tau}{1-H(z_n^*)}\frac{S_n(q^*)}{g(q^*)}, \\
F_n^* &= 0,
\end{aligned}$$

and q^* uniquely solves

$$\frac{[1-H(z_A^*)]^2}{h(z_A^*)} - \frac{[1-H(z_B^*)]^2}{h(z_B^*)} = \tau\left(1-2q^* + \frac{2\left[1-2G(q^*)\right]}{g(q^*)}\right). \tag{19}$$

Proof of Proposition 1. The existence of this equilibrium follows immediately from the derivations in the main text. Since for small concerns for suitability, p_n^* and f_n^* are determined by the first-order conditions with respect to price and commissions, neither firm has an incentive to deviate. Since consumers hold the naive belief that commissions are zero, and thus that advice is objective, the LHS of (19) is constant.Further, the RHS is decreasing in q^* and switches signs at $q^* = 1/2$. Hence, when the difference in cost-efficiencies is not too large, i.e. the LHS is not too large or too small, then by continuity there exists a q^* which solves (19). Uniqueness, follows from the decreasing inverse hazard rates and from the monotonicity of (19) with respect to q^*. ■

When firms are symmetric with respect to costs, they set the same prices and commissions in equilibrium, and consequently the optimal cut-off rule for the intermediary is $q^* = 1/2$. On other hand with asymmetric firms when firm A is more cost-efficient, i.e. $c_A < c_B$, then the optimal cut-off is $q^* < 1/2$. Thus, the intermediary steers more consumers to firm A than to firm B. Additionally, firm A's price is lower, and thus, its overall market share is higher than the market share of firm B.

Next, I analyze regulation where my interest lies particularly on prices and welfare. For this analysis, I stipulate $c_A = c_B$. Then, from above I conclude that regulating τ has no impact. However, as I explore next, imposing a cap on commissions does.

4 Capping commissions

In this section I analyze the effect of regulated commissions on prices. From Proposition 1 and Lemma 5 I know that unregulated commissions are strictly positive, thus regulation can potentially take place as a cap on commissions $\overline{f}$. The effects of regulating commissions are twofold. First, regulating commissions can affect the quality of advice directly. However, here I assume symmetry in costs, i.e. $c_A = c_B$, which allows me to abstract from this distortive effect of commissions, and $\tau < \overline{\tau}$ which rules out the case where firms do not have an incentive to set commissions at all. Rather, I focus on the second effect of regulating commissions which is an effect on profits and prices and thereby deadweight loss. To illustrate this consider the first-order condition of firm n:

$$\frac{\partial \pi_n}{\partial p_n} = \frac{\partial D_n}{\partial p_n}(p_n - f_n - c_n) + D_n = 0.$$

Regulation of commissions has an immediate effect through the margin $p_n - f_n - c_n$ and a more ambiguous effect through $\partial D_n/\partial p_n$. When commissions are capped and the cap binds, then the equilibrium is pinned down by the intermediary's optimal cut-off and the firms' first-order conditions with respect to price. Due to symmetry, the optimal cut-off is at $q^* = 1/2$ regardless of the cap on commissions, or commissions at all, since firms have the same incentives to set prices and commissions. Thus, under symmetry and a binding cap on commissions, the equilibrium is pinned down by the first-order condition on price:

$$\frac{\partial \pi}{\partial p} = \left[-g(1/2)\left[1 - H(z^*)\right]\frac{1}{2\tau}h(z^*)\overline{f} - h(z^*)\frac{1}{2}\right]\left(p^* - \overline{f} - c\right) + \frac{1}{2}\left[1 - H(z^*)\right] = 0, \quad (20)$$

where I have dropped the firm-specific subscripts. I can now evaluate the effect of an increase or decrease of the cap on commissions on equilibrium prices through the implicit derivative of (20), $dp^*/d\overline{f}$.

As surely $1 - H(z^*) \neq 0$ by optimality, I can divide (20) through by $[1 - H(z^*)]$ and thereby define

$$R(p^*, \overline{f}) = \left[-g(1/2)\frac{1}{2\tau}h(z^*)\overline{f} - \frac{h(z^*)}{[1 - H(z^*)]}\frac{1}{2}\right]\left(p^* - \overline{f} - c\right) + \frac{1}{2} = 0. \quad (21)$$

Then, the implicit derivative of the price with respect to the cap on commissions is calculated as

$$\frac{dp^*}{d\overline{f}} = \frac{\frac{h(z^*)}{[1-H(z^*)]}\frac{1}{2} + \left(p^* - 2\overline{f} - c\right)\left[-g(1/2)\frac{1}{2\tau}h(z^*)\right]}{\left[g(1/2)\frac{1}{2\tau}h(z^*)\overline{f} + \frac{h(z^*)}{[1-H(z^*)]}\frac{1}{2}\right] + \left(p^* - \overline{f} - c\right)\left[g(1/2)\frac{1}{2\tau}\frac{\partial h(z^*)}{\partial p^*}\overline{f} + \frac{1}{2}\frac{\partial}{\partial p^*}\frac{h(z^*)}{[1-H(z^*)]}\right]}. \quad (22)$$

Even though the effect is thus generally ambiguous, I can investigate the extreme case of a complete ban on commissions, i.e. $\overline{f} = 0$. For this I obtain clear-cut results.

Lemma 6 *Starting from a full ban of commissions, $\overline{f} = 0$, allowing (at least marginally small) positive commissions leads to lower prices.*

Proof of Lemma 6. In the case of $\overline{f} = 0$, the implicit derivative of (20) reduces to

$$\left.\frac{dp^*}{d\overline{f}}\right|_{\overline{f}=0} = \frac{\frac{h(z^*)}{[1-H(z^*)]}\frac{1}{2} + (p^* - c)\left[-g(1/2)\frac{1}{2\tau}h(z^*)\right]}{\frac{h(z^*)}{[1-H(z^*)]}\frac{1}{2} + (p^* - c)\left[\frac{1}{2}\frac{\partial}{\partial p^*}\frac{h(z^*)}{[1-H(z^*)]}\right]}.$$

It is immediate that the denominator is always positive due to the increasing hazard rate. Thus, an increase in the cap on commissions decreases the price when

$$\frac{h(z^*)}{[1-H(z^*)]}\frac{1}{2} + (p^* - c)\left[-g(1/2)\frac{1}{2\tau}h(z^*)\right] < 0.$$

Plugging in the optimal price given by the equilibrium condition (20) for $\overline{f} = 0$, $p^* = \frac{1-H(z^*)}{h(z^*)} + c$, and rearranging yields

$$g(1/2)\frac{[1-H(z^*)]^2}{h(z^*)} > \tau.$$

This threshold value of the concern for good advice of the intermediary is the same as in Lemma 5 which guarantees positive commissions in the unregulated equilibrium. Thus, when commissions are strictly positive in the unregulated equilibrium, banning commissions entirely is not optimal since a small increase on the cap would reduce prices. ■

In addition, I obtain the following result.

Lemma 7 *When commissions are banned completely, the same prices obtain as if firms would have chosen to set commissions optimally.*

Proof of 7. Evaluate 20 at $\overline{f} = 0$ and solve for the optimal price

$$\begin{aligned}\left.\frac{\partial \pi}{\partial p}\right|_{\overline{f}=0} &= \left[-h(z^*)\frac{1}{2}\right](p^* - c) + \frac{1}{2}\left[1 - H(z^*)\right] = 0 \\ \Leftrightarrow p^* &= \frac{\left[1 - H(z^*)\right]}{h(z^*)} + c.\end{aligned}$$

It is apparent that this expression is identical to the optimal price with unregulated commissions, 17, when firms are symmetric. ■

Taken together, these result are at first surprising. As noted above, one immediate effect of higher commissions is that this reduces firms' margins, similarly to an increase in costs, which obviously tends to increase prices. Put differently, even when there is no bias of advice, given symmetry in this model, regulation could be justified by the argument that higher commissions are ultimately passed on to consumers in the form of higher prices. This would not only directly reduce consumer surplus, but also welfare. The latter follows from the fact that in this model, with downward sloping demand, there is a standard deadweight loss associated with higher prices (and thus higher cut-off values z_A^* and z_B^*). But this argument would ignore a second effect, which, as I have shown, can be so strong as to outweigh the more intuitive, direct effect of lower margins on prices. When firm B pays a positive commission and now firm A raises its price, the advisor becomes more inclined to steer recommendations to firm B, as the higher price of firm A risks making no sale at all (and thus not earning a commission as well). In other words, from the product providers' perspective demand becomes more elastic with respect to their own price if there are positive commissions. This reduces firms' incentives to increase the price.

Starting from an absolute ban of commissions, I showed that the effect of such a more elastic demand is so strong that it outweighs the first effect, so that prices are lower when commissions are (marginally) positive. This observation coupled with Lemma 7 leads to my key result.

Proposition 2 *There exists a socially-optimal, strictly positive cap on commissions* $f^* >$

$\overline{f} > 0$.

Proof of Proposition 2. Trivially follows from Lemmas 6 and 7. ■

Example with a uniform distribution. Consider an example where the private valuation z follows a uniform distribution, i.e. $z \sim U[0, 1]$, and the probability that product A is more suitable q also follows a uniform distribution $q \sim U[0, 1]$. Furthermore, I assume parameter values such that Assumptions 4 and 5 are satisfied, and that commissions in the unregulated symmetric equilibrium are positive.[10] Figure 4 shows the effect of different binding caps on commissions on the equilibrium price for different values of the concern for good advice τ. The endpoint to the right of each graph signifies the equilibrium price which obtains when the cap on commissions is precisely at the value of commissions in the unregulated equilibrium. I can make the following observations. First, when τ is smaller, the equilibrium commissions in the unregulated equilibrium are indeed higher. As I have already observed, when τ is smaller, the intermediary's concern for good advice is smaller and therefore he is more sensitive to commissions. In the uniform case an increase in the cap on commissions on prices is negative until a certain level is reached ,and leads to an increase in prices afterwards. It is also apparent that the negative effect is largest when commissions are banned completely. This makes sense since when commissions are banned, the intermediary's optimal cut-off is not affected by the firms' prices and thus the price elasticity of demand is low. When the cap on commissions is marginally lifted, the intermediary's decision becomes elastic with respect to price and thus firms also start to compete for the intermediary's recommendation through price. Finally, the figure suggests that the optimal cap on commissions from a consumer welfare standard, $\overline{f}$, the location of the minimum of the graphs, increases when τ is higher. Thus, for a small τ the optimal cap is relatively low while for a high τ the optimal commission is high.

[10]For more details regarding the parameters and derivations of the equilibrium prices and commissions under the distributional assumptions see Section B of the Appendix.

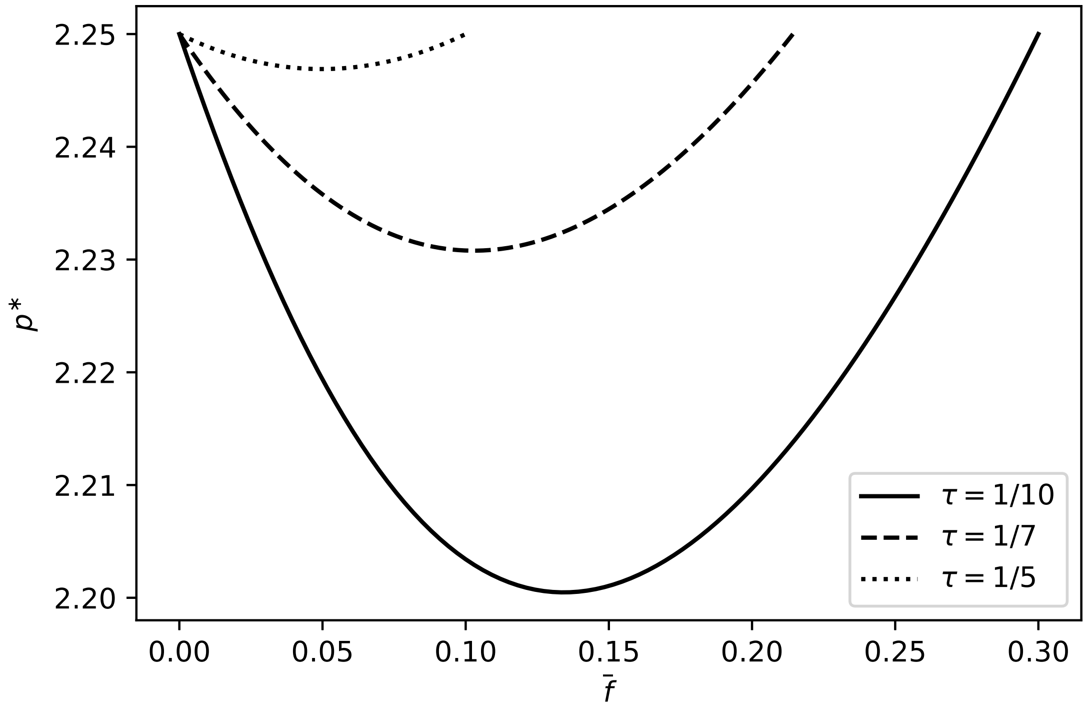

Figure 1: **Equilibrium price with a binding cap on commissions.** This figure depicts the equilibrium price p^* conditional on the cap on commissions $\overline{f}$ for different values of the concern for good advice τ where a higher τ indicates a higher concern for good advice. I assume the following parameters: to generate this figure: $c = 7/4$, $v_h = 3/4$, and $v_l = 1/4$. Furthermore, I assume that the private valuation z as well as the probability that product A is more suitable q are uniformly distributed on $[0, 1]$.

5 Concluding Remarks

This paper analyzes advice when the intermediary and product providers are faced with a downward sloping demand. In a first step of the analysis, I derive the optimal unregulated levels of commission, and prices. Product prices affect demand through two channels. First, there is an obvious direct impact of higher prices on demand. Second, prices also affect advisors' recommendations even when the advisor does not care directly about the level of prices (and thus consumer surplus). Still, prices affect recommendations as an advisor who recommends a more expensive product risks ending up with no sale at all. This insight proves key for the analysis as through this channel higher commissions make demand more price elastic.

I use this framework to analyze the impact of a cap on commissions on welfare. For this I choose a symmetric setting, which allows to abstract from biased advice. Consequently, commissions affect consumer welfare and total welfare only through the price level. I show that a general ban is not welfare optimal as, in contrast to immediate intuition, higher commmissions do not necessarily lead to higher consumer prices. Starting from a general ban, allowing (marginally) higher commissions indeed leads to lower prices as positive commissions make intermediaries wary to recommend more expensive products to consumers, risking no sale at all.

Future work could consider different instruments of regulation such as the disclosure of commissions, which typically has a dampening effect on commissions, notably when it makes previously naive consumers aware of commissions. A further avenue for future research is finally to embed this model with a single advisor into a larger setting with potentially competing advisors.

A First-order conditions

The first-order conditions corresponding to 12 and 13 are

$$\frac{\partial \pi_n}{\partial p_n} = \frac{\partial D_n}{\partial p_n}(p_n - f_n - c_n) + D_n = 0,$$
$$\frac{\partial \pi_n}{\partial f_n} = \frac{\partial D_n}{\partial f_n}(p_n - f_n - c_n) - D_n = 0,$$

where

$$
\begin{aligned}
\frac{\partial D_A}{\partial p_A} =& - g(q^*)\left[1-H(z_A^*)\right]\frac{1}{2\tau}f_A h(z_A^*) - h(z_A^*)\left[1-G(q^*)\right],\\
\frac{\partial D_B}{\partial p_B} =& - g(q^*)\left[1-H(z_B^*)\right]\frac{1}{2\tau}f_B h(z_B^*) - h(z_B^*)G(q^*),\\
\frac{\partial D_A}{\partial f_A} =& \left[1-H(z_A^*)\right]^2 g(q^*)\frac{1}{2\tau},\\
\frac{\partial D_B}{\partial f_B} =& \left[1-H(z_B^*)\right]^2 g(q^*)\frac{1}{2\tau},
\end{aligned}
$$

and where I use

$$
\begin{aligned}
D_A =& \left[1-G(q^*)\right]\left[1-H(z_A^*)\right],\\
D_B =& G(q^*)\left[1-H(z_B^*)\right].
\end{aligned}
$$

Substituting for D_n, $\frac{\partial D_n}{\partial p_n}$ and $\frac{\partial D_n}{\partial f_n}$ yields

$$
\begin{aligned}
\frac{\partial \pi_A}{\partial p_A} =& \left(-g(q^*)\left[1-H(z_A^*)\right]\frac{1}{2\tau}f_A h(z_A^*) - h(z_A^*)\left[1-G(q^*)\right]\right)(p_A - f_A - c_A)\\
&+ \left[1-G(q^*)\right]\left[1-H(z_A^*)\right] = 0, \qquad \text{(A.1)}\\
\frac{\partial \pi_B}{\partial p_B} =& \left(-g(q^*)\left[1-H(z_B^*)\right]\frac{1}{2\tau}f_B h(z_B^*) - h(z_B^*)G(q^*)\right)(p_B - f_B - c_B)\\
&+ G(q^*)\left[1-H(z_B^*)\right] = 0, \qquad \text{(A.2)}\\
\frac{\partial \pi_A}{\partial f_A} =& \left[1-H(z_A^*)\right]^2 g(q^*)\frac{1}{2\tau}(p_A - f_A - c_A) - \left[1-G(q^*)\right]\left[1-H(z_A^*)\right] = 0, \qquad \text{(A.3)}\\
\frac{\partial \pi_B}{\partial f_B} =& \left[1-H(z_B^*)\right]^2 g(q^*)\frac{1}{2\tau}(p_B - f_B - c_B) - G(q^*)\left[1-H(z_B^*)\right] = 0. \qquad \text{(A.4)}
\end{aligned}
$$

B Example with a uniform distribution

I consider an example where both the private valuation z and the probability that product A is more suitable q follow a uniform distribution ,i.e. $z \sim U[0,1]$ and $q \sim U[0,1]$. Under these distributional assumptions, when the concern for good advice is sufficiently small, the symmetric unregulated equilibrium is described by

$$p_A^* = 1 - z_A^* + c_A, \tag{B.1}$$

$$p_B^* = 1 - z_B^* + c_B, \tag{B.2}$$

$$f_A^* = 1 - z_A^* - \frac{\tau}{1 - z_A^*}, \tag{B.3}$$

$$f_B^* = 1 - z_B^* - \frac{\tau}{1 - z_B^*}, \tag{B.4}$$

$$q^* = \frac{1}{2}. \tag{B.5}$$

with $z_A^* = p_A^* - E[v_A(q) \mid q > 1/2]$ and $z_A^* = p_A^* - E[v_A(q) \mid q > 1/2]$. Solving for p_n^* and plugging back into f_n^* yields

$$p_A^* = \frac{1 + c + E[v_A(q) \mid q > 1/2]}{2}, \tag{B.6}$$

$$p_B^* = \frac{1 + c + E[v_B(q) \mid q \leq 1/2]}{2}, \tag{B.7}$$

$$f_A^* = 1 - \frac{1 + c - E[v_A(q) \mid q > 1/2]}{2} - \frac{\tau}{1 - \frac{1+c-E[v_A(q)|q>1/2]}{2}}, \tag{B.8}$$

$$f_B^* = 1 - \frac{1 + c - E[v_B(q) \mid q \leq 1/2]}{2} - \frac{\tau}{1 - \frac{1+c-E[v_B(q)|q\leq 1/2]}{2}}. \tag{B.9}$$

The critical value for the concern for good advice, $\overline{\tau}$, follows from Lemma 5 and the distributional assumptions as

$$\overline{\tau} = (1 - z_n^*)^2 = \left(1 - \frac{1 + c - E[v_A(q) \mid q > 1/2]}{2}\right)^2 = \left(1 - \frac{1 + c - E[v_B(q) \mid q \leq 1/2]}{2}\right)^2. \tag{B.10}$$

In order to produce the graph, I assume the following parameter values: $v_h = 3/4$, $v_l = 1/4$ and $c = 7/4$. With these parameter values, Assumptions 4 and 5 are satisfied as I have

$$E[v_A] + \overline{z} = E[v_B] + \overline{z} = 1/2 + 1 < 7/4, \tag{B.11}$$

and

$$E[v_A(q) \mid q > 1/2] + \overline{z} = E[v_B(q) \mid q \leq 1/2] + \overline{z} = 7/4 + 1 > 7/4. \tag{B.12}$$

Thus, the intermediary is necessary to make trade possible. Plugging the parameters back into optimal prices, I have $p_n^* = 9/4$, commissions are $f_n^* = 1/2 - 2\tau$ and the critical value for the concern for good advice is given by $\overline{\tau} = 1/4$. With the distributional assumptions and plugging in the parameters, condition 20 becomes

$$\left[-\left[1-\left(p^* - \frac{7}{4}\right)\right]\frac{1}{2\tau}\overline{f} - \frac{1}{2}\right]\left(p^* - \overline{f} - \frac{7}{4}\right) + \frac{1}{2}\left[1-\left(p^* - \frac{7}{4}\right)\right] = 0. \tag{B.13}$$

The figure plots the solution of this implicit equation as a function of the cap on commissions for different values of τ.

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