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**The Economics of Advice**

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# The Economics of Advice\*

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## Abstract

A consumer wants to buy one of three different products. An expert observes which of the three products is the best match for the consumer. Under linear prices a monopolistic expert may truthfully reveal, may partially reveal, and may not reveal at all her information. The outcome is inefficient; moreover, the consumer gets some of the surplus. With a two-part tariff the expert truthfully reveals her information. The outcome is efficient and the expert appropriates the entire surplus. If experts are competitive, they also truthfully reveal; here all the surplus goes to consumers.

Keywords: advice, credence good, horizontal product differentiation.

JEL: D18, D82

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# 1 Introduction

When purchasing an experience good, consumers often do not know which variant of the product matches their preferences best. For instance, a consumer wishing to buy a bicycle may consider a racing, a touring, or a city bike. An investor may be interested in a bond, a commodity, or an equity ETF. A car buyer may consider a hatchback, a SUV, or a mini-van. Once the consumer has bought a variant, he will find out over time how well this product fits his needs. The consumer will, however, never figure out whether one of the other two alternatives would have been a better match.

In such a situation consumers often rely on the advice of professional experts who know the products they sell. The bicycle dealer may, e.g., realize that the consumer has little technical knowledge and is best served with an easy to maintain city bike. The investment advisor may find out that given the consumer's risk preferences, he is best served with a government bond ETF. The car dealer may anticipate soaring gas prices and recommend the hatchback to the consumer with the long commute. Typically, the expert's advice constitutes a credence good: even though the consumer observes ex post how well the recommended product fits his needs, he will never find out whether other alternatives would have served him better.<sup>1</sup>

To restate the definition of the different goods: The products the consumer contemplates purchasing are experience goods.<sup>2</sup> The experts' recommendation about which of the experience goods best fits the consumer's needs is a credence good. Our focus is on the credence good *advice*. To set the stage for the analysis of advice: Obviously, the experts' information advantage creates an incentive to behave opportunistically. They may recommend products which are not in the best interest of consumers but in the best interest of the experts.<sup>3</sup>

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<sup>1</sup>The term credence good is due to Darby and Karni (1973).

<sup>2</sup>These products could actually also be credence goods. We think, however, the more common case is experience goods.

<sup>3</sup>To give a few examples: There is much anecdotal evidence that the fee structure of in-

Apparently, there is a need for mechanisms to generate truthful recommendations. Perhaps the simplest mechanism to ensure honest advice is the separation of recommendation and selling. Unless there is collusion, the advising expert has no incentive to recommend unsuitable products and the seller may only sell what has been recommended by her colleague. An example of this simple yet effective mechanism is the often encountered separation of the prescription and the sale of drugs: the medical doctor prescribes, the pharmacist sells. This “separation” mechanism fails, however, to do a good job when it is cheaper to provide advice and selling jointly rather than separately.

In this paper we look at a scenario where the expert gives advice and at the same time sells the products; visiting advice-only experts is simply too inconvenient. In such a scenario the “second-opinion” mechanism is also unattractive.<sup>4</sup> Markets we have in mind are consumer durables (cars, bicycles, electronics,...), financial assets, insurance, etc.

A consumer wants to buy one of three different products. At the time of purchase the consumer’s future utility for each of the three products is uncertain. Utilities are equally distributed and with equal probability each product can be the best match for the consumer.

The expert has more information than the consumer. She observes which of the three products is the best fit for the consumer. Specifically, the expert observes which product will generate the highest utility.<sup>5</sup> The knowledge

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vestment products, rather than their suitability, drives their sale to customers; see Charter et al (2010) and the references quoted therein. Anagol et al. (2017) show that life insurance agents in India commonly recommend products that do not cater to the consumers’ needs, but rather increase commissions. The rate at which insurance agents recommend suitable products is found to be as low as 5%. The White House Council of Economic Advisers estimates that Americans lose about \$17 billion each year in foregone retirements earnings due to conflicted advice; see [obamawhitehouse.archives.gov/the-press-office/2015/02/23/fact-sheet-middle-class-economics-strengthening-retirement-security-cruc](http://obamawhitehouse.archives.gov/the-press-office/2015/02/23/fact-sheet-middle-class-economics-strengthening-retirement-security-cruc).

<sup>4</sup>Actually, with a monopolistic expert advice is not truthful, but there exists no alternative expert for a second opinion. With competitive experts there is no need for second opinions because advice is truthful.

<sup>5</sup>She does, however, not observe how high the utility score is going to be.

which product is the best fit increases the consumer's expected utility from buying this product; at the same time, it lowers his expected utility from buying one of the other two products.

The expert produces the three products at different costs. These different production costs generate the expert's vested interest: at the same price the seller has an incentive to sell the low-cost product to the consumer.

We first look at the scenario where the expert is a monopolist using linear prices. The expert may follow three different revelation strategies: she may fully reveal, she may partially reveal, and she may not reveal her information at all.<sup>6</sup>

In order to reveal truthfully all her information, the expert has to be indifferent between the three products. The high-cost product yields the lowest mark-up. Therefore, she has to set the prices for the other two products such that they generate the same mark-up as the high-cost one. This implies that the consumer gets some of the surplus for the low-cost products.

If the expert reveals no information, consumers have the same willingness-to-pay for all products. Her profit is highest for the low-cost product. Accordingly, the expert charges prices steering the consumer to the low-cost product.

Under partial revelation the expert reveals the medium-cost product and lumps the high- and the low-cost products together. When the consumer learns that he is of the high- or the low-cost type, his willingness-to-pay is higher than with no information. Prices are such that the consumer buys the low-cost version.

All three strategies may constitute equilibria. The higher the cost of the expensive product, the more likely the outcome is going to be inefficient: the expert lures the consumer away from the high-cost product by providing partial or no information. Moreover, even though the expert is a monopolist,

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<sup>6</sup>Partial revelation, a possible equilibrium, can only arise with a minimum of three products. This is the reason why we analyze three rather than two products.

some of the surplus goes to the consumer.

Next we allow the expert to charge two-part tariffs: in addition to the prices for the three products she charges a recommendation fee. She sets marginal cost prices for the products which make her indifferent as to her recommendation. She fully reveals and generates the entire surplus which, in turn, she appropriates with her recommendation fee.

This result immediately implies the outcome for competitive experts. They charge marginal cost prices. The recommendation fee is zero—unless there is a fixed cost of setting up shop; in this case the recommendation fee equals the fixed cost.

Linear prices are thus not a clever tool when truthful expert advice is called for. For truthful reporting the high-cost product restricts the expert's price setting range. Therefore, the expert lures the consumer away from the high-cost product by partial or no revelation. Moreover, we show that two-part tariffs are a powerful instrument to generate truthful advice: the product prices make the expert indifferent as to her recommendation, the recommendation fee serves to appropriate the surplus. This result holds for a monopoly and for competition.

## 1.1 Related Literature

There is a growing literature on credence goods and expert services; see Dulleck and Kerschbamer (2006) and Balafoutas and Kerschbamer (2017) for surveys. Most of this literature considers credence goods from a vertical product differentiation perspective. A consumer needs either a minor version of the good, typically a repair, that solves his problems with some probability or a major version which is always sufficient. This approach gives rise to the problems of under- or overtreatment: the expert only performs the minor repair although the major one is necessary, or she performs the major

treatment although the minor one would have been sufficient.<sup>7</sup>

A different strand of the credence goods literature looks at financial advice from a horizontal product differentiation angle as we do; see Inderst and Ottaviani (2012) for a survey.<sup>8</sup> Financial advisors possess more information than their clients about which asset is the best fit for the consumer. Advisors act as brokers and are driven by financial incentives generated by commissions paid by product providers. Such a horizontally differentiated market gives rise to the problem of mistreatment/misselling: the advisor recommends a product that is not in the best interest of the consumer but in the best interest of the advisor.

The focus of this literature is on the role of the advisor as a firm's direct marketing agent: the firm sets commissions to which the advisor as the agent reacts. Our expert chooses prices/mark-ups herself. With her choice of prices she commits to a recommendation policy. Moreover, in Inderst and Ottaviani (2012) the financial advisor makes a dichotomous recommendation. By contrast, our expert may truthfully reveal, or she may partially reveal, or she may not reveal at all which of the three products is the best match for the consumer.

Finally, our paper is related to the literature on strategic information transmission and delegation; see, e.g., Crawford and Sobel (1982) or Dessein (2002). Whereas in this literature the preference divergence of the sender and receiver is given exogenously, in our framework it arises endogenously through the expert's choice of prices.

The rest of this paper is organized as follows. The next section describes

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<sup>7</sup>The literature also uses the terms under- or overprovision or supplier-induced demand. If the type of repair is not verifiable, the additional problem of overcharging arises: the expert performs the minor repair but charges for the major one.

<sup>8</sup>Consumers have different willingness-to-pay under horizontal and vertical differentiation. Under horizontal differentiation each consumer has his favorite product. Under vertical differentiation consumers with the minor problem value both types of repair equally because both repair types solve the minor problem. Consumers with the major problem only value the major repair.



the model. In section 3 we derive the market outcomes. We first look at a monopolist using linear prices. Then we allow for two-part tariffs and consider competitive experts. In section 4 we discuss our findings. The last section concludes. In the Appendix we derive the statistical results used throughout the paper.

## 2 Model

A consumer wants to buy one (and just one) of the three different products  $\alpha, \beta$ , and  $\gamma$ . The consumer derives utility  $U_i \in [0, 1]$  from product  $i$ ,  $i \in \{\alpha, \beta, \gamma\}$ . Being experience goods, the consumer learns the realization  $U_i$ ,  $i \in \{\alpha, \beta, \gamma\}$  only after consumption. At the time of purchase the consumer's utility for each of the three products is uncertain. Specifically,  $U_i \sim U[0, 1]$ ,  $i \in \{\alpha, \beta, \gamma\}$  and the three random variables are independent.<sup>9</sup> The consumer thus expects  $E(U_i) = 1/2$  from each product. Moreover, with equal probability each of the three products can be the best match for the consumer. Not buying a product generates utility 0.

The products are sold by an expert. The expert has more information than the consumer. She observes which of the three products is the best fit for the consumer: the expert finds out that, say, product  $\alpha$  will generate higher utility than products  $\beta$  and  $\gamma$ . Formally, the expert observes  $i = \operatorname{argmax}_{j \in \{\alpha, \beta, \gamma\}} \{U_j\}$ . The expert does, however, not observe the realizations of the utility scores:  $U_\alpha$  may be higher than  $U_\beta$  and  $U_\gamma$ , yet  $U_\alpha$  may still be pretty low. If good  $i$  is the best fit for the consumer, we call him to be of type  $i$ ,  $i \in \{\alpha, \beta, \gamma\}$ .<sup>10</sup>

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<sup>9</sup>We work with the uniform distribution for the ease of exposition. In the Appendix we first derive the different expected values we use throughout the text for the uniform distribution. More importantly, then we show that the ranking of the expected values holds for any independently and identically distributed variables which implies that all of our results hold at this level of generality.

<sup>10</sup>In terms of our bicycle example, the expert observes that the customer is, say, the racing bike type, yet she cannot observe by how much he is going to use the racer. Note that our expert perfectly observes the consumer's type. Extending our set-up to an expert

The knowledge of being type  $i$  increases the buyer's expected utility from purchasing the product. Specifically,  $E(U_i|U_i = \max\{U_i, U_j, U_k\}) = 3/4$ , i.e., the consumer's willingness-to-pay for good  $i$  increases by  $1/4$  if he learns to be of type  $i$ ,  $i, j, k \in \{\alpha, \beta, \gamma\}$ . At the same time the expected utility of buying good  $j \neq i$  goes down by  $1/8$  when the consumer learns being of type  $i$ , i.e.,  $E(U_j|U_i = \max\{U_i, U_j, U_k\}) = 3/8$ . If the expert partially reveals that the consumer is either of type  $i$  or  $j$  (or, in other words, that he is not type  $k$ ), his expected utility of purchasing  $i$  or  $j$  goes up by  $1/16$ , i.e.,  $E(U_i|U_k \leq \max\{U_i, U_j\}) = 9/16$ ; at the same time his utility of buying good  $k$  goes down by  $1/8$ , i.e.,  $E(U_k|U_k \leq \max\{U_i, U_j\}) = 3/8$ .

The expert observes the consumer's type at no cost. Her cost of production are  $c_\alpha := 0 < c_\beta < c_\gamma < 3/8$ . These costs are common knowledge.<sup>11</sup> All products yield positive surplus even if the consumer doesn't know his type. For the uninformed consumer, product  $\alpha$  is the efficient choice: all products generate the same expected utility and  $\alpha$  comes at the lowest cost. When informed, the consumer of type  $i$  should buy product  $i$ , i.e.,  $3/4 - c_i > 3/8 - c_j$   $i, j \in \{\alpha, \beta, \gamma\}$ ,  $j \neq i$ . In the efficient allocation the expert, therefore, informs the consumer about his type and the consumer buys the corresponding product.

### 3 Market Outcomes

In this section we look at market outcomes. We start with the scenario where the expert is a monopolist. Then we analyze competitive experts.

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who observes the customer's type imperfectly yields qualitatively similar results.

<sup>11</sup>For example, disclosure of financial interests may be mandatory. The Physician Payments Sunshine Act (PPSA) requires physicians to disclose financial interests in manufacturers of drugs, devices, biologicals, and medical supplies. Similarly, the U.S. Securities and Exchange Commission (SEC) issues guidance requiring that investment advisors disclose financial conflicts of interest when advising clients. Note that in our set-up knowing the costs is equivalent to knowing the mark-ups.

### 3.1 Monopolistic Expert

The three products are *experience goods*: the consumer learns the realization  $U_i$  only after consumption. The expert's recommendation is a *credence good*: if the consumer buys product  $i$ , he observes ex post the utility score  $U_i$ , yet he never finds out whether product  $i$  was indeed his best match.<sup>12</sup> To recommend truthfully, the expert, therefore, has to be indifferent between the three products: the *equal compensation principle* has to hold.<sup>13</sup> The products yield, however, different surpluses, with product  $\gamma$  generating the smallest surplus  $3/4 - c_\gamma$ . Equal compensation implies that for truthful advice the expert can appropriate a maximum of  $3/4 - c_\gamma$  for each product or, to put it differently, the consumer gets some of the surplus if he is of type  $\alpha$  or  $\beta$ . In what follows we will show that the expert can do better by partially revealing her information or by revealing no information at all.

#### 3.1.1 Linear Prices

Let us now describe the game. In the first stage the monopolistic expert sets prices  $p_i$ ,  $i \in \{\alpha, \beta, \gamma\}$ . In the second stage the consumer visits the expert and observes prices. The expert observes the consumer's type and makes her recommendation. A recommendation is an element of the powerset without the empty set, i.e.,  $P(\{\alpha, \beta, \gamma\}) \setminus \emptyset$ .<sup>14</sup> Formally, the expert's recommendation strategy is  $r : \{\alpha, \beta, \gamma\} \mapsto P(\{\alpha, \beta, \gamma\}) \setminus \emptyset$ . The range of  $r$  forms the possible recommendations a consumer receives, depending on his type. Upon receiving the recommendation, the consumer updates his beliefs about his

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<sup>12</sup>The expert never observes the utility score  $U_i$ , neither ex ante nor ex post. A contractual arrangement based on the realization  $U_i$  is thus impossible.

<sup>13</sup>We borrow this term from the principal-agent literature. See, e.g., Milgrom and Roberts (1992), 228-232. In the credence goods literature, Emons (1997, 2001, 2013) uses the term equal compensation principle, Dulleck and Kerschbamer (2006) talk about equal mark-up prices.

<sup>14</sup>We assume that the messages  $\emptyset$  or  $\{\alpha, \beta, \gamma\}$  boil down to the same thing: the consumer gets no new information and we drop  $\emptyset$  from the message space. Alternatively, because  $\arg\max_{j \in \{\alpha, \beta, \gamma\}} \{U_j\}$  always exists in our setup,  $\emptyset$  can not be a truthful message.

type and eventually purchases a product or leaves the expert. Off potential equilibrium behavior by the seller, the consumer sticks to his priors. If there is no trade, both consumer and expert have a payoff of 0. We focus on perfect Bayesian equilibria.

In Lemma 1 we derive the profit maximizing prices that support truthful revelation of the consumer's type. With these prices the monopolist does not appropriate the entire surplus: the most expensive product  $\gamma$  determines her mark-up. In Lemma 2 we derive prices under which the expert reveals no information: here it is the least expensive product  $\alpha$  that determines her mark-up. In Lemma 3 we derive prices where the expert partially reveals the type: she pools the most with the least expensive product. In Proposition 1 we show that all three possibilities can indeed be equilibria of our game.

**Lemma 1:** *Suppose  $p_\alpha = 3/4 - c_\gamma$ ,  $p_\beta = 3/4 - (c_\gamma - c_\beta)$ ,  $p_\gamma = 3/4$  and let the consumer be of type  $i$ ,  $i \in \{\alpha, \beta, \gamma\}$ . The expert truthfully reveals  $i$ , i.e.,  $r(i) = \{i\}$ . The consumer believes the message and purchases product  $i$ . These prices are profit maximizing within the set of fully revealing prices.*

Proof: To fully reveal the consumer's type, i.e.,  $r(i) = i$ , the expert has to be indifferent between the three reports  $\{\alpha\}$ ,  $\{\beta\}$ , and  $\{\gamma\}$ . That is, we must have  $p_\alpha = p_\beta - c_\beta = p_\gamma - c_\gamma$ . With these prices the expert has no incentive to report  $j \neq i$ . The consumer believes the message and has willingness-to-pay  $3/4$  for product  $i$ . Setting  $p_\gamma = 3/4$  yields the profit maximizing prices with this property.

Consider now deviations to the partially revealing strategies  $r(i) = \{i, j\}$ , for  $i, j \in \{\alpha, \beta, \gamma\}, j \neq i$ , and the unrevealing strategy  $r(i) = \{\alpha, \beta, \gamma\}$ . Whatever the consumer believes when he hears one of these messages, his willingness-to-pay cannot exceed  $3/4$ . Accordingly, the expert cannot do better by deviating to one of those reports.  $\square$

**Lemma 2:** *Suppose  $p_\alpha = 1/2$ ,  $p_\beta > 1/2$ ,  $p_\gamma > 1/2$  and let the consumer be of type  $i$ ,  $i \in \{\alpha, \beta, \gamma\}$ . The expert reports  $\{\alpha, \beta, \gamma\}$ , i.e.,  $r(i) = \{\alpha, \beta, \gamma\}$ .*

*The consumer sticks to his priors and buys product  $\alpha$ . These prices are profit maximizing within the set of no revealing prices.*

Proof: With the message  $\{\alpha, \beta, \gamma\}$  the consumer gets no new information and sticks to his priors. Since he expects  $1/2$  from all three products with equal probability, he goes for the cheapest one  $\alpha$ . If the consumer has willingness-to-pay of  $1/2$  for all three products, it is optimal for the expert to steer the consumer away from  $\beta$  and  $\gamma$  and charge  $1/2$  for  $\alpha$ .

Consider now deviations to strategies with a single recommendation range. The consumer, thus, gets the message  $\{\alpha\}$ ,  $\{\beta\}$ , or  $\{\gamma\}$ . Suppose the mark-ups of the three products are all different. Then the expert always recommends the product with the highest mark-up, say  $i$ . Given the strategy of always recommending  $i$ , the consumer sticks to his priors when he hears this report. If the consumer hears  $j \neq i$ , he infers a mistake and also sticks to his priors. The consumer buys  $\alpha$ , making a deviation not attractive.

If all mark-ups equal  $1/2$ , the expert reveals the truth. The consumer buys the recommended product, generating a mark-up of  $1/2$ . A deviation is thus not attractive.

Suppose the mark-ups for  $\beta$  and  $\gamma$  are equal and greater  $1/2$ . When the consumer hears  $\{\beta\}$  ( $\{\gamma\}$ ), he knows he is of type  $\alpha$  or  $\beta$  ( $\alpha$  or  $\gamma$ ) and expects  $9/16$ . He buys  $\alpha$  because it is the cheaper one of both products. This deviation is thus not attractive.

If the mark-up for  $\beta$  ( $\gamma$ ) equals  $1/2$  while the mark-up for  $\gamma$  ( $\beta$ ) exceeds  $1/2$ , the expert always recommends  $\gamma$  ( $\beta$ ). The consumer sticks to his priors and accordingly buys  $\alpha$ .

Consider now deviations to strategies with a partially revealing recommendation  $\{\alpha, \beta\}$ ,  $\{\alpha, \gamma\}$ ,  $\{\beta, \gamma\}$ . Suppose the mark-ups of the three products are all different. Then the expert always recommends the product with the highest mark-up, say  $i$ . A partially revealing strategy is thus a mistake. The consumer sticks to the priors and buys  $\alpha$ .

If all mark-ups equal  $1/2$ , the partially revealing message is truthful.

The consumer expects  $9/16$  and buys the cheaper of the two products. The mark-up is  $1/2$ , making this deviation not attractive.

Suppose the mark-ups for  $\beta$  and  $\gamma$  are equal and greater  $1/2$ . When the consumer hears  $\{\alpha, \beta\}$ ,  $\{\alpha, \gamma\}$ , he knows he is of type  $\alpha$  or  $\beta$  ( $\alpha$  or  $\gamma$ ) and expects  $9/16$ . He buys  $\alpha$  because it is the cheaper one of both products. When the consumer hears  $\{\beta, \gamma\}$ , he sticks to his priors and buys  $\alpha$ . This deviation is thus not attractive.  $\square$

**Lemma 3:** *Suppose  $p_\alpha = \min\{9/16, 3/4 - c_\beta\}$ ,  $p_\beta = \min\{9/16 + c_\beta, 3/4\}$ ,  $p_\gamma \in (p_\alpha, p_\alpha + c_\gamma]$  and let the consumer be of type  $i$ ,  $i \in \{\alpha, \beta, \gamma\}$ . The expert reports  $\{\alpha, \gamma\}$  when the consumer is of type  $\alpha$  or  $\gamma$ ; she reports  $\{\beta\}$  when the consumer is of type  $\beta$ . Formally,  $r(s) = \{\alpha, \gamma\}$ ,  $s \in \{\alpha, \gamma\}$  and  $r(\beta) = \{\beta\}$ . The consumer believes the reports and buys product  $\alpha$  when he hears  $\{\alpha, \gamma\}$  and  $\beta$  when he hears  $\{\beta\}$ . These prices are profit maximizing within the set of partially revealing prices.*

Proof: The mark-ups for the reports  $\{\alpha\}$ ,  $\{\beta\}$ , and  $\{\alpha, \gamma\}$  are equal and higher than for  $\{\gamma\}$ : when the consumer hears  $\{\alpha, \gamma\}$ , he expects  $9/16$  and buys  $\alpha$ ; when he hears  $\{\beta\}$ , he expects  $3/4$  and buys  $\beta$ .

These prices are profit maximizing within the set of partially revealing prices. Suppose the expert pools products  $\{i, j\}$  and truthfully reveals type  $\{k\}$ . The willingness-to-pay of type  $k$  equals  $3/4$ ; the willingness-to-pay of the other two types equals  $9/16$ . Let  $i$  be the product which the expert intends to sell to the pooled types. Hence, the mark-up of  $k$  and  $i$  have to be equal so that the equal compensation principle holds.

On the one hand, the expert can extract the entire surplus of type  $k$ , resulting in a mark-up of  $3/4 - c_k$ ; on the other hand, the expert can extract the entire surplus of type  $i$ , resulting in a mark-up of  $9/16 - c_i$ . However, the equal compensation principle implies that the expert can only realize the minimum of the two mark-ups.  $\min\{3/4 - c_k, 9/16 - c_i\}$  weakly decreases in  $c_i$  and  $c_k$ . This implies that  $j = \gamma$ : the expert never sells the most expensive

product. Next, note  $\min\{3/4 - c_\beta, 9/16\} \geq \min\{3/4, 9/16 - c_\beta\}$ . Thus,  $i = \alpha$  and  $k = \beta$  maximizes the expert's profit.

Let  $p_\gamma < p_\alpha + c_\gamma$ . Consider now deviations to strategies with a single recommendation range. The consumer, thus, gets the message  $\{\alpha\}$ ,  $\{\beta\}$ , or  $\{\gamma\}$ . When the consumer hears  $\{\alpha\}$ ,  $(\{\beta\})$ , he knows he is of type  $\{\alpha, \gamma\}$ ,  $(\{\beta, \gamma\})$  and has willingness-to-pay  $9/16$ . In the first case he buys the cheaper product  $\alpha$ ; in the second case he does not buy at all. If he hears  $\{\gamma\}$ , he infers a mistake, sticks to his priors, and does not buy. These deviations are thus not profitable.

If the expert deviates to  $r(\alpha) = \{\alpha\}$  and  $r(s) = \{\beta, \gamma\}$ ,  $s \in \{\beta, \gamma\}$ , the consumer expects  $9/16$  and does not buy. If the expert deviates to  $r(s) = \{\alpha, \beta\}$ ,  $s \in \{\alpha, \beta\}$ , and  $r(\gamma) = \{\gamma\}$ , the consumer expects  $9/16$  and buys  $\alpha$ . These partially revealing strategies are thus not profitable.

Consider the deviation to the unrevealing strategy  $r(i) = \{\alpha, \beta, \gamma\}$ . With the message  $\{\alpha, \beta, \gamma\}$  the consumer gets no new information and sticks to his priors. He expects  $1/2$  from all three products and does not buy.

Finally, if  $p_\gamma = p_\alpha + c_\gamma$ , the expert makes the same mark-up with all three products; thus, no profitable deviation exists.  $\square$

With partial revelation the expert pools the most expensive type with the least costly one. Type  $\gamma$ 's willingness-to-pay for product  $\alpha$  following the recommendation  $\{\alpha, \gamma\}$  is the same as his willingness-to-pay for product  $\beta$  after the recommendation  $\{\beta, \gamma\}$ . The expert has lower costs if type  $\gamma$  buys product  $\alpha$  rather than  $\beta$ . Therefore, she steers the most expensive type to the least expensive product.

We may now establish equilibria for the entire game.

### Proposition 1:

- (i) For  $c_\gamma < 3/16$ , the monopolist sets prices and truthfully reveals all information as described in Lemma 1;

- (ii) for  $c_\beta \geq 1/4$ , the monopolist sets prices and reveals no information as described in Lemma 2;
- (iii) for  $c_\gamma \geq 3/16$  and  $c_\beta < 1/4$ , the monopolist sets prices and partially reveals information as described in Lemma 3.

The proof follows from simply comparing the expert's profits in the three constellations. Figure 1 shows which products are traded in equilibrium. In the vertically shaded area the monopolist truthfully reveals all information. All products are traded and the resulting allocation is efficient. In the diagonally shaded area the monopolist partially reveals her information. The consumer never buys products  $\gamma$  which is inefficient when he is of this type. In the horizontally shaded area the expert reveals no information at all. Only product  $\alpha$  is traded which is inefficient when the consumer is of type  $\beta$  or  $\gamma$ . Overall, unless  $c_\gamma$  is small, the equilibrium is, therefore, inefficient.

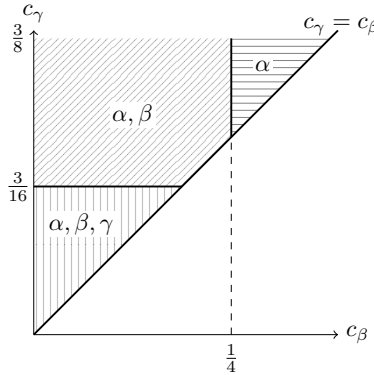


Figure 1: Products traded in equilibrium. In the vertically shaded area the expert fully reveals, in the diagonally shaded area she partially reveals, and in the horizontally shaded area she doesn't reveal.

Full revelation generates profit  $3/4 - c_\gamma$ . Increasing  $c_\gamma$  makes full revelation less attractive. The expert wants to lure the consumer away from good



$\gamma$ . To do so, she sets the price  $p_\gamma$  such that the product is not attractive for the consumer and her mark-up is small, thereby lowering her financial incentives to report  $\{\gamma\}$ . Under partial revelation she lumps  $\gamma$  together with  $\alpha$ ; the consumer buys the cheaper of the two products  $\alpha$ . She reveals  $\beta$ , leading to the profit  $3/4 - c_\beta$ . Partial revelation becomes unattractive with high  $c_\beta$ . The expert lures the consumer away from  $\beta$  and  $\gamma$  by lumping all three products together. With no additional information, the consumer purchases the cheapest product  $\alpha$ .

### 3.1.2 Two-part Tariffs

The equilibrium allocation with linear prices is inefficient. Furthermore, the expert does not appropriate the entire surplus that is generated: Under full revelation the consumer gets some surplus when he is of type  $\alpha$  or  $\beta$ , under partial revelation when he is of type  $\beta$ . Only under no revelation the expected surplus of the consumer is zero.<sup>15</sup> Both phenomena are due to the fact that the expert is restricted to use linear prices. Once we allow for two-part tariffs, efficiency is attained and the monopolist appropriates the entire surplus.

Consider the following modification of our game. In the first stage the expert sets  $p_r$ , the price she charges for her recommendation together with  $p_i$ ,  $i \in \{\alpha, \beta, \gamma\}$  the prices for the three products. In the second stage the consumer observes the prices and decides whether he wants the expert's recommendation for the price  $p_r$ . If the consumer visits the expert, the game continues as our previous one.

**Proposition 2:** *Let  $p_r = 3/4 - (p_\alpha + p_\beta + p_\gamma)/3$ ,  $p_\alpha = p_\gamma - c_\gamma$ ,  $p_\beta = p_\gamma - (c_\gamma - c_\beta)$ ,  $p_\gamma \in [c_\gamma, 3/4]$ , and let the consumer be of type  $i$ ,  $i \in \{\alpha, \beta, \gamma\}$ . The consumer consults the expert and pays  $p_r$ . The expert truthfully reveals  $i$ . The consumer believes the message and purchases product  $i$ .*

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<sup>15</sup>Accordingly, among the equilibrium allocations the consumer prefers full to partial to no revelation.

Proof: The mark-ups of all three products are equal. Given the consumer visits the expert, she recommends truthfully and the consumer purchases the recommended product. Ex ante the consumer expects a surplus of  $3/4 - (p_\alpha + p_\beta + p_\gamma)/3$ , which is equal to the price the expert charges for her recommendation.  $\square$

With this two-part tariff product prices take care of equal compensation. The expert implements the efficient allocation and appropriates the entire surplus thus generated with the recommendation fee. Note that  $p_\gamma = 3/4$  results in the product prices of Lemma 1,  $p_\gamma = c_\gamma$  generates marginal cost prices.

### 3.2 Competitive Experts

For a set-up with competitive experts Proposition 2 immediately implies the following Corollary. Let there be  $l = 1, \dots, L$ ,  $L \geq 2$ , experts who simultaneously charge prices  $p_r^l, p_i^l$ ,  $i \in \{\alpha, \beta, \gamma\}$  in stage 1. In the second stage the consumer observes the list of prices and then decides whether or not to visit an expert. If he does so, the game continues as our previous ones.

**Corollary:** *Let  $p_r^l = 0$ ,  $p_\alpha = 0, p_\beta = c_\beta$ ,  $p_\gamma = c_\gamma$ ,  $l=1, \dots, L$  and let the consumer be of type  $i$ ,  $i \in \{\alpha, \beta, \gamma\}$ . The consumer consults an expert. The expert truthfully reveals  $i$ . The consumer believes the message and purchases product  $i$ .*

Marginal cost pricing ensures equal compensation and Bertrand competition drives profits (or  $p_r$ ) down to zero. For this result to hold we actually do not need a two-part tariff—linear prices also do the job.

Our last two results show that marginal cost prices solve the experts' credibility problem. In a competitive framework where profits are zero, linear marginal cost prices provide proper incentives to recommend the correct product. If the expert has market power as in our framework, or when she

has, say, a fixed cost that she has to recover we need in addition the recommendation fee.

## 4 Discussion

Our results immediately beg a couple of questions. First, under linear prices the high-cost products  $\beta$  and  $\gamma$  restrict the expert's price setting range. Why doesn't the expert stop offering these products? Specifically, in the no revelation equilibrium the expert steers the consumer away from products  $\beta$  and  $\gamma$  by charging high prices; she could as well drop these products from her product line. Likewise, in the partial revelation equilibrium the expert could stop offering  $\gamma$ .

In our set-up it makes no difference whether the expert has a broad range of products and doesn't sell some of these or whether she offers a narrow product range to begin with: there is no fixed cost associated with offering a product. By contrast, with such a fixed cost under partial revelation the expert would offer only  $\alpha$  and  $\beta$  and under no revelation she would restrict herself to selling  $\alpha$ .

Our results are thus compatible with experts offering the full product range, yet charging sky-high prices for some of their products and experts offering a narrow product range. For example, under no revelation our expert could offer only one product like a discounter. Nonetheless, whereas the typical discounter has a limited product range to slash costs, our expert drops certain items in order not to cannibalize the margins of the products she plans to sell.

Offering the full product range may make sense for reasons beyond our framework. For example, the marketing literature asserts that a deep rather than a shallow assortment may give consumers the impression of having a choice, increasing the likelihood that they shop at the store in the first place; see, e.g., Broniarczyk et al. (1998).

Second, why do we not observe more use of two-part tariffs when expert advice is called for? Although there is wide consensus that kickbacks lead to misselling, volume-based sales commissions remain the most widespread form of remuneration for advice in insurance, credit, and investment markets.

Finland, Denmark, the UK, and the Netherlands introduced a ban on commissions so that brokers had to switch to recommendation fees. The experience with (hourly) recommendation fees has been at best mixed. In Finland consumers were unwilling to pay the high fees of intermediaries. In the UK customers had to pay more for financial advice than they did before the ban. Finally, following the ban, the number of brokers or advisers declined in Finland, Denmark, and the UK (Reifner et al. (2013)).

Several explanations may reconcile our results with these empirical observations. A separate recommendation fee increases transparency: consumers become aware of how expensive advice actually is and may decide that it is not worth it. Furthermore, with a separate recommendation fee consumers can turn down the recommendation, yet still buy the product relying solely on their priors. If the recommendation charge is included in the product price, they don't have this option—they can only buy the entire package.

In our framework consumers know that they will buy one of the three products after observing prices: the recommendation always results in a successful purchase. However, suppose there is the possibility that consumers may not want to buy after receiving the recommendation. Then the recommendation fee results in a negative payoff. In such a set-up a loss averse consumer may turn down the recommendation that an expected utility maximizer would buy.<sup>16</sup>

Two-part tariffs weakly dominate linear prices in our framework. Yet, when the costs of the three products are similar, i.e., if  $c_\gamma$  is small, the expert

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<sup>16</sup>In an online experiment Chater et al. (2010) find people disproportionately averse to paying an up-front fee for advice. Between 20-30% of the subjects displayed evidence of narrow framing and loss aversion making them excessively averse to an up-front fee.

truthfully reveals all her information under linear prices.<sup>17</sup> The outcome is efficient. Moreover, when  $c_\gamma$  goes down, total surplus increases and so does the share thereof going to the expert. Therefore, if  $c_\gamma$  is small, the expert gains little by switching from linear prices to a two-part tariff: her incentive to use a two-part tariff is lower, the closer the products' costs are to each other. Furthermore, competitive experts may use either linear prices or two-part tariffs: they make zero profits anyway. Accordingly, for a richer set-up our results suggest that linear prices are more likely to be observed if costs are similar or if the market is competitive.

Our consumers are identical in that they obtain the same expected surplus. The expert appropriates the entire surplus through the recommendation fee  $p_r$ . If there are, say, two groups of consumers differing with respect to the expected surplus, the expert can no longer appropriate the entire surplus with our simple two-part tariff. If  $p_r$  equals the expected surplus of the high-surplus group, the expert loses the low-surplus one. If  $p_r$  equals the expected surplus of the low-surplus group, the expert serves both groups, yet does not get the entire surplus of the high-surplus group. Analyzing two-part tariffs and linear prices with heterogeneous consumers is perhaps an interesting topic for future research.

Third, how is our two-part tariff related to the “separation” mechanism mentioned in the introduction? For truthful revelation under our two-part tariff product prices generate equal mark-ups which render the expert indifferent as to her recommendation. With the recommendation fee she appropriates the surplus. The separation mechanism does not need such fine-tuning of prices. Any product prices above marginal costs do the job. Even if the seller has a strong incentive to sell, say, product  $\beta$ , she cannot do so unless  $\beta$  has been suggested by her advising colleague who, in turn, has no monetary incentive to recommend a particular product.

Fourth, what is the outcome with more than three products? We have

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<sup>17</sup>Recall that  $c_\alpha := 0 < c_\beta < c_\gamma$ .

analyzed the case of four products  $\alpha, \beta, \gamma$ , and  $\delta$  with product  $\delta$  having the highest cost. The results are qualitatively similar. If  $c_\delta$  is small, the expert fully reveals. If  $c_\beta$  is large, she does not reveal at all. Otherwise, she partially reveals. Partial revelation is obviously messier with four products: the number of possible messages more than doubles for each product we add to the assortment.<sup>18</sup> We conjecture that this general structure also holds for more than four products.

## 5 Conclusions

In this paper we study experts advising consumers on which product to buy. Under linear prices a monopolistic expert may truthfully reveal, may partially reveal, and may not reveal at all her information. The outcome is thus inefficient; moreover, the consumer gets some of the surplus. Efficiency is restored with a two-part tariff: in addition to product prices the expert charges a recommendation fee. The product prices render the expert indifferent as to her recommendation, the recommendation fee serves to appropriate the surplus. If experts are competitive, they also truthfully reveal under a two-part tariff; here all the surplus goes to consumers. Two-part tariffs are, therefore, a clever instrument to generate truthful advice.

When we talk about the expert, we have a real person in mind—we use the pronoun *she* after all: *she* knows her products, *she* interacts with the consumer, and eventually *she* finds out the consumer’s best match. Yet, our framework also applies to online recommendation systems. The seller can enter product information as well as all the data she has collected about the customer into the system. A clever algorithm combines these two data sets and comes up with an individual recommendation for the consumer. Picking up on our bicycle example, if the algorithm knows, e.g., the consumer’s age, it seems sensible not to recommend a racing bike to an eighty year old person.

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<sup>18</sup>Since we neglect  $\emptyset$ , the number of possible messages with  $N$  products is  $2^N - 1$ .

Nevertheless, the algorithm can as well ignore the plethora of available data and simply recommend the product with the highest profit margin.

## Appendix

In this Appendix we derive the expected values we use throughout the text. Furthermore, we show that the ranking of the expected values holds for any independently and identically distributed variables.

Let  $U_i \sim U[0, 1]$ ,  $i \in \{\alpha, \beta, \gamma\}$ . Moreover, the three random variables are independent.

**Claim 1:**  $E(U_i) = 1/2$ .

Proof: By definition  $E(U_i) = \int_0^1 u du = 1/2$ .  $\square$

**Claim 2:**  $E(U_i | U_i = \max\{U_i, U_j, U_k\}) = 3/4$ .

Proof: Note that  $E(U_i | U_i = \max\{U_i, U_j, U_k\}) = E(\max\{U_i, U_j, U_k\})$ . Thus, we derive the distribution of  $\max\{U_i, U_j, U_k\}$ . Independence implies  $P(\max_i\{U_i\} < u) = \prod_i P(U_i < u)$ . Moreover, because the distributions are identical,  $F(u) = P(U_i < u)$ , resulting in the cumulative distribution function  $F(u)^N$  for  $N$  identically and independently distributed variables. Accordingly, the probability density function of  $\max\{U_i, U_j, U_k\}$  is  $NF(u)^{N-1}f(u)$ , and

$$\begin{aligned} E(\max_i\{U_i\}) &= \int_0^1 u NF(u)^{N-1} f(u) du \\ &= (uF(u)^N)_0^1 - \int_0^1 F(u)^N du \\ &= 1 - \int_0^1 F(u)^N du. \end{aligned}$$

For the uniform distribution we get the closed form solution  $1 - 1/(N+1) = N/(N+1)$  and for  $N = 3$  this yields  $3/4$ .  $\square$

**Claim 3:**  $E(U_i|U_j = \max\{U_i, U_j, U_k\}) = 3/8$ .

Proof: By the law of iterated expectation

$$\begin{aligned}
E\left(E(U_i|U_i = \max\{U_i, U_j, U_k\})\right) &= E(U_i) \\
\frac{1}{3}E(U_i|U_i = \max\{U_i, U_j, U_k\}) + \frac{2}{3}E(U_i|U_j = \max\{U_i, U_j, U_k\}) &= E(U_i) \\
\frac{1}{3}\frac{3}{4} + \frac{2}{3}E(U_i|U_j = \max\{U_i, U_j, U_k\}) &= \frac{1}{2} \\
E(U_i|U_j = \max\{U_i, U_j, U_k\}) &= \frac{3}{8}. \quad \square
\end{aligned}$$

**Claim 4:**  $E(U_i|U_k \leq \max\{U_i, U_j\}) = 9/16$ .

Proof: Note that the probability density function can be written as  $(\mathbb{1}(U_i \geq U_k) + \mathbb{1}(U_j \geq U_k) - \mathbb{1}(U_i \geq U_k)\mathbb{1}(U_j \geq U_k))/(2/3)$ , where  $\mathbb{1}$  is the indicator function. Thus,

$$\begin{aligned}
E(U_i|U_k \leq \max\{U_i, U_j\}) &= \frac{3}{2} \left( \int_0^1 \int_{u_k}^1 u_i du_i du_k + \right. \\
&\quad \left. \int_0^1 \int_{u_k}^1 \int_0^1 u_i du_i du_j du_k - \int_0^1 \int_{u_k}^1 \int_{u_k}^1 u_i du_i du_j du_k \right) = 9/16. \quad \square
\end{aligned}$$

**Claim 5:**  $E(U_i|U_i \leq \max\{U_j, U_k\}) = 3/8$ .

Proof: By the law of iterated expectation

$$\begin{aligned}
E\left(E(U_i|U_i \leq \max\{U_i, U_k\})\right) &= E(U_i) \\
\frac{2}{3}E(U_i|U_k \leq \max\{U_i, U_j\}) + \frac{1}{3}E(U_i|U_i \leq \max\{U_j, U_k\}) &= E(U_i) \\
\frac{2}{3}\frac{9}{16} + \frac{1}{3}E(U_i|U_i \leq \max\{U_j, U_k\}) &= \frac{1}{2} \\
E(U_i|U_i \leq \max\{U_j, U_k\}) &= \frac{3}{8}. \quad \square
\end{aligned}$$



**Claim 6:**

$$E(X_i|X_i = \max\{X_i, X_j, X_k\}) \geq E(X_i|X_k \leq \max\{X_i, X_j\}) \geq E(X_i) \geq \\ E(X_i|X_i \leq \max\{X_j, X_k\}) = E(X_i|X_j = \max\{X_i, X_j, X_k\}),$$

for any independently and identically distributed variables  $X_i, X_j$ , and  $X_k$ .

Proof: We can split up the expectations in distinct cases, which have equal probability due to the independently and identically distributed variables.

$$\begin{aligned} E(X_i|X_i = \max\{X_i, X_j, X_k\}) &= \\ \frac{1}{2}E(X_i|X_i \geq X_j \geq X_k) &+ \frac{1}{2}E(X_i|X_i \geq X_k \geq X_j), \\ E(X_i|X_k \leq \max\{X_i, X_j\}) &= \\ \frac{1}{4}E(X_i|X_i \geq X_j \geq X_k) &+ \frac{1}{4}E(X_i|X_i \geq X_k \geq X_j) \\ + \frac{1}{4}E(X_i|X_j \geq X_i \geq X_k) &+ \frac{1}{4}E(X_i|X_j \geq X_k \geq X_i), \\ E(X_i) &= \frac{1}{6}E(X_i|X_i \geq X_j \geq X_k) + \frac{1}{6}E(X_i|X_i \geq X_k \geq X_j) \\ + \frac{1}{6}E(X_i|X_j \geq X_i \geq X_k) &+ \frac{1}{6}E(X_i|X_j \geq X_k \geq X_i) \\ + \frac{1}{6}E(X_i|X_k \geq X_i \geq X_j) &+ \frac{1}{6}E(X_i|X_k \geq X_j \geq X_i), \\ E(X_i|X_i \leq \max\{X_j, X_k\}) &= \\ \frac{1}{4}E(X_i|X_j \geq X_i \geq X_k) &+ \frac{1}{4}E(X_i|X_j \geq X_k \geq X_i) \\ + \frac{1}{4}E(X_i|X_k \geq X_i \geq X_j) &+ \frac{1}{4}E(X_i|X_k \geq X_j \geq X_i), \\ E(X_i|X_j = \max\{X_i, X_j, X_k\}) &= \\ \frac{1}{2}E(X_i|X_j \geq X_i \geq X_k) &+ \frac{1}{2}E(X_i|X_j \geq X_k \geq X_i). \end{aligned}$$

For the expectations of  $E(X_i|\cdot)$ ,  $j$  respectively  $k$  are labels that can be interchanged because the variables are independently and identically distributed. Thus, the expressions above can be simplified to

$$E(X_i|X_i = \max\{X_i, X_j, X_k\}) = E(X_i|X_i \geq X_j \geq X_k),$$

$$\begin{aligned}
E(X_i|X_k \leq \max\{X_i, X_j\}) &= \frac{1}{2}E(X_i|X_i \geq X_j \geq X_k) \\
&\quad + \frac{1}{4}E(X_i|X_j \geq X_i \geq X_k) + \frac{1}{4}E(X_i|X_j \geq X_k \geq X_i), \\
E(X_i) &= \frac{1}{3}E(X_i|X_i \geq X_j \geq X_k) + \frac{1}{3}E(X_i|X_j \geq X_i \geq X_k) \\
&\quad + \frac{1}{3}E(X_i|X_j \geq X_k \geq X_i), \\
E(X_i|X_i \leq \max\{X_j, X_k\}) &= \\
&\quad \frac{1}{2}E(X_i|X_j \geq X_i \geq X_k) + \frac{1}{2}E(X_i|X_j \geq X_k \geq X_i), \\
E(X_i|X_j = \max\{X_i, X_j, X_k\}) &= \\
&\quad \frac{1}{2}E(X_i|X_j \geq X_i \geq X_k) + \frac{1}{2}E(X_i|X_j \geq X_k \geq X_i).
\end{aligned}$$

Since  $E(X_i|X_i \geq X_j \geq X_k) \geq E(X_i|X_j \geq X_i \geq X_k) \geq E(X_i|X_j \geq X_k \geq X_i)$ , and all expressions above are a weighted average of these three terms, the claim immediately follows.  $\square$

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