Credence Goods, Experts and Risk Aversion

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Abstract

The existing literature on credence goods and expert services has overlooked the importance of risk aversion. In this paper we extend a standard expert model of credence goods by considering risk-averse consumers. Our results show how the presence of risk premia may lead the experts to mistreat consumers. We also shed light on the role of both liability clauses and competition in the presence of risk aversion.

Keywords: Credence goods, Expert services, Risk aversion.

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1 Introduction

In many instances, the seller of a good or service knows more about this good or service than the consumer himself. Such expert services or goods have been called credence goods (see Darby and Karni, 1973). Examples include the services provided by repair professionals, agricultural consultants, medical doctors or lawyers. In all of these professions the seller not only provides the service but also acts as an expert diagnosing the consumer’s requirements. This gives the expert incentives to bias his recommendation towards the more profitable service for him. Nevertheless, the existing literature on expert-customer relationships shows that the expert provides an efficient treatment when the three following assumptions hold (see Dulleck and Kerschbamer, 2006): i) consumers are homogenous,1 ii) consumers are committed to an expert once this one makes a recommendation, and iii) the type of treatment provided is verifiable.2 The key to this result is that, at the equilibrium, the expert charges the same markup for all possible treatments, removing any incentive to provide an inefficient treatment. Emons (1997, 2001) finds similar result when the expert faces capacity constraints.

In the present paper, we extend the literature by considering risk-averse consumers. This assumption is particular relevant in several markets of credence goods where consumers are known as risk-averse. The pesticide used by farmers is one first example. This type of product is generally supplied in combination with some advice on the precise product to use and the conditions for using it. An important body of the literature in agricultural economics shows that farmers are risk-averse. This aversion helps explain the intensive use of risk-reducing inputs such as pesticides (see e.g. Moschini and Hennessy, 2001, and Carpentier and Weaver, 1997). The supply of car repair to women is another example. An Australian report of the Consumer Law Centre Victoria concludes that in automobile repair industry, women do not receive the same standard of service as men and pay more to protect themselves from such a discrimination (Foster, 1997). Considering risk aversion might help explain this result.3 At last, analyzing the

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1 See Dulleck and Kerschbamer, 2006 and Hyndmana and Ozerturk, 2011, for situations where this assumption does not hold.
2 Several works focus on situations where consumers cannot observe the type of treatment provided, so the expert may defraud the consumers by misrepresenting a low-cost service as a costly one (see e.g. Wolinsky 1993, Fong 2005 or Alger and Salanié, 2006).
3 Numerous studies in sociology, psychology, experimental economics, and econometrics, women are found to be more averse to risk than men (see e.g. Byrnes et al., 1999, Cohen and Einav, 2007, and Gong and Yang, 2011).
supply of medical or legal services has more sense if risk aversion is taken into account especially in countries with weak social insurance programmes.\textsuperscript{4}

We show that the efficiency result of literature described in Dulleck and Kerschbamer (2006) may be broken when consumers are risk-averse. The force that drives our result is the tension between the equal mark-up pricing that allows the expert to commit to providing the appropriate treatment and the risk borne by the consumers under this type of tariff. Because of risk aversion, the customer is in fact willing to pay a premium for a risk free tariff that necessarily involves no equal markup and thus leads either to inefficient overtreatment or undertreatment. Even if it is known in principal-agent games that the optimal contract is second best when the agent is risk averse, we show that the detail of how risk aversion leads to inefficiency is different in a basic model of credence goods.

In addition to this central result, our analysis also sheds new light on the crucial effect of liability on efficiency. So, conversely to the literature with risk-neutral consumers liability plays here a non negligible influence on market efficiency.

The model is presented in the first section. We then analyze the expert’s equilibrium strategy and its consequences on efficiency. Section 5 introduces competition an Section 6 concludes.

\section{The model}

We use a standard expert model of credence goods similar to the one developed in Dulleck and Kerschbamer (2006). We assume a continuum of identical consumers with total mass of 1. Each consumer has a problem which can be major or minor. Two treatments are available: a minor treatment can only solve a minor problem while a major treatment can solve both types of problem. The parameter $v$ is the gross gain of a consumer when his problem is solved, otherwise he gets 0. The consumer knows that he has a problem but he does not know its type. Ex-ante, each consumer expects that his problem is major with a probability $h$ and minor with a probability $(1 - h)$. The consumers are supposed to be risk averse. Their utility follow a Von Neumann-Morgenstern form $u(x)$ with $u(0) = 0$, $x$ being the consumer’s net gain.

An expert can detect the true type of the problem only by conducting a proper diagnostic.

\textsuperscript{4}Numerous studies find a negative correlation between wealth and risk aversion (see for instance Guiso and Paiella, 2008).
Without diagnosis, the expert can not supply an appropriate treatment and can only choose to always supply a minor treatment (undertreatment) or a major one (overtreatment). The cost of a major treatment is $\overline{\sigma}$, and the cost of a minor treatment is $\underline{\sigma}$, with $\overline{\sigma} > \underline{\sigma}$. If diagnostic is performed, the expert bears a cost $d$ that is charged to the consumers. In accordance with the literature on expert markets, we suppose that consumers are committed to stay with the expert once the recommendation is made, and also that the type of treatment provided by the expert is verifiable.

In the first period of the game, the expert posts prices $\overline{p}$ and $\underline{p}$ respectively for a major and a minor treatment, and commits to conducting a diagnosis or not. Consumers observe theses actions and decide whether to visit the expert or not (second period). In the third period, nature determines the type of the consumer’s problem (major or minor). In the fourth period, the expert conducts a diagnosis or not, recommends a treatment, charges for it and provides it. The action of making a diagnosis is observed by the client but the result of this diagnosis is not. As the customer is committed to undergo a treatment by the expert, the game just described is a complete information game.

3 The price setting strategy of the expert

First, consider prices $(\overline{p}, \underline{p})$ that ensure equal markup to the expert for both treatments $(\underline{p} = \overline{p} - \overline{\sigma} + \underline{\sigma})$. The expert performs a diagnosis and is induced to provide the right treatment, so that the gross gain of the consumer is always $v$. The net gain of the consumer is uncertain because the charged price depends on the result of the diagnostic. Hence, before the diagnosis and the expert’s recommendation, the consumer expects that their gain will follow a lottery: $v - \overline{p} - d$ with a probability $h$ and $v - \underline{p} - d$ with a probability $1 - h$. The consumer’s expected utility is given by $h(\overline{v} - \overline{p} - d) + (1 - h) \overline{u}(v - (\overline{p} - \overline{\sigma} + \underline{\sigma}) - d)$. The expert chooses prices that drive the consumer’s expected utility down to 0. The consumer incurs a risk premium $\delta \in (0, (1 - h)(\overline{\sigma} - \underline{\sigma})$ which is such that:

$$u(v - \overline{p} - d + (1 - h)(\overline{\sigma} - \underline{\sigma}) - \delta) = h u(v - \overline{p} - d) + (1 - h) u(v - (\overline{p} - \overline{\sigma} + \underline{\sigma}) - d) = 0 \quad (1)$$
Therefore, the expert posts prices satisfying:

$$\pi = v - d + (1 - h)(\sigma - \zeta) - \delta \quad \text{and} \quad \underline{p} = \pi - \zeta$$

The risk premium clearly reduces the profit of the expert with respect to the case with risk neutral consumers.

The expert could decide instead to post prices \((\pi, \underline{p})\) that induce him to always provide the major treatment (i.e. \(\pi - \zeta > p - \zeta\)). No diagnosis is required and thus no diagnostic cost is charged to the consumer. Moreover, the administration of the major treatment fully insures the consumer: his utility is \(u (v - \pi)\). The prices posted are \(\pi = v\) and \(\underline{p} < \pi - \zeta + \zeta\). The risk aversion of consumers play here no role.

Finally, the expert could also post prices \((\pi, \underline{p})\) that always lead to a minor treatment (i.e. \(\pi - \zeta < p - \zeta\)). The consumer does not pay any diagnostic cost but bears the risk of an insufficient treatment. As a consequence there exists a risk premium \(\gamma \in (0, (1 - h)v]\) such that:

$$u((1 - h)v - \pi - \gamma) = h u(-\underline{p}) + (1 - h) u(v - \underline{p}) = 0$$

and the expert posts prices satisfying:

$$\underline{p} = (1 - h)v - \gamma \quad \text{and} \quad \pi < \underline{p} - \zeta + \zeta$$

The subgame perfect Nash equilibrium is the result of the comparison of previous profits.

**Lemma 1** The equilibrium prices \((\pi, \underline{p})\) satisfy:

$$\begin{cases} 
\pi - \zeta = \pi - \zeta \quad \text{with} \quad \pi = v - d + (1 - h)(\sigma - \zeta) - \delta, \quad \text{for} \quad d \leq \text{Min} \quad \left\{ \frac{(1 - h)(\sigma - \zeta)}{h(v - (\sigma - \zeta)) + \gamma} \right\} - \delta, \\
\pi - \zeta > \pi - \zeta \quad \text{with} \quad \pi = v, \quad \text{for} \quad d \geq (1 - h)(\sigma - \zeta) - \delta \quad \text{and} \quad v \geq \frac{\pi - \zeta - \gamma}{h}, \\
\pi - \zeta < \pi - \zeta \quad \text{with} \quad \pi = (1 - h)v - \gamma, \quad \text{for} \quad d \geq h(v - (\sigma - \zeta)) + \gamma - \delta \quad \text{and} \quad v \leq \frac{\pi - \zeta - \gamma}{h}. 
\end{cases}$$

**Proof.** See Appendix 1. ■

This lemma shows that the risk aversion of the consumers, captured by positive risk-premia \(\delta\) and \(\gamma\), clearly induces the expert to bias its pricing strategy towards the case where the
consumer is fully insured i.e. the overtreatment. Indeed, to credibly commit to the revelation of the correct diagnosis result, the two mark-ups must be equal. This leads the consumer to bear risk whereas under overtreatment, the consumer is certain to always pay the same price. As a result, in the presence of risk aversion, the expert is more inclined than in the risk neutral case to propose the overtreatment to capture the risk premium. The bias between undertreatment against appropriate treatment depends on the case where the consumer bears the highest risk (the comparison between $\gamma$ and $\delta$).

4 Efficiency analysis

To what extent does the introduction of risk aversion lead the expert to bias his behavior with respect to the case where the diagnosis outcome is common knowledge? To answer that question, we first determine the efficient solution, i.e. the equilibrium under symmetric information.

If the expert wants to follow an overtreatment strategy, his profit does not depend on the information available so he does not need to conduct a diagnosis. If we denote by $\pi^{O*}$ the profit of the expert under symmetric information with overtreatment $(O)$ and by $\pi^{O}$ the profit of the expert under asymmetric information with overtreatment, we have: $\pi^{O*} = \pi^{O} \equiv v - \varpi$. In the same way, undertreatment $(U)$ does not require diagnosis so that using a similar notation we have also $\pi^{U*} = \pi^{U} \equiv (1 - h)v - \gamma - \varpi$.

Suppose now that the expert makes a diagnosis and provides the appropriate treatment $(AT)$. His profit under symmetric information is thus given by $\pi^{AT*} \equiv h(\varpi - \varphi) + (1 - h)(p - \varpi)$, which is maximized under the participation constraint of the consumer given by $hu(v - p - d) + (1 - h)u(v - p - d) \geq 0$. Thus the expert charges $\varphi = p = v - d$ and his profit is given by:

$$\pi^{AT*} \equiv v - d - \varpi - h(\varphi - \varpi) \tag{5}$$

So an expert who provides an appropriate treatment earns a higher profit than under asymmetric information since: $\pi^{AT*} > \pi^{AT} \equiv v - d - \delta - \varpi - h(\varphi - \varpi)$.

The following Lemma presents the equilibrium under symmetric information, and Proposition 1 concludes on the efficiency of the equilibrium stated by Lemma 1.
Lemma 2 The efficient solution is such that:

(a) the expert sets a price $p$ if the major treatment is diagnosed and a price $\overline{p}$ if the minor treatment is diagnosed with $\overline{p} = \overline{p} = v - d$, for $d \leq \text{Min}\left\{(1-h)(\overline{p} - \overline{c}), h(v - (\overline{p} - \overline{c}) + \gamma)\right\},$

(b) the expert does not undertake diagnosis and sets a price $\overline{p} = v$ for the major treatment only for $d \geq (1-h)(\overline{p} - \overline{c})$ and for $v \geq \frac{\overline{p} - v \gamma}{h},$

(c) the expert does not undertake diagnosis and sets a price $p = (1-h)v - \gamma$ for the minor treatment only for $d \geq h(v - (\overline{p} - \overline{c})) + \gamma$ and $v \leq \frac{\overline{p} - v \gamma}{h}.$

Proof. See Appendix 2. ■

Based on Lemmata 1 and 2, we have the following implication.

Proposition 1 With risk-averse consumers, the expert strategy leads to an inefficient equilibrium for intermediary level of the diagnostic cost:

$$d \in \left[\text{Min}\left\{(1-h)(\overline{p} - \overline{c}), h(v - (\overline{p} - \overline{c}) + \gamma)\right\} - \delta, \text{Min}\left\{(1-h)(\overline{p} - \overline{c}), h(v - (\overline{p} - \overline{c}) + \gamma)\right\}\right]$$

Our main conclusion concerns the inefficiency of the equilibrium for an intermediate level of the diagnosis cost. Let us explain that result. With symmetric information on the diagnosis outcome, if the expert undertakes the diagnosis, it chooses the same price for both treatments ($\overline{p} = \overline{p} = v - d$) and then provides the appropriate treatment. The information symmetry on the diagnosis outcome allows the combination of a risk free tariff and the completion of the appropriate treatment. As long as the diagnostic cost is low enough, it is profitable for the expert to undertake the diagnosis and to propose the appropriate treatment. Otherwise, the experts either chooses an overtreatment or an undertreatment. With asymmetric information, in order to induce a truthful revelation of the diagnosis result, the expert is constrained to differentiate the price according to the treatment proposed. In other words, full insurance and information revelation are no longer compatible. Thus, under symmetric information, the full insurance allows the expert to capture the risk premium while under asymmetric information the expert is constrained to leave that risk premium to the consumer. This risk premium reduces the rent captured by the expert. If the expert provides instead an overtreatment, there is no
risk since the consumer always pays the treatment and the diagnostic cost is saved. This choice is inefficient as long as the diagnostic cost is not too high but could be preferred by the expert that is no longer constrained to leave the risk premium to the consumer. Hence an inefficient choice of overtreatment for $(1 - h)(\tau - \varrho) - \delta < d < (1 - h)(\tau - \varrho)$. The expert could also choose the undertreatment. The diagnostic cost is also saved but compared to the appropriate treatment, the outcome is also risky. Nevertheless this risk incurred with undertreatment is still present under symmetric information while the risk with an appropriate treatment is only due to the information asymmetry. Hence, as before, there is a bias against appropriate treatment: whenever $d$ is such that $h(v - (\tau - \varrho)) + \gamma - \delta < d < h(v - (\tau - \varrho)) + \gamma$, information asymmetry leads the expert to choose an undertreatment whereas the appropriate treatment is inefficient.

The figure 1 illustrates theses inefficient zones (hatched) with a quadratic utility function.

The usual efficiency result resurfaces when undertreatment is prohibited by a liability clause.

**Proposition 2** A liability clause restores efficiency with risk-averse consumers.

With the liability assumption, undertreatment is *de facto* prohibited. Hence, the expert provides and appropriate treatment for any price such that $p - \varrho \geq \tau - \varrho$. As a result, the expert provides the appropriated treatment from the expert with a risk free tariff: $p = \tau = v - d$. Thus, consumers are always efficiently served. This crucial effect of liability on efficiency is consistent with the recent experimental study of Dulleck *et al.* (2011). These experiments show that, contrary to the predictions of the theoretical literature, verifiability of the treatment provided alone has no significant impact on the degree of efficiency, while the addition of liability has a highly significantly positive impact on the degree of efficiency.

5 Competition, inefficient experts and risk-averse consumers

We consider now an extended version of our model with two identical experts that compete in price. As before, an expert proposes a tariff for each treatment and a possible diagnosis at price $d$. Our purpose is to study whether our previous results is affected by the introduction of competition.
Not surprisingly, the competition between the two identical experts drives the prices down to the treatment costs.

In an equilibrium with appropriate treatment (AT), the two experts propose a diagnosis at price \( d \) with prices at their marginal cost: \( \bar{p} = \bar{c} \) and \( p = c \). Nevertheless, as before, such a tariff induces risk for the consumers. The expected utility of the consumer is 

\[
lu(v - \bar{c} - d) + (1 - h)u(v - c - d) = u(v - h\bar{c} - (1 - h)c - d - \delta)
\]

where \( \delta \) is the corresponding risk premium. We should observe here that since the prices are lower than under monopoly, the risk premium \( \delta \) is potentially different from \( \delta \). It is lower than \( \delta \) if the consumer has a decreasing absolute risk aversion function \( u \) and higher than \( \delta \) in case of an increasing absolute risk aversion function. The AT is an equilibrium as long as one expert is not induced to deviate by proposing, for instance, overtreatment at a price higher than \( \bar{c} \) without diagnosis. The highest price a consumer accepts to pay for overtreatment is 

\[
u_c + (1 - h)c + d + \tilde{\delta}.
\]

Therefore, the deviation is profitable as long as 

\[
\tilde{\delta} \geq (1 - h)c - d - e \tilde{\delta}.
\]

In an equilibrium with overtreatment (O), the experts provide no diagnosis and competition also constrains both experts prices for the major treatment to \( \bar{p} = \bar{c} \). The price \( p \) for the minor treatment is such that \( p < c \). The corresponding utility of the consumer is thus equal to \( u(v - \bar{c}) \). If an expert deviates towards the undertreatment and sets a price \( p > c \) for the minor treatment, the expected utility of the consumer becomes 

\[
lu(-p) + (1 - h)u(v - p) = u((1 - h)v - p - \gamma)
\]

where \( \gamma \) is the risk premium. Therefore, the highest price \( p \) is equal to \( \bar{c} - hv - \gamma \) so that the deviation is profitable as long as 

\[
v \leq \frac{\bar{c} - \gamma}{h}.
\]

Again, the position of the risk premium \( \gamma \) with respect to \( \gamma \) depends on the form of the utility function \( u \).

Note that the homogeneity of consumers ensures that there is no equilibrium where each expert proposes a different tariff. Indeed, all the consumers would prefer only one of these two tariffs and would thus induce one expert to deviate.

We derive the following lemma and proposition from the previous discussion, which respectively specifies the tariff proposed by experts at equilibrium, and summarizes the impact of the competition on the provision of the efficient treatment.
Lemma 3 Competition between two identical experts leads to the following equilibrium:

\[
\begin{cases}
\bar{v} - \bar{c} = p - c = 0 \text{ for } d \leq \min \{(1-h)(\bar{v} - \bar{c}), h(v - (\bar{v} - \bar{c}) + \bar{\gamma})\} - \delta, \\
\bar{v} = \bar{c} \text{ and } p < c \text{ for } d \geq (1-h)(\bar{v} - \bar{c}) - \tilde{\delta} \text{ and } v \geq \frac{\bar{v} - \bar{c} - \tilde{\gamma}}{h}, \\
\bar{v} < \bar{c} \text{ and } p = c \text{ for } d \geq h(v - (\bar{v} - \bar{c})) + \tilde{\gamma} - \tilde{\delta} \text{ and } v \leq \frac{\bar{v} - \bar{c} - \tilde{\gamma}}{h}.
\end{cases}
\]

The subgame-perfect equilibrium with competition is inefficient for:

\[
d \in \left[ \min \left\{ \frac{(1-h)(\bar{v} - \bar{c})}{h}, h(v - (\bar{v} - \bar{c}) + \tilde{\gamma}) \right\} - \tilde{\delta}, \min \left\{ \frac{(1-h)(\bar{v} - \bar{c})}{h}, h(v - (\bar{v} - \bar{c}) + \tilde{\gamma}) \right\} \right]
\]

Based on Lemma 3 and Proposition 1, we have the following implication.

Proposition 3 Competition between experts reduces the inefficiency if the consumers have a decreasing absolute risk aversion VNM function and magnifies the inefficiency if the consumers have an increasing absolute risk aversion VNM function.

Hence, provided that the consumer is characterized by a decreasing absolute risk aversion (DARA) utility function, competition between experts reduces inefficiency in the sense that the range of parameters where the experts provide overtreatment and undertreatment is narrower than under monopoly (i.e. \( \tilde{\delta} < \delta \)). However inefficiency remains a possible outcome despite the competition between experts. Moreover, competition actually increases the range of parameters over which inefficient outcomes arise if the consumer is characterized by a increasing absolute risk aversion (IARA) utility function. The intuition is basically the same as the one with a monopoly. The appropriate treatment requires equal mark-up but the introduction of competition drives the mark-up down to zero. To fully ensure the consumers, an expert could be induced to deviate from that equilibrium by providing overtreatment at a higher price because of the risk premium. Nevertheless, since the prices in the AT equilibrium with competition are lower than under monopoly, the risk premium changes. If the risk premium is lower, the deviation is less likely to be profitable. In that case, competition reduces the likelihood of an inefficient equilibrium. Nevertheless, we cannot exclude a higher risk premium that would increase the incentive to provide an overtreatment. In that case, the introduction of competition worsens the provision of inefficient treatments.
Finally, as in the monopoly case, the efficiency result obtains when the liability assumption holds too. Consider the case where both experts set \( p = \bar{p} = \bar{c} + (1 - h)\xi \). Because \( \bar{p} - \bar{c} < p - \xi \), there is no overtreatment and the undertreatment is prohibited by the liability. As a result, for these prices consumers are served efficiently. Moreover, this tariff is risk free and because both prices are equal to the expected cost, the utility of consumers is maximized. Thus, there is no profitable deviation for an expert.

6 Conclusion

In this paper we show that risk-averse consumers may lead to an inefficient behavior of experts in a credence good market. Information revelation requires that all treatments are sold at the same profit margin. However, with risk-averse consumers such equal margin tariffs generate a risk premium. This may drive the expert to abstain from diagnosis and supply an inefficient treatment. Such a behavior may be cured with a liability clause. By prohibiting undertreatment, a liability clause allows the expert to provide the appropriated treatment with a risk free tariff. Our results hold in a monopoly setting and under Bertrand competition.
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References


Appendix

Appendix 1: Proof Lemma 1

Under equal markup prices (i.e. $\bar{p} - \bar{c} = p - c$) and diagnosis committed, the consumer is provided honestly and its expected utility is $hu(v - \bar{p} - d) + (1 - h) u(v - p - d)$. The most profitable price $\bar{p}$ is such that $hu(v - \bar{p} - d) + (1 - h) u(v - p - d) = 0$. We define the risk premium $\delta$ by the following equality: $hu(v - \bar{p} - d) + (1 - h) u(v - p - d) = u(v - \bar{p} + (1 - h) (\bar{p} - p) - d - \delta)$, with $\delta \in (0, (1 - h) (\bar{p} - p)]$. Under equal markup prices (i.e. $\bar{p} - \bar{c} = p - c$) without diagnosis committed, the expert is fraudulent.5 In that case, overtreatment or undertreatment is more profitable.

Under markup prices more important for the major problem (resp. the minor problem), the expert is fraudulent and has not interest to conduce a diagnosis, the consumer’s utility is $u(v - \bar{p})$ (resp. $hu(-\bar{p}) + (1 - h) u(v - \bar{p})$).

Since consumers are risk-averse, the maximal profit per customer for a monopolist is: $\pi^{AT} \equiv v - d - \delta - c - h (\bar{c} - c)$ under equal markup, $\pi^{O} \equiv v - \bar{c}$ under overtreatment, and $\pi^{U} \equiv (1 - h) v - \bar{c}$.

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5The expert is fraudulent as so far as he may provide an unappropriated treatment.
\[ \gamma - \zeta \] under undertreatment. It is easy to see that i) \( \pi^{AT} \geq \pi^O \) iff \( d \leq (1 - h)(\bar{\sigma} - \zeta) - \delta \), ii) \( \pi^{AT} \geq \pi^U \) iff \( d \leq h(v - (\bar{\sigma} - \zeta) + \gamma - \delta) \), and iii) \( \pi^O \geq \pi^U \) iff \( v \geq \frac{\bar{\sigma} - \zeta - \gamma}{h} \).

**Appendix 2: Proof Lemma 2**

The consumers are efficiently served when they are served as in an environment without asymmetric information. The expert that provides an overtreatment (resp. an undertreatment) does not conduce a diagnosis, so he charges the same prices and has the same profit what the diagnosis result is common knowledge or not (\( \pi^{O*} = \pi^O \equiv v - \sigma \) and \( \pi^{U*} = \pi^U \equiv (1 - h)v - \gamma - \zeta \)).

Without asymmetric information, the expert that provides an appropriate treatment maximizes his profit given by \( \pi^{AT*} \equiv \pi^O \equiv \pi^U \equiv (1 - h)(\bar{\sigma} - \zeta) \) under the consumer participation constraint \( hu(v - \bar{\sigma} - d) + (1 - h)u(v - \bar{\sigma} - d) \geq 0 \). The expert charges \( \bar{\pi} = \bar{p} = v - d \), his profit is superior than in the environment with asymmetric information: \( \pi^{AT*} \equiv \pi^O \equiv \pi^U \equiv (1 - h)(\bar{\sigma} - \zeta) \). It is easy to see that i) \( \pi^{AT*} \geq \pi^{O*} \) iff \( d \leq (1 - h)(\bar{\sigma} - \zeta) \), ii) \( \pi^{AT*} \geq \pi^{U*} \) iff \( d \leq h(v - (\bar{\sigma} - \zeta) + \gamma) \), and iii) \( \pi^{O*} \geq \pi^{U*} \) iff \( v \geq \frac{\bar{\sigma} - \zeta - \gamma}{h} \). Then the equilibrium prices \((\bar{\pi}, \bar{p})\) satisfies:

\[
\begin{cases}
\bar{\pi} = \bar{p} = v - d, \text{ for } d \leq Min \left\{ \begin{array}{c}
(1 - h)(\bar{\sigma} - \zeta), \\
h(v - (\bar{\sigma} - \zeta)) + \gamma
\end{array} \right\}, \\
\bar{\pi} - \bar{\sigma} > \bar{\pi} - \zeta \text{ with } \bar{p} = v, \text{ for } d \geq (1 - h)(\bar{\sigma} - \zeta) \text{ and } v \geq \frac{\bar{\sigma} - \zeta - \gamma}{h}, \\
\bar{\pi} - \bar{\sigma} < \bar{\pi} - \zeta \text{ with } p = (1 - h)v - \gamma, \text{ for } d \geq h(v - (\bar{\sigma} - \zeta)) + \gamma \text{ and } v \leq \frac{\bar{\sigma} - \zeta - \gamma}{h}.
\end{cases}
\]

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6 The superscript \( AT, O, \) and \( U \) indicates the treatment supplied: appropriate treatment, overtreatment and undertreatment.

7 The superscript \( * \) indicates an efficient environment, i.e. without asymmetric information.
Figure 1: Expert’s choice according to $d$ and $v$ with risk-averse consumers.

(with $u(x) = x - \frac{1}{2}x^2$, $\zeta = 0$, $\sigma = 1/2$, $h = 1/2$

and $\tilde{v} = \frac{\zeta - \tilde{c}}{h}$ with $\gamma = 1 - \sqrt{1 + (h - 1)hv^2}$

and $\delta = 1 - \sqrt{1 + (h - 1)h(\sigma - \zeta)^2}$)