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Product Price and Advice Quality: Implications of the Commission System in Life Assurance

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Abstract

The paper examines the implications of the commission system for the price of life assurance products and the quality of advice provided by brokers. The competitive equilibrium is shown to be neither first best nor second best efficient. The sources of the inefficiencies are examined and the effects of policy measures considered.

Key words: Advice quality, Brokers' commissions, Life assurance.

1. Introduction

> . . . it can never be advantageous to permit insurance companies to compete with one another in the sale of their policies by escalating the commissions which they pay to intermediaries. Such competition must be detrimental to the public as likely to lead to higher prices for policies and, more especially, to less prospect of impartial advice by intermediaries. (Gower [1984], 8.39)

Potential consumers of life assurance products are often alleged to be both initially ignorant of many of the products' characteristics and to be passive in that they wait to be provided with information, rather than gathering it themselves. This situation is summarized in the view that life assurance products are 'sold rather than bought'. Potential consumers can be provided with information about the products by brokers who are remunerated from commissions paid by the product companies. Product companies compete for brokers (and thus for sales) through the commission they pay brokers.

As the quotation from the Gower report on Investor Protection indicates, such competition is thought to be harmful to consumers because higher commissions are reflected in higher product prices and increase the incentive for brokers to mislead consumers. Such assertions have been used in a number of European countries to justify product companies making collusive agreements not to compete via commissions to brokers.

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This paper presents a simple model of the determination of product price and commissions and uses it to examine whether the equilibrium of the industry is likely to be efficient and what types of policy could increase efficiency. Section 2 sets out the basic model of a competitive market in which life assurance products are sold via honest brokers to passive consumers. The welfare properties of the equilibrium and possible regulatory policies are considered in section 3. Section 4 examines the incentive for brokers to exaggerate the benefits of the product and mislead consumers into purchases they would not otherwise have made. The welfare properties of a market with dishonest brokers are analyzed in section 5 and the last section draws some conclusions.

Two complementary papers examine other aspects of the market. In Gravelle [1991a] brokers can vary their selling effort and product companies can also engage in direct marketing. These complications make little difference to the results concerning brokers. The current paper extends the analysis in Gravelle [1991a] by considering the effect of the commission system on the incentives for dissembling by brokers and by examining a wider range of policy options. It also separates out the implications of consumer passivity and marketing externalities, which are conflated in the earlier paper, and shows that the assumption of marketing externalities is not essential for the equilibrium of the industry to be inefficient. Gravelle [1991b] develops a model in which brokers are paid fees by potential consumers for providing information about product characteristics and contrasts the equilibria of the fee for advice and commission systems.

2. The competitive equilibrium

Consumers. Potential consumers buy at most one unit of the product and are initially uninformed about product characteristics. It is assumed that ignorance takes a simple form: if a potential consumer is not contacted by a broker, and given information about its characteristics, he will not buy the product.[1] When the potential consumer is contacted and informed he can place a value on the benefits from the product and decide whether to purchase the product. Different individuals have different benefits from the product and buy it if

$$b \geq p \tag{1}$$

where b is the benefit and p is the price of the product. The distribution function of the benefits of the product over the population is $F(b)$. F is assumed to be twice differentiable and to have support $[b_0, b_1]$.

Brokers. There is unimpeded entry into broking. Each broker contacts one potential consumer[2] and incurs three types of cost. The cost of achieving a contact is $K(n)$, where n is the number of brokers in the industry. When $K'(n) > 0$ brokers impose congestion costs, or marketing externalities, on each other because it becomes more difficult to find new contacts as the number of brokers increases.[3] To distinguish the welfare effects of consumer passivity and congestion costs, we also consider the case in which there are no congestion costs: $K' = 0$. The second type of broker cost is an opportunity cost w: a broker must earn an expected income at least as great as her reservation wage w if she is to remain in the industry. The reservation wage of the marginal broker is a non-decreasing function of the number of brokers in the industry: $w'(n) \geq 0$. The broker is also subject to a license fee or broker tax T.

A broker knows the distribution function $F(b)$ of consumer benefits but does not know the realization of b for a contact. Each broker realizes that, once she has contacted a potential customer and explained the characteristics of the product, the probability of a sale is

$$Pr[b \geq p] = 1 - F(p). \tag{2}$$

It is assumed, until section 4, that brokers are honest in their dealings with potential customers and give them accurate information about the characteristics of the product.

Brokers are paid a commission of k if they sell the product. Each contacts one potential consumer and the expected revenue of a broker is

$$r = k[1 - F(p)] = r(p, k). \tag{3}$$

With unimpeded entry, equilibrium requires that the expected revenue of the marginal broker just covers her costs:

$$r(p, k) - K(n) - w(n) - T = 0. \tag{4}$$

Solving (4) for the equilibrium number of brokers gives the broker supply function[4]

$$n = n(r(p, k), T) \tag{5}$$

whose properties are summarized in

Lemma 1: *The supply of brokers is increasing in expected revenue:* $n_r > 0$, *decreasing in the product price:* $n_r r_p < 0$, *increasing in the commission:* $n_r r_k > 0$, *and decreasing in the broker tax:* $n_T < 0$.

Increases in the commission increase broker revenue at a given product price and therefore increase the supply of brokers. The supply of brokers is decreasing in the product price because higher product price reduce the probability of a sale when a contact has been made and so reduce the broker's expected revenue.

Figure 1 illustrates, with $T > 0$, the three possible types of equilibria. When there is no congestion ($K' = 0$, $w' > 0$) the equilibrium is at a, where the total

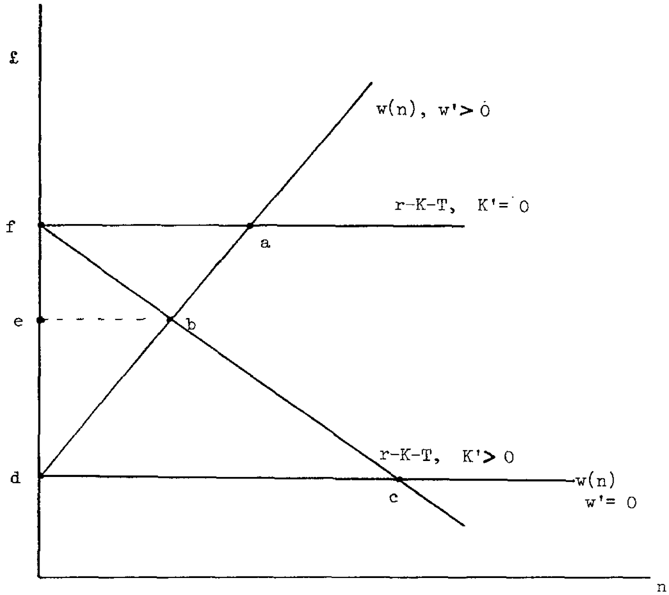

Figure 1. Three possible types of equilibria with $T > 0$.

rent earned by brokers is afd. When there are congestion costs and an increasing reservation wage ($K' > 0$, $w' > 0$) the equilibrium is at b and total rent is bed. If the reservation wage is constant and there are congestion costs ($K' > 0$, $w' = 0$) the equilibrium is at c where the entry of brokers dissipates all the rent.

Product companies. The life assurance companies are risk neutral. Their products have identical characteristics and are perfect substitutes. The product has a constant marginal cost of c and is subject to a per unit tax of t. Firms can only make sales through brokers,[5] so that their costs per unit sold are $c + k + t$.

Equilibrium. Firms compete for brokers through the expected revenue their product offers the brokers who sell it. The price of the product and the commission will be set to maximize the expected revenue of a broker, subject to firms breaking even on sales:

$$p = c + k + t. \tag{6}$$

Since $r(p, k)$ is increasing in k and decreasing in p, companies cannot offer a product with a (p, k) combination which maximizes r and generates a positive profit on sales. If r is not maximized, some company could attract all the brokers by offering a (p, k) combination which yields them a larger expected revenue. In equilibrium, competition amongst product companies for the services of brokers (and thus for sales) must lead to all firms offering the product price and commission which maximizes the expected income of each broker.

Although the number of brokers affects the costs of each broker, all firms and brokers ignore the effect of the commission and product price on the number of brokers. There is free entry into broking and n is not controlled by any single firm or broker. In offering a commission and product price which maximizes a broker's revenue each product firm takes the number of brokers in the industry as given.

A broker is the only means by which a potential customer can learn about the characteristics of the product. Brokers exploit their position by acting as though they were buying the product from the product company at a cost of $c + t$ and reselling it to the captive contact, thereby earning $(p - c - t)(1 - F)$.

Substituting (6) into (3) gives the expected revenue of the broker as $r(c + k + t, k)$ which is maximized when

$$\begin{aligned} dr(c + k + t, k)/dk &= r_p + r_k \\ &= -kf(c + k + t) + 1 - F(c + k + t) = 0 \end{aligned} \tag{7}$$

where f is the density function of benefits. We assume the distribution function is such that $r(c + k, k)$ is strictly concave in k:

$$-kf' - 2f < 0 \tag{8}$$

so that (7) is sufficient for a maximum.

One fairly weak assumption which ensures concavity of r in k is that the hazard rate of the distribution $f/(1 - F)$ is non-decreasing in b. To see this note that $\partial(f/(1 - F)/\partial b \geq 0$ implies

$$0 \leq \left[\frac{(1 - F)f'}{f} + f\right] = kf' + f < kf' + 2f$$

where we have used (7) to substitute k for $(1 - F)/f$. The hazard rate $f(p)/[1 - F(p)]$ can be interpreted as the probability that a contact has a benefit of p given that he has not rejected the product at the price p. By increasing the commission and hence the price by £1 the broker runs the risk that the contact will turn down the product and she will lose her commission k. Thus $kf/(1 - F)$ is the marginal cost from increasing the commission by £1. If the hazard rate is non-decreasing this marginal cost is increasing in k and so there is a unique k at which the marginal gain from an increase in the commission (£1) is equal to the marginal cost. Distributions with increasing hazard rates include the uniform and the chi square with more than two degrees freedom. The exponential distribution has a constant hazard rate, while the hazard rate for the lognormal is increasing and then decreasing.

Since the number of brokers is increasing in the expected revenue we have

Proposition 1: *The competitive equilibrium commission maximizes the number of brokers in the industry.*

The competitive equilibrium is illustrated in Figure 2 for a case in which the benefits to potential customers are uniformly distributed and $c + t \in (b_0, b_1)$. The left hand panel plots the expected demand and marginal revenue curves of a contact. The broker gets an expected revenue equal to the shaded area. Product companies just break even and the product price and commission lie along the $c + t + k$ line in the right hand panel. Contours of the supply function $n(r(p, k), T)$ are positively sloped curves like n^e and n^*, with lower curves corresponding to a larger supply of brokers. The contours are concave in (p, k) space since n is an increasing function of $r(p, k)$, which is quasi-concave by our assumption that $r(c + t + k, k)$ is concave in k. Since the competitive equilibrium commission maximizes the number of brokers, the equilibrium in this panel is at E where the broker supply contour n^e is tangent to the product company break even line.

Comparative statics. Most of the comparative static properties of the equilibrium are straightforward but it is useful to give them explicitly here since they are required for analysis of the welfare effects of various tax policies.

Lemma 2: *(a) Increases in the broker tax T have no effect on the commission or the product price. (b) Increases in the product tax t reduce the number of brokers and (c) increase the product price. (d) Increases in t reduce the commission if and*

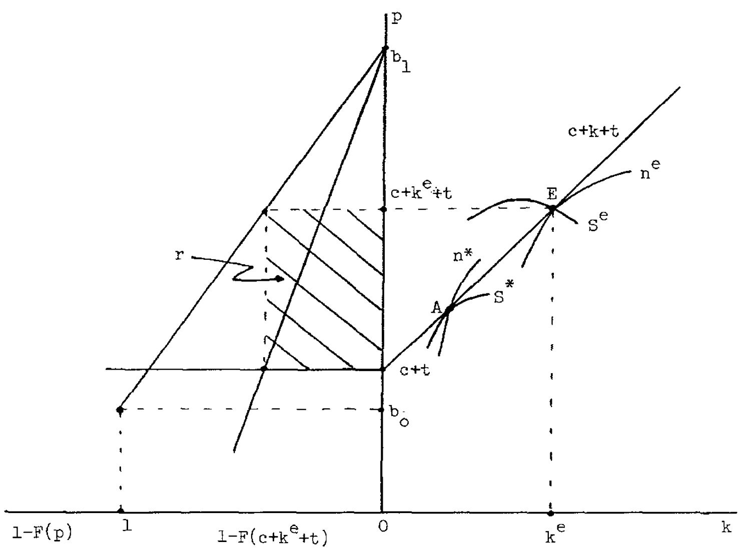

Figure 2. The competitive equilibrium for a case in which the benefits to potential customers are uniformly distributed.

only if the distribution function has an increasing hazard rate: $\partial\{f(b)/[1 - F(b)]\}/\partial b > 0$.

Proof: (a) is obvious since T enters negatively in (4) and not at all in (7). For (d) partial differentiation of the first order condition (7) with respect to t and using $k = (1 - F)/f$ gives $\partial(dr/dk)/\partial t = -kf' - f = -(1 - F)f'/f - f$ which has the same sign as $\partial[-f/(1 - F)]/\partial b$. For (c): $dp/dt = d(c + k + t)/dt = 1 + dk/dt = 1 - [-kf' - f]/[-kf' - 2f] = f/[kf' + 2f]$, which is positive by the second order condition (8). Part (b) follows from the envelope theorem ($dr/dt = \partial r/\partial t < 0$) and the fact that n is increasing in r.

Remarks: Increases in the cost of being a broker affect the number of brokers by reducing the net income from broking. But the assumption that such costs are incurred irrespective of whether a sale is made means that they have no influence on product price and commission.

Since $p = c + k + t$, increases in t affect product price directly and also indirectly because they change the revenue maximizing commission. Brokers are analogous to monopolists, each acting as though she produced the product with a marginal cost of $c + t$ and sold it at a price p to get profit per contact of $(p - c - t)[1 - F(p)]$. As in the standard monopoly model, increases in marginal cost of the product to the broker $(c + t)$ increase the product price. However, the effect of an increase in t on $k = p - c - t$ is ambiguous because it increases both $c + t$ and the product price. Although the required restriction on the distribution function is non-trivial, it is satisfied by some well known distributions.

3. Policy

Welfare. We denote the expected consumer surplus of a contact as[6]

$$Z(p) = \int_p^{b_l} (\tilde{b} - p)dF. \tag{9}$$

To abstract from distributional complications we take the welfare criterion to be an unweighted sum of expected consumer surpluses, broker rents, firm profits and the government budget surplus from any taxes or license fees:

$$\begin{aligned} S(p, n) = {} & nZ(p) + n[r - K(n) - T] - \int_0^n w(\tilde{n})d\tilde{n} \\ & + n(1 - F)(p - c - k - t) + n[(1 - F)t + T] \\ = {} & nZ(p) + n(p - c)(1 - F) - nK(n) - \int_0^n w(\tilde{n})d\tilde{n}. \end{aligned} \tag{10}$$

Welfare depends on the number of brokers, which determines the number of potential consumers who become informed, and on the price informed consumers pay. The marginal social values of *ceteris paribus* increases in n and p are

$$S_n(p, n) = Z(p) + (p - c)(1 - F) - K - nK' - w \tag{11}$$

$$S_p(p, n) = -n[p - c]f \tag{12}$$

and the welfare function is assumed to be concave in p and n.[7]

First best policy. The first best allocation is characterized by $S_n = 0 = S_p$ and is achievable via a competitive equilibrium by a regulator who can control the product tax and the license fee.

Proposition 2: *(a) The unregulated competive equilibrium with $T = 0 = t$ is not first best efficient since the product price exceeds marginal cost. (b) The first best is achievable with a product subsidy equal to the commission $t^* = -k$ and a broker tax T^* which could be negative or positive.*

Proof: Optimal taxes satisfy

$$dS/dT = S_n dn/dT + S_p dp/dT = S_n dn/dT = 0 \tag{13}$$

$$dS/dt = S_n dn/dt + S_p dp/dt = 0. \tag{14}$$

From lemmas 1 and 2 we have $dp/dt = 0$, $dn/dT < 0$ and $dp/dt > 0$. Hence (13) and (14) imply $S_n = 0 = S_p$, as required for the first best. To ensure that $S_p = 0$ the regulator sets a first best product tax $t^* = -k(t^*)$, which implies $p = c$.

The first best number of brokers satisfies

$$S_n(c, n^*) = Z(c) - K(n^*) - n^*K'(n^*) - w(n^*) = 0 \tag{15}$$

which can be achieved by the regulator setting the broker tax

$$T^* = r + n^*K'(n^*) - Z(c)$$

so that the equilibrium condition (4) implies that the first best requirement (15) is satisfied.

Remark: The first best optimal product subsidy ensures that the purchase decision of a contact reflects only the marginal cost of the product, and is not affected by the forgone costs of providing him with information. The first best broker tax T^* internalizes the externalities associated with the fact that the entry decision of the marginal broker reflects only her private costs and benefits. She ignores both the increased costs of all the other brokers and the expected consumer surplus of the potential purchaser she contacts. Depending on which of these externalities is greater when $p = c$ the first best broker tax should be positive or negative.

Second best policy. There is a *second best welfare problem* if the regulator only has one effective instrument. When the regulator can control entry, either directly or via the broker tax T, but cannot tax or subsidize the product, the second best number of brokers is $\hat{n}$, which satisfies

$$S_n(p, \hat{n}) = Z(p) + (p - c)(1 - F) - K(\hat{n}) - \hat{n}(K'(\hat{n}) - w(\hat{n}) = 0. \qquad (16)$$

Proposition 3: *(a) The second best number of brokers is smaller than the first best number. (b) The unregulated competitive equilibrium could have too many or too few brokers compared with the second best number $\hat{n}$ achievable by control of the broker tax T.*

Proof: Because the product price exceeds the first best level c, the sum of the expected consumer surplus and broker revenue is smaller than at the first best: $Z(p) + (p - c)(1 - F) = \int_p(b - c)dF < \int_c(b - c)dF$. Comparing (15) and (16) gives part (a). Using $r = k(1 - F) = (p - c)(1 - F)$ and the brokers' entry equilibrium condition (4) in (11), we see that at the unregulated equilibrium where $T = 0 = t$ the value of an additional broker is

$$S_n(p, n) = Z(p) - nK'(n) \qquad (17)$$

which could be negative or positive.

Remark: Because the marginal broker ignores both the social benefit she generates by contacting another consumer (Z) and the additional costs she imposes on other brokers (nK'), the unregulated competitive equilibrium can have too many or too few brokers. The smaller are congestion effects the more likely is it that there are too few brokers compared with the second best number.

If the regulator could only control the product price by a tax, it is not clear whether the tax should be negative (as in the first best case) or positive. However, we can establish

Proposition 4: *A sufficient condition for the optimal second best product tax to be negative is that there are no congestion effects.*

Proof: When $T = 0$, so that (13) does not hold, the marginal value of increasing the product tax from $t = 0$ is:

$$dS/dt = S_n dn/dt + S_p dp/dt = S_n dn/dt - n(r(c + k), 0)(p - c)f dp/dt. \quad (18)$$

But when $K' = 0$ we see from (11) that $S_n > 0$ and so, using lemma 2, dS/dt is negative at $t = 0$.

Remark: Only in the unlikely event that the optimal first broker tax is $T^* = 0$

will it be true that the first best is achievable via the use of a product subsidy alone. In this sense the inefficiencies in the equilibrium are more intractable than in the usual monopoly case, where a suitable per unit subsidy to the monopolist will yield a first best with price equal to marginal cost. The difficulty here is that total consumption, and therefore welfare, depends on the number of brokers, as well as the product price. Two policy instruments are needed to achieve the first best because there are two first best efficiency requirements.

As a final example of second best policy, suppose that the regulator could fix the commission but had no tax instruments ($T = 0 = t$).

Proposition 5: *It is possible to increase welfare by a suitable mandated reduction in the commission below its unregulated competitive equilibrium level.*

Proof: The marginal social value of an increase in k at the unregulated equilibrium is

$$dS/dk = S_n dn/dk + S_p dp/dk = S_p dp/dk < 0$$

since, from Proposition 1, $dn/dk = 0$.

Remarks: Changing the commission will alter both the number of brokers and the product price. But at the competitive equilibrium the commission maximizes the number of brokers and only the effect on the price is relevant for policy. Since a reduction in the commission reduces the product price, we have a rationale for controls on commissions.

In Figure 2 the second best optimum, when only the commission is regulated ($T = 0 = t$), is at A. The curves S^*, S^e are welfare contours. When $p > c$ welfare is decreasing in p and lower welfare contours correspond to higher welfare levels. Concavity of the welfare contours in (p, k) space require complicated restrictions on the functional forms, but Proposition 5 implies that the welfare contour S^e through E cuts the supply contour and the breakeven line $p = c + t + k$ from above. Thus the second best optimum A on the breakeven line must lie to the left of the competitive equilibrium E. At A the marginal social value of brokers S_n is positive but the benefit from increasing the number of brokers by raising the commission ($S_n dn/dk$) is just offset by the reduced benefit to each purchaser of a policy from the rise in price caused by the higher commission. The second best optimum A has a smaller price and commission than the competitive equilibrium E and lies on a higher $n(r(p, k), 0)$ contour, so that there are fewer brokers than at E.

When brokers are paid by means of a commission included in the price of the product the equilibrium is inefficient compared with the first best level. The product is sold at too high a price. If there are no marketing externalities the equilibrium price is too high even compared with the second best: a subsidy to product companies would increase welfare. There are two reasons for this: the first is the usual argument that a subsidy on a monopolist's output increases welfare because it enables marginal consumers who value the good at more than its marginal cost to consume. The only difference here is that the monopoly power arises from the exploitation of consumer passivity by individual brokers, rather than a single firm. The second reason is that, if there are no marketing externalities, there are too few brokers since they do not internalize all the benefits of their entry to the industry. They ignore the fact that, by contacting additional potential consumers, they generate a positive expected consumer surplus from the informed contact. Thus there will be inefficiency in the industry even if there are no marketing externalities.

4. Misrepresentation by brokers

We have so far ignored the possibility that brokers may be tempted to exploit the initial ignorance of potential customers by providing them with incorrect or misleading information. This section analyses the incentives for such misrepresentation under a commission system and the quality of advice in equilibrium. The following section considers the impact of various policies. Apart from the possibility of misrepresentation, the model is identical to that used in sections 2 and 3.

Misrepresentation.[8] Misrepresentation by a broker could take a variety of forms, including providing misleading information about the characteristics of the product, exaggerating the benefits to be derived from the characteristics or understating the price of the product. As a result the contact may be led to buy the product when he would have been better off without it. We model misrepresentation as increasing the contact's perceived benefit from his true benefit b to

$$\beta = \beta(b; \ell),\ \beta(b; 0) = b,\ \beta_b > 0,\ \beta_\ell > 0. \tag{19}$$

ℓ is a parameter which indicates the amount of exaggeration or lying that the broker can indulge in. If brokers are honest ($\ell = 0$) the perceived and true benefit coincide. To keep the analysis simple it is assumed that ℓ is given: brokers can either choose to be honest or lie to an extent which is the same for all brokers. An increase in the true benefit will presumably increase the perceived benefit ($\beta > 0$). Two obvious and simple examples of the misrepresentation technology are the additive $\beta = b + \ell$ and the multiplicative $\beta = \ell b$.

A contact buys if his perceived benefit is at least as large as the price: $\beta(b; \ell) \geq p$. At the price p the marginal misled consumer has a true benefit of ϱ, defined by $\beta(\varrho; \ell) = p$, so that

$$\varrho = \varrho(p; \ell),\ \varrho_p = 1/\beta_b > 0,\ \varrho_\ell = -\beta_\ell/\beta_b < 0. \tag{20}$$

Since all consumers with $b \geq \varrho(p; \ell)$ will buy, the probability that a contact who has been lied to will buy the product at price p is

$$1 - F(\varrho(p; \ell)). \tag{21}$$

We can interpret $\varrho(p; \ell)$ as the perceived price if a broker lies to a contact: exaggeration of the benefits is equivalent to understating the price of the product.[9] Exaggeration shifts the distribution of perceived benefits and the expected demand curve of contacts to the right.

Figure 3 illustrates the effect of dissembling by a broker. Some of the contacts who buy from dishonest brokers would have been better off not buying the product at all because their true benefit is less than the price of the product. Of the individuals contacted by dishonest brokers, the proportion who are misled into buying the product and who would not have done so if correctly informed, is $F(p) - F(\varrho)$. The expected true benefit from buying the product for an individual in this group is the area under the informed consumers' expected demand curve from $F(\varrho)$ to $F(p)$: $a_6 + a_7 + a_8$. The expected expenditure on the product by this misled group is $p[F(p) - F(\varrho)]$ or $a_5 + a_6 + a_7 + a_8$. The expected benefit or willingness to pay is less than expected expenditure and the individuals in this group have an average loss from purchasing the product equal to area a_5. The other individuals in the misinformed group gain from purchasing the product: their average true willingness to pay is $a_1 + a_2 + a_3 + a_4$ and they pay only $a_2 + a_3 + a_4$. Their true expected consumer surplus from buying the product is a_1 per capita (equal to that of correctly informed group contacts). On average, sales by dishonest brokers may make their contacts better off (if $a_1 > a_5$), despite the fact that they have misrepresented the benefits of the product.

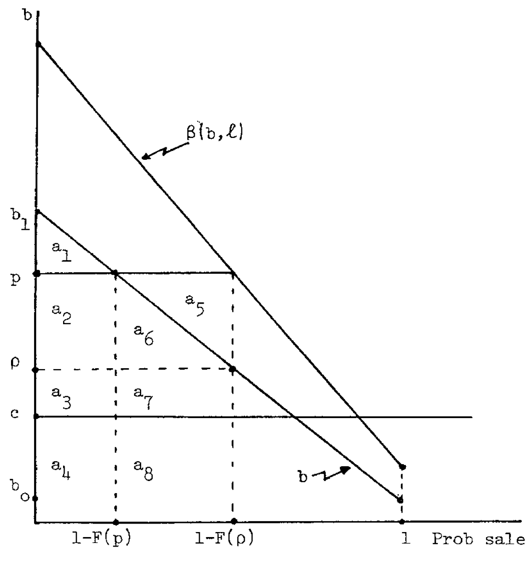

Figure 3. The effect of dissembling by a broker.

Contacts of a dishonest broker buy the product if $b \geq \varrho(p;\ \ell)$ and have an expected consumer surplus of

$$Z(p;\ \ell) = \int_{\varrho}^{b_I} (b - p)dF \tag{22}$$

which is $a_1 - a_5$ in Figure 3. The expected consumer surplus of a contact of an honest broker is defined analogously as $Z(p;\ 0)$ and shown as a_1 in Figure 3. $Z(p;\ 0)$ was written as $Z(p)$ in section 3.

Incentives for misrepresentation. The broker's expected income per contact if he is dishonest and exaggerates the merits of the product is

$$r^1 = k[1 - F(\varrho(p;\ \ell))] = r(p,\ k;\ \ell) \tag{23}$$

which is greater than his expected income per contact if he is honest

$$r^0 = k[1 - F(p)] = r(p,\ k;\ 0). \tag{24}$$

The expected gain per contact from exaggeration is shown in Figure 3 as $a_5 + a_6 + a_7$. Even though there are pecuniary gains to dishonesty not all brokers choose to be dishonest. There are costs associated with lying. These may take the form of a loss of self esteem from misleading contacts who believe the broker is acting in their interest. There may also be some risk of being detected in giving misleading information and of being punished by the regulatory authorities. A broker who chooses to be dishonest incurs a cost of δ.

A potential broker who has a reservation wage of w and a dishonesty cost of δ must decide whether to enter the industry and whether to be honest if she does enter. She will enter the industry if

$$\max\{r^0 - K - w - T,\ r^1 - K - w - T - \delta\} \geq 0. \tag{25}$$

If she does enter she will be dishonest if the gain in expected revenue from dissembling exceeds her dishonesty cost:

$$r^1 - r^0 \geq \delta. \tag{26}$$

The number of honest and dishonest brokers in the industry for given $(p,\ k)$ depends on the distribution of reservation wages and dishonesty costs in the population of potential brokers. To simplify the analysis, it is assumed that w and δ are independently distributed and that a proportion θ of potential brokers have the same positive and finite dishonesty cost $\delta > 0$. Such potential brokers may be dishonest if they enter. The remaining proportion $1 - \theta$ of potential brokers have an arbitrarily large dishonesty cost and are never dishonest if they enter the industry. (More general specifications do not affect the substantive results.)

The number of potential brokers with a reservation wage of w or less is $Q(w)$, where $Q'(w) > 0$. The independence assumption implies that the numbers of honest and dishonest potential brokers with reservation wages less than w are $(1 - \theta)Q(w)$ and $\theta Q(w)$ respectively. Since honest brokers get an income from broking of $r^0 - K - T$, the number of honest brokers in the industry is

$$n^0 = (1 - \theta)Q(r^0 - K(n) - T) \tag{27}$$

and the reservation wage of the marginal honest broker is

$$w^0 = Q^{-1}(n^0/(1 - \theta)) = w^0(n^0; \theta),\ w^0_{n^0} > 0,\ w^0_\theta > 0. \tag{28}$$

When $\delta \leq r^1 - r^0$ all potentially dishonest brokers who enter will be dishonest[10] and there will be

$$n^1 = \theta Q(r^1 - K(n) - \delta - T) \tag{29}$$

dishonest brokers in the industry. The reservation wage of the marginal dishonest broker is

$$w^1 = Q^{-1}(n^1/\theta) = w^1(n^1; \theta),\ w^1_{n^1} > 0,\ w^1_\theta < 0. \tag{30}$$

Entry takes place until the marginal honest and dishonest entrants just break even:

$$r^0 - K(n^0 + n^1) - T - w^0(n^0; \theta) = 0 \tag{31}$$

$$r^1 - K(n^0 + n^1) - T - \delta - w^1(n^1; \theta) = 0. \tag{32}$$

The free entry conditions yield the supply functions of honest and dishonest brokers:

$$n^i = n^i(r^0, r^1; T, \theta, \delta), \qquad i = 0, 1 \tag{33}$$

whose properties are summarized in Table 1.

Most of the results are intuitive but some require comment. The ambiguous responses tend to arise because of congestion effects. For example, a *ceteris paribus* increase in the expected revenue of honest brokers will increase the number of honest brokers. If there are congestion effects the increase in n will increase the costs of dishonest brokers and thereby reduce their number. Notice that, since this argument requires an increase in congestion costs, the total number of brokers must increase when r^0 increases. Another result which requires elaboration is that an increase in the proportion of θ of potentially dishonest types in the population

Table 1. Supply responses of honest and dishonest brokers.

	n^0	n^1	$n^0 + n^1$
r^0	+	sign $-K'$	+
r^1	sign $-K'$	+	+
T	−	−	−
θ	−	+	+
l	sign $-K'$	+	+
δ	sign K'	−	−

of potential brokers increases the total number of brokers. The intuition is clearest in the case in which there are no congestion costs $K' = 0$ which implies that the supply of each type of broker is independent of the other. From (27) and (29) we see that increases in θ reduce the number of honest brokers at the rate $Q(r^0 - K - T)$ and increase the number of dishonest brokers at the rate $Q(r^1 - K - T - \delta)$. Since $Q(r^1 - K - T - \delta) > Q(r^0 - K - T)$ the total number of brokers must increase.

Equilibrium with misrepresentation. Each type of broker would prefer the commission and price which maximize their expected revenue (r^0 or r^1) subject to the firms' break even constraints. The commission preferred by honest brokers satisfies (7). At the commission k^0 favored by honest brokers

$$dr^1/dk = -k^0 f(\varrho(c + k^0 + t; \ell))\varrho_p + 1 - F(\varrho(c + k^0 + t; \ell) \tag{34}$$

could be negative or positive, so that the commission favored by dishonest brokers could be smaller or larger than k^0. We can establish

Proposition 6: *Dishonest brokers prefer a larger (smaller) commission than the honest brokers if the hazard rate $f(p)/[1 - F(p)]$ is increasing (decreasing) and $\varrho_p \leq (\geq) 1$.*

Proof: Substitute $[1 - F(p)]/f(p)$ for k^0 in (34), multiply through by $f(p)/[1 - F(p)][1 - F(\varrho)]$ to see that (34) is positive or negative i.f.f. $f(p)/[1 - F(p)] - f(\varrho)\varrho_p/[1 - F(\varrho)]$ is positive or negative. Since $p > \varrho$ the proposition follows.

Remark: Dishonest brokers face a demand curve for the product which is shifted to the right at all prices. However this is not sufficient to tell us whether they will prefer a higher or lower commission and price than honest brokers for the same reason that a monopolist's price may rise or fall when her demand curve shifts out. We have to make assumptions which, in effect, place restrictions on the effect of dissembling on the slope of the demand curve as well as its position. Note that in the simple case of a uniform distribution and additive lying, dishonest brokers will prefer a higher commission and price than honest brokers.

We will assume that the commission chosen maximizes the expected revenue of honest brokers,[11] so that (7) and the supply functions (33) define the equilibrium with broker misrepresentation.

Comparative statics. The responses of p and k to a change in the product tax are identical to those in the previous section. An increase in the product tax affects the supply of brokers by altering their expected revenues:

$$\frac{dn^i}{dt} = \frac{\partial n^i}{\partial r^0}\frac{dr^0}{dt} + \frac{\partial n^i}{\partial r^1}\frac{dr^1}{dt}, \quad (i = 1, 2). \tag{35}$$

Although in general these supply responses are ambiguous, we have

Proposition 7: *(a)* $dn^0/dt < 0$ *if* $K' = 0$. *(b)* $dn^1/dt < 0$ *if the hazard rate is non-decreasing,* $\varrho_p \leq 1$ *and* $K' = 0$. *(c)* $dn/dt < 0$ *if the hazard rate is non-decreasing.*

Proof: From the envelope theorem, $dr^0/dt = -kf(p)$. The effect of t on r^1 is, from (23)

$$\frac{dr^1}{dt} = \frac{dr^1}{dk}\frac{dk}{dt} - kf(\varrho(p;\ell))\varrho_p. \tag{36}$$

Hence total differentiation of (31) and (32) gives

$$\frac{dn^0}{dt} = \frac{1}{\Delta}\left[-(K' + w_n^1)kf(p) - K'\frac{dr^1}{dt}\right] \tag{37}$$

$$\frac{dn^1}{dt} = \frac{1}{\Delta}\left[K'kf(p) + (K' + w_n^0)\frac{dr^1}{dt}\right] \tag{38}$$

where $\Delta = w_n^0 w_n^1 + (w_n^0 + w_n^0)K' > 0$ is the determinant of the system. Part (a) follows immediately from setting $K' = 0$ in (37). For part (b) note that with $K' = 0$ (38) has the same sign as (36). From Proposition 1, $dk/dt < 0$ if the hazard rate is increasing. From Proposition 6, a non-decreasing hazard rate and $\varrho_p \leq 1$ imply that (34) is non-negative and so $(dr^1/dk)(dk/dt)$ is non-positive and $dr^1/dt < 0$. For part (c) note that the sign of the sum of (37) and (38) is the sign of $w_n^0(dr^1/dt) - w_n^1 kf$ and use the previous argument.

Remark: An increase in the product tax reduces the revenue of honest brokers and, if there are no complicating congestion effects, must lead to a reduction in the number of honest brokers. If there are no congestion effects the effect of the induced change in the commission on the revenue of dishonest brokers could be positive or negative and so the supply of dishonest brokers could increase or decrease. Hence restrictions on the benefit distribution are necessary to sign the effect on the total number of brokers.

5. Policy with dishonest brokers

Welfare with misrepresentation. The welfare function is again the sum of the surpluses of consumers, brokers and firms:

$$S(p, n^0, n^1; \delta, \ell, \theta) = n^0 Z(p; 0) + n^1 Z(p; \ell) + (p - c)\{n^0[1 - F(p)] + n^1[1 - F(\varrho)]\} - (n^0 + n^1)K - \sum_i \int_0^{n^i} w^i(\tilde{n}^i; \theta)d\tilde{n}^i - n^1\delta. \quad (39)$$

Because welfare is an unweighted sum of the utilities of all the agents, even the dishonest ones, the dishonesty cost $n^1\delta$ is counted as a social cost. We note below the occasions on which this assumption may materially affect the conclusions.

Welfare depends on the product price, the amount of misrepresentation that dishonest brokers indulge in and the numbers of each type of broker. As preparation for the policy analysis, consider the *ceteris paribus* welfare effects of changes in p, ℓ, δ.

Lemma 3: *(a) An increase in the product price decreases welfare if the perceived price is not less than marginal cost:* $\varrho \geq c \Rightarrow S_p \leq 0$. *(b) An increase in the amount of exaggeration reduces welfare if and only if the perceived price is less than marginal cost:* $S_\ell \gtreqless 0 \Leftrightarrow \varrho \gtreqless c$. *(c) An increase in the dishonesty cost reduces welfare:* $S_\delta = -n^1$.

Proof: The lemma is established by examining the partial derivatives of (39):

$$S_p = -n^0 f(p)(p - c) - n^1 f(\varrho)(\varrho - c)\varrho_p \quad (40)$$

$$S_\ell = -n^1(\varrho - p)f(\varrho)\varrho_\ell - n^1(p - c)f(\varrho)\varrho_\ell = -n^1(\varrho - c)f(\varrho)\varrho_\ell. \quad (41)$$

Remarks: When a dishonest broker exaggerates the benefit of the product to the extent that the perceived price is less than marginal cost, there is positive probability that the product is sold to a contact for whom $b \in [\varrho, c)$. Such a sale is welfare reducing because the increase in the broker income plus tax revenue $(p - c - t) + t = p - c$ is less than the negative consumer surplus $c - b$ of the buyer. Thus an increase in p when $\varrho < c$ can be welfare increasing because it increases ϱ and reduces the probability of sale to a contact who values the product at less than its marginal cost.

An increase in ℓ means that contacts who previously did not buy the product will now buy it if $b = \varrho$. Such a sale changes the combined surplus of consumers, brokers and the government by $(\varrho - p) + (p - c - t) + t = \rho - c$. Even though the marginal consumer values the product at less than its price ($\varrho < p$) the increase in broker income and tax revenue will more than outweigh the negative consumer surplus of the marginal consumer if $\varrho > c$. Hence an increase in dissembling can be welfare increasing!

Proposition 8: *The competitive equilibrium with dissembling is neither (a) first best efficient nor (b) second best efficient*

Proof: The social values of additional honest and dishonest brokers at the competitive equilibrium ($t = 0 = T$) are

$$S_{n^0} = Z(p; 0) + (p - c)[1 - F(\rho)] - K - nK' - w^0 = Z(p; 0) - nK' \tag{42}$$

$$S_{n^1} = Z(p; \ell) + (p - c)[(1 - F(\varrho)] - K - nK' - w^1 - \delta$$
$$= Z(p; \ell) - nK'. \tag{43}$$

The competitive equilibrium is not first best efficient since replacing a dishonest broker by an honest one increases welfare by

$$S_{n^0}(p, n^0, n^1; \delta, \theta) - S_{n^1}(p, n^0, n^1; \delta, \theta) = Z(p; 0) - Z(p; \ell) > 0. \tag{44}$$

For part (b) note that in general (42) and (43) could be positive or negative and that, from Table 1, increases in the broker tax T reduce the number of brokers of each type. Hence

$$\frac{dS}{dT} = \sum_i S_{n^i} \frac{dn^i}{dT} \tag{45}$$

will in general be non-zero at the competitive equilibrium.

Remarks: A first best allocation would have no dishonest brokers. It is always better to have a given number of contacts made only by honest brokers rather than by a mixture of honest and dishonest brokers. Replacing a dishonest broker with an honest broker with the same reservation wage reduces the probability that her contact is misled into buying a product which makes him worse off.

The competitive equilibrium is not second best efficient because the social value of brokers is not zero and there are feasible policies which will alter the number of brokers. If the regulator is limited to varying T (with $t = 0$) the optimal broker tax could be positive even if there are no congestion effects. If a dishonest broker can mislead her contact to such extent that on average he is worse off if he buys the product [$Z(p; \ell) < 0$], it may be optimal to set $T > 0$ even though honest brokers have a positive marginal social value.

These conclusions are not altered materially if the dishonesty costs of brokers are not regarded as social costs, so that $n^1\delta$ is not included in the welfare function. The marginal social value of a dishonest broker is then

$$S_{n^I} = Z(p; \ell) + (p - c)[(1 - F(\varrho)] - K - nK' - w^1 \\ = Z(p; \ell) - nK' + \delta. \tag{46}$$

Dishonest brokers may now be more valuable at the margin than honest brokers because the marginal dishonest brokers takes account of a private cost δ which is not a social cost. However in general the number of brokers is still inefficient at the competitive equilibrium.

The same arguments imply that taxing or subsidizing the product via t can also be welfare increasing. It is even more difficult to sign the optimal product tax than the broker tax. The product tax also alters the product price with ambiguous welfare effects (see (40)). Further, unlike the broker tax, the effect of the product tax on the numbers of brokers is ambiguous (see Proposition 7).

Control of commissions. If the regulator can control the commission, subject to $p = c + t + k$, the marginal value of an increase in k at the equilibrium is

$$\frac{dS}{dk} = S_p + \sum_i S_{n^i} \frac{\partial n^i}{\partial r^I} \frac{dr^I}{dk} \tag{47}$$

remembering that $dr^0/dk = 0$ from (7). Again the welfare effect of the policy instrument is ambiguous but we can establish

Proposition 9: *A reduction in the commission from the unregulated competitive equilibrium level can increase welfare if (i) $K' = 0$, (ii) the hazard rate is non-increasing and $\varrho_p \geq 1$, and (iii) ℓ is small enough that $S_p < 0$, $S_{n^I} \geq 0$.*

Proof: The first restriction ensures that a small change in k has no effect on the number of honest brokers (see Table 1). The second implies that a reduction in the commission does not decrease the revenue of dishonest brokers (see Proposition 6) and hence their number. The third restriction implies that the reduction in price caused by the reduction in the commission and any increase in the number of dishonest brokers is welfare increasing.

Remark: One simple set of assumptions which satisfies (i) and (ii) is that the benefit distribution is exponential and the exaggeration 'technology' (19) is additive.

Punishment of dishonest brokers. We could interpret the dishonesty cost δ as including the expected value of punishment imposed on brokers who mislead their contacts. The regulator may be able to increase δ by increasing penalties or by increasing the probability of detection. The welfare effect of an increase in δ is

$$\frac{dS}{d\delta} = \sum_i S_{n^i} \frac{\partial n^i}{\partial \delta} - n^1 \tag{48}$$

and we have

Proposition 10: *(a) If there are no congestion effects ($K' = 0$), increases in punishment increase welfare only if $S_{n^I} = Z(p, \ell) < 0$. (b) Punishment is more likely to be welfare increasing the greater are the congestion effects.*

Proof: The sum of the first two terms in (48) is

$$G = [Z(p; 0) - Z(p, \ell)]K'(n)\Delta^{-1} - [Z(p; \ell) - nK'(n)]w_n^0\Delta^{-1} \tag{49}$$

where $\Delta > 0$ is the determinant of the system (27), (29). (48) is positive only if (49) is positive. If $K' = 0$, G is positive if and only if $Z(p; \ell) < 0$. For part (b): when $K' > 0$ the first term in (49) is positive (recall (44)) and so G increases as K' becomes greater.

Remarks: With no congestion effects, changes in punishment only affect the number of dishonest brokers. When dishonest brokers have a positive social value $Z(p; \ell) > 0$ it cannot be optimal to punish them, since this will reduce their number.

When there are congestion effects increases in punishment reduce the number of dishonest brokers and increase the number of honest brokers. This results in a welfare gain, as shown by the first part of (49). However, more dishonest brokers leave than are replaced by honest brokers. The second term in (49) is the welfare effect of the net reduction in the number of brokers. This is more likely to increase welfare the larger are the congestion costs saved by the reduction in the number of brokers.

Variations in ℓ. The regulator may be able to influence the amount of exaggeration that dishonest brokers can engage in without detection by their contacts. For example, it may be possible to control the content of promotional literature or provide cooling off periods within which contacts can revoke their agreements to buy the product. We can model such regulations as a reduction in ℓ.

Proposition 11: *A policy which reduces the amount of exaggeration may be welfare decreasing.*

Proof: Totally differentiating (27) and (29) with respect to ℓ, solving for the supply responses of the two types of broker and making use of (41), (42), (43) and (49) gives

$$\frac{dS}{d\ell} = f(\varrho)\varrho_\ell kG - f(\varrho)\varrho_\ell n'[\varrho - c] \tag{50}$$

which is ambiguously signed (recall the discussion of (49) and (41)).

Remarks: An increase in exaggeration has two types of effect. It alters the expected surplus of potential consumers contacted by a dishonest broker. This direct effect of exaggeration on welfare (the second term in (50)) is ambiguous (recall (41)). Exaggeration also alters the numbers of brokers and thus the number of contacts with given expected consumer surpluses. Much of the discussion of punishment applies here. An increase in exaggeration increases the expected revenue of dishonest brokers and therefore increases their number. If there are congestion effects the increase in the number of dishonest brokers will impose additional costs on honest brokers and drive some of them from the industry. The total number of brokers will increase. Although the replacement of honest by dishonest brokers is welfare reducing the net increase in the number of brokers may increase welfare if dishonest brokers have a positive social value.

6. Conclusions

This paper has used a simple model of the market for life assurance, in which company products are sold to passive consumers by brokers, to investigate whether common criticisms of the commission system are justified. The competition among product companies for sales via brokers was shown to lead to an equilibrium product price and number of brokers which is neither first best nor second best efficient. When brokers are honest and give impartial advice the equilibrium is inefficient for two reasons. First, brokers exploit consumers' passivity. Since consumers do not search, or otherwise attempt to gather information, the broker is in the position of monopoly power in respect of a potential consumer she contacts. In effect the broker "buys" the product from competing product companies at marginal cost and offers it to a contact at a price equal to marginal cost plus her commission. Thus the price to contacts is inefficient compared to the first best level (marginal cost). The price is also second best inefficient because the commission, and thus the product price, maximize the broker's expected revenue from a contact, rather than the sum of the contact's consumer surplus and the broker's revenue.

The second source of inefficiency is that brokers' entry decisions are made on the basis of their private costs and benefits. These differ from the social costs and benefits. Increases in the number of brokers make it more difficult for each broker to achieve a contact. In deciding to enter the industry each broker ignores the resulting increase in the costs of other brokers. Further, brokers do not capture all the consumer surplus of contacts and consequently have too little incentive to enter. Depending on the relative magnitudes of contacts' surpluses and congestion effects, the number of brokers will be too small or too large.

Welfare can be increased by suitably chosen taxes on the product, taxes on brokers and by direct controls on commissions. Indeed the first best is achievable by the combination of a subsidy, equal to the commission to reduce the product price to marginal cost, and a tax or subsidy on brokers to ensure that their entry decisions reflect all the social costs and benefits.

The paper has also examined the incentives for brokers to exaggerate the benefits from products and thereby mislead contacts into making purchases they would not otherwise have made. The equilibrium with dissembling brokers is also first best and second best inefficient. However, policy is less straightforward than in the case where there is no dissembling. The main reason is that, although some contacts of dishonest brokers make purchases which leave them worse off, other contacts are better off being contacted by a dishonest broker compared with not being contacted at all. A purchase made on the basis of misleading information can still leave the contact better off. The expected surplus of the contacts of dishonest brokers may be positive. Hence measures designed to reduce the number of dishonest brokers may be welfare decreasing!

The model used in the paper is very simple and, as indicated at various points, it is not difficult to think of extensions or alternative specifications. However, such amendments are unlikely to alter the basic messages: although the industry equilibrium is second best inefficient, the appropriate policy measures may be counter-intuitive.

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Notes

1. The passivity of most potential consumers appears to be a maintained assumption of many regulators and commentators. Passivity may be a rational response to the fact that it is time consuming and costly to learn about the complex characteristics of a product which may be bought only once. Potential consumers who actively acquire information by searching, hiring financial advisers etc could be incorporated into the model. They could, for example, buy direct from the product companies or negotiate commission sharing with brokers. Such consumers would tend to reduce the rents available to brokers and therefore reduce the equilibrium number of brokers. They will not alter the basic arguments in the paper.
2. This simplifying assumption has no substantive effect on the results. Gravelle [1991a] examines the case in which the broker can increase the number of contacts by increasing her effort.
3. After the first version of this paper was written I discovered Goldberg [1986] which makes a telling analogy between fishing and selling: consumers are like fish, waiting to be hooked by selling efforts of firms. His analysis is wider ranging but less formal.
4. The implicit function theorem requires that either $w' > 0$ or $K' > 0$.
5. Allowing for direct marketing by firms complicates the analysis and makes no difference to the results concerning brokers (see Gravelle [1991a]).
6. Consumer surplus is usually written as the integral of quantity demanded with respect to price. This is equivalent to the formulation given here. Remember that demand by a contact is the

probability that he buys the product at the price p: $1 - F(p)$. Integrating by parts and using $F(b_l) = 1$, we see

$$\int_p^{b_l} (\tilde{b} - p) f(\tilde{b}) d\tilde{b} = (b_l - p) - \int_p^{b_l} F(\tilde{b}) d\tilde{b} = \int_p^{b_l} [1 - F(\tilde{p})] d\tilde{p}$$

since the symbol for the variable of integration is immaterial.

7. The required assumptions are somewhat more severe than for the problem of maximizing broker revenue to be well behaved.
8. An alternative approach to modeling misrepresentation is given in the persuasion game analyzed by Milgrom [1981] and Milgrom and Roberts [1986]. There the salesman is restricted to telling the truth but not the whole truth, there are no costs of dishonesty and the equilibrium number of salesmen is not considered.
9. It would make little difference to assume that consumers realized that a proportion of brokers were dishonest and lied. Since consumers cannot distinguish honest from dishonest brokers the probability of a sale would be reduced for both types of brokers but dishonest brokers would still have a greater probability of a sale.
10. If $\delta > r^1 - r^0$, dishonest potential brokers will not lie if they enter. This is the model of section 2: there will be $n = Q(r^0 - K - T)$ brokers in the industry and the reservation wage of the marginal broker will satisfy $r^0 - K(n) - T = w(n) = Q^{-1}(n)$. Thus the section 2 model in which all brokers are honest is a special case in which either δ always exceeds $r^1 - r^0$ or $\theta = 0$.
11. Product firms may not wish to deal knowingly with dishonest brokers or regulators may be able to detect and punish firms which offer different commissions. If firms were willing to deal with dishonest brokers and consumers did not realize that honest and dishonest brokers would have different commissions, and therefore offer products with different prices, the equilibrium would be characterized by an additional equation: the expression (34) set equal to zero. The results would not be substantially different.

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