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Lack of Credibility in Food Markets
- driving medium quality food out of the market

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LACK OF CREDIBILITY IN FOOD MARKETS
- DRIVING MEDIUM QUALITY FOOD OUT OF THE MARKET

Abstract

Some food markets are dominated by high quality and standard quality segments, whereas medium quality products are almost absent. A modeling framework with asymmetric information regarding true quality of the products and the resulting lack of consumer confidence is presented. Uncertainty regarding the quality of alleged medium quality products provides certain consumer groups to divert consumptions away from medium quality to either standard or high quality products. These countervailing incentives explain the missing medium quality products. Empirical examples are given to motivate the model.

Keywords: Adverse selection, asymmetric information, consumer behavior, product differentiation, uncertainty, JEL: D11, D82, Q13

Introduction

The paper analyzes the phenomenon that a high quality segment and a standard quality segment dominate some consumer markets, whereas medium quality products are almost absent. An adverse selection model provides an explanation. By extending Akerlof's (1970) lemons market to consider three distinct product qualities rather than just two, it is shown that uncertainty regarding the true quality of alleged medium quality products drives medium quality products out of the market.

The following section gives examples from domestic food markets in Denmark. In section 2 an adverse selection model is used to illustrate the market mechanisms leading to almost absence of medium quality food. Section 3 and 4 concludes and discusses.

1. Examples from Danish food markets

This section gives examples of products withdrawn from the market. Firstly definitions of the different qualities are given.

Three distinct quality types q are considered: Standard, medium and high quality ranked on a one-dimensional scale, according to:

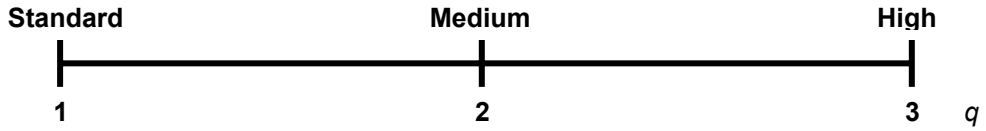

Figure 1. One-dimensional scale of quality

In this paper conventional food products and organic products respectively represent standard quality and high quality within food markets. Non-organic differentiated food products are considered as medium quality.

During the last decade consumers have become more focused on animal welfare and food quality and safety. This focus and the apparent change in consumer preferences has triggered the introduction of animal based products that claim to take animal welfare into account, such as free range eggs and chickens, as well as organic product lines (Bredahl, 2003).

This increased differentiation in food markets is mainly characterized by two groups of products. One group is the broad spectrum of organic food products. The other group is food products that are produced and marketed with higher standards regarding animal welfare and/or quality elements such as taste, fatness, color, tenderness etc.

Pork

For a long time the conventional Danish pork industry did not show any interest in differentiated pig production. Nevertheless, in the beginning of the 1990s the conventional pork industry became more convinced that a small consumer segment was prepared to pay a price premium for pork with higher quality. Therefore, the industry introduced a brand named 'Hjalmar', as a high quality alternative to conventional pork. The attempt failed completely and was terminated within one year, despite extensive promotion campaigns. The main reasons for the failure were that a higher retail price and promotions campaigns suggested a higher quality, however, that was not perceived to be the case by the consumers (Boon, 2001).

Similarly to the story of Hjalmar the two largest retailers in Denmark – COOP Denmark and Danish Supermarket Group (DSG) also took initiative to develop pork brands that differed from conventional pork. COOP Denmark introduced its private label 'Gourmet'-pork in 1995. 'MesterPorker' was introduced in 1989 by DSG as their private label for pork (Boon, 2001). Quality characteristics were more or less the same for both products concerning animal welfare and quality by setting up special requirements to pig breeds, housing conditions, chill period and storages facilities (Danish Crown, 2003; Boon, 2001).

However, ultimo 2001 COOP Denmark cancelled production and marketing of the Gourmet-pork due to non-satisfactory and falling markets shares and lack of profits (Tinggaard, 2002). The production and marketing of MesterPorker finished primo 2003 (Danish, Crown, 2002). In both cases other non-organic differentiated products have replaced the withdrawn products.

Chicken meat

Also the Danish broiler-slaughterhouses have tried to develop and market non-organic specialty chicken meat. One example is the highly promoted 'Skrabekylling', which was developed by the broiler-slaughterhouse Danpo in cooperation with The Danish Animal Welfare Society, who also recommended the consumers to buy Skrabekylling instead of standard chicken meat. Skrabekylling was introduced in 1995 primarily as a broiler raised under better conditions regarding animal welfare (Findal, 1999; Pedersen et al., 2001). (NOTE: In Danish the word 'Skrabekylling' refers to chickens given the possibility to exercise natural behavior by scratching and digging in to the ground).

In November 2001 production of Skrabekylling was terminated. The slaughterhouse Danpo had aimed at a 10-12 percent share of the production to be Skrabekylling, but they didn't even reach a share of 2 percent (Larsen, 2001).

Labeling

As shown by the examples it is extremely difficult to market new differentiated food products of medium quality. On the contrary, organic products have been gaining market shares in Denmark. This is believed to be partly due to lack of confidence in the actual quality of the products. Organic products are labeled and production is controlled by national agencies, leading to high level of consumer confidence. Medium quality products do not have similar detailed and trustworthy control of production. Therefore, labeling medium quality products does not entail significant consumer confidence.

Labeling and control by national agencies is not a guarantee for success. In 1998 the Danish Ministry of Food, inspired by the successful official labeling of organic food products, introduced an authorized label for food quality – 'Den Blaa Lup' (In English: 'The blue magnifying glass'). The label was intended to document higher levels of animal welfare and food quality compared to common standards. Gourmet-pork and MesterPorker were both awarded the label. After two years of using the

quality label it was clear that it had no effect and the system of Den Blaa Lup closed (Ministry of Food, 2003).

Why is it so difficult to establish a market for medium quality food products? In the following sections an adverse selection model is used to illustrate the market mechanisms leading to almost absence of medium quality food. The wine market is used to make presentation concrete. However, the model is general.

2. The model

A high quality segment characterizes the wine market with great consumer confidence and a standard quality segment where consumers at the most only have faint knowledge of particular wines (Benkjær, 2002). In this sense the wine market has a structure similar to the examples described above with a near absent medium quality segment.

2.1 Theoretical background

The analysis in this paper is based on restrictive assumptions on the wine market. Still, useful results are derived, providing explanations regarding the absent medium quality segment. Simple structures are assumed regarding the producer side as well as the consumer side of the wine market. The analysis is partial, in the sense that wine is the only good considered. Therefore, consumption of wine is considered in isolation from all other consumer goods. Consumer income is not considered in the model. Therefore, consumers choose only the type of wine to buy, whereas the quantity is indefinite. In turn, the option of consumers actually preferring a mix of different qualities of wine is excluded.

The assumptions that high quality wines are well reputed and that medium quality wines are not, provide a vital basis explaining the near absence of medium quality wines. Producers of standard quality wines have incentives to promote their wines as medium quality, because the higher price is desirable. Intruders from the standard quality segment misrepresenting their wines would deteriorate any attempt to build-up reputation in the medium quality segment. Since producers with high level of consumer awareness supply the high quality segment, no possibilities exist for the standard and medium quality producers to enter this segment of the wine market. These are the answers suggested to the question on why standard and high quality products dominate the wine market, and medium quality wines are almost absent.

Box 1: The Adverse Selection problem – The Akerlof model

Varian (1992) has given the following presentation of the Akerlof model:

In the market for cars, quality q is distributed uniformly over the interval $[0;1]$. Owners are willing to sell at price q, and potential buyers are willing to buy at price $q3/2$. If quality is observable, trade will occur at a price somewhere in the interval $[q ; q3/2]$. If quality is not observable to potential buyers, risk neutral potential buyers base their willingness to pay on average quality of cars offered for sale q_a. Average quality is assumed to be known to everybody. Let $p > 0$ denote the equilibrium price. Owners of cars with quality less than p are willing to sell at this market price. Average quality of cars offered for sale is then $q_a = p/2$. By insertion, willingness to pay for potential buyers is found to be $p3/4$. Since $p3/4 <$ p, no price exists at which trade would occur. Since p is arbitrary, it is shown that because of the asymmetric information between owners and potential buyers, no car will be sold at any positive price.

The basis model by Akerlof (1970), see Box 1, is modified to consist of three different qualities of products. The development of the model allows for an analysis of consumer behavior when the information asymmetry regarding product quality is present for medium quality products only. The analysis shows, that uncertainty regarding the quality of alleged medium quality wine is a source of countervailing incentives, see Box 2.

Box 2: Countervailing incentives

Salanie (1997) explains the concept of countervailing incentives by the following example:

A cost recovery scheme is considered. Agents are compensated according to their costs. When the actual costs are unknown to the regulator, agents have incentives to claim that they have high costs, whether or not this is true. In other words, agents with low costs have incentives to mimics agents with high costs, in order to receive a higher level of compensation. If total costs are a composite of fixed costs and variable costs, and these are opposite correlated, incentives to mimic runs in both directions. Under certain circumstances, agents with medium level fixed costs and (therefore also) medium level variable costs are better off claiming that they have high fixed costs and are also better off claiming that they have high variable costs. The incentives of two-way mimicking are also referred to as countervailing incentives, a term due to Lewis & Sappington (1989).

The following section describes the producer side of the market. The subsequent sections describe the consumer side of the model and characterize market behavior in the perfect information and the asymmetric information cases. The final sections conclude and discuss results.

2.2 Producers

For the sake of analytical convenience, wine quality is characterized in discrete terms. Wines are either of standard quality, medium quality or high quality. The discrete categorization of wine quality simplifies the more realistic continuous scale, often employed to characterize quality of consumer goods.

Production of wine is undertaken in a competitive industry. Therefore, the marginal cost-pricing rule determines the supply of wine. Marginal costs of producing quality are assumed to be constant. Let $c'(q)$ denote marginal cost of producing wine with quality q and t_q denote the price of quality q wine. Prices are then expressed by $t_q=c'(q)$. Numerical assumptions are made regarding $c'(q)$, giving the following prices at which standard quality $q=1$, medium quality $q=2$ and high quality wines $q=3$ respectively are supplied:

$$t_1 = 0.5$$
$$t_2 = 2$$
$$t_3 = 6$$

The pricing scheme is graphically illustrated by the stepwise linear (q,t_q) curve in figure 2.

Typically, producers with a good reputation produce high quality wines. They want to preserve the good reputation (Wells & Prensky, 1996). Therefore, producers known to deliver high quality wine never falsely label wine. The probability that a wine announced as high quality is in fact high quality is therefore assumed to be $p_1 = 100\%$. Similarly, a high level of consumer confidence presumably characterizes the market for standard quality wine, even though it is also characterized by low involvement purchase. When a seller offers standard quality wine at a low price, the wine is assumed to be standard quality with $p_3 = 100\%$ probability. Intuitively, if a seller has a higher quality product, there is no reason why he would claim that it was in fact standard quality. Relatively anonymous producers dominate the medium quality segment. Only few medium quality producers are well known as medium quality producers in the minds of the consumers, by assumption. Therefore, entry to the segment is relatively easy. Producers of standard quality wines have incentives to claim that their wine is medium quality by setting the price at a medium quality level. Consumers are unable to distinguish between wines of medium quality and wines just claimed to be of medium quality. The uncertainty regarding the true quality of announced medium quality wine is expressed by a probability parameter p_2. The probability that announced medium quality is in fact medium quality is $0\% \leq p_2 \leq 100\%$.

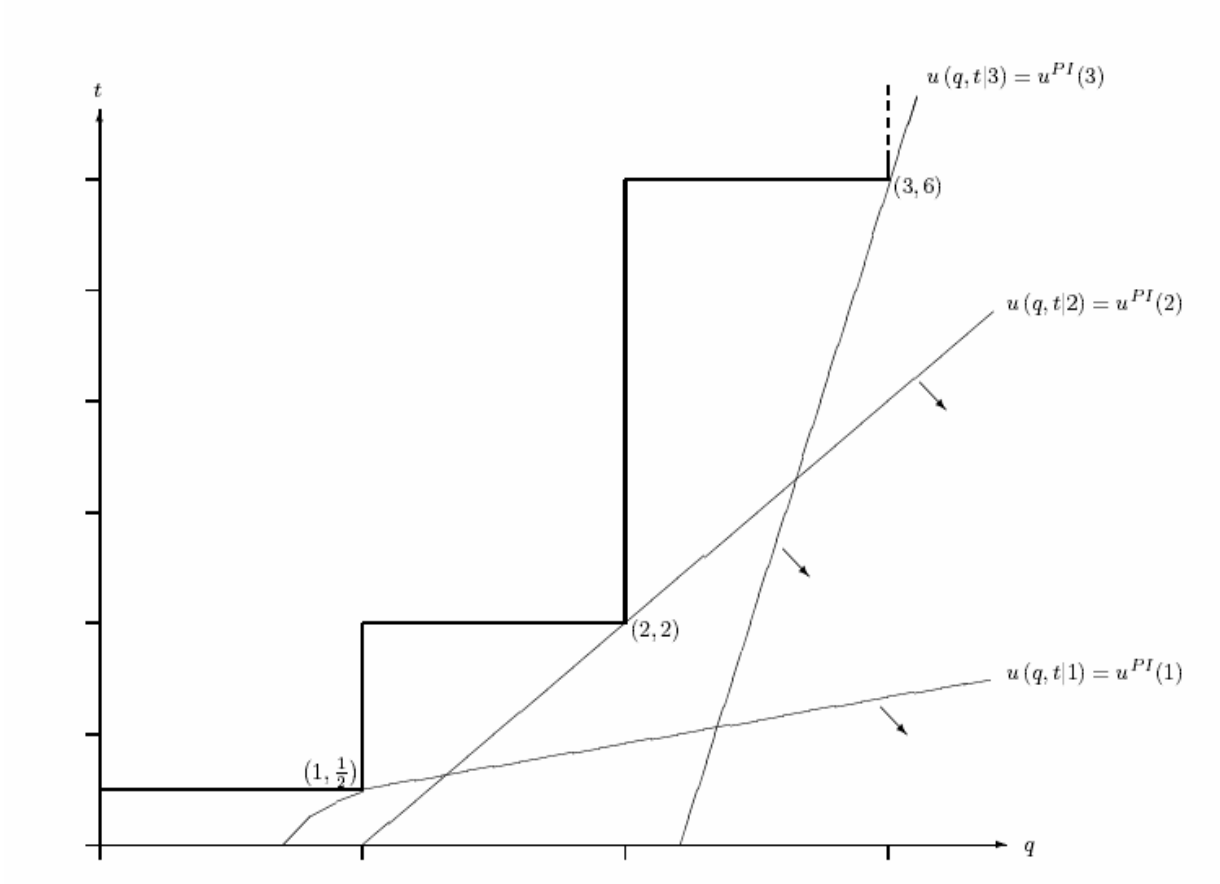

Figure 2. Pricing scheme illustrated by points, (q,t_q). Symmetric information indifference curves at perfect information optima, $u(q|\theta)$.

2.3 Consumers

In this section, consumer preferences are characterized. The consumer side of the market consists of 3 types of consumers. As for the categorization of types of wine, the discrete categorization is done out of analytical convenience. For the scope of the analysis, it is sufficient to consider 3 different types of consumers. Each type of consumer is identified by a taste for wine parameter θ belonging to the set $\{1,2,3\}$. The 3 groups of consumers are referred to as coarse, average and sophisticated respectively. The consumer type labels are partly due to Salanie (1997). The valuation of wine quality is given by the preference function:

$$v(q|\theta) = \theta q^{\theta/2}$$

Curvature conditions depend critically upon θ. For coarse consumers, marginal utility is decreasing: $v'(q|1) = 1/2q^{-1/2}$. For average consumers, marginal utility is constant: $v'(q|2) = 2$. For sophisticated consumers, marginal utility is increasing: $v(q|3) = 9/2q^{1/2}$. The curvature conditions indicate that coarse consumers value increase in quality less than average consumers, who in turn value increase in quality less than sophisticated consumers.

2.4 The market

The problem of lack of confidence in the medium quality segment of the wine market is analyzed in an asymmetric information setting. As described above, consumers cannot be sure that wine sold at a medium price is in fact of medium quality. Perfect information is referred to as the situation where

$p_2=100\%$. Asymmetric information is referred to as the situation where p_2 is known to the customers, but has a value of strictly less than $p_2<100\%$.

The following 2 subsections describe the market in the case of perfect information and asymmetric information respectively.

Perfect information

In the case of perfect information, all wines are truthfully labeled, and therefore consumers can be sure that they get what they are paying for. Perfect information utility of the purchase for the consumer is equal to net utility of wine consumption less the price of the wine. The utility obtained by consumer θ buying a wine of quality q and paying t is expressed by:

$$u^{PI}(q,t|\ \theta) = v(q|\ \theta) - t_q$$

The utility function is linear in the payment, and potentially non-linear in wine consumption. The type of utility function is referred to as quasi linear (Varian, 1992).

Provided with the purchase options stated above, perfect information optimal choices are expressed by $q^{PI}(\theta)$:

$$q^{PI}(1) = 1$$
$$q^{PI}(2) = 2$$
$$q^{PI}(3) = 3$$

Perfect information optimal utility levels are then calculated:

$$u^{PI}(1) = u(q^{PI},t_q|1)=0.5$$
$$u^{PI}(2) = u(q^{PI},t_q||2)=2$$
$$u^{PI}(3) = u(q^{PI},t_q||3)=9\cdot 3^{1/2}-6 \approx 9.6$$

Indifference curves $u(q,t|\theta) = u^{PI}(\theta)$ are illustrated graphically in figure 2. Perfect information optimal choices of wine quality are confirmed by the figure.

Asymmetric information

Consumers desiring medium quality wines are faced with difficulties determining the actual quality of the wines, as discussed above. To be certain that the consumer gets what she is looking for, an effort is required to reveal the true quality of the wine. The effort can be different kinds of information gathering such as reading results of wine tasting, attending wine tasting arrangements frequently held by stores, and some general asking around. Disutility of search effort is expressed by the following function of p_q:

$$\varphi(p_q) = (1-p_q)/p_q$$

For all possible p_q disutility is nonnegative $\varphi \geq 0$. Marginal disutility is decreasing $\varphi' < 0$, implying that higher certainty is associated with lower disutility of search effort. If probability is very low, disutility is extremely high: $\varphi(p_q) \rightarrow \infty$ for $p_q \rightarrow 0$. If wine is in fact what it pretends to be, disutility is expressed by $\varphi(1) = 0$. Due to assumptions about p_1 and p_3 made above, $\varphi(p_1) = 0$ and $\varphi(p_3) = 0$. Therefore, if consumers desire a standard or high quality wine, there is no search effort related to the purchase and no disutility of search effort.

Utility of the purchase for the consumer is equal to net utility of wine consumption less the price of the wine and less the disutility of search effort. The asymmetric information utility obtained by consumer θ buying a wine of quality q is expressed by:

$$u^{AI}(q,t|\theta) = v(q|\ \theta) - (t_q + \varphi(p_q))$$

The utility function is quasi linear, since it is linear in the payment and the disutility of search effort, and potentially non-linear in wine consumption. Utility levels for all possible combinations of consumer and type of wine are stated in table 1.

Table 1. Utility of a θ consumer consuming a wine of quality q is denoted $u(q|\theta)$ and calculated for all possible combinations.

Consumer Type θ	**Wine quality q**		
	1	*2*	*3*
1	*½*	$2^{1/2} - 2 - (1-p_2)/p_2$	$3^{1/2} - 6$
2	*3/2*	$2 - (1-p_2)/p_2$	*0*
3	*2 ½*	$6 \cdot 2^{1/2} - 2 - (1-p_2)/p_2$	$9 \cdot 3^{1/2} - 6$

From table 1 it follows that, for coarse consumers individual utility is maximized when buying cheap wine and for the sophisticated consumer when buying the premium wine. The optimal choice for the average consumer depends on p_2. If, for instance, $p_2 = 2/3$ the average consumer is indifferent between buying a standard quality wine and buying a medium quality wine after committing the required search effort. Consider the sum of payment and disutility of search effort as true cost of the wine purchase: $t_2^{TC}(p_2) = 2 + (1-p_2)/p_2$. Considering true costs instead of just payments, the shape of the step-wise price function changes. In the case of $p_2 = 2/3$, the true costs of medium quality wine is: $t_2^{TC}(2/3) = 2 + (1-2/3)/(2/3) = 2.5$. The new situation is illustrated in figure 3. Recalling preference directions as illustrated in figure 1, it follows immediately that $u^{AI}(2) < u^{PI}(2)$.

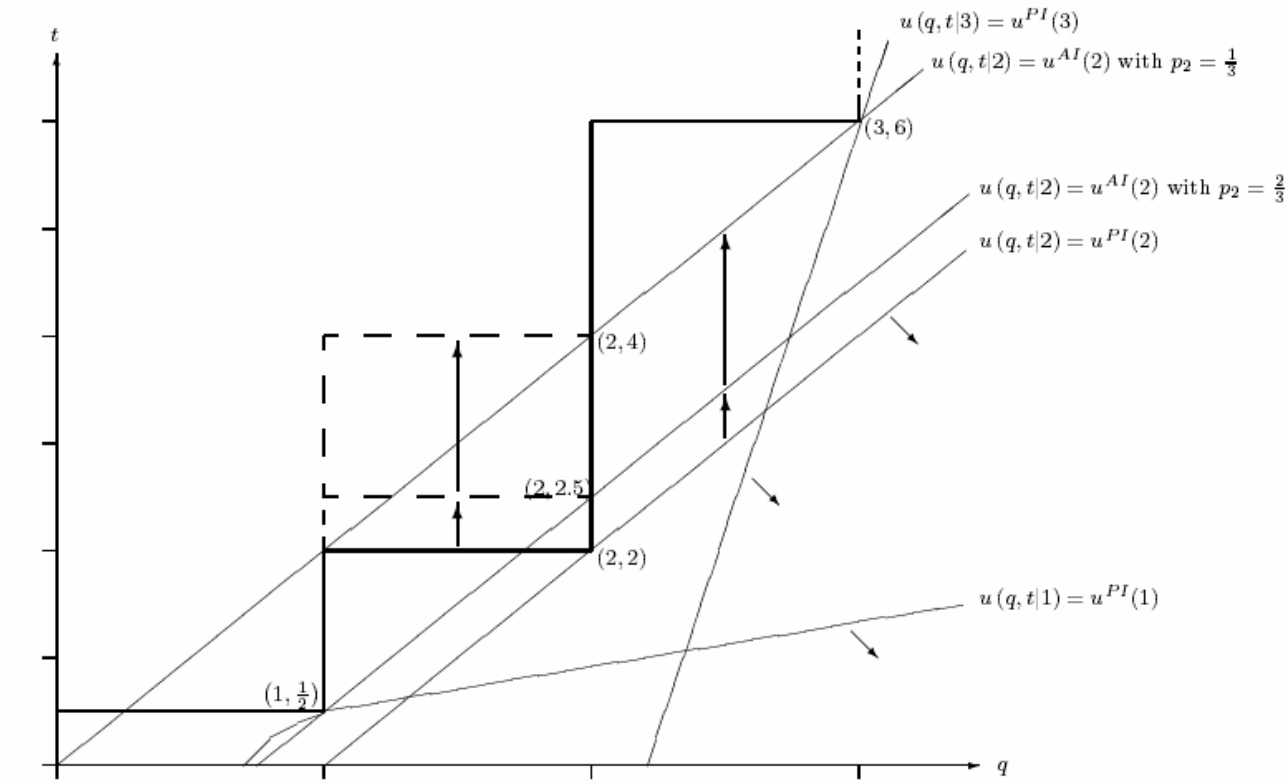

Figure 3. Perfect information and asymmetric information step-wise linear pricing schemes. Vertical arrows indicate shifts in pricing scheme (considering true costs) and utility level for average consumers, as a result of uncertainty.

For $p < 2/3$ the standard quality wine is strictly preferred compared to the alleged medium quality wine by the average consumer. For $p < 1/3$ even the high quality wine is strictly preferred compared to the alleged medium quality wine. Combining the 2 statements implies that for $p < 1/3$ there is two-way mimicking, also referred to as countervailing incentives, as described in box 2.

Countervailing incentives emerge because of high uncertainty regarding the true quality of the alleged medium quality wine. The uncertainty makes the medium quality choice so unattractive, that the average consumer prefers the standard quality option as well as the high quality option. The findings regarding p_2 are summed up in figure 4.

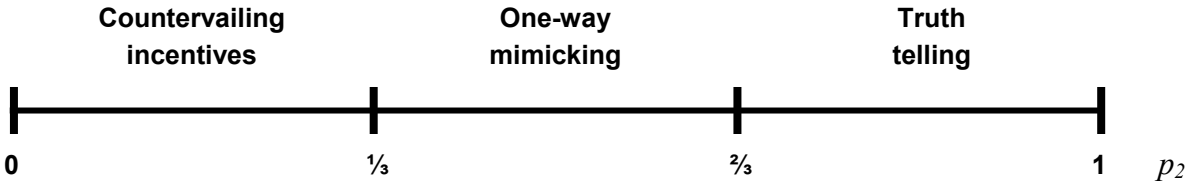

Figure 4. Optimal response for average consumers as a function of p_2.

It should be noted, that coarse and sophisticated consumers have no incentives to mimic other consumers in the perfect information case, as indicated by table 1 and figure 2. In the asymmetric case, alleged medium quality wine becomes less attractive (recall the preference direction), due to the uncertainty regarding its true quality, as illustrated in figure 3. Therefore, coarse and sophisticated consumers have even weaker incentives to mimic.

3. Conclusions

The analysis in the paper indicates that if the medium quality segment of the market is not credible (in the sense that a food product labeled as medium quality has a significant probability of actually being a standard quality product), consumers who would otherwise have preferred the medium quality food product are likely to buy either a standard quality or a high quality food product. If medium quality food cannot be sold at a medium price, but only at a low price, the medium quality producers might as well convert the production into a standard quality one, and thereby presumably save on the production costs. The, admittedly very simple, model of the wine market indicates that lack of credibility in the medium quality segment of the market can create countervailing incentives. Few consumers actually buy the medium quality product; because they cannot be sure that it is in fact a medium quality product. Inability to distinguish between standard quality products and medium quality products drive the medium quality products out of the market.

4. Discussions

The analysis in the paper gives rise to a number of issues discussing assumptions and possible extensions and refinements of the model.

The model is of a very simple structure. Even though it can be thought of as an extension of the Akerlof model, it is a rough simplification of real life conditions to assume that only three distinct quality levels exist. However, extending the model to allow for more levels of quality, while maintaining the general structure of the model, would not alter the conclusions. The assumption that quality is a common one-dimensional parameter is vital to the derivation of the results, but also a controversial assumption. The perception of high quality and standard quality of a product is subjective. Other consumers might perceive certain characteristics of a product perceived by one consumer as high quality as standard quality. Numerous aspects influence the perception of the quality of a food product, e.g. taste, smell, appearance, production methods and food safety aspects. Therefore, a multi-dimensional

quality parameter is needed to capture all the details (Lancaster, 1979). Further modeling work is needed to develop a model capable of handling a quality parameter with more than one dimension.

The assumptions of the model that products are priced according to marginal costs of production and that marginal costs are constant are assumptions found in many economic models. This leaves a zero profit for the producer. As noted by Shapiro (1983) however, this provides the current high quality producers with incentives to lower the quality of their products and thereby presumably save on costs and encounter a strictly positive profit in the short run. Therefore, for high quality producers to treasure their reputation they must earn a strictly positive profit. The profit can be thought of as returns to reputations. Incorporating this into the analysis would unnecessarily complicate the model.

The fact that new brands of medium quality pork products have been introduced into the Danish retail market, as noted in section 1, provides an excellent opportunity to test the validity of the model. According to our model, the new medium quality pork products will not be sufficiently distinguishable from the standard quality pork products, and will therefore within a relatively short period of time be withdrawn from the market. Time will show.

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