Lecture Notes: Systems Competition
Chapter VI: The Competition of Product Standards

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6.1 The Lemons Problem

- Consumers and producers have asymmetric information about the quality of a product.

- Consumers' lack of information implies that sellers who would have liked to offer good quality products and charge a higher price for them refrain from doing so.

- The sellers who offers poor products will try to persuade consumers that these are of high quality.

- So the market for good quality products will disappear.

- The problem is not about justice but one of allocative efficiency.

- The consumers will not be fooled because they can foresee producers behavior and pay a low price.

- The problem is that they will be unable to buy high quality products at higher prices.
- It is most severe when a large number of acts over a long period are required before the quality can be assessed.
- Consumption product that might cause cancer shows how severe the problem can be.
- Consumers often face a small risk of a very serious disease and they may not have time to look for information.
- To solve these problems nations use regulation.
- For example, Germany has developed product standards to prevent French liquor with too little alcohol to be sold.
- Swedish chocolate contains too little cacao to be sold as chocolate in some countries (even though it sometimes tastes better...).

- Our concern today is that if systems competition among regulating countries does not work, then centralized actions on the EU-level may have to be considered.

6.2 Private Quality Competition

Setup of the model.

- Assume there is a lemon good. The quantity of the lemon good is denoted by x and its quality by q.

- Increase in the quality of the lemon good incurs cost. The unit production cost of the lemon good are denoted by $c(q)$

- There is also a normal good, y. The price of the normal good is set to unity and therefore it serves the numeraire.

- Therefore, the price of the lemon good in terms of the normal good is given by P.

- By shifting factors of production between productive activities the lemon good can be transformed into a normal good.

- Consumers' utility function is given by

$$U(x) \cdot V(q) + y,$$

where $U(x)$ and $V(q)$ are strictly concave monotonically increasing functions, implying that

$$U\prime(x) > 0, \qquad U''(x) < 0$$

$$V\prime(q) > 0, \qquad V''(q) < 0.$$

Note that the formulation implies that the quantity as well as the quality of the lemon good consumed matters. Accordingly, quantity and quality of the lemon goods are complements in the sense that the marginal utility of one item increases with the consumption of the other item.

Formally, $\frac{\partial U}{\partial x} = U'(x)V(q)$ is increasing in q.

- Moreover, the individuals endowment is given by $\bar{y}$ and this can consequently be spent on either x or y.

- Importantly, buyers are less informed than sellers: they can only observe the average quality of the lemon good sold, however, they do not know the quality of the lemon good bought.

- This captures assumption that consumers can talk to other people to get an idea about the average quality of a product. However, ex ante, when buying a particular product, the consumer cannot judge whether it is good or bad.

Since consumers can not decide the products' / lemons' quality the consumer only choose the amount of products x and y bought.

Thus, the consumer's problem is given by

$$\max_{x,q} \quad U(x)V(q) + y$$

$$s.t. \qquad \bar{y} = y + Px$$

such that optimal consumer behavior is characterized by:

$$U'(x)V(q) = P.$$

Accordingly, the consumer by spent money on the lemon good up to the point where the marginal willingness to pay for the lemon good (of a certain quality) is equal to the price of the lemon good.

The producer maximizes profits by choosing the lemon good's quantity x and quality q, which only he can observe

$$\max_{x,q} \qquad [P - c(q)]\, x.$$

The first order conditions of the producer state

$$P = c(q)$$

and

$$c'(q) = 0 \qquad for\ x > 0$$

The first condition is standard: the firm selects a quantity such that the marginal benefit from selling one additional unit, P, is equal to the marginal cost, $c(q)$, of production this additional unit.

The second condition says that the producer chooses the quality q^* at which the unit cost of production is minimized.

Assuming that the unit cost function has its minimum at q^*, the following properties are true that

$$c\prime(q) < 0 \qquad for \qquad q < q^*,$$

and

$$c\prime(q) > 0 \qquad for \qquad q > q^*.$$

and

$$c''(q) > 0.$$

In other words, since the price cannot be made dependent on quality, q, there is no marginal benefit of increasing the quality.

Combining the consumers' first-order condition with respect to the quantity with the firms', the expressions for the market equilibrium become

$$U'(x) \cdot V(q) = c(q)$$

$$c'(q) = 0$$

Accordingly in the market equilibrium the consumer's marginal willingness to pay for a unit of the lemon good is equal to the marginal cost and the producer choose the quality q^* at which the unit cost of production is minimized.

$\Longrightarrow$ So there is no efficiency problem with respect to the quantity.

6.3 An Allocative Explanation of the State Regulation of Quality

To study whether the market is efficient or not we now look for the social / welfare optimum.

The social utility, W, is the sum of consumer rent and the producer rent

$$W = U(x)V(q) + y - c(q)x.$$

The welfare optimum follows from the following optimization problem

$$\max_{x,q} \qquad U(x)V(q) + y - c(q)x$$

The necessary condition for a welfare optimum includes the **quantity condition**

$$U'(x)V(q) = c(q).$$

- This was the one we already derived and concluded was efficient (it requires the equality between the marginal benefit and the marginal cost of an increase in quantity x, given the quality q.).

In addition, we have the **quality condition**

$$U(x)V'(q) = c'(q)x.$$

- This equation requires equality between the marginal benefit and the marginal cost of an increase in quality q, given the quantity x.

Given the features of the utility function ($U(x)$ and $V(q)$ are strictly concave monotonically increasing functions), we know that $U\prime(x)V(q) > 0$ and therefore $c'(q)x > 0$ has to be true.

However, $c\prime(q)x > 0$ is only fulfilled if $c\prime(q) > 0$ what implies that $q > q^*$, if $c'(q*) = 0$ and $c''(q) > 0$.

Proposition 6.1: From a welfare perspective it is optimal to choose a higher quality, $q > q^*$, than the one determined by the market.

- The reason is that, due to asymmetric information, the consumers can not identify the higher quality level and thus the price the producer could charge does not depend on the product quality.

$\Longrightarrow$ Therefore, firms do not take into account the positive aspects of increased product quality, since it will not be reflected by market prices.

$\Longrightarrow$ Firms will suffer form the negative effects (= higher cost) of providing a better quality.

To see this, let's study the solution in the case of symmetric information, which implies that the price of the lemon good depends on the quality.

Under this setting the firm's maximization problem states:

$$\max_{x,q} \qquad [P(q) - c(q)]\, x.$$

The first order condition w.r.t. quantity states

$$P(q) = c(q)$$

and the one w.r.t. quality is

$$P'(q) = c'(q)$$

Accordingly, the first condition implies that the optimal quantity provided is determined by the equality of the marginal cost of producing one additional unit and the price earned on this additional unit.

The second condition states that the quality should be improved up to the point where the price increase due to a marginal increase in quality is identical to the increase in the marginal cost due to the marginal increase in quality.

Moreover, if consumer can observe the quality in the symmetric equilibrium, their maximization problem states:

$$\max_{x,q} \quad U(x)V(q) + y$$

$$s.t. \qquad \bar{y} = y + P(q)x$$

and results in the following two first order conditions:

$$U'(x)V(q) = P(q),$$

and

$$U(x)V'(q) = P'(q)x,$$

or

$$U(x)V'(q) = c'(q)x.$$

- Regarding the second f.o.c., consumers optimally choose the quality at which their marginal willingness to pay for an improvement in quality is equal to the expenditure increase the market requires.

- Since $P'(q) = c'(q)$, under symmetric information we arrive at the same optimality conduction as derived when calculation the social / welfare optimum. Hence, there is no distortion in quality in the case of symmetric information.

Returning to the case of asymmetric information we next want to draw the market outcome and the social optimum derived above in the quantity-quality space.

- We will draw an "**optimal quantity curve**", which shows the optimal quantity given quantity

$$U'(x)V(q) = c(q)$$

denoted by DD.

- We also draw an "**optimal quality curve**", which shows optimal quality given quantity

$$U(x)V'(q) = c'(q)x,$$

denoted by EE.

- To be able to see which regulation policy the government should use we now look at the slopes of these curves.

- Implicitly differentiating the DD curve yields

$$\frac{dx}{dq}|_{DD} = -\frac{U'(x)V'(q) - c'(q)}{U''(x)V(q)}.$$

- We know that

$$U''(x)V(q) < 0$$

and

$$U'(x)V'(q) > 0.$$

- Moreover, we have defined that at $q^* : c'(q) = 0$ holds.

- Because $c\prime(q) < 0$ for $q < q^*$ we know that the DD-curve is upward sloping to the left of q^*. This is because it is assumed that the goods are complementary.

- A higher quality increases consumers' marginal utility of quantity.

- But the higher the quality the more costly it is to provide so there will also be a tendency for the quantity to be reduced.

- To the right of q^* the result is therefore ambiguous.

- In particular, for relatively low q's, the effect of $U'(x)V'(q)$ is dominating the effect of $c'(q)$.

- Eventually, for large q's, the DD curve will be downward sloping because of the strong positive effect arising from the marginal cost curve.

- In this interval, more quality leads to reduced quantity because it is very costly to create good products.

- Furthermore, we denote the maximum of the DD curve by $\bar{q}$ which is defined such that

$$\bar{q} : U'(x)V'(q) = c'(q).$$

- Next, consider the optimal quality curve (EE curve)

$$U(x)V'(q) = c'(q)x.$$

- First, rewrite the optimality equation such that

$$\frac{U(x)}{x} = \frac{c'(q)}{V'(q)}.$$

We know that $\frac{U(x)}{x} > 0$, since $U(x)$ was assumed to be a strictly concave monotonically increasing function.

- Moreover, recall that $c'(q) < 0$ for $q < q^*$, $c'(q) = 0$, $c''(q) > 0$ and that $V(q)$ is also strictly concave.

- Thus we can infer, as $x \to \infty$, $\frac{U(x)}{x} \to 0$ and also $c'(q) \to 0$.

- Accordingly, as x approaches infinity $\frac{U(x)}{x}$ approaches zero and consequently so does $c'(q)$. We know that for this to be true q has to come very close to q^*.

- We next study the slope of the EE curve by implicitly differentiating the optimal quality condition and get

$$\frac{dx}{dq}|_{EE} = -\frac{c''(q)x - U(x)V''(q)}{U'(x)V'(q) - c'(q)}.$$

- The nominator is positive because $c''(q)x > 0$ and $U(x)V''(q) < 0$.

- As long as $U'(x)V'(q) - c'(q)$ is negative, DD and EE cuts one another and we have a welfare optimum.

- From the analysis of the DD-curve we know that this term can only be negative to the right of the maximum of the DD-curve, i.e., where $q > \bar{q}$.

- Hence, we know that the point of intersection between EE and DD is where a marginal rise in the quality standards lowers the quantity produced.

- To summarize:

  - The curve EE, which shows $U(x)V'(q) = c'(q)x$ in the x-q space, approaches the vertical at q^* asymptotically as x goes to infinity.

- The curve EE is declining in the relevant interval.

- It cuts the DD curve to the right of its maximum, i.e., to the right of $\bar{q}$.

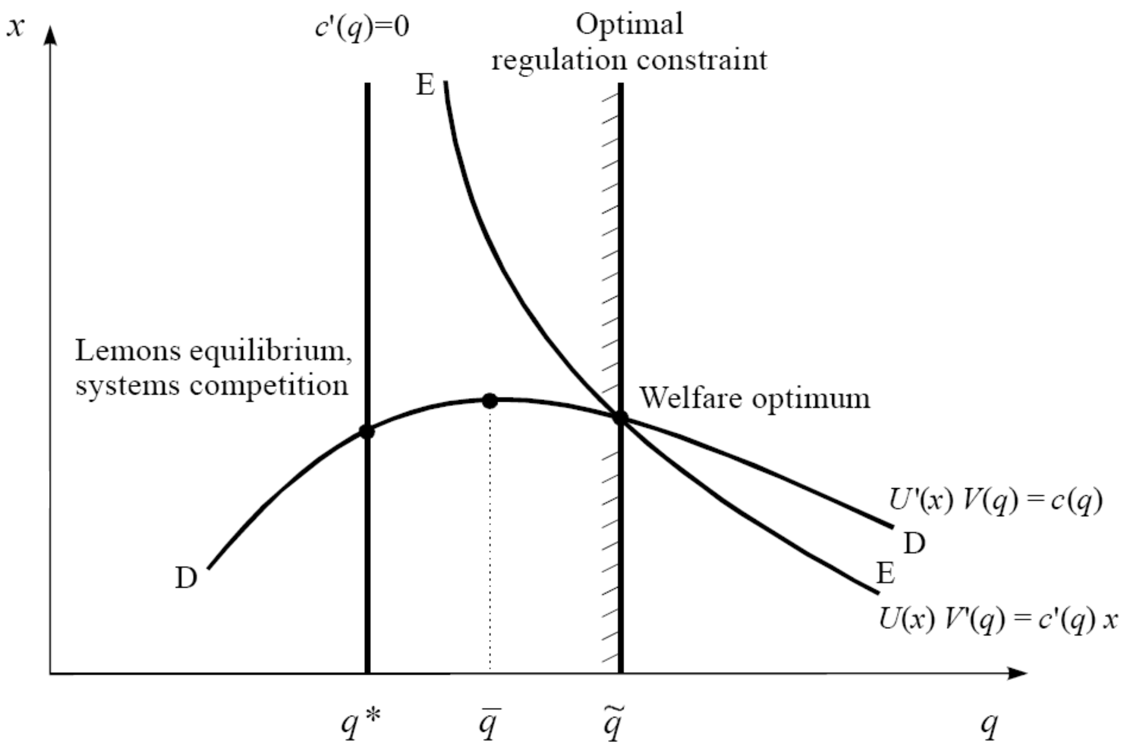

Figure 1: Optimal Regulation

- Let's sum up the results: (*Proposition 6.2*)

$\Longrightarrow$ In the case of asymmetric information the state can increase welfare by setting minimum product-quality standards ($\tilde{q}$) beyond the quality chosen by a competitive market (q^*).

$\Longrightarrow$ The standard is too low if raising it would induce an increase in the quantity produced. The socially optimal standard lies in a range where a marginal rise in the standard results in a decline of the quantity produced (Trade-off between quantity and quality).

6.4 The Competition of Laxity

- What happens when the borders are opened and unrestricted trade is allowed?

- Consider first the optimistic assumption that consumers in all countries know, and can judge, the national standards, $\tilde{q}$

- In this case, $P(\tilde{q})$ would emerge in the market.

- Consumers therefore solve

$$\max_{x,q} \quad U(x)V(\tilde{q}) + y$$

$$s.t. \qquad \bar{y} = y + P(\tilde{q})x.$$

- Consequently, consumers optimally choose the quality at which their marginal willingness to pay for an improvement in quality is equal to the expenditure increase the market requires

$$U(x)V'(\tilde{q}) = P'(\tilde{q})x.$$

- In this setting, the national regulatory agencies would solve

$$\max_{\tilde{q}} \qquad [P(\tilde{q}) - c(\tilde{q})]\, x,$$

- and the standard $\tilde{q}$ is set such that

$$P'(\tilde{q})x = c'(\tilde{q})x.$$

- Combining the two first order conditions yields

$$U(x)V'(\tilde{q}) = c'(\tilde{q})x.$$

- Recall that this is the condition for efficiency, which of course is not surprising since the price is dependent on the quality.

- However, in reality consumer can probably not judge national standards.

- The consumers' confusion in the national context probably carry over to the international choice problem.

- As a matter of fact, the problem is probably larger on the international level because more products may be subject to asymmetric information.

- So consider the following more plausible version of the model.

- Since the product price cannot be made dependent on the state's minimum standards, a profit maximizing national

- regulatory authority selects its standard $\tilde{q}$ such that the production costs of the domestic firms are minimized.

- That is, it chooses

$$c'(\tilde{q}) = 0,$$

- which implies

$$\tilde{q} = p^*$$

- *Proposition 6.3:* When the Selection Principle applies, it cannot be assumed that the consumers will be able to distinguish between state-regulated national quality standards. An equilibrium in the competition between regulatory authorities is thus characterized by too lax standards. Systems competition results in a lemons equilibrium.

- Intuition: Consumer protection benefits the foreigners because the quality of the goods consumed by foreigners increases without their having to pay more to cover the additional costs. And for the same reason, it harms the domestic firms.

$\Longrightarrow$ So a supra-national regulator is necessary!