# Online appendix for "The Certifier for the Long Run"

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In this appendix, we discuss a number of additional extensions.

## OA.1 Multiple Dimensions of Quality

In our model product quality is uni-dimensional, and unobserved by consumers. In reality, quality has many dimensions, some of which are observed by consumers. We present here different ways in which our model can accommodate additional observable quality dimensions. We will also discuss interesting aspects connected to multi-dimensional quality that our model cannot capture. We consider substitute and complement dimensions of quality in turn.

### OA.1.1 Substitutes

Let $y \geq 0$ denote the observable quality of a good, while $x$ denotes the unobservable component. Let the value of a good of quality $(x, y)$ be:

$$v(x, y) = v_0 + x + y,$$

and its cost for firm $i$ be:

$$\tilde{q}_i x^\alpha + \hat{q} y^\beta,$$

where $\hat{q} > 0$, $\beta > 1$. Everything else is as in the benchmark model. Standard arguments ensure that this model is isomorphic to the one we considered so far. To see this, let

$$y^* \equiv \arg\max_y v(x, y) - (\tilde{q}_i x^\alpha + \hat{q} y^\beta) = (\beta \hat{q})^{\frac{1}{1-\beta}}.$$

In equilibrium a mass $n(\underline{x})$ of products have quality $(\underline{x}, y^*)$, they get a certificate and are sold at price $\underline{x} + \hat{q}(y^*)^\beta$. A mass $1 - n(\underline{x})$ of products have quality $(0, y^*)$, do not get a certificate and are sold at price $\hat{q}(y^*)^\beta$.

Note that this argument holds basically unchanged as long as the cost function is separable in the two dimensions of quality, the cost of $y$ is convex and identical for all firms. Non-separable cost functions and heterogeneity in the cost of $y$ are beyond the scope of this paper.

### OA.1.2 Complements

Let now $z \in \{0, 1\}$ denote the observable quality of a good, while $x$ still denotes the unobservable component. Let the value of a good of quality

$(x, z)$ be:

$$v(x, y) = v_0 + xz,$$

and its cost for firm $i$ be:

$$\tilde{q}_i x^{\alpha} + \tilde{q} z,$$

where $\tilde{q} > 0$. Everything else is as in the benchmark model.

It is easy to show that in equilibrium the requirement, $\underline{x}_d$, is an increasing function of $d$, and the mass of firms that satisfy the requirement is a decreasing function of $\underline{x}_d$. These predictions are in line with those of the benchmark model. Regrettably though, this version of the model does not yield closed form expressions for $\underline{x}_d$ and $n(\underline{x}_d)$, making the extensions to endogenous cost of quality and endogenous market structure unfeasible.

## OA.2 Negative Externalities

In our model, a larger weight on quality was justified if high quality had a social value beyond what individual purchasers could be willing to pay for. This situation is reasonable for many types of goods, such as when the good's characteristics or production process determines environmental impacts or labor conditions. As explained already, positive externalities associated with consuming high-quality products is equivalent to negative externalities associated with consuming low-quality products, because we are assuming that every consumer purchases exactly one good. Under this assumption, it also seems reasonable to ignore any externalities associated with entry itself, since many firms do not produce in the equilibrium we have described.

More realistically, however, demand is not as inelastic as we have assumed, and firms that fail to sell in our market may have the opportunity to export their products to other markets and still generate externalities. In this situation, entry itself generates externalities, and it matters a great deal if these externalities are negative or positive. If they are negative, because production leads to emissions, for example, then it is no longer clear that it is socially desirable to encourage entry.

It would be simple to extend our model to this situation. If the externalities were negative and significant, it would be optimal to discourage entry, and this effect is achieved by letting the certifier place higher weights on quality. These externalities are thus having the same impact as the externalities that are already in our model: Everything else equal, such externalities would

raise the weight the optimal certifier places on quality. When the externalities are large, the government would be more likely to prefer to delegate certification authority to an NGO than to the industry itself.

## OA.3 Consumer Surplus

It is straightforward to extend our model to make consumer surplus relevant. Above, consumer surplus was constant (and thus irrelevant) whenever the number of certified firms was smaller than the number of consumers, and this condition, we showed, holds in the model when the certifier does not care about consumer surplus itself.

That said, it is easy to see that the consumer surplus could be larger if one reduced the quality requirement so much that the mass of certified firms becomes larger than the mass of consumers. A certifier that places a large weight on consumer surplus may thus be inclined to lower the quality requirement as a way to intensity competition among certified firms. This effect implies that such a certifier's objective function may not be single-peaked in the quality requirement, and we thus have to compare the values at different local peaks to determine the equilibrium threshold. While this exercise will generate a few additional interesting results, the intuition for the above qualitative findings, as described by Propositions **??**–**??**, seems quite robust, in our view.