December 1986

Discussion Paper No. 715

UMBRELLA BRANDING AS A SIGNAL OF NEW PRODUCT QUALITY: AN EXAMPLE OF REPUTATIONAL ECONOMIES OF SCOPE*

by

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*I am indebted to Kyle Bagwell, David Sappington and an anonymous referee for detailed comments.

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Abstract

I present a signalling model in which a multiproduct firm can use its reputation as a bond for quality by using an existing brand name when it introduces a new experience good. The signal may work whether new product quality is a choice variable or not and I argue that it is an attractive alternative to pricing signals. The latter depend on demonstrated willingness to throw away profits, while branding signals are based on posting a bond on which one may never default.

I. Introduction

The economic theory of advertising as a signal has so far focused on the cost of advertising as opposed to its content. Following the intuition of Nelson (1970, 1974, 1978), it is demonstrated that a high-quality firm may find it profitable to invest more in advertising than do lower-quality firms, and conversely. What prevents lower-quality firms from acting as if they were high-quality firms is that the latter will get more repeat business of experience goods and thus can afford to spend more on advertising (Kihlstrom and Riordan, 1984; Milgrom and Roberts, 1986; Schmalensee, 1978). (Experience goods are products whose quality cannot be determined by inspection, so consumers need to buy the product to learn its quality.)

The analysis in this paper, which applies to multiproduct firms only, takes a different approach. More specifically, I consider what happens if a firm uses an established brand name in its advertising for a new experience good (e.g., Diet Coke vs. Tab). This practice, called umbrella branding, has been very widely used by both retailers, major consumers goods marketers, and several firms in consumer services. In a very simple model I find conditions under which a monopolist can use umbrella branding to send a noise-free credible signal about the quality of a new product. I show the existence of such an equilibrium in Section II, argue that is the "most reasonable" equilibrium in Section III, and consider various extensions in Section IV.

II. Existence of Sequential Rational Expectations Signalling Equilibrium

Following a long tradition in the literature (e.g., Schmalensee, 1982), I look at an experience good whose quality is given by the probability that members of a randomly chosen production batch "work." As an example, I understand that the quality of beer to large extent can be thought of in this way. Only two qualities of product exist, "good" products of which all batches work and "bad" products of which only a fraction $\theta \in (0,1)$ of all batches work.[1] No consumer can buy from more than one production batch at a given time and for technological reasons, each product can be produced in only one quality, known to the firm, but unknown to the consumer. In this formulation, a product's reputation is given by the probability, as seen by various consumer groups, that it is "good."

I consider the last two of three periods (called 0, 1, and 2) in the life of a firm. In period zero, the firm sells its "old" product and develops a reputation based on that. In period one it sells a "new" product, which it may or may not umbrella brand and in period two it sells the old product again. Quality is exogenous and the probability that a given product is good is given by $\eta \in (0,1)$, while the correlation between the two products is $\rho \in (-1,1)$. So the prior probability of both products being good is $\eta(\eta + \rho[1 - \eta])$; the probability that both are bad is $(1 - \eta)(1 - \eta + \rho\eta)$; and the probability that one is good while the other is bad is $2(1 - \eta)\eta(1 - \rho)$. The cost of branding is $\beta \in \mathbb{R}_+$ and the firm decides whether to brand (B) or not (N) at the start of period one, whereas it makes pricing decisions p_1, p_2 at the start of the last two periods.

At first sight, the assumption of a positive branding cost seems unnatural. Why would it be more costly to put any particular name on the new product? However, marketers do, in practice, ascribe a very significant indirect cost to umbrella branding. The argument is that an existing brand name identifies the product's location in attribute space and that the meaning of the name gets fuzzy, resulting in "confused" consumers if it is used on different products (e.g., Kimrey, 1974; Guyon and Long, 1982). Accordingly, one would expect umbrella branding to be used more when the products are in some sense similar. In fact, the theoretical and empirical work of Sappington and Wernerfelt (1985) demonstrates the consistency of this story.

There is a unit mass of initially identical consumers and faced with a price p and a reputation r, each will buy $[y(p) + z(r)]/p$ of the new product and $\alpha[y(p) + z(r)]/p$, $\alpha \in \mathbb{R}_+$ of the old product.[2] Note that r does not depend on p. That is, I am focussing on equilibria in which prices are pooled. It is possible that price could be used to signal the quality of one or both products, but the more interesting signal is the branding choice. We assume that z is positive and increasing and that y is positive, deceasing, concave, and differentiable. If we further assume that production is costless, we can find optimal prices p^* from $\partial y(p^*)/\partial p = 0$ and profits from sale of the new product (with reputation r) as $y(p^*) + z(r)$, whereas the corresponding profits from the old product are $\alpha[y(p^*) + z(r)]$. For simplicity we assume that consumers do not communicate, so they will each form probability assessments as functions of their priors, the branding decision of the firm, and their own purchasing experiences only.

I will now try to establish the existence of a sequential equilibrium (Kreps and Wilson, 1982) in which a firm with two good products always brands while no other type of firm will brand. The equilibrium is supported by the out-of-equilibrium beliefs that (1) if a firm brands and supplies a new product which does not work, then that firm has two bad products, and (2) if a firm brands and supplies an old product which does not work, then that firm has a good new product with probability $\psi \in (0,1)$ (it seems natural to assume $\psi = \eta(1 - \rho)$, but we will not require that this holds). These beliefs will be justified in the next section.

Denote by $r_{ij}(A,v_0)(i,j = g,b;\ A = B,N;\ v_0 = w,f)$ the probability, as seen by a consumer at the start of the first period, that a firm has an old product of type i and a new product of type j, given that it uses branding strategy A and that its product in period zero (w)orked or (f)ailed. From our assumptions, this gives the posteriors:

$$r_{gg}(B,w) = 1$$
$$r_{bg}(N,w) = \theta\eta(1 - \rho)[\theta + \eta(1 - \rho)]^{-1}$$
$$r_{gb}(N,w) = \eta(1 - \rho)[\theta + \eta(1 - \rho)]^{-1}$$
$$r_{bb}(N,w) = \theta(1 - \eta + \rho\eta)[\theta + \eta(1 - \rho)]^{-1}$$
$$r_{bg}(N,f) = \eta(1 - \rho)$$
$$r_{bb}(N,f) = 1 - \eta + \rho\eta$$

Similarly, if we let $s_{ij}(A,V_0,V_1)(i,j = g,b;\ A = B,N;\ v_0,v_1 = w,f)$ denote the analog probability assessment at the start of the second period, given the history (A,v_0,v_1) we get

$$s_{gg}(B,w,w) = 1$$
$$s_{bg}(N,w,w) = s_{gb}(N,w,w) = \eta(1 - \rho)[2\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)]^{-1}$$
$$s_{bb}(N,w,w) = \theta(1 - \eta + \rho\eta)[2\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)]^{-1}$$
$$s_{bg}(N,f,w) = s_{gb}(N,w,f) = \eta(1 - \rho)[\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)]^{-1}$$
$$s_{bb}(N,f,w) = s_{bb}(N,w,f) = \theta(1 - \eta + \rho\eta)[\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)]^{-1}$$

Now denote the profits due to reputation above zero of a firm with an old product of type i, a new product of type j, and branding strategy A, by $\pi(i,j,A)$. Using $x(y) \equiv z(r) - z(0)$ we can find

$$\pi(g,g,B) = x(1)(1 + \alpha) - \beta$$

$$\pi(g,g,N) = x\left(\frac{\eta\theta}{\theta + \eta(1 - \rho)}\right) + \alpha x\left(\frac{\eta(1 - \rho)}{2\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)}\right)$$

$$\pi(g,b,B) = x(1)(1 + \alpha\theta) - \beta$$

$$\pi(g,b,N) = x(\frac{\eta\theta}{\theta + \eta(1 - \rho)}) + \theta\alpha x(\frac{\eta(1 - \rho)}{2\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)})$$

$$+ (1 - \theta)\alpha x(\frac{\eta(1 - \rho)}{\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)})$$

$$\pi(b,g,B) = x(1)\theta(1 + \alpha) + (1 - \theta)x(\psi) - \beta$$

$$\pi(b,g,N) = \theta x(\frac{\eta\theta}{\theta + \eta(1 - \rho)}) + (1 - \theta)\ x(\eta(1 - \rho))$$

$$+ \theta\alpha x(\frac{\eta(1 - \rho)}{2\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)})$$

$$\pi(b,b,B) = x(1)\theta(1 + \theta\alpha) + (1 - \theta)x(\psi) - \beta$$

$$\pi(b,b,N) = \theta x(\frac{\eta\theta}{\theta + \eta(1 - \rho)}) + (1 - \theta)x(\eta(1 - \rho))$$

$$+ \theta^2\alpha x(\frac{\eta(1 - \rho)}{2\eta(1 - \rho) + \theta(1 - \eta + \rho\eta)}) + \theta(1 - \theta)\alpha x(\frac{\eta(1 - \rho)}{\eta(1 - \eta) + \theta(1 - \eta + \rho\eta)})$$

For incentive compatibility we need

(A.1) $\quad \pi(g,g,B) > \pi(g,g,N)$

(A.2) $\quad \pi(g,b,N) > \pi(g,b,B)$

(A.3) $\quad \pi(b,g,N) > \pi(b,g,B)$

and

(A.4) $\pi(b,b,N) > \pi(b,b,B)$

Since $\pi(b,b,N) > \pi(b,g,N)$ and $\pi(b,b,B) < \pi(b,g,B)$, (A.4) is not binding, so we have:

Proposition 1: Given (A.1)-(A.3) there is a sequential equilibrium where only firms with two good products brand.[3]

The assumptions roughly say that umbrella branding is more likely to work when quality differences are large (θ small), qualities are less than perfectly correlated (ρ small), bad products are rare (η big) and the old product is important (α big). Intuitively, these circumstances increase the risk of being identified as a b,b type which again is what sustains the equilibrium against false signals. Note that (A.3) may constrain ψ relative to the other parameters.

The out-of-equilibrium beliefs that (1) "a firm which both brands and supplies a failing new product is of the b,b type" and (2) "a firm which both brands and supplies a failing old product is of the b,b or b,g type," are clearly crucial for our equilibrium. In order to defend this and establish uniqueness of the equilibrium we will need a few more assumptions.

III. Uniqueness of Equilibrium

To defend the out-of-equilibrium belief which sustains our equilibrium we will use an equilibrium dominance type of argument which is stronger than the notion of strategic stability introduced by Kohlberg and Mertens (1986) and the implications of this equilibrium concept emphasized by Kreps (1984). Specifically, we require that out-of-equilibrium signals (a) are not interpreted as coming from types for which the equilibrium dominates any interpretation of the signal (Kreps, 1984, Prop. 4), but (b) possibly could come from any type for which some interpretation of the signals is preferable to the equilibrium.

Consider first the disequilibrium information set where a firm brands and supplies a failing new product. The best a g,b type can get out of branding, given any out-of-equilibrium beliefs, is $x(1)(1 + \alpha) - \beta$, which results if the old product is given a reputation one. So if we replace (A.2) by

$$\text{(A.5)} \qquad \pi(g,b,N) > x(1)(1 + \alpha) - \beta,$$

we have a condition under which branding is dominated for g,b types relative to the equilibrium. Similarly, the best a b,b type can get out of branding, given any beliefs, is $x(1)(1 - \theta\alpha) - \beta$, so if we assume

$$\text{(A.6)} \qquad \pi(b,b,N) < x(1)(1 + \theta\alpha) - \beta,$$

consumers should infer that branding in connection with a failing new product signals the b,b type.[4]

Second, in the case where a firm brands and supplies a failing old product, we wish to show that for some beliefs both b,g and b,b types find branding attractive. As an example of such beliefs, we again set the reputation of the new product equal to one. In this case, b,g and b,b types will get $x(1)(1 + \theta\alpha) - \beta$, so if we assume

$$\text{(A.7)} \qquad \pi(b,g,N) < x(1)(1 + \theta\alpha) - \beta$$

and (A.6) above, we have a set of conditions under which consumers should infer that branding in connection with a failing old product signals either the b,b or b,g type. Since $\pi(b,b,N) > \pi(b,g,N)$, (A.7) is not binding.

To summarize, our combined assumptions at this point are:

$$\text{(A.1)} \qquad x(1)(1+\alpha) - \beta > x\left(\frac{\eta\theta}{\theta + \eta(1-\rho)}\right) + \alpha x\left(\frac{\eta(1-\rho)}{2\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right)$$

$$\text{(A.5)} \qquad x(1)(1+\theta) - \beta < x\left(\frac{\eta\theta}{\theta + \eta(1-\rho)}\right) + \theta\alpha x\left(\frac{\eta(1-\rho)}{2\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right)$$

$$+ (1-\theta)\alpha x\left(\frac{\eta(1-\rho)}{\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right)$$

$$\text{(A.3)} \qquad x(1)(\theta + \theta\alpha) + (1-\theta)x(\psi) - \beta < \theta x\left(\frac{\eta\theta}{\theta + \eta(1-\rho)}\right) + (1-\theta)x(\eta(1-\rho))$$

$$+ \theta\alpha x\left(\frac{\eta(1-\rho)}{2\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right)$$

$$\text{(A.6)} \qquad x(1)(1+\theta\alpha) - \beta > \theta x\left(\frac{\eta\theta}{\theta + \eta(1-\rho)}\right) + (1-\theta)x(\eta(1-\rho))$$

$$+ \theta^2\alpha x\left(\frac{\eta(1-\rho)}{2\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right) + \theta(1-\theta)\alpha x\left(\frac{\eta(1-\rho)}{\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right)$$

While these conditions are messy, they can be consistent.

As a brief, incomplete, check on this, note that if $\psi = \eta(1-\rho)$, we can write (A.3), (A.1), (A.5) and (A.6) as

$$x(1)(1+\alpha) - \beta/\theta < x\left(\frac{\eta\theta}{\theta + \eta(1-\rho)}\right) + \alpha x\left(\frac{\eta(1-\rho)}{2\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right)$$

$$< x(1)(1+\alpha) - \beta < x\left(\frac{\eta\theta}{\theta + \eta(1-\rho)}\right) + \theta\alpha x\left(\frac{\eta(1-\rho)}{2\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right)$$

$$+ (1-\theta)\alpha x\left(\frac{\eta(1-\rho)}{\eta(1-\rho) + \theta(1-\eta+\rho\eta)}\right) < x(1)(1/\theta + \alpha) - \beta/\theta$$

$$- (1 - \theta)/\theta \; x\,(\eta(1 - \rho)).$$

The above arguments show that our equilibrium is reasonable in the class of equilibria where only g,g types brand. Under the stated assumptions it is also unique in that class since the opposite out-of-equilibrium beliefs have been shown to be incompatible with our dominance criterion.

To begin thinking about other equilibria, we first consider what will turn out to be the most difficult case, namely that where g,g and (perhaps only some) b,b types brand. In this situation, g,b types will not brand if

$$x(r_{gg}(B,w)) + \theta\alpha x(s_{gg}(B,w,w)) - \beta$$

$$> x(r_{bg}(N,w)) + \theta\alpha x(s_{gb}(N,w,w)) + (1 - \theta)\alpha x(s_{gb}(N,w,f))$$

while b,b types will brand or randomize if

$$x(r_{gg}(B,w)) + \theta\alpha x(s_{gg}(B,w,w)) - \beta/\theta \geqslant$$

$$x(r_{bg}(N,w)) + \frac{1 - \theta}{\theta} x(r_{bg}(N,f)) + \theta\alpha x(s_{gb}(N,w,w))$$

$$+ (1 - \theta)\alpha x(s_{gb}(N,w,f)).$$

Since the latter constraint has a larger right side and a smaller left side than the former, such an equilibrium cannot exist. Next consider the case where g,g and b,g types brand. In this situation, b,b types will have "too much" to gain from branding and another inconsistency in the incentive compatibility constraints will appear. Similar contradictions result from the conjecture that g,g types plus any two of the three other types brnad. Finally, the cases where g,g types do not brand, but some other type or types do, will not work, essentially because these firms will be paying to identify themselves as low quality producers.

<u>Proposition 2</u>: Given (A.1), (A.3), (A.5) and (A.6), the equilibrium where only firms with two good products brand is unique in the class of separating equilibria which satisfy our dominance criterion.

The pooling equilibria are those where all types brand with probability $q \in [0,1]$. In the absence of a publicly observable randomization device, mixed strategies are clearly incompatible with equilibrium and we are left with the two pure strategy equilibria. Both of these can be sustained by the beliefs that out-of-equilibrium branding decisions signal the b,b type with probability very close to one. (Although the case where all firms brand only works of β is sufficiently small.) There are two weak arguments against these equilibria. First, if we constrain out-of-equilibrium beliefs to follow the prior probability distributions (corresponding to $\psi = \eta(1 - \rho)$ above), these equilibria do not exist. Second, the g,g types, who are the most profitable in these equilibria, will prefer the separating equilibrium under the assumptions of Proposition 2.

The purpose of this paper is only to show the possibility of useful and noise-free umbrella branding signals and the various parametric assumptions, while quite restrictive, could clearly be relaxed in different models, e.g., with longer time horizons. The qualitative assumptions, notably that quality is exogenous and that price is independent of reputation are more worrisome. Is it possible that the whole story collapses without these assumptions? I will briefly discuss this below.

IV. Extensions and Conclusion

In case quality is a decision variable one might suspect that branding is unable to confer a credible signal, especially in light of the analog results about pricing obtained by Farrell (1985) and Riordan (1985). This intuition is, however, incorrect. To see this assume that quality of the old product is exogenous, whereas the new product can be given high quality once and for all for a fixed fee $c \in \mathbb{R}_+$. In this case we may have an equilibrium where firms with a good old product produce a good new product and brand in a fraction $\nu \in (0,1)$ of all cases, while they produce a bad product and do not brand in $1 - \nu$ of all cases. Further, firms with a bad old product produce a bad new product and do not brand.

To check this note that in this equilibrium

$$r_{gg}(B,w) = 1$$

$$r_{gb}(N,w) = \eta\nu[\eta\nu + \theta(1 - \eta)]^{-1}$$

$$r_{bb}(N,w) = \theta(1 - \eta)[\eta\nu + \theta(1 - \eta)]^{-1}$$

$$s_{gg}(B,w,w,) = 1$$

$$s_{gb}(N,w,w) = s_{gb}(N,w,f,) = r_{gb}(N,w)$$

$$s_{bb}(N,w,w) = s_{bb}(N,w,f) = r_{bb}(N,w)$$

So the incentive compatibility constraints in the branding stage are

$$\text{(B.1)} \qquad \pi(g,g,B) = x(1)(1 + \alpha) - c - \beta > \pi(g,g,N) = \alpha x(\frac{\eta\nu}{\eta\nu + \theta(1 - \eta)}) - c$$

$$\text{(B.2)} \qquad \pi(g,b,N) = \alpha x(\frac{\eta\nu}{\eta\nu + \theta(1 - \eta)}) > \pi(g,b,B) = x(1)(1 + \theta\alpha) - \beta$$

$$\pi(b,b,N) = \theta\alpha x(\frac{\eta\nu}{\eta\nu + \theta(1 - \eta)}) > \pi(b,b,B) = x(1)\theta(1 + \theta\alpha) - \beta$$

while

$$\pi(b,g) = \text{Max}\{\theta\alpha x(\frac{\eta\nu}{\eta\nu + \theta(1 - \eta)}) - c,\ x(1)\theta(1 + \alpha) - \beta - c\}.$$

Further, incentive compatibility in the quality stage demands that $\nu \in [0,1]$ satisfy

$$\pi(g,g,B) = x(1)(1 + \alpha) - c - \beta = \pi(g,b,N) = \alpha x(\frac{\eta\nu}{\eta\nu + \theta(1 - \eta)})$$

and that

$$\text{(B.3)} \qquad \pi(b,b,N) = \theta\alpha x(\frac{\eta\nu}{\eta\nu + \theta(1 - \eta)}) > \pi(b,g) = \text{Max}\{\theta\alpha x(\frac{\eta\nu}{\eta\nu + \theta(1 - \eta)}) - c,$$

$$x(1)\theta(1 + \alpha) - \beta - c\}$$

So we have shown:

Proposition 3: Under (B.1)-(B.3), there is a sequential equilibrium in the two period game where new product quality is a decision variable. In this equilibrium firms with a good old product randomize between producing a good or a bad new product, firms with a bad old product produce bad new products and only good new products are branded.

Another interesting extension involves the case where firms with different products charge different prices such that price becomes a credible signal of quality. The idea in such a signalling scheme is that the high quality firms may be able to profitably charge prices which low quality firms, even if they were to fool some consumers, cannot profitably mimic (Kihlstrom and Riordan, 1984; Milgrom and Roberts, 1986). With a general demand function of the form $y(p,r)/p$, this could work in our model too. Note, however, that such a signal typically involves charging a price which is quite different from the full information profit maximizing price. So price signals may be very expensive, depending on the exact properties of the market. By contrast, the branding signal analyzed here will often be quite cheap. The key difference between the two types of signals are that credible pricing signals are based on demonstrated willingness to throw away profits while branding signals are based on willingness to post a bond on which one rarely if ever defaults in equilibrium. So although more realistic models would allow both price and branding signals, it is likely that branding signals would play a major role because of their relative cost effectiveness.

On a final note, I would like to make some comments about communication between consumers. My assumption that consumers do not communicate is clearly unrealistic. On the other hand, it is difficult to formalize a natural communication process without ending up with perfect information transmittal, which again is an unrealistic result. One possible story line would be that consumers live in towns of identical size and that there is perfect communication within the town, but no communication between towns. In such a case the loss of reputation from selling one defective unit will go from the buyer of that unit to the town level and the model would "work" for a much larger value of θ.

Beyond the specifics of the model our results suggest the existence of reputational economies of scope. In a more realistic environment, where quality is a question of degree rather than kind, it would be quite difficult to write a satisfactory leasing contract for a brand name, especially with limited liability. Accordingly, I would expect such market failures to give rise to multiproduct firms, built around their reputations. This could provide another rationale for the existence of "chain stores," e.g., McKinsey, and conglomerates such as Beatrice. Alternatively, one would expect very detailed contracts as, e.g., those of McDonald's.

The fact that a reputation from one market can be valuable (used or leased) in another has implications for competition in the first market. In particular, it may pay off for a firm to net negative profits in the first market in order to maximize its reputational advantages in other markets.[5] Investigation of the welfare implications of this is an important goal of future research.

Notes

1. This formulation allows us to ignore type I errors and thus simplifies the ensuing analysis.

2. Because all consumers always buy some, there is no incentive to buy for purposes of information gathering.

3. By direct computation one can find that (A.1)-(A.3) hold if $\psi = \eta(1 - \rho)$ and $\pi(g,g,N) < x(1)(1 + \alpha) - \beta$, $\pi(g,g,N) > x(1)(1 + \alpha) - \beta/\theta$ and $\pi(g,g,N) \geqslant x(1)(1 + \theta\alpha) - \beta$. Suppose that $x(\cdot)$, ρ and η are such that $x(1) = 1$ and $\pi(g,g,N) = 1/2$. In this case the three inequalities above are satisfied for $\theta = 1/2$, $\alpha = 2$, and $\beta = 1$. It is obviously difficult to say "how often" these conditions will be satisfied. They get weaker if we include more periods, but remain messy and nontrivial. The present paper establishes the feasibility of noise-free branding signals, but the frequency with which this can work is an empirical question.

4. Since Kreps uses only part (1) of the above argument, we could get conditions for his criterion by dropping (A.6).

5. This intermarket externality may have effects quite similar to those of intertemporal externalities such as learning curves or brand loyalty.

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