Online Appendix

To accompany "Global Product Strategies and Cultural Promotion in the Context of Culture-Commerce Interactions", the appendix consists of the following eight parts:

A. Extension 4.1: Cultural network effect
B. Extension 4.2: Forward-looking consumers
C. Extension 4.3: Entry of a local competitor
D. Extension 4.4: Competition between two global firms
E. Extension 4.5: Adaptation through consumption
F. Second-period adaptation
G. Allowing total benefits of culture adaptation to be greater than consumption utility
H. Additional examples of consumer learning foreign culture in order to better appreciate products/services

A. Extension 4.1 Cultural network effect

To accommodate $m > 0$, the conditions C1 and C2 given in the model section need to be adjusted accordingly.[1]

The analysis for the second period remains unchanged, as it does not involve z directly. For the first period, the adaptation choice now involves rational expectation: an individual consumer's adaptation depends partly on the cultural benefits, which in turn depend on the total number of adaptors. Similar to the baseline model, the firm will not set p_1 above v or below $v - d$.

(i) If $v - d < p_1 \leq v$, then g_1 dominates g_3 and g_4 dominates g_2 from Table 1 in the paper. Therefore, consumers choose between g_1 and g_4, which implies that a consumer adapts if and only if she buys, i.e., $q_1 = k$. And k is determined by $z - \phi k + v - p_1 = 0$. Note that $z = z_0 + mk^e$ with the cultural network effect, where k^e is the expected size of adaptation by the consumers. Under rational expectation, $k^e = k$ in equilibrium. Therefore, we have $q_1 = k$, and $k = \frac{z_0+v-p_1}{\phi-m}$ solved from $z - \phi k + v - p_1 = 0$.

(ii) If $p_1 = v - d$, then g_1 dominates g_3 and g_2 dominates g_4. Therefore, consumers choose between g_1 and g_2, which implies that all consumers will buy, i.e., $q_1 = 1$, but only some consumers will adapt. Then k is determined by $z - \phi k + v - p_1 = v - d - p_1$. Again, $z =$

[1] C1 becomes $\overline{d} \leq min\left\{v - u_n, \phi - m - z_0, \frac{v-m-z_0}{2}\right\} \equiv \hat{d}'$ (coming from the same R1 and R2 given the maximum $z = z_0 + m$), and C2 becomes $d_0' \equiv \frac{(\phi-m)(v-u_n)-z_0(v-u_a)}{v-u_a+(\phi-m)} \geq 0$ (coming from the same requirement that the firm will sell to both adaptors and non-adaptors in the second period if the cultural distance is at its minimum: $\underline{d} = 0$).

$z_0 + mk^e$, with $k^e = k$ in equilibrium under rational expectation. Thus, we have $q_1 = 1$, and $k = \frac{z_0+d}{\phi-m}$ solved from $z - \phi k + v - p_1 = v - d - p_1$.

As a result, the first period profits (expressed as a function of k) now become:

$$\pi_1(k) = \begin{cases} [v + z_0 - (\phi - m)k]k, & \text{for } \dfrac{z_0}{\phi - m} \leq k < \dfrac{d + z_0}{\phi - m} \\ v - d, & \text{for } k = \dfrac{d + z_0}{\phi - m}. \end{cases}$$

Compared with equation (1) of the baseline model, the above equation suggests that incorporating cultural network effect will not change the analysis if we (i) replace ϕ with $\phi - m$ and (ii) replace z with z_0. That is, a more positive cultural (or less negative) network effect is equivalent to a lower adaptation cost, with the new measure of adaptors being $k = \frac{d+z_0}{\phi-m}$.

Similar to the results from the baseline model, the optimal cultural distance is either $\overline{d}$ or 0 (which is $\underline{d}$) depending on which of the two profit expressions below is larger:

$$\pi(k) = \begin{cases} \pi(\overline{d}) = (v - \overline{d}) + \delta \dfrac{\overline{d} + z_0}{\phi - m}(v - u_a) \\ \pi(0) = v + \delta(v - u_n). \end{cases}$$

Therefore, the optimal cultural distance is $\overline{d}$ if and only if $\delta(v - u_a) - (\phi - m) > 0$ and $\overline{d} > \delta \frac{(\phi-m)(v-u_n)-z_0(v-u_a)}{\delta(v-u_a)-(\phi-m)} \equiv d'_m$.

When m is larger, it is easier to satisfy that $\delta(v - u_a) - (\phi - m) > 0$ and $\overline{d} > d'_m$, implying that a greater (i.e., more positive or less negative) cultural network effect gives the firm a stronger incentive to maintain a large cultural distance.

Because $\pi(0)$ is independent of m while $\pi(\overline{d})$ increases in m, when m increases, the firm's profits will increase if the firm's optimal cultural distance switches from 0 to $\overline{d}$ or remains at $\overline{d}$. This is similar to the effect of a larger z (when $m = 0$).

Finally, note that $\frac{\partial \pi(0)}{\partial z_0} = \frac{\partial \pi(0)}{\partial m} = 0$ whereas $\frac{\partial^2 \pi(\overline{d})}{\partial z_0 \, \partial m} = \frac{\delta(v-u_a)}{(\phi-m)^2} > 0$, which means that a more positive cultural network effect (i.e., a larger m) gives the firm a stronger incentive to invest in cultural promotion (i.e., to improve z_0), and this effect exists if and only if the firm optimally maintains a large cultural distance (i.e., $d^* = \overline{d}$).[2]

[2] To see this, suppose that the firm can achieve any z_0 by incurring a convex investment cost $c(z_0)$ with $c'(\cdot) > 0$ and $c''(\cdot) > 0$. If the firm's optimal cultural distance is $d^* = 0$, then $\frac{\partial z_0}{\partial m} = 0$ because the firm will not invest

B. Extension 4.2 Forward-looking consumers

For the second period, we have shown that $\pi_2(k) = \max\{v - d - u_n, k(v - u_a)\}$. Denote $k' = \frac{v-d-u_n}{v-u_a}$. If $k \leq k'$, the firm will serve all consumers at price $p_2 = v - d - u_n$, so an adaptor's utility is $z + v - p_2 = u_n + d + z$, and a non-adaptor's utility is $v - d - p_2 = u_n$. If $k > k'$, the firm will only serve adaptors by setting $p_2 = v - u_a$ so an adaptor's utility is $z + v - p_2 = u_a + z$ and a non-adaptor's utility is u_n. Consequently, consumer i 's two-period total utility is:

period 1 choice	Adapt	not adapt
Buy	(g_1) $\begin{cases}(v + z - \phi k_i - p_1) + (u_n + d + z) & \text{if } k \leq k' \\ (v + z - \phi k_i - p_1) + (u_a + z) & \text{if } k > k'\end{cases}$	(g_2) $(v - d - p_1) + u_n$
not buy	(g_3) $\begin{cases}(z - \phi k_i) + (u_n + d + z) & \text{if } k \leq k' \\ (z - \phi k_i) + (u_a + z) & \text{if } k > k'\end{cases}$	(g_4) u_n

The firm will not charge $p_1 > v$ as this results in no sales; and it will not charge $p_1 < v - d$ because it can get all consumers to buy at $p_1 = v - d$. Therefore, we only need to consider two scenarios below.

Scenario 1: If $v - d < p_1 \leq v$, then g_1 dominates g_3 and g_4 dominates g_2. Therefore, a consumer adapts if and only if she buys so that $q_1 = k$. There are two subcases. Subcase (i): If the resulting $k \leq k'$, consumer i buys if and only if $(v + z - \phi k_i - p_1) + (u_n + d + z) \geq 0 + u_n$, which leads to $q_1 = k = \frac{v+d+2z-p_1}{\phi}$ or equivalently $p_1 = v + d + 2z - \phi k$ for $\frac{d+2z}{\phi} \leq k < \frac{2(d+z)}{\phi}$. Subcase (ii): If the resulting $k > k'$, consumer i buys if and only if $(v + z - \phi k_i - p_1) + (u_a + z) \geq 0 + u_n$, which leads to $k = \frac{v+2z-(u_n-u_a)-p_1}{\phi}$ or equivalently $p_1 = v + 2z - (u_n - u_a) - \phi k$. Under the revised conditions for R1 and R2,[3] the firm's total profit increases with k. Thus, the optimal outcome is $p_1 \to v - d$.

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in z_0 as $\frac{\partial \pi(0)}{\partial z_0} = 0$. However, if the firm's optimal cultural distance is $\overline{d}$, then the optimal z_0 is characterized by the first-order condition on the optimization problem $\max_{z_0} \pi(\overline{d}) - c(z_0)$, which results in $\frac{\partial \pi(\overline{d})}{\partial z_0} - c'(z_0) = 0$. Differentiating both sides of the first order condition with respect to m results in $\left(\frac{\partial^2 \pi(\overline{d})}{\partial z_0^2} - c''(z_0)\right)\frac{\partial z_0}{\partial m} + \frac{\partial^2 \pi(\overline{d})}{\partial z_0 \partial m} = 0$. Because $\frac{\partial^2 \pi(\overline{d})}{\partial z_0^2} - c''(z_0) < 0$ due to the second-order condition, $\frac{\partial z_0}{\partial m}$ will have the same sign as $\frac{\partial^2 \pi(\overline{d})}{\partial z_0 \partial m}$ so that $\frac{\partial z_0}{\partial m} > 0$.

[3] With the forward-looking consumers, R2 in the baseline model becomes $2(z + d) \leq v - d$, i.e., the expected total benefit from adaptation per se, $2(z + d)$, is lower than the consumption utility of the product without adaptation, $v - d$. Similarly, R1 is now modified to $2(z + d) \leq \phi$.

Scenario 2: If $p_1 = v - d$, then g_1 dominates g_3 and g_2 dominates g_4. Therefore, all consumers will buy in the first period so that $q_1 = 1$ and $p_1 = v - d$. Obviously, scenario 2 dominates scenario 1 in subcase (ii) because $q_1 = 1 > k$.

To summarize: If the resulting $k > k'$, then consumer i adapts if and only if $(v + z - \phi k_i - p_1) + (u_a + z) \geq (v - d - p_1) + u_n$, leading to $k' < k \leq k'' = \frac{d+2z-(u_n-u_a)}{\phi}$. If the resulting $k \leq k'$, then consumer i adapts if and only if $(v + z - \phi k_i - p_1) + (u_n + d + z) \geq (v - d - p_1) + u_n$, leading to $k \leq \min\left(k', \frac{2(d+z)}{\phi}\right)$.

One can see that $\frac{2(d+z)}{\phi} > k'' = \frac{d+2z-(u_n-u_a)}{\phi}$. Thus, there are three possible orders of k'', k' and $\frac{2(d+z)}{\phi}$: (1) $k' < k'' < \frac{2(d+z)}{\phi}$, the outcome is $k^* = k''$ with $p_2 = v - u_a$ and $q_2 = k''$. (2) $k'' \leq k' < \frac{2(d+z)}{\phi}$, the outcome is $k^* = \min\left(k', \frac{2(d+z)}{\phi}\right) = k'$, with $p_1 = v + d + 2z - \phi k'$, $\pi_1 = p_1 k'$; $p_2 = (v - d - u_n)$ and $q_2 = 1$. (3) $k'' < \frac{2(d+z)}{\phi} \leq k'$, the outcome is $k^* = \min\left(k', \frac{2(d+z)}{\phi}\right) = \frac{2(d+z)}{\phi}$ with $\pi_1 = p_1 = v - d$, $p_2 = (v - d - u_n)$ and $q_2 = 1$.

Note that $k' \geq \frac{2(d+z)}{\phi}$ if and only if $d \leq d_0{}' = \frac{\phi(v-u_n)-2z(v-u_a)}{\phi+2(v-u_a)}$,[4] whereas $k' < k''$ if and only if $d > d_0{}'' = \frac{\phi(v-u_n)-(v-u_a)(2z+u_a-u_n)}{\phi+v-u_a}$. As a result, the firm's two-period total profit as a function of d is:

$$\pi(d) = \begin{cases} v - d + \delta \dfrac{d + 2z - (u_n - u_a)}{\phi}(v - u_a), & \text{if } d > d_0{}'' \\ (v + d + 2z - \phi k')k' + \delta(v - d - u_n), & \text{if } d_0{}' < d \leq d_0{}'' \\ v - d + \delta(v - d - u_n), & \text{if } d \leq d_0{}' \end{cases}$$

where $d_0{}' = \frac{\phi(v-u_n)-2z(v-u_a)}{\phi+2(v-u_a)}$, $d_0{}'' = \frac{\phi(v-u_n)-(v-u_a)(2z+u_a-u_n)}{\phi+v-u_a}$, and $k' = \frac{v-d-u_n}{v-u_a}$.

This profit function is similar to that in the baseline model. Other than a new profit expression when d is moderate, a major difference is that the size of adaptors becomes $k = \frac{d+2z-(u_n-u_a)}{\phi}$ when $d > d_0''$ whereas previously it is $k = \frac{d+z}{\phi}$ when consumers are myopic. This result is intuitive, as in the baseline model consumers' adaptation is determined only by the first-period utility gain from adaptation, which is $z + d$; but when consumers are forward-looking, the total two-period gain from adaptation is $d + z$ in the first period and $z - (u_n - u_a)$ in the second period, which is the difference between an adaptor's surplus and a non-adaptor's surplus.

[4] Similar to condition (C2) in the baseline model, we impose that $d_0' > \underline{d} = 0$, which ensures that the firm sells to all consumers when the cultural distance is at its lower bound.

Given the profit expressions, it is easy to verify that $\pi(d)$ decreases in d if $d \leq d_0{}'$. Therefore, the optimal choice of cultural distance is $d^* = \overline{d}$ if and only if $\delta(v-u_a)-\phi > 0$ and $\overline{d} > \frac{\phi(v-u_n)-(2z-u_n+u_a)(v-u_a)}{(v-u_a)-\frac{\phi}{\delta}} \equiv d_m''$. Recall that $d_m = \frac{\phi(v-u_n)-z(v-u_a)}{(v-u_a)-\frac{\phi}{\delta}}$ in the baseline model (evaluated at $\underline{d} = 0$). Apparently, $d_m'' \leq d_m$ if and only if $z \geq u_n - u_a$.

In the baseline model we have discussed whether the firm prefers an equal marginal increase in v or z at the same cost, which boils down to a comparison between $\frac{\partial\pi(\overline{d})}{\partial v}$ and $\frac{\partial\pi(\overline{d})}{\partial z}$. Here we have

$$\frac{\partial\pi(\overline{d})}{\partial v} = 1 + \delta\frac{\overline{d} + 2z - (u_n - u_a)}{\phi}, \text{ and } \frac{\partial\pi(\overline{d})}{\partial z} = \delta\frac{2(v-u_a)}{\phi}.$$

Then $\frac{\partial\pi(\overline{d})}{\partial v} < \frac{\partial\pi(\overline{d})}{\partial z}$ if and only if $\overline{d} < 2(v-u_a-z)+(u_n-u_a)-\frac{\phi}{\delta}$. Recall that the corresponding condition in the myopic case (Corollary 2) is $\overline{d} < (v-u_a-z)-\frac{\phi}{\delta}$. The condition here is more relaxed, suggesting that when consumers are forward-looking, the firm is more motivated to promote culture (i.e., to raise z) than to improve its product (i.e., to raise v) when the cost efficiency is the same for both, given that the firm optimally chooses a high cultural distance.

C. Extension 4.3 Entry of a local competitor

For convenience, we temporarily use the notations $v_a = v$ and $v_n = v - d$ to denote the two types of consumers' utilities from the foreign product. To determine the final equilibrium, we first consider the possible situation in which both firms have positive demand in equilibrium in the second period, and then compare it with the possible situation where the global firm captures the entire market by pricing out the local firm.

There are two scenarios where both firms can have positive demand in equilibrium.

Scenario 1: $v_n < p_2 \leq v_a$. In this scenario, the non-adaptors will never consider the foreign product. The entrant has two options when choosing its price. (i) The price makes a non-adaptor indifferent between buying the local product and buying nothing: $u_n - p_e = 0$ so $p_e = u_n$. Then $u_a < u_n = p_e$, meaning that adaptors will not buy the local product. The entrant sells only to non-adaptors, earning a profit of $\pi_e = u_n(1-k)$. (ii) The entrant's price makes an adaptor indifferent between the two products: $v_a - p_2 = u_a - p_e$, so $p_e = p_2 - (v_a - u_a)$. Then $u_n - p_e > u_a - p_e \geq 0 > v_n - p_2$, meaning that non-adaptors will also buy the local product. The entrant sells to all consumers and earns a profit of $\pi_e = p_e = p_2 - (v_a - u_a)$. Anticipating the two possible responses from the entrant, the global firm must ensure that the entrant chooses (i) (in which case the global firm sells to adaptors and earns a positive profit) over (ii) (in which case the global firm sells to no consumers and earns zero profit), i.e., $u_n(1-k) \geq p_2 - (v_a - u_a)$, which leads to the optimal price:

$$p_2^x = u_n(1-k) + (v_a - u_a). \tag{A1}$$

Scenario 2: $p_2 \le v_n$. In this scenario, the non-adaptors will get non-negative surplus from the foreign product. Again, the entrant may respond with two possible choices of p_e. (i) It can make non-adaptors to be indifferent between the two products: $v_n - p_2 = u_n - p_e$. Then $v_a - p_2 > v_n - p_2 = u_n - p_e > u_a - p_e$, meaning that adaptors must strictly prefer the foreign product. Then the entrant sells only to non-adaptors, with $p_e = p_2 - (v_n - u_n)$ and $\pi_e = [p_2 - (v_n - u_n)](1-k)$. (ii) The entrant can make adaptors to be indifferent between the two products: $v_a - p_2 = u_a - p_e$. Then $v_n - p_2 < v_a - p_2 = u_a - p_e < u_n - p_e$, meaning that non-adaptors must strictly prefer the local product. As a result, the entrant sells to all consumers, with $\pi_e = p_e = p_2 - (v_a - u_a)$. Anticipating the two possible responses from the entrant, the global firm must again make sure that the entrant will choose (i) over (ii), i.e., $[p_2 - (v_n - u_n)](1-k) \ge p_2 - (v_a - u_a)$, which leads to:

$$p_2^y = \frac{(v_a - u_a) - (v_n - u_n)(1-k)}{k}. \tag{A2}$$

Recall that p_2^x is derived from the premise of $v_n < p_2 \le v_a$, which corresponds to $k^w \le k < k^y$, where $k^w = \frac{u_n - u_a}{u_n}$, and $k^y = \frac{u_n - u_a + d}{u_n}$. This is referred to as case (x). If $k < k^w$, then the global firm's optimal choice is (referred to as case (w)):

$$p_2^w = v_a, \tag{A3}$$

because it will not price above v_a, which will result in zero demand. Finally, p_2^y requires $p_2 \le v_n$, which corresponds to $k \ge k^y$. This is referred to as case (y).

To summarize, depending on the value of k, the global firm's optimal price in period 2 comes in three cases as in p_2^x, p_2^y, and p_2^w. Correspondingly, its profit, π_2, becomes (recall that $v_a = v$ and $v_n = v - d$):

$$\pi_2(k) = \begin{cases} \pi_2^w = vk, & \text{if } k < k^w \\ \pi_2^x = [u_n(1-k) + (v - u_a)]k, & \text{if } k^w \le k < k^y \\ \pi_2^y = (v - u_a) - (v - u_n - d)(1-k), & \text{if } k \ge k^y \end{cases} \tag{A4}$$

The first period game is exactly the same as in the baseline model, where the global firm's profit is reproduced here:

$$\pi_1(k) = \begin{cases} (v + z - \phi k)k, & if\ k < \dfrac{d+z}{\phi} \\ v - d, & if\ k = \dfrac{d+z}{\phi} \end{cases}$$

Depending on the relative values of k^w, k^y and $\frac{d+z}{\phi}$, therefore, there will be different combinations of the global firms' profits from the two periods. We can show that in all combinations the global firm's two-period total profit increases with k if $v > u_a + u_n$ holds, so that the equilibrium k is $k = \frac{d+z}{\phi}$. As a result, its optimal two-period total profit, $\pi = \pi_1 + \delta\pi_2$, can be expressed as a function of d in three possible conditions:

$$\pi(d) = \begin{cases} \pi_w(d) = (v-d) + \delta v \dfrac{d+z}{\phi}, & if\ k < k^w \\ \pi_x(d) = (v-d) + \delta\left[u_n\left(1 - \dfrac{d+z}{\phi}\right) + (v - u_a)\right]\dfrac{d+z}{\phi}, & if\ k^w \le k < k^y \\ \pi_y(d) = (v-d) + \delta\left[(v-u_a) - (v - u_n - d)\left(1 - \dfrac{d+z}{\phi}\right)\right], & if\ k \ge k^y \end{cases} \quad \text{(A5)}$$

Equation (A5) gives the profits of the global firm if both firms have positive demand in equilibrium in the second period. However, the global firm may choose to set its price as $p_2 = p_2^o = v - d - u_n$ to take the whole market, as the local firm has to price $p_e > 0$ but both adaptors and non-adaptors will choose the global firm when $p_2^o = v - d - u_n$ for any $p_e > 0$. In that case, $\pi^o = v - d + \delta(v - d - u_n)$. Note that p_2^o and the corresponding π^o are the same as their counterparts in the baseline model when the firm captures the entire market in the second period. Also note that the equilibrium k is still $\frac{d+z}{\phi}$ when $p_2 = p_2^o$, because $\pi_1(k)$ increases with k and π_2 is independent of k in this case.

In sum, under a very mild sufficient (but not necessary) condition of $v > u_a + u_n$, the number of adaptors continues to be $k = \frac{d+z}{\phi}$ for all cases. To simplify the analysis without losing the main insights, we focus on two special and important cases, corresponding respectively to $k < k^w$ and $k \ge k^y$.

Case (i): $\frac{u_a}{u_n} < 1 - \frac{\bar{d}+z}{\phi}$. This is a case where u_a is sufficiently smaller than u_n so that the local firm does not threaten the global firm's ability to retain adaptors. Consequently, the global firm can set $p_2 = v$ and still keep all the adaptors. The global firm's total profits as a function of d are:

$$\pi(d) = (v-d) + \delta \max\left(v - d - u_n,\ v\frac{d+z}{\phi}\right)$$

It is then easy to see that this case is mathematically equivalent to the baseline model with $u_a = 0$, hence all results in the baseline model hold here.

Case (ii): $\frac{u_a}{u_n} \ge 1 - \frac{z}{\phi}$ and $u_n > \phi$. This is the case where u_a is sufficiently close to u_n and u_n is large, which implies that the local entrant poses a credible threat to the global firm even for the adaptors. Consequently, the global firm has to price aggressively (i.e., with $p_2 < v - d$) in order to retain the adaptors. The corresponding $\pi(d)$ is $\pi(d) = \max(\pi^o, \pi_y(d))$, where $\pi^o = (v-d) + \delta(v - d - u_n)$ and $\pi_y(d) = (v-d) + \delta\left[(v-u_a) - (v - u_n - d)\left(1 - \frac{d+z}{\phi}\right)\right]$.

We denote the solution to $\pi'_y(d) = 0$ as $d_y = \frac{1}{2}\left(v - u_n - z - \frac{1-\delta}{\delta}\phi\right)$ and denote $\check{d} = \min\left(d_y, \overline{d}\right)$. Note that $\pi^o(0) \geq \pi_y(0)$, $\pi^{o\prime}(d) < 0$, and $\pi_y(d)$ is inversely U-shaped in d with $\pi'_y\left(d_y\right) = 0$. Therefore, if $d_y \leq 0$ then $\pi(d)$ decreases with d so that $d^* = 0$. If $d_y > 0$, then $\pi(d)$ is U-shaped in d for $d \in \left[0, \check{d}\,\right]$ and decreases with d for $d \in (\check{d}, \overline{d}]$. Consequently, $d^* = 0$ if $\pi^o(0) \geq \pi_y\left(\check{d}\right)$ and $d^* = \check{d}$ if $\pi^o(0) < \pi_y\left(\check{d}\right)$.

We next show that $\pi^o(0) < \pi_y\left(\check{d}\right)$ is feasible under the parameter conditions imposed for case (ii). Let $\delta = 1$,[5] then $d_y = \frac{1}{2}(v - u_n - z)$, $\pi_y\left(d_y\right) = v + \left[(u_n - u_a) + \frac{(v-u_n+z)^2}{4\phi}\right]$. $d^* = d_y$ if the following conditions are satisfied: (s1) $\pi_y\left(d_y\right) > \pi^o = v - d - \delta(v - d - u_n) \rightarrow \phi < \frac{(v-u_n+z)^2}{4[(v-u_n)-(u_n-u_a)]}$, (s2) $\phi > \frac{z(v-u_n)}{(v-u_n)-(u_n-u_a)}$ (for $\pi^o(0) \geq \pi_y(0)$), (s3) $\frac{u_a}{u_n} \geq 1 - \frac{z}{\phi}$ and $u_n > \phi$ (required for case (ii)), (s4) $d_y > 0 \rightarrow v - u_n - z > 0$, and (s5) $d_y \leq \overline{d} \leq \phi - z \rightarrow \phi \geq \frac{1}{2}(v - u_n + z), \frac{1}{2}(v - u_n - z) \leq \overline{d}, \phi \geq \overline{d} + z$. It follows that if $z = 0$ then (s1)-(s6) cannot hold simultaneously because $z = 0$ implies $u_n = u_a$ from (s3) and then (s1) and (s5) cannot hold simultaneously as $\frac{1}{2}(v - u_n) > \frac{(v-u_n)^2}{4[(v-u_n)} = \frac{(v-u_n)}{4}$.

If $z > 0$, then (s1-s6) can hold simultaneously, and the proof is as follows. First, the conditions for ϕ in (s1-s6) can be summarized as $u_n > \phi \geq \overline{d} + z$ and

$$\max\left(\frac{1}{2}(v - u_n + z), \frac{z(v - u_n)}{(v - u_n) - (u_n - u_a)}\right) < \phi < \min\left(\frac{(v - u_n + z)^2}{4[(v - u_n) - (u_n - u_a)]}, \frac{z u_n}{u_n - u_a}\right)$$

We have that $\frac{z(v-u_n)}{(v-u_n)-(u_n-u_a)} < \frac{(v-u_n+z)^2}{4[(v-u_n)-(u_n-u_a)]}$ always hold as $\frac{z(v-u_n)}{(v-u_n)-(u_n-u_a)} - \frac{(v-u_n+z)^2}{4[(v-u_n)-(u_n-u_a)]} = -\frac{(v-u_n-z)^2}{4[(v-u_n)-(u_n-u_a)]} < 0$, $\frac{(v-u_n)}{(v-u_n)-(u_n-u_a)} < \frac{u_n}{u_n-u_a} \rightarrow v u_a - u_n u_n > 0$ (s7), $\frac{1}{2}(v - u_n + z) < \frac{z u_n}{u_n-u_a} \rightarrow z > \frac{(v-u_n)(u_n-u_a)}{(u_n+u_a)}$ (s8), $\frac{1}{2}(v - u_n + z) < \frac{(v-u_n+z)^2}{4[(v-u_n)-(u_n-u_a)]} \rightarrow z > \frac{(v-u_n)(u_n-u_a)+2(v u_a-u_n u_n)}{(u_n+u_a)}$ (s9). Given (s7), (s8) is dominated by (s9). Then we have the condition on z as $\frac{(v-u_n)(u_n-u_a)+2(v u_a-u_n u_n)}{(u_n+u_a)} < z < v - u_n$ (s10). Because $\frac{(v-u_n)(u_n-u_a)+2(v u_a-u_n u_n)}{(u_n+u_a)} < v - u_n \rightarrow u_n > u_a$, which always hold, (s10) can be satisfied with a non-empty set of z. In sum, as long as $v u_a - u_n u_n > 0$, there exists a parameter space so that $d^* = d_y > 0$. Given the continuity of $\pi_y(d)$, $d^* = \overline{d} > 0$ is also feasible for $\overline{d}$ slightly less than such a d_y. Also, note that $v u_a - u_n u_n > 0$ holds when u_a is close enough to u_n as $v > u_n$.

[5] Since $\pi^o(0) - \pi_y(d)$ decreases with δ, if $\pi^o(0) < \pi_y\left(\check{d}\right)$ is not feasible at $\delta = 1$ it will not be feasible $\delta < 1$.

As for the impact of z in case (ii), one can see that the profits of the global firm are independent of z if $d^* = 0$ but is increasing with z as $\frac{\partial \pi}{\partial z} = \frac{\partial \pi_y}{\partial z} > 0$ if $d^* > 0$,[6] which are similar to the result in the baseline model. Also, because $\frac{\partial \pi_y}{\partial z} > 0$, $\pi_y(\check{d}) > \pi^o(0)$ holds on a wider parameter space when z is larger, i.e., the global firm is less motivated to choose a minimum cultural distance when z is larger. This again is similar to the finding from the baseline model.

D. Extension 4.4 Competition between two global firms

Given what happens in the two periods as analyzed in the text, if $d_A = d_B = 0$, then no adaptation will occur and firms' profits in the second period are $\pi_{A2} = \pi_{B2} = 0$ and their profits in the first period are $\pi_{A1} = \pi_{B1} = \frac{t}{2}$, which are the standard solutions of the Hotelling model (Hotelling 1929). Their total profits in two periods are $\pi(0,0) = \frac{t}{2}$.

If $d_A = d_B = d$, then a proportion k of consumers will adapt and firms' profits in the second period are $\pi_{A2} = \pi_{B2} = \frac{tk}{2}$ and their profits in the first period are $\pi_{A1} = \pi_{B1} = \frac{t}{2}$, which again are the standard solutions of the Hotelling model. Their total profits in two periods are $\pi(d,d) = \frac{t}{2}(1+k)$.

If $d_A = 0$ and $d_B = d$ (the case of $d_A = d$ and $d_B = 0$ can be solved similarly due to symmetry), denote x^* as the location of the indifferent consumer among adaptors in the first period. Then firms' second period profits are $\pi_{A2} = \pi_{B2} = \frac{tk(1-x^*)}{2}$ as only those potential adaptors who buy from firm B will adapt. Then the total profits of A and B are

$$\pi_A = [(1-k)y^* + kx^*]p_1^A + \frac{t}{2}k(1-x^*)$$

$$\pi_B = [(1-k)(1-y^*) + k(1-x^*)]p_1^B + \frac{t}{2}k(1-x^*)$$

respectively, where $x^* = \frac{(p_1^B - p_1^A)+t}{2t}$ and $y^* = \frac{d+(p_1^B-p_1^A)+t}{2t}$ is the location of the indifferent consumer among the $1-k$ proportion of non-adaptors.

Proposition 8 is obtained by comparing the profits of the firms under $(d_A, d_B) = (0,0)$, (d,d), $(0,d)$ and $(d,0)$. The profits from the two symmetric outcomes, $(d_A, d_B) = (0,0)$ and (d,d) have been given in the paper. To solve for the equilibrium for $(d_A, d_B) = (0,d)$, the FOCs of the profits lead to:

$$p_1^A = \frac{3t + [(1-k)d + \frac{t}{2}k]}{3}, \qquad p_1^B = \frac{3t - \left[(1-k)d + \frac{t}{2}k\right]}{3}$$

[6] If $d^* = d_y > 0$, $\frac{\partial \pi}{\partial z} = \frac{\partial \pi}{\partial d}\frac{\partial d}{\partial z} + \frac{\partial \pi}{\partial z} = \frac{\partial \pi}{\partial z}$ after applying the envelop theorem.

The corresponding equilibrium profits are ($\pi(d_i, d_j)$ denotes the profits of the firm that has chosen d_i and its rival is choosing d_j, for $d_i, d_j \in \{0, d\}$):

$$\pi(0,d) = \frac{2(1-k)^2 d^2 + (12+5k)(1-k)td + 2t^2(k^2+3k+9)}{36t}$$

$$\pi(d,0) = \frac{2(1-k)^2 d^2 - (12-5k)(1-k)td + 2t^2(k+3)^2}{36t}$$

Given the equilibrium prices, $d > 0$, $0 < x^* < 1$ and $0 < y^* < 1$ requires that $0 < d < min\left\{\frac{t(3-k)}{2(1-k)}, \frac{t(3+k)}{1+2k}\right\} \equiv \hat{d}$. Denote d_{s1} as the solution of $\pi(d,d) = \pi(0,d)$, we have $d_{s1} = \frac{-(5k+12)+3\sqrt{k^2+24k+16}}{4(1-k)}t$ as the unique solution that satisfies $0 < d < \hat{d}$ and $\pi(d,d) > \pi(0,d)$ if $0 < d < d_{s1}$. Denote d_{s2} as the solution of $\pi(0,0) = \pi(d,0)$, we have $d_{s2} = \frac{(12-5k)-3\sqrt{k^2-24k+16}}{4(1-k)}t$ as the unique solution that satisfies $0 < d < \hat{d}$ and $\pi(0,0) > \pi(d,0)$ if $d_{s2} < d < \hat{d}$. In addition, $d_{s2} > d_{s1}$ always holds for $0 < d < \hat{d}$.

E. Extension 4.5 Adaptation through consumption

The derivations below use the following parameter conditions: (i) $\underline{d} \geq \frac{\lambda}{1-\lambda}z$, (ii) $\overline{d} \geq \lambda(z + u_a - u_n)$, (iii) modified R1 (so that the measure of adaptors is no greater than 1): $d \leq \frac{\phi}{2-\lambda} - z$; and (iv) modified R2: $d \leq \frac{v-2(1-\lambda)z}{3-2\lambda}$. The last two conditions can be combined into: $\overline{d} \leq \min\left\{\frac{\phi}{2-\lambda} - z, \frac{v-2(1-\lambda)z}{3-2\lambda}\right\} \equiv \hat{d}$.

Given k and h, the firm's optimal choice in the second period is: (1) If $v - d - u_n \geq (k + \lambda h)(v - u_a)$, then $p_2^* = v - d - u_n$, $q_2 = 1$, and $\pi_2 = v - d - u_n$. (2) If $v - d - u_n < (k + \lambda h)(v - u_a)$, then $p_2^* = v - u_a$, $q_2 = k + \lambda h$, and $\pi_2 = (k + \lambda h)(v - u_a)$.

These two cases lead to different consumer utilities in the second period. Case (1): If $k + \lambda h \leq k' = \frac{v-d-u_n}{v-u_a}$, the firm will sell to all consumers ($q_2 = 1$) with price $p_2 = v - d - u_n$, so an adaptor's utility is $z + v - p_2 = u_n + d + z$, and a non-adaptor's utility is $v - d - p_2 = u_n$. Case (2): If $k + \lambda h > k' = \frac{v-d-u_n}{v-u_a}$, the firm will sell exclusively to adaptors ($q_2 = k + \lambda h$) with price $p_2 = v - u_a$, so an adaptor's utility is $z + v - p_2 = u_a + z$ and a non-adaptor's utility is u_n.

In the first period, consumers choose whether or not to buy and whether or not to actively learn (i.e., actively adapt) based on their expectation of two-period total utility.

Case (1): Consumers expect $k + \lambda h \leq k' = \frac{v-d-u_n}{v-u_a}$

In this case, $\pi_2 = v - d - u_n$, which is independent of k or h. Therefore, the firm will choose p_1 to maximize π_1 alone.

Among consumers who buy in the first period, those who also actively learn will receive a utility of $(u_n + d + z)$ in the second period, whereas those who do not learn actively will receive an expected utility of $\lambda(u_n + d + z) + (1 - \lambda)u_n = \lambda(d + z) + u_n$. Among consumers who do not buy in the first period, those who actively learn will receive a utility of $(u_n + d + z)$ in the second period, whereas those who do not learn actively will receive a utility of u_n. Accordingly, consumer i 's two-period total utility is:

Period 1 choice	learn actively	not learn actively
buy	(g_1): $(v + z - \phi k_i - p_1) + (u_n + d + z)$	(g_2): $(v - d - p_1) + \lambda(d + z) + u_n$
not buy	(g_3): $(z - \phi k_i) + (u_n + d + z)$	(g_4): u_n

The comparison between g_1 and g_3 depends on whether $p_1 \leq v$, whereas the comparison between g_2 and g_4 depends on whether $p_1 \leq v - d + \lambda(d + z)$. Condition (i), i.e., $d \geq \frac{\lambda}{1-\lambda} z$, implies $v - d + \lambda(d + z) \leq v$. Thus, similar to the baseline model, we only need to consider two possible choices of p_1 by the firm.

If $v - d + \lambda(d + z) < p_1 \leq v$, then g_1 dominates g_3 and g_4 dominates g_2. Consumers choose between g_1 and g_4, meaning that a consumer actively learns if and only if she buys ($q_1 = k$ and $h = 0$), with $p_1 = v + d + 2z - \phi k$ for $\frac{d+2z}{\phi} \leq k < \frac{(2-\lambda)(d+z)}{\phi}$. Given condition (iv), the period-one profit, $\pi_1 = p_1 k$, increases with k, so that optimal choice is $p_1 \to v - d + \lambda(d + z)$. But this outcome is dominated by $p_1 = v - d + \lambda(d + z)$, which is analyzed below.

If $p_1 = v - d + \lambda(d + z)$, then g_1 dominates g_3 and g_2 dominates g_4. Consumers choose between g_1 and g_2, so that they all buy ($q_1 = 1$) with $\pi_1 = v - d + \lambda(d + z)$, $k \leq \frac{(2-\lambda)(d+z)}{\phi}$, and $h = 1 - k$.

To summarize case (1): if $\frac{(2-\lambda)(d+z)}{\phi} \leq \frac{k'-\lambda}{1-\lambda}$, the first-period price is $p_1 = \pi_1 = v - d + \lambda(d + z)$, with $k = \frac{(2-\lambda)(d+z)}{\phi}$ and $h = 1 - k$; if $\frac{(2-\lambda)(d+z)}{\phi} > \frac{k'-\lambda}{1-\lambda}$, then $k = k'$, $h = 0$, $p_1 = v + d + 2z - \phi k'$, $\pi_1 = p_1 k'$. Note that condition (iii) guarantees $k \leq 1$.

Case (2): Consumers expect $k + \lambda h > k' = \frac{v-d-u_n}{v-u_a}$

In this case, $\pi_2 = (k + \lambda h)(v - u_a)$, and the firm chooses p_1 (or equivalently k) to maximize its two-period total profit $\pi = \pi_1 + \delta\pi_2$.

Among consumers who buy in the first period, those who also actively learn will receive a utility of $(u_a + z)$ in the second period, whereas those who do not learn actively will receive an expected utility of $\lambda(u_a + z) + (1-\lambda)u_n = u_n + \lambda(z + u_a - u_n)$. Among consumers who do not buy in the first period, those who actively learn will receive a utility of $u_a + z$ in the second period, whereas those who do not learn actively will receive a utility of u_n. Accordingly, consumer i 's two-period total utility is:

Period 1 choice	learn actively	not learn actively
Buy	(g_1): $(v + z - \phi k_i - p_1) + (u_a + z)$	(g_2): $(v - d - p_1) +$ $u_n + \lambda(z + u_a - u_n)$
not buy	(g_3): $(z - \phi k_i) + (u_a + z)$	(g_4): u_n

The comparison between g_1 and g_3 depends on whether $p_1 \leq v$, whereas the comparison between g_2 and g_4 depends on whether $p_1 \leq v - d + \lambda(z + u_a - u_n)$. Given condition (ii), $v \geq v - d + \lambda(z + u_a - u_n)$. Therefore, similar to the baseline model, we only need to consider two possible choices of p_1.

If $v - d + \lambda(z + u_a - u_n) < p_1 \leq v$, then g_1 dominates g_3 and g_4 dominates g_2. Consumers choose between g_1 and g_4, meaning that a consumer learns if and only if she buys in the first period ($q_1 = k$ and $h = 0$). Then $p_1 = v + 2z - (u_n - u_a) - \phi k$ so that $\frac{2z+u_a-u_n}{\phi} \leq k < \frac{(d+z)+(1-\lambda)(z+u_a-u_n)}{\phi}$. Under condition (iv), the firm's two-period total profit increases with k. Thus, the optimal outcome is $p_1 \to v - d + \lambda(z + u_a - u_n)$. However, this outcome is dominated by the choice of $p_1 = v - d + \lambda(z + u_a - u_n)$, which is analyzed next.

If $p_1 = v - d + \lambda(z + u_a - u_n)$, then g_1 dominates g_3 and g_2 dominates g_4. Consumers choose between g_1 and g_2, and consequently all consumers will buy in the first period ($q_1 = 1$). A consumer actively learns if and only if $(v + z - \phi k_i - p_1) + (u_a + z) \geq (v - d - p_1) + u_n + \lambda(u_a - u_n + z)$, which implies that $k = \frac{(z+d)+(1-\lambda)(z+u_a-u_n)}{\phi}$. Note that the condition of $q_2 = \lambda + (1-\lambda)k \leq 1$ is satisfied given condition (iii).

To summarize case (2), the first-period price is $p_1 = \pi_1 = v - d + \lambda(z + u_a - u_n)$, with $h = 1 - k$ and $k \leq \frac{(z+d)+(1-\lambda)(z+u_a-u_n)}{\phi} = k''$ and $k'' > \frac{k'-\lambda}{1-\lambda}$. Condition (iii) guarantees $k \leq 1$.

Combining cases (1) and (2)

It is clear that $\frac{(z+d)+(1-\lambda)(z+u_a-u_n)}{\phi} = k'' < \frac{(2-\lambda)(d+z)}{\phi}$. Then there are three cases: (a) if $\frac{k'-\lambda}{1-\lambda} < k'' \leq \frac{(2-\lambda)(d+z)}{\phi}$, then it is case (2) with $k = k''$; (b) if $k'' \leq \frac{k'-\lambda}{1-\lambda} < \frac{(2-\lambda)(d+z)}{\phi}$, then it is case (1) with $k = k'$; (c) if $k'' < \frac{(2-\lambda)(d+z)}{\phi} < \frac{k'-\lambda}{1-\lambda}$, then it is case (1) with $k = \frac{(2-\lambda)(d+z)}{\phi}$.

Note that $\frac{k'-\lambda}{1-\lambda} > \frac{(2-\lambda)(d+z)}{\phi}$ if and only if $d < d_0{}' = \frac{\phi(v-u_n)-(v-u_a)[z(1-\lambda)^2+(\phi-z)\lambda+z]}{\phi+(1-\lambda)(2-\lambda)(v-u_a)}$, whereas $\frac{k'-\lambda}{1-\lambda} < k''$ if and only if $d > d_0{}'' = \frac{\phi(v-u_n)-(v-u_a)[(z+u_a-u_n)(1-\lambda)^2+(\phi-z)\lambda+z]}{\phi+(1-\lambda)(v-u_a)}$. As a result, the firm's two-period total profit as a function of d is:

$$\pi(d) = \begin{cases} v - d + \lambda(z + u_a - u_n) + \delta q_2^*(v - u_a), & \text{if } d > d_0{}'' \\ (v + d + 2z - \phi k')k' + \delta(v - d - u_n), & \text{if } d_0{}' < d \leq d_0{}'' \\ v - d + \lambda(d + z) + \delta(v - d - u_n), & \text{if } d \leq d_0{}' \end{cases}$$

where $q_2^* = \lambda + (1-\lambda)\frac{(z+d)+(1-\lambda)(z+u_a-u_n)}{\phi}$ and $k' = \frac{v-d-u_n}{v-u_a}$.

As shown in the above derivations, the firm's optimal choice has three cases. If d is very small ($d \leq d_0{}'$), the firm sells to all consumers in both periods, with $p_1 = v - d + \lambda(d+z)$ and $p_2 = v - d - u_n$, so its two-period total profit decreases with d. If d is intermediate ($d_0{}' < d \leq d_0{}''$), the firm sells to a subset of consumers in the first period ($k' = \frac{v-d-u_n}{v-u_a}$) and all consumers in the second period, with first-period profit $\pi_1 = (v + d + 2z - \phi k')k'$ increasing with k' but k' is decreasing when d is larger, and its second-period profit $\pi_2 = v - d - u_n$ also decreases with d. Finally, when d is large ($d > d_0{}''$), the firm again sells to all consumers in the first period but only to adaptors in the second period, with $p_1 = v - d + \lambda(z + u_a - u_n)$ and $p_2 = v - u_a$. Although the first-period price decreases with d, the second period sales quantity ($q_2 = \lambda + (1-\lambda)k$) increases with d given that the measure of consumers who actively learn in the first period is $k = \frac{(z+d)+(1-\lambda)(z+u_a-u_n)}{\phi}$, which increases with d. The condition $\delta(1-\lambda)(v-u_a) - \phi > 0$ ensures that, when d is large, the latter effect dominates so that the firm's two-period total profit increases with d, leading to the increasing part of the U-shaped profit.[7]

F. Second-period Adaptation

In the baseline model we have assumed that adaptation can happen only in the first period. Now consider the possibility that consumers who have not adapted in the first period will have a chance to

[7] Numerical example: let $v = 1$, $\delta = 1$, $u_a = 0$, $u_n = 0.3$, $\phi = 0.5$, $z = 0.1$, $\lambda = 0.4$. $\underline{d} = 0.07$, and $\overline{d} = 0.2$. Then $d_0' = 0.037$ and $d_0{}'' = 0.147$. For $\underline{d} < d < d_0{}''$, $\pi(d)$ decreases with d and $\pi(\underline{d}) = 1.23$, whereas for $d_0{}'' < d < \overline{d}$, $\pi(d)$ increases with d and $\pi(\overline{d}) = 1.34$. Therefore, $d^* = \overline{d}$.

adapt in the second period.[8] Suppose that consumers with $k_i \in [0, k]$ have adapted in the first period and denote k_2 as the total measure of adaptors in two periods. In the second period, a consumer who has not adapted (i.e., $k_i \in (k, 1]$) will choose whether or not to adapt and whether or not to buy the foreign product.[9] Her utility in the second period is given in the table below:

period 2 choice	Adapt	not adapt
buy the foreign product	(h_1) $z - \phi k_i + v - p_2$	(h_2) $v - d - p_2$
outside option	(h_3) $z - \phi k_i + u_a$	(h_4) u_n

Obviously, the firm will not charge $p_2 > v - u_a$ as this results in no sales; and it will not charge $p_2 < v - d - u_n$ because it can get all consumers to buy at $p_2 = v - d - u_n$. Then there are only two cases to consider. (i) If $v - d - u_n < p_2 \le v - u_a$, we have h_1 dominates h_3 and h_4 dominates h_2. Therefore, consumer i's choice is between h_1 and h_4: she adapts and buys if and only if $z - \phi k_i + v - p_2 \ge u_n$, which implies that $q_2 = k_2 = \max\left\{k, \frac{z+v-u_n-p_2}{\phi}\right\}$. (ii) If $p_2 = v - d - u_n$, then h_1 dominates h_3 and h_2 dominates h_4. Therefore, consumer i's choice is between h_1 and h_2. Consequently, all consumers will buy ($q_2 = 1$), and consumer i adapts if and only if $z - \phi k_i + v - p_2 \ge v - d - p_2$, which implies that $k_2 = \max\left\{k, \frac{d+z}{\phi}\right\}$.

Note that the second-period demand, q_2, is not a function of p_2 in case (ii). In case (i), q_2 is a function of p_2 if and only if $k < \frac{z+v-u_n-p_2}{\phi}$ so that $q_2 = k_2 = \frac{z+v-u_n-p_2}{\phi}$, which implies that $p_2 = v + z - u_n - \phi k_2$ and $\pi_2 = p_2 q_2 = (v + z - u_n - \phi k_2)k_2$. Because in such case $\frac{\partial \pi_2}{\partial k_2} = v + z - u_n - 2\phi k_2 > v + z - u_n - 2\phi\frac{d+z}{\phi}$ as $p_2 > v - d - u_n$ (so that $\frac{z+v-u_n-p_2}{\phi} < \frac{d+z}{\phi}$), and $v + z - u_n - 2\phi\frac{d+z}{\phi} = (v - d - u_n) - (z + d) \ge 0$ under our model assumptions[10], we have $\frac{\partial \pi_2}{\partial k_2} > 0$, which implies that $p_2 \to v - d - u_n$ and $k_2 \to \frac{d+z}{\phi}$ must hold for this case (i.e., case (i) with $k < \frac{z+v-u_n-p_2}{\phi}$) to be the optimal solution. However, this case is dominated by case (ii) because $q_2 = 1$ and $p_2 = v - d - u_n$ in case (ii).

[8] Here we keep the assumption that consumers are myopic. If consumers are forward-looking, then, similar to the case analyzed in Section 4.3 of the paper, forward-looking consumers with rational expectation will adapt in the first-period only as doing so gives them additional cultural benefits in the first period.
[9] For a consumer who has already adapted, her second-period surplus is $v + z - p_2$ if she buys the foreign product and $u_a + z$ if she chooses the outside option. Since the firm will not set $p_2 > v - u_a$, which results in zero demand in the second period, the first-period adaptors will always buy in the second period.
[10] When applied to the second period, R2 in our baseline model requires the benefit from adaptation $(z + d)$ per se is not higher than the incremental consumption utility of the product without adaptation $(v - d - u_n)$.

Therefore, based on the above discussion, the only possible optimal second-period outcomes are (a) $p_2 = v - d - u_n$ and $q_2 = 1$ (i.e., case (ii)) or (b) $p_2 = v - u_a$ and $q_2 = \max\left\{k, \frac{z-(u_n-u_a)}{\phi}\right\} = k$ (i.e., case (i) with $k > \frac{z-(u_n-u_a)}{\phi}$). Note that in both (a) and (b), $\pi_2(k) = p_2 q_2$ is non-decreasing in k. Therefore, following the same derivation as in the baseline model, the firm's two-period total profit $\pi_1(k) + \delta\pi_2(k)$ is also non-decreasing in k. This implies that we have $k = \frac{d+z}{\phi}$ and $p_1 = v - d$ under the profit-maximizing outcome in the first period, which is the same as in our baseline model. Then because $\max\left\{k, \frac{z-(u_n-u_a)}{\phi}\right\} = \frac{d+z}{\phi}$ as $k = \frac{d+z}{\phi} > \frac{z-(u_n-u_a)}{\phi}$, the firm's second-period optimal profit can be summarized as $\pi_2 = q_2 p_2 = max\left\{v - d - u_n, (v - u_a)\frac{d+z}{\phi}\right\}$, which is also the same as that in the baseline model. Finally, note that $k_2 = k$ in the optimal outcome because $\max\left\{k, \frac{z-(u_n-u_a)}{\phi}\right\} = k = \frac{d+z}{\phi}$. Hence, there is no additional adaptation in the second period even though it is allowed.

G. Allowing total benefits of cultural adaptation to be greater than consumption utility

In the baseline model we have imposed assumption R2: $z + d \leq v - d$, which suggests that the benefits associated with the culture adaptation are dominated by the benefits associated with the product consumption. Although this is a fairly realistic assumption, one may imagine some real-world situations in which the condition may not hold, i.e., the cultural adaptation benefits may exceed the consumption utility itself. As shown in the analyses below, we can prove that all results in the baseline model when cultural distance, *d*, is optimally chosen, i.e., all propositions and corollaries except Proposition 1, remain unchanged with the removal of R2. Proposition 1, however, is regarding the relationship of an exogenous *d* and the profits of the global firm. We can show that part (ii) of Proposition 1, i.e., if $\delta(v - u_a) - \phi > 0$ then $\frac{\partial\pi(d)}{\partial d} < 0$ for $d \leq d_0$ and $\frac{\partial\pi(d)}{\partial d} > 0$ for $d > d_0$, still holds. This confirms that the inverse-U relation between cultural distance and global firm's profits, as illustrated in Figure 1, can still occur under the same conditions as in the baseline model. The only difference from the baseline model is that now, with the removal of R2, we cannot ensure the existence of parameter ranges within which the global firm's profits always decrease with its cultural distance, i.e., part (i) of Proposition 1.

The detailed analysis is as follows. We first show that all of our results in the baseline model (i.e., all propositions and corollaries) except Proposition 1 remain unchanged without imposing R2. We then prove that part (ii) of Proposition 1—specifically, that the firm's profits may follow a U-shaped relationship with respect to d—also holds without imposing R2.

Note that the firm's profits in each period, as given by Lemma 1 and equation (1), are not affected by R2.

We show below by contradiction that the equilibrium k^* must still be $k^* = \frac{z+d^*}{\phi}$, where d^* is the equilibrium choice of d, even without R2.

Suppose that equilibrium k^* satisfies $\frac{z}{\phi} \leq k < \frac{z+d^*}{\phi}$ so that $k^* \neq \frac{z+d^*}{\phi}$. From Lemma 1 and equation (1), $\pi(k) = \pi_1(k) + \delta\pi_2(k) = (z + v - \phi k)k + \delta max\big(v - d - u_n, k(v - u_a)\big)$ if $\frac{z}{\phi} \leq k < \frac{z+d}{\phi}$. One can see that $\frac{\partial\pi(k)}{\partial k}$ is not a function of d in this case. Then $\pi(k, d) \leq \pi\big(k, \underline{d}\big)$ so that $d^* = \underline{d}$ must hold because $\pi_2(k)$ is non-increasing with d and $max\big(v - d - u_n, k(v - u_a)\big) = v - \underline{d} - u_n$ given C2, i.e., as we assume that the firm will sell to both adaptors and non-adaptors in the second period if the cultural distance is at its lower bound.

As $\pi\big(k, \underline{d}\big) = (z + v - \phi k)k + \delta\big(v - \underline{d} - u_n\big)$, from $\frac{\partial\pi(k,\underline{d})}{\partial k} = 0$, the optimal k^* can be solved as (i) $k^* = \frac{z+v}{2\phi}$ if $\frac{z+v}{2\phi} \geq \frac{z}{\phi}$, i.e., $v \geq z$; or (ii) $k^* = \frac{z}{\phi}$ if $v < z$.

Case (i): $v \geq z$ so that $k^* = \frac{z+v}{2\phi}$. $k^* = \frac{z+v}{2\phi} < \frac{z+\underline{d}}{\phi}$ implies that $\underline{d} > \frac{v-z}{2} \geq 0$. In addition, $v - \underline{d} - u_n > k^*(v - u_a) = \frac{z+v}{2\phi}(v - u_a)$ must hold in the second period based on Lemma 1 and C2, which then implies that $\underline{d} < v - u_n - \frac{z+v}{2\phi}(v - u_a)$. Then from $\frac{v-z}{2} < \underline{d} < v - u_n - \frac{z+v}{2\phi}(v - u_a)$, $\frac{v-z}{2} < v - u_n - \frac{z+v}{2\phi}(v - u_a)$ must hold, which results in $\phi > \frac{(z+v)(v-u_a)}{v+z-2u_n}$. Moreover, for k^* to be the optimal solution, we must have $\pi\left(k = \frac{z+v}{2\phi}, \underline{d}\right) \geq \pi\left(k = \frac{z+\underline{d}}{\phi}, \underline{d}\right)$, which leads to $\frac{(z+v)^2}{4\phi} \geq v - \underline{d}$ based on Lemma 1 and equation (1). Because $\frac{v-z}{2} < \underline{d} < v - u_n - \frac{z+v}{2\phi}(v - u_a)$, $\frac{(z+v)^2}{4\phi} \geq v - \underline{d}$ implies that $\frac{(z+v)^2}{4\phi} > v - \left[v - u_n - \frac{z+v}{2\phi}(v - u_a)\right] = u_n + \frac{z+v}{2\phi}(v - u_a)$ must hold, which implies that $\phi < \frac{(z+v)(z-v+2u_a)}{4u_n}$. Therefore, from $\frac{(z+v)(v-u_a)}{v+z-2u_n} < \phi < \frac{(z+v)(z-v+2u_a)}{4u_n}$, $\frac{(z+v)(v-u_a)}{v+z-2u_n} < \frac{(z+v)(z-v+2u_a)}{4u_n}$ has to hold. However, $\frac{(z+v)(v-u_a)}{v+z-2u_n} < \frac{(z+v)(z-v+2u_a)}{4u_n}$ implies that $(z - v) + 2(u_a - u_n) > 0$, which can never hold because $v \geq z$ and $u_a \leq u_n$. Hence, case (i) cannot occur.

Case (ii)*:* $v < z$ so that $k^* = \frac{z}{\phi}$. In this case, from $v - \underline{d} - u_n > k^*(v - u_a) = \frac{z}{\phi}(v - u_a)$ based on Lemma 1 and C2, $v - \underline{d} > u_n + \frac{z}{\phi}(v - u_a)$ must hold. Also, for $k^* = \frac{z}{\phi}$ to be the optimal solution, we must have $\pi\left(k = \frac{z}{\phi}, \underline{d}\right) \geq \pi\left(k = \frac{z+\underline{d}}{\phi}, \underline{d}\right)$, which leads to $\frac{z}{\phi}v \geq v - \underline{d}$ based on Lemma 1 and equation (1). Therefore, $\frac{z}{\phi}v > u_n + \frac{z}{\phi}(v - u_a)$ has to hold as $v -$

$\underline{d} > u_n + \frac{z}{\phi}(v - u_a)$. However, $\frac{z}{\phi}v - \left[u_n + \frac{z}{\phi}(v - u_a)\right] = \frac{z}{\phi}u_a - u_n \leq 0$ because $u_a \leq u_n$ and $z \leq \phi$ (from R1). Hence, case (ii) cannot occur either.

Because neither case (i) nor case (ii) can occur in equilibrium, the equilibrium k^* must be $k^* = \frac{z+d^*}{\phi}$. Thus, $\pi(k^*, d)$ still follows equation (2) in equilibrium so that all propositions and corollaries (except Proposition 1) remain unchanged even without imposing R2.

Proposition 1 is different because it is about exogenous *d* but the proof above relies on *d* being optimally decided. Below we prove that part (ii) of Proposition 1, i.e., if $\delta(v - u_a) - \phi > 0$ then $\frac{\partial \pi(d)}{\partial d} < 0$ for $d \leq d_0$ and $\frac{\partial \pi(d)}{\partial d} > 0$ for $d > d_0$, still holds without R2.

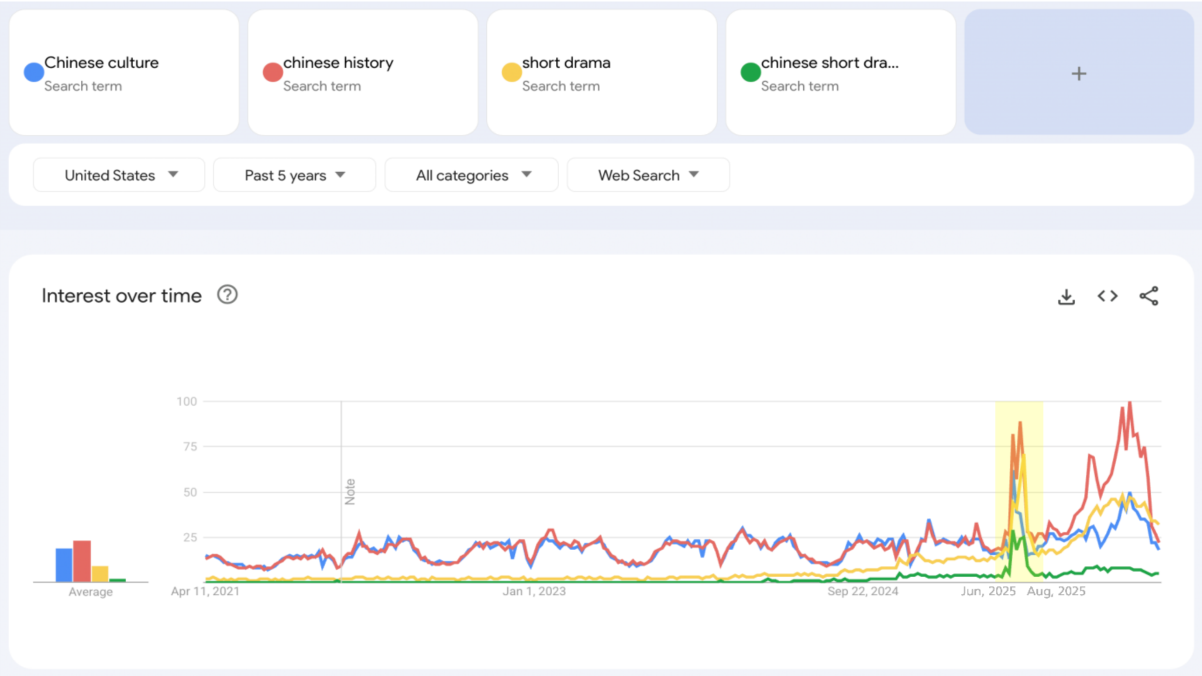
First note that $\delta(v - u_a) - \phi > 0$ implies that $v > \phi$ must hold. Because $\phi \geq z + d$ (from R1), $v > z$ holds as well. If R2 does not hold, i.e., $z + d > v - d$, then $d > \frac{v-z}{2} > 0$.

Denote the solution to $\frac{\partial (z+v-\phi k)k}{\partial k} = 0$ as k_0. $k_0 = \frac{z+v}{2\phi}$ and it lies within $\left(\frac{z}{\phi}, \frac{z+d}{\phi}\right)$ because $\frac{z+v}{2\phi} > \frac{z}{\phi}$ as $v > z$ and $\frac{z+v}{2\phi} < \frac{z+d}{\phi}$ as $d > \frac{v-z}{2}$. Denote the solution $v - d - u_n = k(v - u_a)$ as k_1. Then $k_1 = \frac{v-d-u_n}{v-u_a}$. It can be shown that $k_1 < k_0$ because $\frac{v-d-u_n}{v-u_a} \leq \frac{v-d}{v} \leq \frac{v - \frac{v-z}{2}}{v} = \frac{v+z}{2v} < \frac{v+z}{2\phi}$, where the first inequality is from $0 \leq u_a \leq u_n$, the second inequality is from $d > \frac{v-z}{2}$, and the third inequality is from $v > \phi$. Therefore, from Lemma 1 and equation (1), $\pi(k) = \pi_1(k) + \delta\pi_2(k)$ may decrease with *k* only if $k_0 < k < \frac{z+d}{\phi}$. We show below that $\pi(k)$ is actually increasing with *k* for $k_0 < k < \frac{z+d}{\phi}$.

If $k_0 < k < \frac{z+d}{\phi}$, we have $\pi(k) = (z + v - \phi k)k + \delta k(v - u_a)$ from Lemma 1 and equation (1). Then we have $\frac{\partial \pi}{\partial k} = (z + v - 2\phi k) + \delta(v - u_a) > \left(z + v - 2\phi\frac{z+d}{\phi}\right) + \delta k(v - u_a) = (v - z - 2d) + \delta(v - u_a) = (v - d) - (z + d) + \delta(v - u_a) > -(z + d) + \delta(v - u_a) \geq \delta(v - u_a) - \phi > 0$, where the first inequality is from $k < \frac{z+d}{\phi}$, the second inequality is from $v - d > 0$, and the third inequality is from $z + d \leq \phi$ (**R1**). Thus, we conclude that $\pi(k)$ is non-decreasing for any $\frac{z}{\phi} \leq k < \frac{z+d}{\phi}$ when $\delta(v - u_a) - \phi > 0$. Note that $\pi_1\left(k = \frac{z+d}{\phi}\right) > \pi_1\left(k \to \frac{z+d}{\phi}\right)$ remains the same as in the baseline model as it is not affected by R2. Consequently, $k = \frac{z+d}{\phi}$ always holds for any *d* under the condition of $\delta(v - u_a) - \phi > 0$. Therefore, if $\delta(v - u_a) - \phi > 0$, $\pi(d)$ as given by equation (2) is unchanged even when R2 does not apply. Hence, part (ii) of Proposition 1 still holds without imposing R2.

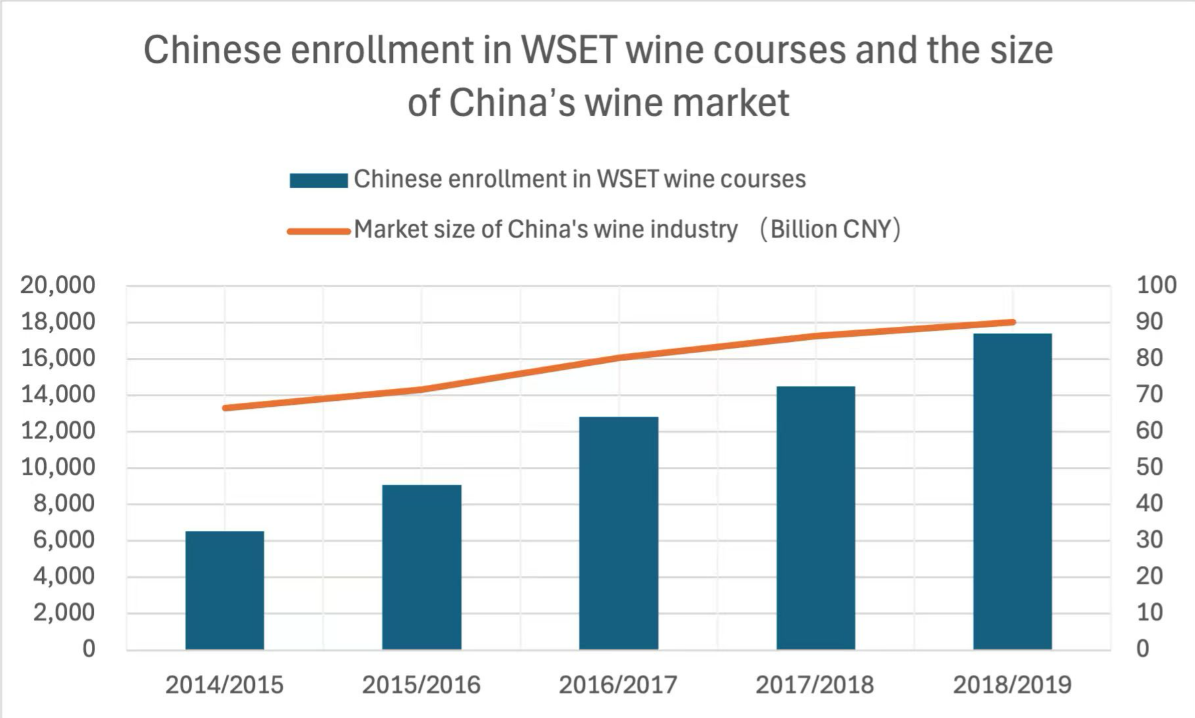
H. Additional examples of consumers learning foreign culture in order to better appreciate products/services

Google Trends, a tool that allows the public to analyze the relative popularity of search queries on Google, generates the chart below. The figure below shows that search interest in the United States for "Chinese short drama" (a proxy for consumption of Chinese short dramas) and "short drama" are correlated with searches for the keywords "Chinese culture" and "Chinese history." Particularly, during the surge in popularity of Chinese short dramas from June to August 2025, searches for "Chinese culture" tripled, while searches for "Chinese history" grew fivefold.



The following chart demonstrates that the number of Chinese consumers enrolling in Wine & Spirit Education Trust (WSET) courses is correlated with the market size of China's wine industry.[11]

[11] Data after 2019 is unavailable due to the disruption of commercial activities during the COVID-19 pandemic.



Year	Number of Chinese consumers enrolled in WSET wine courses	Market size of China's wine industry (billion CNY)
2014/2015	6,545	66.5
2015/2016	9,097	71.6
2016/2017	12,813	80.3
2017/2018	14,513	86.3
2018/2019	17,416	90.2

Sources of data (in Chinese):

Enrollment in Wine & Spirit Education Trust (WSET) courses:

- 2014-16: https://www.wbo529.com/info/100760
- 2016-17: https://m.wineita.com/show-239-35-11146.html
- 2017-19: https://www.wsetglobal.cn/%E6%96%B0%E9%97%BB/2019-09-05/

Size of China's wine market: https://pdf.dfcfw.com/pdf/H3_AP202009081409180629_1.pdf