Online Appendix

Making Inclusive Product Design a Reality: How Company Culture and Research Bias Impact Investment

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1. Proof of results in the case of no research bias

From conditional probabilities as specified in Table 1, we derive $Pr(sig = H) = Pr(sig = H|H)Pr(H) + Pr(sig = H|L)Pr(L) = y$. By Bayes Rule, we have

$$Pr(H|sig = H) = \frac{Pr(sig = H|H)Pr(H)}{Pr(sig = H)} = Pr(sig = H|H) = k + (1-k)y; \tag{1}$$

$$Pr(H|sig = L) = \frac{Pr(sig = L|H)Pr(H)}{Pr(sig = L)} = Pr(sig = H|L) = (1-k)y. \tag{2}$$

If the firm receives $sig = H$, its expected profit from investing is

$$Pr(H|sig = H)\frac{1+x}{4} + Pr(L|sig = H)\frac{1}{4} - c = \frac{1}{4}(1 + xy + kx(1-y) - 4c). \tag{3}$$

This expected profit is greater than its profit of $\frac{1}{4}$ from not investing if $xy > 4c$ or $xy < 4c \& k \geq \frac{4c - xy}{x(1-y)}$. If the firm receives $sig = L$, its expected profit from investing is

$$Pr(H|sig = L)\frac{1+x}{4} + Pr(L|sig = L)\frac{1}{4} - c = \frac{1}{4}(1 + xy - kxy - 4c). \tag{4}$$

This expected profit is greater than its profit of $\frac{1}{4}$ from not investing in inclusive product design if $xy > 4c \& k < \frac{xy - 4c}{xy}$.

We can then summarize the firm's investment decision below:

a) If $xy > 4c \& 0 \leq k < \frac{xy-4c}{xy}$, the firm always invests, that is, $Pr_{nb}(I) = 1$. In this case, the probability of realizing a high demand is $Pr(H) = y$. The firm's expected profit is $\pi_{nb} = y\frac{1+x}{4} + (1-y)\frac{1}{4} - c = \frac{1}{4}(1 + xy - 4c)$ and does not vary with k.

b) If $xy > 4c \& \frac{xy-4c}{xy} \le k \le 1$, the firm always invests upon receiving $sig = H$, but never invests upon receiving $sig = L$. That is, $Pr_{nb}(I) = Pr(sig = H) = y$. In this case, the probability of investing and realizing a high demand is $Pr(H|sig = H)Pr(sig = H) = (k + (1 - k)y)y$ and the probability of investing but realizing a low demand is $Pr(L|sig = H)Pr(sig = H) = (1 - k)(1 - y)y$. The firm's expected profit is $\pi_{nb} = Pr(H|sig = H)Pr(sig = H)(\frac{1+x}{4} - c) + Pr(L|sig = H)Pr(sig = H)(\frac{1}{4} - c) + Pr(sig = L)\frac{1}{4} = \frac{1}{4}(1 + xy^2 - 4cy + kxy(1 - y))$. This profit increases with k.

c) If $xy < 4c \& \frac{4c-xy}{x(1-y)} \le k \le 1$, the firm always invests upon receiving $sig = H$ but never invests upon receiving $sig = L$. This leads to the same outcome as in b).

d) If $xy < 4c \& 0 < k < \frac{4c-xy}{x(1-y)}$, the firm never invests, that is, $Pr_{nb}(I) = 0$. The firm's profit is always $\pi_{nb} = \frac{1}{4}$ and does not vary with k.

The firm's expected profit as a function of k can be written as

$$\pi_{nb}(k) = \begin{cases} y\frac{1+x}{4} + (1-y)\frac{1}{4} - c = \frac{1}{4}(1 + xy - 4c) & if \ \ xy > 4c \& k \le \frac{xy-4c}{xy} \\ \frac{1}{4} & if \ \ xy < 4c \& k \le \frac{4c-xy}{x(1-y)} \\ (k + (1-k)y)y(\dfrac{1+x}{4} - c) + (1-k)(1-y)y(\dfrac{1}{4} - c) & if \qquad otherwise. \\ + (1-y)\dfrac{1}{4} = \dfrac{1}{4}(1 + xy^2 + kxy(1-y) - 4cy) & \end{cases} \tag{5}$$

Rationally anticipating the firm's investment strategy, the unbiased researcher decides her effort level to maximize her expected payoff,

$$\Gamma_{nb}(k) = \begin{cases} yR - (1-y)N - k^2 & if \ \ xy > 4c \& k < \frac{xy-4c}{xy} \\ -k^2 & if \ \ xy < 4c \& k < \frac{4c-xy}{x(1-y)} \\ (k + (1-k)y)yR - (1-k)(1-y)yN - k^2 & if \qquad otherwise. \end{cases} \tag{6}$$

Below we solve for the researcher's optimal effort level in the reward-oriented culture and the punishment oriented culture separately.

Reward-oriented culture ($R > 0 \& N = 0$)

We consider the following conditions.

a) If $xy > 4c \& 0 \le k < \frac{xy-4c}{xy}$, the firm always invests, that is, $Pr_{nb}(I) = 1$. The researcher's expected payoff is $\Gamma_{nb} = yR - k^2$. It is straightforward that the optimal effort level is $k^*_{nb} = 0$, which leads to researcher payoff of $\Gamma^*_{nb} = yR$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy - 4c)$.

b) If $xy > 4c \& k \ge \frac{xy-4c}{xy}$, the firm invests only upon receiving $sig = H$, that is, $Pr_{nb}(I) = Pr(sig = H) = y$. The researcher's expected payoff is $\Gamma_{nb} = (k + (1-k)y)yR - k^2$, which is maximized at interior solution $k^* = min\{1, \frac{R(1-y)y}{2}\}$. Note that this interior solution is valid only if $R \ge \frac{2(xy-4c)}{xy^2(1-y)}$. If $R < \frac{2(xy-4c)}{xy^2(1-y)}$, the boundary solution of $k^* = \frac{xy-4c}{xy}$ holds. We further consider the following sub-conditions.

b.1) If $R \ge \frac{2}{y(1-y)}$: the researcher's optimal effort is $k^* = 1$, leading to payoff of $\Gamma^*_{nb} = yR - 1$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy - 4cy)$. The researcher's payoff is always lower than her payoff in a).

b.2) If $\frac{2(xy-4c)}{xy^2(1-y)} \le R < \frac{2}{y(1-y)}$: the researcher's optimal effort is $k^* = \frac{R(1-y)y}{2}$, leading to payoff of $\Gamma^*_{nb} = \frac{1}{4}Ry^2(R(y-1)^2 + 4)$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy^2 - 4cy + \frac{1}{2}Rxy^2(1-y)^2)$. The researcher's payoff is always lower than her payoff in a).

b.3) If $R < \frac{2(xy-4c)}{xy^2(1-y)}$: the researcher's optimal effort is the boundary solution $k^* = \frac{xy-4c}{xy}$, leading to payoff of $\Gamma^*_{nb} = -\frac{16c^2}{x^2y^2} + \frac{4c(R(y-1)y+2)}{xy} + Ry - 1$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy - 4c)$. The researcher's payoff is always lower than her payoff in a).

Therefore, when $xy > 4c$, the researcher's optimal decision is always to set $k^* = 0$.

c) If $xy < 4c \& 0 \le k < \frac{4c-xy}{x(1-y)}$, the firm never invests, that is, $Pr_{nb}(I) = 0$. The researcher's expected payoff is $\Gamma_{nb} = -k^2$. The optimal effort is thus $k^* = 0$, leading to maximized payoff of $\Gamma^*_{nb} = 0$ and firm profit of $\pi^*_{nb} = \frac{1}{4}$.

d) If $xy < 4c \& \frac{4c-xy}{x(1-y)} \le k \le 1$, the firm invests only upon receiving $sig = H$, that is, $Pr_{nb}(I) = Pr(sig = H) = y$. The researcher's expected payoff is $\Gamma_{nb} = (k + (1-k)y)yR - k^2$, which is maximized at interior solution $k^* = min\{1, \frac{R(1-y)y}{2}\}$. This interior solution is valid only if $R > \frac{8c-2xy}{xy^3-2xy^2+xy}$. If $R < \frac{8c-2xy}{xy^3-2xy^2+xy}$, the boundary solution of $k^* = \frac{4c-xy}{x(1-y)}$ holds. We further consider the following sub-conditions.

d.1) If $R \geq \frac{2}{y(1-y)}$, the researcher's optimal effort is $k^* = 1$, leading to payoff of $\Gamma^*_{nb} = yR - 1$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(-4cy + xy + 1)$. The researcher's payoff is always greater than her payoff in c).

d.2) If $\frac{8c-2xy}{xy^3-2xy^2+xy} \leq R < \frac{2}{y(1-y)}$, the researcher's optimal effort is $k^* = \frac{R(1-y)y}{2}$, which leads to her maximized payoff of $\Gamma^*_{nb} = \frac{1}{4}Ry^2\left(R(y-1)^2 + 4\right)$ and firm profit of $\pi^*_{nb} = \frac{1}{4}\left(-4cy + xy^2\left(2R(y-1)^2 + 1\right) + 1\right)$. The researcher's payoff is always greater than her payoff in c).

d.3) If $R < \frac{8c-2xy}{xy^3-2xy^2+xy}$, the researcher's optimal effort is the boundary solution $k^* = \frac{4c-xy}{x(1-y)}$, leading to payoff of $\Gamma^*_{nb} = \frac{-16c^2+4cxy\left(R(y-1)^2+2\right)-x^2y^2}{x^2(y-1)^2}$ and firm profit of $\pi^*_{nb} = \frac{1}{4}$. The researcher's payoff is greater than her payoff in c) if $R > R_{nb} = \frac{(xy-4c)^2}{4cx(y-1)^2y}$ and lower than her payoff in c) if $R < R_{nb}$.

Therefore, when $xy < 4c$, the researcher makes an effort $k^* = 0$ if $R < R_{nb} = \frac{(xy-4c)^2}{4cx(y-1)^2y}$ and makes an effort of $k^* = max\{\frac{4c-xy}{x(1-y)}, min\{1, \frac{R(1-y)y}{2}\}\}$ if $R > R_{nb}$.

Punishment-oriented culture ($R = 0 \& N > 0$)

We consider the following conditions.

a) If $xy > 4c \& 0 \leq k < \frac{xy-4c}{xy}$, the firm always invests, that is, $Pr_{nb}(I) = 1$. The researcher's expected payoff is $\Gamma_{nb} = -(1-y)N - k^2$. The optimal effort level is $k^*_{nb} = 0$, which leads to researcher payoff of $\Gamma^*_{nb} = -(1-y)N$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy - 4c)$.

b) If $xy > 4c \& k \geq \frac{xy-4c}{xy}$, the firm invests only upon receiving $sig = H$, that is, $Pr_{nb}(I) = y$. The researcher's expected payoff is $\Gamma_{nb} = -(1-k)(1-y)yN - k^2$, which is maximized at interior solution $k^* = min\{1, \frac{N(1-y)y}{2}\}$. Note that this interior solution is valid only if

$N \geq \frac{2(xy-4c)}{xy^2(1-y)}$. If $N < \frac{2(xy-4c)}{xy^2(1-y)}$, the boundary solution of $k^* = \frac{xy-4c}{xy}$ holds. We further consider the following sub-conditions.

b.1) If $N \geq \frac{2}{y(1-y)}$: the researcher's optimal effort is $k^* = 1$, leading to payoff of $\Gamma^*_{nb} = -1$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy - 4cy)$. The researcher's payoff is always higher than her payoff in a).

b.2) If $\frac{2(xy-4c)}{xy^2(1-y)} \leq N < \frac{2}{y(1-y)}$: the researcher's optimal effort is $k^* = \frac{N(1-y)y}{2}$, leading to payoff of $\Gamma^*_{nb} = \frac{1}{4}N(y-1)y(N(y-1)y+4)$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy^2 - 4cy + \frac{1}{2}Nxy^2(1-y)^2)$. The researcher's payoff is always higher than her payoff in a).

b.3) If $N < \frac{2(xy-4c)}{xy^2(1-y)}$: the researcher's optimal effort is the boundary solution $k^* = \frac{xy-4c}{xy}$, leading to payoff of $\Gamma^*_{nb} = -\frac{16c^2}{x^2y^2} + \frac{4c(N(y-1)y+2)}{xy} - 1$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(1 + xy - 4c)$. The researcher's payoff is greater than her payoff in a) if $N^*_{nb} = \frac{(xy-4c)^2}{x(y-1)y^2(4c-x)} < N < \frac{2(xy-4c)}{xy^2(1-y)}$ but lower than her payoff in a) if $N < N^*_{nb}$.

Therefore, when $xy > 4c$, the researcher's optimal decision is to set $k^* = 0$ if $N < N^*_{nb} = \frac{(xy-4c)^2}{x(y-1)y^2(4c-x)}$ and $k^* = max\{\frac{xy-4c}{xy}, min\{1, \frac{Ny(1-y)}{2}\}\}$ if $N > N^*_{nb} = \frac{(xy-4c)^2}{x(y-1)y^2(4c-x)}$.

c) If $xy < 4c \& 0 \leq k < \frac{4c-xy}{x(1-y)}$, the firm never invests, that is, $Pr_{nb}(I) = 0$. The researcher's payoff is $\Gamma_{nb} = k^2$. The researcher's optimal effort is $k^* = 0$, leading to maximized payoff of $\Gamma^*_{nb} = 0$ and firm profit of $\pi^*_{nb} = \frac{1}{4}$.

d) If $xy < 4c \& \frac{4c-xy}{x(1-y)} \leq k \leq 1$, the firm invests only upon receiving $sig = H$, that is, $Pr_{nb}(I) = y$. The researcher's expected payoff is $\Gamma_{nb} = -(1-k)(1-y)yN - k^2$, which is maximized at interior solution $k^* = min\{1, \frac{N(1-y)y}{2}\}$. This interior solution is valid only if $N > \frac{8c-2xy}{xy^3-2xy^2+xy}$. If $N < \frac{8c-2xy}{xy^3-2xy^2+xy}$, the boundary solution of $k^* = \frac{4c-xy}{x(1-y)}$ holds. We further consider the following sub-conditions.

d.1) If $N \geq \frac{2}{y(1-y)}$, the researcher's optimal effort is $k^* = 1$, leading to payoff of $\Gamma^*_{nb} = -1$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(-4cy + xy + 1)$. The researcher's payoff is always lower than her payoff in c).

d.2) If $\frac{8c-2xy}{xy^3-2xy^2+xy} \leq N < \frac{2}{y(1-y)}$, the researcher's optimal effort is $k^* = \frac{(R+N)(1-y)y}{2}$, which leads to her maximized payoff of $\Gamma^*_{nb} = \frac{1}{4}N(y-1)y(N(y-1)y+4)$ and firm profit of $\pi^*_{nb} = \frac{1}{4}(-4cy+xy^2+1)$. The researcher's payoff is always lower than her payoff in c).

d.3) If $N < \frac{8c-2xy}{xy^3-2xy^2+xy}$, the researcher's optimal effort is the boundary solution $k^* = \frac{4c-xy}{x(1-y)}$, leading to payoff of $\Gamma^*_{nb} = \frac{-16c^2+4cxy\left(N(y-1)^2+2\right)-x^2y\left(N(y-1)^2+y\right)}{x^2(y-1)^2}$ and firm profit of $\pi^*_{nb} = \frac{1}{4}$. The researcher's payoff is always lower than her payoff in c).

Therefore, when $xy < 4c$, the researcher makes no effort, $k^* = 0$.

Summarizing the cases of reward-oriented culture and punishment-oriented culture, we summarize the equilibrium results in the case of no research bias below.

Remark 1. When there is no research bias:

- When $xy > 4c$: If $R > 0 \& N = 0$ or if $R = 0 \& N < N_{nb} = \frac{(xy-4c)^2}{x(y-1)y^2(4c-x)}$: $k^* = 0$, $Pr(I) = 1$, and $\pi^*_{nb} = \frac{1}{4}(1+xy-4c)$. If $R = 0 \& N > N_{nb}$, $k^* = max\{\frac{xy-4c}{xy}, min\{1, \frac{Ny(1-y)}{2}\}\}$, $Pr(I) = y$, and $\pi^*_{nb} = \frac{1}{4}(1+xy^2+k^*xy(1-y)-4cy)$.

- when $xy < 4c$: If $R < R_{nb} = \frac{(xy-4c)^2}{4cx(y-1)^2y} \& N = 0$ or if $R = 0 \& N > 0$, $k^* = 0$, $Pr(I) = 0$, and $\pi^*_{nb} = \frac{1}{4}$. If $R > R_{nb} = \frac{(xy-4c)^2}{4cx(y-1)^2y} \& N = 0$, $k^* = max\{\frac{4c-xy}{x(1-y)}, min\{1, \frac{Ry(1-y)}{2}\}\}$, $Pr(I) = y$, and $\pi^*_{nb} = \frac{1}{4}(1+xy^2+k^*xy(1-y)-4cy)$.

2. Proof of results in the research bias-against case

From conditional probabilities as specified in Table 1, we obtain $Pr(sig=H) = Pr(sig=H|H)Pr(H) + Pr(sig=H|L)Pr(L) = (k+y-ky)y$. By Bayes Rule, we have

$$Pr(H|sig=H) = \frac{Pr(sig=H|H)Pr(H)}{Pr(sig=H)} = 1; \tag{7}$$

$$Pr(H|sig=L) = \frac{Pr(sig=L|H)Pr(H)}{Pr(sig=L)} = \frac{(1-k)(1-y)y}{1-(k+y-ky)y}. \tag{8}$$

Equation (7) suggests that when a research bias-against renders a signal $sig = H$ that suggests investing is profitable, the firm has full faith that the investment will be profitable. Upon receiving $sig = L$, the firm's expected profit from investing is

$$Pr(H|sig = L)\frac{1+x}{4} + Pr(L|sig = L)\frac{1}{4} - c = \frac{c(4-4(k-1)y)+(k-1)(x+1)y-1}{4(k-1)y-4}, \quad (9)$$

which exceeds the firm's profit from not investing if $xy > 4c + 4cy \& k < \bar{k}_{bg} = \frac{4cy+4c-xy}{4cy-xy}$. We derive the firm's investment decision in the following conditions.

a) If $xy > 4c + 4cy \& 0 \leq k < \bar{k}_{bg}$, the firm always invests, that is, $Pr_{bg}(I) = 1$. In this case, the firm's realizes a high demand with probability $Pr(H) = y$. The firm's expected profit is thus $\pi_{bg} = y\frac{1+x}{4} + (1-y)\frac{1}{4} - c = \frac{1}{4}(1 + xy - 4c)$.

b) If $xy > 4c + 4cy \& \bar{k}_{bg} \leq k \leq 1$, the firm invests only if receiving $sig = H$. The firm's investment probability is $Pr_{bg}(I) = Pr(sig = H) = (k + y - ky)y < y$. Note that the firm always realizes a high demand when it invests upon receiving $sig = H$. We thus derive the firm's expected profit as $\pi_{bg} = (k + y - ky)y(\frac{1+x}{4} - c) + (1 - (k + y - ky)y)\frac{1}{4} = \frac{1}{4}(4cy(k(y-1)-y) - kx(y-1)y + xy^2 + 1)$. This profit increases with k.

c) If $xy < 4c + 4cy$, the firm invests only if receiving $sig = H$. The firm's investment probability and expected product are the same as in b).

Summarizing the above we obtain the firm's profit function as below.

$$\pi_{bg}(k) = \begin{cases} y\frac{1+x}{4} + (1-y)\frac{1}{4} - c = \frac{1}{4}(1 + xy - 4c) & if\ xy > 4c(1+y) \& k < \bar{k}_{bg} = \frac{4cy+4c-xy}{4cy-xy} \\ (k+y-ky)y(\frac{1+x}{4} - c) + (1-(k+y-ky)y)\frac{1}{4}\ if & otherwise. \end{cases} \quad (10)$$

Anticipating the firm's investment strategy, the researcher chooses the optimal effort level to maximize her payoff function, as given below

$$\Gamma_{bg}(k) = \begin{cases} yR - (1-y)N - k^2\ if\ xy > 4c(1+y) \& k < \bar{k}_{bg} = \frac{4cy+4c-xy}{4cy-xy} \\ (k+y-ky)yR - k^2\ if \quad otherwise \end{cases} \quad (11)$$

We solve the researcher's optimal effect decision by considering the reward-oriented culture and the punishment-oriented culture separately.

Reward-oriented culture $(R>0\&N=0)$

We consider the following conditions.

a) If $xy<4c+4cy$, the researcher's optimal effort can be derived as $k^*=min\{1,\frac{1}{2}(1-y)yR\}$, which leads to researcher payoff of $\Gamma^*_{bg}=min\{yR-1,y^2R+\frac{1}{4}(1-y)^2y^2R\}$ and firm profit of $\pi^*_{bg}=min\{\frac{1}{4}(-4cy+xy+1),\frac{1}{8}\left(-4cy^2\left(R(y-1)^2+2\right)+xy^2\left(R(y-1)^2+2\right)+2\right)\}$.

b) If $xy>4c+4cy\&k<\bar{k}_{bg}$, the researcher's optimal effort is $k^*=0$, leading to payoff of $\Gamma^*_{bg}=yR$ and firm profit of $\pi^*_{bg}=\frac{1}{4}(1+xy-4c)$.

c) If $xy>4c+4cy\&k>\bar{k}_{bg}$, the researcher's optimal effort is $k^*=min\{1,\frac{1}{2}(1-y)yR\}$. We further consider the following sub-conditions.

c.1) If $R\leq\frac{2}{(1-y)y}$, the researcher's optimal effort is $k^*=1$, leading to payoff of $\Gamma^*_{bg}=yR-1$. This payoff is always lower than her payoff in b).

c.2) If $\frac{2(4cy+4c-xy)}{(4cy-xy)(1-y)y}\geq R<\frac{2}{(1-y)y}$, the researcher's optimal effort is $k^*=\frac{1}{2}y(1-y)R$, leading to payoff of $\Gamma^*_{bg}=\frac{1}{4}Ry^2\left(R(y-1)^2+4\right)$. This payoff is always lower than her payoff in b).

c.3) If $R<\frac{2(4cy+4c-xy)}{(4cy-xy)(1-y)y}$, the researcher's optimal effort is $k^*=\bar{k}_{bg}=\frac{4cy+4c-xy}{4cy-xy}$, leading to payoff of $\Gamma^*_{bg}=\frac{16c^2\left((R-1)y^2-2y-1\right)-4cxy(y+1)(Ry-2)+x^2y^2(Ry-1)}{y^2(x-4c)^2}$. This payoff is always lower than her payoff in b).

Summarizing conditions b)-c), we obtain that when $xy>4c+4cy$, the researcher's optimal effort is $k^*=0$.

Punishment-oriented culture $(R=0\&N>0)$

We consider the following conditions.

a) If $xy<4c+4cy$, the researcher optimally makes zero effort $k^*=0$, leading to zero payoff $\Gamma^*_{bg}=0$ and firm profit of $\pi^*_{bg}=\frac{1}{4}(1+xy^2-4cy^2)$.

b) If $xy > 4c + 4cy$, we consider the following sub-conditions.

b.1) If $xy > 4c + 4cy \& k < \bar{k}_{bg}$: the researcher's optimal effort is $k^* = 0$, which leads to researcher payoff of $\Gamma^*_{bg} = -(1-y)N$, firm investment probability of $Pr_{bg}(I) = 1$, and firm profit of $\pi^*_{bg} = \frac{1}{4}(1 + xy - 4c)$.

b.2) If $xy > 4c + 4cy \& k \geq \bar{k}_{bg}$: the researchers' optimal effort is $k^* = \bar{k}_{bg} = \frac{4cy+4c-xy}{4cy-xy}$, which leads to researcher payoff $\Gamma^*_{bg} = -(\frac{4cy+4c-xy}{4cy-xy})^2$, firm investment probability of $Pr_{bg}(I) = \frac{4c-xy}{4c-x} < y$, and firm profit $\pi^*_{bg} = \frac{1}{4}(1 + xy - 4c)$.

It can be proven that the researcher profit in b.1) is greater than in b.2) if $N < N_{bg} = (\frac{4cy+4c-xy}{4cy-xy})^2 \frac{1}{1-y}$ and lower than in b.2) if $N > N_{bg}$.

Summarizing the cases of reward-oriented culture and punishment-oriented culture, we summarize the equilibrium results in the case of research bias-against below.

Remark 2. When there is a research bias-against,

- When $xy > 4c + 4cy$: If $R > 0 \& N = 0$ or if $R = 0 \& N < N^*_{bg} = (\frac{4cy+4c-xy}{4cy-xy})^2 \frac{1}{1-y}$, $k^* = 0$, $Pr(I) = 1$, and $\pi^*_{bg} = \frac{1}{4}(1 + xy - 4c)$. If $R = 0 \& N > N_{bg}$, $k^* = \frac{4cy+4c-xy}{4cy-xy}$, $Pr_{bg}(I) = \frac{4c-xy}{4c-x} < y$, and $\pi^*_{bg} = \frac{1}{4}(1 + xy - 4c)$.
- When $xy < 4c + 4cy$: If $R > 0 \& N = 0$, $k^* = min\{1, \frac{1}{2}(1-y)yR\} > 0$, $Pr(I) = (k^*(1-y) + y)y < y$, $\pi^*_{bg} = \frac{1}{4}(1 + xy^2 - 4cy^2) + k^* \frac{1}{4}(1-y)y(x-4c)$. If $R = 0 \& N > 0$, $k^* = 0$, $Pr(I) = y^2$, and $\pi^*_{bg} = \frac{1}{4}(1 + xy^2 - 4cy^2)$.

Proof of Proposition 1

We consider the two cultures separately.

Reward-oriented culture ($R > 0 \& N = 0$).

We consider the following conditions.

a) If $xy > 4c + 4cy$: $Pr_{nb}(I) = Pr_{bg}(I) = 1$.

b) If $4c < xy < 4c + 4cy$: $Pr_{nb}(I) = 1 > Pr_{bg}(I) = (k + y - ky)y$.

c) If $xy < 4c$: We further consider the following sub-conditions.

c.1) If $R < R_{nb}$: $Pr_{nb}(I) = 0 < Pr_{bg}(I) = (k+y-ky)y$.

c.2) If $R \geq R_{nb}$: $Pr_{nb}(I) = y > Pr_{bg}(I) = (k+y-ky)y$; $k_{nb} = \frac{Ry(1-y)}{2} = k_{bg}$.

Summarizing the above, we obtain that the firm invests with a greater probability with a research bias-against than with no bias in the research if $xy < 4c \& R < R_{nb}$.

Punishment culture ($R = 0 \& N > 0$).

We consider the following conditions.

a) If $xy > 4c + 4cy$: It can be proven that $N_{bg} - N_{nb} = \frac{4c\left(-16c^2-4cxy^2+x^2y^2\right)}{x(y-1)y^2(x-4c)^2} < 0$. We further consider the following sub-conditions.

a.1) If $N < N_{bg}$: $k_{nb} = k_{bg} = 0$; $Pr_{nb}(I) = Pr_{bg}(I) = 1$.

a.2) If $N_{bg} \leq N < N_{nb}$: $k_{nb} = 0 < k_{nb}$; $Pr_{nb}(I) = 1 > Pr_{bg}(I)$.

a.3) If $N \geq N_{nb}$: $Pr_{nb}(I) = y > Pr_{bg}(I)$.

b) If $4c < xy < 4c + 4cy$: We further consider the following sub-conditions.

b.1) If $N < N_{nb}$: $k_{nb} = k_{bg} = 0$; $Pr_{nb}(I) = 1 > Pr_{bg}(I) = y^2$.

b.2) If $N \geq N_{nb}$: $k_{nb} = \frac{Ny(1-y)}{2} > k_{bg} = 0$; $Pr_{nb}(I) = y > Pr_{bg}(I) = y^2$.

c) If $xy < 4c$: $Pr_{nb}(I) = 0 < Pr_{bg}(I) = y^2$.

Summarizing the above, we obtain that the firm invests with a greater probability with a research bias-against than with unbiased research if $xy < 4c$ in a punishment oriented culture.

Proof of Proposition 2

We consider the following conditions of the bias-against case.

a) If $xy > 4c + 4cy$: The firm profit is always $\frac{1}{4}(1 + xy - 4c)$, in the reward-oriented and the punishment-oriented culture.

b) If $xy < 4c + 4cy$: It can be proven that the firm's profit in the reward culture is always greater than the firm profit in the punishment culture by $k^*_{bg}\frac{1}{4}(1-y)y(x-4c)$, where $k^*_{bg} = min\{1, \frac{1}{2}(1-y)yR\} > 0$.

3. Proof of results in the case of research bias-in-favor

From conditional probabilities as specified in Table 1, we obtain $Pr(sig=H) = Pr(sig=H|H)Pr(H) + Pr(sig=H|L)Pr(L) = y + (1-k)y(1-y)$. Using Bayes Rule, we obtain

$$Pr(H|sig=H) = \frac{Pr(sig=H|H)Pr(H)}{Pr(sig=H)} = \frac{y}{y+(1-k)y(1-y)}; \tag{12}$$

$$Pr(H|sig=L) = \frac{Pr(sig=L|H)Pr(H)}{Pr(sig=L)} = 0. \tag{13}$$

Equation (12) allows us to derive the firm's profit from investing in inclusive product design when the researcher produces $sig=H$ as $Pr(H|sig=H)(\frac{1+x}{4}) + Pr(L|sig=H)(\frac{1}{4}) - c = \frac{4c(k(-y)+k+y-2)+k(y-1)+x-y+2}{4k(y-1)-4y+8}$. This profit is greater than that from not investing (i.e., $\frac{1}{4}$) if $4c < x \leq 8c - 4cy \& k \geq \underline{k}_{for} = \frac{4cy-8c+x}{4cy-4c}$ or if $x > 8c - 4cy$. Equation (13) suggests that upon receiving $sig = L$ from a bias-in-favor researcher, the firm has no chance to profit from investing in inclusive design.

We consider the following conditions in deriving the firm's optimal investment decision.

a) If $4c < x \leq 8c - 4cy \& 0 \leq k < \underline{k}_{for} = \frac{4cy-8c+x}{4cy-4c}$, the firm never makes the investment, that is, $Pr_{bf}(I) = 0$. The firm's profit is $\pi_{bf} = \frac{1}{4}$.

b) In all other conditions, the firm makes investment only upon receiving $sig = H$ (note that $x > 4c$ by assumption). The firm's investment probability is $Pr_{bf}(I) = y + (1-k)y(1-y)$, which decreases with k but remains greater than y. Conditional on investing, the probability for the demand to realize as high and low are $Pr(H|sig=H) = \frac{y}{y+(1-k)y(1-y)}$ and $Pr(L|sig=H) = \frac{(1-k)y(1-y)}{y+(1-k)y(1-y)}$, respectively. The firm profit can be derived as $\pi_{bf} =$

$Pr(sig=H)(Pr(H|sig=H)\frac{1+x}{4}+Pr(L|sig=H)\frac{1}{4}-c)+Pr(sig=L)\frac{1}{4}=cy(k(-y)+k+y-2)+\frac{1}{4}(xy+1)$. We obtain the firm's profit function as follows.

$$\pi_{bf}(k)=\begin{cases} \frac{1}{4} & if\ 4c<x\leq 8c-4cy\&k<\underline{k}_{for}=\frac{4cy-8c+x}{4cy-4c} \\ y(\dfrac{1+x}{4}-c)+(1-k)y(1-y)(\dfrac{1}{4}-c) & \\ +(1-y-(1-k)y(1-y))\dfrac{1}{4} & if \quad otherwise \\ =\dfrac{1}{4}(1+xy-4cy(2-y))-cyk(1-y) & \end{cases} \tag{14}$$

Anticipating the firm's investment decision, the researcher chooses the optimal effort level to maximize its payoff

$$\Gamma_{bf}(k)=\begin{cases} -k^2 & if\ 4c<x\leq 8c-4cy\&k<\underline{k}_{for}=\frac{4cy-8c+x}{4cy-4c} \\ yR-(1-k)y(1-y)N-k^2 & if \quad otherwise \end{cases} \tag{15}$$

We solve the researcher's optimal effort decision by considering the two cultures separately.

Reward-oriented culture ($R>0\&N=0$).

We consider the following conditions.

a) If $x\leq 8c-4cy$, we consider the following sub-conditions.

a.1) $x\leq 8c-4cy\&k<\underline{k}_{for}=\frac{4cy-8c+x}{4cy-4c}$: the researcher's optimal effort level is $k^*=0$, which leads to zero payoff $\Gamma^*_{bf}=0$, firm investment probability of $Pr(I)=0$, and firm profit of $\pi^*_{bf}=\frac{1}{4}$.

a.2) $x\leq 8c-4cy\&k\geq\underline{k}_{for}$: the researcher's optimal effort level is $k^*\underline{k}_{for}=\frac{4cy-8c+x}{4cy-4c}$, which leads to payoff of $\Gamma^*_{bf}=yR-(\frac{4cy-8c+x}{4cy-4c})^2$, firm investment probability of $Pr_{bf}(I)=\frac{xy}{4c}>y$, and firm profit profit of $\pi-bf^*=\frac{1}{4}$.

It can be proven that the researcher's payoff in a.1) is greater than in a.2) if $R<R_{bf}=\frac{(4cy-8c+x)^2}{y(4cy-4c)^2}$ and lower than in a.2) if $R>R_{bf}$.

b) If $x > 8c - 4cy$, the researcher's optimal effort level is $k^* = 0$, which leads to payoff of $\Gamma_{bf} = yR$, firm investment probability of $Pr_{bf}(I) = y(2 - y)$, and firm profit of $\pi^*_{bf} = cy(y-2) + \frac{1}{4}(xy+1)$.

Punishment-oriented culture ($R = 0\&N > 0$). We consider the following conditions.

a) If $x > 8c - 4cy$, the researcher's optimal effort is $k^* = min\{1, \frac{Ny(1-y)}{2}\}$, which leads to payoff of $\Gamma_{bf} = min\{-1, \frac{1}{4}N(y-1)y(N(y-1)y+4)\}$, firm investment probability of $Pr_{bf}(I) = min\{y, y + (1 - \frac{Ny(1-y)}{2})y(1-y)\}$, and firm profit of $\pi^*_{bf} = min\{\frac{1}{4}(-4cy + xy + 1), \frac{1}{4}\left(2cy\left(Ny^3 - 2Ny^2 + (N+2)y - 4\right) + xy + 1\right)\}$.

b) If $x \leq 8c - 4cy\&0 \leq k < \underline{k}_{for}$ the researcher's optimal effort is $k^* = 0$, leading to zero payoff $\Gamma^*_{bf} = 0$, firm investment probability of $Pr_{bf}(I) = 0$, and firm profit of $\Pi^*_{bf} = \frac{1}{4}$.

c) If $x \leq 8c - 4cy\&\underline{k}_{for} \leq k \leq 1$ the interior solution of k is $k^* = min\{1, \frac{Ny(1-y)}{2}\}$. This interior solution holds only if $N > \frac{-4cy+8c-x}{2cy^3-4cy^2+2cy}$. Otherwise, the boundary solution $\underline{k}_{bf}$ holds. We further consider the following sub-conditions.

c.1) If $N \geq \frac{2}{y(1-y)}$, the researcher's optimal effort is $k^* = 1$, leading to payoff of $\Gamma^*_{bf} = -1$; this payoff is always lower than her payoff in b).

c.2) If $\frac{-4cy+8c-x}{2cy^3-4cy^2+2cy} \leq N < \frac{2}{y(1-y)}$, the researcher's optimal effort $k^* = \frac{Ny(1-y)}{2}$, leading to payoff of $\Gamma^*_{bf} = \frac{1}{4}N(y-1)y(N(y-1)y+4)$. This payoff is always lower than her payoff in b).

c.3) If $N < \frac{-4cy+8c-x}{2cy^3-4cy^2+2cy}$, the researcher's optimal effort is $k^* = \frac{4cy-8c+x}{4cy-4c}$, leading to payoff of $\Gamma^*_{bf} = N(y-1)y\left(1 - \frac{4cy-8c+x}{4cy-4c}\right) - \frac{(4cy-8c+x)^2}{(4cy-4c)^2}$. This payoff is always lower than her payoff in b).

Summarizing b) and c), we obtain that when $x \leq 8c - 4cy$, the researcher' optimal effort is $k^* = 0$.

Summarizing the cases of reward-oriented culture and punishment-oriented culture, we obtain the equilibrium results in case of research bias in-favor.

REMARK 3. When there is a research bias-in-favor,

- When $xy > 4c(2-y)y$: If $R > 0 \& N = 0$, $k^* = 0$, $Pr(I) = y(2-y) > y$, and $\pi^*_{bf} = \frac{1}{4}(1 + xy - 4cy(2-y))$. If $R = 0 \& N > 0$, $k^* = min\{1, \frac{Ny(1-y)}{2}\}$, $Pr(I) = y(1 + (1-k^*)(1-y)) > y$, and $\pi^*_{bf} = \frac{1}{4}(1 + xy - 4c(2-y)y) + k^* c(1-y)y$.

- When $xy < 4c(2-y)y$: If $R < R_{bf} = \frac{1}{y}(\frac{4cy-8c+x}{4cy-4c})^2 \& N = 0$ or if $R = 0 \& N > 0$, $k^* = 0$, $Pr(I) = 0$, and $\pi^*_{bf} = \frac{1}{4}$. If $R > R_{bf} \& N = 0$, $k^* = \frac{4cy-8c+x}{4cy-4c}$, $Pr(I) = y(1 + (1-k^*)(1-y)) = \frac{xy}{4c} > y$, and $\pi^*_{bf} = \frac{1}{4}$.

Proof of Proposition 3

We consider the two cultures separately.

Reward-oriented culture.

We consider the following conditions.

a) If $xy > 4c$: $k_{nb} = k_{bf} = 0$; $Pr_{nb}(I) = 1 > Pr_{bf}(I) = (2-y)y$.

b) If $4c(2-y)y < xy < 4c$: We further consider the following sub-conditions.

b.1) If $R < R_{nb}$: $k_{nb} = k_{bf} = 0$; $Pr_{nb}(I) = 0 < Pr_{bf}(I) = (2-y)y$.

b.2) If $R \geq R_{nb}$: $k_{nb} > k_{bf} = 0$; $Pr_{nb}(I) = y < Pr_{bf}(I) = (2-y)y$.

c) If $xy < 4c(2-y)y$: It can be proven that $R_{nb} = \frac{(xy-4c)^2}{4cx(y-1)^2 y} > R_{bf} = \frac{(4cy-8c+x)^2}{y(4cy-4c)^2}$. We further consider the following sub-conditions.

c.1) If $R \geq R_{nb}$ $Pr_{nb}(I) = y < Pr_{bf}(I) = \frac{xy}{4c}$.

c.2) If $R_{bf} \leq R < R_{nb}$: $k_{nb} = 0 < k_{bf}$; $Pr_{nb}(I) = 0 < Pr_{bf}(I)$.

c.3) If $R < R_{bf}$: $k_{nb} = k_{bf} = 0$; $Pr_{nb}(I) = Pr_{bf}(I) = 0$.

Summarizing the above we obtain the the firm invests with a lower probability by using a biased-in-favor researcher than an unbiased researcher if $xy > 4c$.

Punishment-oriented culture.

We consider the following conditions.

a) If $xy > 4c$: We further consider the following subconditions.

a.1) If $N < N_{nb}$: $Pr_{nb}(I) = 1 > Pr_{bf}(I) = y + (1-k)y(1-y)$.

a.2) If $N \geq N_{nb}$: $Pr_{nb}(I) = y < Pr_{bf}(I) = y + (1-k)y(1-y)$.

b) If $4c(2-y)y < xy < 4c$ $k_{nb} = 0 < k_{bf}$; $Pr_{nb}(I) = 0 < Pr_{bf}(I) = y + (1-k)y(1-y)$.

c) If $xy < 4c(2-y)y$ $k_{nb} = k_{bf} = 0$; $Pr_{nb}(I) = Pr_{bf}(I) = 0$.

Summarizing the above we obtain that the firm invests with a lower probability by using a biased-in-favor researcher than an unbiased researcher if $xy > 4c \& N < N_{nb}$.

Proof of Proposition 4

We consider the following conditions.

a) If $xy > 4c(2-y)y$: The firm profit in the punishment culture is greater than its profit in the reward culture by $k^*_{bf}c(1-y)y$ where $k^*_{bf} = min\{1, \frac{Ny(1-y)}{2}\} > 0$.

b) If $xy < 4c(2-y)y$: The firm obtains the same profit under both cultures.

Proof of Proposition 5

We consider the two cultures separately.

Reward-oriented culture.

We consider the following conditions.

a) If $xy > 4c + 4cy$: $Pr_{bg}(I) = 1 > Pr_{bf}(I) = (2-y)y$; $\pi^*_{bg} = \frac{1}{4}(1 + xy - 4c) < \pi^*_{bf} = \frac{1}{4}(1 + xy - 4cy(2-y))$.

b) If $4cy(2-y) < xy < 4c + 4cy$: $Pr_{bg}(I) < y < Pr_{bf}(I) = (2-y)y$; $\pi^*_{bg} = \frac{1}{4}(1 + xy^2 - 4cy^2) + k^*_{bg}\frac{1}{4}(1-y)y(x-4c) > \pi_{bf} = \frac{1}{4}(1 + xy - 4cy(2-y))$ if $k^*_{bg} > \frac{8c-x}{4c-x}$, that is, if $R > \frac{2(8c-x)}{(4c-x)y(1-y)}$.

c) If $xy < 4cy(2-y)$: We further consider the following subconditions.

c.1) If $R < R_{bf}$: $Pr_{bg}(I) > Pr_{bf}(I) = 0$; $\pi^*_{bg} = \frac{1}{4}(1 + xy^2 - 4cy^2) + k^*_{bg}\frac{1}{4}(1-y)y(x-4c)\frac{1}{4}(1 + (x-4c)y^2) > \pi^*_{bf} = \frac{1}{4}$.

c.2) If $R \geq R_{bf}$: $Pr_{bg}(I) < y < pr_{bf}(I)$; $\pi^*_{bg} = \frac{1}{4}(1 + xy^2 - 4cy^2) + k^*_{bg}\frac{1}{4}(1-y)y(x-4c)\frac{1}{4}(1 + (x-4c)y^2) > \pi^*_{bf} = \frac{1}{4}$.

Punishment-oriented culture.

We consider the following conditions.

a) If $xy > 4c + 4cy$: We further consider the following subconditions.

a.1) If $N < N_{bg}$: $Pr_{bg}(I) = 1 > Pr_{bf}(I) = (2-y)y$; $\pi^*_{bg} = \frac{1}{4}(1 + xy - 4c)$, and $\pi^*_{bf} = \frac{1}{4}(1 + xy - 4c(2-y)y) + k^*_{bf}c(1-y)y$. Since $k^*_{bf} = min\{1, \frac{Ny(1-y)}{2}\}$, $\pi^*_{bf} > \frac{1}{4}(1 + xy - 4c(2-y)y) + c(1-y)y = \frac{1}{4}(1 + xy - 4cy) > \pi^*_{bg}$.

a.2) If $N \geq N_{bg}$: $Pr_{bg}(I) < y < Pr_{bf}(I)$; $\pi^*_{bg} = \frac{1}{4}(1 + xy - 4c)$, and $\pi^*_{bf} = \frac{1}{4}(1 + xy - 4c(2-y)y) + k^*_{bf}c(1-y)y$, $k^*_{bf} = min\{1, \frac{Ny(1-y)}{2}\}$. Based on a.1), $\pi^*_{bg} > \pi^*_{bf}$ is satisfied.

b) If $4cy(2-y) < xy < 4c + 4cy$: $Pr_{bg}(I) = y^2 < Pr_{bf}(I)$; $\pi^*_{bg} = \frac{1}{4}(1 + xy^2 - 4cy^2) > \pi^*_{bf} = \frac{1}{4}(1 + xy - 4c(2-y)y) + k^*_{bf}c(1-y)y$ if $k^*_{bf} < \frac{8c-x}{4c}$, that is, if $N < \frac{2(8c-x)}{4cy(1-y)}$.

c) If $xy < 4cy(2-y)$: $Pr_{bg}(I) = y^2 > Pr_{bf}(I) = 0$; $\pi^*_{bg} = \frac{1}{4}(1 + xy^2 - 4cy^2) > \pi^*_{bf} = \frac{1}{4}$.

Proof of Table 6

The utility maximizing effort chosen by the researcher is $k^* = E$, where E is proportional to the exogenous reward on effort. This research effort is constant across research bias conditions. We solve for the equilibrium investment probability by plugging this value of k into the preceding analysis defining the conditions for when the firm will invest.

For the case of no research bias, the conditions are defined in (a)-(d) in Section 1 of the Appendix. For the case of research bias-against, the conditions are defined (a)-(c) of Section 2. For the case of research bias-in-favor, we conditions are defined in (a) and (b) of Section 3.