Optimal Work-from-Home Policy Analysis

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Model Description

This document outlines a model for determining the optimal fraction of remote work (α^*) for firms based on their remote efficiency (ψ). The model incorporates non-linear transitions in α^* as ψ increases.

Model Components

1. Production Function

The firm's productivity depends on:

- **On-site work**: $1 - \alpha$
- **Remote work**: $\alpha(\psi - \psi_0)^\gamma$, where:
  - $\psi \in [0, 1]$: Firm's remote efficiency.
  - ψ_0: Threshold efficiency below which remote work is unproductive.
  - $\gamma > 0$: Curvature parameter for non-linearity.

The production function of a firm with remote efficiency ψ that adopts a fraction α of remote work is given by:

$$Y(\alpha \mid \psi) = A\left[(1 - \alpha) + \alpha(\psi - \psi_0)^\gamma\right]$$

2. Worker Utility and Wage

Workers incur a disutility from on-site work, compensated by wage w:

$$w = x + c(1 - \alpha)^\chi$$

- x: Baseline utility guaranteed by the firm.
- $c > 0$: Disutility scaling factor.
- $\chi > 1$: Curvature parameter for on-site work disutility.

3. Profit Function

Profit = Productivity - Wage:

$$\Pi(\alpha \mid \psi) = A\left[(1-\alpha) + \alpha(\psi - \psi_0)^{\gamma}\right] - \left[x + c(1-\alpha)^{\chi}\right]$$

Optimal α^* Derivation

To determine the optimal fraction of remote work $\alpha^*(\psi)$, we maximize the firm's profit function:

$$\Pi(\alpha \mid \psi) = A\left[(1-\alpha) + \alpha(\psi - \psi_0)^{\gamma}\right] - \left[x + c(1-\alpha)^{\chi}\right].$$

Taking the first-order condition:

$$\frac{\partial \Pi}{\partial \alpha} = -A(1 - (\psi - \psi_0)^{\gamma}) + c\chi(1-\alpha)^{\chi-1} = 0.$$

Solving for $\alpha^*(\psi)$:

$$\alpha^*(\psi) = 1 - \left[\frac{A(1 - (\psi - \psi_0)^{\gamma})}{c\chi}\right]^{\frac{1}{\chi-1}}.$$

Corner Solution Analysis

1. Full On-Site Work ($\alpha^*(\psi) = 0$ If the interior solution $\alpha^*(\psi)$ is negative, the firm prefers full on-site work ($\alpha^*(\psi) = 0$). This happens when:

$$1 - \left[\frac{A(1 - (\psi - \psi_0)^{\gamma})}{c\chi}\right]^{\frac{1}{\chi-1}} < 0,$$

which simplifies to:

$$\frac{A(1 - (\psi - \psi_0)^{\gamma})}{c\chi} > 1.$$

Rearranging:

$$A(1 - (\psi - \psi_0)^{\gamma}) > c\chi.$$

Solving for ψ:

$$\psi < \psi_0 + \left(1 - \frac{c\chi}{A}\right)^{\frac{1}{\gamma}}.$$

For this range of ψ, the firm opts for full on-site work.

2. Full Remote Work ($\alpha^*(\psi) = 1$)

Consider:

$$1 - \left[\frac{A(1-(\psi-\psi_0)^\gamma)}{c\chi}\right]^{\frac{1}{\chi-1}} > 1$$

Then:

$$\frac{A(1-(\psi-\psi_0)^\gamma)}{c\chi} < 0 \qquad \Longrightarrow \qquad \psi > \psi_0 + 1$$

Final Optimal Policy for $\alpha^*(\psi)$

$$\alpha^*(\psi) = \begin{cases} 0, & \text{if } \psi \leq \psi_c, \\ 1 - \left[\frac{A(1-(\psi-\psi_0)^\gamma)}{c\chi}\right]^{\frac{1}{\chi-1}}, & \text{if } \psi_c < \psi \leq \psi_0 + 1, \\ 1, & \text{if } \psi > \psi_0 + 1. \end{cases}$$

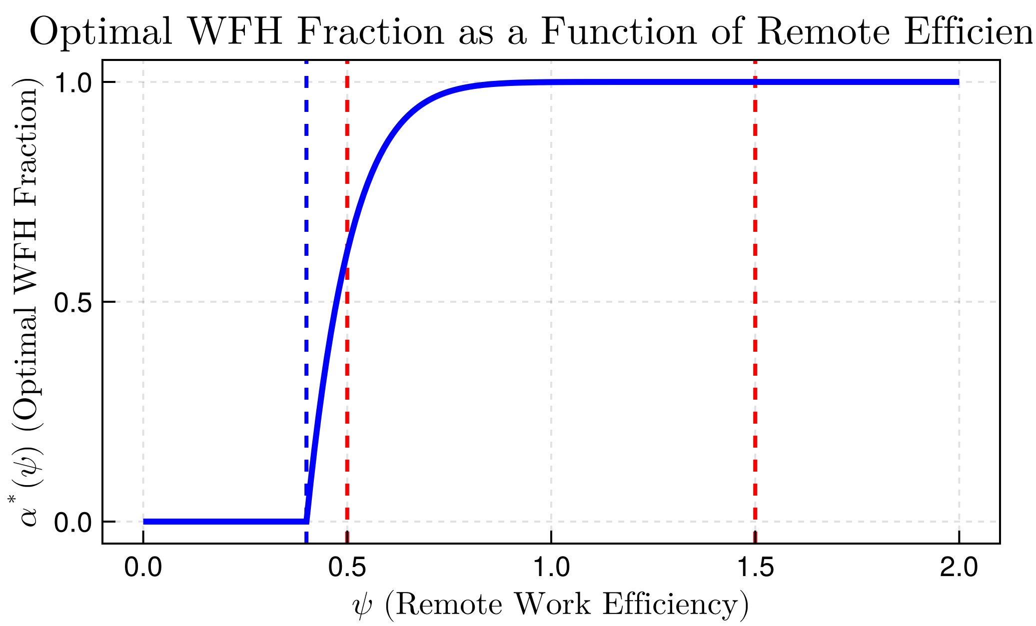

Figure 1: Optimal Work-From-Home (WFH) Fraction as a Function of Remote Efficiency