# Hedging the AI Singularity

## Abstract

This paper examines the financial implications of AI-induced labor displacement by modeling the AI singularity as a potential sudden shock to the capital share of income. We develop a neoclassical growth model in which the capital share parameter may jump to a significantly higher value with a fixed probability, representing the arrival of transformative AI technology that substantially increases the returns to capital relative to labor. We characterize the price of capital in this environment and derive explicit expressions for the risk premium associated with AI singularity risk. Our analysis reveals that capital serves as a natural hedge against shifts in factor shares, providing insurance against labor income risk. This hedging benefit increases the price of capital above what would be justified by expected cash flows alone, potentially explaining why investors might be willing to hold AI-related assets even at seemingly low risk premiums.

## 1. Introduction

The rapid advancement of artificial intelligence (AI) technologies has emerged as one of the most significant economic developments of the 21st century. Recent breakthroughs in large language models, computer vision, and reinforcement learning have dramatically expanded the scope of tasks that can be automated, raising concerns about the potential displacement of human labor across various sectors (Acemoglu and Restrepo, 2020). As AI systems become increasingly capable of performing complex cognitive tasks once thought to be the exclusive domain of humans, investors face growing uncertainty about the future value of their human capital and labor income streams (Gârleanu et al., 2012; Kogan et al., 2020).

Technological change has been a constant feature of economic history, from the Industrial Revolution to the digital transformation of recent decades. However, AI represents a fundamentally different kind of technological shift. Unlike previous innovations that automated specific physical tasks or enhanced particular industries, AI has the potential to impact virtually every sector of the economy simultaneously (Babina et al., 2024). The internet revolution, for instance, primarily transformed information access and communication channels (Ofek and Richardson, 2003; Hong et al., 2006), but still required extensive human involvement to create content and services. In contrast, there is theoretically no product or service that sufficiently advanced AI could not, in principle, create or deliver (Chen and Wang, 2024). This universality of AI's potential application distinguishes it from previous technological revolutions.

Moreover, some researchers and technologists have proposed the possibility of an "AI singularity"—a hypothetical point at which AI systems become capable of recursive self-improvement, potentially leading to an intelligence explosion and rapid, discontinuous technological change (Gofman and Jin, 2024). While the timing and likelihood of such an event remain subjects of debate, the possibility introduces a unique form of tail risk for labor markets and asset prices (Rietz, 1988; Barro, 2006). This risk is characterized not just by the magnitude of potential disruption but also by the suddenness with which it might occur.

This paper examines the financial implications of AI-induced labor displacement by modeling the AI singularity as a potential sudden shock to the capital share of income. We develop a neoclassical growth model in which the capital share parameter $\alpha$ may jump to a significantly higher value $\alpha'$ with a fixed

probability $p$, representing the arrival of transformative AI technology that substantially increases the returns to capital relative to labor. This approach builds on the disaster risk literature (Gourio, 2013; Wachter, 2013) but focuses specifically on the redistribution of income from labor to capital rather than aggregate output declines.

We characterize the price of capital in this environment using the Euler equation and derive explicit expressions for the risk premium associated with AI singularity risk. Crucially, we decompose this premium to isolate the hedging value of capital against the potential loss of labor income. This analysis reveals how forward-looking investors might optimally adjust their portfolios to hedge against the possibility of AI-induced wage displacement.

Our work contributes to several strands of literature. First, we extend the disaster risk framework (Rietz, 1988; Barro, 2006; Gourio, 2012) to model technological disruption rather than traditional macroeconomic disasters. Second, we build on studies of labor income risk and portfolio choice (Cocco et al., 2005; Benzoni et al., 2007; Eiling, 2013) by examining how AI-specific labor market risks might affect optimal investment strategies. Finally, we complement emerging empirical work on AI's impact on firm valuations and stock returns (Babina et al., 2024; Cao et al., 2024; Eisfeldt et al., 2023) by providing a theoretical framework for understanding how AI progress might reshape asset prices and risk premia.

The remainder of the paper is organized as follows. Section 2 presents our theoretical model of AI singularity risk. Section 3 derives the asset pricing implications and characterizes the hedging value of capital against labor income loss. Section 4 examines the extreme case where $\alpha'$ approaches 1, representing near-complete automation. Section 5 discusses empirical implications and potential tests of our theory. Section 6 concludes.

# 2. A Neoclassical Growth Model with Capital Share Disaster Risk

## 2.1 Model Setup

Consider a standard neoclassical growth model with a representative agent and a Cobb-Douglas production function. The key feature of this model is that the capital share parameter $\alpha$ can suddenly jump to a higher value $\alpha'$ with probability $p$ in each period, representing a "disaster" that shifts income from labor to capital.

The production function is given by:

$$Y_t = K_t^{\alpha_t} L_t^{1-\alpha_t}$$

where:

- $Y_t$ is output at time $t$
- $K_t$ is the capital stock
- $L_t$ is labor input (normalized to 1)
- $\alpha_t$ is the capital share parameter, which follows:

$$\alpha_{t+1} = \begin{cases} \alpha' & \text{with probability } p \\ \alpha & \text{with probability } 1-p \end{cases}$$

where $\alpha' > \alpha$

Once the capital share jumps to $\alpha'$, it remains at that value permanently, reflecting the irreversible nature of technological advancement. This assumption aligns with the concept of an AI singularity as a one-way transition to a new economic regime.

Capital evolves according to:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

where $\delta$ is the depreciation rate and $I_t$ is investment.

## 2.2 Household Problem

The representative household maximizes expected lifetime utility:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t U(C_t)$$

where $\beta$ is the discount factor and $U(C_t)$ is the utility function, which we assume takes the constant relative risk aversion (CRRA) form:

$$U(C_t) = \frac{C_t^{1-\gamma}}{1 - \gamma}$$

with $\gamma > 0$ being the coefficient of relative risk aversion.

The household's budget constraint is:

$$C_t + I_t = r_t K_t + w_t L_t$$

where $r_t$ is the rental rate of capital and $w_t$ is the wage rate.

Under competitive markets, factor prices equal their marginal products:

$$r_t = \alpha_t K_t^{\alpha_t - 1} L_t^{1 - \alpha_t} = \alpha_t \frac{Y_t}{K_t}$$

$$w_t = (1 - \alpha_t) K_t^{\alpha_t} L_t^{-\alpha_t} = (1 - \alpha_t) Y_t$$

## 2.3 Euler Equation and Asset Pricing

The household's optimization problem yields the standard Euler equation:

$$U'(C_t) = \beta E_t[U'(C_{t+1})(1 - \delta + r_{t+1})]$$

This can be rewritten to determine the price of capital $P_t^K$:

$$P_t^K = E_t \left[\frac{\beta U'(C_{t+1})}{U'(C_t)}(r_{t+1} + (1 - \delta)P_{t+1}^K)\right]$$

To characterize the hedging value of capital, we need to expand this expression by conditioning on the possible states of $\alpha_{t+1}$. Let's denote the stochastic discount factor as $M_{t,t+1} = \frac{\beta U'(C_{t+1})}{U'(C_t)}$. The price of capital can be written as:

$$P_t^K = (1-p)E_t[M_{t,t+1}(r_{t+1}(\alpha) + (1-\delta)P_{t+1}^K(\alpha))|\alpha_{t+1} = \alpha] + pE_t[M_{t,t+1}(r_{t+1}(\alpha') + (1-\delta)P_{t+1}^K(\alpha'))|\alpha_{t+1} = \alpha']$$

## 3. Impact of Capital Share Disaster Risk

### 3.1 Expected Return on Capital

The expected return on capital depends on the realization of $\alpha_{t+1}$:

$$E_t[R_{t+1}] = E_t[r_{t+1} + (1 - \delta)]$$

$$= p \cdot (\alpha' \frac{Y_{t+1}}{K_{t+1}} + (1 - \delta)) + (1 - p) \cdot (\alpha \frac{Y_{t+1}}{K_{t+1}} + (1 - \delta))$$

$$= [p\alpha' + (1 - p)\alpha] \frac{Y_{t+1}}{K_{t+1}} + (1 - \delta)$$

The key insight is that the expected capital share is $\bar{\alpha} = p\alpha' + (1 - p)\alpha$, which is higher than $\alpha$ due to disaster risk.

### 3.2 Hedging Motive for Labor Income Risk

To understand the hedging motive, we need to examine how consumption is affected by a disaster. The household's income consists of:

$$Y_t = r_t K_t + w_t L_t = \alpha_t Y_t + (1 - \alpha_t)Y_t = Y_t$$

When a disaster occurs, $\alpha_t$ jumps to $\alpha'$, causing:

- Capital income increases: $r_t K_t$ rises from $\alpha Y_t$ to $\alpha' Y_t$
- Labor income decreases: $w_t L_t$ falls from $(1 - \alpha)Y_t$ to $(1 - \alpha')Y_t$

Let's break out this hedging motive more formally. Define the stochastic discount factor (SDF) as:

$$M_{t,t+1} = \beta \frac{U'(C_{t+1})}{U'(C_t)} = \beta \left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}$$

The covariance between the SDF and the return on capital is crucial for understanding the risk premium:

$$Cov_t(M_{t,t+1}, R_{t+1}) = E_t[M_{t,t+1}R_{t+1}] - E_t[M_{t,t+1}]E_t[R_{t+1}]$$

When a disaster occurs, two things happen:

1. $\alpha_t$ increases to $\alpha'$, boosting capital returns $R_{t+1}$
2. Labor income $(1 - \alpha_t)Y_t$ decreases, reducing consumption and increasing the marginal utility of consumption (and thus the SDF)

This creates a positive covariance between the SDF and capital returns, which reduces the risk premium required on capital. In other words, capital serves as a hedge against labor income risk.

To see this mathematically, consider the Euler equation in terms of the risk premium:

$$E_t[R_{t+1}] - R_f = -R_f Cov_t(M_{t,t+1}, R_{t+1})$$

where $R_f$ is the risk-free rate.

Since $Cov_t(M_{t,t+1}, R_{t+1}) > 0$ during disasters (both the SDF and capital returns increase), the risk premium on capital is lower than it would be without this hedging benefit.

### 3.3 Quantifying the Hedging Value

To quantify the hedging value, we can decompose the price of capital into two components:

$$P_t^K = P_t^{risk-neutral} + P_t^{hedging}$$

where:

$$P_t^{risk-neutral} = E_t\left[\frac{1}{R_f}(r_{t+1} + (1-\delta)P_{t+1}^K)\right]$$

$$P_t^{hedging} = Cov_t\left(M_{t,t+1} - \frac{1}{R_f}, r_{t+1} + (1-\delta)P_{t+1}^K\right)$$

The hedging component $P_t^{hedging}$ represents the additional value investors place on capital due to its ability to hedge labor income risk. This component is positive when capital returns are high precisely when consumption is low (i.e., in disaster states).

To further quantify this hedging value, we can express the wage in the state where $\alpha$ jumps to $\alpha'$:

$$w_{t+1}(\alpha') = (1-\alpha')K_{t+1}^{\alpha'}L_{t+1}^{-\alpha'}$$

Compared to the wage if $\alpha$ had remained unchanged:

$$w_{t+1}(\alpha) = (1-\alpha)K_{t+1}^{\alpha}L_{t+1}^{-\alpha}$$

The percentage loss in labor income due to the jump in capital share is approximately:

$$\frac{w_{t+1}(\alpha) - w_{t+1}(\alpha')}{w_{t+1}(\alpha)} \approx \frac{\alpha' - \alpha}{1-\alpha} + (\alpha' - \alpha)\ln\left(\frac{K_{t+1}}{L_{t+1}}\right)$$

This expression shows that the labor income loss depends on both the magnitude of the capital share jump $(\alpha' - \alpha)$ and the capital-labor ratio. The hedging value of capital is higher when this potential labor income loss is larger.

### 3.4 Steady-State Analysis

In the steady state without disasters, the capital-output ratio is:

$$\frac{K}{Y} = \frac{\alpha}{\frac{1}{\beta} - (1-\delta)}$$

With disaster risk, the effective capital share becomes $\bar{\alpha} = p\alpha' + (1-p)\alpha$, leading to:

$$\frac{K}{Y} = \frac{p\alpha' + (1-p)\alpha}{\frac{1}{\beta} - (1-\delta)}$$

This shows that disaster risk increases the steady-state capital-output ratio, as households accumulate more capital to hedge against labor income risk.

## 4. The Extreme Case: AI Singularity with $\alpha' \approx 1$

The most dramatic scenario in our model is when $\alpha'$ approaches 1, representing a situation where capital (including AI systems) captures nearly all economic output. This extreme case resembles concerns about

technological unemployment from advanced AI, where human labor becomes almost entirely redundant.

## 4.1 Human Capital Valuation

The present value of human capital (PVHC) can be expressed as:

$$\text{PVHC}_t = w_t + \sum_{j=1}^{\infty} E_t \left[ \frac{w_{t+j}}{\prod_{i=1}^{j}(1 + r_{t+i} - \delta)} \right]$$

When there's a probability $p$ of $\alpha$ jumping to $\alpha' \approx 1.0$, the expected present value becomes:

$$\text{PVHC}_t = w_t + (1-p) \sum_{j=1}^{\infty} E_t \left[ \frac{w_{t+j}(s)}{\prod_{i=1}^{j}(1 + r_{t+i}(s) - \delta)} \right] + p \sum_{j=1}^{\infty} E_t \left[ \frac{w_{t+j}(s')}{\prod_{i=1}^{j}(1 + r_{t+i}(s') - \delta)} \right]$$

$$\approx w_t + (1-p) \sum_{j=1}^{\infty} E_t \left[ \frac{w_{t+j}(s)}{\prod_{i=1}^{j}(1 + r_{t+i}(s) - \delta)} \right]$$

The second term in the last line approaches zero because $w_{t+j}(s') \approx 0$ when $\alpha' \approx 1.0$.

## 4.2 Optimal Portfolio Choice

The optimal portfolio choice will involve a significant hedging demand for assets that pay off well when $\alpha$ jumps to $\alpha'$. Such assets would provide insurance against the catastrophic decline in labor income.

The hedging demand can be quantified as:

$$\theta_H = \frac{\gamma \cdot \text{Cov}(R_{t+1}, \log(w_{t+1}/w_t))}{\sigma_R^2}$$

Where $\gamma$ is the coefficient of relative risk aversion, $R_{t+1}$ is the return on the hedging asset, and $\sigma_R^2$ is its variance.

When $\alpha' \approx 1.0$, this covariance becomes strongly negative, creating a large positive hedging demand for capital assets that benefit from the regime shift.

In this extreme case, the hedging value of capital becomes paramount. Individuals would optimally hold significant capital assets as insurance against this scenario, even if these assets offer lower expected returns in normal times. This provides a rational explanation for why investors might accept seemingly low risk premiums on AI-related investments.

# 5. Empirical Implications and Potential Tests

Our model generates several testable implications for asset prices and portfolio choices:

1. **AI-exposed stocks should command lower risk premiums than otherwise similar stocks**. This is because they provide a hedge against labor income risk, making investors willing to accept lower expected returns. This prediction aligns with recent findings by Eisfeldt et al. (2023), who document that AI-exposed firms significantly outperformed human-labor-reliant firms following the release of ChatGPT.

2. **Workers in occupations most susceptible to AI displacement should hold more AI-related assets in their portfolios**. This follows from our hedging motive analysis and is consistent with the

literature on industry-specific human capital and portfolio choice (Eiling, 2013). However, this prediction may be confounded by familiarity bias (Massa and Simonov, 2006), as workers might overweight stocks in their own industry.

3. **The risk premium on AI-related assets should decrease as perceived AI progress accelerates**. As the probability $p$ of an AI singularity increases, the hedging value of AI-exposed assets rises, reducing their required returns. This could be tested by examining how AI stock valuations respond to major AI breakthroughs or announcements.

4. **The capital-output ratio should increase with perceived AI progress**. Our steady-state analysis predicts that as the probability of an AI singularity rises, the economy should accumulate more capital relative to output. This could be tested by examining whether sectors with higher AI exposure have experienced increasing capital-output ratios.

5. **The correlation between human capital returns and AI stock returns should become increasingly negative over time**. As AI capabilities expand, the potential for labor displacement increases, strengthening the hedging relationship between AI stocks and human capital. This prediction could be tested using methods similar to those in Lustig and Van Nieuwerburgh (2008).

These empirical implications provide a framework for testing our theory and understanding the financial market implications of AI advancement.

## 6. Conclusion

In this paper, we have developed a neoclassical growth model with stochastic capital share to analyze the financial implications of AI-induced labor displacement. Our key insight is that capital, particularly AI-related capital, serves as a natural hedge against shifts in factor shares that reduce labor income. This hedging benefit increases the price of capital above what would be justified by expected cash flows alone, potentially explaining why investors might be willing to hold AI-related assets even at seemingly low risk premiums.

The magnitude of this hedging value depends on several factors: the size of the potential jump in capital share, the probability of such a jump, the capital-labor ratio, and the degree of risk aversion. In the extreme case where AI could potentially capture nearly all economic output, the hedging value becomes paramount, providing a rational explanation for seemingly excessive valuations of AI-related companies.

Our analysis highlights how technological changes that alter factor shares can have significant implications for asset pricing and portfolio choice. As AI continues to advance, understanding these implications becomes increasingly important for investors, policymakers, and researchers.

Future research could extend our model in several directions. First, incorporating heterogeneity across workers with different skill levels and automation susceptibility would provide a more nuanced understanding of the distributional implications of AI advancement. Second, allowing for endogenous responses in human capital accumulation and labor supply could capture important general equilibrium effects. Finally, empirical work testing the predictions of our model would help validate its relevance for understanding real-world asset prices and portfolio choices in the face of AI advancement.

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