Simulating the End of Work and Money: A Microsimulation of AGI-Driven Automation

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Abstract

The development of Artificial General Intelligence (AGI) raises questions about the future of labor and monetary systems. This paper models firm-level automation decisions as a non-cooperative game, structurally analogous to the Prisoner's Dilemma. Simulations show that automation levels depend critically on competitive pressure (γ) and implementation costs (k), with high γ/k ratios leading to near-complete labor substitution. These results suggest that policy tools—such as automation taxation or universal basic income funded by AI rents—could mitigate adverse economic outcomes. The study underscores that AGI's impact on work and money is not technologically predetermined but shaped by institutional choices.

1 Introduction

1.1 Context: AGI and the Future of Labor

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1.2 Research Problem and Contribution

Our study addresses the following question: *Under what conditions do competitive dynamics between firms lead to excessive automation, and how do these outcomes challenge traditional economic equilibria?* We contribute to the literature by:

- Formalizing firm-level automation decisions as a **non-cooperative game** with a Prisoner's Dilemma structure.
- Simulating the impact of **competitive pressure** (γ) and **automation costs** (k) on long-term equilibrium outcomes.
- Discussing policy implications, including **automation taxation** and **universal basic income (UBI)** funded by AI rents.

1.3 Outline

Section **??** presents the theoretical framework. Section **??** describes the simulation methodology and results. Section **??** discusses the implications for labor markets and policy design. Section **??** concludes and outlines future research directions.

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2 Theoretical Framework: Why a Non-Cooperative Game?

2.1 Limitations of Existing Approaches

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Table 1: Comparison of Modeling Approaches for AGI-Driven Automation

Approach	**Strengths**	**Limitations**	**Relev**
CES Production Functions	Simple, macro-level insights	No strategic firm behavior	Low
Network Models	Captures interdependencies	High complexity, data-intensive	Mediu
Real Options	Handles uncertainty and irreversibility	Static competitive environment	Mediu
Our Game-Theoretic Model	**Firm-level strategies, clear policy levers**	**Homogeneous firms, static**	**High**

2.2 Profit Function and Cournot-Nash Equilibrium

The profit function for firm i is:

$$\Pi_i(a_i, \bar{a}_{-i}) = \gamma a_i(1 - \bar{a}_{-i}) + \beta a_i - k a_i^2,$$

where γ is the competitive advantage, k the cost of automation, and β the baseline gain. The symmetric Cournot-Nash equilibrium is:

$$\bar{a}^* = \min\left(1, \frac{\gamma + \beta}{2k + \gamma}\right).$$

For $\gamma = 2$, $k = 0.5$, and $\beta = 1$, the equilibrium $\bar{a}^* = 0.8$ implies that firms automate 80% of tasks, even if social costs are high.

2.3 Assumptions and Scope

We assume homogeneous firms to isolate the effect of γ and k, but discuss extensions with heterogeneity in Section **??**.

3 Model and Simulation Results

3.1 Methodology

Firms update their automation levels a_i via:

1. **Imitation**: Adopt the level of a more profitable firm with probability $p_{\text{adopt}} = \frac{1}{1+e^{-(\Pi_j - \Pi_i)}}$.
2. **Mutation**: Random perturbation with 5% probability.

Table 2: Simulation Parameters and Economic Interpretation

Parameter	**Values**	**Interpretation**
γ	0.5, 1.0, 2.0, 3.0	Competitive advantage (low to high)
k	0.2, 0.8, 1.4, 2.0	Automation cost (low to high)
β	1.0	Baseline automation gain

3.2 Results

Figure **??** shows final automation levels $\bar{a}^*$ for varying γ and k. Figure **??** compares simulation and analytical convergence.

Table 3: Equilibrium Automation Levels $\bar{a}^*$ for Varying γ and k

$\gamma \downarrow, k \rightarrow$	0.2	0.8	1.4
2.0			
0.5	0.53	0.21	0.15
0.12			
1.0	0.76	0.45	0.30
0.23			
2.0	0.96	0.83	0.63
0.50			
3.0	1.00	0.88	0.70
0.57			

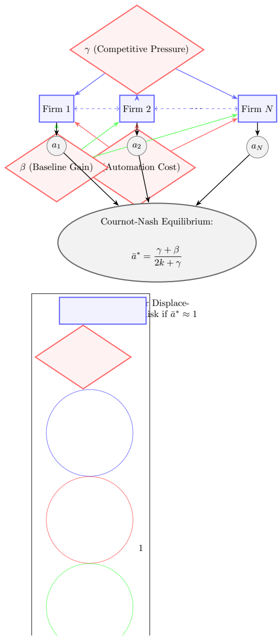

Figure 1: Conceptual diagram of the model: firms, competitive pressure (γ), automation costs (k), and equilibrium $\bar{a}^*$.

4 Implications: Toward a Post-Labor Economy?

4.1 Key Scenarios

- **Full automation** ($\gamma = 3, k = 0.2$): $\bar{a}^* \approx 1 \rightarrow$ Risk of demand collapse.
- **Partial automation** ($\gamma = 1, k = 1.4$): $\bar{a}^* \approx 0.3 \rightarrow$ Human labor persists.
- **Unstable equilibrium** ($\gamma = 2, k = 0.8$): $\bar{a}^* \approx 0.8 \rightarrow$ Sensitive to shocks.

4.2 Policy Responses

4.3 Limitations and Extensions

- **Assumptions**: Homogeneous firms, fixed β.
- **Future work**: Heterogeneity, macro feedback, dynamic $k(t)$.

5 Conclusion

Our study shows that:

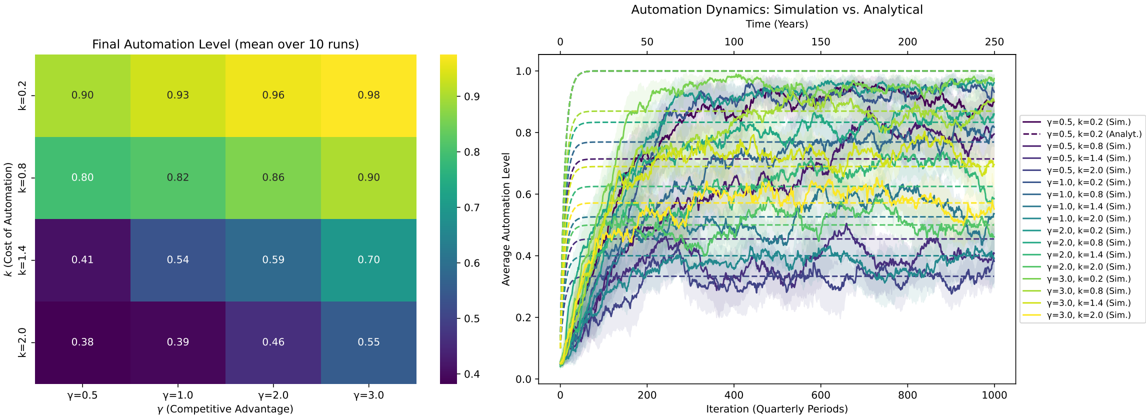

Figure 2: (Left) Heatmap of final automation levels $\bar{a}^*$. (Right) Dynamics of average automation (simulation vs. analytical).

- AGI-driven automation is **not inevitable** but depends on γ and k.
- Competitive dynamics can lead to **excessive automation**, even if socially suboptimal.
- Policies like **automation taxation** or **UBI** could mitigate risks.

Future research should:

1. Calibrate γ and k using sectoral data.
2. Integrate macroeconomic feedback loops.
3. Test policy interventions via simulation.

References

scenarios_policies.pdf

Figure 3: Three automation scenarios and associated policy responses.