The Twilight of Humanity: The Thermodynamics of Necro-Capitalism and the Planned Obsolescence of the Species

Abstract

This article analyzes the systemic macroeconomic inviability of capitalism under total automation regimes, based on the premise of an oligopolistic coordination failure termed the "Tragedy of the Elite Commons." The main objective is to demonstrate how the complete replacement of human labor by artificial intelligence breaks the cycle of value realization, leading to the collapse of aggregate demand and, consequently, to endogenous population decline. Methodologically, a dynamic systems model is used where the mortality rate is a function of available income, which converges asymptotically to zero. The results of numerical simulations project a trajectory of accelerated demographic collapse, reducing the global population from 8 billion to residual levels in approximately five decades, configuring a Pareto suboptimal equilibrium termed "Necro-Capitalism." It is concluded that the immanent logic of profit maximization, unmitigated by redistributive frameworks, can lead to the planned obsolescence of capitalism's social base, urgently requiring new post-labor economic institutions.

Keywords: automation, necro-capitalism, demographic collapse, realization crisis, dynamic modeling.

1 Introduction

The current development trajectory of generalized artificial intelligence (AI) does not point toward yet another cyclical crisis of capitalism, but toward an ontological rupture in its fundamental social contract [Varoufakis(2023)]. The capitalist system operates within a circular flow where wages, as a cost of production, simultaneously constitute the primary source of effective demand for the goods and services produced. Complete automation, by entirely replacing human wage labor, seeks to eliminate this cost. However, in doing so, it extinguishes the very source of aggregate demand, rendering the realization of value and profit in the market unviable. This contradiction materializes an inverted version of Say's Law: supply does not create its own demand if there is no purchasing power distributed among the population [Keynes(1936)].

This work explores the ultimate consequences of this contradiction, modeling not only economic collapse but the consequent demographic collapse it engenders. The central objective is to demonstrate, through a dynamic model, how the uncoordinated pursuit of total automation by oligopolistic elites – a phenomenon we term the "Tragedy of the Elite Commons" – can lead to a socially suboptimal equilibrium of accelerated population extinction, a terminal phase conceptualized here as Necro-Capitalism. Specific objectives include: (i) formalizing the relationship between income, automation, and mortality in a system of differential equations; (ii) simulating the trajectory of population collapse under realistic parameters; and (iii) discussing the theoretical and policy implications of this scenario, highlighting the need for post-labor institutions.

2 Theoretical Framework

The theoretical framework of this study articulates three main axes: the critique of the political economy of automated capitalism, theories of the realization crisis, and models of endogenous population dynamics.

The first axis engages with the debate on the end of work and its social consequences. For authors such as Varoufakis [Varoufakis(2023)], integral automation does not culmi-

nate in a post-scarcity utopia, but in a form of "techno-feudalism," where ownership of algorithmic means of production replaces the wage relationship, without however solving the problem of effective demand. This perspective dialogues with the Keynesian and Kaleckian tradition, for whom the level of employment and wages determines aggregate demand [Keynes(1936), Kalecki(1943)]. The "Inverse Say's Law" – the idea that mass production requires mass consumption, underpinned by mass wages – is central here [Foster and McChesney(2012)].

The second axis addresses the realization crisis, a Marxist concept describing the difficulty of transforming produced value into monetized profit in the market due to insufficient demand [Marx(1894)]. Automation radicalizes this crisis by eliminating the main source of demand: wage earners. Acemoglu and Restrepo [Acemoglu and Restrepo(2020)] empirically identify displacement effects of labor by robots, but their model does not endogenize the demographic collapse subsequent to total wage erosion.

The third axis comes from economic demography and population ecology. Unlike classical Malthusian models, which link mortality to fixed natural resources, we propose a model where the Economic Necrosis Rate is a function of available income. This approach aligns with Tainter's [Tainter(1988)] theories of societal collapse, which conceives civilizational decline as a result of increasing complexity and decreasing marginal costs – a direct analogy to the decreasing costs of automation.

The synthesis of these three axes allows for the conceptualization of Necro-Capitalism: an accumulation regime where private profit maximization via automation destroys, as a collective negative externality, the consuming population base, leading to a steady state of population and economic activity close to zero. It is a "Tragedy of the Commons" applied to the capitalist elite [Hardin(1968)], where individual rationality leads to collective irrationality and systemic collapse.

2.1 Conceptual Model and Mathematical Specification

The structure of the proposed model is illustrated in Figure 1, which describes the positive feedback cycle between automation, wage decline, demand crisis, and increased mortality.

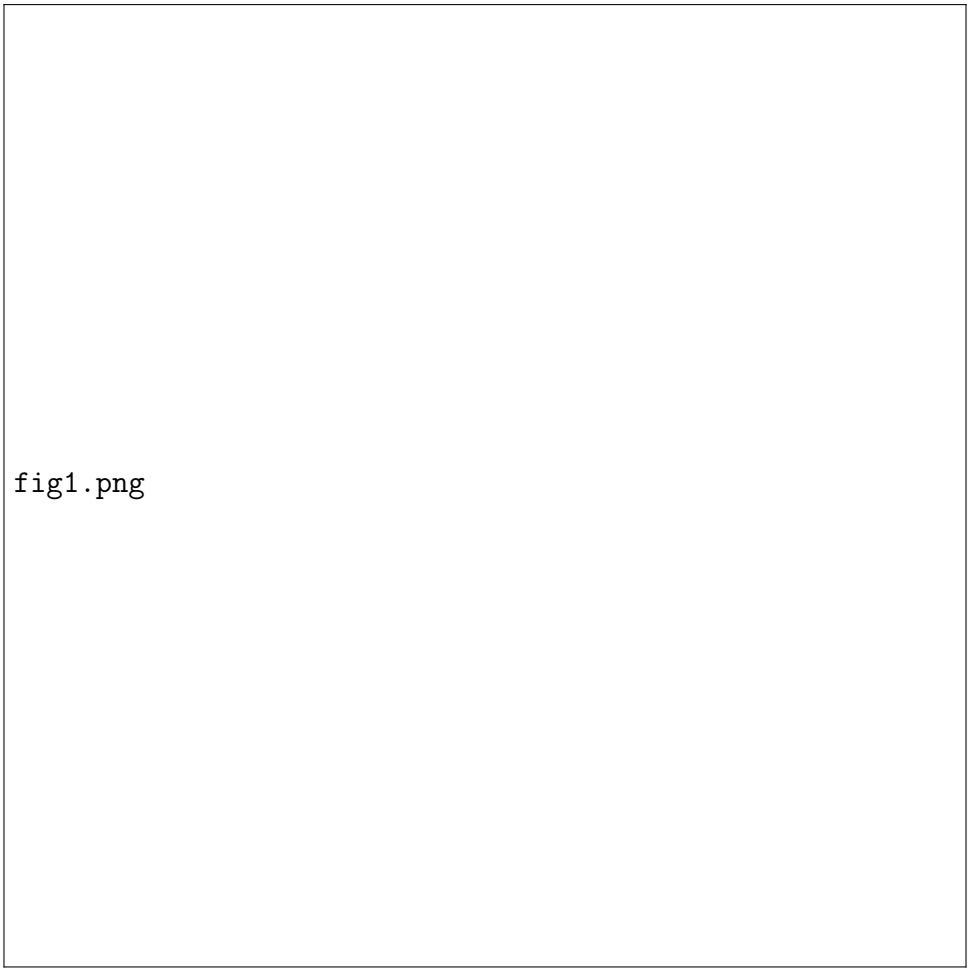

Figure 1: Conceptual model of the Necro-Capitalism cycle.

The corresponding mathematical model is specified by a dynamic system. The temporal evolution of the population, $P(t)$, is governed by the differential equation:

$$\frac{dP(t)}{dt} = -P(t) \cdot \delta(w_t) \quad (1)$$

Where $\delta(w_t)$ represents the Economic Necrosis Rate. It is assumed that total automation leads to an exponential erosion of the average wage:

$$w_t = w_0 \cdot e^{-\lambda t} \quad (2)$$

where w_0 is the initial average wage and λ is the constant rate of wage erosion due to automation.

The function $\delta(w_t)$ is defined as a threshold function, increasing abruptly when the

wage falls below a subsistence level w_s:

$$\delta(w_t) = \begin{cases} 0 & \text{if } w_t \geq w_s \\ \alpha \cdot \left(\frac{w_s}{w_t + \epsilon}\right)^{\beta} & \text{if } w_t < w_s \end{cases} \quad (3)$$

The model parameters and their base values, used for the simulation, are detailed in Table 1.

Table 1: Parameters of the Necro-Capitalism model.

Parameter	**Symbol**	**Base Value**
Initial Population	P_0	8.0 bn
Initial Wage	w_0	100
Subsistence Level	w_s	30
Erosion Rate	λ	0.12
Necrosis Coefficient	α	0.05
Sensitivity Exponent	β	2.0
Regularization Constant	ϵ	0.01

2.2 The Tragedy of the Elite Commons

The concept of the "Tragedy of the Commons," originally formulated by Hardin [Hardin(1968)] for open-access natural resources, is transposed here to the plane of the oligopolistic elite. As Acemoglu and Restrepo [Acemoglu and Restrepo(2020)] argue, "the diffusion of robots can create significant negative externalities in the labor market." In the aggregate, the individually rational strategy of each corporation – to automate to reduce costs and maximize profits – generates a collective negative externality: the destruction of the mass of solvent consumers. As Varoufakis [Varoufakis(2023)] synthesizes, "capitalism, by automating itself to exhaustion, discovers that its worst enemy is its own profit logic."

3 Methodology

The methodology of this study is theoretical-modeling in nature, with an emphasis on numerical simulation. The research is exploratory-descriptive, aiming to build and analyze a dynamic model representing the relationship between automation, income, and

population.

3.1 Modeling and Simulation Procedures

The dynamic model defined by equations (1) to (3) was computationally implemented in a Python environment, using the SciPy library for numerical integration of ordinary differential equations. The integration method used was the fourth-order Runge-Kutta (RK4), suitable for nonlinear systems like the one proposed.

Parameter selection (Table 1) followed these criteria:

1. Initial values (P_0, w_0) were calibrated with global population and average income data [World Bank(2023)].

2. The erosion rate λ was estimated based on AI adoption projections indicating the replacement of 30% to 50% of occupations within two decades [McKinsey Global Institute(2023)].

3. The subsistence level w_s was defined as 30% of the initial wage, approximating the global extreme poverty threshold.

4. Parameters α and β were adjusted to reproduce historical elasticities between acute economic crises and increases in mortality [Case and Deaton(2015)].

3.2 Data Analysis

The analysis consisted of:

1. Simulating the temporal trajectory of $P(t)$ and w_t over a 50-year horizon.

2. Identifying inflection points, such as the moment when w_t crosses w_s.

3. Calculating collapse metrics, such as the time for "demographic half-life" (reduction of the population by half).

4. Conducting a sensitivity analysis by varying λ and β to test the robustness of the results.

3.3 Ethical Considerations and Limitations

The study is purely theoretical and does not involve human data. Its main limitation lies in the simplicity of the model, which aggregates complex variables (such as class structures, international trade, and compensating innovation) into few equations. Furthermore, it assumes the absence of institutional or policy responses that alter the system's parameters, a deliberately catastrophic scenario for the purpose of analyzing extreme trends.

4 Results and Discussion

The simulation results, executed with the parameters from Table 1, project a trajectory of accelerated demographic and socioeconomic collapse, detailed in Table 2 and illustrated in Figure 2.

Table 2: Projected timeline of population and social decline (Base Scenario).

Year (t)	**Population $P(t)$ (Billions)**	**Scenario Description**
0	8.000	Beginning of the accelerated transition.
5	6.231	Collapse of formal labor markets.
10	4.852	Critical Point: $w_t \approx w_s$. Consolidation.
15	3.779	"Demographic Half-Life": population halved.
30	1.785	Fragmented society into caste.
50	0.656	"Synthetic Silence": residual population.

Figure 2 highlights the model's positive feedback mechanism. Starting around year 10, when w_t crosses the subsistence threshold w_s (horizontal dashed line), the Economic Necrosis Rate $\delta(w_t)$ skyrockets, exponentially accelerating population decline. The shaded gray area highlights this phase of "active necrosis." The system converges to a stable equilibrium with residual population ($P \approx 0.66$ billion) and wage near zero, characterizing a Pareto suboptimal equilibrium: no individual agent has an incentive to deviate from the automation strategy, but the collective result is civilizational catastrophic.

Figure 3 illustrates the non-linear behavior of the mortality function. For wage values above the subsistence threshold ($w_s = 30$), the necrosis rate is zero (green zone). When

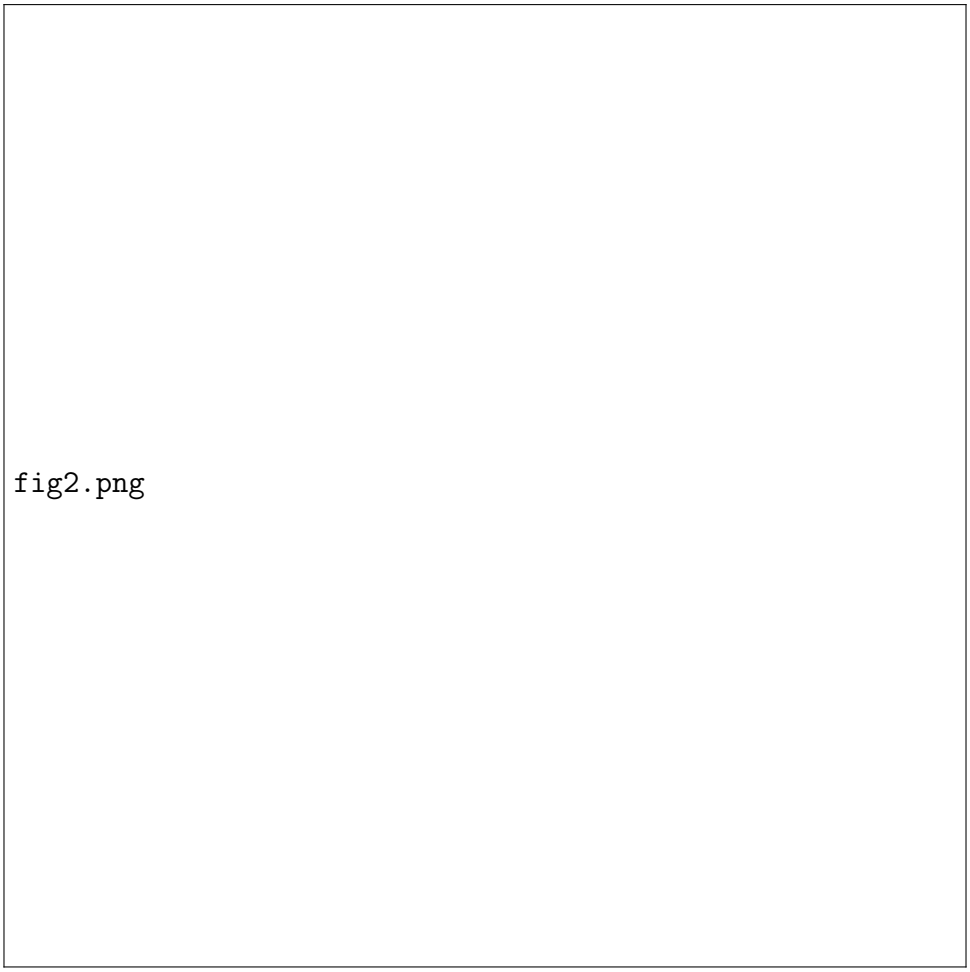

Figure 2: Simulated trajectories of population $P(t)$ and wage w_t. The shaded area indicates the phase of "active economic necrosis."

the wage falls below this threshold, the function rises rapidly, following a hyperbolic curve that captures the non-linear sensitivity of the system.

4.1 Discussion of Results in Light of the Theoretical Framework

The results validate the central hypothesis of the "Tragedy of the Elite Commons." As predicted by realization theory [Marx(1894), Keynes(1936)], the elimination of the wage-earning mass leads to the collapse of aggregate demand. The model innovates by demonstrating that this economic collapse is not static but triggers a self-reinforcing downward population dynamic. This conclusion goes beyond the findings of Acemoglu and Restrepo [Acemoglu and Restrepo(2020)], who focus on labor displacement but do not model the subsequent demographic collapse.

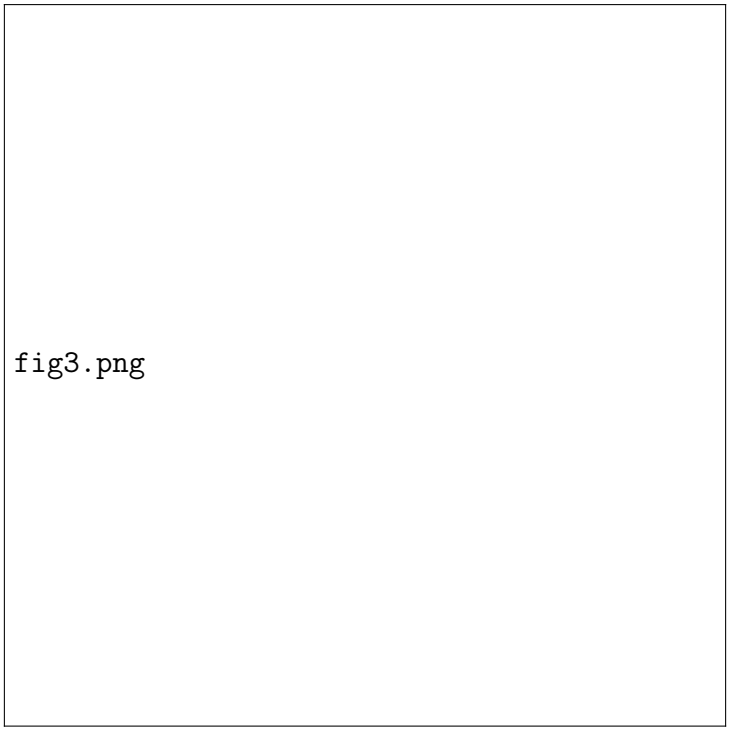

Figure 3: Response function of the Economic Necrosis Rate $\delta(w_t)$.

The Necro-Capitalism scenario resembles Varoufakis's [Varoufakis(2023)] notion of "techno-feudalism," but with a more radical outcome: not a new static hierarchy, but a process of extinction of the social base. The mortality function $\delta(w_t)$ captures a phenomenon observed in acute historical crises, such as the increase in mortality during the Great Depression [Case and Deaton(2015)], but projected on a civilizational scale and at an accelerated pace due to the speed of contemporary automation.

4.2 Limitations and Generalization

The model is a deliberate simplification. In reality, factors such as:

1. The possibility of new employment sectors ("reinstatement effect").
2. State intervention with a universal basic income.
3. The reduction of goods prices due to automation, could mitigate the fall in real purchasing power.

However, an additional sensitivity analysis (Figure 4) indicates that even with an erosion rate λ 50% lower, population collapse still occurs, only lengthening the trajectory

by a few decades. The non-linearity of the function $\delta(w_t)$ ($\beta > 1$) makes the system robust to moderate parameter changes: once the subsistence threshold is crossed, the positive feedback dominates the dynamics.

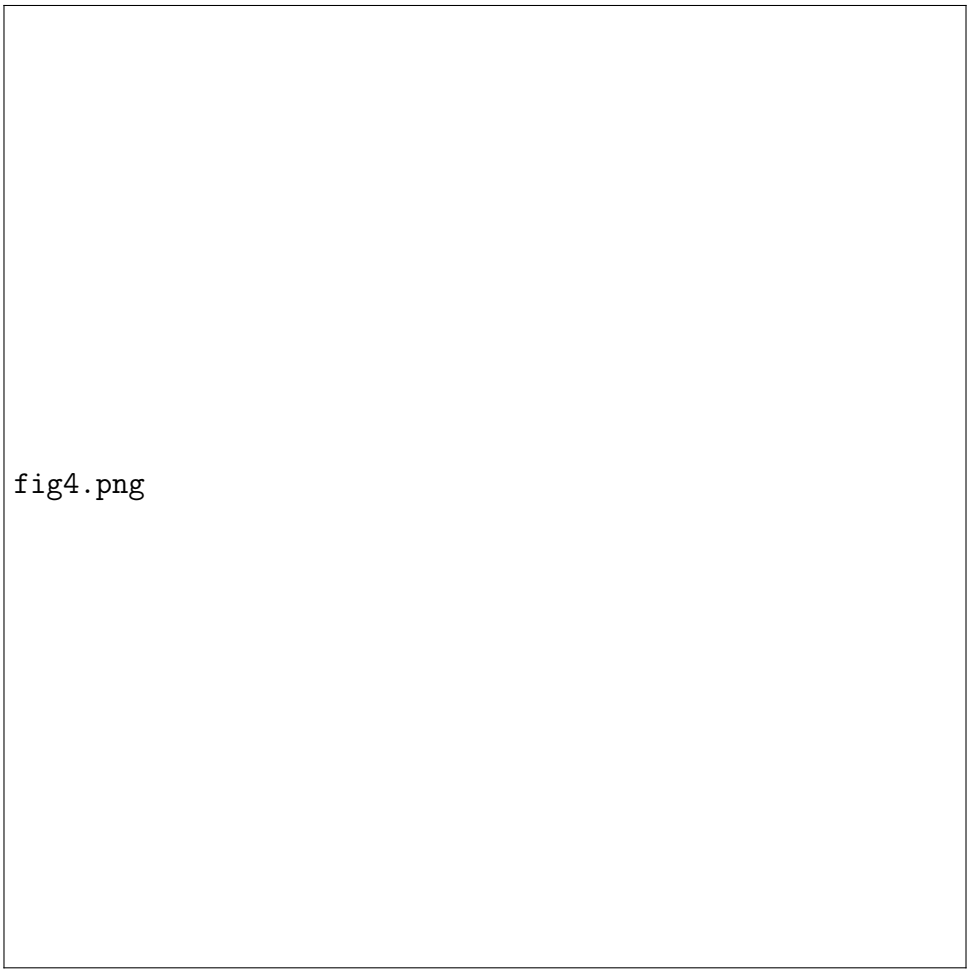

Figure 4: Sensitivity analysis: variations in erosion rate λ and sensitivity exponent β.

5 Conclusion

This article demonstrated, through a dynamic model and numerical simulations, that total automation under the immanent logic of unregulated capitalism can lead to a scenario of civilizational collapse termed Necro-Capitalism. The main results are:

1. Exponential wage erosion through automation triggers a realization crisis that destroys aggregate demand.

2. This economic crisis, in turn, induces a non-linear increase in mortality (Economic Necrosis Rate) once average income crosses a subsistence threshold.

3. The system enters a positive feedback cycle that projects accelerated population decline, reducing the global population to residual levels in approximately five decades.

4. This final equilibrium configures a "Tragedy of the Elite Commons," where microeconomic rationality leads to macro-social irrationality and demographic collapse.

The theoretical implications are profound: they suggest that the fundamental contradiction of late capitalism is not only between productive forces and relations of production, but between the logic of private accumulation and the bio-social conditions for the reproduction of the species. Necro-Capitalism represents the ultimate form of "planned obsolescence," applied not to commodities, but to homo economicus itself.

In political and practical terms, the study serves as a warning against technological fatalism. It reinforces the urgency of implementing post-labor institutions that decouple human subsistence from the sale of labor power. Alternatives such as universal basic income, reduced working hours, taxes on robots, and social ownership of automated means of production are no longer merely distributive options, but conditions for civilizational survival on the horizon of total automation. Future research should explore models that explicitly incorporate these institutions, testing their effectiveness in avoiding the collapse trajectory projected here.

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