

The AI Cognitive Broken-Ladder Theory: The Structural Employment Meltdown of AI from "Tool" to "Agent"

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ABSTRACT

Since the technological breakthrough and widespread application of Generative AI in late 2022, discussions regarding AI's impact on the labor market urgently need to deepen from a simple binary substitution narrative to micro-level mechanisms. Based on the classical theoretical frameworks of Marxist political economy, the sociology of technology, and labor economics, combined with empirical research on the early exposure to Large Language Models (LLMs), this paper conducts a theoretical deduction and mechanism analysis of the employment shock caused by the current technological revolution. The research indicates that the technological essence of AI is evolving from a traditional "production tool" into a "cognitive agent" with autonomous closed-loop capabilities. In this context, corporate organizational structures are trending toward a high-leverage operational model of "senior employees + multiple AI agents," leading to a seniority-biased technological change in the labor market. Microscopically, this change systematically eradicates entry-level cognitive jobs, marking a substantial blockage of the "first step of the ladder" for the upward social mobility of the youth demographic. Based on this, the paper innovatively proposes the "AI Cognitive Broken-Ladder Theory" to explain the mechanism of class stagnation underlying the reorganization of work tasks. Furthermore, integrating Piketty's laws of wealth distribution, it highlights the macroeconomic risks of a "Ghost GDP" and the ensuing crisis of aggregate demand contraction. This paper provides a novel theoretical framework for understanding the relationship between technology, labor, and social stratification in the era of digital intelligence.

I. Introduction

Every industrial revolution has been accompanied by technology profoundly reshaping the labor market. However, the current generative artificial intelligence revolution, driven by Large Language Models (LLMs), is exhibiting an atypical impact on the labor market. Unlike previous technologies that primarily substituted physical labor or routine procedural tasks, the new generation of AI technology directly penetrates the knowledge-intensive cognitive work domain.

Existing theories, such as "Skill-Biased Technological Change (SBTC)" and "routine task substitution", face boundary limits when explaining current phenomena. When AI can complete entry-level cognitive tasks in extremely short periods at marginal costs approaching zero, has the technological impact on labor breached traditional "incremental substitution", thereby triggering a "structural meltdown" in the labor market? Based on this premise, this paper attempts to explore: What is the substitution mechanism of generative AI for entry-level white-collar jobs? What profound structural impact will this substitution have on long-established pathways of social mobility? By constructing the "AI Cognitive Broken-Ladder Theory", this paper aims to provide a theoretical explanation for these questions from the interdisciplinary perspective of sociology and political economy.

2. Literature Review and Theoretical Foundation

2.1 The Logic of Technological Iteration: From "Production Tool" to "Cognitive Agent"

Regarding the relationship between technology and labor, Marx profoundly analyzed the displacement effect of machinery on living labor during the era of large-scale industry, pointing out that capital's application of machines not only increased productivity but also altered the power structure between capital and labor (Marx, 1867). Mid-20th-century philosophy of technology generally viewed technology as an extension of human organs and a "production tool" (McLuhan,

1964). Under this traditional framework, the implicit premise of "technology creating new jobs" is that new tasks will still heavily rely on human subjects for execution.

However, Brynjolfsson and McAfee (2014) predicted in *The Second Machine Age* that when technology possesses the capability to simulate human cognition rather than merely replace physical strength, the substitution logic will fundamentally shift. OpenAI's research on LLMs quantified this widespread "task exposure" for the first time, confirming that high-income, highly educated cognitive jobs are facing unprecedented technological shocks (Eloundou et al., 2023). Building upon this empirical anticipation, this paper further proposes that current AI has transcended the singular attribute of a tool, evolving into a "Cognitive Agent" equipped with autonomous planning and execution closed-loop capabilities. This evolution empowers the technology itself with the ability to self-iterate and take over entire workflows.

2.2 Labor Market Polarization and Structural Meltdown

In the early 21st century, Autor, Levy, and Murnane (2003) proposed the classic "routine task substitution" theory, arguing that middle-skill (routine procedural) jobs are most susceptible to technological shocks, while high-skill (abstract cognitive) and low-skill (non-routine manual) jobs are relatively safe. This "labor market polarization" theory has received broad cross-national empirical support over the past two decades (Goos, Manning & Salomons, 2014).

However, the proliferation of generative AI is disrupting this polarization model. Tasks previously considered "safe zones," such as abstract analysis, code generation, and text writing, are being drawn into the substitution scope on a massive scale (Eloundou et al., 2023). This paper introduces the concept of "structural meltdown" to describe a novel employment crisis where the rate of technological penetration exceeds the limits of the labor market's capacity for self-retraining and job transition, leading to a massive contraction of entry-level cognitive gateways.

2.3 Social Mobility Mechanisms: Occupation as the Ladder for Class Ascent

From a sociological perspective, the occupational division of labor is not solely an economic necessity but the core bond for social integration and the maintenance of

organic solidarity (Durkheim, 1893). Blau and Duncan's status attainment model established the modern path of class mobility: "education—occupation—income" (Blau & Duncan, 1967). This paper argues that the essence of entry-level white-collar jobs is not merely the execution of specific production tasks, but rather the "first step of the ladder" for youth to complete their socialization and accumulate human capital. When these foundational cognitive tasks are taken over by AI, it signifies a profound risk of severance at the very base of the channel for upward social mobility.

2.4 The Evolutionary Challenge to Wealth Distribution Laws

When cognitive agents replace human labor on a massive scale, the foundation of value distribution will be fundamentally shaken. Piketty (2013) demonstrated through long-term historical data that the rate of return on capital historically exceeds the economic growth rate (i.e., $r > g$), leading to wealth concentration among capital owners. In the context of ubiquitous AI, if the immense value created by machines accrues exclusively to the owners of computational capital, it will pose a severe challenge to the traditional macroeconomic cycle, which is heavily reliant on labor compensation.

3. Research Perspectives: The "Cognitive Broken-Ladder" Phenomenon in the Labor Market

Synthesizing the aforementioned classic theories with current technological evolution trends, this paper observes and extracts three core structural phenomena currently occurring in the labor market, serving as the realistic basis for subsequent theoretical construction:

3.1 Seniority-Biased Technological Change

Unlike the "high-skill-biased" characteristic found in traditional polarization theory, the current market exhibits a distinct "seniority-biased" feature. Enterprises increasingly favor utilizing a small number of senior employees in tandem with multiple AI agents to absorb data processing and foundational analysis tasks previously handled by entry-level teams. This creates prohibitively high entry barriers for young laborers lacking prior work experience. With the rapid development of

recursive AI evolution, the future model of a few senior employees coordinating multiple AI agents will likely transition to a model where multiple AI agents coordinate with each other, eventually subjecting even senior employees to layoffs.

3.2 The Implicit Rewriting of Task Cores

Although the "occupational shell" (e.g., job titles) of positions is partially retained, their "task cores" have qualitatively transformed. The demand for foundational execution skills has been drastically curtailed, replaced by high-order capabilities such as "complex system management" and "AI scheduling and output verification." This restructuring of workflows based on AI essentially strips young workers of the opportunity to accumulate experience through foundational tasks during their "apprenticeship phase."

3.3 Extreme Polarization of Intra-Labor Returns

During this technological restructuring, a minority of "hub-type" experienced talents—those capable of proficiently navigating complex AI systems and exercising global judgment—have secured a significant wage premium. Conversely, the bargaining power of the broad demographic of white-collar workers engaged in codifiable cognitive labor has been substantially weakened, further exacerbating income inequality within the labor force.

4. Theoretical Construction: The AI Cognitive Broken-Ladder Theory and Its Hypotheses

Based on the phenomenological induction and theoretical review above, traditional SBTC polarization theory is insufficient to fully explain the current structural contradictions. This paper formally proposes the "AI Cognitive Broken-Ladder Theory" to provide a new explanatory framework for social stratification mechanisms in the era of digital intelligence.

4.1 Core Theoretical Definitions

Before delving into the "broken-ladder effect," it is necessary to rigorously define the ontology of the "Cognitive Agent," the core technological driver. In traditional artificial intelligence and cybernetics paradigms, an "Agent" is defined as

an entity that perceives its environment and takes actions to maximize the achievement of a set goal (Russell & Norvig, 2020). However, past automation software (such as RPA) remained essentially a passive execution terminal of human intent, following a linear logic of "explicit instruction - deterministic response." The "Cognitive Agent" defined in this paper refers to a composite intelligent entity centered on Large Language Models (LLMs), which possesses not only basic perception capabilities but also the abilities of task decomposition, external tool invocation, and error self-correction (Eloundou et al., 2023). This leap in technological attributes means AI is no longer merely an "object" extending human limbs, but has evolved into a "quasi-subject" capable of autonomously completing a "perception-decision-execution-feedback" closed loop within specific cognitive boundaries.

The "Cognitive Broken-Ladder Theory" asserts: As generative AI transitions from "production tool" to "cognitive agent," enterprises irreversibly shift towards a micro-organizational model of "senior elites + AI agents." While this process maintains macro-level productivity, it systematically eradicates entry-level cognitive jobs at the micro level, leading to the substantial removal of the "first step of the ladder" for upward social mobility among the youth. This forms a hidden yet profound mechanism of class stagnation.

4.2 Micro-Occurrence Mechanism: The Closed Loop of Exclusion

The formation of the "broken-ladder effect" follows three evolutionary logics:

Capability Deconstruction: Agentic AI takes over rule-based and semi-rule-based information processing tasks at marginal costs approaching zero, stripping entry-level labor of its comparative advantage.

Human-Machine Closed Loop: Senior employees directly schedule AI via natural language, forging an internal working closed loop of "demand—execution—verification." This completely bypasses the entry-level employee tier in the flow of information.

Absolutization of Experience Barriers: The entry threshold for new labor is abruptly elevated to demand "systematic control and verification capabilities." The

youth demographic falls into a structural deadlock: "cannot be hired without experience, cannot accumulate experience without being hired."

4.3 Core Theoretical Inferences

To guide future quantitative empirical research, this theory proposes three major inferences:

Inference 1: Seniority Premium Hypothesis. In industries with high AI exposure, job seniority requirements are highly positively correlated with salary levels. The dividends of technological progress will disproportionately concentrate among experienced vested interests who have already bypassed the entry-level step.

Inference 2: Organizational Closed-Loop Exclusion Hypothesis. The faster an enterprise's core workflow achieves a "human-machine closed loop," the more its organizational structure will skew toward an "inverted pyramid" or "hourglass" shape, leading to an exponential decline in its capacity to absorb young labor.

Inference 3: Ghost GDP Backfire Hypothesis. Based on Piketty's (2013) capital logic, this paper proposes the concept of "Ghost GDP"—economic output independently generated by machines but not converted into workers' incomes. In the long term, as bottom-tier labor (primarily youth) loses income expectations due to the "broken ladder," macroeconomic aggregate consumer demand will face a sustained contraction. This demand-side collapse will ultimately backfire on the real economy and capital profits, forming a cyclical economic crisis that technology alone cannot repair.

5. Conclusion and Discussion

5.1 Core Conclusion: From Factor Substitution to Class Severance

The theoretical deduction of this paper demonstrates that the labor market shock triggered by LLM-driven generative AI is by no means a short-term cyclical fluctuation or simple "factor substitution" in the traditional economic sense, but rather a profound social structural reorganization. The "Cognitive Broken-Ladder Theory," constructed from empirical observations and classical theories, reveals that

technology's leap from "tool" to "cognitive agent" is physically blocking the "first step of the ladder" for upward class mobility among the youth.

This conclusion fundamentally shatters the long-standing optimistic premise in classical economics that "technology destroying old jobs will inevitably create new jobs of equal scale." When the skill threshold for new jobs far exceeds the learning curve of natural human socialization, and enterprises cease to provide a "trial-and-error space" (apprenticeship period) out of cost-reduction motives, the traditional self-repair and compensation mechanisms of the employment market will face comprehensive failure.

5.2 Theoretical Discussion: The Failure of Alternative Learning Mechanisms and the Irreplaceability of Tacit Knowledge

In establishing the aforementioned theoretical conclusions, this paper must address a potential counterfactual challenge: Can the higher education system or AI-based virtual sandboxes serve as an "alternative learning mechanism" to reconnect the broken ladder outside the enterprise ecosystem?

This paper contends that this techno-optimistic perspective severely underestimates the complexity of knowledge attributes within the commercial arena. Polanyi's classic epistemology divides human skills into "Explicit Knowledge" and "Tacit Knowledge" (Polanyi, 1966). While explicit knowledge, such as programming syntax and financial rules, can be compensated for through virtual sparring, what entry-level white-collar workers accumulate in real corporate operations is primarily tacit knowledge, highly embedded in specific social networks. This includes the perception of organizational micro-power structures, fuzzy decision-making under resource constraints, and complex interpersonal mediation skills. The acquisition of these tacit experiences relies heavily on trial-and-error feedback from actual commercial consequences and the "mentoring" of senior employees. Educational sandboxes, stripped of genuine conflicts of interest, cannot provide this deep socialization training. Therefore, the tacit knowledge transmission gap caused by the closure of workplace entrances cannot be easily bridged by technology, further

proving that the "cognitive broken ladder" is an insurmountable structural obstruction in the channels of social mobility.

5.3 Policy Implications: Reconstructing the Distribution Logic in the Era of Digital Intelligence

Confronted with the irreversible broken-ladder effect and the potential risk of class stagnation, alongside the macroeconomic aggregate demand contraction crisis triggered by "Ghost GDP," current public policy discussions must transcend traditional paradigms of "skills training" and "employment stabilization."

Against the macroeconomic backdrop of the rate of return on capital (r) continuously squeezing the rate of return on labor, society as a whole faces a profound revaluation: How do we redefine the social value of human labor? In a society that may no longer require large-scale entry-level human mental labor, how do we explore novel mechanisms for the secondary distribution of wealth? Rebuilding legitimate pathways for the younger generation to achieve economic security and social dignity is not merely an expedient measure to alleviate short-term employment pressures; it is a core political economy proposition concerning the sustainable development of human society in the era of digital intelligence.

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