SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

The Economic Afterlife of the Dead: Macroeconomic and Governance Implications of Ghost Capital, Digital Inheritance, and AI-Related Price Dynamics

Berat Akıncı[1], Filiz Kutluay Tutar[2], Abdallah Abukalloub[3*]

[1] Faculty of Economics and Administrative Sciences, Department of International Relations, Adana Alparslan Türkeş University of Science and Technology, Türkiye
[2]Faculty of Economics and Administrative Sciences, Department of Economics, Nigde Omer Halisdemir University, Türkiye
[3]Institute of Social Sciences, Department of Economics, Nigde Omer Halisdemir University, Türkiye

Author Email: bakinci@atu.edu.tr[1], flztutar51@gmail.com[2], abdkalloub@gmail.com[3]

ORCID: 0000-0002-5239-5417[1], 0000-0002-2574-9494[2], 0009-0000-1697-5206[3*]

Abstract. This article examines the macroeconomic implications of artificial intelligence, digital inheritance, and posthumous digital agency. It introduces the concept of ghost capital, defined as autonomous, identity-linked, and posthumously persistent digital productive capacity. Rather than treating ghost capital as a new primary factor of production, the framework positions it as an analytically distinct component of digital and intangible capital. A stylized dynamic macroeconomic model incorporates effective ghost capital into an augmented Cobb–Douglas production function. The model distinguishes nominal ghost capital from its economically effective component using a liquidity-governance coefficient, demonstrating that its contribution to output depends on legal recognition, accessibility, transferability, and institutional governance. The study also differentiates AI-related price dynamics arising from productivity gains, investment demand, input scarcity, sectoral price divergence, and asset-price effects. Ghost-to-ghost commerce is conceptualized as machine-executed transactions conducted under delegated legal authority. Through scenario analysis, the article explores how AI adoption, postmortem digital-capital accumulation, and alternative governance conditions may influence output, liquidity, taxation, and intergenerational wealth distribution.

Keywords: Metaverse, ghost capital, digital twins, postmortem economy

1 Introduction

In conventional economic theory, human labor and economic agency are generally understood to be bounded by the biological limits of life. Death is treated as the point at which an individual's active production, consumption, and ownership decisions cease, and accumulated assets are transferred to heirs through traditional inheritance mechanisms. However, the rapid development of artificial intelligence, augmented reality, metaverse platforms, blockchain-based assets, and digital identity systems increasingly challenges this boundary between biological life and economic activity [1].

Today, a person's digital estate extends beyond passwords, files, emails, and social media accounts. It may include crypto assets, NFTs, platform-based identities, digital licenses, smart contracts, AI-generated content, behavioral data, and digital twins trained on personal preferences or communication patterns. In some cases, these digital representations may continue to interact, produce content, manage rights, or participate in platform-based transactions after the biological death of the original individual [2].

This development poses a conceptual challenge for macroeconomic theory. If economic value can be produced by AI-mediated agents, digital twins, or posthumous algorithmic systems, production can no longer be modeled solely by living labor and conventional capital. The question is not whether deceased individuals continue to work but rather whether their data, digital assets, intellectual outputs, likeness, and algorithmic representations can continue to generate value in markets after death [3].

This article seeks to reconceptualize a portion of macroeconomic production in the age of AI, digital inheritance, and the metaverse. Existing research has examined digital inheritance, postmortem privacy,

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

autonomous AI agents, digital twins, digital assets, technological unemployment, and the effects of artificial intelligence on productivity and prices. However, these discussions have largely developed within separate legal, ethical, technological, and economic literatures. Digital inheritance studies primarily focus on ownership, access, privacy, and succession; research on AI afterlives focuses mainly on ethics, interaction, and representation; and macroeconomic studies of AI generally concentrate on productivity, labor displacement, investment, and inflation. What remains insufficiently developed is a unified macroeconomic framework explaining when posthumous digital assets and autonomous agents become economically productive, how their productive capacity differs from conventional digital capital, and how institutional accessibility affects their contribution to output, taxation, liquidity, and intergenerational wealth transmission.

To address this gap, this article builds on the emerging literature on digital inheritance, autonomous AI agents, and posthumous digital agency by developing a macroeconomic formalization of ghost capital. Ghost capital is defined as an analytically distinct component of digital and intangible capital characterized by autonomy, identity or estate linkage, posthumous persistence, and continuing productive capacity. It is not treated as a new primary factor of production equivalent to labor or aggregate capital. Accordingly, aggregate output is modeled through an augmented Cobb–Douglas structure in which conventional digital capital, C_t, and effective ghost capital, G_t*, form the effective digital-capital aggregate. The framework further distinguishes nominal ghost capital from its economically effective component through the liquidity-governance relationship $G_t = \lambda_t G_t$, thereby linking institutional accessibility to productive capacity.

The article makes four interrelated contributions. First, it establishes explicit boundary conditions distinguishing ghost capital from conventional digital capital. Second, it incorporates this distinction into a formal macroeconomic production and accumulation framework. Third, it models the role of legal recognition, transferability, interoperability, and governance in determining how much nominal ghost capital becomes economically effective. Fourth, it connects posthumous digital agency to AI-related price dynamics, liquidity, taxation, ghost-to-ghost commerce under delegated legal authority, and intergenerational wealth distribution.

The remainder of the article proceeds as follows. Section 2 reviews the literature on digital inheritance, postmortem privacy, digital twins, and AI-mediated economic agency. Section 3 develops the conceptual and formal model of ghost capital and examines digital-asset liquidity and governance frictions. Section 4 analyzes AI-related price dynamics, ghost-to-ghost commerce, and distributional and tax implications. Section 5 presents the scenario-based analytical framework, and Section 6 concludes with policy implications and directions for future research.

2 Literature Review and Theoretical Framework

Recent advances in artificial intelligence, extended reality, digital assets, and immersive platforms have broadened the economic meaning of death, inheritance, and posthumous agency. Digital estates now include not only files, passwords, social media profiles, and platform accounts but also data traces, avatars, synthetic personas, and potentially posthumous digital human twins. This shift requires a theoretical framework that links digital inheritance, postmortem commercial rights, consumer digital twins, and AI-driven labor substitution within a broader postmortem economy [4];[5].

The postmortem economy comprises the legal, technological, and economic processes through which the data, digital assets, rights, and AI-mediated representations of deceased persons continue to generate value after death. Earlier work on digital immortality distinguished between passive forms of digital persistence, such as memorialized traces, and more active forms in which virtual humans or AI-mediated representations can continue to interact with the living [1]. Recent work has extended this concern by emphasizing the governance challenges surrounding human digital remains and posthumous digital human twins [5].

This article treats the deceased digital agent not as a legal person in the full human sense but as an analytical category for modeling persistent economic activity after biological death. These agents may include digital estates, algorithmic profiles, AI chatbots trained on personal data, commercial avatars, or digital twins that continue to interact with platforms, consumers, heirs, firms, or markets. This framing aligns with emerging debates on postmortem commercial rights, which examine contractual, intellectual property, digital asset, and AI-liability issues that may persist after death [6].

The theoretical framework therefore connects three bodies of literature. The first addresses digital inheritance, postmortem privacy, and the governance of digital remains. The second addresses digital twins and AI-enabled consumer or human replicas as tools for modeling behavior, consumption, and value creation. The third addresses technological unemployment and the changing role of labor in economies increasingly shaped by automation and autonomous AI systems [7];[8];[9].

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

2.1 Digital Inheritance and the Postmortem Economy

Digital inheritance involves the transfer, preservation, or commercialization of digital assets, including platform contracts, privacy expectations, and intellectual property, after death. Because traditional succession law is often inadequate for these modern assets, postmortem privacy has become a central concern. Protecting the data left behind not only shields the intimate information of the deceased and their relatives but also fosters intergenerational trust amid increasing privacy risks [4];[10].

The growing volume of "human digital remains," from simple data traces to posthumous digital twins, exposes legal and ethical gaps reminiscent of historical markets for biological remains. Addressing these gaps requires anticipatory governance, such as advance data directives and clear rules on digital dignity [5]. Furthermore, the boundary between a living person, their estate, and the market is complicated by enduring postmortem commercial rights [6]. This environment gives rise to "ghost capital" or "orphaned algorithms," where autonomous AI agents continue to generate economic value despite the death of their human owners, operating in a regulatory void without clear accountability [3]. Ultimately, the postmortem economy encompasses both the traditional transfer of digital assets and the persistent, unregulated activity of value-generating digital entities.

2.2 Digital Twins from a Behavioral Economics Perspective

Initially, rooted in engineering and manufacturing, digital twins, data-updated virtual representations of physical entities, have expanded into behavioral economics and customer experience. In consumer behavior, these AI-enabled models synthesize transactional and contextual data to simulate preferences [7];[11]. This technology fundamentally alters the temporal boundaries of economic agency. While conventional economics assumes a living, temporally bounded agent, a digital twin transforms historical behavior into continuous predictive agency [9].

However, deploying these systems after death raises significant ethical and behavioral concerns. If a digital twin continues to act on a deceased person's historical data, it may perpetuate past behavioral biases rather than deliberate, reflective choices. Although digital twins can proactively manage service systems and potentially digital legacies or posthumous brand relationships, they also risk enabling oversurveillance, privacy violations, and commercial manipulation. Therefore, deceased-linked digital twins are not merely neutral technological tools; they are complex sociotechnical agents that blur the lines among memorialization, data simulation, and commercial exploitation.

2.3 Technological Unemployment and the Concept of an "Infinite Workforce"

The proliferation of AI systems has reignited debates about technological unemployment and the broader macroeconomic impacts of automated labor [8];[12]. The evidence suggests that the effect of AI on the labor market, whether it displaces or complements human workers, depends heavily on institutional adaptability and the creation of new occupational tasks [13];[14]. Beyond pure economics, this shift raises ethical questions about social identity, dignity, and the meaning of life in a postwork society [15].

In the postmortem economy, this dynamic extends to the theoretical concept of an "infinite workforce." Unlike living humans, digital agents and posthumous twins can be scaled endlessly, operated continuously, and maintained at minimal marginal cost. If these digital representations to license content, manage assets, or interact with markets after their creator's death, economic activity becomes increasingly detached from biological life. This blurs the traditional economic distinction between living labor and inherited capital, transforming accumulated personal data and behavioral history into automated "ghost capital." To mitigate the destabilizing effects of this automated persistence, economic models and policy frameworks must clearly distinguish among living labor, inherited assets, and posthumous algorithmic activity, ensuring that human oversight and responsibility remain central to increasingly autonomous systems [16].

Taken together, these studies demonstrate that digital assets may outlast their original owners, AI-mediated representations may continue to interact after death, and autonomous systems may generate value with limited direct human intervention. However, the literature does not yet provide a sufficiently integrated macroeconomic account of when such capacity becomes distinct from conventional digital capital or of how legal accessibility, transferability, and governance determine its effective contribution to production. The following section develops a conceptual model to address this analytical gap.

3 Conceptual Modeling of the "Ghost" Component of Capital

Classical macroeconomic frameworks traditionally model output as a function of physical capital and human labor, typically expressed as:

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

$Y_t = A_t F(K_t, L_t)$

However, digital transformation, driven by AI agents, digital twins, and metaverse platforms, increasingly depends on scalable, autonomous, and platform-mediated assets that cannot always be adequately differentiated within highly aggregated measures of conventional capital [17];[18].

To address this theoretical gap, the present study develops and formalizes ghost capital as an analytically distinct component within an expanded capital framework. It does not propose ghost capital as a new primary factor of production equivalent to labor or aggregate capital. Rather, the term "ghost factor" refers to the productive services generated by autonomous, identity-linked, and posthumously persistent digital capital.

Rather than a legally recognized person, a "ghost" denotes a bundle of digital assets, autonomous algorithms, and identity-linked representations that generate economic value even when direct human labor is absent and that may continue operating after the death or permanent absence of the original human principal [3];[2].

The emergence of ghost capital is driven by the autonomy of modern AI, the real-time simulation capabilities of multi-agent digital twins, and the persistent value of blockchain-based assets [39];[40]. Unlike passive digital capital, which primarily stores information or supports production, ghost capital may possess delegated operational or transactional authority. Examples include an orphaned algorithm, an inherited AI agent, or a posthumous chatbot authorized to license content, manage digital rights, or interact within markets. Such technological autonomy does not imply independent legal personality or ownership. Under current institutional conditions, these systems operate on behalf of an identifiable individual, estate, firm, trust, or platform operator that retains legal responsibility for the resulting transactions.

These characteristics do not make ghost capital ontologically independent of capital. Instead, they justify its separate analytical treatment as a capital component with distinctive accumulation, control, transfer, depreciation, and deactivation mechanisms. Its operation may depend on inheritance rules, platform contracts, identity rights, access credentials, and posthumous authorization. Ghost capital is therefore modeled separately from conventional physical and digital capital while remaining within the broader capital category [7];[19].

3.1 Decomposing Capital in the Production Function

To avoid treating ghost capital as an independent primary factor equivalent to labor or aggregate capital, the production structure is represented through a nested capital framework:

$Y_t = A_t F(L_t, \mathcal{K}_t)$

$\mathcal{K}_t = \Phi(K_t, C_t, G_t)$

Here, Y_t denotes aggregate output, A_t represents total factor productivity, L_t denotes living human labor, and $\mathcal{K}_t$ represents the aggregate stock of productive capital. Within this aggregate, K_t denotes conventional physical capital, C_t denotes conventional digital and intangible capital, and G_t denotes nominal ghost capital.

This nested formulation makes clear that ghost capital remains part of the broader capital category rather than constituting a completely independent factor of production. Its separate representation allows the framework to examine differences in operational autonomy, accumulation, institutional accessibility, transferability, depreciation, and posthumous persistence.

C_t denotes nonhuman digital capital, including passive software, datasets, digital infrastructure, intellectual property, and other technological resources that support production without possessing independent posthumous economic agency. By contrast, G_t isolates the narrower subset of digital capital characterized by autonomous or posthumous economic agency [20]. For example, a dataset belongs to C_t, and an ordinary firm-controlled AI application may also remain within C_t. An AI agent moves into G_t only when its economically relevant operation combines autonomy with identity or estate linkage and is capable of continuing after the death or permanent absence of the original human principal [21].

Ghost capital does not encompass all digital assets, automated systems, or AI applications. Within this framework, a digital asset or system is classified as ghost capital only when it satisfies four conditions. First, it must possess a continuing capacity to generate economic value. Second, it must exhibit a meaningful degree of operational or transactional autonomy. Third, it must maintain an identifiable connection to a person, estate, digital identity, or inherited bundle of rights. Fourth, it must be capable of continuing economically relevant operations following the death or permanent absence of its original human principal. When these conditions are not satisfied, the relevant asset remains part of conventional digital capital, C_t.

More explicitly, ghost capital is defined as follows:

$G_t = \psi(D_t, A^g_t, P_t, R_t)$

where D_t is the stock of identity-linked data, digital assets, behavioral records, and inherited digital rights; A^g_t is the degree of algorithmic, operational, and transactional autonomy; P_t captures platform reach, market connectivity, and the capacity to interact with other economic agents; and R_t denotes the institutional and governance framework governing ownership, accountability, transferability, and legal authority [22].

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

This formulation highlights that ghost capital relies jointly on technological capacity and legal legitimacy. More specifically, ghost capital depends on technological capacity, operational autonomy, identity linkage, platform connectivity, and institutional recognition. Technological sophistication or algorithmic autonomy alone is therefore insufficient for an asset or system to qualify as ghost capital. Its economic operation must also be linked to identifiable rights, assets, identities, or estates and supported by an institutional framework that determines who may control, transfer, inherit, tax, or terminate it.

The separate inclusion of G_t in the capital aggregator does not imply that it is independent of capital theory. Rather, it allows ghost capital to exhibit a distinct accumulation path, productive contribution, depreciation process, and degree of substitutability or complementarity with conventional capital. For example, ghost capital may be deactivated not only through technological obsolescence but also through lost credentials, platform closure, disputed succession, legal revocation, or the termination of posthumous authorization.

Agent-based modeling and multiagent digital twin frameworks are well suited for simulating this environment because they can represent humans, firms, platforms, and autonomous digital agents interacting within the same macroeconomic system [23]. Functionally, G_t may augment output by extending activity beyond human working hours, scaling services at low marginal cost, operationalizing accumulated behavioral data, licensing identity-linked content, and sustaining transactions through persistent platform identities [24]. These activities remain attributable to the legally recognized institutional unit that owns, controls, or authorizes the relevant digital system.

Nevertheless, the existence of nominal ghost capital does not necessarily imply an equivalent contribution to realized output. Its effective productive capacity depends on whether the relevant assets and agents are legally recognized, technologically accessible, transferable, interoperable, and economically usable. Accordingly, the following subsection distinguishes nominal ghost capital, G_t, from effective ghost capital, G_t^*, through a liquidity-governance coefficient.

Thus, the theoretical contribution of the framework lies not in presenting ghost capital as a new foundational factor of production, but in disaggregating the broader capital stock to identify a component distinguished by autonomy, identity or estate linkage, posthumous persistence, and institutional dependence.

3.2 A Stylized Dynamic Macroeconomic Model of Ghost Capital

To move beyond conceptual classification and formally demonstrate the macroeconomic role of ghost capital, this section develops a stylized dynamic model based on an augmented Cobb–Douglas production structure [25];[26]. Building on the literature that incorporates intangible assets into capital and growth accounting, the model treats ghost capital as a component of digital and intangible capital rather than as a new primary factor equivalent to labor or aggregate capital [27]. The specific decomposition of digital capital into conventional and effective ghost-capital components is proposed in this study.

Aggregate output is defined as follows:

$$Y_t = A_t K_t^{\alpha} L_t^{\beta} \tilde{C}_t^{1-\alpha-\beta}$$

where Y_t denotes aggregate output, A_t represents total factor productivity, K_t denotes conventional physical capital, L_t represents living human labor, and $\tilde{C}_t$ denotes the total stock of economically effective digital and intangible capital. The parameters satisfy $\alpha > 0$, $\beta > 0$, and $\alpha + \beta < 1$. Consequently, α, β, and $1 - \alpha - \beta$ represent the output elasticities of physical capital, living human labor, and effective digital capital, respectively. Under these restrictions, the production function exhibits constant returns to scale across the three aggregated inputs, consistent with the standard Cobb–Douglas specification [25].

For the purposes of the present framework, total effective digital and intangible capital is decomposed as follows:

$$\tilde{C}_t = C_t + G_t^*$$

where C_t denotes conventional digital and intangible capital, including software, datasets, digital infrastructure, intellectual property, and ordinary firm-controlled AI systems. Treating such assets as components of an expanded capital stock is consistent with the intangible-capital literature and with approaches that model automation as the allocation of productive tasks to capital [28];[27]. G_t^* denotes effective ghost capital.

The additive decomposition $\tilde{C}_t = C_t + G_t^*$ is a simplifying modeling assumption introduced in this study. It ensures that production remains possible in the absence of ghost capital and avoids treating G_t as an indispensable or independent primary factor of production. It also implies that conventional digital capital and effective ghost capital are treated as perfect substitutes within the digital-capital aggregate in this initial specification. More flexible substitution structures, such as a constant elasticity of substitution aggregator, remain possible extensions.

Effective ghost capital is determined by:

$$G_t^* = \lambda_t G_t$$

where G_t represents the nominal stock of autonomous, identity-linked, and posthumously persistent digital productive capacity, while $\lambda_t \in [0,1]$ represents the liquidity-governance coefficient. The institutional mechanisms

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

underlying this distinction include legal recognition, succession rights, technological accessibility, transferability, platform restrictions, and uncertainty regarding the ownership of digital assets [29];[22];[30].

The coefficient λ_t is introduced in this study as a stylized conversion parameter rather than as a previously established or directly observed empirical coefficient. It represents the proportion of nominal ghost capital that can be converted into economically effective productive capacity under prevailing legal, technological, and governance conditions.

Combining these relationships yields:

$$Y_t = A_t K_t^{\alpha} L_t^{\beta} (C_t + \lambda_t G_t)^{1-\alpha-\beta}$$

This expression constitutes the central production equation of the framework. It shows that ghost capital enters production through the effective digital-capital aggregate rather than as an ontologically independent production factor. The equation is an original extension developed in this study by combining the standard Cobb–Douglas structure with the proposed distinction between nominal and institutionally effective ghost capital.

The marginal contribution of nominal ghost capital to aggregate output is obtained by differentiating the production function with respect to G_t:

$$\partial Y_t/\partial G_t = (1 - \alpha - \beta)(\lambda_t/\tilde{C}_t)Y_t > 0$$

provided that $\lambda_t > 0$. This comparative-static result follows directly from the proposed production function and generates the first theoretical proposition.

Proposition 1: Nominal ghost capital increases aggregate output only to the extent that it is institutionally accessible and economically effective. When $\lambda_t = 0$, the marginal contribution of G_t to output is zero, even if the nominal stock of ghost capital is positive.

The marginal effect of the liquidity-governance coefficient is:

$$\partial Y_t/\partial \lambda_t = (1 - \alpha - \beta)(G_t/\tilde{C}_t)Y_t > 0$$

provided that $G_t > 0$. This result produces a second proposition.

Proposition 2: Improvements in legal recognition, succession rights, accessibility, transferability, interoperability, and platform accountability increase aggregate output by converting a larger proportion of nominal ghost capital into economically effective digital capital.

The institutional interpretation of Proposition 2 is consistent with research showing that digital assets and posthumous digital identities may remain economically inaccessible because of uncertain succession rights, platform control, privacy restrictions, and regulatory gaps [5];[29];[22]. Nevertheless, the mathematical proposition itself is a result of the model developed in this study. The magnitude of this effect is therefore conditional on the applicable legal and institutional regime.

These comparative-static results distinguish the proposed framework from an approach that merely adds digital assets to conventional capital. The macroeconomic effect of ghost capital depends not only on its nominal quantity but also on the institutional conditions under which it can continue to operate. A large value of G_t may therefore coexist with a negligible productive contribution when λ_t is close to zero.

To introduce a dynamic dimension, this study specifies the following law of motion for nominal ghost capital:

$$G_{t+1} = (1 - \delta^G - \mu_t)G_t + I^G_t + PM_t$$

where δ^G denotes the technological depreciation rate of ghost capital; μ_t captures institutional, contractual, or legal deactivation risk; I^G_t represents new investment in or activation of autonomous identity-linked digital systems; and PM_t denotes the postmortem conversion flow through which existing data, digital rights, licensed identities, algorithms, or digital twins become active ghost capital.

The inclusion of PM_t is motivated by research on AI afterlives, human digital remains, and posthumous digital twins, which indicates that data and identity-linked digital representations may persist and potentially remain operational after biological death [5];[2]. However, PM_t and the complete accumulation equation are original analytical specifications introduced in this study.

The condition $0 \leq \delta^G + \mu_t < 1$ ensures that a nonnegative proportion of the existing stock survives into the following period. Technological depreciation may arise from software obsolescence, declining model performance, cybersecurity failure, or incompatible infrastructure. Institutional deactivation may result from revoked authorization, disputed succession, platform closure, lost credentials, regulatory prohibition, or the termination of identity and licensing rights. These institutional and legal risks are consistent with documented difficulties surrounding digital-asset access, inheritance, postmortem identity rights, and platform governance [5];[29].

This distinction is important because the depreciation of ghost capital is not exclusively technological. Its productive life may end through legal, contractual, or governance decisions even when the underlying algorithm remains technically operational.

Drawing on the legal and institutional literature on digital inheritance and posthumous digital assets, this study models the liquidity-governance coefficient as the following bounded institutional function:

$$\lambda_t = \Lambda(R_t, P_t, U_t)$$

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

where R_t denotes the strength of property rights, succession rules, and regulatory recognition; P_t represents platform interoperability and technological accessibility; and U_t denotes legal, contractual, and ownership uncertainty [22];[30].

The functional form $\Lambda(\cdot)$ and its comparative-static restrictions are proposed in this study. The expected relationships are:

$\partial\lambda_t/\partial R_t > 0$

$\partial\lambda_t/\partial P_t > 0$

$\partial\lambda_t/\partial U_t < 0$

Thus, stronger legal recognition and platform interoperability increase the effective utilization of ghost capital, whereas legal uncertainty and disputed ownership reduce it.

When the framework is applied across jurisdictions, the coefficient can be indexed as $\lambda_{j,t} = \Lambda(R_{j,t},P_{j,t},U_{j,t})$, where j denotes the relevant jurisdiction. This extension makes the model sensitive to differences in inheritance law, AI governance, platform regulation, ownership recognition, and taxation.

The model can also be expressed in growth-accounting form, building on the standard decomposition of output growth into changes in productivity and productive inputs and its extension to intangible capital [26];[27].

For analytical precision, let gX denote the instantaneous proportional growth rate of variable X. Alternatively, the following expressions may be interpreted as first-order log approximations in discrete time. Aggregate output growth is:

$gY = gA + \alpha gK + \beta gL + (1 - \alpha - \beta)g\tilde{C}$

Because $\tilde{C}_t = C_t + \lambda_t G_t$, the growth rate of effective digital capital can be decomposed as:

$g\tilde{C} = (C_t/\tilde{C}_t)gC + (\lambda_t G_t/\tilde{C}_t)(gG + g\lambda)$

Substituting this expression into the output-growth equation gives:

$gY = gA + \alpha gK + \beta gL + (1 - \alpha - \beta)[(C_t/\tilde{C}_t)gC + (\lambda_t G_t/\tilde{C}_t)(gG + g\lambda)]$

This growth-accounting decomposition is derived from the model proposed in this study. It demonstrates that the contribution of ghost capital to economic growth depends on three elements: the growth of its nominal stock, the change in the liquidity-governance coefficient, and the share of effective ghost capital in the total digital-capital aggregate.

The formal model also provides a direct interpretation of the scenarios developed later in the article. The AI-productivity scenario is represented primarily by increases in A_t and C_t. The ghost-economy scenario is represented by higher I^G_t, PM_t, and G_t. The governance-trap scenario combines rapid growth in G_t with a low or declining λ_t and a potentially higher μ_t. Consequently, the scenario analysis no longer consists only of descriptive narratives but corresponds to alternative trajectories of the variables and parameters defined in the formal model.

The model is intentionally parsimonious and is not presented as a calibrated DSGE or OLG system. Its purpose is to establish the minimum formal structure required to demonstrate how autonomous and posthumously persistent digital capital can affect aggregate production, capital accumulation, and economic growth. A fully microfounded model incorporating household optimization, intergenerational bequests, asset pricing, fiscal policy, and market-clearing conditions remains an important extension for future research.

3.3 Digital Asset Accumulation and the Liquidity-Governance Trap

The accumulation of digital wealth, such as tokenized rights, virtual land, and platform currencies, does not guarantee economic usability or transferability. If credentials are lost, platform terms are restrictive, or succession laws fail to recognize digital property, these assets may become inaccessible [29]. This dynamic creates what this study terms a digital asset liquidity-governance trap, in which technological, contractual, or legal barriers prevent the conversion of nominal digital wealth into usable economic value. The term is not used in the conventional Keynesian sense of a monetary-policy liquidity trap.

This problem is particularly acute after death, as heirs may face inaccessible wallets, disputed ownership rights, nontransferable platform accounts, or orphaned algorithms [30]. It may also complicate valuation, taxation, and intergenerational transfer. However, not every illiquid digital asset constitutes ghost capital. A digital asset enters the stock of ghost capital only when it satisfies the conditions of continuing value generation, operational autonomy, identity or estate linkage, and posthumous persistence established in the preceding section.

As established in Section 3.2, economically effective ghost capital is represented by:

$G_t^* = \lambda_t G_t$

where G_t^* is economically effective ghost capital and $\lambda_t \in [0,1]$ is the liquidity-governance coefficient. The coefficient represents the share of nominal ghost capital that is legally recognized, technologically accessible, transferable, interoperable, institutionally authorized, taxable, and economically usable. If ownership is clear, succession rights are enforceable, and platform interoperability is robust, λ_t approaches 1. If assets are abandoned, inaccessible, nontransferable, tax-opaque, subject to disputed ownership, or legally locked, λ_t approaches 0.

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

The distinction between G_t and G_t* constitutes a central theoretical mechanism of the framework rather than merely a technical adjustment. A digital agent or inherited digital asset may possess substantial nominal value and continuing productive potential while making little or no contribution to realized output because legal, technological, or institutional barriers prevent its effective operation. The coefficient λ_t therefore functions as an institutional transmission mechanism linking nominal posthumous digital capacity to realized economic activity.

Consequently, while a deceased individual may leave a substantial nominal stock of autonomous and identity-linked digital productive capacity, represented by G_t, only the institutionally accessible and economically usable portion, G_t*, contributes effectively to production. A high value of G_t combined with a low value of λ_t may therefore produce a form of posthumous digital wealth overhang: nominal wealth continues to accumulate, but its contribution to output, taxable income, and intergenerational transfer remains limited. Conversely, stronger succession rules, platform accountability, interoperability, ownership recognition, and clearly attributable legal responsibility increase λ_t and allow a larger portion of nominal ghost capital to become economically effective.

By distinguishing between nominal and effective ghost capital, this framework provides a structured basis for examining how autonomous agents and posthumous digital governance reshape production, taxation, liquidity, and intergenerational wealth transfer.

4 Macroeconomic Implications and AI-Related Price Dynamics

Artificial intelligence exerts a profound macroeconomic influence by altering productivity, sectoral output, investment demand, and pricing behavior. However, its net inflationary impact is theoretically ambiguous: productivity gains may lower prices, whereas investment demand, income effects, and expectation-driven behavior may increase them [31];[32].

The term “AI-related price dynamics” is not used here to suggest that the relationship between artificial intelligence and price formation constitutes an entirely new phenomenon. Rather, it serves as an analytical label for the net and potentially asymmetric price effects arising from the interaction of AI-induced productivity gains, investment demand, infrastructure requirements, input scarcity, expectations, and digital asset valuation. AI-related inflationary pressure refers more narrowly to the positive contribution of these mechanisms to the general price level after accounting for productivity-driven disinflation. In this context, AI-related price dynamics do not necessarily imply a sustained or economy-wide increase in the general price level. Instead, they describe a combination of inflationary and disinflationary pressures generated by AI-enabled production, digital assets, and autonomous agents.

The digital economy underpins these effects, although their impact is often asymmetric across sectors and regions because of differences in infrastructure, energy availability, technological capacity, market concentration, and the intensity of AI integration [33];[34]. AI may reduce prices in sectors where automation lowers marginal production costs, while simultaneously increasing costs in sectors dependent on scarce computing capacity, advanced semiconductors, data centers, energy, and specialized labor. Such sectoral divergence does not necessarily constitute aggregate inflation unless it produces a broad and sustained increase in the general price level.

Ultimately, whether AI acts as an inflationary or disinflationary force depends largely on the sequencing and relative strength of productivity gains, demand acceleration, investment requirements, and input-cost pressures. The distinctive purpose of the present framework is therefore not to rename conventional inflationary mechanisms, but to examine how these competing price effects interact with autonomous digital agents, ghost capital, and posthumous digital economic activity.

4.1 Digital Abundance and Nonzero Marginal Costs

While “infinite supply at zero marginal cost” is a useful theoretical limit for purely digital goods, it does not fully capture the AI economy. AI can indeed push prices down by reducing the labor required for digital content, coding, or customer service. Empirical evidence from the European Union supports this, showing that a 10-percentage-point increase in AI-using firms is associated with a 0.3–0.6 percentage-point decline in producer-price inflation, particularly in services [35].

However, AI production relies heavily on scarce upstream inputs, including advanced chips, data centers, energy, and skilled labor. Furthermore, achieving productivity gains often requires substantial fixed investments in cloud services and organizational redesign [32]. Thus, AI creates a dual dynamic: it generates abundance and disinflation in selected digital outputs while intensifying scarcity and cost pressures on complementary physical resources [31].

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

4.2 Mechanisms of AI-Related Price Dynamics

The mechanics of AI-related price dynamics operate through five analytically distinct channels:

a. The Productivity Channel: Inherently disinflationary, this mechanism lowers unit costs by increasing output per input [31].
b. The Demand-Pull Channel: This generates inflationary pressure if households and firms increase consumption and capital spending in anticipation of future AI-led growth, causing demand to outpace short-run supply [32].
c. The Input-Cost Channel: This channel generates inflationary pressure during the transition phase by increasing demand for the scarce computational, energy, semiconductor, and specialized-labor resources required for AI integration [31].
d. The Sectoral Relative-Price Channel: Uneven AI adoption may lower prices in scalable digital sectors while increasing prices in infrastructure-intensive or resource-constrained sectors. These changes affect relative prices but do not necessarily increase the aggregate price level [35].
e. The Asset-Price and Expectations Channel: If AI raises expectations of future profits, the valuations of equities, digital assets, platform tokens, and intellectual-property rights may increase before productivity gains materialize. Such movements constitute asset-price effects rather than consumer-price inflation unless they pass through to expenditure, financing conditions, or production costs [32].

Accordingly, AI-related inflation is not treated as a separate alternative to demand-pull or cost-push inflation theory. It refers to the net aggregate effect that arises when AI-related demand, input-cost, and pass-through pressures exceed productivity-driven disinflation.

Beyond influencing prices, AI also transforms how inflation is measured. Machine learning systems can provide high-frequency forecasts and detect micro-inflation clusters before they appear in aggregate CPI data. This creates a feedback loop in which AI both drives price dynamics and shapes how policymakers and markets perceive them [36];[37].

4.2.1 Resource Scarcity and Asymmetric Price Dynamics

Because AI affects the digital and physical sectors differently, it creates asymmetric price dynamics. Prices for digital services may decline substantially, whereas the costs of upstream infrastructure and labor-intensive complements may rise. This asymmetry is exacerbated by uneven rates of AI adoption across firm sizes and regional infrastructures [33];[34].

Furthermore, algorithmic pricing enables firms to monitor demand and adjust prices in real time. While this improves allocative efficiency, it can also increase price dispersion and accelerate cost pass-through. Consequently, many AI-related price movements should initially be interpreted as sectoral relative-price changes. They constitute aggregate inflation only when they become sufficiently broad, persistent, and transmitted across sectors [35].

4.2.2 Ghost-to-Ghost Commerce under Delegated Authority

Ghost-to-ghost (G2G) commerce emerges when autonomous digital agents, digital twins, or posthumous AI representations transact with minimal human intervention [2]. This includes exchanging virtual goods, automating portfolio management, and licensing digital personalities. The concept does not assume that AI agents currently possess independent legal personality, ownership rights, or contractual capacity. Instead, such transactions are assumed to occur under authority delegated by an identifiable person, estate, firm, trust, or platform operator.

Because digital agents operate continuously without biological constraints, G2G commerce may generate virtual price cycles driven by algorithmic demand, platform scarcity, and token supply rather than human wages [3]. The resulting rights, liabilities, income, and tax obligations remain attributable to the legally recognized principal rather than to the AI agent itself.

The macroeconomic relevance of G2G commerce hinges on its link to the fiat economy. If transactions remain isolated within a platform, their impact is negligible. However, when virtual transactions generate tradable assets, royalties, or cash-out events, they directly influence the income of the relevant household, estate, or institutional owner and taxation [38]. As digital liquidity circulates within these virtual environments before entering the conventional economy, it can have delayed or uneven effects on consumption and asset markets [32].

4.3 Income Distribution and the Inheritance Tax Paradox

AI may exacerbate wealth concentration if productivity gains and digital asset appreciation disproportionately accrue to platform owners and capital holders, even as consumers benefit from lower prices for specific goods

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

[12]. This distributional ambiguity is compounded by the "inheritance tax paradox": although transactions involving blockchain-based assets such as cryptoassets and NFTs may be technologically traceable, digital estates can remain legally and administratively difficult to access, value, transfer, and tax [29].

This paradox is especially relevant in the context of posthumous digital agents. If an authorized AI agent associated with an estate or another legally recognized entity continues to generate revenue or manage assets after its owner's death, traditional tax frameworks may struggle to assign beneficial ownership or define realization events, creating new avenues for tax deferral [38];[3]. Conversely, taxation based on nominal asset values can create severe liquidity pressures for heirs who face immediate liabilities on illiquid or inaccessible virtual assets.

Ultimately, evaluating the macroeconomic implications of AI requires the integration of these factors, including productivity shifts, asymmetric price dynamics, digital asset accumulation, and automated postmortem economic activity, into a cohesive fiscal and monetary framework.

5 Methodology and Scenario Analysis Design

This study uses a stylized dynamic macroeconomic model and scenario-based system dynamics analysis to examine the macroeconomic implications of AI, digital inheritance, and ghost capital. Given the emerging status of the postmortem digital economy, the framework avoids deterministic empirical forecasting. Instead, it evaluates alternative trajectories under varying assumptions about AI adoption, ghost-capital accumulation, institutional accessibility, and postmortem digital agency [17];[21].

The methodology integrates three core elements: defining conceptual variables, formalizing the production and accumulation mechanisms developed in Section 3.2, and applying scenario analysis to identify directional macroeconomic effects.

5.1 Data Definition and Conceptual Variables

To make the emerging digital economy analytically tractable, the study defines several conceptual variables. Digital assets include economically valuable digital objects, such as tokenized rights, platform currencies, and rights to AI-generated content. Digital twins become economically relevant when they simulate behavior or support transactions. They enter ghost capital only when they possess operational autonomy, retain an identity or estate linkage, and continue economically relevant activity after the death or permanent absence of the original human principal [29];[2].

Ghost-to-ghost commerce captures transactions among autonomous digital agents with limited human intermediation. AI-related inflation dynamics capture the net price effects of AI adoption arising from productivity gains, investment demand, resource scarcity, and input-cost pressures [31].

Table 1 summarizes the variables used in the formal and scenario-based framework.

Table 1. Conceptual Variables Used in the Formal and Scenario Framework

Symbol	Variable	Definition
DA_t	Digital asset stock	Total stock of economically valuable digital assets
DT_t	Digital twin stock	Number or intensity of economically active digital twins
G_t	Nominal ghost capital	Stock of autonomous, identity-linked, and posthumously persistent digital productive capacity
G_t^*	Effective ghost capital	Institutionally accessible and economically usable ghost capital
C_t	Conventional digital capital	Software, datasets, digital infrastructure, and ordinary firm-controlled AI systems
$\tilde{C}_t$	Effective digital-capital aggregate	Conventional digital capital plus effective ghost capital
$G2G_t$	Ghost-to-ghost commerce	Machine-executed transaction volume among digital agents operating under delegated authority
AI_t	AI adoption intensity	Degree of AI integration into production and services
π^{AI}_t	AI-related price dynamics	Net inflationary or disinflationary effect of AI
λ_t	Liquidity-governance coefficient	Proportion of nominal ghost capital that is economically effective
μ_t	Institutional deactivation risk	Risk arising from legal, contractual, or platform-based termination
PM_t	Postmortem conversion flow	Digital assets and identities converted into active ghost capital
TAX_t	Taxable digital inheritance	Portion of digital inheritance subject to taxation
Y_t	Output	Aggregate output including conventional and digital production

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

5.2 Analytical System Dynamics Framework

The system dynamics analysis operationalizes the formal macroeconomic structure developed in Section 3.2. It tracks digital assets, digital twins, nominal ghost capital, effective ghost capital, and taxable digital inheritance.

The accumulation of digital assets is represented as:

$DA_{t+1} = DA_t + Creation_t + Returns_t - Liquidation_t - Obsolescence_t$

Obsolescence includes lost credentials, platform shutdowns, technological incompatibility, and legally disputed claims [38].

Consistent with the formal model, nominal ghost capital evolves as follows:

$G_{t+1} = (1 - \delta^G - \mu_t)G_t + I^G_t + PM_t$

where δ^G represents technological depreciation, μ_t denotes institutional deactivation risk, I^G_t represents new investment or activation, and PM_t captures postmortem conversion.

Effective ghost capital is determined by:

$G_t^* = \lambda_t G_t$

When assets are legally recognized, accessible, transferable, and interoperable, λ_t approaches 1. When they are abandoned, inaccessible, disputed, or platform-locked, λ_t approaches 0 [22].

Effective digital capital is therefore defined as:

$\tilde{C}_t = C_t + G_t^*$

This relationship enters the augmented Cobb–Douglas production function:

$Y_t = A_t K_t^{\alpha} L_t^{\beta}(C_t + \lambda_t G_t)^{1-\alpha-\beta}$

Inflation dynamics are represented as:

$\pi_t = \pi^0_t + \theta_1 Demand^{AI}_t - \theta_2 Productivity^{AI}_t + \theta_3 InputCost^{AI}_t + \theta_4 AssetPassThrough_t$

The system contains four principal feedback mechanisms: AI productivity, AI-related investment and input demand, postmortem digital-capital accumulation, and liquidity governance.

5.3 Scenario Design

Because metaverse commerce and AI afterlives remain highly uncertain, five scenarios are used to examine alternative parameter and variable [32].

Table 2. Scenario Design for AI-Mediated Postmortem Economic Dynamics

Scenario	Core Assumption	Expected Macroeconomic Effect
S0: Baseline	Moderate AI adoption and limited G2G commerce	Mixed output and inflation effects
S1: AI Productivity	Higher A_t and C_t; productivity dominates demand pressure	Higher output and weaker inflation
S2: AI-Related Inflation	Investment, demand, and input costs dominate productivity	Higher output with stronger inflationary pressure
S3: Ghost Economy	Higher I^G_t, PM_t, G_t, and $G2G_t$	New income streams and emerging tax gaps
S4: Governance Trap	G_t grows while λ_t remains low and μ_t rises	Low effective ghost capital and fiscal uncertainty

The scenarios therefore correspond directly to alternative trajectories of the variables and parameters defined in the formal model rather than functioning solely as descriptive narratives.

5.4 Scenario and Comparative Analytical Strategy

Because direct national-accounting data for ghost capital and G2G commerce do not yet exist, the study does not estimate a causal econometric model or produce deterministic projections to 2030. Instead, the scenario analysis evaluates the directional implications of changes in G_t, λ_t, μ_t, AI adoption, productivity, and input-cost pressures.

The simulations are interpreted as comparative analytical exercises rather than forecasts. They examine, for example, whether higher λ_t increases the contribution of ghost capital to output and whether AI-related productivity gains offset investment and input-cost pressures under alternative structural conditions.

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

5.5 Methodological Limitations

This framework has three principal limitations. First, it relies on conceptual variables because standard economic indicators do not yet measure posthumous digital agency. Second, measurement gaps remain between nominal and economically effective digital wealth, which the model represents through λ_t. Third, the scenario analysis identifies potential mechanisms and directional effects rather than establishing causal empirical relationships.

Although the study introduces a formal dynamic production structure, it is not a calibrated DSGE or OLG model. Such an extension would require observable data on ghost capital, digital bequests, platform behavior, household preferences, fiscal rules, and posthumous activation and deactivation parameters. The present framework should therefore be interpreted as an initial formalization that provides a foundation for future empirical calibration and microfounded modeling.

6 Conclusions

This article has developed a theoretical framework for understanding how artificial intelligence, digital inheritance, metaverse platforms, and posthumous digital agents may reshape macroeconomic analysis. The central argument is that digital afterlife technologies, autonomous digital twins, inherited digital assets, and orphaned algorithms may enable forms of economic continuity after biological death. These developments do not imply that deceased individuals remain economic actors in a human sense. Rather, they suggest that data, digital assets, synthetic identities, and algorithmic representations may continue to generate value after the original human actor is gone.

From the perspective of production theory, the concept of ghost capital highlights a blind spot in conventional macroeconomic models. Traditional models distinguish between labor and capital, but autonomous digital agents complicate this distinction. A digital twin, posthumous AI agent, or inherited algorithmic system may operate without continuous human labor while still producing content, managing rights, facilitating transactions, or accumulating digital income. For this reason, the article develops ghost capital as an analytically distinct component within the broader category of digital and intangible capital, rather than as a new primary factor of production.

The analysis also shows that AI-driven economic expansion may generate asymmetric price dynamics. AI can reduce costs and increase output through productivity gains, especially in digital goods and services. Moreover, it can create inflationary pressures by increasing demand for computing infrastructure, energy, data centers, advanced hardware, and skilled labor. Therefore, AI-related price dynamics should not be understood as a new form of inflation, but rather as an interaction among productivity-driven disinflation, demand-pull pressure, input scarcity, sectoral relative-price changes, expectations, and asset-price effects.

The rise of ghost-to-ghost commerce further complicates macroeconomic measurement. Under the baseline institutional assumption, such transactions are conducted by autonomous digital agents acting under authority delegated by an identifiable individual, estate, firm, trust, or platform operator. The associated ownership rights, liabilities, income, and tax obligations remain attributable to that legally recognized principal. When these transactions generate recognized output, royalties, service income, or real-world purchasing power, they become relevant for fiscal policy, inheritance law, and macroeconomic accounting.

To avoid double counting, the existing stock of ghost capital should not be added directly to GDP. Only new current-period value added generated through the use of digital capital should be recorded, while inheritance transfers, asset revaluations, and internal transactions among agents controlled by the same institutional unit should not be treated as additional production.

Three policy implications follow from this framework. First, policymakers need to address the inheritance–tax paradox of digital assets. Digital estates may be technically traceable but are difficult to value, transfer, access, or tax. Cryptoassets, NFTs, AI-generated royalties, metaverse property, and licensed digital identities may create liquidity-governance problems when heirs inherit assets that have nominal value but cannot be converted into economically usable wealth. Future digital inheritance law should therefore distinguish between nominal digital wealth and effective transferable value.

Second, ghost-to-ghost commerce requires clearer regulatory and accountability rules. Transactions among autonomous digital agents may create income flows, asset transfers, or platform-based value without real-time human involvement. If such transactions remain hidden inside closed digital ecosystems, they may generate tax gaps and fiscal opacity. Legal systems may therefore need mechanisms such as digital trustees, posthumous data directives, platform reporting obligations, identifiable economic ownership, and rules attributing liability to the relevant legal principal.

Third, ghost capital may intensify income and wealth inequality. Individuals who own advanced AI agents, digital platforms, data-rich identities, or valuable metaverse assets may be able to transmit income-generating

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

digital capital to future generations. If such assets continue to produce value after death, wealth accumulation may become less dependent on biological life and more dependent on the ownership of digital productive systems. This raises new concerns about intergenerational inequality, digital monopolies, and the concentration of AI-enabled capital.

The magnitude of these effects is conditional on legal and institutional arrangements. Differences in inheritance law, digital-property recognition, taxation, platform access, and AI governance may substantially alter the proportion of nominal ghost capital that becomes economically effective.

Overall, the emergence of AI-mediated postmortem economic activity suggests that macroeconomic models should begin to account for digital assets, autonomous agents, and posthumous digital representations. Ghost capital should not be understood as an already established empirical category but as a conceptual and analytical device for studying a rapidly developing economic frontier. Future research should operationalize this framework through empirical proxies, calibrated simulations, agent-based models, and legal–economic analyses of digital inheritance and AI governance.

The main conclusion is that the boundaries among life, death, ownership, and production are becoming increasingly blurred in digital economies. As AI systems, digital twins, and metaverse assets become more economically active, policymakers will need to reconsider taxation, inheritance law, price measurement, digital property rights, and macroeconomic accounting. Recognizing ghost capital as an emerging analytical category is a first step toward understanding how value may be created, transferred, measured, and governed in an economy where digital agency can outlive biological life.

Acknowledgments

Language editing and proofreading of this manuscript were assisted by Grammarly. The tool was used solely for grammar and language improvements, and the scientific content of the study remains the authors' responsibility.

References

[1] M. Savin-Baden, D. Burden, and H. Taylor, “The Ethics and Impact of Digital Immortality,” *Knowledge Cultures*, vol. 5, no. 2, pp. 11–19, 2017, doi: 10.22381/KC52201711.

[2] M. Ringel Morris and J. R. Brubaker, “Generative Ghosts: Anticipating Benefits and Risks of AI Afterlives,” *arXiv*, 2024, doi: 10.48550/arXiv.2402.01662.

[3] A. Al Mashai, “Orphaned Algorithms: Ghost Capital and the Post-Mortem Governance Void—Conceptual Framework,” SSRN, 2026, doi: 10.2139/ssrn.6950519.

[4] L. Edwards and E. Harbinja, “Protecting Post-Mortem Privacy: Reconsidering the Privacy Interests of the Deceased in a Digital World,” *Cardozo Arts & Entertainment Law Journal*, vol. 32, no. 1, 2013.

[5] M. Cunneen, R. AnandFinn, R. Friel, P. Tennent, and S. Brandt, “From Bones to Bytes: Anticipating and Addressing the Governance Challenges of Human Digital Remains and Posthumous Digital Human Twins,” *AI & Society*, vol. 41, no. 3, pp. 2021–2040, 2026, doi: 10.1007/s00146-025-02514-4.

[6] L. I. Nnebuihe, “Postmortem Commercial Rights: The Legal Status of Deceased Persons in Business Transactions,” *GNOSI: An Interdisciplinary Journal of Human Theory and Praxis*, vol. 8, no. 2, pp. 65–78, 2025.

[7] S. Mihai, M. Yaqoob, D. V. Hung, W. Davis, P. Towakel, M. Raza, M. Karamanoglu, B. Barn, D. Shetve, R. V. Prasad, H. Venkataraman, R. Trestian, and H. X. Nguyen, “Digital Twins: A Survey on Enabling Technologies, Challenges, Trends and Future Prospects,” *IEEE Communications Surveys & Tutorials*, vol. 24, no. 4, pp. 2255–2291, 2022, doi: 10.1109/COMST.2022.3208773.

[8] E. Moser, “Artificial Intelligence and Technological Unemployment,” in *The Palgrave Handbook of Global Social Problems*. Cham, Switzerland: Palgrave Macmillan, 2022, doi: 10.1007/978-3-030-68127-2_264-1.

[9] J. Hornik and M. Rachamim, “AI-Enabled Consumer Digital Twins as a Platform for Research Aimed at Enhancing Customer Experience,” *Management Review Quarterly*, 2025, doi: 10.1007/s11301-025-00527-3.

[10] B. Schafer, J. Briggs, W. Moncur, E. Nicol, and L. Azzopardi, “What the Dickens: Post-Mortem Privacy and Intergenerational Trust,” *Computer Law & Security Review*, vol. 49, Art. no. 105800, 2023, doi: 10.1016/j.clsr.2023.105800.

[11] J. R. McColl-Kennedy, M. Zaki, T. W. Andreassen, L. V. Coote, E. Brea, F. Willer, and J. Andrade, “Digital Twins: A Game Changer in Customer Experience,” *Journal of Service Management*, 2025, doi: 10.1108/JOSM-12-2024-0540.

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

[12] A. Pınar, “Technological Unemployment and the AI Revolution: An Investigation on Macroeconomic Consequences,” *Econharran*, vol. 8, no. 14, pp. 15–26, 2024.
[13] Q. P. Nguyen and D. H. Vo, “Artificial Intelligence and Unemployment: An International Evidence,” *Structural Change and Economic Dynamics*, vol. 63, pp. 40–55, 2022, doi: 10.1016/j.strueco.2022.09.003.
[14] M. Qin, Y. Wan, J. Dou, and C. W. Su, “Artificial Intelligence: Intensifying or Mitigating Unemployment?” *Technology in Society*, vol. 79, Art. no. 102755, 2024, doi: 10.1016/j.techsoc.2024.102755.
[15] J. Danaher, “Will Life Be Worth Living in a World Without Work? Technological Unemployment and the Meaning of Life,” *Science and Engineering Ethics*, vol. 23, no. 1, pp. 41–64, 2017, doi: 10.1007/s11948-016-9770-5.
[16] M. Özer and M. Perc, “Human Complementation Must Aid Automation to Mitigate Unemployment Effects Due to AI Technologies in the Labor Market,” *Reflektif Sosyal Bilimler Dergisi*, vol. 5, pp. 503–514, 2024, doi: 10.47613/reflektif.2024.176.
[17] F. Bertani, L. Ponta, M. Raberto, A. Teglio, and S. Cincotti, “An Economy Under the Digital Transformation,” Munich Personal RePEc Archive, 2019.
[19] V. T. Truong, L. B. Le, and D. Niyato, “Blockchain Meets Metaverse and Digital Asset Management: A Comprehensive Survey,” *IEEE Access*, vol. 11, pp. 26258–26288, 2023, doi: 10.1109/ACCESS.2023.3257029.
[20] S. Hrytsai, “The Place of Virtual Assets in the Structure of Digital Financial Technology,” *International Science Journal of Management, Economics & Finance*, vol. 1, no. 3, pp. 34–48, 2022, doi: 10.46299/j.isjmef.20220103.3.
[18] S. M. Schöbel and J. M. Leimeister, “Metaverse Platform Ecosystems,” *Electronic Markets*, vol. 33, Art. no. 12, 2023, doi: 10.1007/s12525-023-00623-w.
[21] C. Gao, X. Lan, N. Li, Y. Yuan, J. Ding, Z. Zhou, F. Xu, and Y. Li, “Large Language Models Empowered Agent-Based Modeling and Simulation: A Survey and Perspectives,” *Humanities and Social Sciences Communications*, vol. 11, Art. no. 1259, 2024, doi: 10.1057/s41599-024-03611-3.
[22] M. Mijatović, “Digital Assets and Inheritance Law: Legal Vacuum or New Paradigm,” *SCIENCE International Journal*, vol. 4, no. 3, pp. 7–11, 2025, doi: 10.35120/sciencej0403007m.
[23] Y. Xia, M. Shenoy, N. Jazdi, and M. Weyrich, “Towards Autonomous System: Flexible Modular Production System Enhanced with Large Language Model Agents,” in *Proc. 2023 IEEE 28th International Conference on Emerging Technologies and Factory Automation (ETFA)*, 2023.
[24] D. Narayan, “Cloud Capitalism and the Rise of Scalable Digital Assets,” *The Information Society*, 2025, doi: 10.1080/01972243.2025.2599589.
[25] C. W. Cobb and P. H. Douglas, “A Theory of Production,” *The American Economic Review*, vol. 18, no. 1, pp. 139–165, 1928.
[26] R. M. Solow, “Technical Change and the Aggregate Production Function,” *The Review of Economics and Statistics*, vol. 39, no. 3, pp. 312–320, 1957, doi: 10.2307/1926047.
[27] C. Corrado, C. Hulten, and D. Sichel, “Intangible Capital and U.S. Economic Growth,” *Review of Income and Wealth*, vol. 55, no. 3, pp. 661–685, 2009, doi: 10.1111/j.1475-4991.2009.00343.x.
[28] D. Acemoglu and P. Restrepo, “Automation and New Tasks: How Technology Displaces and Reinstates Labor,” *Journal of Economic Perspectives*, vol. 33, no. 2, pp. 3–30, May 2019, doi: 10.1257/jep.33.2.3.
[29] E. Harbinja, *Digital Death, Digital Assets and Post-Mortem Privacy: Theory, Technology and the Law*. Edinburgh, U.K.: Edinburgh University Press, 2022.
[30] S. Omoola and H. K. Ibrahim, “The Legal Implications of Abandoned Digital Assets in Sharīʿah-Compliant Fintech Platforms,” *ISRA International Journal of Islamic Finance*, vol. 15, no. 2, pp. 60–76, 2023, doi: 10.55188/ijif.v15i2.542.
[31] I. Aldasoro, S. Doerr, L. Gambacorta, and D. M. Rees, “The Impact of Artificial Intelligence on Output and Inflation,” BIS Working Papers, no. 1179, Bank for International Settlements, 2024.
[32] S. Lenzu, “Artificial Intelligence and Monetary Policy: A Framework and Perspective on Cyclical Transmission, Structural Transition, and Financial Stability,” Federal Reserve Bank of New York, Staff Report no. 1192, 2026, doi: 10.59576/sr.1192.
[33] W. Pan, T. Xie, Z. Wang, and L. Ma, “Digital Economy: An Innovation Driver for Total Factor Productivity,” *Journal of Business Research*, vol. 139, pp. 303–311, 2022, doi: 10.1016/j.jbusres.2021.09.061.
[34] J. Zhang, W. Zhao, B. Cheng, A. Li, Y. Wang, N. Yang, and Y. Tian, “The Impact of Digital Economy on the Economic Growth and the Development Strategies in the Post-COVID-19 Era: Evidence from Countries Along the ‘Belt and Road,’” *Frontiers in Public Health*, vol. 10, Art. no. 856142, 2022, doi: 10.3389/fpubh.2022.856142.

SaNa: Journal of Blockchain, NFTs and Metaverse Technology
Vol 4, Issue 1, February 2026, Pages 286-300
ISSN: 3030-9832 (Media Online)
DOI: https://doi.org/10.58905/sana.v4i1.741

[35] J. Borowski, J. Fidrmuc, and K. Jaworski, "Artificial Intelligence and Inflation in the EU," *Economics Letters*, vol. 257, Art. no. 112638, 2025, doi: 10.1016/j.econlet.2025.112638.
[36] K. Jaworski, "Measuring Inflation Expectations Using Artificial Intelligence," *Computational Economics*, 2025, doi: 10.1007/s10614-025-11231-5.
[37] F. Chowdhury, A. S. Anwar, and M. A. Sayem, "Using AI and Big Data to Predict Inflation Trends Based on Global Economic Sentiment," SSRN, 2025.
[38] Y. R. Kim, "Taxing the Metaverse," *Georgetown Law Journal*, vol. 112, pp. 787–839, 2024.
[39] L. Hughes, Y. K. Dwivedi, T. Malik, M. Shawosh, M. A. Albashrawi, I. Jeon, V. Dutot, M. Appanderanda, T. Crick, R. De, M. Fenwick, S. M. Gunaratnege, P. Jurcys, A. K. Kar, N. Kshetri, K. Li, S. Mutasa, S. Samothrakis, M. Wade, and P. Walton, "AI Agents and Agentic Systems: A Multi-Expert Analysis," *Journal of Computer Information Systems*, vol. 65, no. 4, pp. 489–517, 2025, doi: 10.1080/08874417.2025.2483832.
[40] H. Marah and M. Challenger, "MADTwin: A Framework for Multi-Agent Digital Twin Development: Smart Warehouse Case Study," *Annals of Mathematics and Artificial Intelligence*, vol. 92, pp. 975–1005, 2024, doi: 10.1007/s10472-023-09872-z.