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A Macroeconomic Model with Property-Rights Capital

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Property-rights capital stands as a fragile entity, encountering obstacles, regressions, and challenges worldwide. This underscores the necessity to endogenize both property-rights capital accumulation and physical capital accumulation within an integrated dynamic framework. This paper explores the complex interplay between economic variables and institutional capital. The study reveals that property-rights capital, serving as institutional capital, is deeply interconnected with the accumulation of physical capital, economic growth, and development. Notably, when the cost of property-rights capital formation rises, it results in decreased long-run property-rights investment, the accumulation of property-rights capital, physical capital, and consumption. An increase in the depreciation rate of property-rights capital and a decline in total factor productivity would impact property-rights capital similarly.

Key Words: Property rights; Property-rights capital; Institutional capital; Rule of law; Economic growth; Economic development.

JEL Classification Numbers: C61, P14, P16, P51, O11.

1. INTRODUCTION

Property rights encompass the extent of control and ownership that individuals or entities hold over both tangible and intangible assets that they legally possess. These rights include exclusive use, allowing owners to utilize their property without interference from others, provided it does not infringe on others' rights or violate laws (Durlauf and Blume, 2016). Property owners also have the right to transfer, sell, lease, or gift their property, subject to legal constraints and contractual agreements, as well as the right to exclude others from using or accessing their property without permission, except in cases where public interests or legal exceptions apply (Alchian, 1965). Moreover, property owners are entitled to derive benefits and enjoyment from their property, including the right to profit from its use, receive

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income, and make lawful improvements or alterations. Additionally, property owners have the authority to dispose of their property through various means, such as selling or bequeathing it in a will (Alchian, 1965; Alchian and Demsetz, 1973; Demseta, 1972). However, the scope of property rights may differ across jurisdictions and may be subject to legal limitations, zoning regulations, environmental laws, and public policies aimed at balancing individual property rights with broader societal interests, such as environmental conservation and urban planning. Furthermore, property rights extend to intellectual property, including patents, copyrights, and trademarks, granting individuals and businesses exclusive rights to their creations and innovations.

Political philosophers and economists have emphasized the crucial role of property rights in fostering economic growth and prosperity, yet property insecurity remains a pervasive global issue. In developed nations, citizens contend with challenges like environmental pollution and encroachment by hunters or neighboring livestock, while in the developing world, vulnerable individuals face the risk of property seizure by powerful entities such as tribal leaders, with women often disproportionately affected. Additionally, the looming threat of eminent domain poses the risk of state expropriation without adequate compensation. At the core of property insecurity lies a profound distrust in legal and law enforcement institutions to protect the rights of the vulnerable against the powerful, undermining confidence in the legal system and hindering economic progress by deterring investment and stifling entrepreneurial initiatives De Soto et al. (1989). Addressing property insecurity requires robust legal frameworks and effective enforcement mechanisms to universally safeguard property rights, ensuring equitable access to justice and fostering an environment conducive to economic prosperity and social stability (Cohler, Miller and Stone, 1989).

According to the International Property Rights Index (IPRI, 2024), property rights, inherently linked to human rights, have demonstrated their role in fostering economic growth, social development, prosperity, and innovation, while also serving as a crucial mechanism for safeguarding civil liberties. This underscores the importance of a robust system of property rights in protecting individual freedom. Despite four consecutive years of setbacks in the average IPRI score and its components, there has been a slight recovery of approximately 0.37% in the IPRI, attributed largely to improvements in Intellectual Property Rights (IPR) by approximately 2%. However, the other two components, namely Legal and Political Environment (LP) and Physical Property Rights (PPR), continue to decline. Overall, the IPRI underscores the vital role of property rights in economic prosperity and the rule of law.

This paper seeks to elucidate the concept of property rights as a dynamic process, encompassing both tangible and intangible investments in

property rights as a form of institutional capital accumulation, alongside considerations of consumption and physical capital accumulation. The evolution of property rights institutions has been an ongoing journey spanning from ancient civilizations to the contemporary era. Scholarly contributions by North and Thomas (1973), North (1990), Barzel and Allen (2023), and others underscore gradual institutional shifts over centuries that have facilitated the adoption of emerging technological advancements. Crucial to these transformations are significant changes in institutions, particularly property rights and the societal norms regulating them. The paper is structured as follows: Section 2 provides a concise overview of the gradual development and accumulation of property-rights capital, exploring its economic, political, and legal implications; Sections 3 introduces a formal dynamic model for analyzing property-rights capital accumulation and its relationship with economic growth; finally, Section 4 concludes the study with key insights.

2. THE CONCEPT OF PROPERTY-RIGHTS CAPITAL AND ITS SIGNIFICANT RAMIFICATIONS

Property-rights capital refers to the collective value derived from the legal recognition, protection, and enforcement of property rights within a society or economic system. It encompasses the tangible and intangible assets, including land, real estate, intellectual property, and other forms of ownership, as well as the broader institutional framework that supports and governs these rights.

2.1. A brief, selected review of the gradual accumulation of property-rights capital in history

Property rights represent a cornerstone of institutional capital, serving as a linchpin within legal, economic, and social spheres. Embedded within legal systems, they offer stability and assurance by providing a foundation for ownership laws, thereby fostering predictability and security. This legal safeguarding, in turn, fuels investment and economic dynamism by engendering trust and facilitating seamless market transactions. The clarity and enforceability of property rights encourage individuals and businesses to engage in productive endeavors, innovation, and entrepreneurial ventures, thus propelling wealth creation and capital accumulation. Moreover, these rights incentivize responsible resource stewardship as owners are motivated to preserve and enhance the value of their assets. Furthermore, property rights empower individuals, bestowing upon them a sense of security and control over their possessions, thereby bolstering social stability and fostering trust within communities. Additionally, nations with robust property rights frameworks often attract international investment and drive global

trade, underscoring the pivotal role of these rights in shaping economic prosperity on a global scale. In essence, the recognition and protection of property rights are fundamental to the fabric of institutional capital, fueling economic growth, enhancing social cohesion, and promoting individual well-being.

The trajectory of investments in property-rights capital spans human history, influenced by economic, social, and political dynamics, tracing a transition from communal living to complex governance systems.[1] From early hunter-gatherer societies devoid of modern notions of private ownership to the agricultural revolution anchoring individuals to specific territories, the evolution unfolds through epochs like ancient civilizations with distinct legal frameworks governing property rights. Roman law introduced absolute ownership and formalized property transfer mechanisms, while feudalism concentrated land ownership among nobility, and pivotal documents like the Magna Carta laid the groundwork for property rights protections. The Enclosure Movement in England shifted towards privatization, fostering individualistic property ownership, while the Enlightenment era emphasized individual rights, influencing property rights discourse. Capitalism and the Industrial Revolution emphasized individual ownership's centrality in eco-

[1]The commandments listed in Exodus 20:13-17 are often interpreted as encompassing principles related to property rights, as well as broader concepts such as life and liberty. Here's how each commandment can be understood in the context of property rights:
"You shall not murder": This commandment protects the sanctity of life, which is considered a fundamental aspect of individual rights. In a broader sense, it can be interpreted as safeguarding one's right to own their life, implying that no one has the authority to unjustly take the life of another person.
"You shall not commit adultery": While primarily addressing marital fidelity, this commandment also respects the institution of marriage, which involves a mutual agreement and commitment between individuals. Adultery can be seen as a violation of the property rights of one's spouse, as it breaches the exclusive rights and trust inherent in the marital relationship.
"You shall not steal": This commandment directly addresses the protection of property rights by prohibiting the unauthorized taking of another person's possessions. It upholds the principle that individuals have a right to own and enjoy their property without fear of theft or infringement.
"You shall not give false testimony against your neighbor": By forbidding false testimony or bearing false witness, this commandment promotes the integrity of legal proceedings and the justice system. It safeguards individuals' rights to a fair trial and protection against false accusations, thereby indirectly protecting their property rights from unjust legal actions.
"You shall not covet your neighbor's house...or anything that belongs to your neighbor": This commandment addresses the attitudes and desires that can lead to violations of property rights. Coveting, or desiring what belongs to others, is considered a precursor to theft or other infringements on property rights. By discouraging envy and covetousness, this commandment reinforces respect for the property of others.
Hence, these commandments emphasize the importance of respecting and protecting property rights as essential components of a just and moral society, alongside broader principles such as the sanctity of life and the pursuit of truth and justice.

nomic freedom, solidifying property rights recognition through legal codifications, culminating in contemporary globalization efforts underscoring property rights' indispensability to economic progress.

England's foundation of property rights and the rule of law evolved through a complex process influenced by ancient Greece and Rome, primarily through Roman legal principles absorbed into English common law during Roman occupation and through study by English jurists. Roman legal concepts like absolute ownership and property transfer methods integrated into English legal frameworks, while Greek philosophical ideas indirectly impacted legal thought. Throughout the medieval period, English legal institutions evolved, amalgamating Norman legal customs with Anglo-Saxon and Roman traditions, reinforced by key milestones like the signing of the Magna Carta, extending rights to all English citizens. This tradition of common law refined and codified property rights and the rule of law, establishing a robust system of legal precedent and consistency, laying the groundwork for England's enduring legal framework.

Furthermore, the legal and property rights framework of the United States is a composite of influences from Ancient Rome and England, with English common law standing as the primary cornerstone due to the historical trajectory of American law. The English common law principles, which had evolved over centuries in England, were transplanted to America by English settlers, laying the groundwork for legal concepts such as property rights, contracts, and the rule of law. While the influence of Roman law is less direct, the Founding Fathers of the United States were acquainted with Roman legal principles and drew inspiration from them in structuring the American legal system. These principles, encompassing the protection of property rights, due process, and contract enforcement, are enshrined in the U.S. Constitution and have evolved through centuries of judicial interpretation and legislative action to adapt to societal changes. Thus, the legal landscape of the United States reflects a fusion of English common law traditions with elements of Roman legal thought, demonstrating a dynamic process of adaptation and evolution to meet the evolving needs of society.

The accumulation of property-rights capital and the establishment of the rule of law in Spain, Portugal, and their colonies in Latin America have been marred by challenges and a tumultuous history. During the colonial era, Spain and Portugal prioritized extractive systems that benefited colonial powers, neglecting institutions to protect property rights or uphold the rule of law. Wealth and power became concentrated in a small elite, while the majority faced oppression and dispossession. Legal systems served the ruling elite, perpetuating inequality, particularly marginalizing indigenous peoples and enslaved Africans. After independence, Latin American nations struggled to establish effective legal frameworks amid political in-

stability and entrenched elite interests. Corruption and weak institutions hindered reform efforts, perpetuating social injustice and economic stagnation. Despite contemporary efforts to strengthen legal systems, challenges such as corruption and social inequality persist, rooted in the legacy of colonialism and historical injustices, highlighting the ongoing struggle to build robust property-rights capital and uphold the rule of law.

The gradual accumulation of property-rights capital reflects a dynamic interplay of economic, legal, and philosophical forces across history. While deeply rooted in historical precedent, the concept continues to evolve in response to shifting social, economic, and political landscapes, embodying a timeless journey of adaptation and refinement. Investing in the property-rights capital entails a multifaceted approach involving legal, administrative, and enforcement measures, each with its associated costs. Legal expenses encompass the establishment and upkeep of a legal framework delineating and safeguarding property rights, while administrative costs involve the procedures required for property registration, dispute resolution, and law enforcement. Enforcement expenditures encompass the allocation of resources to policing and judicial activities aimed at deterring and addressing infringements on property rights. These investments are indispensable for ensuring secure property rights, which serve as the bedrock for fostering economic growth, encouraging investment, and maintaining social stability. The overall cost varies depending on the efficiency and intricacy of a country's legal and administrative systems. Furthermore, the formation of property-rights capital necessitates the establishment of a robust legal and administrative infrastructure, encompassing land registries, legal institutions for dispute resolution, and law enforcement agencies to prevent violations. This process also entails the development of clear laws and regulations defining property rights. Such capital formation is vital for economic development, as secure property rights incentivize investment, innovation, and efficient resource allocation. Ultimately, investing in the property-rights capital, through legal, administrative, and enforcement channels, gradually accumulates capital in this domain, leading to a more resilient and effective system for safeguarding property rights. This accumulated capital facilitates economic growth, encourages investment, and fosters social stability by ensuring reliable protection of property rights and fair resolution of disputes.

2.2. Property right provides individuals autonomy

This assertion reflects the perspective of Pipes (1999), this viewpoint resonates with a broader philosophical and political argument often affiliated

with classical liberal and capitalist ideologies, delving into the underlying principles behind this statement.[2]

Firstly, it suggests a fundamental link between individual freedom and the ownership of property, echoing classical liberal thought where property ownership is deemed essential for personal liberty (Hayek 1944, 1960). Secondly, property rights are viewed as crucial for fostering economic freedom, providing individuals with autonomy and incentivizing innovation and productivity. Moreover, ownership of property serves as a safeguard against arbitrary state power, offering a sphere of autonomy protected from government interference (Friedman, 2016). Additionally, it fosters incentives for productivity as individuals invest resources in improving their property, thereby contributing to economic growth. Furthermore, protecting property rights is seen as a means to decentralize economic and political power, preventing its concentration in the hands of a few. Integral to market mechanisms, property rights allow for efficient resource allocation, responding to supply and demand. Moreover, they uphold the rule of law, contributing to a stable environment for individuals and businesses.

Historical evidence and records have supported the assertion: In medieval Europe, during the feudal system, peasants were tied to the land they worked and had little to no ownership rights. They were subject to the whims of feudal lords and had limited personal freedom. The absence of property rights meant that individuals had little control over their economic destinies and were essentially bound to the land and obligations imposed by the feudal hierarchy. Whatsmore, throughout history, colonial powers have frequently deprived indigenous peoples of their traditional lands and re-

[2]Recall the perspectives of James Harrington, a 17th-century English political theorist, regarding the relationship between property distribution and various forms of government:
Monarchical Property Ownership: Harrington proposed that when property ownership is highly concentrated in the hands of a single individual, it tends to facilitate the establishment of monarchy. Under such a system, the monarch possesses substantial wealth and authority, with governmental decisions often aligning with the monarch's personal interests and goals.
Oligarchic Property Ownership: Harrington argued that if property is owned predominantly by a privileged few, it typically leads to the emergence of a republican form of government. In a republic, power is frequently consolidated within a ruling class or aristocracy, who wield significant property holdings and influence the direction of the state.
Democratic Property Distribution: Harrington asserted that widespread property ownership among the general populace tends to give rise to democratic governance. In a democracy, political power is decentralized, and decision-making authority is distributed among the broader citizenry rather than being concentrated in a select elite.
Harrington's principle (Harrington, 1887) underscores his belief in the intrinsic link between property ownership patterns and the structure of political authority within a society. He viewed the distribution of property as a crucial factor shaping the political framework and governance mechanisms.

sources without regard for their property rights. This dispossession resulted in loss of autonomy, cultural disruption, and economic marginalization for indigenous communities. The absence of property rights contributed to the exploitation and subjugation of indigenous peoples by colonial authorities.

In the 20th century, there are still nations that suppressed individual freedoms, stifled entrepreneurship and innovation, and precipitated widespread economic stagnation and poverty. The collectivization of agriculture, for instance, engendered inefficiencies, food shortages, and famine. Extensive government oversight, have often led to the concentration of power and wealth among a select few. The process typically involves the centralization of economic control, empowering government officials and bureaucrats to dictate resource allocation and wealth distribution. Consequently, assets become monopolized, accruing to government elites and affiliated individuals or groups, fostering corruption and nepotism amidst a dearth of accountability and transparency. The resulting lack of oversight facilitates the erosion of political freedoms, enabling leaders to suppress dissent and consolidate authoritarian rule. Moreover, the structures inhibit innovation, entrepreneurship, and economic growth, perpetuating stagnation and inefficiency.

Pipes and Bracken (1974), Pipers (1990) and Pipers (1993) posited that Muscovy's distinctive trajectory was in absence of a property concept. Muscovy's devoid property concept, unlike its European counterparts, rendered everything as the domain of the Grand Duke or Tsar, fostering a patrimonial system where the ruler wielded extensive control over resources and wealth. This lack of property rights, according to Pipes and Bracken (1974), reinforced Muscovy's autocratic governance structure, as the concentration of power and wealth in the ruler's hands, devoid of the checks and balances offered by property-owning classes, cemented autocracy in Russia. Despite attempts at modernization in the 19th century, Pipes argued that Russia's "patrimonial" framework endured largely unchanged, impeding the emergence of a more pluralistic system.

2.3. Current challenges to property-rights protection

The formation and accumulation of property-rights capital, crucial for protecting property, have encountered considerable hurdles across diverse regions such as Latin America and Africa in recent history. In these regions, efforts to establish secure property rights have been impeded by a myriad of challenges, including inadequate legal frameworks, disputes over land ownership, and complex socio-political dynamics. These persistent obstacles in property rights governance have hampered economic development and undermined investor confidence, highlighting the ongoing struggles in amassing property-rights capital in contemporary contexts.

Furthermore, the erosion of property rights capital is evident even in Europe and the United States, where the proliferation of robust public sectors and governments has exacerbated the situation. Certain European countries with extensive welfare states have witnessed a noticeable trend towards heightened government intervention in property rights through measures like stringent land-use regulations and taxation policies. These interventions often restrict property owners' autonomy and control over their assets, hindering the accumulation of property rights capital. Similarly, in the United States, governmental expansion across various levels has led to onerous regulations and zoning restrictions encroaching upon property rights. Controversial eminent domain laws have exacerbated the issue, enabling governments to seize property for public purposes, resulting in disputes over fair compensation and infringements on property rights. Additionally, debates surrounding environmental regulations and property rights have underscored the tensions between property ownership and governmental interference, indicating a broader erosion of property rights capital in Western democracies and raising concerns about individual liberties and economic freedoms amidst expanding government authority (Demsetz, 1972).

After the end of 1991, Russia embarked on a transition to a market-based economy. However, this transition was fraught with difficulties, including inadequate legal frameworks, corruption, and political instability, which hindered the effective establishment of property rights. The privatization process itself was marred by controversies and accusations of asset-stripping and insider deals, leading to widespread mistrust in the newly emerging private sector. Moreover, the lack of clear property rights and enforcement mechanisms created uncertainties for investors, deterring both domestic and foreign investment. Despite efforts to reform property laws and improve the business environment, challenges persist, and property rights remain precarious in Russia, impacting economic development and investor confidence.

Hence, property-rights capital emerges as a vulnerable entity facing obstacles, regressions, and challenges globally. This underscores the necessity to integrate both property-rights capital accumulation and physical capital accumulation within a unified dynamic framework. Through this holistic approach, our goal is to explore the intrinsic interaction and integration between property rights, institutional capital, physical capital, and economic progress. Ultimately, by elucidating these complex dynamics, we seek to provide deeper insights into the intricate interplay shaping property-rights capital, economic growth, and overall societal development.

3. A DYNAMIC MODEL OF PROPERTY-RIGHTS CAPITAL AND ECONOMIC GROWTH

3.1. The Model specification

Let P be the property-rights capital, p be the new investments in protecting property rights, c be final goods consumption, and K be physical capital. The utility function of the representative agents is $U(c, p, P)$, and the production function is $f(K, p, P)$. An increase in property-rights-protection investment p and the property-rights-protection capital P contributes positively to utility and production for both consumers and producers for obvious reasons: (i) Enhanced Security and Stability: When property rights are well-protected, individuals and businesses feel more secure in their investments and assets. This security fosters confidence and stability in the economy, encouraging consumers to spend and producers to invest in expansion, innovation, and productivity-enhancing measures; (ii) Incentive for Investment and Innovation: Strong property rights protection provides individuals and businesses with the assurance that they will reap the rewards of their investments and innovations. This incentive encourages entrepreneurs to take risks, develop new products and services, and engage in long-term ventures that contribute to economic growth and competitiveness; (iii) Efficient Allocation of Resources: Property rights protection facilitates the efficient allocation of resources by allowing markets to function effectively. With clear ownership rights and legal mechanisms for resolving disputes, resources are allocated based on market demand and supply dynamics, leading to optimal production levels and allocation efficiency. (iv) Access to Credit and Capital: Property rights serve as collateral for accessing credit and capital in financial markets. When property rights are well-defined and enforceable, individuals and businesses can use their assets as security to obtain loans, invest in expansion projects, and pursue entrepreneurial opportunities. This access to capital fuels economic activity and promotes investment in productive ventures; (v) Promotion of Competition and Innovation: Property rights protection fosters a competitive environment where businesses compete based on quality, price, and innovation. With confidence in their ability to protect intellectual property and proprietary information, firms are more willing to invest in research and development, product differentiation, and market competition, leading to greater consumer choice and technological advancement; (vi) Attracting Foreign Investment: Countries with strong property rights protection regimes often attract foreign investment and talent. Investors are more inclined to allocate capital to jurisdictions where their property rights are safeguarded, reducing investment risks and promoting economic development. Additionally, a robust property rights framework can enhance a country's reputation as a safe and transparent investment destination; (vii) Encouraging Long-Term Planning and Investment: Property rights protec-

tion encourages individuals and businesses to engage in long-term planning and investment strategies. With confidence in their property rights, stakeholders are more likely to make investments in infrastructure, human capital, and sustainable development initiatives that yield long-term benefits for society as a whole.

Therefore, at the heart of a flourishing market economy lies property-rights capital, which is intricately connected to the rule of law and individual freedoms. This institutional framework not only ensures secure ownership of assets but also guarantees that individuals reap the rewards of their labor and have the autonomy to make unrestricted market decisions. Consequently, it fosters incentives for both utility and profit maximization. Oskar Lange's debate with Mises and Hayek fails to acknowledge that property rights, the rule of law, and liberties are not inherently ingrained in people's production and utility functions within such a system. Furthermore, in many developing capitalist economies under authoritarian regimes and in several US states where left-leaning Democrats hold power, the lack of robust property rights and adherence to the rule of law raise concerns about safeguarding what is produced and ensuring freedom in making consumption choices.

The agents accumulate the property-rights-protection capital and production capital, respectively, as follows:

$$\frac{dP}{dt} = p - \delta_P P,$$

$$\frac{dK}{dt} = f(K, p, P) - c - vp - \delta_K K,$$

where δ_P and δ_K are the depreciation rates of the property-protection capital and production capital, respectively; v is the unit price of new investment in upholding property rights. The initial stocks of the property-rights-protection capital and production capital are give by $P(0) = P_0$ and $K(0) = K_0$, respectively.

The representative agent maximizes his discounted utility at a subjective time preference $\rho > 0$,

$$\max \int_0^\infty U(c, p, P) e^{-\rho t} dt,$$

subject to the two capital accumulation paths mentioned above.

The total cost of upholding property rights, denoted as vp, encompasses a range of expenses and efforts essential for ensuring the protection, enforcement, and maintenance of property rights within a legal and societal framework. These components include legal expenses, such as fees for drafting

contracts and legal proceedings; enforcement costs, covering law enforcement and judicial systems; regulatory compliance expenses, including adherence to zoning and environmental regulations; insurance premiums for property coverage; monitoring and surveillance costs to prevent trespassing and vandalism; investments in security measures like alarm systems and guards; expenses related to litigation and dispute resolution; due diligence costs for property transactions; educational initiatives to promote understanding of property rights; and opportunity costs associated with resource allocation. These various elements collectively contribute to the comprehensive cost structure involved in upholding property rights.

Through new investments in protecting property rights, the representative agents aim to accumulate the stock of property-rights capital following $\frac{dP}{dt} = p - \delta_P P$. The process of accumulating property rights involves allocating resources, efforts, and expenditures to bolster the legal, institutional, and practical frameworks that safeguard these rights. Representative agents invest in various avenues to protect property rights, including legal services, security measures, regulatory compliance, insurance coverage, and other mechanisms. These investments aim to strengthen the legal framework governing property rights, enhance security measures, mitigate risks associated with property ownership, and facilitate legal enforcement and dispute resolution. Additionally, investments may target community engagement, education, technology, and innovation to promote respect for property rights and foster economic activity. By accumulating the capital stock of property rights protection, representative agents strive to create an environment conducive to economic growth, stability, and social well-being, ultimately contributing to prosperity and development in communities and societies.

3.2. An example with CRRA utility and a Cobb-Douglas production function

To maintain model simplicity, we opt for a basic specification featuring the CRRA utility function and the Cobb-Douglas production function. Unlike traditional literature, our model framework considers a representative agent who engages in consumption, production, and property investment simultaneously. This modeling approach is adopted because, historically, every citizen could participate in the consumption and accumulation of property-rights capital. The representative agent's utility function takes the form:

$$U(c,p,P) = \frac{c^{1-\sigma}-1}{1-\sigma} + \theta\frac{p^{1-\tau}-1}{1-\tau} + \kappa\frac{P^{1-\psi}-1}{1-\psi}, \tag{1}$$

For simplicity, we omit the time subscript t of the variables in the model. For example, P represents the accumulation of property-rights capital at

the current period t, and P^* represents the steady-state value of this variable. Where c is the final goods consumption, σ represent the coefficient of relative risk aversion and also is the intertemporal elasticity of substitution. The representative agent derives utility not only from the consumption of final goods but also from new investments in protecting property rights p and the stock of property rights capital P accumulated in the social environment. We use θ and κ to measure the relative preferences of the representative agent for p and P, respectively.

In a continuous-time and infinite-horizon model framework, the representative agent maximizes the discounted utility with a subjective time preference $\rho > 0$:

$$\max \int_0^\infty U(c, p, P)e^{-\rho t}dt, \tag{2}$$

The representative agent uses physical capital and property-rights capital to produce output Y :

$$Y = f(K, P) = AK^\alpha P^\beta, \tag{3}$$

where A represents the aggregate productivity, α and β measure the productivity of physical capital and property-rights capital, respectively.[3]

The dynamic equations governing the accumulation of physical capital and property-rights capital are as follows:

$$\dot{K} = f(K, P) - c - vp - \delta_K K, \tag{4}$$

$$\dot{P} = p - \delta_P P. \tag{5}$$

Where $f(K, P)$ is the aggregate production, v represent the cost of investment in property-right capital. δ_K and δ_P defined the depreciation rate of the two state variables K and P, both of them are exogenous. The accumulation of property capital is achieved through the representative agent's investment in protecting property in each period.

Maximizes the objection function (2) subject to (4) and (5), we can derive the current-value Hamiltonian function :

$$\mathcal{H} = \frac{c^{1-\sigma} - 1}{1-\sigma} + \theta\frac{p^{1-\tau} - 1}{1-\tau} + \kappa\frac{P^{1-\psi} - 1}{1-\psi} + \lambda_1[f(K, P) - c - vp - \delta_K K] + \lambda_2[p - \delta_P P]. \tag{6}$$

Where λ_1 and λ_2 represent the costate variable corresponding to the two budget constrains. The first-order conditions for optimal choices are:

$$c^{-\sigma} - \lambda_1 = 0, \tag{7}$$

[3] $0 < \alpha$, $0 < \beta$, $\alpha + \beta < 1$ which holds to insure the existence of equilibrium with the condition of $A > 0$.

$$\theta p^{-\tau} - \lambda_1 v + \lambda_2 = 0, \tag{8}$$

$$\lambda_1(f_K - \delta_K) = \rho\lambda_1 - \dot{\lambda_1}, \tag{9}$$

$$\kappa P^{-\psi} + \lambda_1 f_P - \lambda_2 \delta_P = \rho\lambda_2 - \dot{\lambda_2}. \tag{10}$$

By simplifying these above FOCs, the Hamiltonian multiplier can be rewritten as:

$$\lambda_1 = c^{-\sigma}, \lambda_2 = c^{-\sigma} v - \theta p^{-\tau}. \tag{11}$$

Under the consition of $\theta p^{-\tau} < c^{-\sigma}(v-1)$, relaxing the proprity-right capital accumulation constraint has a larger marginal impact on the objective compared to relaxing the physical capital accumulation constraint. Differentiate (7) with respect to t and then substitute λ_1 and $\dot{\lambda_1}$ into (9), the specific form of $\dot{c_t}$ can be described as:

$$\dot{c} = \frac{c}{\sigma}(f_K - \delta_K) - \frac{\rho c}{\sigma}. \tag{12}$$

Which means that the greater the total output, the lower the depreciation rate of physical assets, leading to an increase in the consumption of the representative agent. By differentiating (8) with respect to t, the specific form of $\dot{\lambda_2}$ can be derived:

$$\dot{\lambda_2} = -\sigma c^{-\sigma-1} v\dot{c} + \theta\tau p^{-\tau-1}\dot{p}, \tag{13}$$

Substitute λ_1, λ_2 and $\dot{\lambda_2}$, $\dot{c_t}$ into (10) to derive the motivation function of $\dot{p_t}$:

$$\dot{p} = \frac{c^{-\sigma} p^{\tau+1} v(\delta_P - \delta_K + f_K)}{\theta\tau} - \frac{p_t(\rho + \delta_P)}{\tau} - \frac{\kappa P^{-\psi} p^{\tau+1} + f_P c^{-\sigma} p^{\tau+1}}{\theta\tau}. \tag{14}$$

By simplifying the above results, we can use a four-dimensional dynamical system to characterize the dynamics of this model. Unlike traditional models, the representative agent selects the control variables final goods consumption c and property-right capital p while two state variables physical capital K and property-right capital P, participate in economic activities. We can derive the four-dimensions dynamic system:

$$\dot{c} = \frac{c}{\sigma}(f_K - \rho - \delta_K), \tag{15}$$

$$\dot{p} = \frac{c^{-\sigma} p^{\tau+1} v(\delta_P - \delta_K + f_K)}{\theta\tau} - \frac{p(\rho + \delta_P)}{\tau} - \frac{f_P c^{-\sigma} p^{\tau+1} + \kappa P^{-\psi} p^{\tau+1}}{\theta\tau}, \tag{16}$$

$$\dot{P} = p - \delta_p P, \tag{17}$$

$$\dot{K} = f - \delta_K K - c - vp. \tag{18}$$

3.3. Equilibrium and Dynamic System

In this section, we solve for the values of each variable at the steady state based on the four-dimensional dynamical system derived above. The steady-state values of the key variables in the four-dimensional dynamical system are (c^*, p^*, P^*, K^*), which satisfy the following conditions:

$$A\alpha K^{*\alpha-1} P^{*\beta} = f_K^* = \rho + \delta_K, \tag{19}$$

$$c^{*-\sigma} p^{*\tau} [v(\delta_P - \delta_K + f_K^*) - f_P^*] = \theta(\rho + \delta_P) + \kappa P^{*-\psi} p^{*\tau}, \tag{20}$$

$$p^* = \delta_P P^*, \tag{21}$$

$$AK^{*\alpha} P^{*\beta} - \delta_K K^* = c^* + vp^*. \tag{22}$$

Using (19), P^* can be described as a function of K^*:

$$P^* = \left[\frac{\rho + \delta_K}{A\alpha K^{*\alpha-1}} \right]^{\frac{1}{\beta}}, \tag{23}$$

Based on the parameter constraints $0 < a < 1$ and $0 < b < 1$, if more physical capital is accumulated at the steady state, the corresponding accumulation of property capital at the steady state will also be greater. Substituting (21) into (22) yields another equation of P^* and K^*:

$$AK^{*\alpha} P^{*\beta} - \delta_K K^* = c^* + v\delta_p P^*. \tag{24}$$

Using (21) , (24) and (23) to simplify equation (20) leads to a nonlinear equation $\Gamma(K)$ at the steady state only with physical capital K^*:

$$\begin{aligned} &\delta_P^{\tau} \left(\frac{\rho + \delta_K}{A\alpha K^{*\alpha-1}} \right)^{\frac{\tau}{\beta}} \left[\frac{(\rho + \delta_K)}{\alpha} K - \delta_K K - v\delta_P \left(\frac{\rho + \delta_K}{A\alpha K^{*\alpha-1}} \right)^{\frac{1}{\beta}} \right]^{-\sigma} \\ &\times \left[v(\delta_P + \rho) - A\beta K^{\alpha} \left(\frac{\rho + \delta_K}{A\alpha K^{*\alpha-1}} \right)^{\frac{\beta-1}{\beta}} \right] \\ &- \theta(\rho + \delta_P) - \kappa\delta_P^{\tau} \left(\frac{\rho + \delta_K}{A\alpha K^{*\alpha-1}} \right)^{\frac{\tau-\psi}{\beta}} = 0. \end{aligned} \tag{25}$$

Linearize tthe four-dimension dynamic system around the steady state, where $\dot{c}_t = 0$, $\dot{p}_t = 0$, $\dot{K}_t = 0$, $\dot{P}_t = 0$:

$$\begin{bmatrix} \dot{c} \\ \dot{p} \\ \dot{K} \\ \dot{P} \end{bmatrix} = \begin{bmatrix} \frac{f_K - \rho - \delta_k}{\sigma} & 0 & \frac{c^*}{\sigma} f_{KK} & \frac{c^*}{\sigma} f_{KP} \\ J_{21}^* & J_{22}^* & J_{23}^* & J_{24}^* \\ -1 & -v & f_K^* - \delta_K & f_P^* \\ 0 & 1 & 0 & -\delta_P \end{bmatrix} \begin{bmatrix} c - c^* \\ p - p^* \\ K - K^* \\ P - P^* \end{bmatrix} \tag{26}$$

Where:

$$f_K^* = \alpha A K^{*\alpha-1} P^{*\beta}, f_P = \beta A K^{*\alpha} P^{*\beta-1},$$

$$f_{KK}^* = \alpha(\alpha-1) A K^{*\alpha-2} P^{*\beta}, f_{KP}^* = \alpha\beta A K^{*\alpha-1} P^{*\beta-1},$$

$$J_{21}^* = \frac{-\sigma c^{*-(\sigma+1)} p^{*\tau+1}}{\theta\tau} [v(\delta_P - \delta_K + f_K^*) - f_P^*], \tag{27}$$

$$J_{22}^* = \frac{(\tau+1) c^{*-\sigma} p^{*\tau}}{\theta\tau} [v(\delta_P - \delta_K + f_K^*) - f_P^*] - \frac{\rho + \delta_P}{\tau} - \frac{(\tau+1)\kappa P^{*-\psi} p^{*\tau}}{\theta\tau}, \tag{28}$$

$$J_{23}^* = \frac{c^{*-\sigma} p^{*\tau+1}}{\theta\tau} (v f_{KK}^* - f_{PK}^*), \tag{29}$$

$$J_{24}^* = \frac{c^{*-\sigma} p^{*\tau+1}}{\theta\tau} (v f_{KP}^* - f_{PP}^*) + \frac{\kappa\psi P^{*-(\psi+1)} p^{*\tau+1}}{\theta\tau}. \tag{30}$$

3.4. Simulation results

3.4.1. The steady-state values of the four endogenous variables

We use the following parameter values to solve for the steady-state values of the four endogenous variables:

We follow Acemoglu and Akcigit (2012) to set the time preference rate $\rho = 0.05$ as the standard value in constinuous-time modelling. Following Acemoglu et al. (2018), we set the coefficient of relative risk aversion of final goods consumption $\sigma = 2$. We set the depreciation rate of physical capital δ_K to 0.1 as the standard economic models.

Given parameter values in Table 1, the model has a unique steady state, physical capital can be determined solely by the nonlinear equations (22) and shown in Figure 1.

The steady-state values of the model are:

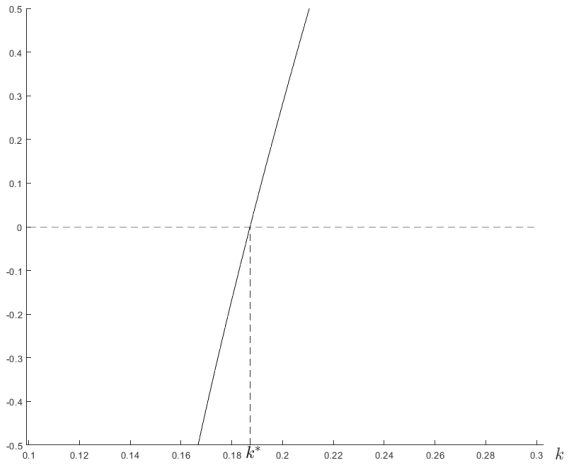
$$c^* = 0.0367, p^* = 0.0074, P^* = 0.0737, K^* = 0.1872.$$

TABLE 1.

Table of Parameters

Parameter	Description	Value
ρ	Subjective discount rate	0.05
σ	Coefficient of relative risk aversion of final goods consumption	2.46
τ	Coefficient of relative risk aversion of property-rights investments	0.8
ψ	Coefficient of relative risk aversion of property-rights capital	0.8
θ	Preference for property-rights investments	0.6
κ	Preference for property-rights capital	0.75
δ_P	Depreciation rate of the property-rights capital	0.1
δ_K	Depreciation rate of physical capital	0.1
α	Productivity of physical capital	0.4
β	Productivity of property-right capital	0.3
v	Price of property-rights investments	2
A	Exogenous level of total factor productivity	0.3

FIG. 1. The steady state of physical capital K



The optimal paths for the four endogenous variables are:

$$\begin{bmatrix} c \\ p \\ K \\ P \end{bmatrix} = \begin{bmatrix} c^* \\ p^* \\ K^* \\ P^* \end{bmatrix} + a_1 V_1 e^{\mu_1 t} + a_2 V_2 e^{\mu_2 t} + a_3 V_3 e^{\mu_3 t} + a_4 V_4 e^{\mu_4 t}, \qquad (31)$$

where the eigenvalues and corresponding eigenvectors of (26) are:

$$\mu_1 = -1.2507, \mu_2 = -0.0300, \mu_3 = -0.0800, \mu_4 = 1.3007,$$

$$V_1 = \begin{bmatrix} -0.0092 \\ -0.4566 \\ -0.7963 \\ 0.3968 \end{bmatrix}, V_2 = \begin{bmatrix} -0.1284 \\ -0.0264 \\ -0.9165 \\ -0.3778 \end{bmatrix}, V_3 = \begin{bmatrix} -0.0540 \\ 0.0629 \\ 0.9333 \\ 0.3494 \end{bmatrix}, V_4 = \begin{bmatrix} 0.0084 \\ 0.5264 \\ -0.7626 \\ 0.3758 \end{bmatrix}.$$

Since the number of eigenvalues with a modulus greater than one is two, which is exactly equal to the number of control variables in the four-dimensional dynamical system, the system satisfies the Blanchard-Kahn (B-K) conditions. This indicates that the system has a unique stable solution under these parameters. However, because one eigenvalue, $u_4 > 0$, it proves that the dynamical system is not stable.

3.4.2. Simulation results and dynamic implications

In this section, we will explore the impact of different exogenous variables on the four endogenous variables through a comparative dynamic analysis of the steady-state equations. This analysis will illustrate how economic and institutional variables dynamically influence each other over time.

Proposition 1. *When the preferences towards investing in property rights, θ, and accumulating property-rights capital, κ, are strong (weak), the equilibrium levels of property-rights investments, property-rights capital, physical capital, and consumption in the long run are elevated (depressed).*

This implies that when there is a high preference for property-rights investment, individuals and institutions allocate more resources towards acquiring and protecting property rights, leading to increased levels of property-rights capital. Consequently, higher property-rights capital fosters greater confidence in property ownership, incentivizing investments in physical capital such as machinery, infrastructure, and technology, which are essential for economic production. As a result, higher levels of physical capital accumulation contribute to higher overall consumption levels, as the economy becomes more productive and efficient, translating into increased goods and services available for consumption. Conversely, when there is a low preference for property-rights investment, the levels of property rights investments, property-rights capital, physical capital, and consumption in the long run are diminished. In this scenario, reduced investments in property rights lead to lower levels of property-rights capital, which can under-

mine confidence in property ownership and deter investments in physical capital. Consequently, lower levels of physical capital accumulation result in decreased economic productivity and efficiency, leading to reduced levels of consumption as there are fewer goods and services available for consumption.

Of course, different countries under varying political regimes can exhibit distinct preferences or priorities regarding property-rights investments and the accumulation of property-rights capital. These preferences are shaped by a range of factors including historical, cultural, economic, and institutional contexts. In democratic countries with strong rule of law and institutions that protect property rights, there tends to be a higher preference for property-rights investments. Citizens and businesses feel confident in their ability to own and protect property, leading to a greater willingness to invest in acquiring and safeguarding property rights. This fosters the accumulation of property-rights capital over time, contributing to economic stability, growth, and prosperity. Conversely, in authoritarian regimes or countries with weak rule of law, property rights may be less secure, and there may be less incentive to invest in property rights. In such contexts, the government may have greater control over property rights, leading to lower levels of property-rights capital accumulation. Additionally, political instability, corruption, and lack of legal protections can deter individuals and businesses from making significant investments in property rights.

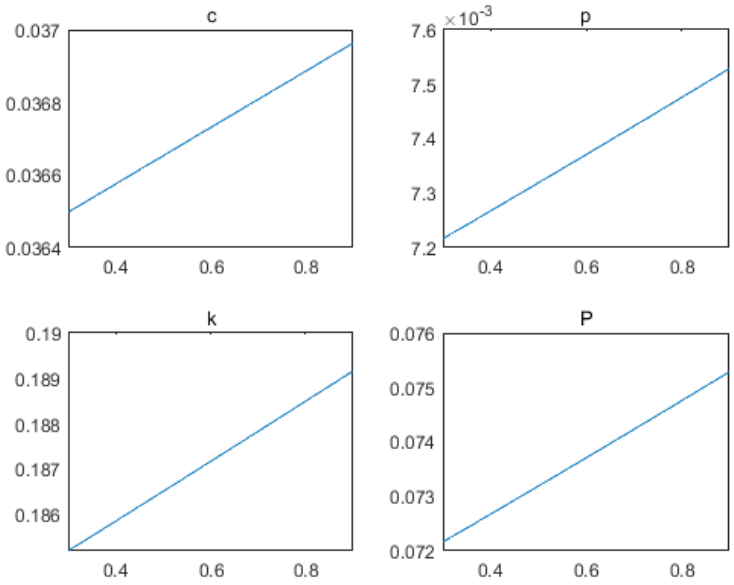
Moreover, cultural and historical factors can influence preferences for property-rights investments. In some societies, there may be a strong tradition of property ownership and protection, leading to a higher preference for property-rights investments. In others, communal or collective ownership norms may prevail, resulting in a lower emphasis on individual property rights.

Overall, the preferences for property-rights investments and property-rights capital can vary widely across different countries and political regimes, reflecting the complex interplay of political, economic, social, and cultural factors that shape attitudes towards property rights and ownership.

Proposition one is proved in Figures 2 and 3. Let the preference values for property-rights investment increase from 0.3 to 1.0. Then, the simulation results indicate that the quantities of ordinary consumption, physical capital, and accumulation of property-rights capital all increase, as shown in Figure 2.

When the preference values for property-rights capital increase from 0.3 and 1.5, the simulation results demonstrate an increase in the quantities

FIG. 2. The impact of θ (preferences for investments on property-rights capital) on four endogenous variables

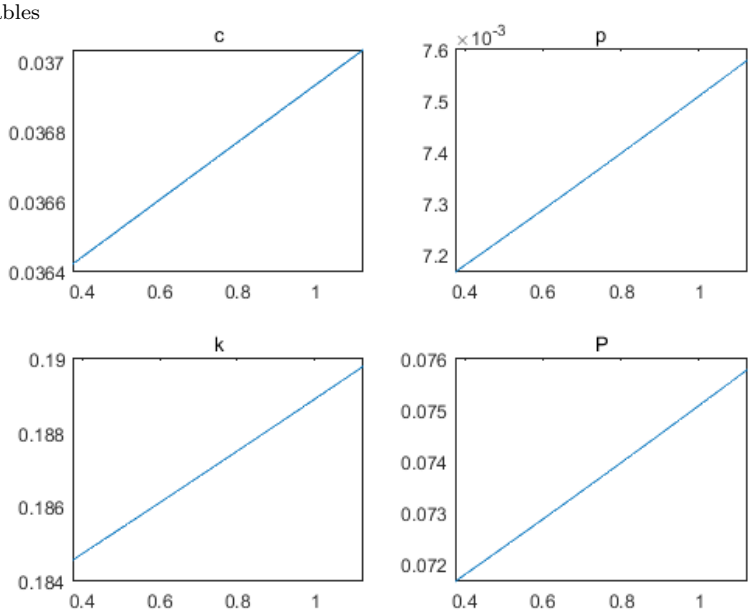


of ordinary consumption, physical capital, and accumulation of property-rights capital, as depicted in Figure 3.

PROPOSITION 2. *When v, the cost of new investments on property-rights capital formation, is rising, the long-run property-rights investment, property-rights capital, physical capital, consumption all decrease as shown in Figure 4.*

The reason is obvious: As the expenses associated with new investments in property-rights capital formation have surged globally, there is a noticeable decline in people's willingness to amass additional property-rights capital. This reluctance has cascading effects, resulting in reduced levels of physical capital accumulation, decreased consumption, and slower economic growth and development in many nations. The rising costs associated with acquiring and protecting property rights act as a deterrent, discouraging individuals and businesses from making substantial investments in this crucial aspect of economic infrastructure. Consequently, the diminished accumulation of property-rights capital undermines the foundation for robust economic activity, as secure property rights are funda-

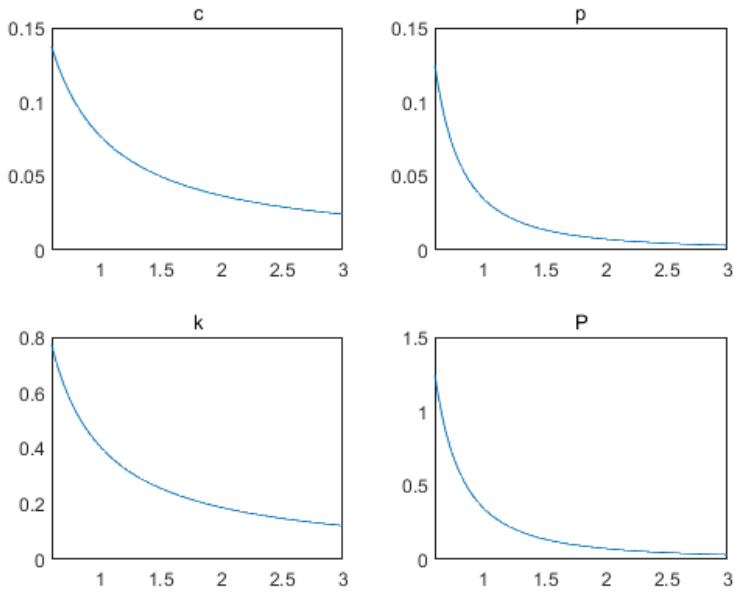
FIG. 3. The impact of κ (preferences for property-rights capital) on four endogenous variables



mental for fostering investment, entrepreneurship, and innovation. With fewer resources allocated towards property-rights capital formation, the overall pool of available capital for investment and productive activities shrinks, stifling economic expansion and progress. This trend underscores the critical importance of addressing the escalating costs associated with property-rights capital formation to stimulate sustained economic growth and development on a global scale.

Many examples around the globe have illustrate the high costs and prices for the formation and accumulation of property-rights capital. De Soto et al. (1989) and De Soto and Diaz (2002) seminal work addresses the critical issue of the lack of property-rights capital and its investment in Latin America, stressing its profound implications for economic development and the rule of law in the region. He emphasizes how the absence of clear property rights frameworks raises the price and cost of new property-rights investment, hindering entrepreneurship, physical investment, and economic growth across Latin America. Without secure property rights, individuals and businesses face barriers to accessing credit, formal markets, and legal protections, impeding their ability to build wealth and fully participate in the economy. De Soto argues that the lack of property rights

FIG. 4. The impact of v (Price of property-rights investments) on four endogenous variables



enforcement contributes to widespread informality and extralegal activities, exacerbating social inequalities and undermining the rule of law. By advocating for the formalization of property rights and the establishment of robust legal frameworks, de Soto asserts that Latin American countries can unlock vast economic potential, empower marginalized communities, and foster greater social and political stability. His insights have influenced policymakers, economists, and development practitioners, shaping discussions and initiatives aimed at addressing economic informality and promoting inclusive growth in the region. Additionally, De Soto's ideas underscore the intertwined nature of law and property rights, highlighting how unrecorded economic activities hinder entrepreneurs' access to credit and legal remedies, leading to the emergence of parallel economies. He argues for legal reforms to simplify regulations, enhance legal frameworks, and promote inclusive systems, emphasizing the importance of secure and enforceable property rights for economic development. Through empirical research and case studies, De Soto illustrates how legal reforms and property rights recognition can spur economic growth, alleviate poverty, and enhance social inclusivity in developing nations.

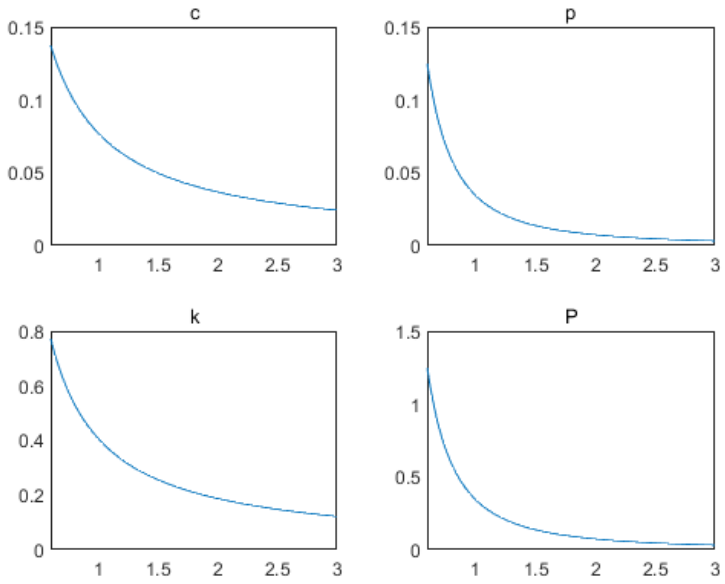
In Russia, the costs and prices associated with new investments in healthy property-rights capital are notably high, presenting significant challenges for individuals, businesses, and investors. This situation arises due to several interconnected factors within the country's legal, political, and economic landscape.Firstly, Russia has faced persistent issues related to corruption and bureaucratic inefficiencies, which can greatly inflate the costs of navigating the legal system and obtaining necessary permits or approvals for property-related transactions. Corruption within government institutions and law enforcement agencies can lead to extortion, bribery demands, and other illicit practices, adding layers of expense and complexity to property rights acquisition and protection. Secondly, the lack of transparency and consistency in Russia's legal system poses considerable risks for property investors. Ambiguous or inconsistently applied property laws, coupled with a judiciary that may lack independence or impartiality, can lead to protracted legal disputes and uncertainties surrounding property rights. As a result, investors may incur substantial costs related to legal fees, litigation, and compliance with varying regulations across different regions or jurisdictions within Russia. Furthermore, the broader economic and geopolitical context in Russia can contribute to elevated costs for property-rights investments. Economic volatility, currency fluctuations, and geopolitical tensions can increase risk perceptions among investors, leading to higher demands for returns and greater caution in committing capital to property-related ventures. Additionally, factors such as fluctuating energy prices, sanctions, and geopolitical instability can impact market conditions and investor confidence, further complicating the calculus for property-rights investments.

Thus, the combination of corruption, legal ambiguities, economic volatility, and geopolitical uncertainties in Russia contributes to an environment where the costs and prices for new investments in property-rights capital are disproportionately high. Addressing these challenges would require comprehensive reforms aimed at improving governance, enhancing legal clarity and enforcement, and fostering a more predictable and conducive investment climate for property rights in Russia.

Overall, addressing these challenges would require reforms aimed at promoting institutional transparency, strengthening the rule of law. By fostering a more equitable and predictable environment for property protection, one economic system could unlock greater potential for property-rights capital formation and stimulate long-term economic growth and development.

PROPOSITION 3. *An increase in the depreciation rate of property-rights capital, δ_P, reduces the long-run property-rights investments, the accumulation of property-rights capital, physical capital, and consumption as illustrated in Figure 5.*

FIG. 5. The impact of δ_P(Depreciation rate of property right) on four endogenous variables



The high depreciation rates of property-rights capital, δ_P, indicate the lack of secure property rights in developed countries, despite their advanced legal systems, can be attributed to several factors. Firstly, the complexity of legal systems in these countries, characterized by numerous regulations and bureaucratic procedures, often leads to delays and uncertainties in property-related matters, thereby undermining the perception of security among property owners. Additionally, eminent domain abuse presents a significant challenge, as governments may misuse their power to expropriate property without fair compensation or for purposes not genuinely in the public interest, further eroding trust in property rights protection. Moreover, inefficient legal processes, including land registration, title transfers, and dispute resolution, contribute to the problem by creating lengthy and cumbersome procedures that deter individuals from asserting their property

rights effectively. Furthermore, underlying inequalities and power dynamics within society can exacerbate property rights insecurity, as wealthier and more influential individuals or corporations may exploit legal loopholes or wield political influence to circumvent protections, disadvantaging weaker members of society. Weak enforcement mechanisms, resource constraints, corruption, and policy and regulatory uncertainty further compound the challenges, diminishing the effectiveness of property rights protections. Addressing these issues necessitates comprehensive reforms aimed at streamlining legal processes, enhancing enforcement mechanisms, promoting transparency and accountability, and fostering inclusive governance to strengthen property rights protections and create a more conducive environment for investment, economic growth, and social stability in developed countries.

In developing countries, the insecurity of property rights or high depreciation rates of property-rights capital poses significant challenges, stemming from a nexus of interconnected factors. Weak legal systems, characterized by corruption, inefficiency, and inadequate enforcement capacity, leave property owners vulnerable to exploitation and expropriation, undermining the rule of law and exacerbating insecurity. Informal land tenure systems prevalent in many developing nations lack legal protections, exposing occupants to eviction or displacement without recourse to legal remedies. Limited access to formal land titling systems deprives individuals and communities of legal recognition and protection of their land rights, hindering ownership validation, credit access, and dispute resolution. Government expropriation practices, often arbitrary and lacking in due process, further compound issues, particularly when coupled with corruption within government institutions, enabling officials to exploit their power for personal gain. Socioeconomic disparities and systemic discrimination perpetuate unequal access to land and property rights, marginalizing vulnerable populations such as indigenous peoples, women, and marginalized communities. The lack of political will to address property rights issues hampers progress, as political elites may prioritize self-interest over broader societal needs, perpetuating conditions of insecurity and inequality. Conflict-affected regions and areas with weak governance structures face heightened property rights violations and land disputes, as armed conflict, political instability, and weak state institutions undermine protections and exacerbate tensions. Comprehensive reforms are essential to address these challenges, encompassing strengthened legal frameworks, enhanced transparency and accountability, expanded access to formal land titling systems, empowerment of marginalized groups, and promotion of inclusive governance. By

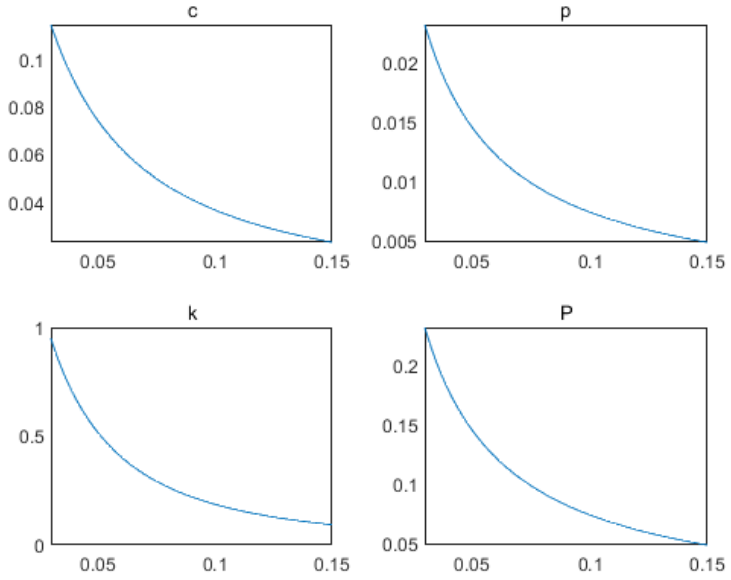
bolstering property rights protections, developing countries can unlock economic potential, foster social stability, and advance sustainable development goals.

Property rights are often insecure in authoritarian and totalitarian countries due to a confluence of critical factors. Centralized control, typical of such regimes, concentrates power within a small ruling elite group, enabling broad state authority to expropriate property without due process or compensation, thereby undermining ownership security for individuals and businesses. Additionally, the absence of the rule of law exacerbates this insecurity, as legal systems prioritize state interests over individual rights, leading to arbitrary, inconsistent, and manipulable frameworks that breed uncertainty. Political repression tactics, including censorship and intimidation, are employed to suppress dissent and maintain control, with property rights violations often used as tools of punishment, asset seizure from political opponents, or consolidation of wealth among ruling elites. Rampant corruption and cronyism further corrode property rights, as state officials exploit their positions for personal gain through bribery and nepotism, privileging well-connected entities at the expense of the populace. Judicial systems, lacking independence and subject to political interference, fail to provide impartial recourse, undermining confidence in property rights protections. Moreover, state ownership and intervention in key economic sectors stifle investment and entrepreneurship, perpetuating cycles of poverty and inequality amid a climate of fear regarding property seizure and confiscation by the state. Addressing this pervasive insecurity necessitates foundational reforms to fortify the rule of law, enhance transparency, safeguard judicial independence, and empower civil society. Without robust property rights protections, individuals and communities remain vulnerable to state exploitation, impeding social advancement and economic prosperity.

PROPOSITION 4. *An increase in the depreciation rate of physical capital, δ_K, reduces the long-run property-rights investments, the accumulation of property-rights capital, physical capital, and consumption as illustrated in Figure 6.*

A rise in the depreciation rate of physical capital, denoted as δ_K, diminishes long-term investments in property rights, property-rights capital, physical capital, and consumption. Essentially, when physical capital becomes obsolete and depreciates quickly, a larger portion of output is allocated to replacing physical capital, leaving fewer resources for consumption and investments in both physical and property-rights capital. Con-

FIG. 6. The impact of δ_K (Depreciation rate of physical capital) on four endogenous variables

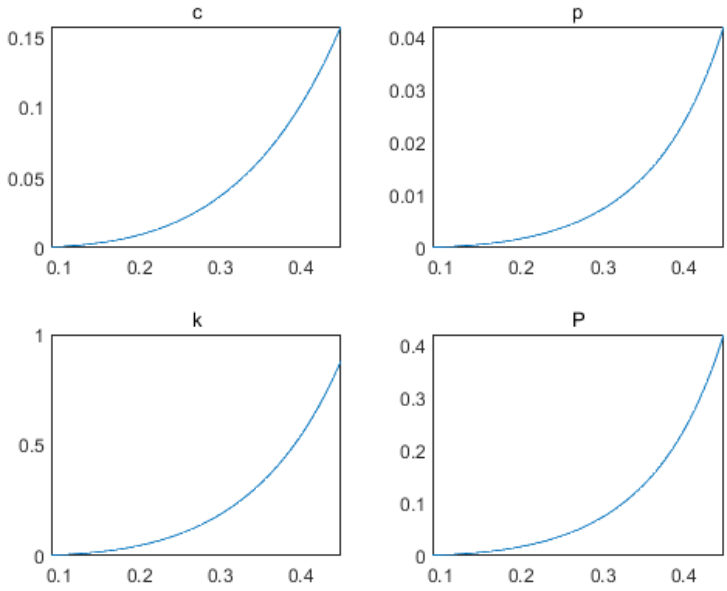


sequently, the economy experiences a decrease in long-term consumption, physical capital accumulation, and the stock of property-rights capital. This serves as a straightforward illustration of how changes in economic factors impact institutional variables like property-rights capital.

PROPOSITION 5. *An increase in total factor productivity, A, leads to higher long-run property-rights investments, the accumulation of property-rights capital, physical capital, and consumption as illustrated in Figure 7.*

An uptick in total factor productivity, A, results in higher overall output, providing additional resources for consumption and investments in both physical capital and property-rights capital. Consequently, in the long term, the economy experiences increased accumulation of property-rights capital and physical capital. In essence, an increase in total factor productivity leads to greater institutional capital, including property rights, the rule of law, and individual liberties, benefiting society as a whole.

FIG. 7. The impact of A (Total factor productivity) on four endogenous variables

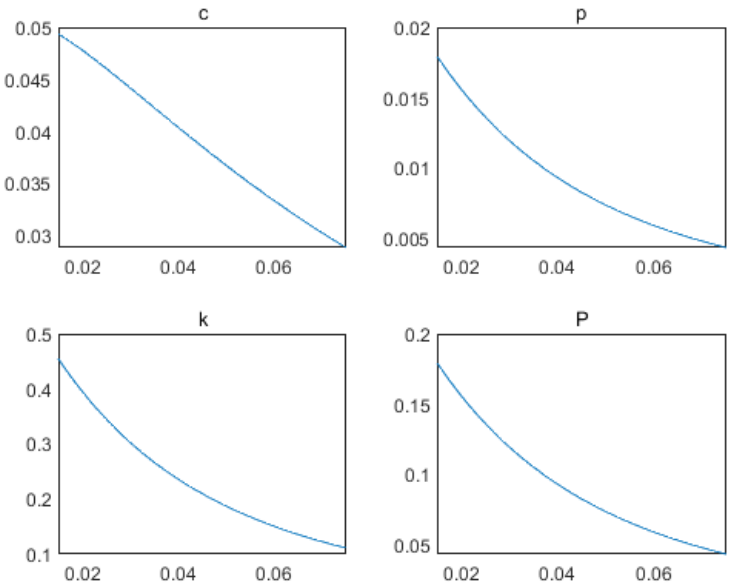


PROPOSITION 6. *An elevated subjective discount rate, ρ, leads to reduced long-term consumption, diminished long-term physical capital, and decreased long-term property-rights capital as illustrated in Figure 8.*

In essence, a higher subjective discount rate indicates a preference for immediate gratification over long-term gains, reflecting a myopic outlook. Consequently, individuals tend to prioritize present consumption over future investments in both physical capital and property-rights capital. This behavior results in a reduction in property rights protection, weakened adherence to the rule of law, and diminished liberties over time. This pattern aligns with a common psychological tendency where individuals prioritize immediate rewards over delayed benefits, neglecting the importance of long-term stability and prosperity.

Propositions one to six have demonstrated the intricate relationship between changes in economic variables and their impact on institutional capital, particularly property-rights capital. They also emphasize how property-rights capital, along with other institutional variables, influences economic variables, highlighting the interconnectedness and endogenous determination between institutions and economic performance. This un-

FIG. 8. The impact of ρ on four endogenous variables



derscores the dynamic nature of the relationship, wherein shifts in economic conditions can shape institutional frameworks, which in turn shape economic outcomes. Essentially, these propositions highlight the mutual influence and feedback loop between institutions and economic variables, emphasizing the importance of understanding and analyzing this interplay for a comprehensive understanding of economic dynamics and performance.

4. CONCLUSION

The paper explores the complex interplay between economic variables and institutional capital, with a specific focus on property-rights capital. It emphasizes the necessity of integrating the accumulation of property-rights capital and physical capital within a dynamic framework to fully grasp their interaction. The study reveals that property-rights capital, serving as institutional capital, is deeply interconnected with the accumulation of physical capital, economic growth, and development. Notably, when the cost of new investments in property-rights capital formation rises, it results in decreased long-run property-rights investment, property-rights capital, physical capital, and consumption. Similarly, an increase in the depreciation rate of property-rights capital leads to reductions in long-run

property-rights investments, the accumulation of property-rights capital, physical capital, and consumption. Conversely, an increase in the total factor productivity is associated with higher long-run property-rights investments, accumulation of property-rights capital, physical capital, and consumption.

Despite the common perception that property rights should be inherently robust and aligned with principles of human nature and justice, we present a contrasting view by highlighting the fragility of private property-rights capital across human history and countries worldwide. Factors such as the rising costs of strengthening property rights, insecurity of property rights, and high depreciation rates of property-rights capital contribute to this fragility. Many nations suffer from a lack of rule of law, violent seizures of private properties, and bureaucratic hurdles in legalizing private ownership, as identified by De Soto et al. (1989) and De Soto and Diaz (2002). The absence of secure property rights creates barriers for individuals and businesses, hindering their access to credit, formal markets, and legal protections, thereby impeding wealth accumulation and economic participation. De Soto argues that weak property rights enforcement fuels informality and extralegal activities, exacerbating social inequalities and undermining the rule of law. He advocates for formalizing property rights and establishing robust legal frameworks to unlock economic potential, empower marginalized communities, and foster stability.

At the same time, in Russia, high costs and prices associated with investments in property-rights capital pose significant challenges due to corruption, bureaucratic inefficiencies, legal ambiguities, and economic volatility. Corruption within government institutions inflates costs, while inconsistent application of property laws and lack of judicial independence lead to legal uncertainties and disputes. Economic and geopolitical factors, such as volatility and sanctions, further complicate property-rights investments.

In concluding this paper, it is imperative to emphasize the intricate interplay between property-rights capital and its correlation with physical capital, production, and consumption. Serving as the cornerstone of a thriving market economy, property-rights capital is intricately linked with the rule of law and individual liberties. This legal framework guarantees secure ownership of assets, ensures individuals receive the fruits of their labor, and facilitates free market choices, thereby incentivizing utility and profit maximization. Without such safeguards, individuals confront significant uncertainty, as their possessions, investments, and personal security become vulnerable to external threats like arbitrary seizures or governmental expropriation. Additionally, the absence of robust property rights

undermines trust in the economic system, hampering entrepreneurship, innovation, and sustained investment. Emphasizing the concept of spontaneous order underscores the organic emergence of property-rights capital within a society governed by the rule of law, enabling individuals to engage in economic endeavors confidently, assured that their rights are protected and their contributions duly acknowledged.

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