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Article — Published Version

Aristotle vs. Plato: The classical origins of capitalist & socialist political economies

Scottish Journal of Political Economy

Provided in Cooperation with:

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Suggested Citation: Grigoriadis, Theocharis (2022) : Aristotle vs. Plato: The classical origins of capitalist & socialist political economies, Scottish Journal of Political Economy, ISSN 1467-9485, Wiley, Hoboken, NJ, Vol. 70, Iss. 4, pp. 372-390, <https://doi.org/10.1111/sjpe.12339>

This Version is available at:

<https://hdl.handle.net/10419/288094>

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Aristotle vs. Plato: The classical origins of capitalist & socialist political economies*

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Abstract

Competing definitions of justice in Plato's *Republic* and Aristotle's *Politics* indicate the existence of two distinct economic systems with different priorities. The three-class society of the Platonic economy (guardians, auxiliaries, producers) gives rise to guardians who by virtue are expected to enforce output targets on producers directly or through auxiliaries. The three-class society of the Aristotelian economy (rich, middle, poor) facilitates the emergence of different ruling coalitions and compensates the efficiency losses of central planning with political gains derived from representative governance. In the Aristotelian economy, the middle class is better off than in the Platonic economy (auxiliaries), because a just society (polity) is achieved under its coalition with the rich. I argue that the equilibrium solutions of the Platonic and Aristotelian economic systems provide analytical insights on the origins of capitalist and socialist political economies.

KEYWORDS

Aristotle, central planning, economic systems, market mechanism, Plato, political regimes

JEL CLASSIFICATION

D63, P11, P14, P16, P21, P26, P52

*Thanks are due to the Editor and one anonymous reviewer for useful comments and suggestions. I am also grateful to Nikolaus Wolf and Giacomo Corneo for their insightful feedback on earlier drafts of this paper. All remaining errors are mine.

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1 | INTRODUCTION

The comparative study of capitalism and socialism has been underpinned by the role of informational asymmetries in the fulfillment of planned production targets and the centrality of principal-agent models in explaining the comparative advantages of the market mechanism over central planning (Weitzman, 1974, 1976). Moreover, resource allocation defined by impartiality, priority and solidarity introduces a novel concept of fairness, where egalitarian distribution may be the compromise outcome between the equal-resource and the equal-outcome rules (Moreno-Ternerero & Roemer, 2006). As the authors argue, impartiality, priority and solidarity can be fulfilled in a society that maximizes the welfare of either its ablest or its disablest agent (*ibid.*). This is why social welfare maximization is achieved when the allocation of resources occurs through an equalisandum that corresponds to an index of both resources and outcomes (*ibid.*). Lawless societies reach competitive equilibrium solutions based on the initial distribution of power among their agents (jungle equilibrium as per Piccione & Rubinstein, 2007); the difference between an exchange and a jungle economy lies in the existence of involuntary exchange driven by coercion in the jungle (*ibid.*). In his integrated theory of justice and economic development, Roemer (2013) proposes the definition of an opportunity-equalizing economic development measured along two dimensions: the average income level of those more disadvantaged in society, and the effect of differential effort rather than circumstances on total income inequality. The political economy of egalitarianism underscores the difference between resource and welfare egalitarianism (Moreno-Ternerero & Roemer, 2012). While Dworkin's (1981a, 1981b) resource egalitarianism reflects randomly distributed characteristics and, for that matter, endowments, Roemer (1985a) suggests that it is efficient to implement welfare rather than resource egalitarianism.

The origins of the comparison between Platonic and Aristotelian regime types on the one hand and the strategic organization of economic systems on the other are to be found both in the divergent reception of Plato and Aristotle in the capitalist and socialist camps of the Cold War and the central role of formal contract theory in modeling hierarchical institutions. Both Plato and Aristotle advocate the rise of strictly stratified societies, whose primary goal is the maximization of collective welfare. This is also a key prerogative in the design of economic systems and it has led to differentiated approaches toward redistribution and the role of political-economic hierarchies in providing it. While both Platonic and Aristotelian economies assume the existence of hierarchical production processes, the monitoring monopoly of the guardians is in contrast with class competition in the formation of government. The emergence of different possible coalitions between the rich, the middle and the poor and the tradeoff between expropriation by the poor and rent-seeking by the rich render Aristotle's *Politics* the analytical core for the analysis of redistributive politics in modern democracies. Similarly, the absence of institutional alternative to the guardians constitutes the core of authoritarian welfare regimes of Soviet or Chinese style, whose governance reaches its optimal form in Plato's *Republic*.

Hence, the regimes of *politeia* (Plato) and *polity* (Aristotle) embody two distinctive concepts of distributive justice. *Politeia* constitutes the Pareto-optimal equilibrium of a vertically organized authoritarian regime; the principal-agent relationship between the guardians and the producers leads to the equilibrium solution of *politeia* under conditions of high effort by producers and overcommitment toward the common good by guardians. In the Platonic economy equilibrium, democracy and tyranny are corner equilibrium solutions, which arise as a result of the producers' low effort and the high share of guardians and/or auxiliaries in society. Furthermore, oligarchy and timocracy assume the fulfillment of production plan by the producers; however, in both cases there is underprovision of the public goods, because competent (oligarchy) or incompetent (timocracy) guardians exhibit low levels of commitment toward the common good. *Polity* reflects the distributive commitment of the rich toward the common good, which may be achieved only jointly with the middle class. In the Aristotelian economy equilibrium, tyranny, oligarchy and democracy signal the abstinence of the poor from the fulfillment of the optimal production target. While democracy is the outcome of the political disenfranchisement of the poor that rule in coalition with the middle class, tyranny and oligarchy are regime types of an underperforming economic system that offers differential degrees of punishment on

targets on the poor. Kingship and aristocracy indicate differential levels of competence for the rich; while in both regime types a coalition of the rich with the middle class occurs, under kingship the rich exhibit higher levels of competence and, therefore, extractive capacity than under aristocracy.

Modeling the Athenian democracy as an economic system driven by interest representation and class conflict implies the relativity of institutional and growth differences between Cylon's tyranny and Solon's democracy (Fleck & Hanssen, 2012).¹ The decentralized structure of the ancient Greek world that was organized in city-states (*poleis*) allowed the existence of multiple balanced growth paths in the same space and suggests that the speed of transition from tyranny to democracy can explain differential wealth levels throughout the 5th century BC. Furthermore, the inclusiveness of social, legal and economic institutions that allowed foreigners, resident aliens and sometimes slaves to seek judicial protection reveals that democracy is not the only explanatory variable for Athenian growth. The definition of Athens as a progressively open-access regime that facilitated prosperity implies that social stability and commitment to justice are equally important to democracy for economic development (Carugati et al., 2016).

Communitarian and democratic critiques of capitalism rely on Aristotle's analysis of markets and labor (Katz, 1997). A comparative analysis of the *Republic* and *Politics* indicates the different focus of the two ideal forms of government. Plato treats oligarchy and democracy as equally detrimental for unity; oligarchy divides society into poor and rich, while democracy leads to slavery in its extensive form of freedom (Grant, 2014). The three-class society of guardians, auxiliaries and producers proposed in the *Republic* preserves the hierarchical advantage of guardians and facilitates a fixed political unity without social mobility. In the Aristotelian economy, however, resource autonomy of economic units maximizes collective efficiency, because it allows the emergence of a middle-class government, which is *ex-ante* excluded in the Platonic model (*ibid.*). In this paper, I model the Platonic economy as a three-player game, where guardians set production targets on producers directly or through auxiliaries. Furthermore, I model the Aristotelian economy as a three-player game, where there is no *ex-ante* hierarchy, but each of the three classes – rich, middle and poor – compete for leadership, with the leader in each round imposing production targets on the others directly. Aristotelian constitutional arrangements may lead to the emergence of three different regime types (kingship, aristocracy and polity) and its deviant forms (tyranny, oligarchy and democracy). Distributive efficiency in the Aristotelian economy is higher under polity than under any other regime type, whereas it is higher in the Platonic economy when planned targets are set directly by the guardians rather than through delegation by auxiliaries.

The comparative analysis of Platonic and Aristotelian economic systems contributes to the Meltzer and Richard's (1981) theory by suggesting that political competition according to the Aristotelian model is likely to generate higher levels of redistribution than the preservation of political-economic hierarchies in its Platonic equivalent. The distributive commitment of the guardians toward the provision of the public good is a weaker guarantee for higher levels of distribution, as it depends solely on his ability to monitor the auxiliary and the producer. Hence, it is possible to explain the Meltzer and Richard's (1981) argument that higher inequality in income distribution will lead to a stronger political demand for redistribution through the electoral process by focusing on two solutions of the proposed Aristotelian equilibrium: democracy and polity. Under democracy, the absence of redistribution by the rich leads to the rise of a coalition of the poor and middle class at the expense of the production process. Under polity, the production target is achieved by the poor, and a coalition of the rich and the middle class delivers the optimal level of public good such that the expropriation capacity of the poor is constrained and rent-seeking by rich is dominated by their individual commitment to the common good.

The paper is structured as follows. In Sections 2 and 3, I solve the Platonic and Aristotelian economy games in their basic forms. In Section 4, I derive the linkages between socialism and the Platonic economy on the one hand, and capitalism and the Aristotelian economy on the other. Section 5 concludes.

¹In their framework, tyranny and democracy can be treated as complementary stages of a single balanced growth path, where tyranny involves transition dynamics from backwardness to the new steady state of sustainable growth, and democracy itself is the consolidating steady state.

2 | THE PLATONIC ECONOMY

I assume a three-class society composed of guardians, auxiliaries and producers, with different levels of endowment and population share such that $y^G > y^A \geq y^P$ and $\alpha^P > \alpha^A > \alpha^G$, $\sum_j \alpha^j = 1$, where y^j is the average income of each class in society and α^j is the population share of each of the three classes such that $J = \{G, A, P\}$, $j \in J$.²

The guardian cares both about his individual welfare and the collective welfare of the city. His expected payoff equals:

$$EU^G(y^G; g) = \rho \left[\frac{y^G}{\alpha^G} + H(g) - C(g, \varepsilon) \right] + (1 - \rho) \left[\frac{y^G - C(g, \varepsilon)}{\alpha^G} + H(g) \right] \quad (1)$$

where y denotes the average income in society, ρ denotes the probability of direct monitoring of the guardian on the producer whereas $1 - \rho$ suggests that the guardian monitors the producer through the auxiliary, $C(g, \varepsilon)$ denotes the cost of providing the public good, $\varepsilon \in (0, 1)$ is the degree of monitoring capacity over the auxiliary and the producer that reflects the *ex-ante* quality of monitoring institutions, g denotes the public good and $H(g)$ is the utility from the provision of the public good in society.³ $C(g, \varepsilon)$ is monotonically increasing in ε and it is a concave function such that $\frac{\partial C}{\partial \varepsilon} > 0$ and $\frac{\partial^2 C}{\partial \varepsilon^2} < 0$.

The competing concepts of justice proposed by Polemarchus, Thrasymachus and Socrates in the *Republic* suggest three different concepts of economic efficiency. What Polemarchus defines as justice is the enforcement capacity of the ruler, who must be able to meet his obligations vis-à-vis his friends and punish his enemies (Book I, 332c–335d). Thrasymachus suggests that justice is a welfare-maximization mechanism for the guardians (Book I, 336b–354c). Socrates responds that justice is a residual concept and at the same time a synthesis of three human qualities: wisdom, moderation and courage (Book IV, 427d–433b). Hence, the constraints on the guardian's payoff are the following:

$$y^G \leq g + \eta + \theta$$

$$\theta = \iint_{\sigma^G, \sigma^L} \Delta(g, \varepsilon) \varphi(\sigma^G) f(\sigma^L) d\sigma^G d\sigma^L = \Delta(g, \varepsilon)$$

where θ is the individual quality of the guardians as commitment to the common good, η denotes the output offered by the producer, $\Delta(g, \varepsilon)$ denotes the common good payoff, $\sigma^L \in [0, \bar{\sigma}^L]$ denotes the competence level (skills) of auxiliaries and producers in society and $\sigma^G \in (\bar{\sigma}^L, 1]$ denotes the competence level (skills) of guardians, whereas $\varphi(\sigma^G)$, $f(\sigma^L)$ are the respective probability distribution functions and $\bar{\sigma}^L$ the upper bound of the closed set of competence level (skills) for auxiliaries and producers in society.

To complete the optimization problem of the guardian, it is also essential to define the payoffs of auxiliaries and producers, where $y^A = y^P = y \leq g + \eta$. The expected payoff of the auxiliary is $EU^A(y^A; g) = \rho \frac{y}{\alpha^A} + (1 - \rho) \frac{y - C(g, \varepsilon)}{\alpha^A}$. Moreover, the producer will implement the plan proposed, either monitored directly by the guardian, or monitored indirectly by the guardian and directly by the auxiliary such that:

$$EU^P = \rho \left[\frac{y}{\alpha^P} + \frac{B(e)}{\alpha^G} - \alpha^G J(\eta, e) \right] + (1 - \rho) \left[\frac{y}{\alpha^P} + \frac{B(e)}{\alpha^G + \alpha^A} - (\alpha^G + \alpha^A) J^2(\eta, e) \right] \quad (2)$$

²It is essential to consider that by definition $y = \frac{y^j}{\alpha^j}$, for all $j \in \{G, A, P\}$.

³The basic setup follows the structure of the Meltzer–Richard model (1981).

where $e \in (0, 1)$ denotes effort, $J(\eta, e)$ denotes the cost of production such that $J_e, J_{\eta} > 0$ and $J_{ee}, J_{\eta\eta} < 0$, and $B(e)$ is the pairwise property (incentive) structure as per Weitzman (1976), such that:

$$B(e) = \begin{cases} B_1(e) = \eta(e) + \beta [\eta(e) - \eta^*], & \text{if } \eta^* \leq \eta(e) \\ B_2(e) = \eta(e) - \gamma [\eta^* - \eta(e)], & \text{if } \eta^* > \eta(e) \end{cases} \quad (3)$$

where η^* is the planned target proposed by the guardian and $\beta, \gamma \in (0, 1)$ are the parameters of reward and punishment for over- and underfulfillment of the proposed plan, respectively. Following the logic of pairwise linear incentive schemes (Gjesdal, 1988), it is possible to rewrite them as follows:

$$B(e) = \int_0^{\bar{e}} B_2(e) f(e) de + \int_{\bar{e}}^1 B_1(e) f(e) de = \int_0^{\bar{e}} \eta(e) - \gamma [\eta^* - \eta(e)] f(e) de + \int_{\bar{e}}^1 \eta(e) + \beta [\eta(e) - \eta^*] f(e) de$$

In the Platonic economy, the distinction between direct (probability ρ) and indirect (probability $1 - \rho$) monitoring of producers by the guardians occurs to differentiate the role of the auxiliaries in the planned production process. On the one hand, the guardians' distributive commitment to the common good may be sufficient to inspire producers toward plan implementation without the intermediation of the auxiliaries. On the other hand, the enforcement capacity of the auxiliaries may be necessary to achieve the same objective. This differentiation also explains why the producers' effort may be constrained by the relatively high share of the guardians or the high joint share of guardians and auxiliaries; either condition is likely to lead to the collapse of the production process and the rise of tyranny or democracy. This is why the cost of providing the public good is either carried by the guardians alone or jointly by the guardians and the auxiliaries. Given their hierarchical positions, the producers do not carry the cost of providing the public good $C(g, \varepsilon)$; however, the cost of production $J(\eta, e)$ is part of their own utility function and it rises with the joint monitoring of their output and related effort by the guardians and their auxiliaries.

The timing of the game between the guardian, the auxiliary and the producer is the following:

1. The guardian sets the planned target η^* and decides whether to monitor its implementation directly or through the auxiliary. This is a binary decision denoted by $\rho \in \{0, 1\}$.
2. The producer decides how much effort to provide in order to fulfill the plan and delivers the output η .

I find that $\eta_e > 0$, which suggests that output $\eta(e)$ is monotonically increasing in effort e , an unsurprising result. I also observe that the existence of auxiliaries increases the marginal output provided by producers and, therefore, the overall efficiency of the economy. The larger the share of guardians in the economy, the less the effort the producers will deliver toward the optimal output level. Hence, Plato's argument about a just society ruled by the charismatic few is also shown in this model. A relatively higher share of auxiliaries has a smaller negative effect on the producer's effort than a relatively higher share of guardians.

As the *Republic* primarily concentrates on the justice-bound accountability of the guardians and the commitment of producers to output, the auxiliary does not have any decision-making capacity in my model. The wealth of the Platonic economy depends primarily on guardians and producers since the presence of auxiliaries reduces the cost of monitoring for guardians and increases the effort provided by producers. However, it is important also to consider the moral environment and the differential justice commitments of guardians and producers (Schokkaert & Overlaet, 1989).

Following the Leibniz rule, optimal output is given by $\tilde{\eta} = \int_e \eta_e f(e) de$, which offers the basis for the optimization problem of the guardian and his decision to delegate the monitoring of output production to the auxiliary or not. The indirect utility function of the guardian develops as follows:



$$\begin{aligned}
 EU^G(y^G; g, \theta) &= \rho \left[\frac{y}{\alpha^G} + H(g) - C(g, \theta, \varepsilon) \right] + (1 - \rho) \left[\frac{y - C(g, \theta, \varepsilon)}{\alpha^G} + H(g) \right] \Rightarrow \\
 EU^G(y^G; g, \theta) &= \rho \left[\frac{g + \tilde{\eta} + \theta}{\alpha^G} + H(g) - C(g, \theta, \varepsilon) \right] + (1 - \rho) \left[\frac{g + \tilde{\eta} + \theta - C(g, \theta, \varepsilon)}{\alpha^G} + H(g) \right]. \quad (4)
 \end{aligned}$$

Similarly, the guardian's optimization problem with respect to g :

$$\begin{aligned}
 \frac{\partial EU^G}{\partial g} &= \rho \left[\frac{1}{\alpha^G} + H_g - C_g \right] + (1 - \rho) \left[\frac{g - C_g}{\alpha^G} + H_g \right] = 0 \Rightarrow \\
 \frac{\partial EU^G}{\partial g} &= \frac{1}{\alpha^G} + H_g - \rho C_g - (1 - \rho) \frac{C_g}{\alpha^G} = 0 \Rightarrow \frac{1}{\alpha^G} + H_g = \rho C_g + (1 - \rho) \frac{C_g}{\alpha^G} \Rightarrow \\
 \frac{1}{\alpha^G} + H_g &= \frac{\alpha^G \rho C_g + (1 - \rho) C_g}{\alpha^G} \Rightarrow H_g = \frac{\alpha^G \rho C_g + (1 - \rho) C_g}{\alpha^G} - \frac{1}{\alpha^G} \Rightarrow \\
 H_g &= \frac{\alpha^G \rho C_g + (1 - \rho) C_g}{\alpha^G} - \frac{1}{\alpha^G} = \frac{C_g [1 + \rho (\alpha^G - 1)]}{\alpha^G} - \frac{1}{\alpha^G} \Rightarrow \\
 H_g &= \frac{C_g [1 + \rho (\alpha^G - 1)] - 1}{\alpha^G} < 0, \text{ which solves for } g^* \Rightarrow g^* = H_g^{-1} \left(\frac{C_g [1 + \rho (\alpha^G - 1)] - 1}{\alpha^G} \right). \quad (5)
 \end{aligned}$$

The marginal utility from the provision of the public good is negative for the guardian, resulting in $H_g < 0$. In the *Republic*, the concept of justice is twofold. First, it is linked to the provision of public goods by guardians, and, second, as the individual commitment of the guardians to the common good.

PROPOSITION 1 (The Platonic Equilibrium)

There is a unique subgame perfect equilibrium of the Platonic economy game that has the following form:

1. If $e < \alpha^G$ or $e \leq \alpha^G + \alpha^A$, then the producer does not deliver $\tilde{\eta}$ and a just society collapses in favor of democracy.
2. If $|e - \beta| \leq |\gamma - e|$ and $e < \alpha^G$ or $e \leq \alpha^G + \alpha^A$, then the producer does not deliver $\tilde{\eta}$ and a just society collapses in favor of tyranny.
3. If $e \geq \alpha^G$ or $e > \alpha^G + \alpha^A$, then the producer delivers $\tilde{\eta}$ and the following solutions are observed:
 - a) If $\theta \leq \varepsilon$ and $\bar{\sigma}^L > \frac{1}{2}$, then the guardian underprovides the public good g and a just society (politeia) collapses in favor of timocracy.
 - b) If $\theta \leq \varepsilon$ and $\bar{\sigma}^L \leq \frac{1}{2}$, then the guardian underprovides the public good g and a just society (politeia) collapses in favor of oligarchy.
 - c) If $\theta > \varepsilon$, then the guardian provides the public good g at least at g^* and a just society (politeia) is preserved.

PROOF OF PROPOSITION 1 See the Appendix A.

The idea of a just society (*politeia*) is preserved when the guardian's individual commitment to the common good is higher than the combined skills of the auxiliary and the producer. However, when the share of skills possessed by the auxiliary and the producer is higher than the distributive commitment of the guardian, then two possible regime equilibria are observed, *timocracy* and *oligarchy*. When the marginal cost of individual commitment to the common good is lower than the marginal cost of effort toward its delivery and lower than the marginal benefit from the common good, then timocracy emerges. In the Platonic economy, this regime type advances the significance of honor through power and of military capacity through the accumulation of resources (Book VIII, 543a–550c). Oligarchy is the regime type that relies on the power of the wealthy, whose actions are constrained by some public standards for values, which do not exist in democracy (Book VIII, 550c–555d). In oligarchy, the guardians are extractive, as they are under timocracy, but the objective of wealth accumulation is private rather than public.

In the Platonic economy, the distributive commitment of the guardian to the provision of the public good shapes the emergence of *politeia*, whereas in the economy of Greek city-states as per Fleck and Andrew

Hansen (2006) it is the monitoring of returns to agricultural investment that does this.⁴ The rise of both democracy and tyranny are conditioned on the non-fulfillment of the optimal plan by the producer. If the effort delivered by the producer is strictly dominated by the share of guardians in society, then the enforcement capacity of the guardian is weakened and the *politeia* collapses toward democracy. The Platonic definition of democracy implies a distributive anarchy, where producers do not perform based on the joint monitoring of guardians and auxiliaries, but maximize their utility without hierarchical constraints. This is particularly the case in societies with a large share of guardians and auxiliaries, which renders optimal effort extremely high for producers and therefore makes the option of democracy a preferred outcome. The difference between democracy and tyranny in that respect lies in the ability of the guardians to provide a system of rewards and punishments as per Weitzman (1976) that they can implement in such a way that punishment for underfulfillment of the proposed plan schedule is costlier than its exact or overfulfillment. The relative difference between the consequences of underfulfillment and exact fulfillment or overfulfillment – their asymmetry – offers an additional incentive to producers not only to radicalize in the direction of democracy, but also to consolidate their rule with the appointment of a tyrant, who expropriates the resources not only of the guardians and the auxiliaries, but also of some of the producers. While both democracy and tyranny are deviations from *politeia*, tyranny complements distributive anarchy with centralized rule.

As it becomes evident from Lemmas 1, 2 and Corollary 2A (see the Appendix A), monitoring capacity is an exogenous parameter related to the long-run quality of institutions in a city-state. Contingent on the high level of *ex-ante* quality of monitoring institutions in the city-state, the guardian commits to the common good, which leads to the rise of a just society (*politeia*). However, in societies with an initial low quality of institutions, there is a much higher inclination toward oligarchy or timocracy, depending on the punitive nature of the guardian's proposed plan schedule. A Platonic economy with a high share of guardians is more likely to become a democracy because, in a populist pluralist regime, as Plato defines democracy, guardians can buy off the producers' support with the provision of public goods, while avoiding internal conflict. In contrast, if a Platonic economy has a low share of guardians, it is more likely to become a tyranny. In this case, a guardian has a lower opportunity cost and is faced with less internal competition toward the imposition of a repressive regime that underprovides public goods and relies less on the support of producers. Hence, Plato proposes an economic system where the monitoring capacity of the elites and their direct agents does not undermine output production and thus does not provide incentives for free riding by producers.

In Plato's *Republic*, the distributive commitment of guardians drives the economy toward its self-realization as *politeia*. My results are driven by two sets of exogenous parameters, the *ex-ante* quality of monitoring institutions and the share of elites and their intermediaries in society. City-states with a higher level of prior institutional development are more likely to reach the equilibrium of *politeia* because guardians are less inclined to free ride against the common good. A more advanced set of political and judicial institutions predicts higher levels of economic development and social peace. Similarly, an economy with an overwhelmingly large share of guardians and auxiliaries leads to the collapse of production processes and the generalization of anarchy in the direction of repressive (tyranny) or populist (democracy) solutions. Oligarchy and timocracy are suboptimal solutions with respect to *politeia*. Oligarchy transforms political office into private gain for the elites, whereas timocracy advances their public standing with the purpose of authority preservation.

⁴Fleck and Hansen (2006) offer an interesting comparison of Greek city-states by concentrating not only on Athens and Sparta as the key competing paradigms but also on Argos, Thebes and Corinth as well as Thessaly, the most fertile area of the classical Greek world. They argue that democracy is more likely to emerge when political institutions can resolve time-inconsistency problems and facilitate investment. Exogenous variation in potential returns to agricultural investment explains—from an elite's perspective – the value of granting secure land property to *demos* and therefore the likelihood of democracy (*ibid.*).

3 | THE ARISTOTELIAN ECONOMY

Aristotle treats socio-economic classes as agents that mutually restrain each other's extractive activities. The realization of polity does not constitute an equilibrium in relation to a continuous individual commitment to the common good by the rich or an implementation of the production plan by the poor. The Aristotelian logic underscores the significance of mutually restraining the accumulation of political rents by the rich and expropriation activities by the poor. Deriving the proposed social structure from Aristotle's *Politics*, I assume a three-class society composed of rich, middle and poor with different income levels and population share such that $y^R > y^M > y^\Phi$ and $\alpha^R < \alpha^M < \alpha^\Phi$, $\sum_{j \in J} \alpha^j = 1$, where y^j corresponds to the representative income of each class in society and α^j denotes the population share for each social class such that $J = \{R, M, \Phi\}$, $j \in J$. I treat the rich class as the incumbent whose utility depends on their income and the provision level of public goods such that:

$$EU^R(y^R; g) = \psi \left[\frac{y^R}{\alpha^R + \alpha^M} + H(g) + \kappa r - (\alpha^R + \alpha^M) C(g, \varepsilon) \right] + (1 - \psi) \left[\lambda \left(\frac{y^R}{\alpha^R + \alpha^\Phi} + H(g) + (1 + \kappa)r - (\alpha^R + \alpha^\Phi) C(g, \varepsilon) \right) + \frac{(1 - \lambda)y^R}{\alpha^R} \right] \quad (6)$$

where ψ denotes the probability of a coalition with the middle class in the state legislature (*ecclesia of demos*), λ the probability of a coalition with the poor, $r > 0$ political rents and $\kappa \in (0, 1)$ an expropriation rate. For $C(g, \varepsilon)$ and $H(g)$, the same properties as in the Platonic economy hold.

A key difference between the Platonic and the Aristotelian economies is the permissibility of rents, which allows the constituent members of a winning coalition to derive private gains from politics. Rents are modeled as a cost carried by the class that finds itself in the minority condition and are inversely related to the provision of public goods and the utility accumulated therefrom. The three-class society of the Aristotelian economy (rich, middle, poor) concentrates on the emergence of governing majorities that are based on interclass alliances and thus facilitate efficient constitutional arrangements. Aristotle in *Politics* defines monarchy, aristocracy and polity as optimal forms of political regimes depending on the number of people ruling: one in monarchy, a few in aristocracy and many in polity (Book III, Chapter 7). Similarly, their respective deviations are tyranny, oligarchy and democracy (ibid.: 1289a38). The underlying difference between the optimal regime forms and their deviations is the ruler's commitment to the common good (ibid.).

I assume that monarchy or tyranny emerges when there is a coalition between the rich and the middle. Aristocracy or oligarchy emerges when there is a coalition between the rich and the poor. Similarly, polity or democracy emerges when there is a coalition between the middle and the poor. In the Aristotelian concept of political competition, distributive justice is linked to the government's ability to serve the common good and at the same time deliver a minimum level of public good to the class that is not part of the governing coalition. Hence, the resource and policy constraints to the ruler's payoff are the following:

$$y^R \leq g + r + \theta^R + \omega$$

$$\theta^R = \frac{\psi}{\alpha^R} \iint_{\xi^R, \xi^M} \Gamma(r, \varepsilon) \chi(\xi^R) h(\xi^M) d\xi^R d\xi^M + \frac{(1 - \psi)\lambda}{\alpha^R} \iint_{\xi^R, \xi^\Phi} \Gamma(r, \varepsilon) \chi(\xi^R) q(\xi^\Phi) d\xi^R d\xi^\Phi = \frac{\psi + (1 - \psi)\lambda}{\alpha^R} \Gamma(r, \varepsilon)$$

where θ^R the individual quality of the rich as commitment to the common good, $\Gamma(r, \varepsilon)$ the common good payoff, $\xi^M \in [0, \bar{\xi}^M]$ the competence level (skills) of the middle class, $\xi^\Phi \in [0, \bar{\xi}^\Phi]$ the competence level (skills) of the poor class and $\xi^R \in (\bar{\xi}^M, 1]$ the competence level (skills) of the rich. Moreover, $\chi(\xi^R)$, $h(\xi^M)$ and $q(\xi^\Phi)$ are the respective probability distribution functions and $\bar{\xi}^M$ the upper bound of the closed set of competence level (skills) for the middle

class where $\bar{\xi}^M > \bar{\xi}^\Phi$. Unlike in the Platonic economy, in the Aristotelian economy there is no fixed hierarchy *ex-ante*. However, the rich class has an initial incumbency advantage.

The payoff and constraints for the middle class are the following:

$$EU^M(y^M; g) = \psi \left[\frac{y^M - C(g, \varepsilon)}{\alpha^R + \alpha^M} + (1 - \kappa)r \right] + (1 - \psi) \left[\lambda \frac{y^M}{\alpha^M} + (1 - \lambda) \left(\frac{y^M - C(g, \varepsilon)}{\alpha^M + \alpha^\Phi} + \kappa r \right) \right] \quad (7)$$

$$y^M \leq g + r + \theta^M + \omega$$

$$\theta^M = \frac{\psi}{\alpha^M} \iint_{\varepsilon^R, \xi^M} \Gamma(\varepsilon, r) \chi(\xi^R) h(\xi^M) d\xi^R d\xi^M + \frac{(1 - \psi)(1 - \lambda)}{\alpha^M} \iint_{\xi^M, \xi^\Phi} \Gamma(\varepsilon, r) h(\xi^R) q(\xi^\Phi) d\xi^M d\xi^\Phi$$

Similarly, the poor will either implement the plan proposed by the rich or coalesce with the middle such that:

$$EU^\Phi = \psi \left[\frac{y^\Phi + Y(\kappa)}{\alpha^\Phi} - \alpha^\Phi W(\omega, \kappa) \right] + (1 - \psi)(1 - \lambda) \left[\frac{y^\Phi}{\alpha^\Phi} + \frac{Y(\kappa)}{\alpha^M + \alpha^\Phi} - (\alpha^M + \alpha^\Phi) W^2(\omega, \kappa) \right] \quad (8)$$

$$+ (1 - \psi)\lambda \left[\frac{y^\Phi}{\alpha^\Phi} + \frac{Y(\kappa)}{\alpha^R + \alpha^\Phi} - (\alpha^R + \alpha^\Phi) W^2(\omega, \kappa) \right]$$

where $W(\omega, \kappa)$ denotes the cost of output delivery and κ the degree of expropriation such that $W_\kappa < 0, W_\omega > 0$ and $W_{\kappa\kappa}, W_{\omega\omega} < 0$, and Y is the pairwise property (incentive) structure also as per Weitzman (1976):

$$Y(\kappa) = \begin{cases} Y_1(\kappa) = \omega(\kappa) + v[\omega(\kappa) - \omega^*], & \text{if } \omega^* \leq \omega(\kappa) \\ Y_2(\kappa) = \omega(\kappa) - \iota[\omega^* - \omega(\kappa)], & \text{if } \omega^* > \omega(\kappa) \end{cases} \quad (9)$$

where $v, \iota \in (0, 1)$ are the parameters of reward and punishment such that $v > \alpha$ and $\iota < \beta$, which implies that overfulfillment is rewarded more and underfulfillment is penalized less in the Aristotelian economy than in the Platonic one. Following the logic of pairwise linear incentive schemes (Gjesdal, 1988), it is possible to rewrite them as follows:

$$Y(\kappa) = \int_0^{\bar{\kappa}} Y_2(\kappa) h(\kappa) d\kappa + \int_{\bar{\kappa}}^1 Y_1(\kappa) f(\kappa) d\kappa = \int_0^{\bar{\kappa}} \omega(\kappa) - \iota[\omega^* - \omega(\kappa)] h(\kappa) d\kappa + \int_{\bar{\kappa}}^1 \omega(\kappa) + v[\omega(\kappa) - \omega^*] h(\kappa) d\kappa$$

In the Aristotelian economy, the distinction between coalition with the middle class (probability ψ) and coalition with the poor (probability λ) lies in the core of the rich's optimization problem. The tradeoff between the poor's expropriate rate and the relative share of the rich or the joint share of the rich and the middle class in society predicts the willingness of the poor to implement the production process and achieve the production target set by the rich. Moreover, the cost of providing the public good $C(g, \varepsilon)$ is carried by the rich and the middle class, whereas the cost of production $W(\omega, \kappa)$ is part of the poor's utility. When the punishment of underfulfillment is higher than the reward of overfulfillment, then the collapse of the production process becomes likely and the public good is not provided at all. The only regime type that empowers the poor according to Aristotle is democracy, under which they can maximize their expropriation rate at the expense of the rich without fulfilling the proposed production target. Not being part of the ruling coalition is costlier for the poor in the Aristotelian economy than it is for the producers in the Platonic economy. While producers are excluded by definition from ruling the city, this is not the case for the poor, who are, nevertheless, confronted with quadratic costs, when they are not part of the ruling coalition.

The timing of the game between the rich, the middle and the poor is the following:

1. The rich class selects the planned output target ω^* and its optimal level of rents r^* and decides whether to form a coalition government with the middle class; this is a binary decision denoted by $\psi \in \{0, 1\}$.
2. The poor observe the decision of the rich and decide whether to form a coalition with the middle or accept the incumbent's decision and produce ω . This is a binary decision denoted by $\lambda \in \{0, 1\}$.

It is certain that ω_κ is monotonically decreasing in the expropriation rate κ , which implies that the extractive capacity of the poor undermines the output they produce. The larger the share of rich and middle in the economy, the higher the expropriation rate to be observed and therefore the lower the level of optimal output. In the Aristotelian economy, class competition is explicit and defines wealth. The decision of the poor to form a government coalition with the rich or the middle is driven by the effect of the two competing classes on the poor's expropriation rate. As the regime analysis in Book V of *Politics* indicates, democracy as the rule of the poor allows the expropriation of the middle and particularly the rich at the expense of the economy (1301a37–1320a1). The same holds for oligarchy as the rule of the rich. However, oligarchies are inclined to be less stable than democracies because the former involve not only redistributive conflicts between the rich and the poor, but also rivalries among the rich themselves (*ibid.*).

PROPOSITION 2 (*The Aristotelian Equilibrium*)

There is a unique subgame perfect equilibrium of the Aristotelian economy game that has the following form:

1. If $\kappa < \alpha^R$ or $\kappa \leq \alpha^R + \alpha^M$, then the poor do not deliver $\tilde{\omega}$ and polity collapses in favor of democracy.
2. If $|\kappa - v| \leq |\iota - \kappa|$ and $\kappa < \alpha^R$ or $\kappa \leq \alpha^R + \alpha^M$, then the poor do not deliver $\tilde{\omega}$ and tyranny occurs.
3. If $|\kappa - v| > |\iota - \kappa|$ and $\kappa < \alpha^R$ or $\kappa \leq \alpha^R + \alpha^M$, then the poor do not deliver $\tilde{\omega}$ and oligarchy occurs.
4. If $\kappa \geq \alpha^R$ or $\kappa > \alpha^R + \alpha^M$, then the poor deliver $\tilde{\omega}$ and the following solutions are observed:
 - a) If $\theta^R \leq r$ and $\bar{\zeta}^M > \frac{1}{2}$, then the rich underprovide the public good g and kingship occurs.
 - b) If $\theta^R \leq r$ and $\bar{\zeta}^M \leq \frac{1}{2}$, then the rich underprovide the public good g and aristocracy occurs.
 - c) If $\theta^R > r$, then the rich provide the public good g at least at g^* and polity is preserved.

PROOF OF PROPOSITION 2 See the Appendix A.

The main drivers of the Aristotelian economy are the expropriation capacity of the poor κ and the rent extraction of the rich r . When the expropriation capacity of the poor is strictly dominated by the share of the rich in society or weakly dominated by the joint share of the rich and the poor, then the poor have no incentive to be productive and do not deliver the optimal output that maximizes cross-class collective welfare and the political incumbency of the rich. Democracy emerges as a coalition of the poor and the middle against the rich, and allows the poor to produce the output level that maximizes the utility of the poor and the middle only. Tyranny emerges when the rich implement a repressive form of monitoring over production processes, such that the poor have a much higher incentive to expropriate and at the same time underfulfill rather than overfulfill and keep expropriation at modest levels. The difference between tyranny and oligarchy is that in an oligarchy monitoring is less repressive and the productive poor are rewarded relatively more than the less productive ones are penalized.

The proposed model of Aristotelian *Politics* treats the expropriation capacity of the poor and the rent-seeking activities of the rich as morally equivalent. There is no moral advantage for the rich in the Aristotelian economy, as there is for the guardians in the Platonic economy. Furthermore, the upper bound of the joint level of skills for auxiliaries and producers $\bar{\sigma}^L$ distinguishes itself from the upper bound of the competence level of the middle class $\bar{\zeta}^M$. When the expropriation rate of the poor dominates the electoral magnitude of the rich and/or the middle in society, then optimal output will be produced. Three political regimes are then possible: kingship, aristocracy and polity. Kingship occurs when the rent-seeking activities of the rich weakly dominate their individual commitment to the common good and their level of skills is defined by a closed set whose lower bound is above the average level of skills in society. Hence, it becomes obvious why kingship is a regime that requires a coalition between the rich and the middle: the rich are competent enough to rule society through a representative. Nevertheless, they are inclined to coalesce

with the middle rather than the poor because their high level of rent extraction is more likely to be compensated by the higher skill level of the middle class in relation to the provision of public goods.

In contrast, when rent-seeking dominates the common good mission of the rich, but their level of skills takes a value from a closed set whose lower bound is below the average level of skills in society, then aristocracy emerges. The difference between kingship and aristocracy lies in the comparison of the lower bound of the competence level of the rich in society with the average level of skills for any citizen, which I assume to be $1/2$. When the rich class is extractive and reveals high levels of skills, then it is possible for one enlightened representative of the rich class to function as a king. When the rich class is extractive but it operates at low skill levels, then a collective solution such as aristocracy is Pareto-improving with respect to kingship such that the distance between the lower bound of skill levels for the rich and the upper bound of skill levels for the poor $|\bar{\xi}^M - \bar{\xi}^\Phi|$ is minimized. This is why the provision level of public goods is higher under kingship than under aristocracy: lower skills of the rich under aristocracy and coalition with the poor produce an overall more extractive ruling coalition.

As Lemma 3 (see Appendix A) suggests, rent extraction by the rich undermines their commitment to the common good and leads to less representative forms of government. The rich are then more willing to seek coalitions that lead to kingship or aristocracy, depending on their own level of skills and the compensatory power of the skills of the middle or the poor toward the common good, and in compensation of their own rent-seeking activities. A coalition between the poor and the middle facilitates the provision of the public good under democracy, but at lower levels than in a polity. When the share of rich in society is very low and it strictly dominates the expropriation capacity of the poor, tyranny emerges as a political regime that also underprovides public goods. The same observation holds when the joint share of rich and middle weakly dominate the expropriation rate of the poor. In contrast to the case with democracy, under tyranny and oligarchy the participation of the rich in the government of the city-state leads to higher levels of underprovision of the public good. Polity occurs at low levels of rent-seeking such that $r \leq \underline{r}$, whereas kingship occurs at intermediate levels of rent-seeking such that $\underline{r} < r \leq \bar{r}$. Similarly, at high levels of rent-seeking aristocracy occurs such that $r > \bar{r}$.

Aristotle treats socio-economic classes as agents that mutually restrain each other's extractive activities (see Lemma 4 and Corollary 4A in the Appendix A). The realization of polity does not constitute an equilibrium in relation to a continuous individual commitment to the common good by the rich or an implementation of the production plan by the poor. The Aristotelian logic underscores the significance of mutually restraining the accumulation of political rents by the rich and expropriation activities by the poor. An overwhelmingly large size of the rich and middle undermines the delivery of the optimal output by the poor and allows an excessive rent extraction by the rich. Hence, an underprovision of the public good occurs, where democracy becomes an equilibrium solution that punishes the rent-seeking of the rich without introducing punitive sanctions for underfulfillment against the poor. Tyranny as a political-economic outcome in the Aristotelian economy suggests that the implied coalition between the rich and the poor does not advance social welfare. In reality, it subdues governmental policy to rent accumulation by the rich. The underprovision of the public good becomes even more acute under oligarchy. The coalition between the rich and the middle increases the predatory activities of the rich against the poor, while being more dependent on the output produced by the poor as a compensatory mechanism for their own extractive history.

4 | CLASSICAL ORIGINS & DISTRIBUTIVE JUSTICE

In this paper, I argue that the distinction between Platonic and Aristotelian political economies constitutes the archetypical comparison that has underpinned the study of economic systems, the comparison between plan and market. While Plato's *Republic* and Aristotle's *Politics* propose five and six regime types, respectively, as possible equilibrium solutions to the distribution of resources and political power, there are significant differences even for regime types that share the same characterization: democracy, oligarchy and tyranny. The Platonic *politeia* is also significantly

distinctive from the Aristotelian polity.⁵ Tyranny under Plato is a planning pathology that emerges when guardians penalize producers that deviate from production targets more than they reward producers that meet them. Tyranny under Aristotle occurs when the rich are better off by forming a coalition government with poor and underprovide public goods under conditions of limited production.

This tradeoff between the political effect of representative governance and the efficiency loss related to a vertical production process is crucial for our understanding of Platonic and Aristotelian economies.⁶ While the performance of a Platonic economic system depends on the enforcement capacity of the guardian and his degree of individual commitment to the common good, the performance of an Aristotelian economic system depends on the relative competence advantage of the rich and the fulfillment of the production plan by the poor. Extractive poor can be much more detrimental for the emergence of polity per Aristotle than for the emergence of *politeia* per Plato. The guardian-centric nature of the Platonic economy makes oligarchy a relatively more efficient regime than its Aristotelian equivalent. The same observation holds for tyranny. Commitment to the common good is a much more powerful constraint than the interests of the middle class in singular regimes. The reverse observation holds for democracy: the Platonic version of democracy is more extractive than its Aristotelian equivalent.

Plato's criticism of poverty and wealth as the foundation of underdevelopment and conflict in Greek city-states reflects his commitment to what could be interpreted as a socialist plan with the guardians as the central authority (Fuks, 1977). *Politeia* is treated as the optimal regime type in the *Republic*, because it maximizes collective welfare through the abolition of class competition (547B-C, *Republic* in Fuks, 1977). Nietzsche's concept of "master morality" and von Pöhlmann's critique of individualism and materialism render the *Republic* a crucial analytical bridge between top-down socio-economic transformation, utopian distributive justice and Soviet-style central planning (Sasaki, 2012). The Platonic affinities of the Soviet Union become particularly obvious, when one observes Plato's distance from representative forms of government and his commitment to the power of the guardians as sine-qua-non condition for the achievement of the common good (Kessidis, 1972). Welles (1948) draws some interesting linkages between Plato's *Republic* and modern economic thought. He argues that the concepts of autarky and state regulation of the economy along with price control and delimitation of profit approximate strongly the ideological grounds of socialist economic organization (ibid.). The Soviet experiment of the 20th century has, therefore, provided a solid empirical basis for rethinking the regime types in the *Republic* as an economic equilibrium.

Similarly, it is also possible to trace in Aristotle's *Politics* the origins of capitalist political economy (Meikle, 1979). This relates to concepts of barter and exchange, but it also expands to the multiplicity of socio-economic classes and their role toward the achievement of the common good (ibid.). The Aristotelian economy, therefore, lies in sharp contrast with its Platonic counterpart, given the latter's abolition of private property (Copeland, 1924). While Aristotle identifies as the main cause for the collapse of polity the excessive rent-seeking of the rich and the focus of the poor on property expropriation, Plato suggests that the economic rise of Athens and other Greek city-states has created adverse incentives for the emergence of *politeia*. Furthermore, production surplus in the Aristotelian economy provides citizens with the leisure required to facilitate their political involvement, while maintaining a stable level of economic performance (Prasch, 2013). Aristotle, therefore, advocates a market-based political economy, whose foundation is political competition and the ensuing mutual restraint of rent-seeking and expropriation.

The optimal regime – *politeia/polity* – is achieved differently in these two types of economic systems. In the *Republic*, *politeia* is the equilibrium regime where the guardians are self-invested in the maximization of social welfare and place the interests of the community before their own. In *Politics*, polity is the equilibrium regime that consolidates the dominance of the middle class while preserving the expropriation capacity of the poor such that the production process is not interrupted. Hence, the concept of just society in the Platonic equilibrium is related to

⁵Gaertner (1994) underscores the significance of distributive justice theories and particularly utilitarianism. As Faravelli (2007) indicates, justice conceptualizations are context-dependent.

⁶Cross-class competition not only reveals the close affinity between Aristotle and Marx (Schwartz, 1979), but it also proposes that government coalitions may reduce the efficiency losses generated by the underfulfillment of production targets.

the enlightened nature of society's leadership, whereas in the Aristotelian equilibrium it is linked to the majoritarian imposition of the middle class in coalition with the less extractive of the two remaining classes, the poor. Just society in the *Republic* is a phenomenon *ad personam*; in *Politics*, it is *ad rem*. I argue that this is yet another powerful distinction between plan and market and, in particular, the way they reflect on political-economic outcomes.

Similarly to Plato and Aristotle, Roemer (1998) and Nozick (1974) advocate competing definitions of distributive justice based on equality and liberty, respectively. Nozick (1974) suggests that distributive justice is a series of competitive exchanges that maximize property entitlements per individual. Rawls (1999) approaches justice through the difference principle and the veil of ignorance, which gives rise to another important concept, the *maximin* principle. His theory underpins the presence of a morally acceptable inequality, where the poorest person in society becomes better off compared to the equilibrium solutions proposed by equality or liberty (Rawls, 1999; Roemer, 1998). While the veil of ignorance allows for the equalization of primary social goods, it does not correct for inequality in their initial distribution across social groups (*ibid.*). Roemer (1998) distinguishes between equality of opportunity and equality of resources. He argues that equalization of advantage (opportunity) rather than resources for all voters across types can provide the most efficient solution to the problem of distribution of social resources, as it holds people responsible only for traits within their own reach of control rather than exogenous factors (*ibid.*). In that sense, Roemer (1998) offers the most comprehensive critique to Dworkin's distinction between the individual's personal responsibility and societal obligations toward distributive justice. The long-run significance of the Plato-Aristotle comparison toward the rise of differential political economies is also corroborated by the concepts of morality and justice in another monument of ancient legal thought, the Talmud, and its entanglement with its contemporaneous Roman law (May, 2019). Personal responsibility for fairness in the distribution of resources beyond the boundaries of one's household constitutes a common normative foundation both for Talmudic and classical Greek political economy (Cohen, 2012).

While Corneo (2017) supports that the Platonic economy is compatible with capitalism, he acknowledges that Plato's abstinence from democracy may be conducive to military dictatorship and institutional underdevelopment. Sen (2011) proposes his nontranscendental approach, where a comparative (relative) notion of injustice in terms of social choice theory may be more attainable than absolute justice; this is in line with both the Platonic and the Aristotelian economy equilibria. Marx's expropriation theory does not imply any equality of resources *ex-ante* (Roemer, 1985b). Neither the Platonic nor the Aristotelian economy does this. Guardians are the persistent winners of a Platonic economy with differential rates of success, depending on the type of regime that emerges. The frequent change in government coalitions points to a more complex institutional environment. In this sense, Aristotle is an advocate of what Roemer calls the egalitarian principle (Roemer, 1993): the core of human nature and the resources related to it should be common to all people. Moreover, the transition from modeling economic environments to the modeling of ethical environments is central here (Roemer, 1986). What makes the Aristotelian equilibrium more interesting and diverse is its reliance on political majorities rather than on hierarchical structures that are fixed *ex-ante*. While the incumbency advantage of the rich is assumed in society for purposes of comparability with its Platonic counterpart, it may also be the case that the starting point of production may involve the incumbency of the middle class. I have not included that in my model, because I have intended to produce a model that would be historically contingent upon the historical realities developed in the 5th and 4th centuries BC in Athens. The rich are winners at differential levels under tyranny, kingship, aristocracy and oligarchy, while the middle under polity and the poor under democracy. Despite his straightforward support of the common good, Aristotle is also convinced that injustice undermines the realization of the common good by prioritizing individual profit over collective welfare (Smith, 1999). The prevalence of a replacement mechanism for the ruling coalition and the achievement of a just society through the elimination of rent-seeking activities of the rich indicate the market-based orientation of the Aristotelian economic system, whereas the existence of a fixed hierarchy and the achievement of a just society through the distributive commitment of the guardian to the common good and the high *ex-ante* quality of monitoring institutions reveal the plan-based orientation of the Platonic economy.



5 | CONCLUSIONS

Aristotle introduced the proportional rule as a key definition for equity; in the presence of resource scarcity such that claimants cannot be fully compensated for their respective claims, proportionality leads to the symmetric payback of claimants based on their original demands (Thomson, 2019). Nevertheless, Aristotle's proportional rule is incompatible with several allocation axioms such as claims truncation invariance and minimal rights first, which is not the case for the concede-and-divide rule (ibid.). At the same time, it is compatible with *ex-post* random changes in the endowment to be divided among the claimants (composition up, composition down) or with (self-)duality (ibid.). Hence, it becomes obvious that an Aristotelian economy does not advance constrained models of equal or egalitarian distribution; it aims rather at the achievement of a distributive equilibrium among the rich, the middle and the poor, which reflects their prior differences in endowment and societal impact. The concept of proportionality, which lies both in Thomson's analysis of the Aristotelian allocation and the model proposed above, is in stark contrast with Plato's rigid hierarchies and the central role of the guardians in maximizing the common good. In Plato, the Aristotelian resource advantage of the rich is replaced by the institutional advantage of the guardians, which is the key driver of the political-economic process.

In this paper, I model the emergence of political regimes and their relationship to justice when it comes to the distribution of resources and the maximization of collective welfare. Based on the regime outcomes proposed in Plato's *Republic* and Aristotle's *Politics*, I argue that the Platonic economic system constitutes an archetypical form of a socialist political economy, whereas the Aristotelian economic system represents an archetypical form of a capitalist political economy. What drives plan fulfillment in the Platonic economy is the *ex-ante* quality level of monitoring institutions and the distributive commitment of the guardians to the common good. What drives production processes in the Aristotelian economy is the rent-seeking of the rich class and the expropriation rate of the poor class. The Aristotelian equilibrium may lead to higher levels of overall efficiency, since it identifies tradeoffs between the political effect of representative government and vertical production processes.

This paper suggests that the distinction between plan and market is not unknown, or at least it should not be considered unrelated, to classical political philosophy and its two main Greek thinkers, Plato and Aristotle. While Aristotle became the intellectual force behind the Renaissance and the reconceptualization of the West, Plato defined the development of Byzantine and Near Eastern political thought and later on became very popular in the Soviet Union, which never integrated Aristotle into the core of its philosophical and political-economic thinking. Developing an analytical framework to delineate the distributive origins of the Cold War within the context of classical philosophy is only the first step toward what may become an extensive research program.

ACKNOWLEDGEMENTS

Open Access funding enabled and organized by Projekt DEAL.

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How to cite this article: Grigoriadis, T. (2023) Aristotle vs. Plato: The classical origins of capitalist & socialist political economies*. *Scottish Journal of Political Economy*, 70, 372–390. Available from: <https://doi.org/10.1111/sjpe.12339>

APPENDIX A

PROOF OF Proposition 1 For continuous levels of effort e , the producer's optimization problem can be written as follows:

$$\begin{aligned} \max_e EU^P &= \max_e \rho \left[\int_0^{\bar{e}} \frac{y}{\alpha^P} + \frac{\eta(e) - \gamma [\eta^* - \eta(e)]}{\alpha^G} - \alpha^G J(\eta, e) f(e) de + \int_{\bar{e}}^1 \frac{y}{\alpha^P} + \frac{\eta(e) + \beta [\eta(e) - \eta^*]}{\alpha^G} - \alpha^G J(\eta, e) f(e) de \right] + \\ (1 - \rho) &\left[\int_0^{\bar{e}} \frac{y}{\alpha^P} + \frac{\eta(e) - \gamma [\eta^* - \eta(e)]}{\alpha^G + \alpha^A} - (\alpha^G + \alpha^A) J^2(\eta, e) f(e) de + \int_{\bar{e}}^1 \frac{y}{\alpha^P} + \frac{\eta(e) + \beta [\eta(e) - \eta^*]}{\alpha^G + \alpha^A} - (\alpha^G + \alpha^A) J^2(\eta, e) f(e) de \right] \Rightarrow \\ \max_e EU^P &= \max_e \rho \left[\int_0^{\bar{e}} \frac{y}{\alpha^P} + \frac{\eta(e)(1 + \gamma) - \gamma \eta^*}{\alpha^G} - \alpha^G J(\eta, e) f(e) de + \int_{\bar{e}}^1 \frac{y}{\alpha^P} + \frac{\eta(e)(1 + \beta) - \beta \eta^*}{\alpha^G} - \alpha^G J(\eta, e) f(e) de \right] + \\ (1 - \rho) &\left[\int_0^{\bar{e}} \frac{y}{\alpha^P} + \frac{\eta(e)(1 + \gamma) - \gamma \eta^*}{\alpha^G + \alpha^A} - (\alpha^G + \alpha^A) J^2(\eta, e) f(e) de + \int_{\bar{e}}^1 \frac{y}{\alpha^P} + \frac{\eta(e)(1 + \beta) - \beta \eta^*}{\alpha^G + \alpha^A} - (\alpha^G + \alpha^A) J^2(\eta, e) f(e) de \right] \end{aligned}$$

I then derive the first-order condition with respect to effort e :

$$\begin{aligned} \frac{\partial EU^P}{\partial e} &= \rho \left[P(\eta^* > \eta(e)) \left[\frac{(1 + \gamma)\eta_e}{\alpha^G} - \alpha^G J_e \right] + P(\eta^* \leq \eta(e)) \left[\frac{(1 + \beta)\eta_e}{\alpha^G} - \alpha^G J_e \right] \right] + \\ (1 - \rho) &\left[P(\eta^* > \eta(e)) \left[\frac{(1 + \gamma)\eta_e}{\alpha^G + \alpha^A} - 2(\alpha^G + \alpha^A) J_e \right] + P(\eta^* \leq \eta(e)) \left[\frac{(1 + \beta)\eta_e}{\alpha^G + \alpha^A} - 2(\alpha^G + \alpha^A) J_e \right] \right] = 0 \Rightarrow \\ \eta_e &\left[\frac{2\alpha^G + \alpha^A}{\alpha^G(\alpha^G + \alpha^A)} \right] \left[P(\eta^* > \eta(e))(1 + \gamma) + P(\eta^* \leq \eta(e))(1 + \beta) \right] = J_e \left[\rho \alpha^G + 2(1 - \rho)(\alpha^G + \alpha^A) \right] \Rightarrow \\ \eta_e = J_e &\frac{\rho \alpha^G + 2(1 - \rho)(\alpha^G + \alpha^A)}{\left[\frac{2\alpha^G + \alpha^A}{\alpha^G(\alpha^G + \alpha^A)} \right] \left[P(\eta^* > \eta(e))(1 + \gamma) + P(\eta^* \leq \eta(e))(1 + \beta) \right]} \Rightarrow \eta_e = J_e \frac{[\alpha^G(\alpha^G + \alpha^A)] [\alpha^G(2 - \rho) + 2(1 - \rho)\alpha^A]}{[2\alpha^G + \alpha^A] [1 + P(\eta^* > \eta(e))\gamma + P(\eta^* \leq \eta(e))\beta]}, \end{aligned}$$

$$\text{which solves for } e^* \Rightarrow e^* = \eta_e^{-1} \left(J_e \frac{[\alpha^G(\alpha^G + \alpha^A)] [\alpha^G(2 - \rho) + 2(1 - \rho)\alpha^A]}{[2\alpha^G + \alpha^A] [1 + P(\eta^* > \eta(e))\gamma + P(\eta^* \leq \eta(e))\beta]} \right).$$

To solve the guardian's optimization problem, I take the first-order condition with respect to θ . Given that θ is a function of ε , I implement the implicit function theorem, yielding:

$$\begin{aligned} \frac{\partial EU^G}{\partial \theta} &= \rho \left[\frac{1}{\alpha^G} - C_\theta \right] + (1 - \rho) \left[\frac{1 - C_\theta}{\alpha^G} \right] = 0 \Rightarrow C_\theta = \frac{1}{1 - \rho(1 - \alpha^G)} \Rightarrow \theta^* = C_\theta^{-1} \left(\frac{1}{1 - \rho(1 - \alpha^G)} \right) \\ \frac{\partial EU^G}{\partial \varepsilon} &= \rho \left[\frac{\frac{\partial}{\partial \varepsilon} \iint_{\sigma^G, \sigma^L} \Delta(g, \varepsilon) \varphi(\sigma^G) f(\sigma^L) d\sigma^G d\sigma^L}{\alpha^G} - C_\varepsilon \right] + (1 - \rho) \left[\frac{\frac{\partial}{\partial \varepsilon} \iint_{\sigma^G, \sigma^L} \Delta(g, \varepsilon) \varphi(\sigma^G) f(\sigma^L) d\sigma^G d\sigma^L - \tau C_\varepsilon}{\alpha^G} \right] \Rightarrow \\ \frac{\partial EU^G}{\partial \varepsilon} &= \rho \left[\frac{F(\bar{\sigma}^L) [1 - F(\bar{\sigma}^L)] \Delta_\varepsilon}{\alpha^G} - C_\varepsilon \right] + (1 - \rho) \left[\frac{F(\bar{\sigma}^L) [1 - F(\bar{\sigma}^L)] \Delta_\varepsilon - \tau C_\varepsilon}{\alpha^G} \right] = 0 \Rightarrow \\ \frac{F(\bar{\sigma}^L) [1 - F(\bar{\sigma}^L)] \Delta_\varepsilon}{\alpha^G} &= C_\varepsilon \left[\frac{\alpha^G \rho + 1 - \rho}{\alpha^G} \right] \Rightarrow \Delta_\varepsilon = C_\varepsilon \frac{1 - \rho(1 - \alpha^G)}{F(\bar{\sigma}^L) [1 - F(\bar{\sigma}^L)]} \Rightarrow \\ \frac{\partial \theta}{\partial \varepsilon} &= - \frac{1 - C_\theta [1 - \rho(1 - \alpha^G)]}{F(\bar{\sigma}^L) [1 - F(\bar{\sigma}^L)] \Delta_\varepsilon - C_\varepsilon [1 - \rho(1 - \alpha^G)]}. \end{aligned}$$

PROOF OF Proposition 2 For continuous levels of expropriation κ , the optimization problem of the poor can be written as follows:

$$\begin{aligned} \max_\kappa EU^\Phi &= \max_\kappa \psi \left[\int_0^{\bar{\kappa}} \frac{y^\Phi + \omega(\kappa) - \iota[\omega^* - \omega(\kappa)]}{\alpha^\Phi} - \alpha^\Phi W(\omega, \kappa) h(\kappa) d\kappa + \int_{\bar{\kappa}}^1 \frac{y^\Phi + \omega(\kappa) + \nu[\omega(\kappa) - \omega^*]}{\alpha^\Phi} - \alpha^\Phi W(\omega, \kappa) h(\kappa) d\kappa \right] + \\ (1 - \psi)(1 - \lambda) &\left[\int_0^{\bar{\kappa}} \frac{y^\Phi}{\alpha^\Phi} + \frac{\omega(\kappa) - \iota[\omega^* - \omega(\kappa)]}{\alpha^M + \alpha^\Phi} - (\alpha^M + \alpha^\Phi) W^2(\omega, \kappa) h(\kappa) d\kappa + \int_{\bar{\kappa}}^1 \frac{y^\Phi}{\alpha^\Phi} + \frac{\omega(\kappa) + \nu[\omega(\kappa) - \omega^*]}{\alpha^M + \alpha^\Phi} - (\alpha^M + \alpha^\Phi) W^2(\omega, \kappa) h(\kappa) d\kappa \right] + \\ (1 - \psi)\lambda &\left[\int_0^{\bar{\kappa}} \frac{y^\Phi}{\alpha^\Phi} + \frac{\omega(\kappa) - \iota[\omega^* - \omega(\kappa)]}{\alpha^R + \alpha^\Phi} - (\alpha^R + \alpha^\Phi) W^2(\omega, \kappa) h(\kappa) d\kappa + \int_{\bar{\kappa}}^1 \frac{y^\Phi}{\alpha^\Phi} + \frac{\omega(\kappa) + \nu[\omega(\kappa) - \omega^*]}{\alpha^R + \alpha^\Phi} - (\alpha^R + \alpha^\Phi) W^2(\omega, \kappa) h(\kappa) d\kappa \right] \end{aligned}$$

The first-order condition with respect to expropriation κ is the following:

$$\begin{aligned} \frac{\partial EU^\Phi}{\partial \kappa} &= \psi \left[P(\omega^* > \omega(\kappa)) \left[\frac{(1+\iota)\omega_\kappa}{\alpha^\Phi} - \alpha^\Phi W_\kappa \right] + P(\omega^* \leq \omega(\kappa)) \left[\frac{(1+\nu)\omega_\kappa}{\alpha^\Phi} - \alpha^\Phi W_\kappa \right] \right] + \\ &(1-\psi)(1-\lambda) \left[P(\omega^* > \omega(\kappa)) \left[\frac{(1+\iota)\omega_\kappa}{\alpha^M + \alpha^\Phi} - 2(\alpha^M + \alpha^\Phi) W_\kappa \right] + P(\omega^* \leq \omega(\kappa)) \left[\frac{(1+\nu)\omega_\kappa}{\alpha^M + \alpha^\Phi} - 2(\alpha^M + \alpha^\Phi) W_\kappa \right] \right] + \\ &(1-\psi)\lambda \left[P(\omega^* > \omega(\kappa)) \left[\frac{(1+\iota)\omega_\kappa}{\alpha^R + \alpha^\Phi} - 2(\alpha^R + \alpha^\Phi) W_\kappa \right] + P(\omega^* \leq \omega(\kappa)) \left[\frac{(1+\nu)\omega_\kappa}{\alpha^R + \alpha^\Phi} - 2(\alpha^R + \alpha^\Phi) W_\kappa \right] \right] = 0 \Rightarrow \\ &W_\kappa \frac{\left[\alpha^\Phi (\alpha^\Phi + \alpha^M) (\alpha^\Phi + \alpha^R) \right] \left[\alpha^\Phi (4-3\psi) + 2(1-\psi) (\alpha^R + \alpha^M) \right]}{\left[\alpha^\Phi (3\alpha^\Phi + 2(\alpha^R + \alpha^M)) + \alpha^M \alpha^R \right] \left[1 + P(\omega^* > \omega(\kappa))\iota + P(\omega^* \leq \omega(\kappa))\nu \right]}, \text{ which solves for } \kappa^* \Rightarrow \\ &\kappa^* = \omega_\kappa^{-1} \left(W_\kappa \frac{\left[\alpha^\Phi (\alpha^\Phi + \alpha^M) (\alpha^\Phi + \alpha^R) \right] \left[\alpha^\Phi (4-3\psi) + 2(1-\psi) (\alpha^R + \alpha^M) \right]}{\left[\alpha^\Phi (3\alpha^\Phi + 2(\alpha^R + \alpha^M)) + \alpha^M \alpha^R \right] \left[1 + P(\omega^* > \omega(\kappa))\iota + P(\omega^* \leq \omega(\kappa))\nu \right]} \right) \end{aligned}$$

The optimal output in the Aristotelian economy is defined by $\tilde{\omega} = \int_{\kappa} \omega_\kappa h(\kappa) d\kappa$ and the indirect utility of the rich is the following:

$$\begin{aligned} EU^R(y^R; g) &= \psi \left[\frac{g+r+\theta^R+\tilde{\omega}}{\alpha^R + \alpha^M} + H(g) + \kappa r - (\alpha^R + \alpha^M) C(g, \varepsilon) \right] + \\ &(1-\psi) \left[\lambda \left(\frac{g+r+\theta^R+\tilde{\omega}}{\alpha^R + \alpha^\Phi} + H(g) + (1+\kappa)r - (\alpha^R + \alpha^\Phi) C(g, \varepsilon) \right) + \frac{(1-\lambda)(g+r+\theta^R+\tilde{\omega})}{\alpha^R} \right]. \end{aligned}$$

The first-order condition with respect to g in the optimization problem of the rich is the following:

$$\begin{aligned} \frac{\partial EU^R}{\partial g} &= \psi \left[\frac{1}{\alpha^R + \alpha^M} + H_g - (\alpha^R + \alpha^M) C_g \right] + (1-\psi) \left[\lambda \left(\frac{1}{\alpha^R + \alpha^\Phi} + H_g - (\alpha^R + \alpha^\Phi) C_g \right) + \frac{1-\lambda}{\alpha^R} \right] = 0 \Rightarrow \\ H_g &= \frac{(\alpha^R + \alpha^M) \left[\psi C_g - (1-\psi) \left[(1-\lambda) (\alpha^R + \alpha^\Phi) + \lambda \alpha^R \right] \right] + (\alpha^R + \alpha^\Phi) \left[\lambda (1-\psi) C_g - \psi \alpha^R \right]}{\psi + (1-\psi)\lambda} \\ &\text{which solves for } g^{**} \Rightarrow \\ g^{**} &= H_g^{-1} \left(\frac{(\alpha^R + \alpha^M) \left[\psi C_g - (1-\psi) \left[(1-\lambda) (\alpha^R + \alpha^\Phi) + \lambda \alpha^R \right] \right] + (\alpha^R + \alpha^\Phi) \left[\lambda (1-\psi) C_g - \psi \alpha^R \right]}{\psi + (1-\psi)\lambda} \right) \end{aligned}$$

I also take the first-order condition with respect to θ^R . Given that θ^R is a function of r , I implement the implicit function theorem, yielding:

$$\begin{aligned} \frac{\partial EU^R}{\partial \theta^R} &= \psi \left[\frac{1}{\alpha^R + \alpha^M} - (\alpha^R + \alpha^M) C_{\theta^R} \right] + (1-\psi) \left[\lambda \left(\frac{1}{\alpha^R + \alpha^\Phi} - (\alpha^R + \alpha^\Phi) C_{\theta^R} \right) + \frac{1-\lambda}{\alpha^R} \right] = 0 \Rightarrow \\ \theta^{R*} &= C_{\theta^R}^{-1} \left(\frac{\left[\psi \alpha^R + (1-\lambda)(1-\psi) (\alpha^R + \alpha^M) \right] (\alpha^R + \alpha^\Phi) + \lambda (1-\psi) \alpha^R (\alpha^R + \alpha^M)}{\psi (\alpha^R + \alpha^M) + \lambda (1-\psi) (\alpha^R + \alpha^\Phi)} \right). \end{aligned}$$

Similarly with respect to r :

$$\begin{aligned} \frac{\partial EU^R}{\partial r} &= \psi \left[\frac{1+\Gamma_r X(\xi^R) \left[\frac{\psi}{\alpha^R} H(\xi^M) + \frac{(1-\psi)\lambda}{\alpha^R} Q(\xi^\Phi) \right]}{\alpha^R + \alpha^M} + \kappa - (\alpha^R + \alpha^M) C_r \right] + \\ &(1-\psi) \left[\lambda \left(\frac{1+\Gamma_r X(\xi^R) \left[\frac{\psi}{\alpha^R} H(\xi^M) + \frac{(1-\psi)\lambda}{\alpha^R} Q(\xi^\Phi) \right]}{\alpha^R + \alpha^\Phi} + 1 + \kappa - (\alpha^R + \alpha^\Phi) C_r \right) \right] = 0 \Rightarrow \\ &\left[\psi (\alpha^R + \alpha^M) + (1-\psi)\lambda (\alpha^R + \alpha^\Phi) \right] C_r = \left[1 + \Gamma_r X(\xi^R) \left[\frac{\psi}{\alpha^R} H(\xi^M) + \frac{(1-\psi)\lambda}{\alpha^R} Q(\xi^\Phi) \right] \right] \left[\frac{\psi}{\alpha^R + \alpha^M} + \frac{\lambda(1-\psi)}{\alpha^R + \alpha^\Phi} \right] + \kappa \left[\psi + (1-\psi)\lambda \right] + (1-\psi)\lambda \end{aligned}$$

Hence, according to the implicit function theorem:

$$\frac{\partial \theta^R}{\partial r} = - \frac{\frac{\psi}{\alpha^R + \alpha^M} + \frac{\lambda(1-\psi)}{\alpha^R + \alpha^\Phi} + \frac{(1-\lambda)(1-\psi)}{\alpha^R} - \tau C_{\theta R} \left[\psi (\alpha^R + \alpha^M) + \lambda(1-\psi) (\alpha^R + \alpha^\Phi) \right]}{\left[1 + \frac{\Gamma_r X(\xi^R)}{\alpha^R} \right] \left[\psi H(\xi^M) + (1-\psi) \lambda Q(\xi^\Phi) \right] \left[\frac{\psi}{\alpha^R + \alpha^M} + \frac{\lambda(1-\psi)}{\alpha^R + \alpha^\Phi} \right] + \kappa [\psi + (1-\psi)\lambda] + (1-\psi)\lambda}$$

LEMMA 1 In the Platonic economy game, there is a positive monotonic relationship between the guardian's distributive commitment to the common good and the ex-ante quality of monitoring institutions. When $\underline{\varepsilon} \leq \varepsilon$, oligarchy is observed, whereas for intermediate values of ε such that $\underline{\varepsilon} < \varepsilon \leq \bar{\varepsilon}$ timocracy occurs. Politeia emerges at high levels of ex-ante monitoring such that $\varepsilon > \bar{\varepsilon}$.

PROOF OF Lemma 1 I identify the relationship between the distributive commitment of the guardian to the provision of the public good and his degree of monitoring over the auxiliary and the producer, the relationship between public goods provision and the share of guardians, and the relationship between effort delivered by the producers and the joint share of guardians and auxiliaries.

I find that

$$\frac{\partial \theta}{\partial \varepsilon} = - \frac{1 - C_\theta [1 - \rho(1 - \alpha^G)]}{F(\bar{\sigma}^L) [1 - F(\bar{\sigma}^L)] \Delta_\varepsilon - C_\varepsilon [1 - \rho(1 - \alpha^G)]} > 0$$

which means that the distributive commitment of the guardian is monotonically increasing with the quality of monitoring institutions in the economy. The higher the degree of monitoring, the higher the distributive commitment of the guardian to the common good.

LEMMA 2 In the Platonic economy game, there is a positive monotonic relationship between the provision of the public good and the share of guardians. When $\alpha^G \leq \bar{\alpha}^G$, tyranny is observed, whereas for higher values of α^G such that $\alpha^G > \bar{\alpha}^G$ democracy occurs.

PROOF OF Lemma 2 The relationship between the provision of public goods and the share of guardians in the population of the city-state is defined by $g^* = H_g^{-1} \left(\frac{C_g [1 + \rho(\alpha^G - 1)] - 1}{\alpha^G} \right)$ such that $\frac{\partial g}{\partial \alpha^G} = H_{g\alpha^G}^{-1} \left(\frac{C_g [1 + \rho(\alpha^G - 1)] - 1}{\alpha^G} \right) C_g \frac{\rho - 1}{\alpha^{G2}} > 0$. The higher the share of the guardian class in society, the higher the provision of public goods. Because the guardian preserves his authority through the provision of public goods, he is better able to do so where his share of influence in society is higher rather than lower.

COROLLARY 2A In the Platonic economy game, there is a negative monotonic relationship between the effort delivered by producers and the joint share of guardians and auxiliaries. When $\alpha^G + \alpha^A > \underline{\alpha}^G + \underline{\alpha}^A$, then $\tilde{\eta}$ is not delivered and tyranny or democracy emerges. When $\alpha^G + \alpha^A \leq \underline{\alpha}^G + \underline{\alpha}^A$, then $\tilde{\eta}$ is delivered and politeia or timocracy or oligarchy emerges.

PROOF OF Corollary 2A $\frac{\partial e}{\partial \alpha^G} < 0$ and $\frac{\partial e}{\partial \alpha^A} < 0$, which suggests that the effort delivered by producers decreases with the share of elites and their direct agents.

LEMMA 3 In the Aristotelian economy game, there is a positive monotonic relationship between the distributive commitment to the common good by the rich and their rate of rent extraction. When $r \leq \underline{r}$, politeia is observed, whereas for intermediate values of r such that $\underline{r} < r \leq \bar{r}$ kingship occurs. Aristocracy emerges at high levels of rent extraction such that $r > \bar{r}$.

PROOF OF Lemma 3 As in the Platonic economy, I identify the relationship between the distributive commitment of the rich class to the provision of the public good and its degree of rent-seeking, the relationship between public goods provision and

the share of the rich class in the Aristotelian economy, and the relationship between the expropriation rate of the poor and the joint share of rich and middle in society. I find that

$$\frac{\partial \theta^R}{\partial r} = - \frac{\frac{\psi}{\alpha^R + \alpha^M} + \frac{\lambda(1-\psi)}{\alpha^R + \alpha^\Phi} + \frac{(1-\lambda)(1-\psi)}{\alpha^R} - C_{\theta^R} \left[\psi (\alpha^R + \alpha^M) + \lambda(1-\psi) (\alpha^R + \alpha^\Phi) \right]}{\left[1 + \frac{\Gamma r X(\xi^R)}{\alpha^R} \right] \left[\psi H(\xi^M) + (1-\psi) \lambda Q(\xi^\Phi) \right]} \left[\frac{\psi}{\alpha^R + \alpha^M} + \frac{\lambda(1-\psi)}{\alpha^R + \alpha^\Phi} \right] + \kappa [\psi + (1-\psi)\lambda] + (1-\psi)\lambda < 0$$

which means that the distributive commitment of the rich is monotonically decreasing with their rent extraction rate. Therefore, as per Aristotle, political rents have a negative effect on the common good. The higher the rate of rent extraction, the lower the distributive commitment of the rich class to the common good.

LEMMA 4 *In the Aristotelian economy game, there is a negative monotonic relationship between the provision of the public good and the share of the rich. When $\kappa < \alpha^R$ or $\kappa \leq \alpha^R + \alpha^M$, tyranny is observed for low values of α^R such that $\alpha^R \leq \underline{\alpha}^R$, whereas for high values of α^R such that $\alpha^R > \bar{\alpha}^R$ oligarchy occurs. Democracy occurs for intermediate values of α^R such that $\underline{\alpha}^R < \alpha^R \leq \bar{\alpha}^R$.*

PROOF OF Lemma 4 I define $\underline{\alpha}^R$ and $\underline{\alpha}^M$ in the Aristotelian economy as the respective lower bounds of the rich and middle class population shares that facilitate the implementation of the production schedule by the poor. When $\tilde{\omega}$ is not delivered by the poor, the level of public goods provision collapses and I observe the emergence of three regime types, which Aristotle considers to be deviations from the correct forms of regimes: democracy, tyranny and oligarchy. The relationship between the provision of public goods and the share of rich in the population of the city-state is defined by the following expression:

$$g^{**} = H_g^{-1} \left(\frac{(\alpha^R + \alpha^M) \left[\psi C_g - (1-\psi) \left[(1-\lambda) (\alpha^R + \alpha^\Phi) + \lambda \alpha^R \right] \right] + (\alpha^R + \alpha^\Phi) \left[\lambda(1-\psi) C_g - \psi \alpha^R \right]}{\psi + (1-\psi)\lambda} \right)$$

such that:

$$\frac{\partial g}{\partial \alpha^R} = H_{g\alpha^R}^{-1} \left(\frac{(\alpha^R + \alpha^M) \left[\psi C_g - (1-\psi) \left[(1-\lambda) (\alpha^R + \alpha^\Phi) + \lambda \alpha^R \right] \right] + (\alpha^R + \alpha^\Phi) \left[\lambda(1-\psi) C_g - \psi \alpha^R \right]}{\psi + (1-\psi)\lambda} \right)^* \left[C_g - \frac{2\alpha^R + \alpha^\Phi \left[\psi + (1-\psi)(1-\lambda) \right] + \alpha^M(1-\lambda)(1-\psi)}{\psi + (1-\psi)\lambda} \right] < 0.$$

The higher the share of the rich in society, the lower the provision of public goods. Because polity emerges only as a coalition between the poor and the middle, the provision level of public goods is maximized only if the rich are unable to form a ruling coalition. However, democracy is more likely to emerge than polity when the poor maintain a low rate of expropriation. Under oligarchy, the level of public goods provision reaches its lower bound because the high share of the rich in society leads to higher levels of aggregate extraction of rents and makes the poor more indifferent toward the provision of the public good.

COROLLARY 4A *In the Aristotelian economy game, there is a negative monotonic relationship between the expropriation rate by the poor and the joint share of the rich and middle. When $\alpha^R + \alpha^M > \underline{\alpha}^R + \underline{\alpha}^M$, then $\tilde{\omega}$ is not delivered and tyranny or democracy or oligarchy emerges. When $\alpha^R + \alpha^M \leq \underline{\alpha}^R + \underline{\alpha}^M$, then $\tilde{\omega}$ is delivered and politeia or kingship or aristocracy emerges.*

PROOF OF Corollary 4A $\frac{\partial \kappa}{\partial \alpha^R} < 0$ and $\frac{\partial \kappa}{\partial \alpha^M} < 0$, which suggests that the expropriation rate by the poor decreases with the share of the rich and the middle.