A Note on Evolutionary Stability in Post-Wage Economies

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Abstract

Standard game-theoretic analysis often evaluates economic outcomes through the concept of Nash equilibrium. While useful as a condition of mutual best response, Nash equilibrium does not necessarily determine the evolutionary stability of a system. If new strategies appear through experimentation, imitation, or institutional change, the relevant question becomes whether these deviations spread or disappear under competitive selection.

This note applies the framework of evolutionary game theory to the problem of redistribution in post-wage economies. When firms compete under decentralized market incentives, strategies that retain a larger share of profits grow faster, leading evolutionary dynamics to select for minimal redistribution. This generates a Darwinian drift in aggregate redistribution toward lower $\bar{\theta}$ over time. In this environment, zero redistribution is the Nash equilibrium and, under the specified selection dynamics, an ESS.

The analysis further shows that enforceable institutional coordination can alter these dynamics. By modifying the growth incentives associated with profit retention, coordinated redistribution rules reshape the evolutionary fitness landscape of the economy and allow positive redistribution regimes to become evolutionarily stable.

1 From Nash Equilibrium to Evolutionary Stability

In standard game theory, the central equilibrium concept is the Nash equilibrium [Nash, 1951]. A strategy profile is a Nash equilibrium if no player can improve their payoff by unilaterally deviating from it. In this sense, the Nash concept captures a form of mutual best response: given what others are doing, no player has an incentive to change their strategy.

While powerful, the Nash equilibrium is fundamentally a static concept. It describes a configuration of strategies that is internally consistent, but it does not explain how such configurations arise or whether they remain stable when small perturbations occur. If a new strategy appears in small numbers—through experimentation, imitation, or institutional change—the Nash concept alone does not determine whether that strategy will disappear or spread.

Evolutionary game theory approaches this problem from a different perspective. Rather than assuming that agents compute optimal responses, strategies are treated as traits within a population. Some strategies perform better than others, and those that perform better tend to expand over time. The central question therefore shifts from strategic choice to evolutionary selection: which strategies survive competitive dynamics?

This perspective was formalized in classic work on evolutionary game theory [Maynard Smith, 1982], which introduced the concept of an evolutionarily stable strategy. Informally, a strategy is evolutionarily stable if, when it is widely adopted in a population, a small group of mutants using a different strategy cannot successfully invade.

The distinction between the two concepts can be summarized simply. A Nash equilibrium asks whether a player would like to deviate. Evolutionary stability asks whether a deviation, once introduced, can spread through the population.

2 Population Dynamics and Selection

Evolutionary game theory models strategic interaction within a population of agents using different strategies. Let x_i denote the share of agents using strategy i, where $\sum_i x_i = 1$. If strategy i yields payoff f_i and the population average payoff is $\bar{f}$, strategies that perform better than average tend to expand over time.

A common formalization of this idea is given by the replicator dynamics [Taylor and Jonker, 1978; Weibull, 1995]:

$$\dot{x}_i = x_i(f_i - \bar{f}).$$

where

$$\bar{f} = \sum_i x_i f_i$$

is the average payoff.

This equation captures a simple selection mechanism. Strategies that earn higher-than-average payoffs increase their population share, while those that perform worse gradually disappear.

Within this framework, equilibrium has a dynamic interpretation. A population state is stable if small perturbations do not grow over time. If a small group of agents adopts a new strategy, the crucial question is whether the resulting dynamics amplify that deviation or eliminate it.

Evolutionary models therefore focus not only on equilibrium conditions but also on the adjustment processes that determine which strategies persist in the long run.

3 Why Evolutionary Stability Matters

The distinction between Nash equilibrium and evolutionary stability becomes particularly important in environments characterized by experimentation, imitation, and competitive selection. In such settings, strategies may emerge gradually rather than through fully rational coordination.

Economic systems often display precisely these features. Firms imitate successful competitors, new organizational forms appear, and policies evolve through institutional experimentation. In such environments, the long-run configuration of strategies is shaped not only by best responses but also by selection dynamics.

From this perspective, the relevant question is not merely which strategies constitute mutual best responses, but which strategies survive competitive selection. Strategies that cannot resist invasion by alternative behaviors may persist temporarily, yet they are unlikely to remain stable over longer horizons.

Evolutionary game theory therefore provides a useful framework for analyzing institutional and economic regimes in which adaptation and competition play a central role. The analysis below applies this perspective to the problem of redistribution in post-wage economies, treating redistribution policies as strategies subject to evolutionary selection among competing firms.

4 Redistribution as an Evolutionary Game

The framework above can be applied to the problem of income redistribution in post-wage economies. The central idea is to treat redistribution policies as strategies within a competitive population of firms. This note complements Pravithana (2026) by providing an evolutionary interpretation of the redistribution game developed there. This setup extends the decentralized redistribution game developed in [Pravithana, 2026], now interpreted explicitly through evolutionary selection.

Consider a continuum of firms indexed by

$i \in [0,1]$. Each firm chooses a redistribution rate $\theta_i \in [0,1]$, representing the share of its profits returned to households through mechanisms such as dividends, transfers, or public taxation. Let aggregate redistribution be

$$\bar{\theta} = \int_0^1 \theta_i \, di.$$

Higher aggregate redistribution raises household purchasing power and therefore relaxes demand constraints in the economy. Let firm profits be

$$\pi = \pi(\bar{\theta}),$$

with $\pi'(\bar{\theta}) > 0$. This captures the positive demand externality: when redistribution increases, realized profits across firms rise [Pravithana, 2026].

However, each individual firm bears the cost of its own redistribution decision. Retained earnings for firm i are therefore

$$r_i = (1 - \theta_i)\pi(\bar{\theta}).$$

From a static strategic perspective, each firm prefers to minimize its own redistribution rate. Given $\bar{\theta}$, increasing θ_i reduces retained earnings without significantly affecting aggregate demand when the number of firms is large. As a result, the best response is $\theta_i = 0$, and the unique Nash equilibrium of the decentralized redistribution game is [Nash, 1951]

$$\theta = 0.$$

This result mirrors the coordination failure identified in the decentralized redistribution game in [Pravithana, 2026].

This equilibrium captures a familiar coordination problem: while higher redistribution may increase aggregate profits, no individual firm has an incentive to contribute to it unilaterally.

4.1 Selection Dynamics

The evolutionary perspective extends this analysis by considering how such strategies evolve under competitive selection.

Firms that retain a larger share of their profits can reinvest those resources in expansion, capital accumulation, or technological adoption. We capture this advantage with a reduced-form growth equation

$$g_i = g_0 + \kappa(1 - \theta_i),$$

where g_i denotes the growth rate of firm i, g_0 is a baseline growth component, and $\kappa > 0$ measures the competitive advantage from retained earnings.

While Sections 1–3 describe evolutionary dynamics using the standard population-share notation x_i, the economic model developed below tracks selection through firms' profit shares. Let $s_i(t)$ denote the share of aggregate profits earned by firm i. Competitive selection therefore operates through changes in profit shares rather than through changes in the number of firms. In this interpretation, profit shares play the role of population weights in the replicator dynamics.

Under standard evolutionary dynamics, profit shares evolve according to the replicator equation

$$\dot{s}_i = s_i(g_i - \bar{g}),$$

where $\bar{g}$ is the average growth rate across firms.

Aggregate redistribution is the share-weighted average of firm-level policies:

$$\bar{\theta} = \int_0^1 s_i \theta_i \, di.$$

Differentiating with respect to time yields

$$\dot{\bar{\theta}} = \mathrm{Cov}_s(\theta_i, g_i).$$

Substituting the growth equation gives

$$\dot{\bar{\theta}} = \kappa \, \mathrm{Cov}_s(\theta_i, 1 - \theta_i) = -\kappa \, \mathrm{Var}_s(\theta_i).$$

Since $\kappa > 0$ and $\mathrm{Var}_s(\theta_i) \geq 0$, it follows that

$$\dot{\bar{\theta}} \leq 0,$$

with strict inequality whenever firms differ in their redistribution policies.

This monotonic decline is the Darwinian drift result: competitive selection systematically pushes aggregate redistribution downward over time.

4.2 Evolutionary Stability

This result has a clear interpretation. Whenever firms adopt heterogeneous redistribution policies, competitive selection favors firms that retain a larger share of profits. These firms grow faster and gradually increase their share of the economy.

As their weight expands, the aggregate redistribution rate $\bar{\theta}$ declines. The evolutionary dynamics therefore reinforce the incentives identified in the static game.

In this model, zero redistribution is the Nash equilibrium of the decentralized game. Under the assumptions above, it is an ESS under competitive selection. Any firm that attempts to redistribute more than its competitors sacrifices growth and gradually loses market share.

The evolutionary perspective thus sharpens the coordination problem. Even if a higher-redistribution regime were temporarily established, competitive selection would generate Darwinian drift back toward lower redistribution over time.

In the absence of coordination mechanisms, the decentralized evolutionary outcome of the system is therefore

$$\theta = 0.$$

In ESS terms, this means nearby mutant strategies with higher redistribution cannot successfully invade under the given selection dynamics [Maynard Smith, 1982; Weibull, 1995].

5 Institutional Coordination and the Emergence of a New ESS

The evolutionary result derived above implies that decentralized competition selects for low redistribution. Firms that retain a larger share of their profits grow faster, expand their market share, and gradually dominate the population. As a result, the decentralized evolutionary equilibrium of the system is characterized by $\theta = 0$.

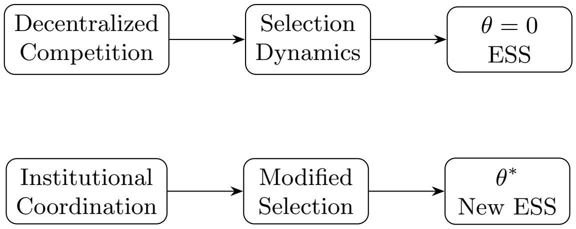

Figure 1: Institutional coordination modifies the selection environment. Under decentralized competition, evolutionary dynamics converge to $\theta = 0$, whereas coordinated rules can stabilize a positive redistribution level θ^*.

This conclusion changes, however, when redistribution is sustained by enforceable institutional coordination.

Suppose a policy rule requires firms to transfer a fraction of profits to households, for example through profit taxation funding universal dividends or other rule-based redistribution mechanisms. Let deviations from the required redistribution level incur an enforcement cost $\Psi(\theta_i)$.

The growth equation then becomes

$$g_i = g_0 + \kappa(1 - \theta_i) - \Psi(\theta_i).$$

The key feature of this formulation is that deviations from the coordinated redistribution rule are penalized. A firm that attempts to increase retained earnings by lowering θ_i faces a countervailing cost through taxation, regulation, or institutional enforcement.

If the enforcement rule is sufficiently strong, the growth advantage from reducing redistribution disappears. In particular, suppose the institutional rule sustains a target redistribution level θ^*. Firms that comply with this rule grow at rate

$$g^* = g_0 + \kappa(1 - \theta^*) - \Psi(\theta^*),$$

while firms that attempt to deviate experience lower effective growth due to the enforcement penalty.

Under these conditions, strategies that deviate from θ^* no longer possess a selective advantage.

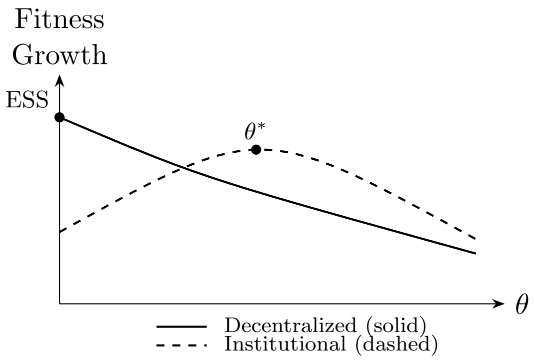

Figure 2: Institutional enforcement reshapes the evolutionary fitness landscape. Under decentralized competition, selection favors minimal redistribution; with coordination, a positive redistribution level can become evolutionarily stable.

Mutant strategies that attempt to reduce redistribution cannot expand their population share because the growth benefits of retention are offset by institutional penalties.

From an evolutionary perspective, institutional coordination therefore changes the fitness landscape of the system. Strategies that previously dominated under decentralized competition may cease to be viable once enforcement mechanisms alter the relationship between retention and growth.

Proposition 1 (Coordinated ESS Condition)**.** *Suppose coordination targets $\theta^* > 0$ and enforcement satisfies, for any unilateral downward deviation $\theta_i < \theta^*$,*

$$\Psi(\theta_i) - \Psi(\theta^*) \geq \kappa(\theta^* - \theta_i).$$

Then deviating firms do not obtain a growth advantage relative to compliant firms. Under replicator dynamics with growth rates g_i defined above, such deviations cannot invade, so θ^* is evolutionarily stable.

Interpretation. The condition states that enforcement must offset the retention gain from reducing redistribution. When this holds, competitive selection no longer rewards under-redistribution.

This leads to a different evolutionary outcome. Whereas decentralized competition selects for zero redistribution, an enforceable coordination rule can stabilize a positive redistribution regime under explicit penalty conditions.

In evolutionary terms, the coordinated redistribution level θ^* becomes an evolutionarily stable strategy. Once widely adopted, small deviations toward lower redistribution cannot successfully invade the population. This directly applies the standard ESS invasion criterion to an institutionally modified fitness landscape [Maynard Smith, 1982; Taylor and Jonker, 1978].

The role of institutions in post-wage economies can therefore be understood in evolutionary terms. Institutions do not merely redistribute income after market outcomes have been determined. Rather, they reshape the selection environment within which firms compete.

In the absence of coordination, competitive dynamics select strategies that minimize redistribution. With enforceable coordination, the evolutionary equilibrium shifts toward a regime in which redistribution is sustained as part of the institutional structure of the economy.

6 Conclusion

This note has interpreted redistribution in post-wage economies through the lens of evolutionary game theory. The key distinction emphasized here is the difference between Nash equilibrium and evolutionary stability. While Nash equilibrium describes a configuration in which no individual agent has an incentive to deviate, evolutionary stability asks a different question: if a deviation occurs, will it spread through the population under competitive dynamics?

When redistribution policies are treated as strategies within a population of competing firms, the decentralized equilibrium exhibits a strong evolutionary force toward lower redistribution. Firms that retain a larger share of profits grow faster and gradually expand their economic weight. As a result, the evolutionary dynamics of decentralized competition reinforce the static incentives identified in the redistribution game. Zero redistribution is therefore the Nash equilibrium and, under the specified selection dynamics, an ESS.

Institutional coordination changes this result. When redistribution is sustained through enforceable rules—such as profit taxation funding universal dividends or other rule-based allocation mechanisms—the growth advantage from reducing redistribution can be eliminated. In this case, strategies that deviate from the coordinated redistribution level lose their selective advantage.

From an evolutionary perspective, institutions therefore reshape the selection environment of the economy. They do not merely correct market outcomes after the fact; they alter which strategies survive competitive dynamics. In decentralized systems the evolutionarily stable outcome is minimal redistribution, whereas enforceable coordination can stabilize regimes in which redistribution persists as a structural feature of the economic system.

The broader implication is that the stability of income regimes in post-wage economies cannot be understood purely through static equilibrium analysis. It depends on the evolutionary dynamics through which economic strategies expand, compete, and persist over time.

References

Maynard Smith, J. (1982). *Evolution and the Theory of Games.* Cambridge University Press, Cambridge.

Nash, J. (1951). Non-cooperative games. *Annals of Mathematics*, 54(2):286–295.

Pravithana, N. (2026). Income regimes after wage anchoring: Coordination and stability in post-wage economies. Working Paper.

Taylor, P. D. and Jonker, L. B. (1978). Evolutionarily stable strategies and game dynamics. *Mathematical Biosciences*, 40(1–2):145–156.

Weibull, J. W. (1995). *Evolutionary Game Theory.* MIT Press, Cambridge, MA.