The evolution of a labor market

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Abstract
We develop a formal equilibrium model to show how a subsistence population organized around the institution of private property can undergo internal differentiation into wage laborers and employers. The supply of labor is provided by potential workers facing a familiar time allocation problem: should they invest their limited endowment of time into food production on their own land or on land owned by someone else? Demand for labor comes from potential employers whose labor investments are constrained by the wage rate, which is set by the market. The well-known requirement of environmental heterogeneity, or variance in the productivity of private land, is derived analytically from the model. We conclude with some discussion of how an initially competitive labor market may become less so over time, with important consequences for the distribution of goods.

Keywords: patron-client model, marginal value theorem, inequality, monopsony, private property, economic defensibility

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1. Introduction

In neoclassical labor economics, the supply of labor is derived from a potential worker's utility function, which takes the form of a trade-off between work and leisure, with work providing indirect utility through a wage that can be converted into the consumption of goods (Borjas, 2023; Hicks, 1963; Marshall, 1920). The term 'leisure' is something of a misnomer, however, as it does not refer strictly to, say, lounging on a couch or having a barbecue with friends, but rather to any amount of time invested in non-wage activities. In that very technical sense at least, the system that prevailed throughout most of human history can be characterized as a leisure economy, with wage labor being an extremely recent phenomenon, only emerging in the last ten thousand or so years (Flannery & Marcus, 2012; Graeber, 2014; Kelly, 2016; Kohler & Smith, 2018). This raises an obvious question: why did work or wage labor suddenly become a profitable alternative to leisure? And for that matter, where did the wages come from?

Prior to the evolution of labor markets, and probably for a time afterwards, mostly dispersed and isolated economies were built around pure subsistence, with largely self-sufficient individuals producing for most or all of their own needs (Childe, 1950; McCool et al., 2025). There was, of course, variability in the mode of subsistence, from foraging to farming and everything in between, but within those subsistence modes, specialization was largely absent from the picture. There were no companies or firms, no cities or states, nor governments and laws. And financial systems were not available to support the exchange of goods and services, at least not at the scale and level of organization we see today. This leaves us as theorists in the somewhat awkward position of having to impoverish our models, taking care not to introduce complexities that run the risk of circularity, or assuming what we mean to explain.

At the same time, we want to avoid re-inventing wheels, especially big economic wheels like the labor market model, which has proven to be an endless fount of economic insight (Borjas, 2023). So, this is our modeling task. We take it for granted that labor market roles - specifically, the roles of employee and employer - are well-defined by the labor market model. We only seek to explain how individuals within a homogeneous economy, an economy in which everyone does more or less the same thing, could be persuaded to inhabit those different roles.

2. Background

Our inspiration for this modeling exercise comes from two models of persistent institutionalized inequality, one proposed by the economists Dow & Reed (2013), the other by the behavioral ecologists Wilson & Codding (2020). Both models (Dow & Reed, 2023a; 2023b; Wilson et al., 2023) may be considered variations on the patron-client model (Bell & Winterhalder, 2014; Boone, 1992; Hooper et al., 2010; 2018; Kennett et al., 2009; Powers & Lehmann, 2014; Smith et al., 2023; Smith & Codding, 2021; Webster, 1990) as they both rely on more or less the same underlying optimization argument. It starts with the premise that individuals will adopt one or the other of the patron-client strategies only if they confer some competitive advantage, like a boost to subsistence efficiency. However, competition in a commons should in general flatten the distribution of resources, pushing the marginal gain for each individual toward the average or per-capita product for the population as a whole. So, a mechanism is required to maintain differential resource access, and the mechanism that everyone seems to have landed on is private property, otherwise known in behavioral ecology as economically defensible resources (Mattison et al., 2016; Smith et al., 2023; Smith & Choi, 2007; Smith & Codding, 2021).

Proponents of the patron-client model will then go on to argue that resources are typically privatized because they are densely clustered and predictable, as those conditions maximize the benefits of consumption while minimizing the costs of defense, compressing total energetic returns into a smaller more easily monitored spatial extent (Brown, 1964; Dyson-Hudson & Smith, 1978). Obvious examples of resources with these qualities may be found in agricultural systems where domesticated plants are typically clustered on farming plots and have seasons of harvest (Bowles & Choi, 2013; 2019), but many types of wild resources may also exhibit those qualities, like salmon fisheries along the northwest coast of North America (Smith & Codding, 2026). The important point in either case is that a system of patrons and clients is unlikely to evolve without private property, which is itself unlikely to evolve without resources that can be profitably monopolized (Smith & Codding, 2026).

While the patron-client model has found some limited empirical support from the available ethnographic and archaeological evidence (Smith et al., 2023; Smith & Codding, 2021; Wilson & Codding, 2020), attempts to formalize the model are rare. Where formalism has shown up, it usually takes the form of game-theoretic simulation studies using agent based models (Hooper et al., 2018; Powers & Lehmann, 2014; Wilson et al., 2023) or complex Malthusian dynamics (Bell & Winterhalder, 2014; Dow & Reed, 2013), with the former lacking analytical derivations of short-run equilibrium and the latter focusing on aggregate settlement logic rather than individual time allocation. To thread the needle between these alternative modeling strategies, we propose a simplified version of the neoclassical labor market model, one that combines a formalization of the patron-client model with the logic of supply and demand. The result is a conceptual framework capable of unifying diverse explanations for the evolution of inequality, including population pressure (Keeley, 1988; Prentiss et al., 2014), land scarcity (Bogaard et al., 2019; 2025; Shenk et al., 2010), monopoly power (Earle, 1997; Hayden & Villeneuve, 2010), surplus (Hayden, 2001; Kirch, 2010), technology (Johnson & Earle, 2000), and wealth transmission (Borgerhoff Mulder et al., 2009), among others. We will touch briefly on some of these connections in the discussion, but first we need to develop the model.

3. Model

As a first approximation, we consider an economy in isolation, without trade or migration, and consisting of a single agricultural sector with two factors of production, labor and land. These serve as variable and fixed inputs into agricultural production on farms, each privately held by

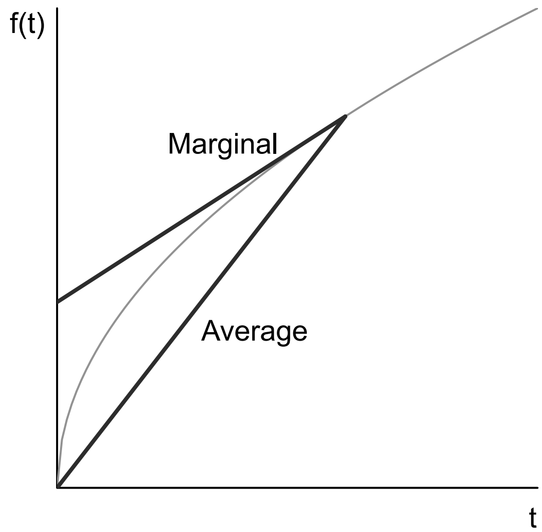

Figure 1: Total, marginal, and average product on a hypothetical farm. Total product is the curved gray line. Marginal product is the slope of the tangent line at a given level of investment, t. Average product is the slope of the line extending from the origin to the total product at t, or $f(t)/t$.

a single farmer or farming household. The total energetic output for a farm with labor input t is

$$f(t) = Gt^{\alpha}$$

where G is the quality of farm land (its intrinsic gain rate) and $0 < \alpha < 1$ is the elasticity of production, representing a percent change in $f(t)$ given a percent change in t. The shape of this production curve is shown in Figure 1 for some G and α. This is a greatly simplified version of Stiglitz (1974, Eq. 1.1) and Dow & Reed (2013), with land a fixed input, elasticity constant across farms, farmers assumed to be risk-insensitive, and the effects of technology and capital being negligible. As a consequence, variation in G is the only means by which to obtain variation in output for equal input.

Taking the derivative of f with respect to input t gives the farm's marginal productivity at a given level of investment

$$f'(t) = \alpha G t^{\alpha - 1}$$

Because $\alpha < 1$, the second derivative of f must be negative, so f' decreases with each additional input. In behavioral ecology, this is known as the Marginal Value Theorem (Charnov & Parker, 1995; Charnov, 1976). In economics, it is referred to as the diminishing marginal product. Because it is diminishing, the marginal product will always be less than the average product, $f(t)/t$, across all levels of investment. If returns were constant, with $\alpha = 1$, then both rates would be equal to G.

Next, we assign to each subsistence farmer a fixed endowment of time T that they can invest either in work on their own farm or in wage labor L. Because those alternatives are mutually exclusive, a fixed T entails that a potential worker's choice is subject to the budget constraint $L \leq T$, so every increase in L must lead to a decrease in own-farm production and vice versa, hence the fundamental trade-off between work and leisure that neoclassical models attribute to labor. A potential employer, however, does not face the same trade-off. Because the additional time investment comes from labor's budget, not the employer's, the investment of L into production on the employer's farm can actually be much greater than T. As a consequence, the only constraint on the potential employer's agricultural production is the cost of that additional labor, which is the wage w.

Finally, everyone is assumed to be a utility maximizer, with utility in this case being a simple linear function of agricultural output. One may also think of this utility in Darwinian terms as inclusive fitness, in which case the objective is adaptation. Given the divergence in constraints confronting potential workers and employers, their optimization problems must also diverge:

$$\max U_l = f(T - L) + wL \quad \text{s.t.} \quad L \leq T$$
$$\max U_e = f(T + L) - wL$$

U_l tells us that a potential worker may gain some advantage wL by increasing L. However, because time is scarce - because they have a limited time budget T, they will also forego some amount of income from their own farm. Similarly, U_e tells us that a potential employer may increase L on their farm, thereby gaining an increase in output, but they will also incur a cost wL as a result.

For the sake of simplicity, we will assume that these roles are mutually exclusive, so that there are no mixed strategies. Farmers who employ others will not also seek employment from others, and farmers who work for others will not also seek to employ others. In this way, we avoid many of the complexities associated with agrarian household models in development economics, notably the potential for separation failures (Singh et al., 1986).

The crucial rate in either case is the wage w, which we define as some proportion p of the food produced in excess of what is achieved by the employer alone or

$$w = pQ/L$$

with $Q = f(T + L) - f(T)$ being the surplus. Notice that Q/L is the average product of wage labor on the employer's farm, so that the wage is proportional to that rate, as shown in Figure 2 A. The excess product is, thus, distributed *pro rata* over the total wage labor input L, meaning each worker gets a portion of the food surplus based on the amount of time they work on the employer's farm. The quantity $(1 - p)Q$ is, in turn, the employer's net profit after wages. It is equivalent to a rent that workers pay to the employer for access to their land, which is also known as Ricardian rent (Ricardo, 1817; Samuelson, 1959).

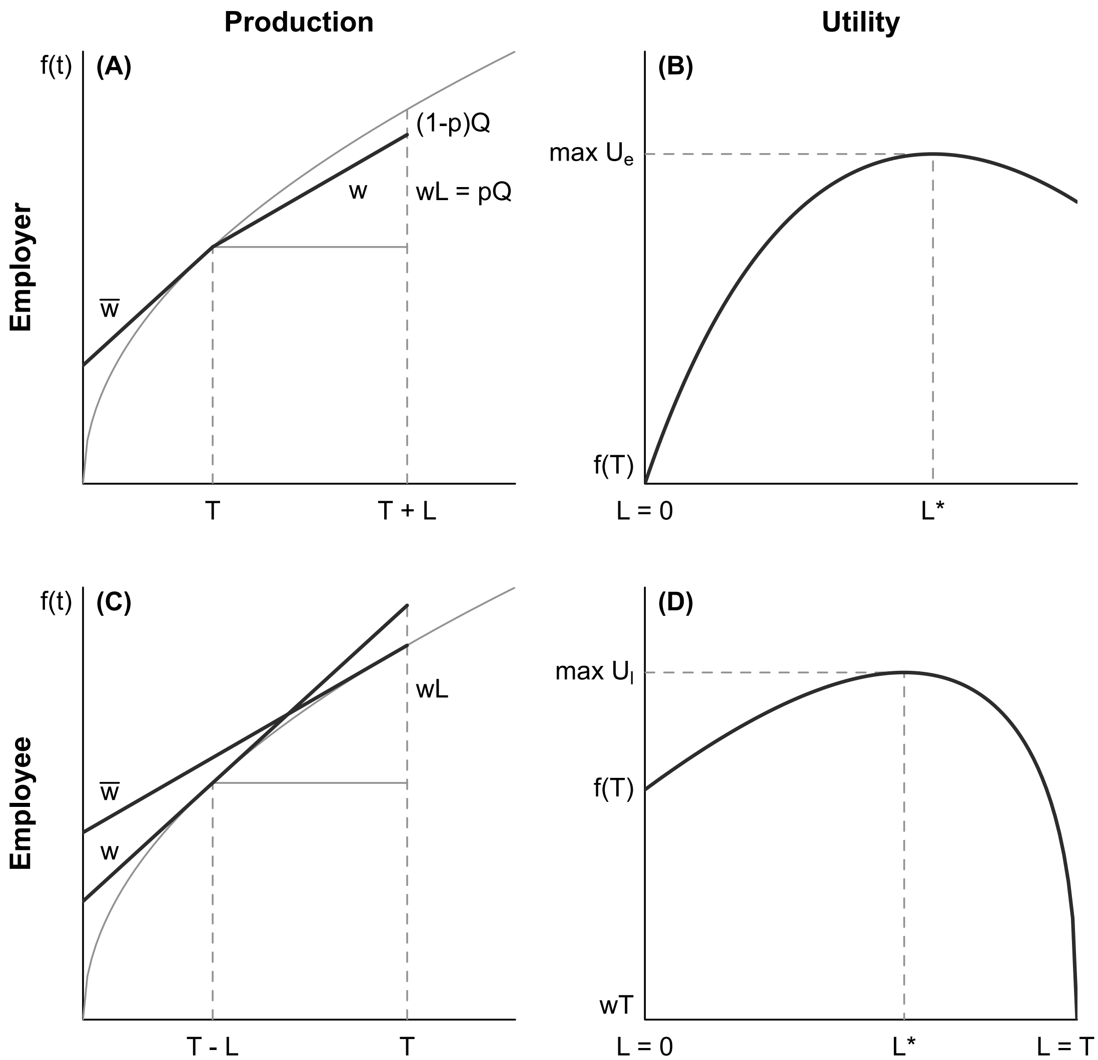

Figure 2: Energy production and utility for a hypothetical employer and employee at a given market wage w. The production curve $f(t)$ is shown as a thin gray curve, and reservation prices and wages $\bar{w}$ are shown at $L = 0$. (A) The employer's production function. The wage w is a fraction p of the surplus production Q from labor. (B) The employer's utility function. When $L = 0$, $U_e = f(T)$. The quantity of labor that maximizes U_e will also satisfy $f'(T + L) = w$. (C) The employee's production function. (D) The employee's utility function. When $L = T$, $U_l = wT$. The quantity of labor that maximizes U_l will also satisfy $f'(T - L) = w$.

When $L = 0$, all yields are derived entirely from subsistence effort on private farms. We would like to know what is required for $L > 0$. These requirements are precisely the conditions in which the population specializes into labor market roles. To define those conditions mathematically, we first take the derivatives of their utility functions with respect to L, set them equal to zero, and solve for w

$$-f'(T-L)+w=0 \quad \Longrightarrow \quad f'(T-L)=w$$
$$f'(T+L)-w=0 \quad \Longrightarrow \quad f'(T+L)=w$$

Evaluating these first order conditions (FOCs) at the corner $L=0$ gives us the following threshold for specialization

$$\bar{w}=f'(T)$$

which is the marginal return rate a farmer obtains by investing their entire time budget T into production on their own farm. While these corner solutions are formally the same for workers and employers, they are interpreted differently. For a potential worker, $\bar{w}$ is the lowest return rate they will accept for wage labor, also known as the reservation wage (Mortensen, 1977). For a potential employer, it is the highest return rate they will pay for wage labor, also known as the reservation price or maximum willingness to pay. To avoid confusion, we will denote the reservation wage and price with $\bar{w}_l$ and $\bar{w}_e$, respectively.

We now turn to the supply of labor. From the above, it follows that an individual farmer will shift time from own-farm production to wage labor whenever the market wage is greater than their reservation wage, that is, $w>\bar{w}_l$, but how much labor should the potential worker actually supply? The answer, denoted L_l^*, is found by solving the worker's FOC for L, this time using the explicit expression for f', giving us

$$L_l^*=T-(w/\alpha G)^{\phi}$$

with $\phi=1/(\alpha-1)$ and $(w/\alpha G)^{\phi}$ being the total time invested in own-farm production. Because $\alpha<1$, ϕ must always be negative, meaning investment in own-farm production will be proportional to the inverse of the wage premium, or the ratio of the market wage to their own farm's productivity. That is, the fraction of time invested in own-farm production will decrease as the market wage w goes up, with wage labor as the complement increasing at the same rate.

To get some intuition behind this, consider a farmer who currently invests all of their time into production on their own farm, so that $(w/\alpha G)^{\phi}=T$ and $L_l^*=0$, meaning they are a subsistence farmer - this would be the point $f(T)$ in Figure 3 C. Suppose further that for whatever reason the market wage suddenly leap frogs over their reservation wage, that being the marginal productivity of their farm at full subsistence. Realizing this, they choose to shift some small amount of time away from their own farm and into wage labor. Because the marginal productivity of their farm diminishes with increasing investments of time, that small shift into wage labor will actually increase their farm's marginal productivity, but not, let us say, enough to exceed the market wage. They will, therefore, make the same choice as before, moving a little more time into wage labor, with their farm's marginal productivity again going up. Repeating this process, they will eventually reach a point where the marginal productivity of their own farm becomes equal to the market wage, at which point they will have achieved the optimal allocation of wage labor, L_l^*, that being the allocation that maximizes their utility (or fitness), as shown in Figure 3 D. To get the total supply of labor in the economy $S(w)$ at a particular market wage, we simply apply the same logic to all potential workers in the population, and then sum the resulting L_l^* over all of them.

Next we consider the demand for labor. To incentivize an individual farmer to hire wage labor, the market wage must be less than their reservation price, that is, $w < \bar{w}_e$, but how much wage labor should the potential employer actually hire beyond that threshold? For a particular farm employer, the optimal amount of wage labor to hire, denoted L_e^*, is found by solving its FOC for L

$$L_e^* = (w/\alpha G)^\phi - T$$

with ϕ being the same as before. Here $(w/\alpha G)^\phi$ represents the total labor input into the employer's farm, including the employer's own investment of T. Again, ϕ is always negative, so the quantity of hired labor will be inversely proportional to the cost premium and, therefore, decreasing in w, reducing to subsistence with sufficiently large market wages. The intuitions behind this run parallel to those for the supply of labor, only with the signs reversed (see Figure 3 A). We imagine a subsistence farmer who has hired no labor, so that $(w/\alpha G)^\phi = T$ and $L_e^* = 0$. The market wage suddenly drops below their reservation price, so they hire a small fraction of labor, and the marginal productivity of their farm diminishes. They continue this process until the marginal productivity of their farm becomes equal to the market wage, at which point they achieve the optimal allocation of wage labor, L_e^*, and maximize their utility, as shown in Figure 2 B. As with the supply of labor, we can estimate total demand for labor $D(w)$ at a particular market wage by summing L_e^* over all farm employers.

The labor market clearing wage w^* is the wage at which these interior solutions become equal to each other, $S(w^*) = D(w^*)$. This is a market equilibrium as no profitable deviations exist. A worker that attempted to work one more or one less hour of wage labor and an employer that attempted to input one more or one less unit of labor would both suffer a loss to their utility.

For those not steeped in the logic of the labor market model, the market wage may at first blush seem *sui generis*, but in fact it has a simple explanation based in the logic of competition, an explanation whose roots go back at least to Adam Smith (Smith, 1776; Stigler, 1957). Given the option between two equally skilled workers, an employer should prefer the one willing to work for a lower wage. This implies that two workers competing for the same job will drive wages down. Conversely, a potential worker faced with a choice between two employers who are otherwise equal should prefer the one willing to offer a higher wage. Again, the consequence will be that two employers competing for the same employee will drive wages up. The point where no one can out-compete anyone else in these two arenas is the market clearing wage. The key here is that competition is perfect, meaning no one has sufficient market share to dictate prices - everyone is a price-taker rather than a price-setter.

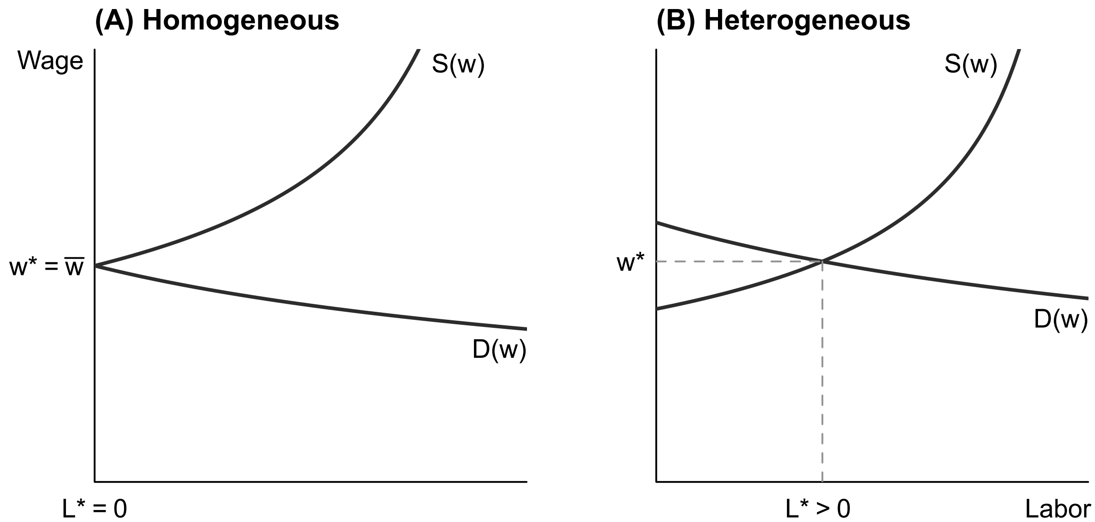

Figure 3: Supply and demand curves. At equilibrium, $L^* = 0$ in a homogeneous environment and $L^* > 0$ in a heterogeneous environment. Note: the convention in economics is to plot supply and demand graphs with quantity on the x-axis and price on the y-axis even though price operates more like the independent variable. A negative slope indicates that increasing prices reduces demand for a given quantity. A positive slope indicates that increasing prices also increases supply.

As shown in Figure 3 A, our model entails that in a perfectly homogeneous environment, where each farm has an identical gain rate, the market equilibrium is, in fact, the null equilibrium where $L = 0$. Why? Because the reservation wage of potential workers and the reservation price of potential employers will be effectively the same in a homogeneous environment, making it impossible to satisfy the inequalities that incentivize individuals to pursue one or the other strategy. In that circumstance, any wage that exceeds the reservation wage of potential labor will also exceed the reservation price of the employer (increasing supply but driving demand down to zero), and any wage that falls below the reservation price of potential employers will also fall below the reservation wage of workers (increasing demand but driving supply down to zero). So, environmental heterogeneity is a necessary condition for specialization (Kennett et al., 2009; Smith & Codding, 2021; Wilson et al., 2023; Wilson & Codding, 2020).

In fact, variance is also sufficient for specialization. To see why, it is instructive to evaluate a simple statistic like the range. Consider first the least productive farm, which has a gain rate of G_{min}. Because it is the least productive farm, it will never be able to afford to hire others. The farmer's reservation price will always be less than the reservation wage of everyone else (the farm's marginal utility at $L = 0$ will be less than $\bar{w}$ for all other farms), so its owner will, in effect, have only a reservation wage $\bar{w}_{min} = \alpha G_{min} T^{\alpha-1}$. Now consider the most productive farm, with a gain rate of G_{max}. Because it is the most productive farm, no one can afford to hire its owner. The farmer's reservation wage will be greater than the reservation price of everyone else (their $\bar{w}$ will be greater than the marginal utility at $L = 0$ for all other farms), so its owner will, in effect, have only a reservation price $\bar{w}_{max} = \alpha G_{max} T^{\alpha-1}$. Combining these ideas, we might say that the owner of the least productive farm produces too little to hire, and the owner of the most productive farm produces too much to be hired. So their respective labor market roles are more or less forced upon them by the logic of optimization, a point we can show mathematically by substituting into the equilibrium and rearranging terms, which gives us

$$\frac{G_{max}}{G_{min}} = \left(\frac{T - L}{T + L}\right)^{\alpha-1}$$

From this equation, it follows that $L > 0$ if and only if $G_{max} > G_{min}$. In other words, variance in the quality or productivity of private land is not only necessary but also sufficient for specialization to occur. This biconditional is implicit in the outward shifting supply and demand curves in Figure 3 B.

4. Discussion

By combining the patron-client model as outlined in Dow & Reed (2013) and Wilson & Codding (2020) with the logic of supply and demand, we are able to derive a simple variation of the neoclassical labor market model. The resulting model explains levels of employment or patronage in terms of the prevailing market wage. Provided the market wage exceeds the reservation wage of those on less productive farms, there will be a potentially non-zero supply of labor. However, to determine the actual level of employment, it remains to determine who is willing to pay those wages, and how much they are willing to pay. Here it was shown that the market wage must drop below the reservation price of those on more productive farms for there to be any demand at all and that competition among employers based on the productive capacity of their respective farms would determine total demand in the market. Satisfying the combination of the reservation thresholds, of course, requires variation in productivity across farms, which can only be sustained by privatizing those farms. Otherwise, the population will revert to the mean, and the incentives for differentiating will be lost.

From the model, we can derive three important predictions. First, specialization should start in the tails of the distribution and work its way in. Or, to put that another way, where there is the greatest difference in productivity, there will also be the greatest incentive for adopting the various labor market roles. Second, as the mass of the distribution of labor shifts toward more productive farms, the average productivity of the population should also increase. This is known as allocative efficiency. It does not mean that everyone benefits equally, just that no one can be made better off without making someone else worse off (Arrow & Debreu, 1954).

The final prediction was first formulated by Ricardo in his theory of rent (Ricardo, 1817). According to Ricardo, rent of land should be proportional to the difference between its productivity and the productivity of the least productive land in use. As a consequence, rent must necessarily go up as less productive land comes under cultivation. In our model, the problem is recast as one about wages. As farmers move onto less productive land, their reservation wages go down, and they invest more time in wage labor. The supply curve shifts out, and demand goes up to take advantage of cheaper labor, resulting in more intensive production on the most productive land, with larger shares of the surplus shifting from wages to rent. This boon the better-off enjoy despite the fact that they contribute nothing to its attainment. They are simply the beneficiaries of population spill-over into marginal land given private property. Indeed, it was this fact that led Henry George, following John Stuart Mill, to refer to their profit from rents as the "unearned increment" (George, 1881; Mill, 1848).

It has long been recognized that increasing reliance on domesticates typically increases birth rates and at least initially stabilizes death rates, leading to substantial population growth, a process commonly referred to as the Neolithic Demographic Transition (Bocquet-Appel, 2002; Kohler & Reese, 2014; Shennan, 2013). For regions that are effectively saturated, that have transitioned from labor-limited horticulture to land-limited intensive agriculture (Bogaard et al., 2019; 2025; Shenk et al., 2010), the only available outlet for that population growth would presumably be less productive land - the land everyone else skipped over because there were initially better alternatives. It would, thus, appear that intensive food production provides the perfect conditions for the explosive growth of inequality. It runs right through the Ricardian logic of our labor market model.

The situation has the potential to become substantially worse, in fact, since competition in a labor market is almost certainly imperfect. There are many reasons for this, but for the sake of brevity, we will focus on spatial constraints. So far, we have been thinking of these farms as dimensionless points between which travel is effectively instantaneous. If farm productivity is highly skewed, however, and highly productive farms are spatially dispersed, there will be potential for the development of local monopsonies (Robinson, 1933), as each worker will have only one realistic employer, like nineteenth century factory workers in U.S. company towns. Commute costs will simply be too high to work anywhere else, a circumstance known among anthropologists as circumscription (Boone, 1992; Carneiro, 1970; Kennett et al., 2009; Wilson et al., 2023; Wilson & Codding, 2020) - economists call them switching costs, which are closely related to search frictions (Bhaskar & To, 1999; Fox, 2010; Ransom, 1993; Staiger et al., 2010). The consequence of this market friction is that employers become effective price-setters, able to reduce wages below the market clearing rate because those wages will still be better than non-local or outside alternatives.

Throughout this paper, we have intentionally kept our model as simple as possible in order to focus specifically on the interaction of employers and employees. This required making many unrealistic assumptions: the economy is isolated, precluding trade and migration; land is fixed, freeing farmers from difficult decisions about how much land to fallow or bring under cultivation; and capital and technology are negligible, foreclosing investments in agricultural improvements like irrigation infrastructure. Our model is also restricted to a single industry with a single factor market, namely labor, even though land itself is a plausible candidate for the first medium of hereditary inequality (Shenk et al., 2010; 2016). Still, the simplicity of the model is actually a feature, not a bug, for the model is much more flexible in its simplest form, offering powerful conceptual machinery to investigate the consequences for equilibrium wages and labor levels of different initial conditions, and to do so in a precise, constructive, and coherent way. Indeed, one could argue that this is one of the primary advantages of formal optimality modeling for the study of human social organization (Krugman, 1995).

We emphasize two additional advantages of this modeling exercise. First, it offers additional evidence that the gulf between evolution and economics may not be so great after all, as we have tried to highlight throughout the text. Second, and perhaps more importantly, our model does not anywhere assume a solution to the collective action problem. Contrary to what many anthropologists have argued (Carballo & Feinman, 2016; Diehl, 2000; Glowacki & Rueden, 2015; Hayden, 2001; Hooper et al., 2010; Smith & Choi, 2007), our model does not require elites to manage cooperative behavior for the provision of public goods. Instead, everyone in our model is simply trying to get along the best that they can in light of their circumstances. Together, all their individual choices have the cumulative effect of upending the social structure of their own population, opening up new arenas of competition. Where before, in the homogeneous economy, there were the standard Darwinian forms of somatic and reproductive competition, individuals must now confront Marshallian dimensions of competition in a factor market. Employers must now compete for workers, and workers must now compete for jobs. No where did we have to leverage sky hooks like collective action to generate that complexity (Dennett, 1995). We were able to derive it all from first principles instead, principles shared by economists and ecologists alike.

Bibliography

Arrow, K. J., & Debreu, G. (1954). Existence of an Equilibrium for a Competitive Economy. *Econometrica*, *22*(3), 265–290. https://doi.org/10.2307/1907353

Bell, A. V., & Winterhalder, B. (2014). The population ecology of despotism: Concessions and migration between central and peripheral habitats. *Human Nature*, *25*(1), 121–135. https://doi.org/10.1007/s12110-014-9190-7

Bhaskar, V., & To, T. (1999). Minimum wages for Ronald McDonald monopsonies: A theory of monopsonistic competition. *The Economic Journal*, *109*(455), 190–203. https://doi.org/10.1111/1468-0297.00427

Bocquet-Appel, J.-P. (2002). Paleoanthropological traces of a Neolithic Demographic Transition. *Current Anthropology*, *43*(4), 637–650. https://doi.org/10.1086/342429

Bogaard, A., Cruz, P., Fochesato, M., Birch, J., Cervantes Quequezana, G., Chirikure, S., Crema, E. R., Feinman, G. M., Green, A. S., Hamerow, H., Jin, G., Kerig, T., Lawrence, D., McCoy, M. D., Munson, J., Ortman, S. G., Petrie, C. A., & Roscoe, P. (2025). Labor, land, and the global dynamics of economic inequality. *Proceedings of the National Academy of Sciences*, *122*(16), e2400694122. https://doi.org/10.1073/pnas.2400694122

Bogaard, A., Fochesato, M., & Bowles, S. (2019). The farming-inequality nexus: new insights from ancient Western Eurasia. *Antiquity*, *93*(371), 1129–1143. https://doi.org/10.15184/aqy.2019.105

Boone, J. L. (1992). Competition, conflict, and the development of social hierarchies. In E. A. Smith & B. Winterhalder (Eds.), *Evolutionary ecology and human behavior*. Aldine de Gruyter.

Borgerhoff Mulder, M., Bowles, S., Hertz, T., Bell, A., Beise, J., Clark, G., Fazzio, I., Gurven, M., Hill, K., Hooper, P. L., Irons, W., Kaplan, H., Leonetti, D., Low, B., Marlowe, F., McElreath, R., Naidu, S., Nolin, D., Piraino, P., … Wiessner, P. (2009). Intergenerational wealth transmission and the dynamics of inequality in small-scale societies. *Science*, *326*(5953), 682–688. https://doi.org/10.1126/science.1178336

Borjas, G. J. (2023). *Labor economics* (Ninth). McGraw Hill.

Bowles, S., & Choi, J.-K. (2013). Coevolution of farming and private property during the early Holocene. *Proceedings of the National Academy of Sciences*, *110*(22), 8830–8835. https://doi.org/10.1073/pnas.1212149110

Bowles, S., & Choi, J.-K. (2019). The Neolithic agricultural revolution and the origins of private property. *Journal of Political Economy*, *127*(5), 2186–2228. https://doi.org/10.1086/701789

Brown, J. L. (1964). The evolution of diversity in avian territorial systems. *The Wilson Bulletin*, *76*(2), 160–169. http://www.jstor.org.ezproxy.lib.utah.edu/stable/4159278

Carballo, D. M., & Feinman, G. M. (2016). Cooperation, collective action, and the archeology of large-scale societies. *Evolutionary Anthropology: Issues, News, And Reviews*, *25*(6), 288–296. https://doi.org/10.1002/evan.21506

Carneiro, R. L. (1970). A theory of the origin of the state. *Science*, *169*(3947), 733–738. https://doi.org/10.1126/science.169.3947.733

Charnov, E. L., & Parker, G. A. (1995). Dimensionless invariants from foraging theory's marginal value theorem. *Proceedings of the National Academy of Sciences*, *92*(5), 1446–1450. https://doi.org/10.1073/pnas.92.5.1446

Charnov, E. L. (1976). Optimal foraging, the marginal value theorem. *Theoretical Population Biology*, *9*(2), 129–136. https://doi.org/10.1016/0040-5809(76)90040-X

Childe, V. G. (1950). The urban revolution. *Town Planning Review*, *21*(1), 3. https://doi.org/10.3828/tpr.21.1.k853061t614q42qh

Dennett, D. (1995). *Darwin's dangerous idea*. Simon & Schuster.

Diehl, M. W. (2000). *Some thoughts on the study of hierarchies* (M. W. Diehl, Ed.). Center for Archaeological Investigations, Southern Illinois University.

Dow, G. K., & Reed, C. G. (2013). The origins of inequality: Insiders, outsiders, elites, and commoners. *Journal of Political Economy*, *121*(3), 609–641. https://doi.org/10.1086/670741

Dow, G. K., & Reed, C. G. (2023a). *Economic prehistory: six transitions that shaped the world*. Cambridge University Press.

Dow, G. K., & Reed, C. G. (2023b). The Economics of Early Inequality. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *378*(1883), 20220293. https://doi.org/10.1098/rstb.2022.0293

Dyson-Hudson, R., & Smith, E. A. (1978). Human Territoriality: An Ecological Reassessment. *American Anthropologist*, *80*(1), 21–41. https://doi.org/10.1525/aa.1978.80.1.02a00020

Earle, T. K. (1997). *How chiefs come to power: The political economy in prehistory*. Stanford University Press.

Flannery, K., & Marcus, J. (2012). *The creation of inequality: How our prehistoric ancestors set the stage for monarchy, slavery, and empire*. Harvard University Press.

Fox, J. T. (2010). Estimating the employer switching costs and wage responses of forward-looking engineers. *Journal of Labor Economics*, *28*(2), 357–412. https://doi.org/10.1086/651458

George, H. (1881). *Progress and poverty: An enquiry into the cause of industrial depressions, and of increase of want with increase of wealth: The remedy*. D. Appleton and Company.

Glowacki, L., & Rueden, C. von. (2015). Leadership solves collective action problems in small-scale societies. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *370*(1683), 20150010. https://doi.org/10.1098/rstb.2015.0010

Graeber, D. (2014). *Debt: The first 5,000 years*. Melville House Publishing.

Hayden, B. (2001). *Richman, poorman, beggarman, chief: The dynamics of social inequality* (G. M. Feinman & T. D. Price, Eds.; pp. 231–272). Springer.

Hayden, B., & Villeneuve, S. (2010). *Who benefits from complexity? A view from Futuna* (T. D. Price & G. M. Feinman, Eds.; pp. 95–145). Springer.

Hicks, J. (1963). *The theory of wages* (Second). Palgrave MacMillan.

Hooper, P. L., Kaplan, H. S., & Boone, J. L. (2010). A theory of leadership in human cooperative groups. *Journal of Theoretical Biology*, *265*(4), 633–646. https://doi.org/10.1016/j.jtbi.2010.05.034

Hooper, P. L., Smith, E. A., Kohler, T. A., & Kaplan, H. S. (2018). *Ecological and social dynamics of territoriality and hierarchy formation* (J. A. Sabloff & P. L. Sabloff, Eds.; pp. 105–130). Princeton University Press.

Johnson, A. W., & Earle, T. K. (2000). *The evolution of human societies: from foraging group to agrarian state*. Stanford University Press.

Keeley, L. H. (1988). Hunter-gatherer economic complexity and "population pressure": A cross-cultural analysis. *Journal of Anthropological Archaeology*, *7*(4), 373–411. https://doi.org/10.1016/0278-4165(88)90003-7

Kelly, R. L. (2016). *The fifth beginning: What six million years of human history can tell us about our future*. University of California Press.

Kennett, D. J., Winterhalder, B., Bartruff, J., & Erlandson, J. M. (2009). *An ecological model for the emergence of institutionalized social hierarchies on California's Northern Channel Islands* (S. Shennan, Ed.). University of California Press.

Kirch, P. V. (2010). *How chiefs became kings: Divine kingship and the rise of archaic states in ancient Hawai'i*. University of California Press.

Kohler, T. A., & Reese, K. M. (2014). Long and spatially variable Neolithic Demographic Transition in the North American Southwest. *Proceedings of the National Academy of Sciences*, *111*(28), 10101–10106. https://doi.org/10.1073/pnas.1404367111

Kohler, T. A., & Smith, M. E. (2018). *Ten thousand years of inequality: The archaeology of wealth differences*. University of Arizona Press.

Krugman, P. R. (1995). *Development, geography, and economic theory: 6* (Vol. 6). MIT press.

Marshall, A. (1920). *Principles of economics: An introductory volume* (Eighth). MacMillan, Co.

Mattison, S. M., Smith, E. A., Shenk, M. K., & Cochrane, E. E. (2016). The evolution of inequality. *Evolutionary Anthropology: Issues, News, And Reviews*, *25*(4), 184–199. https://doi.org/10.1002/evan.21491

McCool, W. C., Codding, B. F., Degnan, B., Ebert, C. E., Johnson, E. S., Vernon, K. B., Wilson, K. M., Beach, T., Prufer, K. M., & Kennett, D. J. (2025). Modeling the rise and demise of Classic Maya cities: Climate, conflict, and economies of scale. *Proceedings of the National Academy of Sciences*, *122*(42), e2512325122. https://doi.org/10.1073/pnas.2512325122

Mill, J. S. (1848). *Principles of political economy*. John W. Parker.

Mortensen, D. T. (1977). Unemployment insurance and job search decisions. *ILR Review*, *30*(4), 505–517. https://doi.org/10.2307/2523111

Powers, S. T., & Lehmann, L. (2014). An evolutionary model explaining the Neolithic transition from egalitarianism to leadership and despotism. *Proceedings of the Royal Society B: Biological Sciences*, *281*(1791), 20141349. https://doi.org/10.1098/rspb.2014.1349

Prentiss, A. M., Cail, H. S., & Smith, L. M. (2014). At the Malthusian ceiling: Subsistence and inequality at Bridge River, British Columbia. *Journal of Anthropological Archaeology*, *33*, 34–48. https://doi.org/10.1016/j.jaa.2013.11.003

Ransom, M. R. (1993). Seniority and monopsony in the academic labor market. *The American Economic Review*, *83*(1), 221–233. http://www.jstor.org.ezproxy.lib.utah.edu/stable/2117505

Ricardo, D. (1817). *On the principles of political economy and taxation*. John Murray.

Robinson, J. (1933). *The economics of imperfect competition*. Macmillan.

Samuelson, P. A. (1959). A modern treatment of the Ricardian Economy: I. The pricing of goods and of labor and land services. *The Quarterly Journal of Economics*, *73*(1), 1–35. https://doi.org/10.2307/1883824

Shenk, M. K., Borgerhoff Mulder, M., Beise, J., Clark, G., Irons, W., Leonetti, D., Low, B. S., Bowles, S., Hertz, T., Bell, A., & Piraino, P. (2010). Intergenerational wealth transmission among agriculturalists: Foundations of agrarian inequality. *Current Anthropology*, *51*(1), 65–83. https://doi.org/10.1086/648658

Shenk, M. K., Towner, M. C., Voss, E. A., & Alam, N. (2016). Consanguineous marriage, kinship ecology, and market transition. *Current Anthropology*, *57*(S13), S167–S180. https://doi.org/10.1086/685712

Shennan, S. (2013). Demographic continuities and discontinuities in Neolithic Europe: Evidence, methods and implications. *Journal of Archaeological Method and Theory*, *20*(2), 300–311. https://doi.org/10.1007/s10816-012-9154-3

Singh, I., Squire, L., & Strauss, J. (1986). *Agricultural household models: Extensions, applications, and policy*. The John Hopkins University Press.

Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. W. Strahan, T. Cadell.

Smith, E. A., & Choi, J.-K. (2007). *The emergence of inequality in small-scale societies: simple scenarios and agent-based simulations* (T. A. Kohler & S. E. van der Leeuw, Eds.; pp. 105–120). School for Advanced Research Press.

Smith, E. A., & Codding, B. F. (2021). Ecological variation and institutionalized inequality in hunter-gatherer societies. *Proceedings of the National Academy of Sciences*, *118*(13), e2016134118. https://doi.org/10.1073/pnas.2016134118

Smith, E. A., & Codding, B. F. (2026). Explaining inequality in Northwest Coast and Native California societies: A critical assessment. *Journal of Archaeological Research*. https://doi.org/10.1007/s10814-025-09215-y

Smith, E. A., Mattison, S. M., & DiNapoli, R. (2023). *The emergence of institutionalized inequality* (P. J. Richerson, J. Bednar, T. E. Currie, S. Gavrilets, & J. J. Wallis, Eds.). Cultural Evolution Society. https://institutionaldynamicsbook.culturalevolutionsociety.org/

Staiger, D. O., Spetz, J., & Phibbs, C. S. (2010). Is there monopsony in the labor market? Evidence from a natural experiment. *Journal of Labor Economics*, *28*(2), 211–236. https://doi.org/10.1086/652734

Stigler, G. J. (1957). Perfect competition, historically contemplated. *Journal of Political Economy*, *65*(1), 1–17. https://doi.org/10.1086/257878

Stiglitz, J. E. (1974). Incentives and risk sharing in sharecropping. *The Review of Economic Studies*, *41*(2), 219–255. https://doi.org/10.2307/2296714

Webster, G. S. (1990). Labor control and emergent stratification in prehistoric europe. *Current Anthropology*, *31*(4), 337–366. https://doi.org/10.1086/203848

Wilson, K. M., & Codding, B. F. (2020). The marginal utility of inequality. *Human Nature*, *31*(4), 361–386. https://doi.org/10.1007/s12110-020-09383-4

Wilson, K. M., Cole, K. E., & Codding, B. F. (2023). Identifying key socioecological factors influencing the expression of egalitarianism and inequality among foragers. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *378*(1883), 20220311. https://doi.org/10.1098/rstb.2022.0311