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Positional competition: A theory of the Great Gatsby curve and the Easterlin paradox

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ABSTRACT

This paper provides a novel theory that simultaneously explains the Great Gatsby curve and the Easterlin paradox, demonstrating that these two phenomena could be driven by the same mechanism. I model positional competition, in which productive opportunities are allocated according to relative performance, as a Nash equilibrium outcome of agents reacting optimally to a distribution of productive opportunities. Positional competition is not a zero-sum game and its intensity is endogenously determined. The distribution of income and intergenerational mobility are also endogenously determined, with income following a power law distribution. As productivities become more dispersed, optimizing agents respond by competing more intensely with each other. This endogenous intensification lies at the heart of my explanation for both the Great Gatsby curve and the Easterlin paradox.

1. Introduction

This paper presents positional competition as a unifying framework for simultaneously explaining the income–mobility relationship known as the ‘Great Gatsby curve’ and the Easterlin paradox by creating a dynamic model with heterogeneous family dynasties and where the distributions of both income and economic opportunities are endogenously determined.

One key component of this model is positional competition. The income received by an individual depends on his/her talent and the productive opportunities secured; the productive opportunities are assigned according to his/her relative performance in an economy-wide contest among all individuals. Crucially, the intensity of positional competition between individuals is endogenously determined in a Nash equilibrium and changes in the (exogenously given) degree of dispersion in productive opportunities. I derive a closed-form solution, showing unambiguously that as productive opportunities become more dispersed, positional competition intensifies, which, in turn, increases cross-sectional income inequality, reduces intergenerational mobility, and weakens the link between average income and average utility. Thus, the positional competition mechanism explains both the Great Gatsby curve and the Easterlin paradox.

To my knowledge, this model is the first to suggest that positional competition can explain the Great Gatsby curve. It is also the first to demonstrate that the Great Gatsby curve and Easterlin paradox could be driven by the same mechanism.

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1.1. Related literature

There is enormous public concern over the causes and consequences of inequality. Income inequality has been rising in the last few decades in many advanced economies (Piketty, 2014; Bourguignon, 2017). Moreover, inequality appears to be negatively related to intergenerational mobility. The phrase 'Great Gatsby curve' was coined by Alan Krueger in his 2012 presidential address, to describe the positive correlation between cross-sectional income inequality and intergenerational persistence of earnings in some advanced economies (Aaronson and Mazumder, 2008; Corak, 2013; Krueger, 2012). Subsequent studies also found substantive variation in intergenerational mobility within the US; the areas with more unequal income distribution had less mobility (Chetty et al., 2014; Davis and Mazumder, 2017; Durlauf and Seshadri, 2017; Kearney and Levine, 2015).

The Easterlin paradox suggests that economic growth could weaken the relationship between income and well-being. Easterlin (1974) observed that while higher incomes are associated with higher levels of happiness in the US, the average level of happiness does not appear to increase in line with increases in average income over time. While subsequent studies have shown a strong empirical relationship between the logarithm of per capita GDP and average happiness in cross-sectional data (Deaton, 2008; Sacks et al., 2012), the essence of the Easterlin paradox—'at a point in time happiness varies directly with income both among and within nations, but over time happiness does not trend upward as income continues to grow' (Easterlin, 2016, p.3)—appears robust even four decades after the initial paper in 1974 with the vast increase in the available data.

Various reasons have been suggested till date as explanations for the rise in inequality; the most common ones are the nature of new technology and globalization. New forms of technology not only raise productivity, but also influence income distribution and industrial concentration. Rosen (1981) pointed out that 'superstar markets'—markets in which a 'relatively small number of people earn enormous amounts of money and dominate the activities they engage'—are likely to become more prevalent with new technologies.

New technology alters income distribution because in an increasingly knowledge-based economy, technological products are often both nonrival and partially excludable, making them expandable on the supply side (or 'scalable', as described by Haskel and Westlake, 2018). Conversely, a limitation of time or other capacity for consumption means that the customer needs a limited number of suppliers; thus, only a few suppliers will gain the opportunity to meet this 'scarce' demand. The concentration of productive opportunities is an ongoing process. Autor et al. (2020) presented evidence of increasing firm concentration in all sectors that also has implications for workers' opportunities. Barth et al. (2016) and Song et al. (2019) found that much of the rise in earnings inequality can be attributed to the increased dispersion of earnings among firms rather than within firms. Haskel and Westlake (2018) pointed out that intangible capital is becoming increasingly important in the modern economy and that this will have implications for inequality.

Given that new technologies can create inequalities in productive opportunities, the question of what the criterion is for allocating these productive opportunities arises. One possible answer is talent. Rosen (1981) pointed out that the rise of the superstar market enlarges the reward difference for a given difference in talent. Conversely, Adler (1985) showed that the superstar effect can exist without any correlation between income and talent. Random elements can also play a role in determining the allocation of these productive opportunities (Arthur, 1989) and 'luck' could be enhanced through extra expenditure by the contestants. The model presented in this paper includes these elements. Productive opportunities are treated as a scarce resource over which people fight; in particular, they are allocated according to relative performances in a contest, where performance depends on talent and can be boosted by performance-enhancing expenditure.

While new technology and globalization have affected all advanced economies, these countries differ both in their levels of inequality and in the rate of increase in inequality over time. This indicates that other factors are at play, such as differences in labor market regulations, redistributive policies, and investments in public education (Bourguignon, 2017).

In terms of the relationship between inequality and mobility, theories of intergenerational mobility include models that focus on family transmission, combined with imperfect capital markets (Becker and Tome, 1979; Loury 1981) and models based on the endogenous formation of communities (Benabou, 1996a, b; Durlauff, 1996a, b; Durlauf and Seshadri, 2017). Hassler et al. (2007) developed a model of inequality and mobility and showed that differences in the quality of education or subsidies for education can lead to a negative correlation between inequality and mobility. Rauh (2017) explained the Great Gatsby curve using a calibrated model of endogenously determined education policy via voting. In addition, Galor and Zeira (1993) showed that wealth inequality can persist over time when the credit market is imperfect. Clark (2014) found that mobility rates vary little across countries for many generations.

Theories explaining the Easterlin paradox often include social comparison. These explanations suggest that the paradox arises when individuals' welfare depend on comparing their income with the incomes of others in their reference groups. One explanation is that individuals adapt to new income levels. The related literature was surveyed by Clarke et al. (2008) and Hopkins (2008). Easterlin et al. (2012) also proposed that factors such as increase in unemployment or inequality could explain the time-series relationship between income and happiness. Oishi and Kesebir (2015) found that rising inequality could adequately explain the Easterlin paradox.

This paper offers a novel explanation for the Great Gatsby curve and Easterlin paradox. I show that both phenomena can be explained by the same mechanism—intensification of (endogenously determined) degree of positional competition. In other words, my framework provides the big picture on some of the implications of new technology.

Positional competition modelled in this paper focuses on the matching process between diverse productive opportunities and talents. Scenarios in which positional competition could be relevant include the competition between students for university places for gaining education and credentials, competition between workers for diverse employment opportunities, and competition between start-up companies to gain dominant positions in new industries that will eventually become concentrated. In these settings, it is natural to assume that the output each contestant eventually produces after matching takes place depends on his/her own talent as well as on the productive opportunity with which he/she is matched.

In these matching processes, if talent is observable, there would be perfect assortative matching between talent and the quality of productive opportunities. However, since talent is not directly observable, agents compete for productive opportunities, which are allocated according to their observable performances in these contests. The levels of performance agents produce depend positively on talent and on the amounts of effort agents choose to exert, which in turn could be influenced by factors other than talent. In this way, the matching achieved is not perfectly assortative. For example, admission to university places is often determined by students' performances in entrance examinations, which is imperfectly correlated with talent. Similarly, in the case of job matching, the observable characteristics and performance history of each candidate are only a partial reflection of his/her talent. In new industries, because of the existence of network effects and path dependence, the eventual size of firms could be influenced by the relative effectiveness of the strategic actions designed to enlarge their market share, but could also depend on the quality of their products.

In the equilibrium characterised in this paper, talent is not perfectly correlated with productive opportunities, as performances also depend on the efforts agents exert, and having a more favourable family background makes it easier for an agent to exert effort. Thus, the matching between productive opportunities and talent under positional competition is not perfectly assortative. Positional competition differs from the perfectly assortative matching of talented CEOs and productive firms modelled by Gabaix and Landier (2008). Specifically, with positional competition, agents act strategically by choosing the effort to expend in the matching process, and the choice of these strategies among agents of multidimensional heterogeneity is solved as a Nash equilibrium. By contrast, the matching process in Gabaix and Landier (2008) does not require such a strategic interaction between agents and can be solved as a competitive equilibrium under rational expectations.

Positional competition is not completely wasteful since it enables talent to be matched with productive opportunities more efficiently. This is demonstrated in Section 2. Consequently, while positional competition has similarities with rent-seeking and lobbying, in that the effort of one agent undermines the efforts of other agents, it is not identical to them, as positional competition can raise efficiency.

Positional competition is different from the existing literature on relative concern. There are broadly three ways of modelling relative concern. First, people's welfare can depend on how their income is compared with a reference income level such as the average income (Duesenberry, 1949; Clark and Oswald, 1996, 1998; Futagamia and Shibata, 1998). Second, instead of comparing with a reference income level, the comparison can be made using the rank of income (Layard, 1980; Frank, 1985; Robson, 1992). Third, even when social comparison does not enter the utility function directly, when the nature of competition is tournament-like, people can still behave in a similar way to when their utility function depends directly on social comparison (Cole et al., 1992; Hopkins and Kornienko, 2004). As Hopkins (2008) pointed out, all these ways of modelling relative concern can explain the Easterlin paradox.

In positional competition, relative concern does not directly enter the utility function. Moreover, positionality is characterized by rank rather than a comparison with a reference income level. In addition, as discussed previously, positional competition serves the purpose of improving matching efficiency and hence is not necessarily socially wasteful by itself. In other words, positional competition serves the purpose of providing information, a key feature in a rapidly changing technological environment. Positional competition as modeled in this paper is an alternative way to study the Easterlin paradox and the Great Gatsby curve.

In the theoretical literature on relative concern, inequality is often negatively related to welfare.[1] While my model also contains this feature, however, the key insight of my explanation for the Easterlin paradox, as demonstrated in detail in the paper, is that intensifying positional competition incurs a cost that incrementally erodes the utility gain from economic growth.

At the technical level, this paper uses power law distributions to model inequality. Power law distributions have been widely observed in many natural world phenomena and computer science (Newman, 2005; Mitzenmacher, 2003), academia (Lokta, 1926), and economics and finance (Gabaix et al., 2006; Gabaix, 2009). Models of income distribution as power law distributions include those of Benhabib et al. (2011), Jones and Kim (2018), and Gabaix et al. (2017). In my model, variables such as income, bequests, the productivity of productive opportunities, and talent are Pareto distributed. Income distributions are characterised by power law at the top end (Piketty and Saez, 2003, 2014; Jones, 2015). There is some evidence that productive opportunities are also Pareto distributed. In addition to Autor et al. (2020), Gabaix and Landier (2008) show that firm sizes, which we can as a proxy for productive opportunities, follow a Pareto distribution. For the distribution of talent, the assumption that skill levels are Pareto distributed has been used by Diamond (1998). In addition, if talent is multidimensional and each person can use the best among endowed talents, then from extreme value theory (Embrechts et al., 1997; Gabaix and Landier, 2008), the distribution of talent is likely to be characterised by a power law.

[1] In some models in the theoretical literature, inequality can be positively related to happiness, as Hopkins (2008) pointed out.

Intergenerational mobility in this paper is characterised by the bivariate copula of the income of two consecutive generations. To my knowledge, this is the first theoretical paper that characterises and ranks intergenerational mobility using endogenously determined copula in a dynamic general equilibrium model.

The remainder of this paper is organised as follows. Section 2 describes the model. Section 3 presents the short-run equilibrium analysis. Section 4 analyses the long-run steady state and derives the Great Gatsby curve result. Section 5 explains the Easterlin paradox and Section 6 concludes.

2. Model

In this model, people live for one period during which they are economically active, and then transfer their wealth to their single offspring before dying. Each person begins life with bequest b from the parent as well as talent z, which is stochastic and independent of the talent of their parent. To engage in economic production, each person needs to be matched with a productive opportunity. There is a known distribution of productive opportunities A, which is allocated in an economy-wide contest, whereby the productive opportunities are assigned to the contestants according to their performance ranks. Performance depends on talent z as well as on the effort level k chosen by each person. Once matched, output produced by each person depends on the quality of the productive opportunity and talent and is given by Az.

Section 3 solves for the short-run equilibrium of the economy, which refers to the static, period-t general equilibrium given the distribution of bequests. In the short-run equilibrium, the distributions of $\{A, z, b\}$ are exogenously given; agents compete for productive positions A by choosing effort level k optimally in a Nash equilibrium, where the optimal choice of k for each agent depends on the overall distribution of performances, which, in turn, is endogenously determined. The intensity of positional competition is characterized by an endogenously determined value of γ, which is dependant on the shape parameter of the distribution of performances and is time-invariant.

In a short-run equilibrium, while the distribution of the bequest to the next generation depends on the distribution of initial bequests, it need not be identical to the initial distribution of bequests. Under suitable conditions described in the appendix, the distribution of bequests converges to a unique stationary distribution; this is referred to as the long-run equilibrium and is analyzed in Section 4. In this long-run equilibrium, only the distributions of $\{A, z\}$ are exogenously given; in contrast to the short-run equilibrium, the distribution of bequests to the next generation is identical to the initial distribution of bequests in the long-run equilibrium. In other words, the initial distribution of bequests is endogenized. All the main results of the model are then developed using the long-run equilibrium. Inequality can be characterized using the steady-state marginal distribution of income, and the correlation structure of income over two successive generations characterizes mobility. The appendix provides a review of the relevant techniques and related notations used in this paper.

More formally, consider an economy comprising a continuum of family dynasties, normalized to a unit measure. Each generation lives for one period. At time t, the agent in family dynasty i is endowed with a certain level of talent z_{it} drawn from an i.i.d. Pareto distribution, $Z \sim Par(z_0, \beta_z)$. In addition to talent, the agent also receives bequest b_{it} from the previous generation of the same family dynasty. This distribution of bequests b_{it} is endogenously determined in the model.

The income received by the agent depends on the quality of productive opportunity with which he/she is matched, denoted as A_{it}, and his/her own talent z_{it}, such that $y_{it} = A_{it}z_{it}$. One key assumption of this paper is that the quality of productivity A is heterogeneous and assigned to agents based on their relative performance in a contest for productive opportunities. Productivity A is distributed according to a Pareto distribution, $A \sim Par(A_0, \beta_A)$. It is convenient to define $\theta \equiv \frac{1}{\beta_A}$ as the degree of dispersion of the productive opportunities. I assume $\theta < 1$ to ensure that the expected value of A is finite.

Let ρ_A denote the productivity rank of A, $0 \le \rho_A \le 1$ and $A(\rho_A)$ denote the productivity associated with rank ρ_A. Using the definition of the Pareto distribution, the value of productivity rank can be written as $\rho_A = 1 - \frac{A(\rho_A)^{-\frac{1}{\theta}}}{A_0^{-\frac{1}{\theta}}}$. Similarly, productivity can be written as $A(\rho_A) = A_0(1-\rho_A)^{-\theta}$.

The degree of dispersion of productive opportunities θ can depend on the nature of technology or country-specific factors, such as the policy environment or cultural influences. Consider the formulation $\theta = g(A_0, \theta_1)$, where A_0 is the effect of productivity growth on the superstar effect and the parameter θ_1 represents country-specific factors. Function g is positive and increasing in both elements and strictly bounded in the unit interval, $0 < g(A_0, \theta_1) < 1$. These factors are not modelled explicitly in this paper, and thus I treat the value of θ as exogenously given.

Productivity A is assigned to individuals in an economy-wide contest, where contestants are matched with productive opportunities according to their performance rank. Let p_{it} denote performance and Φ_P (which is endogenized in the subsequent analysis) denote the cumulative distribution function (CDF) of performances. Let the performance rank of an agent who generates performance p_{it} be denoted as ρ_P, where $\rho_P = \Phi_P(p_{it})$. The agent who generates performance rank ρ_P is assigned the productive opportunity $A(\rho_P)$.

Performance is determined by

$$p_{it} = G(k_{it}, z_{it}) = k_{it}z_{it}, \tag{1}$$

where k_{it} is the effort, or, more generally, contest expenditure, optimally chosen by the agent. It will be shown that in a Nash equilibrium, the distribution of performance is approximately Pareto distributed.

Once an agent of talent z_i is matched with productivity $A(\rho_P)$, his/her income can be written as

$$y_{it} = A(\rho_P)z_{it}. \tag{2}$$

An agent of generation t maximizes the following utility function

$$U(c_{it}, b_{it+1}, k_{it}) = {c_{it}}^m + {b_{it+1}}^m - \chi(k_{it}, b_{it}) \tag{3}$$

where c_{it} is consumption and b_{it+1} is the 'warm glow' bequest to the next generation; these two variables are subject to the constraint $c_{it} + b_{it+1} \le y_{it}$. The parameter m satisfies $0 < m \le 1$. The function $\chi(k_{it}, b_{it})$ is the utility cost of the contest expenditure and is given by

$$\chi(k_{it}, b_{it}) = k_{it}/b_{it} \tag{4}$$

The term b_{it} in the function $\chi(k_{it}, b_{it})$ provides a channel for the intergenerational transmission of family advantage.[2] In this specification, disutility k_{it}/b_{it} reduces as inherited bequest b_{it} rises. Thus, having a higher bequest makes it easier to exert effort. This specification follows Loury (1981), where parental bequest can only be used for the child's training.[3] In such a context, it seems natural to assume, as I do here, that the effectiveness of bequest at reducing the disutility of effort grows at a diminishing rate.

In any generation, the economy consists of heterogeneous agents, along with two dimensions: talent and bequests. An agent endowed with talent z_{it} and bequest b_{it} chooses $\{c_{it},\ b_{it+1}, k_{it}\}$ optimally to maximize the utility function in Eq. (3), subject to Eqs. (1) and (2), the constraint $c_{it} + b_{it+1} \le y_{it}$, and taking the distribution of performances among all contestants as given.

In the short run—within each generation—the expectation about the distribution of performances of all contestants is rationally formed. Consequently, for the given joint distribution of talent and bequest, the actual distribution of contest performances is identical to the anticipated distribution upon which all the rational agents based their optimal effort choices. In other words, if the joint CDF of b_{it} and z_{it} is denoted as $\Lambda(b_{it}, z_{it})$ and the optimal choice of contest expenditure is denoted as $k_{it} = k(b_{it}, z_{it}; \Phi_P)$ to highlight its dependence on Φ_P, then in the equilibrium, the following equation must hold for all values of p in the range of performance distribution. $\Phi_P(p) = \iint \mathbb{I}[k(b, z; \Phi_P)z_{it} \le p]\Lambda_{bz}(b, z)dbdz$, where $\mathbb{I}$ denotes the indicator function and $\Lambda_{bz} = \frac{\partial^2 \Lambda}{\partial b \partial z}$. In other words, contest expenditures are determined in a Nash equilibrium among all individuals who compete for productive opportunities.

In the long run, the distribution of bequests of any given generation depends on the distribution of income of the previous generation, while the distribution of income depends on the distribution of bequests from the previous generation and the distribution of talent. Consequently, the distribution of income can be described as a Markov process and it is possible to characterise the cross-sectional income distribution and nature of intergenerational income persistence, both of which are endogenously determined in this model.

More specifically, in the short-run equilibrium at time t, the distributions of $\{A, z_t, b_t\}$ are exogenously given, while the distributions $\{c_t, b_{t+1}, k_t, p_t, y_t\}$ are endogenously determined. The choice of $\{c_t, b_{t+1}, k_t\}$ depends on all agents rationally expecting the distribution of p_t and these choices then determine the distribution of $\{p_t, y_t\}$ at the aggregate level. In the short run, the distribution of bequests at time $t+1$, b_{t+1}, which is itself the aggregate outcome of the optimal choices by individuals, need not be distributed in the same way as the distribution of bequests at time t, b_t.

Conversely, in the long-run equilibrium, only the distributions of $\{A, z_t\}$ are exogenously given. The distribution of b_t is endogenously determined because the optimally chosen distribution of b_{t+1} must be identically distributed as b_t. Similarly, the distribution of incomes of any two generations y_t and y_{t+1} must also be identical. Consequently, in the long-run equilibrium, the distributions of $\{c, b, k, p, y\}$ are all endogenously determined. These distributions are approximately Pareto distributed, especially at the top end.

The positional competition modeled in this paper is not zero-sum because its existence generates a gain in efficiency through better matching. To see this, note that given the distributions of productivity A and talent z, the total output of the economy depends on how these two variables are associated with each other. Further, focusing on situations in which the two variables are positively correlated, it is possible to derive the upper and lower bounds of such an association in terms of total output, $(Y) = E(Az)$.

The lower bound is attained when the two variables are independent of each other and is given by $E(Y) = E(Az) = E(A)E(z) = \frac{\beta_A}{\beta_A - 1}\frac{\beta_z}{\beta_z - 1}A_0 z_0$, whereas the upper bound is attained when the two variables are perfectly correlated and is given by $E(Y) = E(Az) = \int_0^1 A(\rho)z(\rho)d\rho = \int_0^1 A_0 z_0 (1-\rho)^{-\frac{1}{\beta_A} - \frac{1}{\beta_z}} d\rho = \frac{\beta_A \beta_z}{\beta_A \beta_z - \beta_A - \beta_z} A_0 z_0$, which is clearly greater than the lower bound. A more positive association would imply a better allocation of talent, leading to output enhancement.

To ensure that the upper bound is finite, I introduce the parameter restriction of $\beta_A \beta_z - \beta_A - \beta_z > 0$. Since $\beta_A = \frac{1}{\theta}$, this condition can be equivalently written as $\theta < \frac{\beta_z - 1}{\beta_z}$. This restriction is stated in Assumption 1.

[2] It is shown in Section 3 that agents choose to bequeath a constant fraction of their incomes, therefore, the term b_{it} in Eq. (4) can be replaced by the income of the previous generation y_{it-1} without qualitatively affecting the results of this study.

[3] To allow for bequests as inter vivos transfers from parent to child that eases the child's income constraint in the setting of this model would require separating the wealth distribution from the income distribution, as well as tracing the bivariate distribution of wealth and income over time; such an exercise is beyond the scope of this paper, and is left for future research.

Assumption 1. $\theta < \frac{\beta_z - 1}{\beta_z}$ implies that total output is bounded away from infinity even when the allocation of talent is perfect.

3. Short-run equilibrium

The short-run equilibrium characterized in this section is the static, period-t general equilibrium with the distribution of initial bequest at the beginning of period t taken as given. In Section 4, the distribution of bequests will be endogenously determined in a Markov steady state.

The additive separable nature of utility function (3) ensures that the problems faced by each agent can be decomposed into two parts. First, given income y_{it}, utility maximization can be carried out through appropriate choices of c_{it} and b_{it+1}. Second, income y_{it} itself is maximized through an appropriate choice of contest expenditure k_{it} with agents rationally expecting the distribution of contest performances.

In the first stage, maximizing utility ${c_{it}}^m + {b_{it+1}}^m$ subject to $c_{it} + b_{it+1} \leq y_{it}$ gives the optimal choices $c_{it} = b_{it+1} = \frac{y_{it}}{2}$. Substituting these choices into ${c_{it}}^m + {b_{it+1}}^m$ gives the indirect utility of $V(y_{it}) = 2(\frac{y_{it}}{2})^m = 2^{1-m}{y_{it}}^m$. This indirect utility function is then used in the second stage of the problem, where an agent chooses contest expenditure k_{it} to maximise $V(y_{it}) - \chi(k_{it}, b_{it})$. The second stage of the problem involves an interaction between contestants, as the optimal choice of k_{it} is dependant on the choices made by all the other agents; it is solved as a Nash equilibrium among all contestants.

I assume that all agents formulate their optimal strategies based on a particular belief structure, which they hold *a priori*, that contest performance is Pareto distributed. Once all agents formulate their optimal strategies on the basis of this specific common prior, the resulting performance distribution in the Nash equilibrium indeed turns out to be Pareto.

Specifically, when choosing contest expenditure, agents consider it given that performance is distributed with a Pareto distribution, $P \sim Par(p_0, \beta_p)$. Therefore, performance rank is given by $\Phi_p(p_i) = 1 - \frac{{p_i}^{-\beta_p}}{{p_0}^{-\beta_p}}$.

Now, define $\gamma \equiv \beta_p \theta$. Since β_p is the shape parameter of the distribution of performance p, which is endogenously determined as part of the Nash equilibrium, if follows that the value of γ is also endogenous. Moreover, since the value of β_p is time-invariant, the value of γ is also time-invariant in the model. As I demonstrate, the value of γ indicates the intensity of positional competition and plays a crucial role in explaining both the Great Gatsby curve and the Easterlin paradox. Using $A(\rho_A) = A_0(1-\rho_A)^{-\theta}$ and the definition of γ gives

$$A(\Phi_p(p_{it})) = p_1 {p_{it}}^{\gamma}, \tag{5}$$

where $p_1 \equiv A_0 {p_0}^{-\gamma}$. For now, I assume that $\gamma m < 1$; this is shown to be the case when I solve for the Nash equilibrium.

Eq. (5) makes it possible to write income y_{it} as a function of performance p_{it}. Now, using the indirect utility function and Eq. (1), the optimal choice of contest expenditure k_{it} that maximises $V(y_{it}) - \chi(k_{it}, b_{it})$ can be written as follows:

$$k_{it} = argmax\left\{2^{1-m}{p_1}^m(k_{it})^{\gamma m}(z_{it})^{(\gamma+1)m} - \frac{k_{it}}{b_{it}}\right\}.$$

Solving the individual optimization problem gives

$$k_{it} = 2^{\frac{1-m}{1-\gamma m}} p_1^{\frac{m}{1-\gamma m}} (\gamma m)^{\frac{1}{1-\gamma m}} {b_{it}}^{\frac{1}{1-\gamma m}} {z_{it}}^{\frac{m+\gamma m}{1-\gamma m}}. \tag{6}$$

If both k_{it} and b_{it} follow power law distributions (which is the case in an equilibrium), then, as z_{it} is i.i.d., it is independent of bequest b_{it}, therefore the distribution at the upper tail of k_{it} must be determined either by the distribution of ${b_{it}}^{\frac{1}{1-\gamma m}}$ or by the distribution of ${z_{it}}^{\frac{m+\gamma m}{1-\gamma m}}$, whichever is more unequal. In other words, the parameter β_k must satisfy

$$\beta_k = (1-\gamma m)min\left\{\beta_b, \frac{1}{m+\gamma m}\beta_z\right\}. \tag{7}$$

The fact that b_{it} and z_{it} are independent of each other does not contradict the intergenerational transmission of family advantage. In this model, performances p_{it} and income y_{it} are correlated with bequest b_{it}. Moreover, the nature of these correlations is endogenously determined. The assumption that z_{it} is i.i.d. makes it easier to analyse these correlations.

Note from Eq. (6) that the optimal contest expenditure k_{it} is sensitive to the value of γ. As γ increases, total effort in the contest increases which particularly favours those at the higher end of the distribution. The value of γ, therefore, indicates the intensity of positional competition. I now analyse how the value of γ is endogenously determined.

Given the optimal effort choice in positional competition described in Eq. (6), the distribution of performance is determined by the distributions of k_{it} and z_{it}.

$$p_{it} = k_{it}z_{it} = 2^{\frac{1-m}{1-\gamma m}} p_1^{\frac{m}{1-\gamma m}} (\gamma m)^{\frac{1}{1-\gamma m}} {b_{it}}^{\frac{1}{1-\gamma m}} {z_{it}}^{\frac{1+m}{1-\gamma m}}. \tag{8}$$

Given that b_{it} and z_{it} are independently distributed, the Pareto exponent of the distribution of performance β_p is given by

$$\beta_p = (1-\gamma m)min\left\{\beta_b, \frac{1}{1+m}\beta_z\right\}. \tag{9}$$

Now using $\gamma \equiv \beta_p\theta$, Eq. (9) can be re-written as

$$\gamma = (1-\gamma m)\theta\beta_b min\left\{1, \frac{1}{1+m}\frac{\beta_z}{\beta_b}\right\}. \tag{10}$$

Solving Eq. (10) makes it possible to endogenize the value of γ as

$$\gamma = \frac{\theta\beta_b min\left\{1, \frac{1}{1+m}\frac{\beta_z}{\beta_b}\right\}}{1+m\theta\beta_b min\left\{1, \frac{1}{1+m}\frac{\beta_z}{\beta_b}\right\}}. \tag{11}$$

Clearly, $\gamma m < 1$. Further, the value of β_p is given by

$$\beta_p = \frac{\gamma}{\theta} = \frac{\beta_b min\left\{1, \frac{1}{1+m}\frac{\beta_z}{\beta_b}\right\}}{1+m\theta\beta_b min\left\{1, \frac{1}{1+m}\frac{\beta_z}{\beta_b}\right\}}. \tag{12}$$

The use of power law distribution of performance makes it reasonable to model positional competition as an economy-wide Nash equilibrium. In general, an economy-wide Nash equilibrium requires every agent in the economy to be fully aware of the strategy of every other agent. Such a requirement would appear unreasonable, as there are very large numbers of agents and multiple dimensions of heterogeneity. However, in this model, there is no need for every agent to possess detailed knowledge of every other agent in the economy with all their diverse backgrounds. Instead, all these complexities involving the strategies of other agents are reducible to a single number γ.

The endogenous determination of the intensity of positional competition in Eq. (11) is a key step at the heart of this model. The value of γ, which denotes the intensity of positional competition, is determined as the solution to a fixed-point problem: when agents respond to the structure of competition characterised by the value of γ, their actions collectively form a performance distribution that maps to productive opportunities with the parameter γ. Crucially, Eq. (11) demonstrates that the value of γ is an increasing function of the degree of dispersion in productive opportunities θ, which is exogenously given. Thus, this model is driven by the way the socially determined intensity of positional competition γ responds to the exogenously given inequality of productive opportunities.

An increase in the dispersion of productive opportunities θ has two effects, in opposing directions, on the value of γ. First, recall that $\gamma \equiv \beta_p\theta$. Thus, holding the value of β_p constant, a rise in the value of θ clearly increases the value of γ. I call this the 'competition-inducement effect'. Second, an increase in the value of γ reduces the value of β_p. Since a higher value of γ increases the incentive for agents to expend effort, the distribution of performance p becomes more unequal, as reflected by the value of β_p becoming smaller. Since $\gamma \equiv \beta_p\theta$, a smaller β_p will exert downward pressure on γ. In other words, more unequally distributed performances would now discourage effort, as a bigger difference in the performances for any positional increment would be needed. This can be seen from Eq. (10), where the right-hand side (RHS) of the equation decreases as the value of γ increases. I call this the 'competition-impeding effect'. Overall, this model shows that the competition-inducement effect dominates. This can be seen from Eq. (11), where the numerator on the RHS corresponds to the competition-inducement effect, while the denominator on the RHS corresponds to the competition-impeding effect. Thus, an increase in the dispersion of productivity θ leads to a rise in the intensity of positional competition γ.

We can now analyse income inequality in the short run. We focus on the Pareto exponent of y_{it}, taking the distribution of b_{it} as given. Using Eqs. (1), (2), (5), and (6), income can be written as

$$y_{it} = p_1{}^{\frac{1}{1-\gamma m}}(\gamma m)^{\frac{\gamma}{1-\gamma m}} b_{it}{}^{\frac{\gamma}{1-\gamma m}}(z_{it})^{\frac{1+\gamma}{1-\gamma m}}. \tag{13}$$

As b_{it} and z_{it} are independently distributed, the Pareto exponent β_y needs to satisfy

$$\beta_y = min\left\{\frac{1-\gamma m}{\gamma}\beta_b, \frac{1-\gamma m}{1+\gamma}\beta_z\right\}. \tag{14}$$

In the equilibrium, the value of γ and β_y, as shown in Eqs. (11) and (14), is determined either by the distribution of bequests or by the distribution of talent. It appears that when the value of γ is determined by the distribution of talent, the Pareto exponent of income is also determined by the distribution of talent, whereas, when the value of γ is determined by the distribution of bequests, the Pareto exponent of income can be determined either by the distribution of talent or by the distribution of bequests. Consequently, depending on the parameter values, there are three possibilities.

Case 1: Both γ and β_y are determined by β_z.
Case 2: The value of γ is determined by β_b while the value of β_y is determined by β_z.
Case 3: Both γ and β_y are determined by β_b.

This result is summarized in Proposition 1. For the ease of exposition, the proofs of all the propositions are presented in the appendix.

Proposition 1. *In the short-run equilibrium, the Pareto exponent of income distribution is given by*

$$\beta_y = \begin{cases} \dfrac{1}{\frac{1}{\beta_z} + \theta}, & If\ \beta_z \le (1+m)\beta_b \\ \dfrac{\beta_z}{1 + (1+m)\theta\beta_b}, & If\ (1+m)\beta_b < \beta_z \le \frac{(1+m)\beta_b}{\theta} \\ \dfrac{1}{\theta} & If\ \beta_z > \frac{(1+m)\beta_b}{\theta} \end{cases} \tag{15}$$

In Proposition 1, the parameter space is divided into three parts, corresponding to Cases 1, 2, and 3, respectively.[4] As the distribution of productive opportunities becomes more dispersed, the short-run equilibrium moves from Casea 1 to 2 and then from Cases 2 to 3. In all cases, income inequality increases as the value of θ increases.

3.1. Intertemporal equilibrium

In the short-run equilibrium analyzed in this section, agents economically active in period t are heterogeneous in initial bequest and in talent. The efforts and performances in positional competition, chosen by the optimising agents themselves, are functions of the bivariate distribution over talent and initial bequests; these, in turn, determine the intensity of positional competition, the distribution of income, and the distribution of bequests to the next period. The distribution of bequests to the next period needs not be identical to the initial distribution of bequests. As the economy evolves over time, the distribution of bequests each generation receives can also evolve. The appendix shows that under suitable conditions, the distribution of bequests converges to a unique stationary state such that in each period, the initial distribution of bequests is identical to the distribution of bequests agents leave to the next generation.[5] The stationary-state distribution of bequests characterizes the long-run equilibrium, which is analyzed in the next section.

4. Long run: Great Gatsby curve

4.1. Inequality

In the long run, the Markovian structure of the model requires the distribution of bequests b to be endogenously determined. The endogenization of the distribution of bequest, in turn, impacts the distribution of income and makes it possible to endogenize intergenerational mobility. Consequently, the model can be used to analyse the impact of changes ins the parameter values (such as the value of θ) on inequality and mobility.

I use $\beta_{y,t}$ and $\beta_{b,t}$ to denote the Pareto exponents of y and b, respectively, at time t. Recall that the optimal choice of bequest is given by $b_{it+1} = \frac{y_{it}}{2}$. As bequests are proportional to income, the condition $\beta_{y,t} = \beta_{b,t}$ holds. In other words, the distributions of y and b have the same Pareto exponent in each period. Using Eq. (15), the way $\beta_{y,t}$ and $\beta_{b,t}$ evolve over time can be described by a difference equation $\beta_{y,t+1} = H(\beta_{b,t})$, where the function $H(.)$ is defined as

$$H(\beta_{b,t}) = \begin{cases} \dfrac{1}{\frac{1}{\beta_z} + \theta}, & \text{If } \beta_z \le (1+m)\beta_{b,t} \\ \dfrac{\beta_z}{1 + (1+m)\theta\beta_{b,t}}, & \text{If } (1+m)\beta_{b,t} < \beta_z \le \frac{(1+m)\beta_{b,t}}{\theta} \\ \dfrac{1}{\theta} & \text{If } \beta_z \le \frac{(1+m)\beta_{b,t}}{\theta} \end{cases} \tag{16}$$

Eq. (16) shows that the evolution of $\beta_{y,t+1}$ varies depending on the value of $\beta_{b,t}$. In Cases 1 and 3, the steady state value of $\beta_{y,t+1}$ is attained immediately, while there is typically a convergence process in Case 2.[6] I focus on the steady-state value of β_y in my analysis. Fig. 1 illustrates the steady-state with Case 2.

The parameter values demarcating the three cases now depend on the values of both β_z and θ, since the value of β_b is now endogenously determined. As the value of θ increases, the steady state moves from Cases 1 to 2 and then from Cases 2 to 3. Moreover, the steady-state value of β_y is also affected by the parameter restriction in Assumption 1: $\theta < \frac{\beta_z - 1}{\beta_z}$. When this constraint is not binding, the steady-state value of β_y still follows the three cases parallel to Proposition 1. If this constraint is binding, the number of admissible cases falls.

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[4] Recall there is also an upper bound on matching efficiency, $\theta < \frac{\beta_z - 1}{\beta_z}$, but this does not affect the analysis. It does, however, affect the analysis when b is endogenously determined, as I show in the next section.

[5] This does not imply each agent will leave the same bequest as he/she receives, otherwise mobility would not be possible.

[6] In Case 2, convergence to the new steady state is not immediate. Moreover, since the function $\frac{\beta_z}{1+(1+m)\theta\beta_{b,t}}$ is decreasing in $\beta_{b,t}$, the path of convergence is not monotonic. While the convergence process is not explicitly analyzed in this paper, the lack of monotonicity in the movement of inequality is consistent with the findings of Bourguignon (2017).

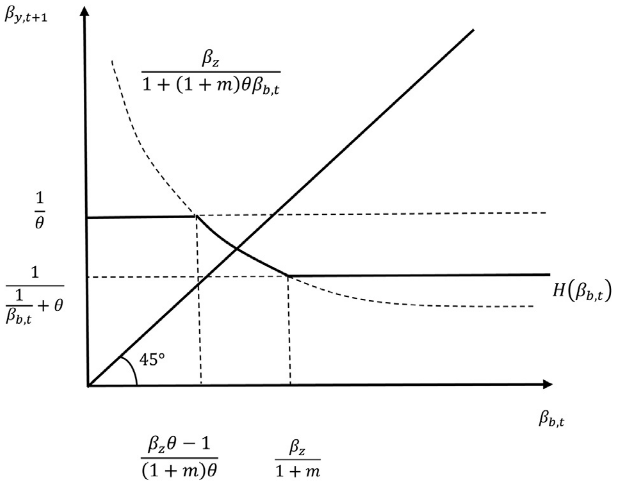

Fig. 1. Endogenous Determination of the Pareto Exponent of Income Distribution: Equilibrium occurs where the $H(\beta_{b,t})$ function intersects the 45° line. This figure denotes Case 2 in which the 45° line intersects the middle segment of the $H(\beta_{b,t})$ function. In general, a rise in the dispersion of productivity (increase in θ) shifts the $H(\beta_{b,t})$ function downwards and alters the segment of the $H(\beta_{b,t})$ function, which intersects the 45° line.

Proposition 2. *If $2+m<\beta_z-1$, then the endogenously determined Pareto exponent of income is given by*

$$\beta_y^* = \begin{cases} \dfrac{1}{\frac{1}{\beta_z}+\theta} & If\ 0<\theta\le\frac{m}{\beta_z} \\ \dfrac{\left(\sqrt{1+4(1+m)\theta\beta_z}\right)-1}{2(1+m)\theta} & If\ \frac{m}{\beta_z}<\theta<\frac{2+m}{\beta_z} \\ \dfrac{1}{\theta} & If\ \frac{2+m}{\beta_z}\le\theta<\frac{\beta_z-1}{\beta_z} \end{cases} \tag{17}$$

If $m<\beta_z-1\le 2+m$, then the endogenously determined Pareto exponent of income is given by

$$\beta_y^* = \begin{cases} \dfrac{1}{\frac{1}{\beta_z}+\theta} & If\ 0<\theta\le\frac{m}{\beta_z} \\ \dfrac{\left(\sqrt{1+4(1+m)\theta\beta_z}\right)-1}{2(1+m)\theta} & If\ \frac{m}{\beta_z}<\theta<\frac{\beta_z-1}{\beta_z} \end{cases} \tag{18}$$

If $\beta_z-1\le m$, then the endogenously determined Pareto exponent of income is given by

$$\beta_y^* = \frac{1}{\frac{1}{\beta_z}+\theta},\ 0<\theta\le\frac{\beta_z-1}{\beta_z}. \tag{19}$$

Proposition 2 shows that the value of β_y^* clearly decreases with θ in all cases in Eqs. (17), (18), and (19). In other words, inequality rises as the dispersion of productivity widens. Similarly, a rise in the dispersion of talent (or equivalently, a fall in the Pareto exponent β_z) has the same effect as a rise in θ, leading to increasing inequality in all cases except in Case 3, where it has no effect on income distribution.

4.2. Mobility

In this paper, mobility is characterized using the copula of income ranks across two consecutive generations in the same family dynasty. A higher copula represents a greater amount of intergenerational persistence of income and, therefore, a lower degree of intergenerational mobility.

In general, the copula ordering is a partial order. Thus, the degree of mobility of two economic environments cannot always be strictly ranked. However, when the marginal distributions are Pareto, the results become unambiguous: the comparative statics result of this model demonstrates that any changes in θ always lead to changes in the mobility copula that can be unambiguously ranked. Further, the ranking is consistent with the stochastically increasing (SI) order which is stronger than the positive quadrant dependant (PQD) order. When the Markov transition functions are the products of power functions, as is the case in this paper, mobility only depends on a subset of parameters of the model. This is demonstrated in Proposition 3.

Proposition 3. *Consider the Markov process with the following transition equation.*

$$y_t = B{y_{t-1}}^{\beta}{z_t}^{\eta}. \tag{20}$$

The random variables Y_t, Y_{t-1} and Z_t have Pareto marginals and Z_t is i.i.d. The Pareto exponents are denoted as $\beta_{y'}$, β_y, and β_z, respectively. Then, the copula of Y_t and Y_{t-1} is increasing in the value of $\frac{\beta}{\eta}\frac{\beta_z}{\beta_y}$. Moreover, $\frac{\beta}{\eta}\frac{\beta_z}{\beta_y}$ is the only parameter that influences the size of the copula of Y_t and Y_{t-1}.

Proposition 3 shows that when the Markov transition functions are the products of power functions as in Eq. (20), mobility falls as the value of $\frac{\beta}{\eta}\frac{\beta_z}{\beta_y}$ increases. Moreover, $\frac{\beta}{\eta}\frac{\beta_z}{\beta_y}$ is the only parameter that influences mobility.

Using Eq. (13), and $b_{it+1} = \frac{y_{i,t}}{2}$, the income dynamics in this model can be described using the following Markov transition equation

$$y_{it+1} = 2^{-\frac{\gamma}{1-\gamma m}} p_1^{\frac{1}{1-\gamma m}} (\gamma m)^{\frac{\gamma}{1-\gamma m}} y_{it}^{\frac{\gamma}{1-\gamma m}} (z_{it+1})^{\frac{1+\gamma}{1-\gamma m}}. \tag{21}$$

Using Proposition 3, the term corresponding to $\frac{\beta}{\eta}\frac{\beta_z}{\beta_y}$ in Eq. (21) is given by $\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y}$. Therefore, the copula between Y_{t+1} and Y_t is increasing in $\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y}$. Moreover, any change to the mobility copula should be reflected in the value of $\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y}$. Specifically, in the stationary state, intergenerational mobility decreases as the value of $\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y}$ increases. Proposition 4 characterises the value of $\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y}$ using the parameters in this model.

Proposition 4. *In the stationary state, the copula between Y_{t+1} and Y_t is increasing in $\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y}$, where*

$$\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y} = \begin{cases} \frac{\theta\beta_z}{1+m} & If\ 0 < \theta \le \frac{m}{\beta_z} \\ \dfrac{\left(\sqrt{1+4(1+m)\theta\beta_z}\right)-1}{2(1+m)} & If\ \frac{m}{\beta_z} < \theta < \frac{2+m}{\beta_z} \\ \dfrac{\theta\beta_z}{2+m} & If\ \frac{2+m}{\beta_z} \le \theta < \frac{\beta_z-1}{\beta_z} \end{cases} \tag{22}$$

if $2+m < \beta_z - 1$,

$$\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y} = \begin{cases} \frac{\theta\beta_z}{1+m} & If\ 0 < \theta \le \frac{m}{\beta_z} \\ \dfrac{\left(\sqrt{1+4(1+m)\theta\beta_z}\right)-1}{2(1+m)} & If\ \frac{m}{\beta_z} < \theta < \frac{\beta_z-1}{\beta_z} \end{cases} \tag{23}$$

if $m < \beta_z - 1 \le 2+m$, *and*

$$\frac{\gamma}{1+\gamma}\frac{\beta_z}{\beta_y} = \frac{\theta\beta_z}{1+m},\ 0 < \theta \le \frac{\beta_z - 1}{\beta_z}, \tag{24}$$

if $\beta_z - 1 \le m$. *In all cases, mobility falls as* θ *or* β_z *increases.*

Combining Propositions 2 and 4, changes in the dispersion of productivity θ unambiguously leads to a Great Gatsby curve, as the following result summarizes.

Theorem 1 (Great Gatsby curve)**.** *A rise in the dispersion of productivity θ leads to an increase in inequality and a fall in mobility.*

Proof of Theorem 1. This result follows directly from Proposition 2 and Proposition 4.

Now, consider a rise in the dispersion of talent (or equivalently, a fall in the Pareto exponent β_z). As can be seen from Proposition 4, this will have exactly the opposite effect: a rise in θ will lead to increasing mobility in all three cases. Further, from Proposition 2, it can be seen that a rise in the dispersion of talent will, like the rise in θ, lead to a rise in inequality accompanied by a rise in mobility. Consequently, if the distribution of talent were to increase at the same time as productivity, there would be a race between technology and talent dispersion. To compare the combined effect of such changes in θ and β_z, consider the benchmark case in which θ increases and β_z falls in such a way that the value of $\theta\beta_z$ remains constant. This gives the following result.

Proposition 5. *If the dispersions of both productive opportunities and talent widen such that mobility stays unaffected, income inequality must be rising.*

5. Easterlin paradox

The Easterlin paradox raises questions at the core of economics—whether increases in GDP lead to higher levels of happiness. This has been disputed (e.g. Deaton 2008; Sacks et al., 2012). However, Easterlin (2016) pointed out an essential aspect of the paradox, namely, for happiness to trend with income depends on whether the regression is cross-sectional or time-series.

This model does not prove the absence of income–happiness correlation in the long run, though the prediction of the model is not inconsistent with such a possibility. Instead, I focus on the following question: Are there grounds to expect the cross-sectional regression coefficient to be different from the time-series regression coefficient? My model indicates there are not, except when economic growth is accompanied by intensifying positional competition. More specifically, my model makes the following predictions.

(1) If economic growth is unaccompanied by the intensification of positional competition, the regression coefficients of happiness on income using cross-sectional or time-series data are identical.
(2) If economic growth is accompanied by the intensification of positional competition, the regression coefficients of happiness on income using cross-sectional data is greater than the regression coefficient using time-series data.

Consider a standard model which does not feature positional competition. Specifically, assume income is Pareto distributed with exponent β_y which remains constant. Economic growth is reflected by the rise in y_0. The utility of an agent with income y is given by $U(y) = 2^{1-m}y^m$. Consequently, the cross-sectional relationship between the logarithm of utility and the logarithm of income can be written as

$$\log U = m_0^{b,c} + m\ln(Y), \tag{25}$$

The superscripts b, c on $m_0^{b,c}$ denote the benchmark and cross-sectional cases, respectively, and $m_0^{b,c} = (1-m)\ln(2)$ is a constant.

To characterise the time-series relationship between utility and income, note that $EU(Y) = 2^{1-m}E(Y^m) = 2^{1-m}\frac{\beta_y}{\beta_y - m}{y_0}^m$ and $E(Y) = \frac{\beta_y}{\beta_y - 1}y_0$. Therefore, the time-series relation between the logarithm of average utility and the logarithm of average income can be written as

$$\log E(U) = m_0^{b,t} + m\log E(Y). \tag{26}$$

where $m_0^{b,t} = (1-m)\ln(2) + \ln(\frac{\beta_y}{\beta_y - m}) - m\ln(\frac{\beta_y}{\beta_y - 1})$ is a constant and the superscripts b, t on $m_0^{b,t}$ denote the benchmark and time-series cases, respectively.[7]

Comparing the cross-sectional relationship with the time-series relationship between utility and income in the standard model, the regression coefficient would be m in both cases. Thus, in the standard model, the coefficient of cross-sectional regression would correctly represents the nature of the long-run, time-series relationship. In other words, the Easterlin paradox is not compatible with the setting of the standard model.

By contrast, when positional competition is featured and if positional competition intensifies as the economy grows, then consistent with the Easterlin paradox, the time-series regression coefficient would indeed be different from and less than the cross-sectional regression coefficient. To see this, using the optimal choice of k_{it} in Eq. (6), agent i at time t attains the utility value of

$$u_{it} = (1-\gamma m)2^{1-\frac{m}{1-\gamma m}}{p_1}^{\frac{m}{1-\gamma m}}(\gamma m)^{\frac{\gamma m}{1-\gamma m}}{y_{it-1}}^{\frac{\gamma m}{1-\gamma m}}{z_{it}}^{\frac{m+\gamma m}{1-\gamma m}}. \tag{27}$$

It follows that

$$E(u) = (1-\gamma m)2^{1-\frac{m}{1-\gamma m}}{p_1}^{\frac{m}{1-\gamma m}}(\gamma m)^{\frac{\gamma m}{1-\gamma m}}E\left({y_{it-1}}^{\frac{\gamma m}{1-\gamma m}}\right)E\left({z_{it}}^{\frac{m+\gamma m}{1-\gamma m}}\right). \tag{28}$$

Now, the value of $E(Y)$ can be obtained from Eq. (21) as

$$E(Y) = 2^{-\frac{\gamma}{1-\gamma m}}{p_1}^{\frac{1}{1-\gamma m}}(\gamma m)^{\frac{\gamma}{1-\gamma m}}E\left({y_{it-1}}^{\frac{\gamma}{1-\gamma m}}\right)E\left((z_{it})^{\frac{1+\gamma}{1-\gamma m}}\right). \tag{29}$$

For the cross-sectional regression, using Eqs. (21) and (27), we obtain $U(y) = (1-\gamma m)2^{\frac{1-m}{1-\gamma m}}y^m$. Taking the logarithm gives

$$\ln(U) = m_0^{p,c} + m\ln(Y), \tag{30}$$

where $m_0^{p,c} = (\frac{1-m}{1-\gamma m})\ln(2) + \ln(1-\gamma m)$ and the superscript p, c on $m_0^{p,c}$ denotes the positional-competition and cross-sectional cases, respectively. The value of $m_0^{p,c}$ is decreasing in γ on the unit interval.[8] In addition, the term p_1 does not enter the cross-sectional relationship between income and utility. This would also be the case with the time-series relationship. In other words, the location parameters of income distribution do not affect the utility–income relationship.

For the time-series relationship, using Eqs. (28) and (29), we obtain

$$\log E(U) = m_0^{p,t} + m\ln(E(Y)), \tag{31}$$

[7] More specifically, we have $EU(Y) = 2^{1-m}(\frac{\beta_y}{\beta_y - m})(\frac{\beta_y}{\beta_y - 1})^{-m}E(Y)^m$. Therefore, $\ln(E(U)) = m_0^{b,t} + m\ln(E(Y))$.

[8] To see this, differentiating $m_0^{p,c}$ with respect to γ gives $\frac{m}{1-\gamma m}(\frac{1-m}{1-\gamma m}\ln(2) - 1)$ which is negative for all $0 \le \gamma \le 1$.

where

$$m_0^{p,t} = m_0^{p,c} + \ln\left(\frac{\beta_y}{\beta_y - \frac{\gamma m}{1-\gamma m}}\right) - m\ln\left(\frac{\beta_y}{\beta_y - \frac{\gamma}{1-\gamma m}}\right) + \ln\left(\frac{\beta_z}{\beta_z - \frac{m+\gamma m}{1-\gamma m}}\right) - m\ln\left(\frac{\beta_z}{\beta_z - \frac{1+\gamma}{1-\gamma m}}\right) \tag{32}$$

and the superscripts p, t on $m_0^{p,t}$ denote the positional-competition and time-series cases, respectively. Crucially, if positional competition intensifies as an economy grows, the difference between the intercept terms $m_0^{p,t}$ and $m_0^{p,c}$ decreases with the intensity of positional competition γ instead of remaining constant, as Proposition 6 demonstrates.

Proposition 6. *The value of $m_0^{p,t} - m_0^{p,c}$ decreases with γ.*

From Proposition 6, since $m_0^{p,t} - m_0^{p,c}$ decreases with γ, the coefficient of the time-series regression is lower than the coefficient of the cross-sectional regression, purely due to the intensification of positional competition. The analysis above is summarized in the following theorem showing that the intensification of positional competition that accompanies economic growth explains the Easterlin paradox.

Theorem 2 (Easterlin paradox)**.** *If A_0 increases while θ remains constant, both the cross-sectional and the time-series regression coefficients of utility on income are m. By contrast, if θ increases with A_0, the time-series regression coefficient of average utility on average income is less than the cross-sectional regression coefficient of average utility on average income.*

Proof of Theorem 2. This follows immediately from comparing Eqs. (25), (26), (30), and (31) and using Proposition 6.

Theorem 2 shows that the intensification of positional competition accompanying productivity growth can explain the Easterlin paradox, whereas the standard model cannot. Theorem 2 rests on the direct utility cost of rising inequality. This confirms the findings of Easterlin et al. (2012) and Oishi and Kesebir (2015). To see this, consider the indirect utility function $V(y) = 2^{1-m}y^m$ and the effect of a reduction in the Pareto exponent β_y which simultaneously lead to an increase in inequality and expected income. It follows that $E(Y) = \frac{\beta_y}{\beta_y - 1}y_0$ and $EV(Y) = 2^{1-m}\frac{\beta_y}{\beta_y - m}{y_0}^m$. Consequently, $EV(Y)$ can be rewritten as $EV(Y) = 2^{1-m}(\frac{\beta_y}{\beta_y - m})(\frac{\beta_y}{\beta_y - 1})^{-m}E(Y)^m$. The value of $2^{1-m}(\frac{\beta_y}{\beta_y - m})(\frac{\beta_y}{\beta_y - 1})^{-m}$ decreases as inequality increases (i.e. β_y decreases) and this reflects the utility cost of rising inequality. In addition, a direct utility cost of rising intensity of positional competition can weaken the utility–income relation in this framework. This is reflected by $(1 - \gamma m)$ in Eq. (28). Recall that the intensity of positional competition γ itself is endogenously determined and it rises as productivities become more dispersed.

Together, Theorems 1 and 2 highlight the crucial role of intensifying positional competition in explaining the Easterlin paradox. Without them, the existence of positional competition alone does not generate the Great Gatsby curve or explain the Easterlin paradox. Conversely, with the rising intensity of positional competition, the initial widening in the dispersion of productive opportunities results in both the Great Gatsby curve and a flattening of the utility–income gradient.

Overall, this paper explains the Easterlin paradox, without assuming a relative income or adaptation element in the utility function. More importantly, this explanation is based on the same structure that gives rise to the Great Gatsby curve.

This model is consistent with the findings of Deaton (2008) and Sacks et al. (2012) that, in cross-sectional data, income is positively correlated with utility in the short run. This is the case in the standard/benchmark model as well as in the model of positional competition in which the intensity of positional competition remains unchanged along the growth path. While my model does not predict that a rise in income has no positive effect on average utility, it is not incompatible with such a possibility. The way the intensification of positional competition impacts utility depends on how the increase in θ is related to the increases in A_0 which is not explicitly modelled in this paper. Recall that this model is consistent with the formulation $\theta = g(A_0, \theta_1)$ where A_0 is the effect of productivity growth on the superstar effect and the parameter θ_1 represents country-specific factors. Thus, my explanation of the Easterlin paradox rests on the premise that θ is an increasing function of A_0, whereas my explanation of the Great Gatsby curve is based on the existence of country- or region-specific factors θ_1. Both explanations hinge on the result that a higher value of θ induces more intense positional competition.

6. Conclusion

This paper develops a dynamic model of positional competition with heterogeneous agents who interact with each other strategically, to provide a novel explanation for the Great Gatsby curve and the Easterlin paradox. In this framework, changes in technology or policy environment impact economic outcomes through an endogenously determined pattern of strategic interactions among agents. The endogenous intensification of positional competition is shown to be the mechanism behind rising inequality, falling mobility, and the flattening of the utility–income relationship.

Technically, both inequality and intergenerational mobility are endogenously determined, with inequality modeled as a power law distribution and intergenerational mobility ranked using the copula function. This method of characterizing the joint determination of inequality and mobility is new.

While the model setup has been deliberately kept simple to highlight the main mechanism, the analysis can be extended in future research in several aspects. First, instead of taking skill level z to be exogenously given, it could be endogenously determined, chosen by optimizing agents in a way akin to the problem of costly investment in human capital. Second, the distribution of wealth could be endogenously determined alongside income distribution. This would make it possible to examine factors that determine the correlation between wealth and income, the wealth-to-income ratio, and the relationship between income mobility and wealth mobility. Third, the model could be extended to allow for aspects of political economy, including the mechanisms by which inequality leads to changes in economic policies.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2021.04.003.

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