

**ORIGINAL ARTICLE**

# Public policy, dynamic status preferences, and wealth inequality

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This paper studies the effect of productive government spending (taxation) on aggregate savings behavior and its consequences for the dynamics of wealth inequality, taking into consideration key behavioral changes that occur during the process of economic development. Substantial empirical evidence suggests that during this process agents' preferences toward status (positional consumption) evolves according to the average wealth of the society. The sources of wealth include private capital and productive public capital, the latter financed by a distortionary income tax. This dynamic status effect impacts peoples' responses to tax policy in ways which contrast with those of the standard neoclassical model. Specifically, we find that in response to an increase in the income tax, in economies with a strong (weak) enough dynamic status effect, savings and inequality increase (decrease). Incorporating the behavioral changes to fiscal policy expands the set of mechanisms available to explain the observed variations of savings and wealth distribution dynamics that cannot be attributed to technological or other structural factors.

## 1 | INTRODUCTION

This paper analyzes the impact of productive government spending, financed by distortionary taxation, on the aggregate savings behavior and its consequences for the dynamics of wealth inequality. In addressing this issue, we focus on an important behavioral change that has been documented to occur in the process of economic development. This pertains to the decline in the importance of status preferences as countries develop and accumulate capital. In a nutshell, this paper shows that the same public policy that raises productivity and reduces wealth inequality in a conventional macrodynamic model that neglects behavioral changes in status preferences may *raise* wealth inequality once these changes in behavior are taken into account. In light of the empirically established importance of this phenomenon, this has significant implications for the long-run consequences of fiscal policy.

Productive government spending is a significant element in the accumulation of wealth and its redistribution across societies. In our analysis, the effect of productive spending on savings and wealth inequality operates through two channels. The first is the conventional channel where government spending raises productivity, thereby encouraging

savings, *ceteris paribus*.<sup>1</sup> To the extent this government spending is financed by distortionary taxation there is some crowding out, causing some offsetting reduction in savings. The second, and novel, channel we consider is what we call the *dynamic status effect*. Individuals are status conscious, but, as the economy develops (over time), their concern for status declines (see below for a discussion). As a consequence of the declining (dynamic) status concern, individuals shift consumption forward from the future toward the present. Following this dynamic behavioral concern, a policy shock first affects the level and then the transition of savings. *Ceteris paribus*, after a positive increase in productive spending, individuals reduce their saving rate instantaneously (to consume more in order to raise status), but during the transition they raise their saving rate. Overall, due to the interplay of both channels, whether upon implementation of the fiscal expansion the saving rate instantaneously jumps up and subsequently gradually declines toward its steady-state level or initially jumps down and increases toward its steady-state level depends on the respective strengths of these two effects.

The important insight from this is the sharp contrast in the implications for wealth inequality; the former (conventional) pattern implies a decline in wealth inequality, whereas the latter pattern implies a rise in wealth inequality, during transition.<sup>2</sup> In other words, the transitional dynamics of the saving rate turn out to be key for the dynamics of wealth inequality. The main reason stems from the fact that the lower the saving rate (during transition), the slower the rate of interest declines during transition, and this benefits wealthy households more than it does poor households. While, in our framework, the steady-state saving rate is unaffected by the policy shock, the transitional dynamics are impacted. Thereby, both the transitional dynamics and the steady-state level of wealth inequality are affected by a policy shock.

Dating back to Arrow and Kurz (1970) and more recently Barro (1990), the relationship between public investment and growth has been widely studied, with general agreement that government spending on infrastructure can yield significant productivity and growth benefits.<sup>3</sup> At the same time, by affecting factor productivity and therefore relative factor returns, public investment may also play a critical role in the evolution of wealth and income distributions as the economy grows over time. But in contrast to the extensive theoretical treatment of the effect of government spending on growth and output, its impact on the joint determination of savings and the dynamics of wealth inequality has received less attention. Recently, this issue has begun to be addressed from different perspectives, and a comparison of the contrasting insights and conclusions is provided by Turnovsky (2015).

Also, in contrast to the public investment–wealth/growth relationship, empirical evidence on the relationship between public investment and inequality is sparse, inconclusive, and largely anecdotal. For instance, Ferranti, Perry, Ferreira, and Walton (2004), Fan and Zhang (2004), Lopez (2004), and Calderon and Servén (2004) find that public investment has promoted growth and contributed toward the alleviation of inequality. Wolff and Zacharias (2007) document an inverse short-run relationship between government expenditure and inequality for the United States, though they do not distinguish between public consumption and investment. In contrast, Brakman, Garretsen, and van Marrewijk (2002) find that government spending has increased regional disparities within Europe, and Artadi and Sala-i-Martin (2003) point to excessive public investment as a contributing factor to rising income inequality in Africa.

The diversity of these empirical findings underscores the need for further investigation of the link between public spending and inequality. In fact, even in the cases in which productive government spending outweighs its crowding-out effect (through taxation) on private investment, its effect on the saving dynamics and the distribution of wealth do not appear to be monotonic. In other words, countries having similar levels of government spending, tax policies, and structural characteristics (e.g., Southern European countries) may nevertheless exhibit disparities regarding savings and the dynamics of wealth distributions that persist. Atolia, Chatterjee, and Turnovsky (2012) offer one possible

<sup>1</sup> Throughout, we consider the case where an increase in the tax rate raises government revenue.

<sup>2</sup> A different channel, based on the intergenerational transmission of prosocialness, provides another reason for the fact that economies with similar initial conditions might end up in drastically different steady states (cf. Long, 2017).

<sup>3</sup> See Glomm and Ravikumar (1994) and Rioja (2003) for theoretical contributions; Agéonor (2011) provides an exhaustive survey of the literature. Recent empirical evidence of a positive relationship between public capital (infrastructure) and growth is provided by Loayza, Fajnzylber, and Calderon (2005), Calderon and Servén (2004), and Arslanalp, Bornhorst, and Gupta (2011). Bom and Ligthart (2014) provide a comprehensive survey of the empirical evidence pertaining to the productivity of public capital.

explanation in terms of the path dependence of the development process. In this respect, by extending the neoclassical growth model to include heterogeneous agents having dynamic positional preferences that endogenously depend upon the growing economywide capital stock, this paper provides an interesting alternative mechanism that may help provide additional insight into the diverse wealth distributions of otherwise similar economies.

The idea that individuals are motivated in their behavior by a quest for social status is not new. It dates back to the earliest writings known to humanity and has been a recurring theme in a diverse range of endeavors long before the birth of economics. Although economic theory has focused on the implication of status preferences on economic outcomes and policy, little work has been done on the bidirectional interaction of status preferences and economic development that is determined by government policy.

Our key mechanism relies on behavioral changes that occur during the development process, as proxied by a rise in wealth (capital) which shapes the behavioral response of agents to government spending. It is well documented that people derive utility not only from their own consumption but also from their relative social position (Easterlin, 2001). As long as consumption is visible (Heffetz, 2011, 2012), the social position of individuals can largely be inferred from their own consumption relative to the average consumption of others. Thus, by consuming more, people increase their own relative position and, in turn, their utility. However, the pursuit of one's own status initiates a race with others, which results in excessively high equilibrium consumption that strains savings and intertemporal utility. We argue that during the development process, increases in average wealth induced by government spending lead to the formation of educational institutions, cultures, and social norms that discourage such conspicuous consumption. As a result, the increase in average wealth induces behavioral changes that lead to a lower degree of status concern, which tends to reduce the initial level of the saving rate followed by a rising saving rate along subsequent transitional paths. We show that this latter effect dominates over long periods when the dynamic status effect is strong along transition, so that the saving rate is observed to increase over an extended period of time.

This mechanism is developed in detail in an earlier paper by Dioikitopoulos, Turnovsky, and Wendner (2017). We extend that paper in two important directions. First is the introduction of productive government spending, absent from the previous analysis, but important in its interaction with dynamic status. Second, in this paper we focus on the consequences of the dynamic status effect for the effects of public policy (income taxation, rise in productive government spending) rather than on the global dynamics of savings and inequality.

The hypothesis of a declining degree of status concern during development is supported by a number of empirical studies. Clark and Senik (2010), using a large European survey, demonstrate that comparisons are mostly in an upward direction. In this respect, there is much more scope for upward comparisons for the poor (countries) than for the rich (countries)—see in particular Clark and Senik (2010, p. 580). Moreover, the poor tend to care more about status with respect to relative consumption. Heffetz (2011) estimates income elasticities for the consumption of “status” goods and confirms the negative relationship between the degree of status concern and income. In a cross-country context, Moav and Neeman (2012) provide examples where the consumption basket of individuals in poor countries includes many goods that do not appear to alleviate poverty. In their theoretical model, unobservable income is correlated with observable human capital. As a result, they conclude that in rich countries people signal status rather through professional titles and degrees and have less motivation to signal it through conspicuous consumption.

Our explanation of the transitional dynamics of wealth inequality is based on the interplay between the dynamics of the saving rate through the behavioral changes induced by productive government spending, on the one hand, and the dynamics of the return to capital, on the other. There is an extensive literature examining the effect of capital returns on wealth inequality (among many others, Piketty, 2014). This paper highlights the fact that saving rate behavior is not only affected by a fiscal policy shock via its impact on the return to capital, but also by the evolution of the dynamic status preferences in response to a fiscal policy shock. In a standard neoclassical world, as the capital stock increases, the rate of return to capital declines. This “return-to-capital effect” benefits the poor, who hold less capital than do the rich. As a consequence, wealth inequality tends to decline. In contrast, the additional mechanism being emphasized here—the “endogenous dynamic status effect”—impinges on both the level and the rate of change of the saving rate. Initially, following the policy shock, the level of the saving rate tends to be reduced, *ceteris paribus*. During the development process, as the economy's capital stock increases individuals tend to increase their saving rate due to a reduction of the

degree of status. This endogenous dynamic status effect opposes the standard return-on-capital effect, and it dominates the latter if it is sufficiently strong.

The remainder of the paper is structured as follows. Section 2 sets out the model. Section 3 analyzes the impact of tax policy on the saving rate dynamics. Section 4 analyzes the dynamics of the impact of tax policy on income inequality and wealth inequality—via the saving rate dynamics. Section 5 concludes the paper and discusses further research directions.

## 2 | THE MODEL

We modify a standard growth model with productive government expenditures with heterogeneous agents to allow for interdependence in consumption and *endogenous dynamic status* preferences, the strength of which declines as the country develops.

### 2.1 | Households

The economy is populated by a continuum of individuals (households) of mass one, each of whom is endowed with one unit of labor that it supplies inelastically. They are identical in all respects except for their initial endowment of capital (wealth),  $K_{i0}$ .<sup>4</sup> At each instant,  $k_i(t) \equiv \frac{K_i(t)}{K(t)}$  is household  $i$ 's share of total wealth.<sup>5</sup> Heterogeneity in wealth shares is summarized by the cumulative distribution function,  $H_t(k_i(t))$  with the standard deviation (coefficient of variation of  $K_i(t)$ ) denoted by  $\sigma_t$ . The initial distribution  $H_0(k_{i0})$  is exogenous, with standard deviation  $\sigma_0$ .

#### 2.1.1 | Dynamic status preferences

Individuals' utility depends both on their own consumption level,  $C_i(t)$ , as well as their consumption relative to some comparison group, as reflected by the status function  $S_i(\frac{C_i(t)}{\bar{c}(t)})$ , where  $\bar{c}(t)$  represents a consumption reference level. An individual's status function  $S_i(t)$  is increasing in  $C_i(t)$  and decreasing in the consumption reference level  $\bar{c}(t)$ . We represent the consumption reference level by average consumption, that is,  $\bar{c}(t) = \int_0^1 C_i(t) di$ , where the bar indicates that individual households view the consumption reference level as exogenously given.<sup>6</sup> A preference for relative consumption is frequently termed "positional or status preference." Our theory of endogenous dynamic status preferences focuses primarily on how intensely  $S_i(t)$  is valued in a given country over time. We hypothesize that the valuation of  $S_i(t)$  relative to own individual consumption evolves over time, as a country develops, as measured by the *average* capital stock  $k(t) \equiv K(t)$ .<sup>7</sup>

The key components of our theory of endogenous dynamic status preferences hence comprise individual consumption,  $C_i(t)$ , relative consumption,  $C_i(t)/\bar{c}(t)$ , and a development-dependent ( $k(t)$ -dependent) variable,  $\varepsilon(k(t))$ , which measures the relative strength of status preferences as a function of the average capital stock in the economy as it evolves over time.

**Assumption 1.** The properties of  $\varepsilon(t) \equiv \varepsilon(k(t))$  are:

1.  $\varepsilon(t) > 0$  is strictly positive and continuously differentiable;
2.  $\varepsilon'(t) \equiv \frac{\partial \varepsilon(t)}{\partial k(t)} < 0$ ;
3.  $\lim_{k(t) \rightarrow 0} \varepsilon(t) = \varepsilon_0 > 0$  and  $0 < \lim_{k(t) \rightarrow \infty} \varepsilon(t) = \varepsilon_\infty < 1$ , with  $\varepsilon_0 > \varepsilon_\infty$ .

<sup>4</sup> Restricting labor supply to be inelastic has the advantage of sharpening the discussion (and intuition) of the impact of *endogenous dynamic status preferences*. A natural extension would allow labor to be endogenously supplied.

<sup>5</sup> We consider a closed economy in which capital is the only asset; that is, total wealth in the economy corresponds to the aggregate capital stock  $K(t)$ .

<sup>6</sup> Clearly, the consumption reference level might differ from  $\bar{c}(t)$ . In this paper, however, we focus on the endogeneity of status preferences and would otherwise like to keep the setup as simple as possible.

<sup>7</sup> By normalizing the population to one, averages and aggregates coincide.

Assumptions 1.1–1.3 characterize the concern for status (positional preferences). Assumption 1.1 indicates that households are concerned with status. However, the strength of such concerns, as measured by  $\varepsilon(t)$ , need not be constant over time. In contrast, the strength of status concerns changes over time. Importantly, this strength is not individual-specific, that is, it is not determined by individual households according to some rational decision. Rather, the strength of the status preference is socially determined. Specifically, this is determined by the society's wealth (proxied by average wealth), which individual households take as given, and therefore treat  $\varepsilon(k)$  as given as well. Assumption 1.2 asserts that the strength of status concerns declines with wealth (income), as suggested by the empirical evidence summarized in the introduction. That is, agents are more concerned with positional consumption in a low-wealth society than in a high-wealth society. For a deep discussion of Assumption 1, see also Clark, Frijters, and Shields (2008, p. 101).

Preferences are specified by the constant elasticity of substitution (CES) utility function (1) which satisfies our assumptions:

$$U(t) = U\left(C_i(t), S\left(\frac{C_i(t)}{\bar{c}(t)}\right), \varepsilon(k(t))\right) = \frac{1}{\gamma} \left( [1 - \varepsilon(k)]C_i^\rho + \varepsilon(k)\left(\frac{C_i}{\bar{c}}\right)^\rho \right)^{\frac{\gamma}{\rho}}, \quad \gamma < 0, \rho < 1. \quad (1)$$

In (1), parameter  $\rho$  governs the constant elasticity of substitution, whereas parameter  $\gamma$  governs the intertemporal elasticity of substitution (IES), assuming  $\gamma < 0$  implies an IES less than one, as is overwhelmingly suggested by the literature; see, for example, Guvenen (2006).

To capture the weight that is being applied to the absolute and relative consumption levels, we introduce the notion of the *degree of positionality* (DOP). The DOP, as defined by Johansson-Stenman, Carlsson, and Daruvala (2002), reflects the proportion of the total marginal utility of individual consumption that can be attributed to its impact on the increase in relative consumption. Formally, we specify this by

$$DOP_i(t) = \frac{(\partial U / \partial S_i(t))(\partial S_i(t) / \partial C_i(t))}{(\partial U / \partial S_i(t))(\partial S_i(t) / \partial C_i(t)) + \partial U / \partial C_i(t)}. \quad (2)$$

Thus, if  $DOP_i(t) = 0.3$ , then 30% of marginal utility of consumption arise from an increase in relative consumption, and 70% of marginal utility of consumption arise from an increase in own *absolute* consumption (holding fixed  $S_i$ ). Considering (1), the DOP is then given by

$$DOP = \frac{\varepsilon(k)\bar{c}^{-\rho}}{1 - \varepsilon(k) + \varepsilon(k)\bar{c}^{-\rho}}. \quad (3)$$

Importantly, for our specification of instantaneous utility (1), the DOP is the same for all individuals:  $DOP_i = DOP$ . Notice that  $\rho \rightarrow 0$  yields the Cobb–Douglas case, and  $DOP = \varepsilon(k)$ .

### 2.1.2 | Household optimization

The individual household's optimization problem is to choose a consumption stream,  $C_i(t)$ , and to accumulate capital,  $K_i(t)$ , so as to maximize intertemporal utility

$$\int_0^{\infty} U(C_i(t), S_i(t), \varepsilon(k(t)))e^{-\beta t}, \quad \beta > 0 \quad (4)$$

subject to the flow budget constraint

$$\dot{K}_i(t) = r(t)K_i(t) + w(t) - C_i(t), \quad (5)$$

the initial asset endowment,  $K_i(0)$ , the transversality condition, and taking  $\bar{c}(t)$  and  $k(t)$  as given. In Equations 4 and 5,  $\beta$  is the constant pure rate of time preference,  $r(t)$  is the real return on asset (capital), and  $w(t)$  is the wage rate.

Solving the intertemporal maximization problem, the individual's equilibrium consumption growth rate is given by (see the appendix)

$$\frac{\dot{c}_i(t)}{c_i(t)} = \frac{1}{1 - \gamma(1 - DOP(t))} [r(t) - \beta + \Psi(t) \varepsilon'(k(t))\dot{k}(t)], \quad (6)$$

where  $\Psi \equiv \left( \frac{\gamma}{\rho} \frac{\bar{c}^{-\rho} - 1}{[1 - \varepsilon(k)] + \varepsilon(k)\bar{c}^{-\rho}} \right) > 0$ .<sup>8</sup> Equation 6 represents the usual Euler equation, modified by the dynamic status effect. Consumption growth depends positively on the difference between the return on assets and the pure rate of time preference (return-to-capital effect). In the absence of positional preferences ( $DOP = 0 = \varepsilon'(k(t))$ ), the optimal consumption growth rate (6) reduces to that of the standard Euler equation.

Positional preferences modify the optimal consumption growth rate in two ways. First, they impact the IES, which is now given by

$$IES(c(t), k(t)) = \frac{1}{1 - \gamma(1 - DOP(c(t), k(t)))} > 0. \quad (7)$$

If  $\gamma < 0$ , as empirical evidence overwhelmingly suggests, positionality raises the IES, relative to that of the standard neoclassical growth model,  $\frac{1}{1-\gamma}$ .<sup>9</sup> For a given interest rate, individuals raise the optimal consumption growth rate, as documented by, among others, Liu and Turnovsky (2005).

Second, positional preferences introduce a dynamic status effect. As described in more detail in Dioikitopoulos et al. (2017), if  $\dot{k} > 0$ , under Assumption 1.2, the status effect causes the optimal consumption growth rate to decline as a country develops. The intertemporal consumption decision is affected by the degree to which people evaluate their social status over time. The more agents evaluate their *relative* position, the more they consume in order to raise their respective relative position. However, as the economy accumulates capital, the degree of positionality declines. That is, the marginal utility from *relative* consumption declines over time. As a consequence, consumption is shifted from the future to the present, and the optimal consumption growth rate declines. The latter has an impact on both the saving rate level and the subsequent evolution of the saving rate. As discussed below, the level of the saving rate is lowered, and its rate of change may become positive along transitional paths. It is this effect of positional preferences that we emphasize and focus on in the analysis of public policy.

## 2.2 | Production

There is a single representative firm, which produces aggregate output,  $Y$ , in accordance with the Cobb–Douglas production function

$$Y(t) = \Omega K(t)^\omega L(t)^{1-\omega} G(t)^\chi, \quad \omega > 0, \chi > 0, \omega + \chi < 1, \Omega > 0, \quad (8)$$

where  $K(t)$  and  $L(t)$  denote, respectively, capital- and labor inputs,  $G(t)$  denotes government spending, and  $\Omega$  represents total factor productivity. For the firm, productive government spending  $G(t)$  is considered exogenous. The parameters  $\omega$  and  $\chi$  are output elasticities. As their sum falls short of unity,  $\omega + \chi < 1$ , in contrast to Barro (1990), the production technology exhibits decreasing returns to scale, and there is no endogenous growth. The government finances government spending by a *constant* tax on production following a balanced budget in each period:

$$G(t) = \tau Y(t), \quad (9)$$

<sup>8</sup> The denominator of  $\Psi$  is strictly positive due to positivity of marginal utility of consumption. The numerator of  $\Psi$  is strictly positive as marginal utility for status is a positive function of the degree for status. As a consequence,  $\Psi > 0$ .

<sup>9</sup> See, for example, Guvenen (2006) for extensive empirical evidence on  $\gamma$ .

where  $\tau$  denotes the tax rate on production. Hence, the profit function becomes  $P(t) = (1 - \tau)\Omega K(t)^\omega L(t)^{1-\omega} G(t)^\chi - r(t)K(t) - w(t)L(t)$ . Maximizing profit, the return to capital and the wage rate are

$$r(t) = \frac{\partial Y(t)}{\partial K(t)}(1 - \tau) - \delta = \omega \frac{Y(t)}{K(t)}(1 - \tau) - \delta,$$

$$w(t) = \frac{\partial Y(t)}{\partial L(t)}(1 - \tau) = (1 - \omega) \frac{Y(t)}{L(t)}(1 - \tau),$$

where  $\delta \geq 0$  is the depreciation rate of physical capital. Combining the government tax rule (9) with the production function (8) yields  $Y(t) = \Omega K(t)^\omega L(t)^{1-\omega} (\tau Y(t))^\chi$ . Labor endowment is normalized to unity, and we assume no population growth. Hence, ex post,

$$\frac{Y(t)}{K(t)} = \Omega^{\frac{1}{1-\chi}} K(t)^{\frac{\omega}{1-\chi}-1} \tau^{\frac{\chi}{1-\chi}}$$

so that

$$r(t) = \omega \Omega^{\frac{1}{1-\chi}} K(t)^{\frac{\omega}{1-\chi}-1} \tau^{\frac{\chi}{1-\chi}} (1 - \tau) - \delta, \quad (10)$$

$$w(t) = (1 - \omega) \Omega^{\frac{1}{1-\chi}} K(t)^{\frac{\omega}{1-\chi}-1} \tau^{\frac{\chi}{1-\chi}} (1 - \tau).$$

Due to the externality generated by productive government investment, the private return on capital,  $r(t)$ , is lower than the social return on capital,  $(\partial Y / \partial K)(1 - \tau) - \delta$  (where the derivative refers to the ex post production function):

$$r(t) = \omega \Omega^{\frac{1}{1-\chi}} K(t)^{\frac{\omega}{1-\chi}-1} \tau^{\frac{\chi}{1-\chi}} (1 - \tau) - \delta < \frac{\partial Y}{\partial K} = \frac{\omega}{1-\chi} \Omega^{\frac{1}{1-\chi}} K(t)^{\frac{\omega}{1-\chi}-1} \tau^{\frac{\chi}{1-\chi}} (1 - \tau) - \delta.$$

Defining the per-capita production function, ex post, by  $f(k(t)) \equiv \Omega^{\frac{1}{1-\chi}} k(t)^{\frac{\omega}{1-\chi}} \tau^{\frac{\chi}{1-\chi}}$ , the above can be rewritten as

$$r(t) + \delta = \omega \frac{f(k(t))(1 - \tau)}{k(t)} < f'(k(t))(1 - \tau) = \frac{\omega}{1-\chi} \frac{f(k(t))(1 - \tau)}{k(t)}. \quad (11)$$

### 2.3 | Equilibrium, steady state, and aggregate dynamics

In this subsection, we characterize the competitive equilibrium. Variables in upper case (lower case) without a household-subindex denote aggregate (per-capita) quantities:  $C(t) \equiv \int_0^1 C_i(t) di$ ,  $K(t) \equiv \int_0^1 K_i(t) di$ ,  $c(t) \equiv \frac{C(t)}{L(t)}$ ,  $k(t) \equiv \frac{K(t)}{L(t)}$ . Finally, individual  $i$ 's capital share is given by  $k_i(t) \equiv \frac{K_i(t)}{K(t)}$ , so that  $\int_0^1 k_i(t) di = 1$ . Equipped with this notation, we can express the economy's aggregate resource constraint as

$$\dot{K}(t) = Y(t) - G(t) - C(t) - \delta K(t) = Y(t)(1 - \tau) - C(t) - \delta K(t). \quad (12)$$

An allocation satisfying the resource constraint (12) is called an attainable allocation.

**Definition 1 (Equilibrium).** A competitive equilibrium is a price vector  $(r(t), w(t))$ , an income tax rate  $\tau$  and an attainable allocation for  $t \geq 0$  such that:

1. Individuals choose feasible streams of  $C_i(t)$  and  $K_i(t)$  so as to maximize intertemporal utility, given the factor prices, initial individual wealth endowments, aggregate capital, and the consumption reference level.
2. Firms choose  $K(t)$  and  $L(t)$  in order to maximize profits, given the factor prices and the income tax rate, as given in (10).
3. All markets clear:  $K(t) = \int_0^1 K_i(t) di$  (capital market);  $L(t) = 1$  (labor market).
4. Consumption reference level:  $\bar{c}(t) = c(t)$ .

5. The government budget constraint (9) is satisfied.<sup>10</sup>

Observe that individual households take the consumption reference level,  $\bar{c}$ , as given. In equilibrium, however, the consumption reference level is given by the economywide average consumption level.

*Aggregate dynamics.* Combining (6) with (12), and omitting time indexes for the rest of this section, we can express the aggregate dynamics, in equilibrium, as

$$\begin{aligned} \dot{k} &= \Omega^{\frac{1}{1-\chi}} k^{\frac{\omega}{1-\chi}} \tau^{\frac{\chi}{1-\chi}} (1-\tau) - c - \delta k, \\ \dot{c} &= \frac{c}{1-\gamma(1-DOP)} [r(k) - \beta + \Psi \varepsilon'(k)k]. \end{aligned} \quad (13)$$

In order to simplify notation and raise intuition, we introduce the following notation.  $A(\tau) \equiv \Omega^{\frac{1}{1-\chi}} \tau^{\frac{\chi}{1-\chi}} (1-\tau)$ . Notice, in particular, that

$$\frac{\partial A(\tau)}{\partial \tau} \begin{cases} > 0, & \tau < \chi, \\ < 0, & \tau > \chi. \end{cases}$$

This distinction is important to note, as the effects of the tax policy considered below depend critically upon whether the tax rate exceeds or is less than the government's productive expenditure share  $\chi$  (see Barro, 1990). Furthermore, we introduce the elasticity of instantaneous utility with respect to capital,  $E(c, k)$ . By Assumption 1, this elasticity is strictly negative in the presence of dynamic status preferences. Specifically,

$$E(c, k) \equiv \frac{\partial U}{\partial k} \frac{k}{U} = \frac{\gamma}{\rho} \frac{\bar{c}^{-\rho} - 1}{[1 - \varepsilon(k)] + \varepsilon(k)\bar{c}^{-\rho}} \varepsilon'(k)k = \Psi \varepsilon'(k)k.$$

Under dynamic status preferences  $\varepsilon'(k) < 0$ , thus,  $E(c, k) < 0$  (see also footnote 8). Finally, observing (10), we note that  $r(k) = \omega A(\tau)k^{\frac{\omega}{1-\chi}-1} - \delta$ . With this notation at hand, and noting (7), we conveniently rewrite the dynamic system as

$$\begin{aligned} \dot{k} &= A(\tau)k^{\frac{\omega}{1-\chi}} - c - \delta k, \\ \dot{c} &= c \text{IES}(c, k) \left[ \omega A(\tau)k^{\frac{\omega}{1-\chi}-1} - (\delta + \beta) + \left( \frac{E(c, k)}{k} \right) k \right], \end{aligned} \quad (14)$$

where  $\text{IES}(c, k)$  is specified in (7). The two-dimensional dynamic system, (14), fully describes the evolution of our growth model with productive government spending and dynamic status preferences. In the absence of the latter,  $\varepsilon'(k) = 0 = E(c, k)$ , the system reduces to a straightforward variant of the standard Ramsey model. The introduction of dynamic status preferences, leaves the dimension of the dynamic system unchanged, in terms of the usual state variable  $k$ , and the jump variable  $c$ . As we shall see below, the saddle-path stability in a neighborhood of the steady-state equilibrium, associated with the conventional Ramsey model, continues to apply.

*Steady-state equilibrium.* In steady-state equilibrium, the economy follows a path along which  $\dot{c} = \dot{k} = 0$ , so that the dynamic variables are stationary. We denote these constant steady-state values by  $(k^*, c^*)$ . From the dynamic system (14), these steady-state values are given by

$$k^* = \left( \frac{\omega A(\tau)}{\beta + \delta} \right)^{\frac{1-\chi}{1-\chi-\omega}} > 0, \quad c^* = A(\tau)k^{*\frac{\omega}{1-\chi}} - \delta k^* > 0, \quad (15)$$

implying the existence of a unique, viable, nontrivial steady state. Importantly, the steady-state equilibrium is independent of the presence of dynamic status preferences. This characteristic reflects the fact that the strength of status preferences does not affect the production process, which is the driving force behind the long-run equilibrium. For our purposes, this characteristic is crucial, in that the effects of the analyzed tax policy are independent of *steady-state effects* (potentially) induced by dynamic status preferences.

<sup>10</sup> As described below, the above conditions imply the aggregate resource constraint (output market clearing).



*Stability of the steady-state equilibrium.* Linearizing the dynamic system (14) around the steady state one can easily show that the determinant of the matrix of coefficients of the linearized system is negative, implying that the unique steady state is a saddle point and is saddle-point stable. Moreover, while the dynamic status effect does not affect the steady-state equilibrium, it does affect the transitional dynamics, and thereby the responses of the distributions of income and wealth to changes in public tax policy.<sup>11</sup>

By postulating the declining dynamic status as a function of average economywide capital stock, we are linking it to the norms of society as a whole, which we find to be most plausible and to be supported by empirical evidence. But a reasonable alternative is that status is a decreasing function of the individual agent's relative position,  $K_i(t)/K(t)$ , so that it is of greater concern to poorer households. This changes the analysis dramatically. One of the consequences of specifying it in terms of aggregates is that the aggregate dynamics, as represented by (13), are independent of individual decisions. With this alternative formulation, this would, in general, no longer be the case. Instead, the aggregate dynamics, (13), and the individual's wealth dynamics, given by (20), become interdependent. With an arbitrary number of individual agents, as is being assumed here, the analysis becomes intractable. However, if we restrict the analysis to just two classes of agents, say "relatively rich" and "relatively poor," we can analyze it along the lines pursued by Koyuncu and Turnovsky (2016) in the case of progressive taxes.

### 3 | INCOME TAXATION AND THE DYNAMICS OF THE SAVING RATE

In what follows, we argue that the effects of tax policy on both the transitional dynamics and the steady state of wealth inequality critically depend on its impact on the saving rate. Noting that  $Y(1 - \tau) = A(\tau)k^{\frac{\omega}{1-\chi}}$  and  $L = 1$ , we define the saving rate as

$$s(t) = 1 - \frac{c(t)}{A(\tau)k(t)^{\frac{\omega}{1-\chi}}}, \quad (16)$$

which when considered in conjunction with (15) reduces to

$$s^* = \frac{\delta\omega}{\beta + \delta}. \quad (17)$$

An important insight from (16) and (17) is the following. A change in the income tax rate does not impact the steady-state level of the saving rate, although it does impact the steady-state level of wealth inequality. The reason for this difference is that a tax change impacts the transitional dynamics of the saving rate—which is decisively influenced by the dynamic status effect—which, in turn, affects both the transitional dynamics and the steady-state level of wealth inequality.

#### 3.1 | The impact of taxation on the saving dynamics

In this and the following subsections, we investigate the impact of taxation on the savings dynamics by taking into account the dynamic evolution of status preferences. In doing so, we make use of a factor  $\xi(c, k)$  that captures the dynamic status effect and, thereby, decisively impacts the saving rate dynamics:

$$\xi(c, k) \equiv 1 - \frac{IES(c, k)E(c, k)}{\omega/(1 - \chi)} \geq 1.$$

Clearly, in the absence of dynamic status preferences,  $E = \varepsilon'(k) = 0$ , and  $\xi(c, k) = 1$ . However, in the presence of dynamic status preferences,  $\xi(c, k) > 1$ , as  $E < 0$ . Importantly, on grounds of theory, there is no upper limit to  $\xi(c, k)$ .

<sup>11</sup> This characteristic is identical to the conventional model where status preferences are exogenously fixed; see Liu and Turnovsky (2005). As in that model, status preferences have only long-run effects if labor supply is elastic. As we show below, isolating any long-run productive effects of status is quite helpful in facilitating comparisons between economies with similar income per capita while having different levels of wealth inequality (e.g., the United States vs. Europe).

A positive, permanent tax shock on  $\tau$  initially affects the term  $IES(c^*, k^*)(1 - \chi)/\xi(c^*, k^*)$  both via its impact on  $A(\tau)$  as well as its impact on the jump variable  $c$ . If the tax shock implies  $s^* > \frac{IES(c, k)(1 - \chi)}{\xi(c, k)}$ , then savings initially jump down and increase during the subsequent transition. Otherwise, savings initially jump up and decrease during the subsequent transition.

**Proposition 1.** *An increase in the tax rate  $\tau$  affects the transitional path—but not the steady state—of the saving rate. Under Assumption 1, the effect of  $\tau$  on the initial level and the dynamics of the savings rate is given by the following conditions:*

- (i) *Following a tax shock, the saving rate dynamics depend on whether  $IES(c, k)(1 - \chi)/\xi(c, k)$  initially declines or rises in response to the tax shock. An initial decline (increase) of the saving rate is followed by a rising (falling) saving rate during transition to the steady state. Specifically,*

$$\dot{s} \geq 0 \text{ if and only if } s^* \geq \frac{IES(c, k)(1 - \chi)}{\xi(c, k)}. \quad (18)$$

- (ii) *The impact of an increase in the tax rate  $\tau$  on the saving rate dynamics depends on whether  $\tau > \chi$  or  $\tau < \chi$  initially. Specifically, in response to the same tax shock, if the saving rate jumps down initially and increases during transition when  $\tau < \chi$ , then, the opposite pattern holds when  $\tau > \chi$ .*
- (iii) *Whether, initially, the saving rate  $IES(c, k)(1 - \chi)/\xi(c, k)$  jumps up or down in response to the tax shock critically depends on the strength of the dynamic status effect. If  $\tau < \chi$ , the dynamic status effect raises the initial positive response of the jump variable  $c$ , thereby, ceteris paribus, lowering the initial saving rate. If strong enough, the dynamic status effect gives rise to the pattern according to which the saving rate initially jumps down and rises during transition to its steady state level.*

*Proof.* See the appendix. ■

Proposition 1 shows that the transitional dynamics of the saving rate, following an increase in taxation, is sensitive to two factors. First, it matters whether the initial tax rate falls short of or exceeds the output elasticity of government investment, that is, whether  $\tau < \chi$  or  $\tau > \chi$  (traditional channel). Second, it matters how strong the dynamic status effect is (dynamic channel). The first issue is an immediate consequence of the fact that  $A(\tau)$  increases (decreases) in  $\tau$  when  $\tau < \chi$  ( $\tau > \chi$ ). The second issue is more subtle. For the time being, consider  $\tau < \chi$  (the alternative case of  $\tau > \chi$  follows parallel reasoning).

Consider an economy that is in a steady state initially. A rise in the tax rate raises government spending and, for  $\tau < \chi$ , outweighs the crowding out of capital. In turn, the tax increase has a positive effect on the productivity of capital according to (10), and consequently  $\dot{k} > 0$ . In a standard neoclassical growth model, capital accumulation imposes both a substitution and an income effect on the saving rate dynamics. The substitution effect works via the decline of the return on capital, once  $\dot{k} > 0$ . The lowering of  $f'(k)$  during transition lowers the return on savings and shifts consumption from the future to the present. The substitution effect contributes to lowering the saving rate during transition. The income effect stems from a rise in income following the tax increase, thereby the increase in  $A(\tau)$ . As future (after shock) steady-state income exceeds present income, the desire for consumption smoothing requires the consumption–income ratio to be high initially and declining during transition. As a consequence, the income effect contributes toward a rise of the saving rate during transition. For a plausible parameterization, the substitution effect dominates the income effect and thus, the neoclassical growth model predicts a declining saving rate as capital increases; see, for example, Barro and Sala-i-Martin (2004, p. 136).

Consider now our growth model, augmented by the dynamic status effect. The dynamic endogenous status effect introduces a third channel, whereby an increase in the capital stock impinges on the intertemporal consumption–savings decision. This effect tends to increase the saving rate over time (as capital is accumulated following the increase in productive government spending). When the capital stock increases, agents choose a lower rate of consumption growth, together with an initially higher level of consumption, compared with the standard neoclassical growth model. This is evident from (14) due to the fact that  $E(c, k) < 0$ . The higher initial consumption level necessitates a lower

initial saving rate (compared to the standard neoclassical growth model—recall that the steady-state saving rate is unaffected by either status preferences or the tax instrument). Consequently, the presence of dynamic endogenous status preferences implies either a lower rate of decline of the saving rate or an increasing saving rate along the transitional path toward its steady state. In particular, if the dynamic status effect is sufficiently strong—that is, the absolute value  $|E(c, k)|$  is sufficiently large—then the consumption growth rate is lower than the output growth rate, and the saving rate increases along its transitional path. In other words, even when the substitution effect exceeds the income effect, our extended model can produce an increasing saving rate.

Formally, in the absence of both dynamic status preferences (i.e.,  $E(c, k) = 0 \equiv \xi(c, k) = 1$ ) and productive government spending ( $\chi = 0 = \tau$ ), condition (i) of Proposition 1 reduces to Barro and Sala-i-Martin's (2004) familiar condition,  $\dot{s} \leq 0 \equiv s^* \leq IES(c, k)$ . In the presence of the endogenous dynamic status effect,  $\xi(c, k) > 1$ . The correcting factor  $\xi(c, k)$  is unconstrained by any upper bound. As long as  $\xi(c, k)$  is large enough,  $\dot{s} > 0$  during transition after the tax increase (higher level of government spending). This holds true even when  $s^* < IES(c, k)$ —that is, the case in which the substitution effect exceeds the income effect, following empirical evidence (among many others, see Barro & Sala-i-Martin, 2004). In our framework, however, for large  $\xi(c, k)$ —for large  $|E(c, k)|$ —we may have  $s^* < IES(c, k)$ , in accordance with empirical evidence. At the same time, though, we may have  $s^* > IES(c, k)(1 - \chi)/\xi(c, k)$ . In such a case, a standard neoclassical growth model predicts a declining saving rate during transition, whereas our model, augmented by dynamic status preferences, predicts an increasing saving rate during transition.

Three observations are worth noting. First, the empirical evidence for a declining saving rate during transition is weak, at best (Barro & Sala-i-Martin, 2004, p. 109). While the standard neoclassical growth model is unable to explain an increasing transitional behavior of the saving rate (at least, for empirically plausible parameter values), our model with dynamic status preferences is able to.

Second, consider the asymptotic behavior of  $E(c, k)$ . As asymptotically  $\dot{k} \approx 0$ , it follows that  $\xi \approx 1$ . That is, asymptotically, our model behaves the same way the standard growth model does, and  $\dot{s} < 0$  close to the after-shock steady state.

Third, the initial response of the saving rate to the tax shock determines the transitional dynamics (increasing or decreasing over the initial period, and probably the large part, following the tax shock). Specifically, an initial decline (increase) of the saving rate is followed by a rising (declining) saving rate over (most of the) transition. Proposition 1 shows that the dynamic status effect makes the initial response of the saving rate smaller. That is, if the initial response of the saving rate is an upward jump in the neoclassical standard model, the upward jump is smaller in our model augmented with dynamic status preferences. If the dynamic status effect ( $\xi > 1$ ) becomes strong enough, the initial response of the saving rate becomes negative. In this case, the saving rate rises during transitional dynamics.

The main reason for this discussion of the transitional dynamics of the saving rate lies in its implication for the transitional dynamics of income inequality and wealth inequality. A tax shock affects income inequality and wealth inequality via the saving rate behavior. As discussed below, if the saving rate jumps downward (upward) in response to the tax shock, wealth inequality rises (falls) during transition to the after-shock steady state.

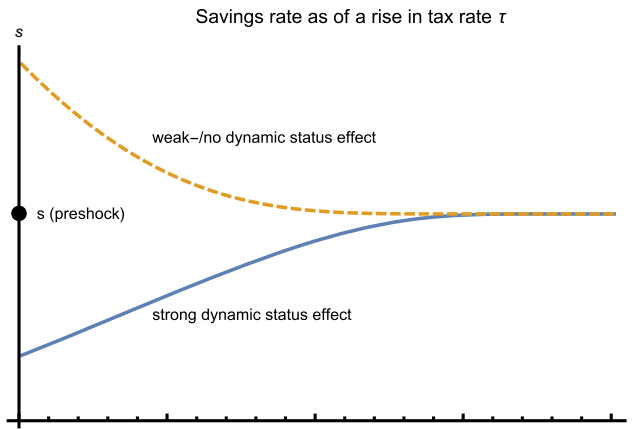
### 3.2 | Tax policy and savings: A numerical illustration

We illustrate Proposition 1 with a numerical example. The simulation is based on “plausible” parameter values. However, the simulation should not directly be seen as trying to mimic specific real economies. For the evolution of the dynamic status preferences, we use an explicit function that satisfies Assumption 1:

$$\varepsilon(k(t)) = \varepsilon_\infty + (\varepsilon_0 - \varepsilon_\infty) \exp(-\kappa k(t)), \quad \kappa \geq 0, \quad \varepsilon_0 \geq \varepsilon_\infty \geq 0. \quad (19)$$

Parameter  $\kappa$  captures the sensitivity of  $\varepsilon(t)$  with respect to a change in  $k$ . If either  $\kappa = 0$  or  $\varepsilon_0 = \varepsilon_\infty$ ,  $\varepsilon(t)$  is constant over time, and the dynamic (endogenous) status mechanism is absent.

The parameterization follows standard growth literature and is largely uncontroversial. The technology parameters are assigned the following values:  $\Omega = 5$ ,  $\chi = 0.25$ ,  $\omega = 0.25$ ,  $\delta = 0.08$ . The preference parameters assume the values



**FIGURE 1** Dynamics of the savings rate

$\beta = 0.04$ ,  $\gamma = -2$ , and  $\rho = 0$  (unless otherwise stated). Finally, the status parameters are  $\kappa = 0.1$  and  $\varepsilon_\infty = 0.2$ . Parameter  $\varepsilon_0$  is varied between simulations.

In particular, consider two countries, A and B. The two countries are identical in every aspect except for their cultural parameters in status preferences. Country A exhibits a stronger response in status concerns to the development of wealth ( $\varepsilon_0 = 2$ ) than Country B ( $\varepsilon_0 = 0.2$ ).<sup>12</sup> In other words, cultural differences in status preferences among countries are captured by a single parameter,  $\varepsilon_0$ , which defines the range of values the status function,  $\varepsilon(t)$ , can assume. In particular, the higher the value of  $\varepsilon_0$  the more intensely a country responds to changes in aggregate wealth.<sup>13</sup> In our numerical example, Country A exhibits a strong dynamic status effect, whereas Country B exhibits a weak/no dynamic status effect.<sup>14</sup>

We consider the transitional dynamics of the saving rate in response to an increase in the tax rate from 0.1 to 0.2. Figure 1 illustrates the dynamics of savings following the tax shock.

Figure 1 shows that, along the respective transitional paths, in Country A (strong dynamic status effect, solid line in Figure 1), saving increases, whereas in Country B (weak/no dynamic status effect, dashed line in Figure 1), saving declines in response to the same positive tax shock. In the economy with a weak/no dynamic status effect, the return-to-capital effect dominates. Interest and the saving rate initially increase due to higher productivity from government spending. Along the transition to the steady state the saving rate falls, as the return to-capital-effect dominates the dynamic status effect (people do not adjust their behavior toward lower status evaluation). In contrast, in the economy having a strong dynamic status effect, initially, the saving rate jumps down. This is because, initially, due to higher income from the productivity increase through government spending, agents consume more to display their status (*initial level effect*). Over time, as their marginal utility from status declines, the race for status consumption comes to an end. As a consequence, the consumption growth rate becomes less than the income growth rate, and the saving rate rises during transition. As the level of the saving rate is low, capital is accumulated slowly, and the rate of interest remains high for a long time.

*In contrast to the prediction of the standard neoclassical growth model*, where a net productive increase in government spending results in a negative correlation of savings and capital, in our model in economies with a strong dynamic status

<sup>12</sup> Notice that  $\varepsilon_0 = \varepsilon(0) \neq \varepsilon(k_0^*) = \varepsilon(t_0)$ . In our simulations, the initial capital stock equals  $k_0^* > 0$ , implying an associated  $\varepsilon(t_0) < 1$  as consistent with our restrictions.

<sup>13</sup> Notice that the decline in  $\varepsilon(t)$  is governed by the term  $\kappa(\varepsilon_0 - \varepsilon_\infty)$ . That is, instead of specifying parameter  $\varepsilon_0$  as country-specific, we could have specified either parameter  $\kappa$  or parameter  $\varepsilon_\infty$  as country-specific. These specifications are equivalent, though, and yield the same results.

<sup>14</sup> In fact, as  $\varepsilon_0 = \varepsilon_\infty$ , the status function  $\varepsilon(t)$  is constant in Country B.

effect, the correlation is positive. This positive correlation can explain the cross-country evidence, according to which rich countries save more (see, among others, Dynan, Skinner, & Zeldes, 2004; Weil, 2005). While the rate of return to capital historically falls, poor countries never seem to catch up. In this discussion, our behavioral mechanism provides an additional explanation.

Although productive government spending imposes positive productivity gains (when  $\tau < \chi$ , at which levels of the tax rate the distortionary effect is lower than the productivity gain), the dynamics of the saving rate depend on the magnitude of behavioral changes. Productivity increases through government spending can result in lower savings and higher positional consumption in case the dynamic status effect is strong. This is in contrast with the standard results according to which the saving rate is raised by an increase in productive government spending. Importantly, this channel provides an alternative explanation for cross-country differences in the impact of public policy on savings, even if countries have the same technological characteristics otherwise.

## 4 | INCOME TAXATION, PUBLIC INVESTMENT, AND THE DYNAMICS OF WEALTH INEQUALITY

In this section, we examine the comparative wealth inequality dynamics across countries that experience an increase in government spending through income taxation when they differ in terms of their dynamic status preferences. Our analytical results are illustrated by a numerical example, where we compare the wealth inequality dynamics for two cases: (a) presence of strong endogenous dynamic status effects (Country A) versus (b) weak/no endogenous dynamic status effect (Country B). While in the former case (Country A) wealth inequality is increased (decreased) for a positive tax shock when  $\tau < \chi$  (when  $\tau > \chi$ ), in the latter case (Country B), the shock reduces (increases) wealth inequality. The bottom line is that in countries having strong dynamic status preferences and a low level of taxes ( $\tau < \chi$ ), a rise in  $\tau$  raises inequality, while in other economies with weak or no dynamic status preferences—which are otherwise identical—the same tax shock (and associated rise in productive government spending) also raises productivity but reduces inequality both along transition and in the steady state.

### 4.1 | The dynamics of inequality

We keep this subsection short as it draws on García-Peñalosa and Turnovsky (2008, pp. 463ff) as well as Dioikitopoulos et al. (2017). We first determine the equilibrium dynamics of individual  $i$ 's share of total capital,  $k_i(t)$ . To do so, we consider the individual wealth accumulation equation (5) together with the corresponding aggregate accumulation relationship  $\dot{K}(t) = r(t)K(t) - w(t) - C(t)$ , to yield

$$\dot{k}_i(t) = \frac{w(t)}{k(t)}(1 - k_i(t)) + \frac{c(t)}{k(t)}(-\theta_i(t) + k_i(t)), \quad (20)$$

where  $\theta_i(t) \equiv \frac{C_i(t)}{C(t)}$ . Following the procedure described by García-Peñalosa and Turnovsky (2008, pp. 463ff), the bounded solution for  $k_i(t)$  is

$$\dot{k}_i(t) = k_i^* + h(k^*)(1 - k_i^*) \frac{k(t) - k^*}{k^*} \frac{1}{\mu^* - \beta}, \quad (21)$$

where variables with an asterisk are *final* (after-shock) steady-state values,  $\mu$  is the negative eigenvalue associated with the dynamic system (14) evaluated at the final steady state, and  $v_1^* = \beta - \mu^* > 0$  is the normalized part of the eigenvector associated with  $\mu^*$ . Function  $h(k^*)$  is given by

$$h(k^*) = \underbrace{\frac{(1 - \omega)(\beta + \delta)}{(1 - \chi)[\beta + \delta(1 - \omega)]}}_{>0} \left[ \underbrace{\delta(1 - \omega - \chi)}_{>0} + \underbrace{\mu(1 - \chi)}_{<0} \right], \quad (22)$$

which is derived in the appendix. As the sign of  $h(k^*)$  plays a decisive role for the shock-induced development of wealth inequality, we need to investigate this term further. Importantly,  $h(k)$  depends only on average characteristics. Moreover, under Assumption 1,  $\text{sgn}[h(k)]$  is ambiguous. If status preferences are exogenous ( $\varepsilon'(t) = 0$ ) and the technology is Cobb–Douglas, then  $h(k) < 0$ .<sup>15</sup> However, in the present case  $h(k)$  also depends on the change of the intensity of status concerns,  $\varepsilon'(t)$ , via its impact on the negative eigenvalue. If  $\varepsilon'(t) < 0$  and large enough (in absolute terms), then  $h(k)$  becomes positive.

Integrating (16) across all agents, García-Peñalosa and Turnovsky (2008) show that the dynamics of the coefficient of variation of wealth (treated as a measure of inequality) are given by

$$\sigma_k(t) = \frac{\zeta(t)}{\zeta(0)} \sigma_k(0), \quad (23)$$

where  $\zeta(t) \equiv 1 + \frac{h(k^*)}{\beta - \mu^*} \frac{k(t) - k^*}{k^*}$  and  $\zeta_0 \equiv 1 + \frac{h(k^*)}{\beta - \mu^*} \frac{k(0) - k^*}{k^*}$ . We employ (23) to measure the transitional development of inequality close to a steady state. Being a function of  $h(k)$ , it is a function of average wealth only.

## 4.2 | The effect of taxation and productive government spending on the evolution of wealth inequality

To illustrate how differences in status preferences between countries can account for the differential dynamics of wealth inequality, as observed in contemporary data (see Dioikitopoulos et al., 2017), we consider an increase in the income tax rate (associated with a rise in productive government spending). In doing so, differences in status preferences are reflected in different values of  $E(c, k) \leq 0$ , viewed as proxying *cultural differences* between countries. In particular, the smaller (the more negative) the  $E(c, k)$ , the more responsive are a country's status concerns with respect to an increase in its aggregate capital,  $k$ . From Proposition 1, we know that the impact of the shock on savings depends critically on the strength of the dynamic status effect. Indeed, we find that the necessary and sufficient conditions for the tax shock to generate rising or declining wealth inequality are closely related to condition (i) in Proposition 1. The way the dynamic status effect influences the saving rate is crucial to the differential impact of the considered tax shock on inequality.

We shall demonstrate that the key mechanism explaining the impact of a positive tax shock on the development of inequality relies on the initial response of the saving rate (a jump variable) to the shock.

**Proposition 2.** *A positive tax shock,  $\Delta\tau > 0$ , impacts on both the transitional dynamics and the steady state of wealth inequality. The strength of the dynamic status effect is key in determining whether inequality rises or falls following the tax shock. If  $\tau < \chi$ , in countries with a strong (small) dynamic status effect, the saving rate increases (decreases) during transition, and inequality rises (falls). In particular,*

$$\dot{s} \geq 0 \Leftrightarrow \dot{\sigma}_k \geq 0.$$

*If  $\tau > \chi$ , in countries with a strong (small) dynamic status effect, the saving rate decreases (increases) during transition, and inequality falls (rises).*

*Proof.* See the appendix. ■

Proposition 2 shows that a positive tax shock that has a positive effect on the productivity of capital ( $\tau < \chi$ ) increases inequality in countries having a “strong” dynamic status effect, and it reduces inequality in countries with a “weak” dynamic status effect.

More generally, the impact of a positive tax shock on the development of inequality depends on two factors. First, it depends on the tax level. If  $\tau < \chi$  (if  $\tau > \chi$ ), a rise in the tax rate (along with an increase in government spending) raises (lowers) the productivity term  $A(\tau)$ . Second, it depends on the strength of the dynamic status effect. If the dynamic

<sup>15</sup> See García-Peñalosa and Turnovsky (2008, p. 455)

status effect is strong (weak), then a rise in productivity (as induced from taxation) transforms in higher initial consumption (savings), thereby affecting the saving rate *dynamics*.<sup>16</sup>

The saving rate dynamics impact both the dynamics and the steady-state level of wealth inequality (although, the steady-state saving rate is unaffected by the tax shock). The main mechanism works via the initial response of the saving rate following the taxation shock, and we identify two alternative scenarios. The first is one in which the saving rate jumps *up* initially, and monotonically declines to its steady-state value thereafter. In this case,  $h(k) < 0$  (see the appendix), and inequality declines during transition and is lower in the post-shock steady state than in the initial equilibrium. The high(er) saving rate implies a high rate of capital accumulation and a fast decline in the rate of interest. This fast decline disadvantages wealthy households, who derive a large share of income from capital, more so than do poor households. Consequently, inequality declines. As argued above, this situation,  $h(k) < 0$ , occurs without (and with weak) dynamic status preferences.

The second situation is one in which the saving rate jumps *down* initially, and during the subsequent transition increases toward its steady-state value. As the saving rate is low here, the rate of capital accumulation is low as well, and so is the pace at which the rate of interest declines. This benefits the wealthy households more than the poor ones; thus, inequality rises during transition and is higher in the post-shock steady state than in the initial steady state. This situation occurs when  $h(k) > 0$ , that is, under strong dynamic status preferences.

We complete this subsection by a brief discussion of the role of the productivity of government investment ( $\chi > 0$ ). As government investment induces a production externality, the private return on capital is smaller than the social return, according to (11). As a consequence, firms underinvest, and capital accumulation is lower compared to a situation in which firms fully take into account the social return on capital.

**Proposition 3.** *The productivity of public spending ( $\chi > 0$ ) induces a production externality. Thereby, in response to a positive tax shock, productive public spending contributes to a rising wealth inequality both along transition and in the steady state.*

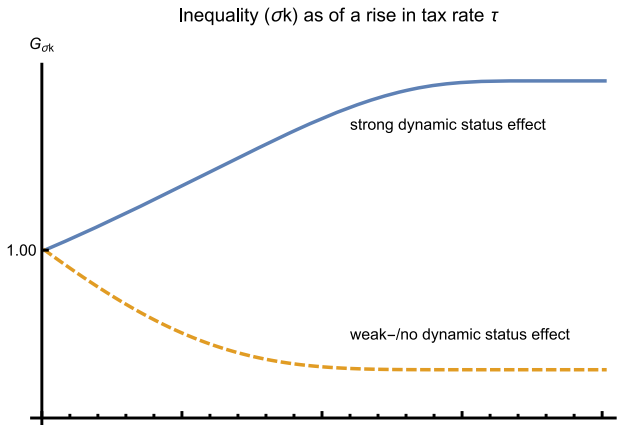
*Proof.* Proposition 2 establishes  $\text{sgn}\dot{s} = \text{sgn}\dot{\sigma}_k$ . Moreover, Proposition 1 shows  $\dot{s} > 0 \Leftrightarrow s^* > IES(c, k)(1 - \chi)/\xi(c, k)$ . Ceteris paribus,  $\dot{s} > 0$  is the more likely to be higher for a higher  $\chi$ . Moreover, consider  $\dot{s} > 0 \Leftrightarrow -E > \frac{\beta + \delta}{\delta} \left[ 1 - \frac{s^*}{IES(1 - \chi)} \right]$ , as derived in the appendix (Proof of Proposition 2). As  $s^*$  is independent of  $\chi$  (and so is  $IES$  when  $\rho = 0$ ), the right-hand side of the inequality declines in  $\chi$  (and becomes negative for  $\chi$  large enough). As  $-E \geq 0$ , there always exists a  $\chi > 0$  for which the inequality is satisfied. ■

Proposition 3 shows that the productivity of the government investment,  $\chi$ , impacts inequality (in addition to a change in the tax rate). The reason is simple and intuitive. Private firms (households) do not internalize the externality generated by productive government spending. That is, the private return on capital is lower than the social return. So, private firms invest less than they would when internalizing the government spending externality. Consequently, the implied underinvestment keeps the rate of interest high (higher compared to the situation in which firms internalize the production externality) for a longer period. This benefits the rich households whose income share of wealth is comparatively larger. In other words, and as shown in the proof, a higher value of  $\chi$  makes  $\dot{s} > 0$  more likely. The dynamic status effect (contributing to a lower initial saving rate) is magnified by the externality generated by productive government spending (also contributing to a lower initial saving rate).

### 4.3 | Tax policy and inequality dynamics: A numerical illustration

Consider again countries A and B, as in the example above. They have the same structural parameters and initial wealth/income distribution. As in the example above, they differ in the values for  $\varepsilon_0$ , respectively. Figure 2 illustrates the dynamics of wealth inequality following a positive increase in taxation from  $\tau = 0.1$  to  $\tau = 0.2$ . The figure shows that in the economy where status preferences are more responsive to changes in wealth induced by productive government spending (Country A, solid line in Figure 2), inequality increases, whereas for the economy where status is less responsive to a rise in wealth (Country B, dashed line in Figure 2), inequality declines in response to the same tax shock.

<sup>16</sup> The tax shock does not affect the steady-state saving rate, as discussed above.



**FIGURE 2** Dynamics of wealth inequality

The intuition is given in the discussion of Proposition 2. For the simulation displayed in Figure 2, parameters were chosen to produce opposite effects regarding the impact of government spending on the transitional dynamics of inequality. More generally, whether inequality rises or falls following a positive change in government spending depends on the respective strengths of the return-on-capital- and dynamic status effects as implied by Proposition 2. A rise in the tax rate, associated with a rise in productive government spending increases productivity in this numerical example, as  $\tau < \chi$ . In a country with strong (weak) dynamic status preferences, households raise consumption strongly (weakly) initially, thereby reducing (increasing) the saving rate initially. Along transition, both the saving rate and inequality increase (decrease).

Combining these two cases suggests that the introduction of dynamic status preferences can potentially generate a Kuznets curve. Specifically, during early stages of development the strong dynamic status effect dominates and inequality increases, albeit at a declining rate. After reaching some threshold development level, the return-on-capital effect dominates and wealth inequality begins to decline.

## 5 | CONCLUSION

This paper has studied the effect of productive government spending (taxation) on aggregate savings behavior and its consequences for the dynamics of wealth inequality, taking into consideration key behavioral changes that occur during the process of economic development. Following empirical evidence we assumed that agents' preferences toward status (positional consumption) evolve according to the average wealth (capital) of the society. The sources of wealth included private capital and productive public capital, where the latter was financed by a distortionary income tax. We found that, in response to an increase in income tax, in economies with a strong (weak) enough dynamic status effect, savings and inequality increase (decrease). In contrast to the standard neoclassical model, such an outcome that incorporates the behavioral changes to fiscal policy expands the set of mechanisms that is available to explain the variation of savings and wealth distribution dynamics we observe around the globe and that cannot be attributed to technological or other structural parameters.

Our main policy implication is that policies targeted to increase productivity through productive government spending raise income, but they do not necessarily decrease wealth inequality. In fact, as argued above, such policies may raise wealth inequality. This may occur because in the presence of dynamic status preferences, people raise consumption in response to the positive policy shock, rather than increasing savings that generate future income and economic convergence. That is, instead of creating wealth, such a policy shock contributes to increasing both consumption and inequality. Thus, investment in institutions that induce behavioral changes away from status concerns, rather than



policies of enhancing productivity increases, might turn out to be effective policy measures curtailing the inequality epidemic.<sup>17</sup>

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## REFERENCES

- Agénor, P. (2011). *Public capital, growth and welfare: Analytical foundations for public policy*. Princeton, NJ: Princeton University Press.
- Arrow, K. J., & Kurz, M. (1970). *Public investment, the rate of return, and optimal fiscal policy*. Baltimore, MD: Johns Hopkins University Press.
- Arslanalp, S., Bornhorst, F., & Gupta, S. (2011). Investing in growth. *Finance and Development*, 48, 34–37.
- Artadi, E. V., & Sala-i-Martin, X. (2003). *The economic tragedy of the XXth century: Growth in Africa*. NBER Working Paper No. 9865.
- Atolia, M., Chatterjee, S., & Turnovsky, S. J. (2012). Growth and inequality: Dependence on the time path of productivity increases (and other structural changes). *Journal of Economic Dynamics and Control*, 36, 331–348.
- Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98, S103–S125.
- Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth* (2nd ed.). Cambridge, MA: MIT Press.
- Brakman, S., Garretsen, H., & van Marrewijk, C. (2002). *Locational competition and agglomeration: The role of government spending*. CESifo Working Paper No. 775.
- Bom, P., & Ligthart, J. (2014). What have we learned from three decades of research on the productivity of public capital? *Journal of Economic Surveys*, 28, 889–916.
- Calderon, C., & Servén, L. (2004). *The effects of infrastructure development on growth and income distribution* (World Bank Policy Research Paper No. 3400). Washington, DC: World Bank.
- Clark, A. E., Frijters, C. P., & Shields, M. A. (2008). Relative income, happiness, and utility: An explanation for the Easterlin paradox and other puzzles. *Journal of Economic Literature*, 46, 95–144.
- Clark, A. E., & Senik, C. (2010). Who compares to whom? The anatomy of income comparisons in Europe. *Economic Journal*, 120, 573–594.
- Dioikitopoulos, E. V., Turnovsky, S. J., & Wendner, R. (2017). Dynamic status effects, savings, and income inequality. SSRN: <https://ssrn.com/abstract=3026997>
- Dynan, K. E., Skinner, J., & Zeldes, S. (2004). Do the rich save more? *Journal of Political Economy*, 112, 397–444.
- Easterlin, R. A. (2001). Income and happiness: Toward a unified theory. *Economic Journal*, 111, 465–484.
- Fan, S., & Zhang, X. (2004). Infrastructure and regional economic development in rural China. *China Economic Review*, 15, 203–214.
- Ferranti, D., Perry, G., Ferreira, F., & Walton, M. (2004). *Inequality in Latin America: Breaking with history?* Washington, DC: The World Bank.

<sup>17</sup> Our policy conclusion resembles that of Long (2017) who, in his study on pro-socialness, argues that international aid agencies should allocate aid resources not only in building up physical capital but also in promoting pro-socialness in childhood education.

- García-Peñalosa, C., & Turnovsky, S. J. (2008). Consumption externalities: A representative consumer model when agents are heterogeneous. *Economic Theory*, 37, 439–467.
- Glomm, G., & Ravikumar, B. (1994). Public investment in infrastructure in a simple growth model. *Journal of Economic Dynamics and Control*, 18, 1173–1187.
- Güvenen F. (2006). Reconciling conflicting evidence on the elasticity of intertemporal substitution: A macroeconomic perspective. *Journal of Monetary Economics*, 53, 1451–1472.
- Heffetz, O. (2011). A test of conspicuous consumption: Visibility and income elasticities. *Review of Economics and Statistics*, 93, 1101–1117.
- Heffetz, O. (2012). Who sees what? Demographics and the visibility of consumer expenditures. *Journal of Economic Psychology*, 33, 801–818.
- Johansson-Stenman, O., Carlsson, F., & Daruvala, D. (2002). Measuring future grandparents' preferences for equality and relative standing. *Economic Journal*, 112, 362–383.
- Koyuncu, M., & Turnovsky, S. J. (2016). The dynamics of growth and income inequality under progressive taxation. *Journal of Public Economic Theory*, 18, 560–588.
- Liu, W. F., & Turnovsky, S. J. (2005). Consumption externalities, production externalities, and long-run macroeconomic efficiency. *Journal of Public Economics*, 89, 1097–1129.
- Loayza, N., Fajnzylber, P., & Calderon, C. (2005). *Economic growth in Latin America and the Caribbean: Stylized facts, explanations, and forecasts*. Central Bank of Chile Working Paper No. 265.
- Long, N. V. (2017, December). *Warm glows and the transmission of pro-socialness across generations*. Paper presented at the APET Conference "At the Forefront of Public Economics," New York University, Abu Dhabi.
- Lopez, H. (2004). *Macroeconomics and inequality, macroeconomic challenges in low income countries*. The World Bank Research Workshop. Washington, DC: World Bank.
- Moav, O., & Neeman, Z. (2012). Saving rates and poverty: The role of conspicuous consumption and human capital. *Economic Journal*, 122, 933–956.
- Piketty, T. (2014). *Capital in the twenty-first century*. Cambridge, MA: Harvard University Press.
- Rioja, F. (2003). Filling potholes: Macroeconomic effects of maintenance vs. new investments in public infrastructure. *Journal of Public Economics*, 87, 2281–2304.
- Turnovsky, S. J. (2015). Economic growth and inequality: The role of public investment. *Journal of Economic Dynamics and Control*, 61, 204–221.
- Weil, D. (2005). *Economic growth*. Boston, MA: Pearson.
- Wolff, E., & Zacharias, A. (2007). The distributional consequences of government spending and taxation in the U.S., 1989 and 2000. *Review of Income and Wealth*, 53, 692–715.

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## APPENDIX

### A.1 Euler equation (6)

In what follows, we disregard time indexes, unless needed for clarity. The current-value Hamiltonian reads

$$H(C_i, K_i, \mu_i) = U(C_i, S_i, \varepsilon(k)) + \mu_i(rK_i + wL - C_i) = \frac{C_i^\gamma [1 - \varepsilon(k) + \varepsilon(k)\bar{c}^{-\rho}]^{\frac{\gamma}{\rho}}}{\gamma} + \mu_i(rK_i + wL - C_i).$$

Differentiating the Hamiltonian with respect to the choice variable  $C_i$  as well as the state variable  $K_i$  yields

$$\mu_i = U_{C_i} = C_i^{\gamma-1} [1 - \varepsilon(k)[1 - \bar{c}^{-\rho}]^{\frac{\gamma}{\rho}}],$$

$$-\frac{\dot{\mu}_i}{\mu_i} = r - \beta.$$

Differentiation of the former first-order condition with respect to time implies

$$-\frac{\dot{\mu}_i}{\mu_i} = (1 - \gamma) \frac{\dot{C}_i}{C_i} - \frac{\gamma}{\rho} \left\{ \frac{-\varepsilon(k)\rho\bar{c}^{-\rho}}{1 - \varepsilon(k)[1 - \bar{c}^{-\rho}]} \frac{\dot{\bar{c}}}{\bar{c}} - \frac{[1 - \bar{c}^{-\rho}]e'(k)\dot{k}}{1 - \varepsilon(k)[1 - \bar{c}^{-\rho}]} \right\}.$$

As a consequence, the consumption growth rate of all individuals is the same, and  $\dot{C}_i/C_i = \dot{c}/c = \dot{\bar{c}}/\bar{c}$ , where the lower-case  $c$  denotes per capita consumption. Considering the DOP (3), the above becomes

$$r - \beta = (1 - \gamma) \frac{\dot{C}_i}{C_i} - \frac{\gamma}{\rho} (-\rho DOP) \frac{\dot{C}_i}{C_i} - \underbrace{\frac{\gamma}{\rho} \frac{[\bar{c}^{-\rho} - 1]}{1 - \varepsilon(k)[1 - \bar{c}^{-\rho}]} e'(k)\dot{k}}_{\equiv \Psi}.$$

As  $\bar{c}^{-\rho} - 1 > 0$ , see footnote 8,  $\Psi > 0$ . Rearranging terms yields Equation 6.

### A.2 Aggregate resource constraint (12)

As  $K = \int_0^1 K_i di$ , we know  $\dot{K} = \int_0^1 \dot{K}_i di = \int_0^1 rK_i di + \int_0^1 wL_i di - \int_0^1 C_i di$  (the latter follows from the individual flow budget constraints) so that the aggregate budget constraint becomes

$$\dot{K} = rK + wL - C.$$

Next, consider firm behavior. First-order conditions (10) imply

$$(r + \delta)K + wL = Y(1 - \tau).$$

Considering both conditions together (and eliminating  $(rK + wL)$ ) yields (12), the aggregate resource constraint (output market-clearing condition).

### A.3 Proof of Proposition 1

**Part (i).** Remember  $A(\tau) \equiv \Omega \frac{1}{1-\chi} \tau \frac{\chi}{1-\chi} (1 - \tau)$ . According to (16) and (17), in a steady state,

$$s^* = 1 - \frac{c^*}{f(k^*)(1 - \tau)} = 1 - \frac{c^*}{A(\tau)(k^*)^{\omega/(1-\chi)}} = \frac{\delta\omega}{\beta + \delta},$$

thus, we will employ the steady-state relationship  $\delta\omega = s^*(\beta + \delta)$ . Along transition,

$$s = 1 - \underbrace{\frac{c}{A(\tau)k^{\omega/(1-\chi)}}}_{\equiv z},$$

so that  $s = 1 - z$ . Let the  $g_x$  denote the growth rate of some variable  $x$ . Then, the growth rate of  $z$ ,  $g_z = g_c - \frac{\omega}{1-\chi}g_k$ . Clearly,  $\dot{s} \geq 0 \iff g_z \leq 0$ .

Noting the dynamic system (14) and  $\xi \equiv 1 - (IES E)/[\omega/(1 - \chi)]$  yields

$$g_z = IES(f'(1 - \tau)(1 - \chi) - (\beta + \delta)) - \xi \frac{\omega}{(1 - \chi)}g_k.$$

Consider (11). Elaborating on  $g_k$  yields

$$\begin{aligned} \frac{\omega}{1 - \chi}g_k &= \frac{\omega}{1 - \chi} \left[ \frac{f(k)(1 - \tau)}{k} - \frac{c}{k} - \delta \right] = \frac{\omega}{1 - \chi} \left[ \frac{r(k) + \delta}{\omega} - \frac{c}{f(k)(1 - \tau)} \frac{f(k)(1 - \tau)}{k} - \delta \right] \\ &= \frac{\omega}{1 - \chi} \left[ \frac{r(k) + \delta}{\omega} (1 - z) - \delta \right] = \frac{\omega}{1 - \chi} \left[ \frac{(1 - \chi)}{\omega} f'(k)(1 - \tau)(1 - z) - \delta \right] \\ &= f'(k)(1 - \tau)(1 - z) - \frac{\omega}{1 - \chi} \delta = f'(k)(1 - \tau)(1 - z) - \frac{s^*(\beta + \delta)}{1 - \chi}. \end{aligned}$$

Thus, after some manipulation,

$$g_z = IES f'(k)(1 - \tau)(1 - \chi) - IES(\beta + \delta) - \xi f'(k)(1 - \tau)(1 - z) + \xi \frac{\beta + \delta}{1 - \chi} s^*$$

$$= f'(k)(1 - \tau)\xi \left[ \frac{IES}{\xi/(1 - \chi)} - (1 - z) \right] + \frac{\xi}{1 - \chi}(\beta + \delta) \left[ s^* - \frac{IES}{\xi/(1 - \chi)} \right].$$

Following the arguments by Barro and Sala-i-Martin (2004, p. 135ff), during transition the saving rate increases as long as  $s^* > IES(c, k)(1 - \chi)/\xi(c, k)$ . Likewise, the saving rate decreases if  $s^* < IES(c, k)(1 - \chi)/\xi(c, k)$ .

**Part (ii).** The result follows immediately from the fact that the impact of a rise in the tax rate has opposing effects on  $A(\tau)$  depending on whether  $\tau < \chi$  or  $\tau > \chi$ .

**Part (iii).** Suppose  $\tau < \chi$ . Then, a rise in the tax rate raises  $A(\tau)$ . As  $1 - \omega - \chi > 0$ , a rise in the tax rate also raises  $k^*$ , according to (15). Thus,  $\dot{k} > 0$ . In this case, the dynamic status effect,  $E < 0$ , lowers the optimal consumption growth rate (compared to the case  $E = 0$ ). As a consequence,  $c_0$  jumps up by more (compared to the case  $E = 0$ ). Consequently,  $s_0$  jumps up by less or, given the dynamic status effect is strong enough, declines. A thorough phase diagram analysis, discussing a similar case, is provided by Dioikitopoulos et al. (2017). ■

#### A.4 Derivation of $h(k^*)$

The Jacobian of the dynamic system (14), evaluated at the steady state, is given by

$$J \equiv \begin{bmatrix} \partial \dot{k} / \partial k & \partial \dot{k} / \partial c \\ \partial \dot{c} / \partial k & \partial \dot{c} / \partial c \end{bmatrix} = \begin{bmatrix} \frac{\beta + \chi \delta}{1 - \chi} & -1 \\ j_{21} & j_{22} \end{bmatrix}.$$

Let  $\mu$  be the negative eigenvalue of the Jacobian. By definition, we have

$$\begin{bmatrix} \frac{\beta + \chi \delta}{1 - \chi} - \mu & -1 \\ j_{21} & j_{22} - \mu \end{bmatrix} \begin{bmatrix} 1 \\ v_1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix},$$

where  $(1, v_1)$  is a normalized eigenvector associated with eigenvalue  $\mu$ . Clearly,  $v_1 = \frac{\beta + \chi \delta - \mu(1 - \chi)}{1 - \chi}$ .

Remember that  $f(k)(1 - \tau) = A(\tau)k^{\omega/(1 - \chi)}$ , and  $(r(k) + \delta) = \omega f(k)(1 - \tau)/k = f'(k)(1 - \tau)(1 - \chi)$ . Linearizing (20) and considering that  $(c_t - c) = v_1(k_t - k)$ , we can rewrite individual capital accumulation as<sup>18</sup>

$$\dot{k}_i = \frac{\partial \dot{k}_i}{\partial k_i} (k_{it} - k_i) + \frac{\partial \dot{k}_i}{\partial k} (k_t - k) + \frac{\partial \dot{k}_i}{\partial c} v_1 (k_t - k) = \beta (k_{it} - k_i) + (k_t - k) \left[ \frac{\partial \dot{k}_i}{\partial k} + v_1 \frac{\partial \dot{k}_i}{\partial c} \right],$$

where  $\partial \dot{k}_i / \partial k_i = -(w - c)/k = -[(1 - \omega)f(k)(1 - \tau) - [f(k)(1 - \tau) - \delta k]]/k = \omega f(k)(1 - \tau)/k - \delta = r = \beta$ , in a steady state.

We next consider the term in square brackets,  $\partial \dot{k}_i / \partial k = 1/k[(1 - k_i)\partial w / \partial k]$ , in a steady state. As  $w = (1 - \omega)f(k)(1 - \tau)$ , we know that  $\partial w / \partial k = (1 - \omega)f'(k)(1 - \tau) = (1 - \omega)(\beta + \delta)/(1 - \chi)$  in a steady state (considering  $r = \beta$ ). Thus,  $\partial \dot{k}_i / \partial k = [(1 - k_i)/k][(1 - \omega)(\beta + \delta)/(1 - \chi)]$ .

<sup>18</sup> In the following, we omit the asterisk-superscript whenever values refer to the final (after-shock) steady state.

Next,  $\partial \dot{k}_i / \partial c = (-\theta_i + k_i) / k = -(w/c)(1 - k_i) / k$  in a steady state, by (20). Therefore, we can reexpress the individual capital accumulation equation as

$$\dot{k}_i = \beta (k_{it} - k_i) + (1 - k_i) \underbrace{\left[ \frac{(1 - \omega)(\beta + \delta)}{1 - \chi} - \frac{\frac{\beta + \chi\delta - \mu(1 - \chi)}{1 - \chi} w(k)}{c(k)} \right]}_{\equiv h(k)} \frac{k_t - k}{k}.$$

Finally,

$$\begin{aligned} w(k)/c(k) &= [(1 - \omega)f(k)(1 - \tau)]/[f(k)(1 - \tau) - \delta k] \\ &= (1 - \omega)[f(k)(1 - \tau)/k]/[f(k)(1 - \tau)/k - \delta] \\ &= (1 - \omega)[(r + \delta)/\omega]/[(r + \delta)/\omega - \delta] \\ &= (1 - \omega)[(\beta + \delta)]/[(\beta + \delta) - \delta\omega] \end{aligned}$$

in a steady state. Substituting the latter term for  $w(k)/c(k)$ , and simplifying yields

$$h(k) = \frac{(1 - \omega)(\beta + \delta)}{(1 - \chi)[\beta + \delta(1 - \omega)]} [\delta(1 - \omega - \chi) + \mu(1 - \chi)].$$

### A.5 Proof of Proposition 2

García-Peñalosa and Turnovsky (2008, p. 455) show that wealth inequality rises over time ( $\sigma_k(t) > \sigma_k(0)$ ) if  $h(k) > 0$ , and falls over time if  $h(k) < 0$ . To show the proposition, we therefore need to show that

$$h(k^*) \geq 0 \Leftrightarrow \dot{s} \geq 0.$$

Proposition 1 establishes that

$$\dot{s} \geq 0 \Leftrightarrow s^* \geq IES(c, k)(1 - \chi)/\xi(c, k) \Leftrightarrow -E \geq \frac{\beta + \delta}{\delta} \left[ 1 - \frac{s^*}{IES(1 - \chi)} \right],$$

where the latter inequality follows from the definition  $\xi \equiv 1 - (IES E)/[\omega/(1 - \chi)]$  and  $s^* = \omega\delta/(\beta + \delta)$ . We show that these inequalities are equivalent with  $h(k^*) \geq 0$ .

Considering (22),

$$\text{sgn} h(k) = \text{sgn} \left[ \underbrace{\delta(1 - \omega - \chi)}_{>0} + \underbrace{(1 - \chi)\mu}_{<0} \right].$$

Consider the Jacobian matrix as given above. Observe that  $j_{22} = -c IES E / k$  and  $j_{21} = c IES f''(k)(1 - \tau)(1 - \chi) - j_{22}(\beta + \chi\delta)/(1 - \chi)$ . Furthermore, we consider  $c/k = [f(k)(1 - \tau) - \delta k] / k = [\beta + \delta(1 - \omega)] / \omega$  and  $f'(k)(1 - \tau)(1 - \chi) = \beta + \delta$  in a steady state. By definition,

$$2\mu = \frac{\beta + \chi\delta}{1 - \chi} + j_{22} - \sqrt{\left( \frac{\beta + \chi\delta}{1 - \chi} + j_{22} \right)^2 - 4 \left( \frac{\beta + \chi\delta}{1 - \chi} j_{22} + j_{21} \right)}.$$

Considering (22),  $h(k) \geq 0 \Leftrightarrow \delta(1 - \omega - \chi) + \mu(1 - \chi) \geq 0$ . Employing the definition of the eigenvalue,

$$\begin{aligned} 2\delta(1 - \omega - \chi) + (\beta + \chi\delta) + j_{22}(1 - \chi) &\geq (1 - \chi) \sqrt{\left( \frac{\beta + \chi\delta}{1 - \chi} + j_{22} \right)^2 - 4 \left( \frac{\beta + \chi\delta}{1 - \chi} j_{22} + j_{21} \right)} \Leftrightarrow \\ 4\delta^2 \left( \frac{1 - \omega - \chi}{1 - \chi} \right)^2 + 4\delta \left( \frac{1 - \omega - \chi}{1 - \chi} \right) \left( \frac{\beta + \chi\delta}{1 - \chi} + j_{22} \right) &\geq -4 \left( \frac{\beta + \chi\delta}{1 - \chi} j_{22} + j_{21} \right) \Leftrightarrow \end{aligned}$$

$$\delta \left( \frac{1-\omega-\chi}{1-\chi} \right) \left[ \delta \left( \frac{1-\omega-\chi}{1-\chi} \right) + \left( \frac{\beta+\chi\delta}{1-\chi} + j_{22} \right) \right] \geq -c IES f''(k)(1-\tau)(1-\chi) \Leftrightarrow$$

$$j_{22} \geq IES \frac{\beta+\delta(1-\omega)}{s^*} - \frac{\beta+\delta(1-\omega)}{(1-\chi)} \Leftrightarrow -\frac{c}{k} IES E \geq [\beta+\delta(1-\omega)] \left[ \frac{IES}{s^*} - \frac{1}{1-\chi} \right] \Leftrightarrow$$

$$-E \geq \frac{\beta+\delta}{\delta} \left[ 1 - \frac{s^*}{IES(1-\chi)} \right].$$

Thereby,  $\text{sgn}\dot{s} = \text{sgn}h(k) = \text{sgn}\dot{\sigma}_k$ . The inequality depends on the strength of the dynamic status effect. In its absence  $E = 0$ , and  $\dot{s} < 0$  (standard case). If the dynamic status effect is strong enough ( $-E$  is large enough),  $\dot{s} > 0$  and inequality rises. ■