Analysis

Endogenous fiscal policies, environmental quality, and status-seeking behavior

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Abstract

This paper analyzes endogenous fiscal policy in an endogenous growth model where agents care about social status and environmental quality. The quest for a higher status is assimilated to a preference for capital wealth. The government uses income tax to finance infrastructure and environmental protection. We find that accounting for preferences for social status and environmental quality may lead to an allocation of tax revenue in favor of a cleanup effort to the detriment of infrastructure. Economic growth is not necessarily and negatively affected by this allocation as it is partly explained by an excessive accumulation of capital wealth due to the quest of status. Status seeking can however harm economic growth and environmental quality when its motive is important enough. Finally, we show that economic growth may be consistent with environmental preservation but is not necessarily welfare-improving as in the case of absence of status-seeking behavior.

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1. Introduction

The relationship between growth and environment has been extensively explored in the literature. The emergence of endogenous growth theories in the last two decades has provided a novel framework to address the sustainability issue and especially the role of public policy in improving environmental quality. In this respect, the works of Jones and Manuelli (2001), and Economides and Philippopoulos (2008) are particularly appealing. These authors pleaded for environmental protection policy, which was also recommended by Arrow et al. (1995), and underlined that policy choice is a source of cross-country heterogeneity in terms of economic performance and environmental quality. Economides and Philippopoulos (2008) studied a second-best optimal policy in an endogenous growth model with a renewable resource. The latter is depleted by economic activity but can be maintained by a cleanup policy. The government chooses the tax rate and the allocation of tax revenue between infrastructure spending and cleanup effort by maximizing individual welfare. Their results show that the more representative individual cares about the environment, the more growth-enhancing policies should be chosen. In other words, only growing economies can afford to improve environmental quality.

However, these works used the traditional approach on economic growth, which emphasizes the supply-side of the economy and assumes that individual preferences are exogenous and independent of social interactions. Accounting for the relative position of individuals in society would lead to consider alternative economic models, including particularly those with endogenous preferences and relative utility. Several recent research studies showed that individuals care about their relative positions in society and recommend a broader use of these models in environmental studies (see, e.g., Brekke and Howarth, 2002; van den Bergh et al., 2000; Welsch, 2009, and Wendner, 2003). Empirical evidence supporting relative utility can be found in numerous works on subjective well-being (Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005; Kapteyn et al., 1997, among others). Most of them found that an individual’s utility depends not only on her income but also on a reference income.1

The conjecture of relative utility dates back to The Theory of Moral Sentiments by Smith (1759) and The Theory of the Leisure Class by Veblen (1899), and was emphasized by Duesenberry (1949). The latter by maximizing individual welfare. Their results show that the more representative individual cares about the environment, the more growth-enhancing policies should be chosen. In other words, only growing economies can afford to improve environmental quality.

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1 See, e.g., Clark et al. (2008) and Pham (2008) for status-seeking implications in economic analysis.
where the fiscal policy is chosen from a two-step decision process: firstly given public policy, the representative individual determines her consumption and her private capital, the representative firm chooses its production, and secondly the altruist government determines the allocation of tax revenue that maximizes the individual’s utility subject to private decisions. Section 4 presents the impacts of status and environmental concerns on fiscal policy, growth, and the relationship between growth and welfare. Section 5 concludes.

2. The Model

We assume that the economy has a continuum of infinitely-lived identical individuals uniformly distributed in [0,1]. Competitive firms produce a consumption good from three inputs: private capital, public capital, and labor. This production degrades environmental quality, which has an externality effect on the individual’s utility. As in Kempf and Rossignol (2007) and Economides and Philippopoulos (2008), we assume that the government uses income tax to finance public capital and environmental protection.

2.1. Individuals’ Preferences

Each individual has an initial endowment of capital, $k_0 > 0$, and is supposed to supply one unit of labor at each period. Her preferences for consumption, environmental quality, and social status are represented by the following intertemporal utility function:

$$U(c_t, k_t, K_t, E_t) = \sum_{t=0}^{\infty} \beta^t \left[ (1-s_k-s_e) \ln c_t + s_k \ln E_t + s_k \ln \frac{k_t}{K_t} \right]$$

where $0 < \beta < 1$, $0 < \theta < 1$. The first term of the instantaneous utility function expresses the satisfaction from consumption $c_t$, the second from environmental quality $E_t$, and the last from status seeking $k_t/K_t$. Parameter $\theta$ can be interpreted as the degree of the individual’s social interaction (Jellal and Rajhi, 2003).

As underlined previously, status-seeking behavior, which is a way of modeling endogenous preferences, enables us to avoid consequences of making wrong public decisions. In our model, status is expressed in terms of relative wealth ($k_t/K_t$) and the associated coefficient ($s_k$) represents the relative importance attributed by the individual to her status in society. When $s_k = 0$, the utility function has a classical form (i.e. utility is absolute) which implies that individual preferences only depend on consumption and environmental quality as described in Economides and Philippopoulos (2008). Utility is known as relative when $s_k > 0$ and $\theta > 0$. We assume that $s_k + s_e = [0,1]$ to avoid extreme configurations where consumption is not important at all and only social status and environmental quality ensure the individual’s survival ($s_k + s_e = 1$).

2.2. Environmental Quality

As in Acemoglu et al. (2012), environmental quality evolves according to

$$E_{t+1} = E_t + aG_{at} - by_t, \quad a, b > 0$$

where $by_t$ is environmental degradation relative to production at $t$, $aG_{at}$ corresponds to environmental improvement from public pollution abatement. The effectiveness of environmental policy is expressed by the exogenous parameter $a > 0$. $E_t$ is a public good indicating an index of environmental quality, e.g. soil quality, air quality, groundwater, or some biodiversity index. The initial level of environmental quality is $E_0 \geq 0$. Like John et al. (1995) and Acemoglu et al. (2012), environmental

\[ \text{2 The result remains unchanged when using the utility function of the form } s_k \ln c_t + s_k \ln E_t + s_k \ln \ln(k_t/K_t) \text{ with } s_k + s_e + s_k \neq 1. \]
quality is assumed to be always positive in order to justify the logarithmic form in the utility function.3

2.3. Production Technology

The consumption good is produced by a representative firm with a Cobb–Douglas production function

\[ y_t = AZ_t^{\alpha}k_t^{1-\alpha}l_t^\beta \]  

(3)

where \( A \) is the technological level. The aggregate variable \( Z_t \), which is the stock of public capital at \( t \), is assumed to be a pure public good. Variables \( k_t \) and \( l_t \) correspond to private capital and labor respectively. For simplicity’s sake, we assume that private capital is entirely depreciated at each period, i.e. private capital at \( t+1 \) depends on private investment at \( t \):

\[ k_{t+1} = i_t. \]  

(4)

Our model is a discrete version of Barro’s (1990) model with the modification that public capital is introduced into the production process as a stock, instead of a flow variable.4 We assume that public capital is entirely depreciated at each period, i.e. public capital at \( t+1 \) is equal to public investment at \( t \):

\[ Z_{t+1} = G_{t+1}. \]  

(5)

2.4. Public Sector

The overall public expenditure is financed by income tax:

\[ G_t = \gamma_t(W_t^l + r_t l_t) \]  

(6)

where \( \gamma_t \) is the tax rate at time \( t \). We also assume that a share \( \varepsilon \) of public expenditure is devoted to the provision of public capital and the remaining \( 1-\varepsilon \) to environmental protection. Eq. (5) can be rewritten as

\[ G_t = G_{Z} + G_{E} = \varepsilon \gamma_t(W_t^l + r_t l_t) + (1-\varepsilon)\gamma_t(W_t^l + r_t l_t). \]  

(7)

or equivalently as

\[ G_t = G_{Z} + G_{E} = \gamma_{Z_t} + \gamma_{E_t}(W_t^l + r_t l_t). \]  

(8)

where \( \gamma_{Z_t} \) and \( \gamma_{E_t} \) are respectively the ratio of infrastructure expenditure to income and that of environmental expenditure to income. Public policy can be therefore summarized by \( \gamma_{Z_t} \) and \( \gamma_{E_t} \), which we can also call infrastructure and environmental tax rates, respectively.

3. Equilibrium

We study in this section the political–economic equilibrium which results from a sequential process. In other words, at the beginning of each period, fiscal policy is chosen before decisions about consumption, production, and wealth accumulation.5 Taking fiscal policy and environmental quality as given, the individual and the firm will make their own decisions. We have then a two-step decision design. In the first step, the representative firm maximizes its profit by choosing the profile of production factors. The representative individual maximizes her utility by choosing her consumption and her saving (private investment) given fiscal policy and environmental quality. A competitive equilibrium is therefore defined. In the second step, the altruist government determines the allocation of tax revenue by maximizing the individual’s utility subject to private decisions at the competitive equilibrium. The political–economic equilibrium resulting from this two-step procedure corresponds then to a second-best allocation. This sequential process was often considered as a voting mechanism in a democratic economy as in Glomm and Ravikumar (1995), Krusell et al. (1997), Jones and Manuelli (2001), among others. Hereafter, we derive the private decisions at the competitive equilibrium and the allocation of tax revenue determined by the government.

3.1. Consumption and Investment Decisions

At each period, the representative firm employs inputs, \( k_t \) and \( l_t \), following the optimization program:

\[ \max_{k_t, l_t} AZ_t^{\alpha}k_t^{1-\alpha}l_t^\beta - wk_t - rl_t \]  

(P1)

with \( l_t, k_t > 0 \). \( t = 0,1,... \). The price of the consumption good is normalized to unity. Factor prices, fiscal policy, and environmental quality are considered as given. First-order conditions of the optimization program are:

\[ w_t = \alpha AZ_t^{\alpha-1}k_t^{-\alpha}l_t^\beta = \frac{\alpha \gamma_t}{l_t}, \]  

(9)

\[ r_t = (1-\alpha)AZ_t^{\alpha-1}k_t^{-\alpha}l_t^\beta = \frac{(1-\alpha)\gamma_t}{k_t}. \]  

(10)

Given fiscal policy, factor prices, and environmental quality, the representative individual determines her consumption \( c_t \) and her investment \( k_t \) (or private capital \( k_{t+1} \)), by maximizing her utility

\[ \max_{\{c_t, k_t\}} \sum_{t=0}^{\infty} \beta^t \left( (1-s_k-s_{\bar{E}}) \ln c_t + s_k \ln E_t + s_{\bar{E}} \ln \left( \frac{k_t}{K_t} \right) \right) \]  

(P2)

subject to

\[ \begin{cases} c_t + k_{t+1} = (1-\gamma_Z)(W_t^l + r_t l_t), \\ c_t, k_{t+1} > 0, \\ k_0, Z_0, E_0, \{W_t, r_t\}_{t=0}^{\infty}, \{\gamma_Z, \gamma_{E_t}, Z_{t+1}, E_{t+1}\}_{t=0}^{\infty} \text{ given.} \end{cases} \]  

First-order conditions are:

\[ \frac{1-s_k-s_{\bar{E}}}{c_t} = \beta \left[ (1-s_k-s_{\bar{E}})(1-\gamma_{Z_{t+1}}-\gamma_{E_{t+1}})r_{t+1} + s_{\bar{E}} \right] \frac{s_k}{k_{t+1}}, \]  

(11)

This relation represents the equality between the marginal cost (in terms of utility) of a reduction of one unit of consumption good at \( t \) (left-hand side) and the marginal benefit of an increase of one unit of private capital at \( t+1 \) (right-hand side). This benefit is composed of two elements: the marginal utility of capital at time \( t+1 \), \( s_k/k_{t+1} \), on the one hand, and the product between the net marginal return of saving (private investment at \( t \), \( 1-\gamma_{t+1} \), \( r_{t+1} \), and the marginal utility of consumption at \( t+1 \), \( 1-s_k-s_{\bar{E}}/c_{t+1} \), on the other hand.

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3 We thank an anonymous referee for drawing our attention on this point. Acemoglu et al. (2012) assumed there is a rate of ‘environmental regeneration’, \( m > 0 \), so that \( E_{t+1} = (1+m)E_t + e_{Z_t} - b_{y_t} \). Including \( m > 0 \) in our framework will not change the results. It should be noticed that contrary to Acemoglu et al. (2012), who also assumed that \( E_t \) is bounded above \( E_t \leq E_t^\max \), environmental quality is unbounded in our specification as well as in John and Pecchenino (1994), John et al. (1995), and Economides and Manuelli (2006). Other forms than in Eq. (2) were proposed by Agron and Howitt (1998, chapter 5) where \( E_t \) measured as the distance between the current environmental quality to its upper limit, is always lower or equal to zero. The zero value corresponds then to the upper limit in the case of absence of human activity. Moreover, when environmental quality is considered as a flow, factors affecting it (consumption, production, capital, pollution abatement, etc.) can be modeled in a nonseparable way, such as the Cobb–Douglas specification (see, e.g., Smulders, 2000, and Xepapadeas, 2005).

4 Similar models, without social status or environment, were proposed by Glomm and Ravikumar (1994, 1995) and Lau (1995), etc.

5 Some authors assumed that the tax rate is fixed at the beginning of time and remains constant subsequently (see, e.g., Fiaschi, 1999 and Lau, 1995).
Definition 1. Given initial values $k_0, Z_0, E_0 > 0$ and sequences $(\gamma_{t}, \Omega_{t}, Z_{t}, E_{t})_{t=0}^{\infty}$, a competitive equilibrium is the sequences $(c_{t}, k_{t+1})_{t=0}^{\infty}$ and $(w_{t}, r_{t})_{t=0}^{\infty}$ such that:

(i) $(w_{t}, r_{t})_{t=0}^{\infty}$ is the solution of the profit-maximization program of the competitive firm (P1),

(ii) $(c_{t}, k_{t+1})_{t=0}^{\infty}$ is the solution of the optimization program of the individual (P2),

(iii) $c_{t} + k_{t+1} = (1 - \gamma_{t} - \gamma_{t+1})y_{t}$. $l_{t} = 1$, $k_{t} = K_{0}$. $y_{t} = AZ_{t}^{\cdot1-\alpha}$ and $Z_{t} = \frac{\gamma_{t}}{ct_{t}-1}(w_{t} - r_{t}-1 + \frac{t_{t}}{k_{t}-1})$.

At the competitive equilibrium, we have

\[ c_{t} = \phi_{t}(1 - \gamma_{t} - \gamma_{t+1})y_{t} \] (12)

\[ k_{t+1} = (1 - \phi_{t})(1 - \gamma_{t} - \gamma_{t+1})y_{t} \] (13)

\[ Z_{t+1} = \gamma_{t}y_{t} \] (14)

\[ E_{t+1} = E_{t} + (a\gamma_{t} - b)y_{t} \] (15)

\[ \gamma_{t} = \gamma_{t} + y_{t} \] (16)

where

\[ \phi_{t} \equiv \frac{\beta(1 - \alpha)(1 - s_{k} - s_{h})}{(1 - s_{k} - s_{h})^{2} + b}s_{k} \] (17)

3.2. Economic and Environmental Policies

We now discuss how the government finances environmental protection and public good provision. The altruist government faces a trade-off between costs and benefits of an increase in the ratio of infrastructure expenditure to income ($\gamma_{t}$) and the ratio of environmental expenditure to income ($\gamma_{t}$). On the one hand, an increase of $\gamma_{t}$ and $\gamma_{t}$ at period $t$ will reduce the after-tax income, causing a drop of consumption and private capital accumulation at the same period. It will also reduce current utility and future production (and then future income). On the other hand, higher tax rates at $t$ will increase public expenditures devoted to environmental protection and public investment, which will consequently foster the future individual’s utility.

The government’s optimization program is as follows

\[ \max_{(\gamma_{t}, \gamma_{t})} \sum_{t=0}^{\infty} \beta^{t}[\ln c_{t} + s_{k} \ln E_{t} + s_{k}(1 - \theta) \ln k_{t}] \] (P3)

subject to

\[ \begin{cases} c_{t} = \phi_{t}(1 - \gamma_{t} - \gamma_{t+1})y_{t} \\ k_{t+1} = (1 - \phi_{t})(1 - \gamma_{t} - \gamma_{t+1})y_{t} \\ Z_{t+1} = \gamma_{t}y_{t} \\ E_{t+1} = E_{t} + (a\gamma_{t} - b)y_{t} \\ y_{t} = AZ_{t}^{\cdot1-\alpha} \end{cases} \]

where $k_0, Z_0$ and $E_0$ are given, $\gamma_{t}, \gamma_{t} \in [0, 1]$, $\gamma_{t} + \gamma_{t} \in [0, 1]$, and $\phi_{t}$ is defined as previously. Thanks to the logarithm form and the separability of the utility, the choice of tax rates at $t$ is independent of those at $t - 1$ and $t + 1$. We rewrite the program which only depends on terms containing $\gamma_{t}$ and $\gamma_{t}$

\[ \max_{(\gamma_{t}, \gamma_{t})} \left[ (1 - s_{k} - s_{h}) \ln c_{t} + s_{k} \ln E_{t} + s_{k}(1 - \theta) \ln k_{t} \right] \]

\[ + \beta[(1 - s_{k} - s_{h}) \ln c_{t+1} + s_{k} \ln E_{t+1} + s_{k}(1 - \theta) \ln k_{t+1}] \]

By plugging the constraints into the utility function we obtain the equivalent optimization problem

\[ \max_{(\gamma_{t}, \gamma_{t})} \Omega(\gamma_{t}, \gamma_{t}) \]

where

\[ \Omega(\gamma_{t}, \gamma_{t}) = \frac{\beta(1 - \alpha)(1 - s_{k} - s_{h})}{(1 - s_{k} - s_{h})^{2} + b}s_{k} \]

\[ b = a \]

\[ \gamma_{t} = \frac{s_{k}y_{t}}{\alpha(1 - s_{k} - s_{h})} + \frac{b}{a}E_{t} \]

The subsequent step corresponds to the choice of $\gamma_{t}$ which maximizes $\Omega(\gamma_{t}, \gamma_{t})$ where relation (18) was included. The selected values of the tax rates $\gamma_{t}$ and $\gamma_{t}$ are presented in Result 1 below.

Definition 2. Given initial values $k_0, Z_0, E_0 > 0$, a political–economic equilibrium is the sequences $(c_t, k_{t+1})_{t=0}^{\infty}$, $(w_t, r_t)_{t=0}^{\infty}$, $(\gamma_{t}, \Omega_{t}, Z_{t}, E_{t})_{t=0}^{\infty}$ such that

(i) $(\gamma_{t}, \Omega_{t})_{t=0}^{\infty}$ are the values defined at the competitive equilibrium

(ii) $(\gamma_{t}, \Omega_{t})_{t=0}^{\infty}$ is the solution of the optimization program (P3),

(iii) $c_{t} + k_{t+1} = (1 - \gamma_{t} - \gamma_{t+1})y_{t}$. $l_{t} = 1$, $k_{t} = K_{0}$

(iv) $Z_{t+1} = \gamma_{t}y_{t}$ and $E_{t+1} = E_{t} + (a\gamma_{t} - b)y_{t}$ where $y_{t} = AZ_{t}^{\cdot1-\alpha}$

Result 1. At the political–economic equilibrium, the public decision is

\[ \gamma_{t} = \frac{1}{\alpha(X + b\xi)} \left[ -X \frac{E_{t}}{y_{t}} \right] \] (19)

\[ \gamma_{t} = \frac{\alpha(1 - s_{k} - s_{h})}{\alpha(X + b\xi)} \left[ E_{t} \right] \] (20)

where

\[ X \equiv (1 - s_{k} - s_{h})(1 + \beta) + b\xi(1 - \theta). \] (21)

We remark that the conditions $\gamma_{t}, \gamma_{t} \in [0, 1]$ imply

\[ b - a \leq E_{t} \frac{bX + a\xi\eta}{X}. \] (22)

These inequalities define the set of possible values of the ratio between environmental quality and income for an interior solution.

We also observe that the ratio of environmental expenditure to income rises with income whereas the ratio of infrastructure expenditure to income decreases with income:

\[ \frac{\partial \gamma_{t}}{\partial y_{t}} > 0, \frac{\partial \gamma_{t}}{\partial y_{t}} < 0, \text{ and } \frac{\partial \gamma}{\partial y} > 0. \] (23)
Environmental protection (being more important if $\gamma_{zt}$ is higher) is not a priority in low income countries where most public expenditure is devoted to economic development to the detriment of environmental protection. This result appears consistent with that of Economides and Philippopoulos (2008) in a framework without status-seeking, which shows that only growing economies can afford to improve environmental quality. It is also particularly consistent with empirical findings. In particular, Pearce and Palmer (2001) found that public environmental expenditure is positively correlated with GDP and that the elasticity of environmental expenditure with respect to GDP is statistically greater than unity. This result also constitutes a plausible explanation of the Wagner's law which states that the ratio of government expenditure to GDP is positively related to GDP per capita. Indeed, even if the infrastructure expenditure ratio decreases when the economy grows, the total public expenditure ratio continues to expand due to the increase of environmental protection expenditure ($\partial \gamma_{zt} / \partial t > 0$). In a similar study, Magnani (2000) found that log of public R&D expenditure per capita also increases with GDP per capita.

Another observation is that the environmental expenditure ratio decreases with environmental quality while the infrastructure expenditure ratio rises with environmental quality:

$$\frac{\partial \gamma_{zt}}{\partial E_t} < 0 \text{ and } \frac{\partial \gamma_{zt}}{\partial E_t} > 0.$$  

(24)

This is rather intuitive as one may feel less urgent to improve environmental quality when it is already high. To summarize, an increase of environmental expenditure may be explained either by an increase of income or by an environmental deterioration.

4. Steady-state Analysis

We transform all the variables to make them stationary. From Eqs. (12) and (13), the ratio capital-consumption is given by

$$\frac{k_{t+1}}{c_t} = 1 - \frac{\partial t}{\partial c_t} \equiv \psi \left( \frac{k_t}{c_{t-1}} \right).$$  

(25)

At the steady-state, we obtain a constant ratio between consumption and wealth

$$k = \psi \left( \frac{1 - \gamma_{zt} - \gamma_{zt} \psi \left( \frac{k_t}{c_{t-1}} \right)}{1 - \beta (1 - \alpha) (1 - s_k - s_t)} \right).$$  

(26)

Current consumption and future private capital can be then rewritten as

$$c_t = \psi (1 - \gamma_{zt} - \gamma_{zt} \psi \left( \frac{k_t}{c_{t-1}} \right)),$$  

(27)

$$k_{t+1} = (1 - \phi) (1 - \gamma_{zt} - \gamma_{zt} \psi \left( \frac{k_t}{c_{t-1}} \right)),$$  

(28)

where

$$\phi \equiv \frac{(1 - s_k - s_t) [1 - \beta (1 - \alpha)] + \beta s_k}{(1 - s_k - s_t) + \beta s_k}.$$  

(29)

Now let us consider the following variables

$$T_{t+1} \equiv \frac{Z_{t+1}}{k_{t+1}} = \frac{\gamma_{zt}}{(1 - \gamma_{zt} - \gamma_{zt}) (1 - \psi t)}$$  

(30)

$$V_{t+1} \equiv \frac{E_{t+1}}{Z_{t+1}} = \frac{E_t}{\gamma_{zt} y_t} + \frac{\alpha \gamma_{zt} - b}{\gamma_{zt}}$$  

(31)

Moreover, we have

$$E_t = \frac{V_T^{1 - \alpha}}{A}.$$  

(32)

It is straightforward to show from expressions of $\gamma_{zt}$ and $\gamma_{zt}$ in Eqs. (19) and (20) that

$$V_t = \frac{a \gamma_{zt}}{\alpha (1 - s_k - s_t)}. \quad \forall t.$$  

(33)

Furthermore, from Eqs. (19) and (20), we obtain

$$\gamma_{zt} = \frac{\alpha (1 - s_k - s_t) [1 - \beta (1 - \alpha)] + \beta s_k}{X - \alpha (1 - s_k - s_t) [1 - \beta (1 - \alpha)] + \beta s_k}.$$  

(34)

At the steady-state, all variables (consumption, private capital, public capital, production and environmental quality) grow at the same rate. We obtain the following result:

Result 2. The ratio of infrastructure expenditure to income and the ratio of environmental expenditure to income are respectively given by

$$\gamma_{le} = \frac{1}{a(X + b s_k)} \left[ - \frac{X V_T^{1 - \alpha}}{A} + b X + a \gamma_{zt} \right],$$  

(35)

$$\gamma_{le} = \frac{\alpha (1 - s_k - s_t) [1 - \beta (1 - \alpha)] + \beta s_k}{a(X + b s_k)} \left[ \frac{V_T^{1 - \alpha}}{A} + a - b \right],$$  

(36)

where $X$, $V$, and $T$ are given in Eqs. (21), (32), and (34) respectively.

This result can be better understood with a numerical exercise. For this purpose, we use the following parameter values: $\alpha = 0.7$, $A = 5$, $\beta = 0.8$, $\theta = 0.5$, $a = 1$, and $b = 0.2$. The results are displayed in Figs. 1 to 3. We analyze how status concern (measured by $s_k$) and environmental concern ($s_t$) affect public decisions. Effects of $s_k$ on $\gamma_{zt}$, $\gamma_{zt}$, $\gamma$, and growth rate are computed by fixing $s_t$ at an arbitrary value, here we choose $s_t = 0.2$. And vice versa, we study the effects of $s_t$ by assuming $s_k = 0.2$.

We observe that status-seeking behavior ($s_k$) has two opposite effects on $\gamma_{zt}$ (Fig. 1a). On the one hand, a stronger status concern implies lower total public expenditure (i.e. smaller $\gamma$) and lower environmental protection expenditure. On the other hand, the government is aware that a stronger status concern will induce an excessive accumulation of capital wealth and then degrade the environment. Hence, the government will raise environmental expenditure (i.e. higher $\gamma_{zt}$) to counterbalance this degradation. This result is compatible with that found in the previous section concerning the allocation of tax revenue at the political economic equilibrium, according to which a higher public investment will be associated with a higher environmental protection (see Eq. (18)). While Howarth (1996) and Brekke and Howarth

\footnote{Recently, Shelton (2007) looked at cross-country data on public expenditure (defense, education, health care) at different levels (focal, central) of government and found a result consistent with Wagner's law. The author stressed that the Wagner's law may be explained by the redistribution policy in rich countries or by demographic factors. Consequently, even if other expenditure declines, richer countries spend more on social security due to population aging, resulting in higher total expenditure per capita than in poorer countries.}

\footnote{The results remain very similar when $s_k$ and $s_t$ are fixed at other values.}
obtained in a different setting that accounting for status-seeking results in a more aggressive environmental policy, our result is here more subtle. Indeed, when status concern is low, the positive effect dominates, i.e. $\gamma_E$ is higher. On the contrary, when status concern becomes sufficiently strong, environmental protection receives a lower priority than wealth accumulation, yielding a smaller $\gamma_E$.

The relationship between $\gamma_E$ and $s_{E}$ (representing the weight of environmental preference) is also non-monotonic as described in Fig. 1b. Actually, an increase of $s_{E}$ has two opposite effects on $\gamma_E$. It raises the ratio of environmental expenditure $\gamma_E$ (direct effect) and simultaneously diminishes the ratio of infrastructure expenditure $\gamma_Z$, which, in turn, reduces production and environmental degradation. The latter effect will result in a lower value of $\gamma_Z$ (indirect effect) as environmental protection becomes less urgent. The increasing part of the curve $\gamma_E$ corresponds to the case where the direct effect dominates the indirect one.

Figs. 2 and 3 illustrate the evolution of infrastructure expenditure and overall public expenditure with respect to changes in status and environmental concerns given other parameters. Status-seeking behavior exerts a negative effect on infrastructure expenditure (Fig. 2a). A similar finding was also found by Pham (2005) who did not account for the environment. Other things being equal, a higher value of $s_{K}$ corresponds to a higher utility derived from social status compared to the utility derived from consumption and that from environmental quality. This implies a higher capital wealth accumulation to the detriment of consumption, of overall public expenditure (Fig. 3a) and, particularly, of infrastructure expenditure. This explanation is also valid for the negative effect of $s_{E}$ on infrastructure expenditure (Fig. 2b).

Our model provides a non-monotonic relationship between environmental concern and the ratio of overall expenditure to income (Fig. 3b) while Economides and Philippopoulos (2008) predicted rather a negative relationship. Actually, in our model the impact of environmental concern ($s_{E}$) on the overall public expenditure ($\gamma$) depends on the positive effect of $s_{E}$ on $\gamma_E$ and the negative effect of $s_{E}$ on $\gamma_Z$. It becomes positive when the former effect dominates the latter.
Result 3. The long-run growth rate of the economy is
\[ g = \ln A + \ln (1 - \alpha) \ln T, \]
where \( T \) is given in Eq. (34).\(^8\)

We observe that the relationship between the growth rate \( g \) and status motive \( \beta \) has an inverted-U shaped form. Our finding is different from most existing studies which found that status-seeking has a positive effect on the growth rate (see, e.g., Corneo and Jeanne, 1997, 2001b; Rauscher, 1997). Indeed, in their models status concern is directed toward a producible asset (i.e. capital wealth), which encourages individuals to invest in wealth accumulation in order to acquire a higher social status as in our model. However, our model adds another effect, i.e. the negative effect on growth of status preferences via tax rates. Indeed, when economic policy is welfare-maximizing, a stronger status-seeking motive has a negative effect on public investment \((\partial T/\partial \beta < 0)\), see Fig. 2a), generating a lower output. This effect will dominate the positive one when the status-seeking motive is strong enough, giving the decreasing part of the curve \( g \) in Fig. 4a.\(^9\)

Moreover, when environmental concern is not important enough our model gives the same prediction than Economides and Philippopoulos (2008) about its effect on growth. Indeed, these authors underlined that individual preferences for the environment require extra revenue for cleanup policy, and that this can only be achieved by high growth. Here, this result corresponds to the increasing part of \( g \) in Fig. 4b where an increase of \( \beta \) may imply a consumption concern \((1 - \beta_x - \beta_k)\) relatively lower than the status concern. In this case, agents are more willing to accumulate capital wealth than to consume, which fosterst growth. Therefore, we can conclude that taking preferences for environmental quality into account may yield an allocation of tax revenue in favor of cleanup policy to the detriment of infrastructure. This choice is not necessarily harmful for economic growth as growth is only partially explained by an excessive accumulation of capital wealth for higher status. Our models adds however another feature to this result. In particular, when environmental concern is sufficiently high, agents may privilege environmental expenditure to the detriment of infrastructure, leading to a lower growth rate (which corresponds to the decreasing part of curve \( g \) in Fig. 4b).

We now turn to the link between individual lifetime utility and sustainable growth. This relationship has received a particular attention from numerous works in the literature. For example, Ng (2008) proposed an ‘environmentally responsible happy nation index’ that accounts for a measure of happiness and a global environmental impact of the economy. Other authors explored the relationship between some proxies of happiness and various measures of sustainable growth and environmental quality (e.g., Bonini, 2008; Engelbrecht, 2008; Zidanšek, 2007). In particular, Zidanšek (2007) found that sustainable development in the interest of future generation does not negatively affect the happiness of the current generation. This finding suggests a possibility of improving happiness and sustainability simultaneously.\(^10\) Here, we find a similar result when economic growth is not sufficiently high. Let us note that
\[ \ln x_t = \ln x_0 + g t, \quad x = c, k, E, \forall t > 0, \]
where \( \varepsilon_0 = (1 - \gamma \gamma_E - \gamma_k) y_0 - k_0 e^\theta \) and \( y_0 = A z_0 k_0^{1 - \beta}. \) The lifetime utility of the individual is
\[ U = (1 - s_x - s_k) \ln c_0 \sum \beta_t^t + \gamma c(1 - \theta) \ln k_0 + s_k \ln E_0 \left( 1 - s_x - s_k \right) \ln c_0 \sum \beta_t^t + (1 - s_x - s_k) \ln k_0 \sum \beta_t^t \]
\[ = (1 - s_x - s_k) \ln (1 - \gamma \gamma_E - \gamma_k) y_0 - k_0 e^\theta \left( 1 - \beta \right)^{-1} + \left( 1 - s_x - s_k \right) \ln k_0 \sum \beta_t^t \left( 1 - s_x - s_k \right) \ln c_0 \sum \beta_t^t \left( 1 - s_x - s_k \right) \]

Result 4. The relationship between the individual’s utility and the growth rate has an inverted-U shaped form instead of a monotonous form as in the case without status. In other words, we have
\[ \frac{\partial U}{\partial g} \geq 0 \iff g \leq g, \]
where \( g = \ln (1 - s_x - s_k) \gamma_k y_0 - \ln (1 - \beta) (1 - s_x - s_k) + \beta (1 - s_x - s_k) k_0. \)

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\(^8\) We formulate here the growth rate in continuous time to have the logarithmic form that help to make our analysis easier. Note that, when \( t \) tend to infinity, the growth rates formulated in discrete time and continuous time are similar.

\(^9\) We observe that with exogenous policies the growth rate of the economy is given by \( g = \ln x + (1 - \alpha) \ln x + \alpha \ln \gamma_k + (1 - \alpha) \ln (1 - \gamma - \gamma_E), \) where \( \pi = (1 - \alpha) (1 - s_x - s_k + k_0). \) In this case, the relationship between status preference and growth rate is positive as in previous studies.

\(^10\) Zidanšek (2007) investigated the relationship between three measures of happiness and two environmental sustainability indicators and found a causal link in both directions, i.e. happier agents care about the environment and a better environment makes them happy.
even if economic growth is consistent with environmental preservation, it is not necessarily welfare-improving as in the case of absence of status-seeking behavior. There is a compatibility between environmental preservation, economic growth and individual welfare when the growth rate is lower than the threshold $g$, defined as a function of parameters and initial values $k_0$ and $y_0$ of the economy.

Remark that empirical findings in the life satisfaction literature, which underlined the absence of a positive correlation between individual life satisfaction and income (Easterlin, 1974, 1995; Oswald, 1997, among others) appears consistent with the result above. In particular, Easterlin (1974), based on US data from 1946 to 1970, found that the average level of American well-being did not significantly improve during the post-war decades where rapid economic growth was observed. In another study, Easterlin (1995) took up this question again and gave a negative answer to the question \textit{\`{W}ill raising the income of all increase the happiness of all?}, suggesting that individual’s utility depends on her relative income, or her social status. As claimed by Easterlin (1974, 1995), this inverted-U shaped feature supports the idea that relative utility constitutes an explanation of the absence of correlation between welfare and income. This explanation was also attained by de la Croix (1998) but in a different theoretical setting where environmental quality was neglected.

Let us now turn to the local dynamics of the model. By using $E_t/y_t = V_tT_t^{1-\alpha}/A$ as obtained previously and the fact that $V_t$ is constant (see Eq. (32)), we find that $\gamma_2$ and $\gamma_3$, given by Eqs. (19) and (20) respectively, depend on $T_t$. Furthermore, by using Eq. (33) concerning the constancy of $\gamma_2/(1-\gamma_2-\gamma_3)$, we observe in Eq. (30) that $T_{t+1}$ only depends on the ratio $k_t/c_{t-1}$. It results that the dynamics of the economy is entirely described by the dynamic behavior of $k_t/c_{t-1}$, which is given by Eq. (25). Based on this equation, the first derivative of $k_{t+1}/c_{t}$ with respect to $k_t/c_{t-1}$ is merely $-d\varphi_t/d\lambda_t$ where $\varphi_t$ is given in Eq. (17). The value of this derivative evaluated at the steady-state is equal to $1/\beta(1-\alpha)$ which is strictly higher than 1. This exercise shows that the steady-state is locally determinate. This corresponds to a basic characteristic of the AK model (see, e.g., Barro and Sala-i-Martin, 1995, and Economides and Miaoulis, 2006) which means that variables of the model will jump immediately to the steady-state and remain there.

5. Concluding Remarks

We study in this paper the consequences of status and environmental externalities on public decision regarding environmental protection and infrastructure. We find that accounting for preferences for social status and environmental quality may lead to an allocation of tax revenue in favor of a cleanup effort to the detriment of infrastructure. However, economic growth is not necessarily and negatively affected by this choice as it is partly explained by an excessive accumulation of capital wealth due to the quest for status. Status concern may be harmful for economic growth and environmental quality when its motive is important enough. These results suggest that individual preferences should be considered as a possible explanation of the trade-off between economic and environmental policies. They can also explain the observed cross-country heterogeneity of the government size and of the growth rate.

We also show that economic growth is consistent with environmental preservation but it is not necessarily welfare-improving as in the case of absence of status-seeking behavior. This result is consistent with empirical findings in the life satisfaction literature, which underlined the absence of a positive correlation between individual life satisfaction and income.

Our results would require an empirical investigation in a future work. The theoretical model deserves further analysis with a more general framework with, for example, a nonseparable utility function. It would be also interesting to address the status-seeking behavior in a model with heterogeneous agents where the question of social mobility is included. Furthermore, it would be interesting to study the same model with endogenous labor supply to take into account the impact of potential oversupply of labor due to the effort devoted to wealth accumulation.

References


