Socially Responsible Investment in an Environmental Overlapping Generations Model
Lammertjan Dam

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Lammertjan Dam, Department of Economics, University of Groningen

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Summary
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Keywords: Overlapping Generations, Environmental Quality, Corporate Social Responsibility, Sustainability, Stock Market

JEL classification: D11, D21, D62, Q01, Q20

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Address for correspondence:

Lammertjan Dam
Department of Economics
University of Groningen
P.O. Box 800
9700 AV Groningen
The Netherlands
Phone: +310503636518
E-mail: L.Dam@rug.nl
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Lammertjan Dam *

University of Groningen, Department of Economics

Abstract

Intergenerational externalities associated with conservation of the environment are usually tackled by fiscal policy. Alternatively, socially responsible investment funds create a role for the stock market to deal with environmental externalities. We analyze the role of the stock market in an overlapping generations model, in which agents choose between investing in “clean” bonds or “polluting” firms. Generally, when agents are short-lived, they do not account for long-term effects of pollution. We show that when corporate property rights are traded, proper firm valuation can resolve the conflict between current and future generations.

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1 Introduction

A problem of growing concern is the threat to the environment resulting from polluting economic activity. From economic theory we know that there

* Address: University of Groningen, Department of Economics, P.O. Box 800, 9700 AV Groningen, The Netherlands, or L.Dam@rug.nl, tel: +31(0)50-3636518. I wish to thank Bert Scholtens, Elmer Sterken, and Ben Heijdra for detailed comments on earlier drafts and useful suggestions. I am also grateful to Martine Quinzii, Richard Tol, José Luis Moraga González, and Pim Heijnen for helpful comments. Gratitude also goes to participants of the SURED conference held in Ascona, Switzerland June 4-9, 2006, participants of the “Forschungsseminar” Quantitative Wirtschaftsforschung held in Hamburg University, Germany, may, 2005, and participants of the IEE Brown Bag Seminar held in Groningen, the Netherlands for inspirational discussions.
is an externality associated with the conservation of the environment. This externality exhibits two dimensions. First, there is an intra-generational dimension. The environment is a public good and as such its conservation suffers from the standard free rider problem. Second, there is an inter-generational dimension. Since pollution typically accumulates, future generations bear the costs of the actions of the current generation. Various studies have proposed fiscal policy measures to manage the long-term threat of pollution to the environment in order to achieve sustainable development. This paper proposes an alternative mechanism to deal with the inter-generational aspect of the pollution externality.

In recent years, not only policy makers, but also large corporations have put sustainable development on their agenda. Corporations publicly report that they engage in corporate social responsibility (CSR) or sustainability programs. This attitude creates the possibility of socially responsible investment (SRI). The idea is that shareholders do not only care about the cash flows of a project, but also about how these cash flows are generated. For instance, an investor might oppose to use child labor or heavily polluting technologies in production processes. Socially responsible investment funds, or “green funds”, allow the stock market to function as a tool in dealing with environmental externalities. Typically agents are short-lived, so they do not internalize the long-term effects of pollution. However, in the presence of a forward looking stock market, we show that proper valuation can resolve the coordination failure between current and future generations.

To capture the conflict between generations, we study the environment in a Diamond type overlapping generations (OLG) model, in line with John and Pecchinino (1994, JP). Agents live for two periods. They work when they are young, retire and derive utility from consumption and environmental quality when they are old. We adapt the model of JP such that, instead of choosing between consumption and environmental maintenance, agents choose between investing in bonds and corporate shares. The novelty of our model is that investors acknowledge that as owners of the firm they are also responsible for the generation of the externality. The change from a consumption into an investment decision allows us to introduce and analyze the role of a stock market. Magill and Quinzii (2003) point out that when corporate ownership rights are traded separately on a stock market, externalities or
frictions can push the value of equity away from the value of real capital goods. The introduction of this “missing market” can potentially deal with the negative externality of pollution in a natural way, as especially the stock market can be characterized by its forward-looking nature.

We are not the first to study the threat to the environment in a Diamond-type OLG model (John and Pecchinino, 1994; John et al, 1995; Guruswamy Babu et al., 1997; Zhang, 1999; Seegmuller and Verchère, 2004; Wendner 2006). However, most of these studies rely on fiscal policy to overcome the intergenerational conflicts instead of the mechanism we propose. Moreover, the proposed tax programs are not straightforward, because they require the use of various different instruments. The reason is that, even without externalities, the decentralized solution needs not to be Pareto-optimal. Finally, the value of financial equity is not necessarily equal to the replacement value of physical capital when there are externalities, which has not been explored in this literature. Our paper is also closely related to Mäler (1994) in which property rights on renewable resources are traded between generations. Mäler (1994) shows that in such a setting, the market solution is optimal in the first-best sense, which is in accordance with the Coase Theorem (1960).

The introduction of a stock market in an OLG model brings some technical complications that we address in this paper. Various studies discuss the indeterminacy of asset prices in OLG models (See, for example, Woodford, 1984; Tirole, 1985; Huffman, 1986; Magill and Quinzii, 2003). However, we show that our model does not suffer from this indeterminacy.

In section 2 we present the core of the model. We describe preferences and technology and calculate the benchmark equilibrium for the case of a central planner. In section 3 we turn to the discussion on socially responsible investment and its consequences for corporate valuation and reporting on firm value. We show that when introducing a stock market, proper valuation resolves the coordination problem. We briefly discuss dynamics. We conclude in section 4.

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1 This is the well known result of Diamond (1965) that agents can over- or under invest in physical capital compared to the Golden Rule solution.
2 A two sector environmental OLG model

We introduce environmental quality in a standard Diamond (1965) overlapping generations (OLG) model. Environmental quality is modeled as a renewable resource. Pollution due to production decreases the ‘stock’ of environmental quality. In this section we discuss technology, consequences for environmental quality, and household preferences.

2.1 Technology, preferences and environmental quality

Output is represented by a linear homogeneous production function

\[ F(K_t, L_t) \]

where \( K_t \) denotes the capital stock and \( L_t \) labor used at time \( t \). Capital invested at \( t \), denoted \( I_t \), becomes productive at \( t + 1 \). Firms depreciate capital at a uniform rate \( \delta \):

\[ K_{t+1} = (1 - \delta)K_t + I_t \]  

Because of constant returns to scale, we can rewrite output as a function of per capita capital \( k_t \):

\[ F(K_t, L_t) = f(k_t)L_t \]

where \( f(k_t) \) is production per capita. We use lower case letters, \( i_t, k_t, c_t \), to denote per capita investment, capital, and consumption. Capital \( K_t \) creates contemporaneous pollution. We assume there is a linear relation between capital and pollution and as a consequence we are free to choose our unit of account of pollution. We normalize such that one unit of capital creates one unit of pollution.

Environmental quality \( E_t \) is modeled as a renewable resource (see JP, 1994):

\[ E_{t+1} = (1 - \beta)E_t - K_{t+1} \]  

with \( 0 < \beta < 1 \) representing the rate of natural recovery. Without pollution, environmental quality will return to its virgin value which is equal to zero. Note that \( E_t \) takes only non-positive values; \( E_t \leq 0 \). Basically, environmental quality is the negative of a stock of pollution.

At each date \( t \) a generation of finitely-lived consumers of fixed size \( L \) is born. Consumers live for two periods and have preferences defined over per capita consumption \( c_{t+1} \) and environmental quality \( E_{t+1} \) at old age characterized by a utility function \( u(c_{t+1}, E_{t+1}) \). This simplification is quite common in OLG models which include environmental quality (see Gu-
ruswamy Babu et al., 1997; and JP, 1994). Since we focus on intergenerational conflicts due to investment choice (how are savings used), and not due to savings behavior (how much is saved), we can make this simplifying assumption without loss of generality.

2.2 A centrally planned economy

We calculate both the optimal transition path and the long-run efficient steady state benchmark equilibrium for the case of a central planner. Consider a central planner that maximizes a social welfare function that assigns a fixed weight $1/(1 + R)$ to the utility of each generation, with the planner’s discount rate $R > 0$. The planner maximizes:

$$\max \sum_{t=0}^{\infty} (1 + R)^{-t} u(c_t, E_t)$$

subject to

$$c_t = f(k_t) + (1 - \delta)k_t - k_{t+1}$$

$$E_t = (1 - \beta)E_{t-1} - k_t$$

and given initial values $k_0, E_0$. Along the optimal path the following first-order condition must hold:

$$\frac{1 - \beta}{1 + \lambda_{t+1}} [f'(k_{t+1}) - (\lambda_{t+1} + \delta)] = f'(k_t) - (\lambda_t + \delta) - \frac{u'_{E_t}}{u'_{c_t}}$$

with $(1 + \lambda_{t+1}) \equiv (1 + R) \frac{u'_{E_t}}{u'_{c_t}}$, the inverse of the marginal rate of intertemporal substitution. Equation (6) provides the planner with a simple investment rule. We give the interpretation of this equation in the following section.

Next we turn to steady state efficiency. A steady state $(\hat{k}, \hat{E}, \hat{c})$ is steady state optimal if it satisfies the following first-order condition:

$$f'(\hat{k}) = \delta + \frac{1}{\hat{\beta}} \frac{u'_{E}}{u'_{c}}$$

from which we can derive that the optimal path will lead to the steady state if the planner’s discount rate $R = 0$. 

5
3 Competitive economy

3.1 Consumers

Consumers inelastically supply one unit of labor when young at a real wage rate \( w_t \), save all their wages, invest in either bonds or shares, yet to be defined, and consume when old. The price of the consumption good is the numeraire. A young agent \( j \) at time \( t \) takes as given the interest rate \( r_t \) and environmental quality \( E_t \) at time \( t \), the price \( p_t \) per share and dividends \( d_t \) per share. He constructs a portfolio of \( b^i_t \) bonds and \( n^i_t \) shares to maximize his utility:

\[
u(c^i_{t+1}, E^i_{t+1})
\]

subject to:

\[
c^i_{t+1} = b^i_{t}(1 + r_{t+1}) + n^i_{t}(p_{t+1} + d_{t+1}) \tag{9}
\]

\[
E^i_{t+1} = s^i_{t}E_{t+1} + \sum_{i\neq j}^{L} s^i_{t}E_{t+1} \tag{10}
\]

\[
w_t = b^i_t + n^i_t p_t \tag{11}
\]

with \( s^i_{t} = n^i_{t} / \sum_{i=1}^{L} n^i_{t} \) the fraction of shares owned by consumer \( j, j = 1, \ldots, L \) out of total shares. Equation (11) is the budget constraint. Socially responsible investment is modeled through equation (10). An investor acknowledges that, by buying shares of the firm, he is also partly responsible for the state of environmental quality. He behaves as if property rights on the resource are defined. Nyborg et al. (2006) use a comparable approach in the context of socially responsible consumers. To a socially responsible investor it matters how the cash-flows are generated. This type of modeling is standard in models of vertical differentiation where goods have a quality dimension (see, e.g. Tirole, 1988, pp. 296-298).

We assume that consumers have perfect foresight and impose symmetry. The first-order optimality condition of the consumer problem takes the form of a pricing equation:

\[
p_t = \frac{p_{t+1} + d_{t+1} + \Delta_{t+1}E_{t+1}}{1 + r_{t+1}} \tag{12}
\]
with the stock of pollution times the marginal rate of substitution between environmental quality and consumption \( \Delta_{t+1} E_{t+1} \equiv \frac{u'_{E_{t+1}}}{u'_{c_{t+1}}} E_{t+1} \) defined as the “externality” premium. We label this a premium since in the steady state the firm has to deliver a return equal to \( d/p = r - E\Delta/p > r \). With social damage, the return on an asset depends on characteristics other than direct financial gain. We can give a general interpretation to these non-financial characteristics, for instance, the investor might consider externalities to be liabilities such as potential environmental scandals or consumer boycotts. Hence, the externality premium represents any liability or negatively valued characteristic of the firm, or any subjective ethical concerns of investors, that cannot be directly observed in financial statements.

As the novelty of our model lies in how we approach socially responsible investment, we elaborate on this preference structure with an example. Suppose an investor enjoys utility from living in or near a forest and has the opportunity to invest in either bonds or in a firm that uses wood to fuel its production. As enabler of this firm, an investor will feel partially responsible for the state and degradation of the forest and is therefore only willing to invest in the firm if there is a premium on the return on investment compared to the interest rate. Effectively, a socially responsible investor acts as if she privately acquired a parcel of the forest and requires payments whenever the firm decides to cut down some of her trees. By analogy, investing in bonds is not associated with gaining control over the firm and is therefore free of this externality-premium.

The broad interpretation of property and control rights plays a crucial role in classifying this type of investment as either behavioral or rational. Whether socially responsible investment is rational or not is subject of discussion, but it is certainly distinct from traditional behavioral economics. Socially responsible investment fits best with theories such as compensating wage differentials (see e.g. Rosen, 1974) or vertical differentiation as used in environmental economics, where consumers can buy green goods. In the context of financial markets it is questionable whether an investor makes a distinction between “normal” money and, e.g. “blood” money.
3.2 Corporate behavior

At time $t$ a firm issues corporate bonds $B_t$. For simplicity, we assume that firms do not issue new equity. We have:

$$F(K_{t+1}, L_{t+1}) - w_{t+1}L_{t+1} - (1 + r_{t+1})B_t + B_{t+1} = I_{t+1} + D_{t+1} \tag{13}$$

A firm can use its production net of labor payments and net interest payments to finance its real capital investments or to pay out dividends $D_{t+1}$. We choose a particular financing policy where firms issue one period bonds to finance investments, i.e. $B_t = I_t$. Rewriting (13), in per capita form using $d_t = D_t / L$, and rearranging we find:

$$d_{t+1} = f(k_{t+1}) - w_{t+1} - (1 + r_{t+1})i_t \tag{14}$$

where we have implemented the financing policy. We normalize the number of consumers and shares to one so that in equilibrium we find for the stock market value of the firm:

$$v_t = \frac{v_{t+1} + d_{t+1} + \Delta_{t+1}E_{t+1}}{1 + r_{t+1}} \tag{15}$$

The total value of the firm $m_t$ is equal to its share value plus debt value:

$$m_t \equiv b_t + v_t = \frac{f(k_{t+1}) - w_{t+1} - i_{t+1} + \Delta_{t+1}E_{t+1} + m_{t+1}}{1 + r_{t+1}} \tag{16}$$

which depends only on output and the financial structure does not make a difference (Modigliani and Miller, 1958).

A firm makes investments in real capital to maximize shareholder value according to (15). We let the optimal investment $i_t^*$ at time $t$ depend on the state variables $k_t$ and $E_t$, such that for the firm’s market value $v_t^* = v^*(k_t, E_t)$ we have:

$$v_t^* = \frac{f(k_{t+1}) - w_{t+1} - (1 + r_{t+1})i^*(k_t, E_t) + \Delta_{t+1}E_{t+1} + v_{t+1}^*}{1 + r_{t+1}} \tag{17}$$

which is a Bellman Equation. The maximum principle then gives the fol-
ollowing first-order conditions:\(^2\):

\[
\frac{1 - \beta}{1 + r_{t+1}} [f'(k_{t+1}) - (r_{t+1} + \delta)] = f'(k_t) - (r_t + \delta) - \Delta_t \tag{18}
\]

\[f(k_t) - f'(k_t)k_t = w_t \tag{19}\]

We can see immediately that equation (18) is equivalent to the planner’s solution (6), provided that the interest rate is equal to the marginal rate of intertemporal substitution of the planner, i.e. \(1 + r_t = (1 + R) \frac{u_t'}{u_{t+1}'}\). If this is the case, than the stock market economy is both dynamically and steady-state efficient.

Iteratively substitute (18) and find:

\[f'(k_t) = (r_t + \delta) + \sum_{\tau=0}^{\infty} \frac{(1 - \beta)\tau}{\prod_{i=0}^{\tau}(1 + r_{t+i})} \Delta_{t+\tau} \tag{20}\]

which states that the marginal product of one unit of capital today should equal the familiar \((r_t + \delta)\) plus the discounted sum of the externality premia \(\Delta_t\) of all future generations. Since pollution due to investment today yields an externality flow of \((1 - \beta)\) one period ahead we have a discount rate equal to \(\frac{1 - \beta}{1 + r_t}\). If firms adopt this investment policy, firm value is maximized and the externality is fully internalized.

For comparison reasons, we show that the possibility of the market value of the firm differing from its replacement value matters for corporate behavior. Imposing that the market value of the firm should equal its replacement value\(^3\), i.e. \(v_t = (1 - \delta)k_t\), yields first order conditions equivalent to JP, namely

\[f'(k_t) = r_t + \delta - \Delta_t \tag{21}\]

and (19). Now the marginal product of capital covers only the externality premium of the current generation. This is equivalent to JP who assume that there is a form of intragenerational coordination to establish optimal provision of the public good for agents alive at time \(t\), but no intergenerational coordination.

\(^2\) To solve the maximization problem, it is useful to rewrite (2) as \(E_{t+1} = (1 - \beta)E_t - (1 - \delta)k_t - i_t\) and note that the firm takes into account the direct effect on the externality premium \(\Delta_tE_t\), but not second-order effects, i.e. it treats \(\Delta_t\) as a price.

\(^3\) Young agents buy the depreciated capital stock from the old.
Finally we point out that pure profit maximization, e.g. maximizing discounted cash flows -not firm value- yields the familiar conditions:

\[ f'(k_t) = r_t + \delta \] (22)

and (19). Production factors are rewarded their marginal productivity, but the externality is not internalized by the firm.

3.3 Equilibrium and dynamics

In equilibrium we assume factor markets clear, and utility and firm value are maximized. Note that we have not dealt yet with the ambiguity of role of the interest rate \( r_t \). The return on equity requires an externality-premium relative to the interest rate, but it does not fix the level of the interest rate. We should clear the bond market to find an endogenous interest rate. However, this makes the dynamic analysis less straightforward and adds little to the core of the analysis. We choose not to blur the focus of this paper and keep the model tractable. We therefore take the interest \( r_t \) rate as given and constant. One can think of our economy as a small, open economy that faces full capital mobility. Alternatively, there can be trade in government bonds. Since bonds are risk-free externality-free assets and there is no growth, one can view the interest rate as a rate of pure time preference. Since the rate of pure time preference is equal to zero in our model, it would imply that bonds are simply a storing technology.

In equilibrium we can write wages, consumption, and the externality premium in terms of the state variables capital and environmental quality, i.e. \( w_t = w(k_t) = f(k_t) - f'(k_t)k_t, c_t = c(k_t, k_{t+1}) = f(k_t) + (1 - \delta)k_t - k_{t+1}, \) and \( \Delta_t = \Delta(k_t, k_{t+1}, E_t) = \frac{u_{E_{t+1}}}{u_{E_{t+1}}} \). Equations, (2), (15) and (18) can then be used to study dynamic behavior. The paths of the state variables \( k_t, E_t, \) and \( v_t \) fully determine all other variables. In a steady state we have:
\( f'(\hat{k}) = r + \delta + \frac{1 + r}{r + \beta} \hat{\Delta} \) \hspace{1cm} (23)

\[ \hat{E} = -\frac{\hat{k}}{\beta} \] \hspace{1cm} (24)

\[ \hat{\vartheta} = (1 - \delta - \frac{1 - \beta}{r + \beta} \Delta)\hat{k} \] \hspace{1cm} (25)

A hat on a variable denotes its steady state value. Equation (23) and (24) uniquely\(^4\) determine the steady state values for \( k_t \) and \( E_t \), from which the steady state value for \( v_t \) follows directly. Here we require that the standard transversality condition holds; \( \lim_{T \to \infty} \prod_{T_\tau=0}^{T} \frac{V_T}{r_{T_\tau} \cdots r_{T+\tau}} = 0 \).

To study the stability of the steady state and the dynamics of the economy, we first note that the system of three difference equations is decomposable. Equation (2) and (18) define an independent subsystem that can be studied separately, since there is no feedback from \( v_t \) on \( k_t \) and \( E_t \). Before we study the independent subsystem we focus on the difference equation in \( v_t \), the pricing equation for the stock market value of the firm.

Imposing the steady state values for capital and environmental quality and substitute these in (15) and rewrite:

\[ v_{t+1} = (1 + r)v_t - \hat{d} \hat{\Delta} \hat{E} \] \hspace{1cm} (26)

and we see that \( 1 + r > 1 \) is an unstable root of the system. Therefore, provided that the independent subsystem in \( k_t \) and \( E_t \) is stable, the whole system is saddle-point stable.\(^5\)

For given initial values \( k_0 \) and \( E_0 \), the firm value jumps to the saddle-point stable path and hence \( v_0 \) is determinate. Often OLG models, in which assets are traded suffer from indeterminacy of asset prices. The system is then determinate in the sense that for given initial values the whole path of the

\(^4\) Equation (24) is a downward sloping curve and using implicit differentiation we find for (23) that \( dE/dk = [f'(k) - \delta][u'E'/u'E] + \frac{r + \beta}{1 + r (u''E'/u'E)} u''E'/u'E \) which is positive for all \( k \geq 0 \) and \( E \leq 0 \) satisfying (23), so that (23) implicitly defines \( \hat{E} \) as a strictly increasing function in \( \hat{k} \). The implied single crossing property of the two functions defines a unique steady state.

\(^5\) Formally, since (15) is a second order difference equation we need to rewrite the linearized system in four first-order difference equations and calculate the four eigenvalues of the associated matrix. One can show that these are equal to the two eigenvalues of the independent subsystem, \( 1 + r \), and zero.
economy can be derived. However, the initial asset price is not an equilibrium result, but must be exogenously given to the model. In our model, however, if the transversality condition is met, asset prices are fully determined.

In the steady state the total value of the firm is equal to $\hat{m} = \hat{\vartheta} + \hat{b} = \hat{\vartheta} + \hat{\delta} \hat{k} = (1 - \frac{1 - \beta}{r + \hat{\beta}} \hat{\Delta}) \hat{k}$. The market value of the firm is lower than its replacement value $\hat{k}$ because of the externality it generates. Note, however, that this discrepancy between market value and replacement value does not imply that there are arbitrage opportunities. If capital goods are to be used for consumption, production is stopped and so is future pollution. Then, immediately the market value of the firm will jump to its replacement value.

We turn to the stability of the independent subsystem by log-linearizing equations (2) and (18) around the steady state. A variable with a tilde denotes a percentage change from its initial value e.g. $\tilde{k} = d \log k_t$

$$\begin{bmatrix} -f'(\hat{k}) \frac{1 - \beta}{1 + r} \epsilon_{kl} - \sigma_c \hat{\Delta} \hat{k} \frac{\hat{k}}{\hat{E}} & 0 \\ \hat{k} & \hat{E} \end{bmatrix} \begin{bmatrix} \tilde{k}_{t+1} \\ \tilde{E}_{t+1} \end{bmatrix} = \begin{bmatrix} -f'(\hat{k}) \epsilon_{kl} - \sigma_c \hat{\Delta} \hat{k} \frac{f'(\hat{k})}{\hat{E}} \right(1 - \delta) & -\sigma_E \hat{\Delta} \\ 0 & (1 - \beta) \hat{E} \end{bmatrix} \begin{bmatrix} \tilde{k}_t \\ \tilde{E}_t \end{bmatrix}$$

(27)

with $\epsilon_{kl} = \frac{f''(\hat{k})\hat{k}}{f'(\hat{k})}$ the elasticity of substitution between capital and labor, $\sigma_c = \frac{u''}{u_c}$ the elasticity of marginal utility of consumption, and $\sigma_E = \frac{u''}{u_E}$ the elasticity of marginal utility of environmental quality. Since it is always possible to find an interest rate such that the system is stable, we analyze stability in the case where the economy is steady-state efficient, $r = 0$. The loglinearized system can be rewritten as:

$$\begin{bmatrix} \tilde{k}_{t+1} \\ \tilde{E}_{t+1} \end{bmatrix} = \frac{1}{A} \begin{bmatrix} -f'(\hat{k}) \epsilon_{kl} - \sigma_c \hat{\Delta} \hat{k} \frac{f'(\hat{k})}{\hat{E}} \right(1 - \delta) -\sigma_E \hat{\Delta} \\ -\beta(f'(\hat{k}) \epsilon_{kl} + \sigma_c \hat{\Delta} \hat{k} \frac{f'(\hat{k})}{\hat{E}} \right)(1 - \delta) - (1 - \beta) A - \beta \sigma_E \hat{\Delta} \end{bmatrix} \begin{bmatrix} \tilde{k}_t \\ \tilde{E}_t \end{bmatrix}$$

(28)

with $A = -f'(\hat{k}) \frac{1 - \beta}{1 + r} \epsilon_{kl} - \sigma_c \hat{\Delta}$. The absolute value of the determinant of this
Fig. 1. Comparison of steady state equilibria.

The line $0 - a - JP - B$ is associated with equation (24) and any point on this line can be a steady state economic outcome. The curve $E_{min} - A$ is associated with equation (24). Point $A$ is the steady-state equilibrium in a stock-market economy with socially responsible investors. The stock-market assures intra and intergenerational coordination with respect to environmental quality. The arrows reflect the dynamic forces of this equilibrium. Point $JP$ is the steady-state equilibrium of the economy of John and Pecchenino (1994) in which there is only coordination within each generation with respect to environmental quality. Point $B$ reflects an economy without any coordination.

Matrix is less than one if $f'(\hat{k}) - \delta < \frac{\beta}{1 - \beta}$; a necessary condition for stability since in general the determinant of a matrix is equal to the product of its eigenvalues. In a steady state this is equivalent to $\frac{\hat{\beta}}{\beta} < \frac{\beta}{1 - \beta}$ which implies that for we require that the marginal rate of substitution between environmental quality and consumption should not be too high. Furthermore we need that $\sigma_c$ and $\sigma_E$ should not be too large.

In figure 1 the curve $E_{min} - A$ is associated with equation (23), the line $0 - A - JP - B$ with equation (24), and point $A$ with the steady state of the independent subsystem. We also depict the JP steady state as defined by equation (21); an equilibrium in which one requires that the value of the firm is equal to its replacement value at all times. In such an equilibrium environmental quality is too low and invested capital is too high. Finally, if firms maximize pure profits instead of value -which is equivalent to an economy in which investors are not socially responsible- the economy will end up in point $B$ and environmental quality will be even lower, naturally.
As mentioned before, point $A$ is also the first-best optimal steady state equilibrium. Finally, since the social planner finds the same allocation rule as the competitive economy, we argue that the introduction of a stock market does not bring additional restrictions in terms of stability requirements.

4 Conclusion

One of the key issues in achieving sustainable development is managing the impact of economic activity on the environment. In the last decade, corporations have increasingly put sustainable development on their agendas, creating the possibility of socially responsible investment. This paper argues that the stock market can play a role in achieving sustainable development.

We analyze this in a Diamond-type overlapping generations model with short-lived consumers that care about environmental quality, comparable to John and Pecchenino (1994). A lack of coordination between old and young agents leads to overaccumulation of pollution. We show that introducing an equity market that allows for trade of property rights can resolve the coordination failure. The intuition is straightforward: since the stock market is forward looking, equity allows for trade in future valued capital, incorporating the welfare loss of pollution of future generations.

The novelty of this paper lies in how socially responsible investment is modeled in a dynamic setting. Such behavior will only lead to the social optimum if the stock of externalities is considered in firm valuation, not the flow. As such, a socially responsible investor acts as if property rights are assigned to the firm as well as to the stock of pollutants.

Finally, we have focused on a specific externality, namely the intergenerational problems associated with short-lived agents and a long-lived public good. The emphasis has been on environmental issues. However, the idea that proper firm valuation can incorporate negative externalities can be generalized.
References


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