

Papyrakis, Disraios; Gerlagh, Reyer

Working Paper

Natural Resources, Investment and Long-Term Income

Nota di Lavoro, No. 87.2004

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Papyrakis, Disraios; Gerlagh, Reyer (2004) : Natural Resources, Investment and Long-Term Income, Nota di Lavoro, No. 87.2004, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<http://hdl.handle.net/10419/117961>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Natural Resources, Investment and Long-Term Income

Elissaios Papyrakis and Reyer Gerlagh

NOTA DI LAVORO 87.2004

MAY 2004

KTHC – Knowledge, Technology, Human Capital

Elissaios Papyrakis and Reyer Gerlagh, *IVM, Institute for Environmental Studies, Vrije Universiteit*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
<http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm>

Social Science Research Network Electronic Paper Collection:
<http://ssrn.com/abstract=XXXXXX>

The opinions expressed in this paper do not necessarily reflect the position of
Fondazione Eni Enrico Mattei

Natural Resources, Investment and Long-Term Income

Summary

We study the negative correlation between natural resource-abundance and long-term income focusing on the savings-investment channel. We first present empirical evidence on this channel and then develop an OverLapping-Generations (OLG) model to study the issue. In this model, savings adjust downwards to income from natural resources, and investment in capital contributes to knowledge creation, a feature based on endogenous growth theory. We analyze the link from resource income future income through savings and investment. Natural resources have two counteracting effects on income. In the short term, resource wealth augments income, but in the long-term, it decreases income through a crowding-out effect on capital and knowledge. We discuss different scenarios under which the resource curse is most likely to take place.

Keywords: Natural resources, Growth, Investment, OLG models

JEL Classification: E22, O13

Address for correspondence:

Elissaios Papyrakis
IVM/VU
De Boelelaan 1087
1081 HV Amsterdam
The Netherlands
Phone: +31 20 44 49502
Fax: +31 20 44 49553
E-mail: elissaios.papyrakis@ivm.vu.nl

1. INTRODUCTION

Over the last three decades a negative correlation between resource-abundance and economic growth has been observed as a general pattern (Gylfason 2000, 2001a, 2001b, Leite and Weidmann 1999, Papyrakis and Gerlagh 2004, Rodriquez and Sachs 1999, Sachs and Warner 1995, 1997, 1999a, 1999b, 2001). Countries rich in minerals, oil, fish banks and agriculture tend to grow at slower pace compared to resource-scarce countries. Despite the potential beneficial role that resource abundance may play in fostering economic development, experience over the last decades reveals that natural resources seem to frustrate rather than promote economic growth. The OPEC countries, rich in natural wealth, experienced on average a negative rate of GDP per capita growth over the last four decades (Gylfason 2001b). Alaska, the richest U.S. state in natural resources with vast fish banks and oil reserves, was the only U.S. state experiencing a negative income growth rate the last two decades. In contrast, resource-scarcity was no obstacle to economic development for countries such as Switzerland, Singapore, Japan and South Korea that surged ahead during the last decades.

Figure 1 illustrates the relation between natural resources and income with a scatter plot of 84 countries. Growth of GDP per capita between 1975-96, adjusted for initial income, has been set out against resource-abundance as measured by the share of natural capital in total capital. The figure also presents the estimated regression line and the adjusted- R^2 . Data on GDP per capita and natural capital are provided by the 6.1 Penn World Tables of the Center for International Comparisons at the University of Pennsylvania (CIC), (2002) and the World Bank (1997) respectively.³ As shown in the figure, there is a significant negative statistical association between the two variables. An increase in the natural capital share by 10% results in a decrease of annual

³ Although earlier observations on natural capital would be preferable in order to avoid endogeneity, 1994 is the only year for which data on natural capital are available from the World Bank Database. Gylfason (2001) argues that the share of natural capital is still a good proxy for resource-abundance, since resource-abundance is not a variable varying substantially over time. Indeed, the results in all tables can be reproduced by using alternative measures of resource abundance, such as the Sachs and Warner (2002) measure of the share of primary exports in GDP in 1971 or the share of agricultural production in GDP for the same year.

growth by about 0.8%. The regression line shows that on average, a natural capital share of around 12% implies economic stagnation in terms of growth.

In the literature, the resource curse is often associated with a crowding-out logic (Sachs and Warner 2001). Natural resources are not harmful to growth per se but tend to crowd-out growth-promoting activities. We mention three channels. First, natural resources reduce institutional quality, as they induce rent-seeking behaviour and corruption. Gains from bribing officials and from forming politically powerful interest groups to obtain privileged access to the resource-rents rise (Krueger 1974, Leite and Weidmann 1999, Gray and Kaufmann 1998, Torvik 2002). Second, resource-abundance tends to deteriorate the terms and reduce the degree of openness. A major cause is an overvaluation of the local currency and the resulted loss of competitiveness, as well as the imposition of tariffs and quotas that are supposed to protect domestic producers (Auty 1994, Torvik 2001, Sachs and Warner 1995). Third, natural resources reduce the investment in high-quality education and skilled-labour. Resource booms are often followed by a contraction of the manufacturing sector, for which human capital is an important production factor and the demand and returns to educational quality successively decline as well (Gylfason 2001a, Sachs and Warner 1999b).

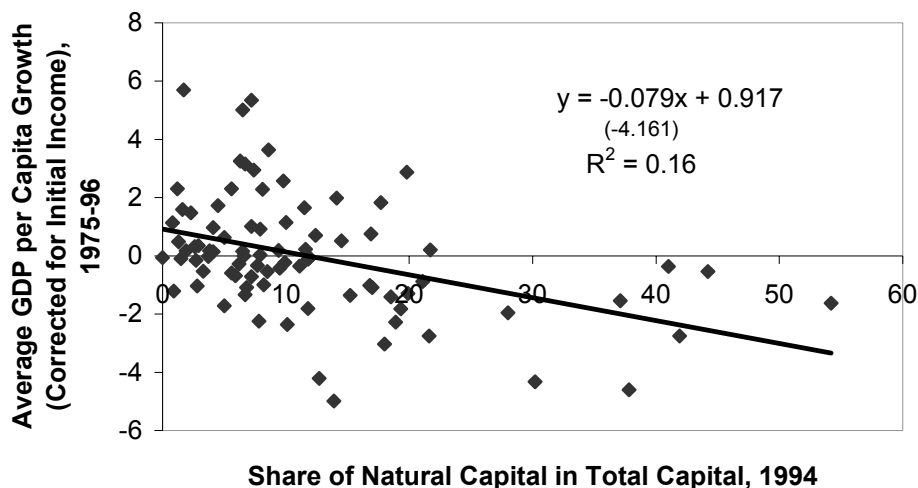


Figure 1. *Resource-Abundance and Economic Growth*

This paper is concerned with a fourth channel, namely the role of resource-abundance in crowding-out investments. Papyrakis and Gerlagh (2004, Table 4) argue that the investment channel is probably the most important channel in terms of its contribution to the resource curse. There are various mechanisms that can explain the crowding out of investments. World prices for primary commodities tend to be very volatile and this creates uncertainty for investors in resource-abundant economies (Sachs and Warner 1999b). Additionally, resource booms reallocate factors of production from the manufacturing sector to the primary sector. Since it is often the manufacturing sector that is characterized by increasing returns to scale and positive externalities, this shift in production factors reduces the productivity and profitability of investments (Sachs and Warner 1995, 1999a, Gillis *et al.*1996). As another mechanism, Atkinson and Hamilton (2003) show that governments often spend resource rents on public consumption. The few countries that use resource rents for public investments are those that have avoided the resource curse.

Our analysis combines the insights from the various studies mentioned above. We develop an overlapping-generations model to demonstrate how public spending of resource rents decreases national savings. Furthermore, we show that the decrease in the level of investment is exacerbated when, in turn, labor productivity (through technology or education) depends on the level of investment. The decline in income may more than offset the increase in resource revenues, when we take account of the decrease in savings and the responsiveness of technology to investment.

The paper is organized as follows. Section 2 provides empirical evidence to the negative correlation between alternative measures of resource-abundance and savings, investment, and growth. Section 3 presents the OLG model, and explains how resource-abundance crowds-out savings and investment. Section 4 compares the steady states of the OLG model under different parameter scenarios and provides numerical examples of the resource curse hypothesis under alternative assumptions. Section 5 concludes.

2. EMPIRICAL EVIDENCE: RESOURCE-ABUNDANCE, SAVINGS, INVESTMENT AND GROWTH

In this section we graphically depict correlations between several measures of resource-abundance, savings, investment and growth in order to establish empirically the relations that we study in our theoretical analysis of section 3. Data on GDP per capita, investment and savings are provided by the 6.1 Penn World Tables of the Center of International Comparisons at the University of Pennsylvania (CIC), (2003). Data on natural capital and agricultural production are provided by the World Bank (1997) and the Sachs and Warner dataset at the Center for International Development at Harvard University (CID), (2002). The causal chain linking resource-abundance to economic performance we study here operates in three steps: first, resource-abundance discourages national savings, second, lower national savings frustrate investment, and third, lower investment slows down economic growth.

Figures 2 and 3 depict a scatter plot of the share of net national savings in GDP set out against two measures of resource abundance. Both scatter plots indicate that resource-abundance tends to significantly decrease the level of savings in the economy.⁴ Figure 2 points out a significantly negative correlation between national savings and the share of agriculture in GDP. Agricultural production can explain by itself almost half of the overall variation in savings across the sample of 107 countries. It is striking to see that negative net national savings throughout the period 1975-96 characterizes the majority of countries with a share of agricultural production above 35%. Many resource-abundant countries seem to suffer from over-debt problems. Sao Tome and Principe, where agriculture makes up about a quarter of the total economy, has the lowest net savings rate of the sample. Over the last two decades, it had an average current account deficit ratio of almost -40%, and a debt value as a percentage of GDP close to 400% at the end of the 90's.

⁴ The correlation is significant at the 1% level in both scatterplots.

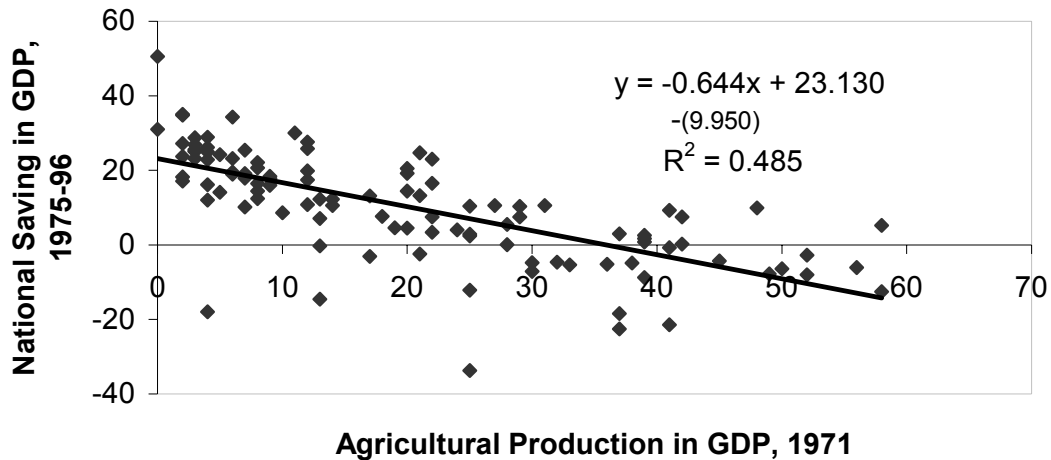


Figure 2. *Savings and Agriculture*

Figure 3 shows a similar scatter plot for 84 countries taking the share of natural capital in total wealth as a proxy of resource-abundance. The results are equally revealing and the negative correlation is highly significant at the 1% level. We notice also that the coefficients for natural wealth are of similar magnitude in both regressions.

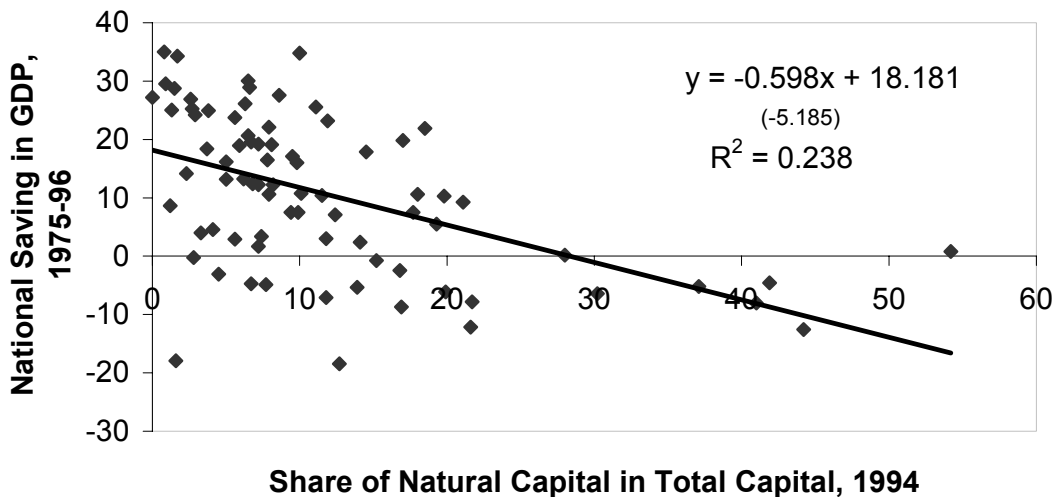


Figure 3. *Savings and Natural Capital*

As a second step, we investigate whether our data support the assumed positive correlation between savings and investment. Figure 4 depicts, for a cross-sectional sample of 113 countries, the relation between net national savings and domestic investment for the 1975-96 period. Indeed,

we find a highly significant and positive correlation between the two variables. The correspondence is less than one-to-one, which is not surprising, since foreign investment can compensate for a lack of national savings when an economy offers attractive opportunities. Nonetheless, it is a resource-scarce country, Singapore, which has an agricultural product close to zero, with the highest savings and investment ratio: above 44%.

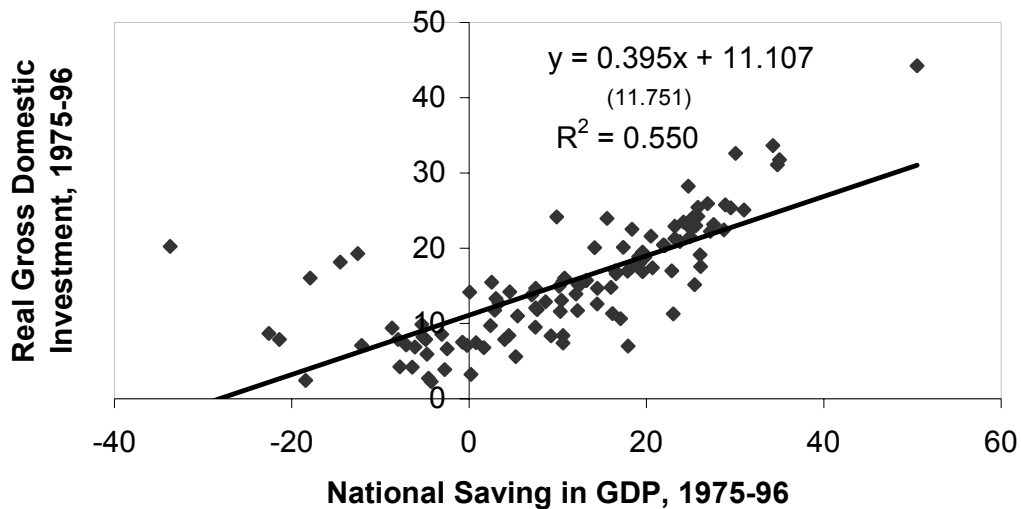


Figure 4. *Investment and Savings*

The sample used for Figure 4 is fairly diverse; the relation between national savings and domestic investments becomes stronger when we focus on a more homogeneous group of countries, such as a sample of 27 OECD countries. Figure 5 is restricted to this group, and shows that savings can explain almost all variation in investment levels, and the estimated coefficient almost doubles. In OECD countries, most of the national savings is converted into investment.

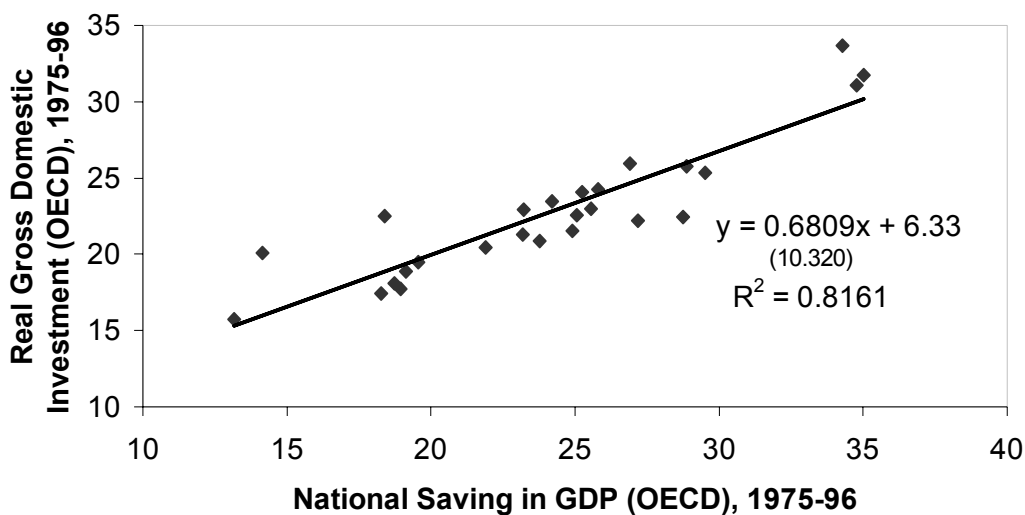


Figure 5. *Investment and Savings (OECD)*

Finally, Figure 6 shows the significant and positive correlation between economic growth and investment for a cross-sectional sample of 113 countries. We corrected economic growth for initial income, so that our data reflect the economic growth rate explained by other factors than convergence. A 10% increase in the investment ratio increases on average the annual economic growth rate by almost 1.4%. To summarize, our data reveal three major relationships: first, resource-abundance varies inversely with savings, second, investment is positively correlated to savings, and third, economic growth depends positively on investment. Together, there seems to be ample statistical evidence that investment is a significant crowding-out channel through which resource-abundance frustrates economic growth.



Figure 6. *Investment and Growth*

3. MODEL SPECIFICATION

The model employed in this paper extends the usual OLG models by containing reference to a primary sector that provides the consumers with pure resource rents, and by including a technology spill-over from the capital stock to a labour productivity variable. The model distinguishes discrete time steps, $t \in \mathbf{T} = \{1, \dots, \infty\}$.

A. Demography

We assume that in every interval two generations live, an old and a young generation. At the beginning of a period, a new generation enters the model and the previously old generation leaves the model, so that there is a turnover in population. Each generation is indexed by their date of entering the model t (as a subscript). Each individual's lifetime consists of two periods. The generations work when young and live from savings when old. We thus only examine the adult part of the life-cycle, i.e. from the age of 20 onwards, and each interval consists of a period of about 30 years. Population grows exponentially at a rate n :

$$L_t = (1+n)L_{t-1} \quad (1)$$

where L_t stands for the population size. Each individual provides inelastically one unit of labour during her youth time and retires at the second period of her lifetime. Therefore L_t also measures the supply of labor.

B. Producers

There is a simple production sector for a man-made consumer good Y_t , where physical capital K_t , technology h_t and labour L_t are combined to produce output Y_t . We assume a constant returns to scale Cobb-Douglas production function for the economy:

$$Y_t = K_t^\alpha (h_t L_t)^{1-\alpha}, \quad 0 < \alpha < 1. \quad (2)$$

Setting $y_t = Y_t/L_t$ and $k_t = K_t/L_t$ we can rewrite the production process in its intensive form:

$$y_t = k_t^\alpha h_t^{1-\alpha} \quad (3)$$

We assume a simple form of learning-by-doing based on the endogenous growth models developed by Romer (1990) and Aghion and Howitt (1992), where human capital or technology h_t is a by-product of physical capital production. The rate of knowledge or technological accumulation depends directly on the rate of physical capital accumulation. We assume the following specification for the level of technology or knowledge:

$$h_t = k_t^\pi, \quad 0 < \pi < 1 \quad (4)$$

Since each period covers about 30 years, we assume that the capital of the previous period fully depreciates, and we set the capital stock equal to the level of investment of the previous period,

$$k_t = i_{t-1}/(1+n). \quad (5)$$

Markets for labour and capital are competitive so that the interest rate and labour wage per labour unit are given by:

$$r_t = \alpha k_t^{\alpha-1} h_t^{1-\alpha} - 1, \text{ and} \quad (6)$$

$$w_t = (1-\alpha) k_t^\alpha h_t^{1-\alpha}, \quad (7)$$

respectively. Taking account of the endogenous channel for human capital (eq.(4)) the output, interest, and wage equations become:

$$y_t = k_t^{\alpha+(1-\alpha)\pi} \quad (8)$$

$$r_t = \alpha k_t^{(\alpha-1)(\pi-1)} - 1, \quad (9)$$

$$w_t = (1-\alpha) k_t^{\alpha+\pi(1-\alpha)}. \quad (10)$$

C. Consumers

Each generation maximises its lifetime utility derived from its two-period consumption scheme. Its utility function $U(c_t^t, c_{t+1}^t(1+n))$ only depends on consumption per capita in the two periods c_t^t and $c_{t+1}^t(1+n)$ and is assumed to be logarithmic, which implies a unitary inter-temporal elasticity of consumption. The variable c_{t+1}^t denotes the consumption of the old in period $t+1$, divided by L_{t+1} , whereas c_t^t is defined as the consumption of the old in period t divided by L_t ; the multiplication with $(1+n)$ corrects for this change in unit of measurement. Thus:

$$U_t = \ln c_t^t + [1/(1+\rho)] \ln [c_{t+1}^t(1+n)], \quad (11)$$

where $\rho > -1$ is the pure rate of time preference. Higher values of ρ represent a larger preference for current compared to future consumption. The restriction $\rho > -1$ rules out a negative weight on second-period consumption. Notice that the utility function is differentiable, concave and strictly increasing in its arguments.

Each generation divides its labour income (wages) in the first period between its first period consumption and savings, s_t . These savings are used to finance their second period consumption.

$$c_t^t + s_t = w_t, \quad (12)$$

$$c_{t+1}^t = [(1+r_{t+1})/(1+n)]s_t. \quad (13)$$

where w_t , r_{t+1} , c_t^t and c_{t+1}^t indicate the first-period wage, the interest rate between the first and second-period, and the level of consumption per capita during her two lifetime periods. Notice that when writing variables in intensive form, we should correct for population growth. Over the two periods, the present value of an individual's consumption stream is equal to labour income:

$$c_t^t + c_{t+1}^t (1+n)/(1+r_{t+1}) = w_t, \quad (14)$$

Now, we extend the economy with a natural-resource base (e.g. oil reserves) that generates resource rents G_t , or g_t per person, at period t . For convenience of the analysis, these rents are assumed to be a proportion q of that period's total income Y_t . In the appendix, we show that results do not change much when resource rents are assumed independent of the income level Y_t . The distribution of resource rents over generations will determine its effect on savings. We distinguish two resource policies. First, resources are considered public property and the rents are used to pay for public expenditures such as social security. Second, resources are considered common property and the rents are equally distributed over all consumers. This paper focuses on the first resource policy, when resource rents are used for public expenditures. In the appendix, we briefly analyse the second case.

We assume that the resource rents are used for social security; i.e. in every period, resource rents are paid to the retired generation. The second-period budget constraint becomes:

$$c_{t+1}^t = [(1+r_{t+1})/(1+n)]s_t + qy_{t+1}. \quad (15)$$

The inter-temporal budget constraint adjusts to:

$$c_t^t + c_{t+1}^t (1+n)/(1+r_{t+1}) = w_t + qy_{t+1}(1+n)/(1+r_{t+1}). \quad (16)$$

Each generation maximises utility subject to the budget constraint. The first order conditions with respect to consumption provide us with the Euler equation for the inter-temporal consumption allocation:

$$c_{t+1}^t = c_t^t [(1+r_{t+1})/(1+n)(1+\rho)] \quad (17)$$

The distribution of consumption over time does not depend on resource-income or labour income. It only depends on the interest rate, population growth, and the pure rate of time preference.

Substitution of the Euler equation in the budget constraint (eq.(16)) gives consumption c_t^t as a function of the interest rate, the rate of time preference, population growth, and labour and resource income. Thus:

$$c_t^t = [(1+\rho)/(2+\rho)][(w_t + qy_{t+1}(1+n)/(1+r_{t+1})] \quad (18)$$

Savings, s_t , will be given by:

$$s_t = w_t - c_t^t = [1/(2+\rho)] w_t - [(1+n)(1+\rho)/(2+\rho)(1+r_{t+1})] qy_{t+1}. \quad (19)$$

The savings curve is upwards-sloping with respect to the interest rate. An increase in the interest rate lowers the net present value of the resource revenues and increases the need for savings. When substituting for y_t , r_t and w_t from equations (8), (9), and (10), the savings equation becomes:

$$s_t = [(1-\alpha)/(2+\rho)] k_t^{\alpha+\pi(1-\alpha)} - [(1+n)(1+\rho)/(2+\rho)\alpha] qk_{t+1} \quad (20)$$

D. Equilibrium

The commodity balance is given by:

$$c_t^{t-1} + c_t^t + i_t = (1+q)y_t, \quad (21)$$

where c_t^{t-1} , c_t^t and i_t stand for total consumption of the older and younger generation and total investment, respectively. Equation (21) indicates that total production inclusive of resource rents

can be used for either consumption or investments. The value of consumption of the older generation is equal to the value of capital rents, αy_t , plus resource rents, qy_t . Thus, (15) can be restated as:

$$c_t^{t-1} = (\alpha + q)y_t \quad (22)$$

The remainder of the manufactured income $(1-\alpha)y_t$ is used by the younger generation to both consume and save. Thus, equation (12) becomes:

$$c_t^t + s_t = (1-\alpha)y_t \quad (23)$$

Equations (21)-(23) combined reveal the saving-investment balance:

$$i_t = s_t. \quad (24)$$

The savings-investment balance, together with the capital identity (5) and the savings equation (20), enables us to write the equilibrium as a recursive dynamic equation for k_t :

$$(1+n)k_{t+1} = [(1-\alpha)/(2+\rho)] k_t^{\alpha+\pi(1-\alpha)} - [(1+n)(1+\rho)/(2+\rho)\alpha]qk_{t+1} \quad (25)$$

Rearranging terms provides k_{t+1} as a function of k_t :

$$k_{t+1} = \psi(k_t) = \frac{\alpha(1-\alpha)}{(1+n)[(2+\rho)\alpha + (1+\rho)q]} k_t^{\alpha+\pi(1-\alpha)} \quad (26),$$

where $\psi' > 0$, $\psi'' < 0$, $\psi(0) = 0$, $\psi'(0) = \infty$, $\psi'(\infty) = 0$. This implies that the sequence k_t is convergent, and there is a unique non-trivial equilibrium level of capital per person denoted by k^* .

We set $k_{t+1} = k_t$ in equation (26) in order to calculate the steady-state value of capital per capita.

This provides us with:

$$k^* = \left[\frac{\alpha(1-\alpha)}{(2+\rho)(1+n)\alpha + (1+\rho)(1+n)q} \right]^{1/(1-\alpha)(1-\pi)} \quad (27)$$

Similarly, the steady-state value of man-made output per capita is given by:

$$y^* = \left[\frac{\alpha(1-\alpha)}{(2+\rho)(1+n)\alpha + (1+\rho)(1+n)q} \right]^{\frac{\alpha+\pi(1-\alpha)}{(1-\alpha)(1-\pi)}} \quad (28)$$

As the parameter q positively enters the denominator and the power coefficients are positive, it follows immediately from these equations that the capital stock and output are decreasing in the resource wealth parameter q , as stated in the next proposition.

Proposition 1. *An increase in the share q of resource rents in income results in a decrease in the steady-state levels of capital and output.*

The responsiveness of output to resource rents depends, to a large part, on the spill-over effects of capital on technology, π . From equation (28), we derive the relative increase of steady-state output y^* with respect to the resource share q , that is the semi-elasticity:

$$\frac{dy^*}{dq} \frac{1}{y^*} = - \frac{\alpha + \pi(1-\alpha)}{(1-\pi)(1-\alpha)} \frac{(1+\rho)}{(2+\rho)\alpha + (1+\rho)q} < 0 \quad (29)$$

In turn, taking the derivative of $(dy^*/dq)/y^*$ with respect to π , we find,

$$\frac{d\{(dy^*/dq)/y^*\}}{d\pi} < 0 \quad (30)$$

That is, a larger value for π intensifies the negative effect of resource revenues on the steady state levels of capital and man-made income. This result is stated in the next proposition.

Proposition 2. *A large responsiveness of technology to capital accumulation, as captured by π , enhances the negative impact of resource wealth on the steady-state levels of capital and man-made income per person.*

Furthermore, as we can see from (29), the impact of resource rents on long-term output is independent of population growth.

4. The Resource Curse

For the resource curse to materialize, the decrease in output should exceed the increase in income brought by the resource rents. In order to investigate the effect of resource rents on total income, $(1+q)y^*$, we compare an initial situation, denoted with subscript ‘0’, in which there is a negligible proportion of man-made income $q_0 = 0$, with an alternative situation after a resource boom, denoted with subscript ‘1’, when a resource base is discovered and revenues account for 10% of man-made income, $q_1 = 0.1$. The change in resource income is about one standard deviation of the share of natural capital in GDP used for Figure 1 in the introduction.

We use a set of parameter values to test the dependence of the resource curse thereon. In the baseline, we set the discount factor ρ equal to one, which implies that individuals value their first-period consumption twice as much their second period consumption. In terms of pure time preference, for periods of 30 years, this assumption is equivalent to a pure rate of time preference of 2.3 per cent annually. We assume an annual population growth rate of 1%, which is approximately equivalent to a rate of 35% for a period of thirty years.⁵ We consider ranges for both parameters as the analysis proceeds. We allow the capital share α to vary between 0.30 and 0.70. The lower value is a reasonable approximation for a narrow concept of physical capital (see, e.g. Romer 1996 ch.3), while the latter parameter value is reasonable if we interpret capital k_t broadly to consist of human capital as well (e.g. see Mankiw, Romer and Weil 1992 and Romer

⁵ This is the population growth rate for Canada and the U.S. in 1999 (World Bank (WB), 2003).

1996 p.134).⁶ In the first case, h_t can be thought of as a measure of both technological and educational improvements induced by capital investments. In the latter case, h_t stands for technological advancement rather than educational quality. Finally, we let the technological parameter π of the endogenous technological channel vary between 0 and 0.9. We evaluate the steady-state values for total income $(1+q)y^*$ before and after the resource boom, assuming the above parameter values. We calculate the steady-state income differential created by the resource exploitation. The resource curse is defined as the negative relative income change,

$$RC = 1 - \frac{y_1^*(1+q_0)}{y_0^*(1+q_1)} \quad (31)$$

The results are depicted in Figure 7. The vertical axis presents the steady-state income differential defined by (31). Positive values imply that resource exploitation results in a lower steady-state income per capita. The legend on the right hand side of the figure divides the figure area according to the magnitude of the resource curse.

⁶ Barro and Sala-I-Martin (1992 p.226) set α equal to 0.80 for an augmented measure of capital.

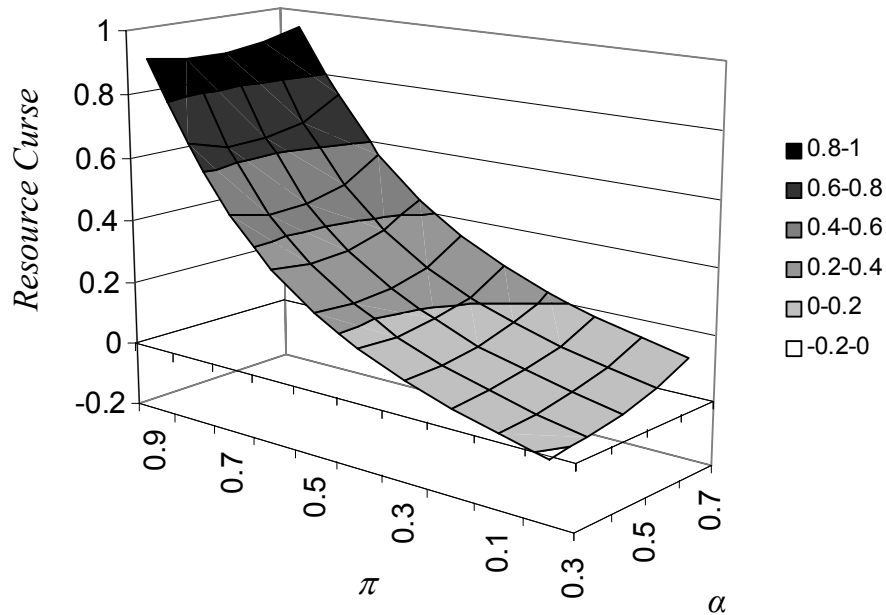


Figure 7. *Decrease in income following a 10% increase in resource revenues, dependence on the technology spillover (π) and the capital share (α).*

As Figure 7 depicts, for almost all parameter values, the steady-state income per capita decreases when resource rents enter the economy. Only for the lowest values of π and α , assuming a narrow concept of capital and the absence of capital spill-over effects, the economy benefits from the resource rents.

As the occurrence of a resource curse depends to a large extent on the value for the technological parameter π , we investigate which is a plausible range of values for it. Linearizing equation (20) around k^* shows that the economy converges to its balanced growth path at a rate $\alpha + \pi(1 - \alpha)$:

$$k_{t+1} - k^* \simeq [\alpha + \pi(1 - \alpha)](k_t - k^*). \quad (32)$$

Most econometric studies find an annual convergence speed in the range between 0.005 and 0.025, depending on the set of additional variables included and the time span under investigation (e.g. Gylfason 2001a p.856, Barro and Sala-I-Martin 1992 p.242, Kormendi and Meguire 1985 p.149, Mo 2000 p.72, Sachs and Warner 1995 p.24). For a 30-year period, we calculate that the

factor $\alpha + \pi(1-\alpha)$ should lie in the range $[0.47, 0.85]$. For $\alpha=0.3$, this range is consistent with $\pi \in [0.24, 0.79]$. For $\alpha=0.7$, this range is consistent with $\pi \in [0.0, 0.46]$. For all possible pairs (α, π) that produce a rate of convergence in the abovementioned range, the resource curse is minimal for the pair $\alpha=0.30, \pi=0.24$, when it has the value 0.078. It is maximal for the pair $\alpha=0.3, \pi=0.79$, when it has the value 0.657. The numerical calculations confirm the presence of a resource curse for the plausible range of parameters.

As a further check of our results, we also investigate how changes in the discount factor ρ affect the resource curse effect. An increased value of ρ enhances the resource curse, as can be calculated by equation (29):

$$\frac{d\{(d y^* / d q)(1 / y^*)\}}{d \rho} = \frac{\alpha + \pi(1 - \alpha)}{(1 - \pi)(1 - \alpha)} \frac{q\alpha}{(2 + \rho)\alpha + (1 + \rho)q} < 0 \quad (33)$$

Barro and Sala-I-Martin (1992 p.226) assume a rate of pure time preference of 0.05 per year for their calibrations for the U.S. This approximates a parameter value ρ of 3.35 for a period of 30 years. One could claim that for a developing country this parameter value could be even higher, since consumers in the developing world tend to value current consumption more compared to uncertain future consumption. Kotlikoff and Summers (1981) assume a range of (0.02, 0.07) for their yearly discount factor for their calibrations, which implies that the parameter value ρ lies approximately in the (0.8, 6.6) range for a 30-year period. For our robustness check, we set the capital share α and the population growth rate n equal to 0.3 and 0.35, respectively, and let the technological parameter π vary as aforementioned. We allow the discount factor ρ to vary between 1 and 6, so that the values remain in the range adopted by Kotlikoff and Summers (1981). We calculate the resource curse effect and present our results in Figure 8. For increased values of ρ , the resource curse becomes more acute. For instance, for a π value of 0.5, an increase of the discount rate from 1 to 6 amplifies the resource curse from 0.242 to 0.316.

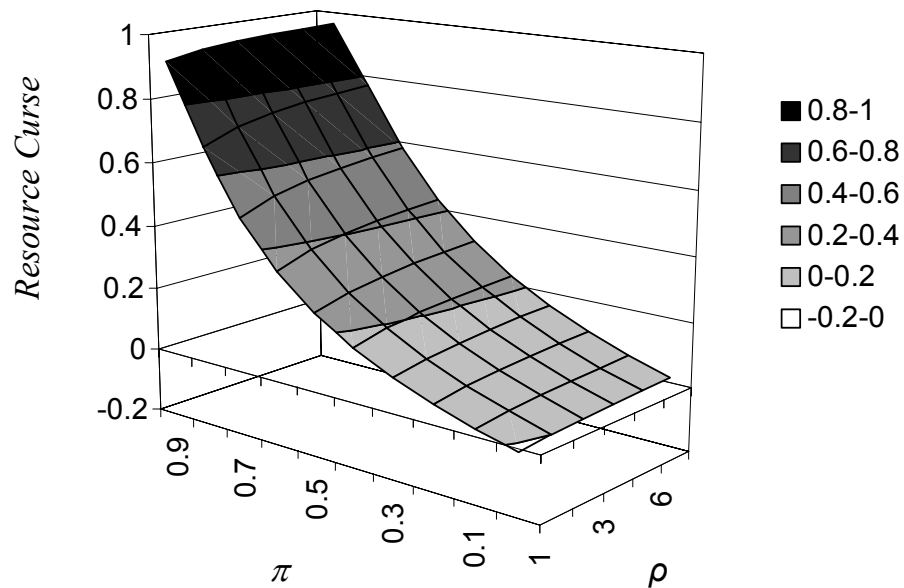


Figure 8. *Decrease in income following a 10% increase in resource on technology spillover (π) and the rate of time preference (ρ).*

Finally, we investigate whether our measurements in Figures 7 and 8 conform with empirical results found in the literature. Papyrakis and Gerlagh (2003) estimate the resource curse effect for revenues from mineral production, for the 1975-96 period, for a sample of 39 countries. They conclude that an increase in resource income of 10% decreases long-term income per capita by 60%, about half of which (30%) is due to a drop in investments in capital and education. The 30% decrease can be reproduced by our model for a set of parameters, e.g. for $(\alpha, \pi, \rho) = (0.3, 0.5, 4)$, or $(0.5, 0.6, 1)$, or $(0.7, 0.4, 1)$.

5. Conclusions

During the last three decades, a tendency has been observed of resource-abundant countries to grow at a relatively slow pace. In this paper, we have focused on a situation in which resource income decreases the incentive to save and invest. The focus has been motivated by earlier papers and by empirical data analysis.

We have developed a stylized model in which technology (or education) depends endogenously on the level of investment. In this setting, increasing resource rents lead to a decrease in investment that multiply over time, and long-term income substantially diminishes. For most of the reasonable parameter values, the effect of the decline in investment more than offsets the increase in income through resource revenues. Our analysis also reveals that the resource curse worsens with an increasing elasticity of output to capital and with a larger inter-temporal pure rate of time preference.

The mechanism described here provides an explanation to the resource-curse hypothesis that is an alternative to the mechanisms described in earlier literature. From the literature, we know that resource rich countries tend to suffer from currency overvaluations and loss of competitiveness (Corden 1984), enhanced corruption and rent-seeking (Krueger 1974, Torvik 2002), bad-decision making (Sachs and Warner 1999b, Auty 2001), political instability (Collier and Hoeffler, 1998) low levels of educational quality (Gylfason 2001a), and low capital investment (Atkinson and Hamilton, 2003). Papyrakis and Gerlagh (2004) claim that the last-mentioned channel is most important in explaining the resource curse phenomenon. In this paper, we describe a mechanism to explain this transmission channel, focusing on the role of resource abundance in crowding-out savings by enhancing future income for which no savings are required. Assuming that labor productivity depends endogenously on the level of investment, the decrease in savings and investment leads to a decline in output that exceeds the increase in resource income, thus producing the resource curse. Such a mechanism can help to understand why resource-abundant countries are characterized by smaller shares of savings and investment in their GDP and lack behind in terms of long-run income.

APPENDIX

A. Exogenous versus endogenous resource rents

The dynamics of our analysis are much simplified by assuming a constant share of resource rents in man-made income over time, $G = qY$, for constant q . It can be the case, though, that resource revenues are an either increasing or decreasing proportion of man-made income y as time evolves. Figure 9 depicts the relationship between the share of primary exports in GDP in 1990 and 2001. Data are compiled from the United Nations (UN, 2003) Database of Human Development Indicators. As the figure shows, the share of primary exports remained fairly stable over a period of eleven years. For instance, the share of primary exports in GDP fell from 30 to 29% for Panama and rose from 42 to 44% for Kuwait.

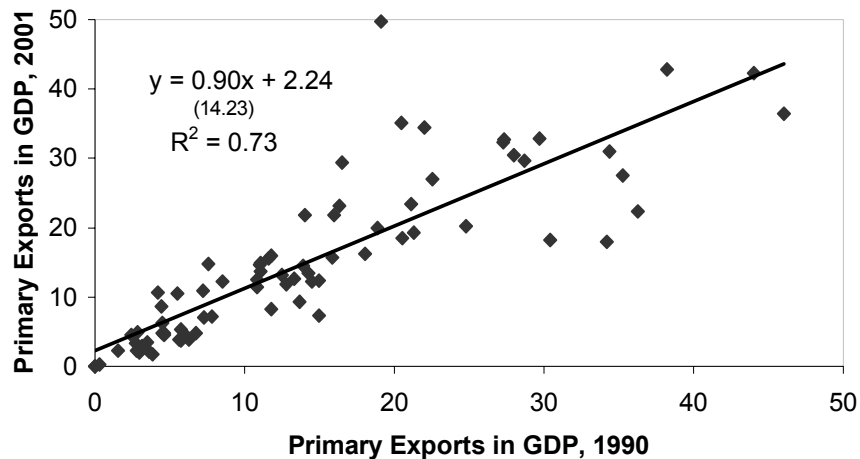


Figure 9. *Share of primary exports in GDP over time*

Still, the objective of this appendix is to show that our steady state model results carry over to an economy where total resource rents R are exogenous with an adjusting share in total income q , instead of the opposed assumption made in the main text. *Figure 10* is helpful in this respect; it depicts the relation between q , y^* , and g . It shows the steady state levels of man-made income y^* , resource income g , and total income $y^* + g = (1+q)y^*$, as functions of q . We adopt the following values for the capital share, $\alpha=0.4$, the discount factor, $\rho=2$, the population growth rate, $n=1$ and

the technological externality, $\pi=0.5$. The figure shows that, as q increases, the steady-state man-made income y^* decreases (Proposition 1). Furthermore, steady-state income per capita $y^*+g^*=(1+q)y^*$ strictly decreases in q . Resource rents g^* (equal to qy^*) increase initially, and then decrease after a certain value of q , that is, when the decrease in output y^* more than offsets the increase in q .

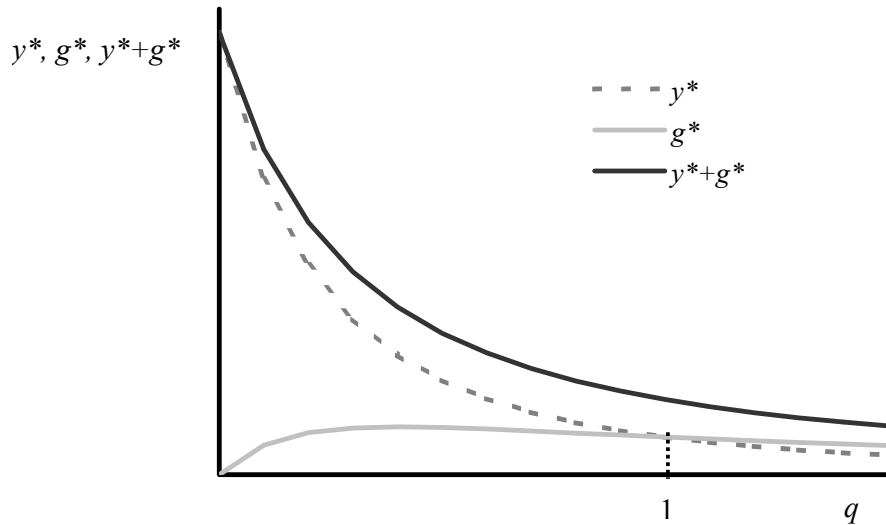


Figure 10. *Resource income g , man-made income y^* , and total income y^*+g*
Graph based on $\alpha=0.4$, $\pi=0.5$, $\rho=2$, $n=1$.

Consider the case that a resource starts to be exploited and revenues R are constant and independent of other income sources y . The steady-state per capita income level y^* decreases due to the resource revenues, and as the economy shifts to the new equilibrium, the share of resource revenues in total income q will gradually increase over time.⁷ Consequently, for fixed total resource revenues R , the resource curse will turn out worse when compared to a situation where q is constant.

⁷ We implicitly assume that an economy is initially on a steady-state point. The assumption is inessential to the argument.

B. The case of equal intergenerational distribution of resource rents

As an alternative scenario of distribution of the resource rents G_t , we assume that the rents are equally distributed between the young and the old generation. Since population increase at an exogenous growth rate n , this implies that $(1+n)/(2+n)$ share of the resource rents accrues to the younger generation and the rest $1/(2+n)$ to the older one. The commodity balance for the consumer good is the same as in equation (21). The older generation consumes in period t the resource rents $[1/(2+n)]G_t$ and the savings from period $t-1$, which is a share α of manufactured income. Thus, equation (22) becomes

$$c_t^{t-1} = (\alpha + q/(2+n))y_t \quad (34)$$

The remainder of manufactured income $(1-\alpha)y_t$ and resource rents $[(1+n)/(2+n)]G_t$ are used by the younger generation to both consume and save. Thus, equation (23) becomes

$$c_t^t + s_t = (1-\alpha + q(1+n)/(2+n))y_t \quad (35)$$

Equations (21), (34) and (35) combined reveal that the saving-investment balance (24) is maintained. By considering the inter-temporal budget constraint for each generation, as in equation (12)-(19), we can adjust the savings equation (20), and reproduce the recursive dynamic equation for k_t as in (25):

$$\begin{aligned} (1+n)k_{t+1} = & [(1-\alpha)/(2+\rho) + (1+n)q/(2+\rho)(2+n)]k_t^{\alpha+\pi(1-\alpha)} \\ & - [(1+n)(1+\rho)/(2+\rho)(2+n)\alpha]qk_{t+1} \end{aligned} \quad (36)$$

We set $k_{t+1} = k_t$ in order to calculate the steady-state value of capital per capita. This provides us with the equivalent of (27):

$$k^* = \left[\frac{(1-\alpha)(2+n)\alpha + (1+n)\alpha q}{(1+n)(2+\rho)\alpha(2+n) + (1+\rho)(1+n)q} \right]^{1/(1-\alpha)(1-\pi)} \quad (37)$$

For $q=0$, the two equations (27) and (37) produce the same steady state capital stock k^* . Under the scenario of equal distribution of resource rents, however, resource revenues have smaller effect on the capital stock, dk^*/dq has decreased. Thus, an equal distribution of resource rents is less harmful to investments than the social security scheme.

REFERENCES

- Aghion, Philippe, and Howitt, Peter, "A Model of Growth through Creative Destruction." *Econometr.* **56**, 2:323-351, Mar. 1992.
- Atkinson, G. and K. Hamilton, "Savings, growth and the resource curse hypothesis" *World Develop.* **31**: 1793-1807, 2003.
- Auty, Richard M., "Industrial Policy Reform in Six Large Newly Industrializing Countries: The Resource Curse Thesis." *World Develop.* **22**, 1:11-26, Jan. 1994.
- Barro, Robert J., and Sala-I-Martin, Xavier X., "Convergence." *J. Pol. Econ.* **100**, 2:223-251, Apr. 1992.
- Center for International Comparisons at the University of Pennsylvania (CIC), 2002. Data on GDP and domestic investment from Penn World Tables 6.0. Available at <http://pwt.econ.upenn.edu>. Philadelphia: CIC.
- Center for International Development at Harvard University (CID), 2002. Sachs and Warner Dataset, Data on Mineral Production, Openness, the Terms of Trade and Schooling. Available at <http://www.cid.harvard.edu/ciddata/ciddata.html>. Cambridge, Massachusetts: CID.
- Gillis, Malcolm, Perkins, Dwight H., Roemer, Michael, Snodgrass, Donald R., 1996. *Economics of Development*. Norton, New York.
- Gray, Cheryl W., and Kaufmann, Daniel, "Corruption and Development." *Finance and Development.* **35**, 1:7-10, March 1998.
- Gylfason, Thorvaldur, "Resources, Agriculture, and Economic Growth in Economies in Transition." *Kyklos.* **53**, 4:545-580, 2000.
- Gylfason, Thorvaldur, "Natural Resources, Education, and Economic Development." *European Econom. Rev.* **45**, 4-6: 847-859, May 2001a.
- Gylfason, Thorvaldur, "Nature, Power and Growth." *Scot. J. Polit. Economy.* **48**, 5:558-588., Nov. 2001b.
- Kormendi, Roger C., and Meguire, Philip G., "Macroeconomic Determinants of Growth: Cross-Country Evidence." *J. Monet. Econ.* **16**, 2:141-163, Sept. 1985.
- Kotlikoff, Laurence J., and Summers, Lawrence H., "The Role of Intergenerational Transfers in Aggregate Capital Accumulation." *J. Polit. Economy.* **89**, 4:706-732, Aug. 1981.
- Krueger, Anne O., "The Political Economy of the Rent-Seeking Society." *Amer. Econom. Rev.* **64**, 3:291-303, June 1974.
- Leite, Carlos, and Weidmann, Jens, "Does mother Nature Corrupt? Natural Resources, Corruption and Economic Growth," IMF Working Paper No 99/85, Washington, DC: International Monetary Fund, July 1999.
- Mankiw, Gregory N., Romer David, and Weil, David N., "A Contribution to the Empirics of Economic Growth." *Quart. J. Econ.* **107**, 2:407-438, May 1992.

- Mo, Pak Hung, "Income Inequality and Economic Growth." *Kyklos* **53**, 3:293-316, 2000.
- Papayrakis, Elissaios, and Gerlagh Reyer, "The Resource Curse Hypothesis and Its Transmission Channels." *J. Comp. Econ.* 2004 *forthcoming*.
- Rodriguez, Francisco, and Sachs, Jeffrey D., "Why Do Resource-Abundant Economies Grow More Slowly?" *J. Econ. Growth.* **4**, 3:277-303, Sept. 1999.
- Romer, Paul M., "Endogenous Technological Change." *J. Pol. Econ.* **98**, 2:71-102, Oct. 1990.
- Romer, David. *Advanced Macroeconomics*. London, UK: McGraw-Hill, 1996.
- Sachs, Jeffrey D., and Warner, Andrew M., "Natural Resource Abundance and Economic Growth," NBER Working Paper No 5398, Cambridge, Massachusetts, National Bureau of Economic Research, Dec. 1995.
- Sachs, Jeffrey D., and Warner, Andrew M., "Fundamental Sources of Long-Run Growth." *Amer. Econ. Rev.*, **87**, 2:184-188, May 1997.
- Sachs, Jeffrey D., and Warner, Andrew M., "The Big Push, Natural Resource Booms and Growth." *J. Dev. Econ.* **59**, 1:43-76, June 1999a.
- Sachs, Jeffrey D., and Warner, Andrew M., "Natural Resource Intensity and Economic Growth." In Mayer Jörg, Chambers Brian, and Ayisha Farooq, Eds., *Development Policies in Natural Resource Economics*, Ch.2. Cheltenham, UK and Northampton Massachusetts: Edward Elgar, 1999b.
- Sachs, Jeffrey D., and Warner, Andrew M., "Natural Resources and Economic Development: The Curse of Natural Resources." *Eur. Econ. Rev.* **45**, 4-6:827-838, May 2001.
- Torvik, Ragnar, "Learning by doing and the Dutch disease". *Eur. Econ. Rev.* **45**, 2:285-306, Feb 2001.
- Torvik, Ragnar, "Natural Resources, Rent Seeking and Welfare." *J. Dev. Econ.*, **67**, 2:455-470, Apr. 2002.
- United Nations, 2003 (UN), 2003. Human Development Indicators. Data on primary exports. Available at www.undp.org/hdr2003. New York: UN.
- World Bank, "Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development". *Environmentally Sustainable Development Studies and Monographs Series* 17. Washington D.C.: World Bank, 1997.
- World Bank, 2003 (WB), 2003. Global Development Network Growth Database. Data on population growth per annum by William Easterly and Mirvat Sewadeh. Available at www.worldbank.org/research/growth/GDNdata.htm. Washington D.C.: WB.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:

<http://www.feem.it/Feem/Pub/Publications/WPapers/default.html>

<http://www.ssrn.com/link/feem.html>

NOTE DI LAVORO PUBLISHED IN 2003

PRIV	1.2003	<i>Gabriella CHIESA and Giovanna NICODANO</i> : <u>Privatization and Financial Market Development: Theoretical Issues</u>
PRIV	2.2003	<i>Ibolya SCHINDELE</i> : <u>Theory of Privatization in Eastern Europe: Literature Review</u>
PRIV	3.2003	<i>Wietze LISE, Claudia KEMFERT and Richard S.J. TOL</i> : <u>Strategic Action in the Liberalised German Electricity Market</u>
CLIM	4.2003	<i>Laura MARSILIANI and Thomas I. RENSTRÖM</i> : <u>Environmental Policy and Capital Movements: The Role of Government Commitment</u>
KNOW	5.2003	<i>Reyer GERLAGH</i> : <u>Induced Technological Change under Technological Competition</u>
ETA	6.2003	<i>Efrem CASTELNUOVO</i> : <u>Squeezing the Interest Rate Smoothing Weight with a Hybrid Expectations Model</u>
SIEV	7.2003	<i>Anna ALBERINI, Alberto LONGO, Stefania TONIN, Francesco TROMBETTA and Margherita TURVANI</i> : <u>The Role of Liability, Regulation and Economic Incentives in Brownfield Remediation and Redevelopment: Evidence from Surveys of Developers</u>
NRM	8.2003	<i>Elissaios POPYRAKIS and Reyser GERLAGH</i> : <u>Natural Resources: A Blessing or a Curse?</u>
CLIM	9.2003	<i>A. CAPARRÓS, J.-C. PEREAU and T. TAZDAÏT</i> : <u>North-South Climate Change Negotiations: a Sequential Game with Asymmetric Information</u>
KNOW	10.2003	<i>Giorgio BRUNELLO and Daniele CHECCHI</i> : <u>School Quality and Family Background in Italy</u>
CLIM	11.2003	<i>Efrem CASTELNUOVO and Marzio GALEOTTI</i> : <u>Learning By Doing vs Learning By Researching in a Model of Climate Change Policy Analysis</u>
KNOW	12.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO and Dino PINELLI (eds.)</i> : <u>Economic Growth, Innovation, Cultural Diversity: What are we all talking about? A critical survey of the state-of-the-art</u>
KNOW	13.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO, Dino PINELLI and Francesco RULLANI (lix)</i> : <u>Bio-Ecological Diversity vs. Socio-Economic Diversity. A Comparison of Existing Measures</u>
KNOW	14.2003	<i>Maddy JANSSENS and Chris STEYAERT (lix)</i> : <u>Theories of Diversity within Organisation Studies: Debates and Future Trajectories</u>
KNOW	15.2003	<i>Tuzin BAYCAN LEVENT, Enno MASUREL and Peter NIJKAMP (lix)</i> : <u>Diversity in Entrepreneurship: Ethnic and Female Roles in Urban Economic Life</u>
KNOW	16.2003	<i>Alexandra BITUSIKOVA (lix)</i> : <u>Post-Communist City on its Way from Grey to Colourful: The Case Study from Slovakia</u>
KNOW	17.2003	<i>Billy E. VAUGHN and Katarina MLEKOV (lix)</i> : <u>A Stage Model of Developing an Inclusive Community</u>
KNOW	18.2003	<i>Selma van LONDEN and Arie de RUIJTER (lix)</i> : <u>Managing Diversity in a Globalizing World</u>
Coalition		
Theory	19.2003	<i>Sergio CURRARINI</i> : <u>On the Stability of Hierarchies in Games with Externalities</u>
Network		
PRIV	20.2003	<i>Giacomo CALZOLARI and Alessandro PAVAN (lx)</i> : <u>Monopoly with Resale</u>
PRIV	21.2003	<i>Claudio MEZZETTI (lx)</i> : <u>Auction Design with Interdependent Valuations: The Generalized Revelation Principle, Efficiency, Full Surplus Extraction and Information Acquisition</u>
PRIV	22.2003	<i>Marco LiCalzi and Alessandro PAVAN (lx)</i> : <u>Tilting the Supply Schedule to Enhance Competition in Uniform-Price Auctions</u>
PRIV	23.2003	<i>David ETTINGER (lx)</i> : <u>Bidding among Friends and Enemies</u>
PRIV	24.2003	<i>Hannu VARTIAINEN (lx)</i> : <u>Auction Design without Commitment</u>
PRIV	25.2003	<i>Matti KELOHARJU, Kjell G. NYBORG and Kristian RYDQVIST (lx)</i> : <u>Strategic Behavior and Underpricing in Uniform Price Auctions: Evidence from Finnish Treasury Auctions</u>
PRIV	26.2003	<i>Christine A. PARLOUR and Uday RAJAN (lx)</i> : <u>Rationing in IPOs</u>
PRIV	27.2003	<i>Kjell G. NYBORG and Ilya A. STREBULAIEV (lx)</i> : <u>Multiple Unit Auctions and Short Squeezes</u>
PRIV	28.2003	<i>Anders LUNANDER and Jan-Eric NILSSON (lx)</i> : <u>Taking the Lab to the Field: Experimental Tests of Alternative Mechanisms to Procure Multiple Contracts</u>
PRIV	29.2003	<i>TangaMcDANIEL and Karsten NEUHOFF (lx)</i> : <u>Use of Long-term Auctions for Network Investment</u>
PRIV	30.2003	<i>Emiel MAASLAND and Sander ONDERSTAL (lx)</i> : <u>Auctions with Financial Externalities</u>
ETA	31.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>A Non-cooperative Foundation of Core-Stability in Positive Externality NTU-Coalition Games</u>
KNOW	32.2003	<i>Michele MORETTO</i> : <u>Competition and Irreversible Investments under Uncertainty</u>
PRIV	33.2003	<i>Philippe QUIRION</i> : <u>Relative Quotas: Correct Answer to Uncertainty or Case of Regulatory Capture?</u>
KNOW	34.2003	<i>Giuseppe MEDA, Claudio PIGA and Donald SIEGEL</i> : <u>On the Relationship between R&D and Productivity: A Treatment Effect Analysis</u>
ETA	35.2003	<i>Alessandra DEL BOCA, Marzio GALEOTTI and Paola ROTA</i> : <u>Non-convexities in the Adjustment of Different Capital Inputs: A Firm-level Investigation</u>

GG	36.2003	<i>Matthieu GLACHANT</i> : <u>Voluntary Agreements under Endogenous Legislative Threats</u>
PRIV	37.2003	<i>Narjess BOUBAKRI, Jean-Claude COSSET and Omrane GUEDHAMI</i> : <u>Postprivatization Corporate Governance: the Role of Ownership Structure and Investor Protection</u>
CLIM	38.2003	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Policy under Technology Spillovers</u>
KNOW	39.2003	<i>Slim BEN YOUSSEF</i> : <u>Transboundary Pollution, R&D Spillovers and International Trade</u>
CTN	40.2003	<i>Carlo CARRARO and Carmen MARCHIORI</i> : <u>Endogenous Strategic Issue Linkage in International Negotiations</u>
KNOW	41.2003	<i>Sonia OREFFICE</i> : <u>Abortion and Female Power in the Household: Evidence from Labor Supply</u>
KNOW	42.2003	<i>Timo GOESCHL and Timothy SWANSON</i> : <u>On Biology and Technology: The Economics of Managing Biotechnologies</u>
ETA	43.2003	<i>Giorgio Busetti and Matteo MANERA</i> : <u>STAR-GARCH Models for Stock Market Interactions in the Pacific Basin Region, Japan and US</u>
CLIM	44.2003	<i>Katrin MILLOCK and Céline NAUGES</i> : <u>The French Tax on Air Pollution: Some Preliminary Results on its Effectiveness</u>
PRIV	45.2003	<i>Bernardo BORTOLOTTI and Paolo PINOTTI</i> : <u>The Political Economy of Privatization</u>
SIEV	46.2003	<i>Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH</i> : <u>Burn or Bury? A Social Cost Comparison of Final Waste Disposal Methods</u>
ETA	47.2003	<i>Jens HORBACH</i> : <u>Employment and Innovations in the Environmental Sector: Determinants and Econometrical Results for Germany</u>
CLIM	48.2003	<i>Lori SNYDER, Nolan MILLER and Robert STAVINS</i> : <u>The Effects of Environmental Regulation on Technology Diffusion: The Case of Chlorine Manufacturing</u>
CLIM	49.2003	<i>Lori SNYDER, Robert STAVINS and Alexander F. WAGNER</i> : <u>Private Options to Use Public Goods. Exploiting Revealed Preferences to Estimate Environmental Benefits</u>
CTN	50.2003	<i>László Á. KÓCZY and Luc LAUWERS</i> (Ixi): <u>The Minimal Dominant Set is a Non-Empty Core-Extension</u>
CTN	51.2003	<i>Matthew O. JACKSON</i> (Ixi): <u>Allocation Rules for Network Games</u>
CTN	52.2003	<i>Ana MAULEON and Vincent VANNETELBOSCH</i> (Ixi): <u>Farsightedness and Cautiousness in Coalition Formation</u>
CTN	53.2003	<i>Fernando VEGA-REDONDO</i> (Ixi): <u>Building Up Social Capital in a Changing World: a network approach</u>
CTN	54.2003	<i>Matthew HAAG and Roger LAGUNOFF</i> (Ixi): <u>On the Size and Structure of Group Cooperation</u>
CTN	55.2003	<i>Taiji FURUSAWA and Hideo KONISHI</i> (Ixi): <u>Free Trade Networks</u>
CTN	56.2003	<i>Halis Murat YILDIZ</i> (Ixi): <u>National Versus International Mergers and Trade Liberalization</u>
CTN	57.2003	<i>Santiago RUBIO and Alistair ULPH</i> (Ixi): <u>An Infinite-Horizon Model of Dynamic Membership of International Environmental Agreements</u>
KNOW	58.2003	<i>Carole MAIGNAN, Dino PINELLI and Gianmarco I.P. OTTAVIANO</i> : <u>ICT, Clusters and Regional Cohesion: A Summary of Theoretical and Empirical Research</u>
KNOW	59.2003	<i>Giorgio BELLETTINI and Gianmarco I.P. OTTAVIANO</i> : <u>Special Interests and Technological Change</u>
ETA	60.2003	<i>Ronnie SCHÖB</i> : <u>The Double Dividend Hypothesis of Environmental Taxes: A Survey</u>
CLIM	61.2003	<i>Michael FINUS, Ekko van IERLAND and Robert DELLINK</i> : <u>Stability of Climate Coalitions in a Cartel Formation Game</u>
GG	62.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>How the Rules of Coalition Formation Affect Stability of International Environmental Agreements</u>
SIEV	63.2003	<i>Alberto PETRUCCI</i> : <u>Taxing Land Rent in an Open Economy</u>
CLIM	64.2003	<i>Joseph E. ALDY, Scott BARRETT and Robert N. STAVINS</i> : <u>Thirteen Plus One: A Comparison of Global Climate Policy Architectures</u>
SIEV	65.2003	<i>Edi DEFRANCESCO</i> : <u>The Beginning of Organic Fish Farming in Italy</u>
SIEV	66.2003	<i>Klaus CONRAD</i> : <u>Price Competition and Product Differentiation when Consumers Care for the Environment</u>
SIEV	67.2003	<i>Paulo A.L.D. NUNES, Luca ROSSETTO, Arianne DE BLAEIJ</i> : <u>Monetary Value Assessment of Clam Fishing Management Practices in the Venice Lagoon: Results from a Stated Choice Exercise</u>
CLIM	68.2003	<i>ZhongXiang ZHANG</i> : <u>Open Trade with the U.S. Without Compromising Canada's Ability to Comply with its Kyoto Target</u>
KNOW	69.2003	<i>David FRANTZ</i> (Iix): <u>Lorenzo Market between Diversity and Mutation</u>
KNOW	70.2003	<i>Ercole SORI</i> (Iix): <u>Mapping Diversity in Social History</u>
KNOW	71.2003	<i>Ljiljana DERU SIMIC</i> (Ixi): <u>What is Specific about Art/Cultural Projects?</u>
KNOW	72.2003	<i>Natalya V. TARANOVA</i> (Ixi): <u>The Role of the City in Fostering Intergroup Communication in a Multicultural Environment: Saint-Petersburg's Case</u>
KNOW	73.2003	<i>Kristine CRANE</i> (Ixi): <u>The City as an Arena for the Expression of Multiple Identities in the Age of Globalisation and Migration</u>
KNOW	74.2003	<i>Kazuma MATOBA</i> (Ixi): <u>Glocal Dialogue- Transformation through Transcultural Communication</u>
KNOW	75.2003	<i>Catarina REIS OLIVEIRA</i> (Ixi): <u>Immigrants' Entrepreneurial Opportunities: The Case of the Chinese in Portugal</u>
KNOW	76.2003	<i>Sandra WALLMAN</i> (Ixi): <u>The Diversity of Diversity - towards a typology of urban systems</u>
KNOW	77.2003	<i>Richard PEARCE</i> (Ixi): <u>A Biologist's View of Individual Cultural Identity for the Study of Cities</u>
KNOW	78.2003	<i>Vincent MERK</i> (Ixi): <u>Communication Across Cultures: from Cultural Awareness to Reconciliation of the Dilemmas</u>
KNOW	79.2003	<i>Giorgio BELLETTINI, Carlotta BERTI CERONI and Gianmarco I.P. OTTAVIANO</i> : <u>Child Labor and Resistance to Change</u>
ETA	80.2003	<i>Michele MORETTO, Paolo M. PANTEGHINI and Carlo SCARPA</i> : <u>Investment Size and Firm's Value under Profit Sharing Regulation</u>

IEM	81.2003	<i>Alessandro LANZA, Matteo MANERA and Massimo GIOVANNINI: <u>Oil and Product Dynamics in International Petroleum Markets</u></i>
CLIM	82.2003	<i>Y. Hossein FARZIN and Jinhua ZHAO: <u>Pollution Abatement Investment When Firms Lobby Against Environmental Regulation</u></i>
CLIM	83.2003	<i>Giuseppe DI VITA: <u>Is the Discount Rate Relevant in Explaining the Environmental Kuznets Curve?</u></i>
CLIM	84.2003	<i>Reyer GERLAGH and Wietze LISE: <u>Induced Technological Change Under Carbon Taxes</u></i>
NRM	85.2003	<i>Rinaldo BRAU, Alessandro LANZA and Francesco PIGLIARU: <u>How Fast are the Tourism Countries Growing? The cross-country evidence</u></i>
KNOW	86.2003	<i>Elena BELLINI, Gianmarco I.P. OTTAVIANO and Dino PINELLI: <u>The ICT Revolution: opportunities and risks for the Mezzogiorno</u></i>
SIEV	87.2003	<i>Lucas BRETSCGHER and Sjak SMULDERS: <u>Sustainability and Substitution of Exhaustible Natural Resources. How resource prices affect long-term R&D investments</u></i>
CLIM	88.2003	<i>Johan EYCKMANS and Michael FINUS: <u>New Roads to International Environmental Agreements: The Case of Global Warming</u></i>
CLIM	89.2003	<i>Marzio GALEOTTI: <u>Economic Development and Environmental Protection</u></i>
CLIM	90.2003	<i>Marzio GALEOTTI: <u>Environment and Economic Growth: Is Technical Change the Key to Decoupling?</u></i>
CLIM	91.2003	<i>Marzio GALEOTTI and Barbara BUCHNER: <u>Climate Policy and Economic Growth in Developing Countries</u></i>
IEM	92.2003	<i>A. MARKANDYA, A. GOLUB and E. STRUKOVA: <u>The Influence of Climate Change Considerations on Energy Policy: The Case of Russia</u></i>
ETA	93.2003	<i>Andrea BELTRATTI: <u>Socially Responsible Investment in General Equilibrium</u></i>
CTN	94.2003	<i>Parkash CHANDER: <u>The γ-Core and Coalition Formation</u></i>
IEM	95.2003	<i>Matteo MANERA and Angelo MARZULLO: <u>Modelling the Load Curve of Aggregate Electricity Consumption Using Principal Components</u></i>
IEM	96.2003	<i>Alessandro LANZA, Matteo MANERA, Margherita GRASSO and Massimo GIOVANNINI: <u>Long-run Models of Oil Stock Prices</u></i>
CTN	97.2003	<i>Steven J. BRAMS, Michael A. JONES, and D. Marc KILGOUR: <u>Forming Stable Coalitions: The Process Matters</u></i>
KNOW	98.2003	<i>John CROWLEY, Marie-Cecile NAVES (Ixxiii): <u>Anti-Racist Policies in France. From Ideological and Historical Schemes to Socio-Political Realities</u></i>
KNOW	99.2003	<i>Richard THOMPSON FORD (Ixxiii): <u>Cultural Rights and Civic Virtue</u></i>
KNOW	100.2003	<i>Alaknanda PATEL (Ixxiii): <u>Cultural Diversity and Conflict in Multicultural Cities</u></i>
KNOW	101.2003	<i>David MAY (Ixxiii): <u>The Struggle of Becoming Established in a Deprived Inner-City Neighbourhood</u></i>
KNOW	102.2003	<i>Sébastien ARCAND, Danielle JUTEAU, Sirma BILGE, and Francine LEMIRE (Ixxiii) : <u>Municipal Reform on the Island of Montreal: Tensions Between Two Majority Groups in a Multicultural City</u></i>
CLIM	103.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>China and the Evolution of the Present Climate Regime</u></i>
CLIM	104.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>Emissions Trading Regimes and Incentives to Participate in International Climate Agreements</u></i>
CLIM	105.2003	<i>Anil MARKANDYA and Dirk T.G. RÜBBELKE: <u>Ancillary Benefits of Climate Policy</u></i>
NRM	106.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Management Challenges for Multiple-Species Boreal Forests</u></i>
NRM	107.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Threshold Effects in Coral Reef Fisheries</u></i>
SIEV	108.2003	<i>Sara ANIYAR (Ixiv): <u>Estimating the Value of Oil Capital in a Small Open Economy: The Venezuela's Example</u></i>
SIEV	109.2003	<i>Kenneth ARROW, Partha DASGUPTA and Karl-Göran MÄLER(Ixiv): <u>Evaluating Projects and Assessing Sustainable Development in Imperfect Economies</u></i>
NRM	110.2003	<i>Anastasios XEPAPADEAS and Catarina ROSETA-PALMA(Ixiv): <u>Instabilities and Robust Control in Fisheries</u></i>
NRM	111.2003	<i>Charles PERRINGS and Brian WALKER (Ixiv): <u>Conservation and Optimal Use of Rangelands</u></i>
ETA	112.2003	<i>Jack GOODY (Ixiv): <u>Globalisation, Population and Ecology</u></i>
CTN	113.2003	<i>Carlo CARRARO, Carmen MARCHIORI and Sonia OREFFICE: <u>Endogenous Minimum Participation in International Environmental Treaties</u></i>
CTN	114.2003	<i>Guillaume HAERINGER and Myrna WOODERS: <u>Decentralized Job Matching</u></i>
CTN	115.2003	<i>Hideo KONISHI and M. Utku UNVER: <u>Credible Group Stability in Multi-Partner Matching Problems</u></i>
CTN	116.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for the Room-Mates Problem</u></i>
CTN	117.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for a Generalized Marriage Problem</u></i>
CTN	118.2003	<i>Marita LAUKKANEN: <u>Transboundary Fisheries Management under Implementation Uncertainty</u></i>
CTN	119.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Social Conformity and Bounded Rationality in Arbitrary Games with Incomplete Information: Some First Results</u></i>
CTN	120.2003	<i>Gianluigi VERNASCA: <u>Dynamic Price Competition with Price Adjustment Costs and Product Differentiation</u></i>
CTN	121.2003	<i>Myrna WOODERS, Edward CARTWRIGHT and Reinhard SELTEN: <u>Social Conformity in Games with Many Players</u></i>
CTN	122.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>On Equilibrium in Pure Strategies in Games with Many Players</u></i>
CTN	123.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Conformity and Bounded Rationality in Games with Many Players</u></i>
	1000	Carlo CARRARO, Alessandro LANZA and Valeria PAPPONETTI: <u>One Thousand Working Papers</u>

NOTE DI LAVORO PUBLISHED IN 2004

IEM	1.2004	<i>Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB: <u>Empirical Analysis of National Income and So2 Emissions in Selected European Countries</u></i>
ETA	2.2004	<i>Masahisa FUJITA and Shlomo WEBER: <u>Strategic Immigration Policies and Welfare in Heterogeneous Countries</u></i>
PRA	3.2004	<i>Adolfo DI CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI: <u>Do Privatizations Boost Household Shareholding? Evidence from Italy</u></i>
ETA	4.2004	<i>Victor GINSBURGH and Shlomo WEBER: <u>Languages Disenfranchisement in the European Union</u></i>
ETA	5.2004	<i>Romano PIRAS: <u>Growth, Congestion of Public Goods, and Second-Best Optimal Policy</u></i>
CCMP	6.2004	<i>Herman R.J. VOLLEBERGH: <u>Lessons from the Polder: Is Dutch CO2-Taxation Optimal</u></i>
PRA	7.2004	<i>Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN (lxv): <u>Merger Mechanisms</u></i>
PRA	8.2004	<i>Wolfgang AUSSENEGG, Pegaret PICHLER and Alex STOMPER (lxv): <u>IPO Pricing with Bookbuilding, and a When-Issued Market</u></i>
PRA	9.2004	<i>Pegaret PICHLER and Alex STOMPER (lxv): <u>Primary Market Design: Direct Mechanisms and Markets</u></i>
PRA	10.2004	<i>Florian ENGLMAIER, Pablo GUILLEN, Loreto LLORENTE, Sander ONDERSTAL and Rupert SAUSGRUBER (lxv): <u>The Chopstick Auction: A Study of the Exposure Problem in Multi-Unit Auctions</u></i>
PRA	11.2004	<i>Bjarne BRENDSTRUP and Harry J. PAARSCH (lxv): <u>Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders</u></i>
PRA	12.2004	<i>Ohad KADAN (lxv): <u>Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values</u></i>
PRA	13.2004	<i>Maarten C.W. JANSSEN (lxv): <u>Auctions as Coordination Devices</u></i>
PRA	14.2004	<i>Gadi FIBICH, Arieh GAVIOUS and Aner SELA (lxv): <u>All-Pay Auctions with Weakly Risk-Averse Buyers</u></i>
PRA	15.2004	<i>Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (lxv): <u>Competition and Cooperation in Divisible Good Auctions: An Experimental Examination</u></i>
PRA	16.2004	<i>Marta STRYSZOWSKA (lxv): <u>Late and Multiple Bidding in Competing Second Price Internet Auctions</u></i>
CCMP	17.2004	<i>Slim Ben YOUSSEF: <u>R&D in Cleaner Technology and International Trade</u></i>
NRM	18.2004	<i>Angelo ANTOCI, Simone BORGHESI and Paolo RUSSU (lxvi): <u>Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics</u></i>
SIEV	19.2004	<i>Anna ALBERINI, Paolo ROSATO, Alberto LONGO and Valentina ZANATTA: <u>Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice</u></i>
NRM	20.2004	<i>Guido CANDELA and Roberto CELLINI (lxvii): <u>Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly</u></i>
NRM	21.2004	<i>Jacqueline M. HAMILTON (lxvii): <u>Climate and the Destination Choice of German Tourists</u></i>
NRM	22.2004	<i>Javier Rey-MAQUIEIRA PALMER, Javier LOZANO IBÁÑEZ and Carlos Mario GÓMEZ GÓMEZ (lxvii): <u>Land, Environmental Externalities and Tourism Development</u></i>
NRM	23.2004	<i>Pius ODUNGA and Henk FOLMER (lxvii): <u>Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya</u></i>
NRM	24.2004	<i>Jean-Jacques NOWAK, Mondher SAHLI and Pasquale M. SGRO (lxvii): <u>Tourism, Trade and Domestic Welfare</u></i>
NRM	25.2004	<i>Riaz SHAREEF (lxvii): <u>Country Risk Ratings of Small Island Tourism Economies</u></i>
NRM	26.2004	<i>Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA (lxvii): <u>Tourism and Economic Growth in Latin American Countries: A Panel Data Approach</u></i>
NRM	27.2004	<i>Raúl Hernández MARTÍN (lxvii): <u>Impact of Tourism Consumption on GDP. The Role of Imports</u></i>
CSRM	28.2004	<i>Nicoletta FERRO: <u>Cross-Country Ethical Dilemmas in Business: A Descriptive Framework</u></i>
NRM	29.2004	<i>Marian WEBER (lxvi): <u>Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: an Application to Canada's Boreal Mixedwood Forest</u></i>
NRM	30.2004	<i>Trond BJORN DAL, Phoebe KOUNDOURI and Sean PASCOE (lxvi): <u>Output Substitution in Multi-Species Trawl Fisheries: Implications for Quota Setting</u></i>
CCMP	31.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part I: Sectoral Analysis of Climate Impacts in Italy</u></i>
CCMP	32.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part II: Individual Perception of Climate Extremes in Italy</u></i>
CTN	33.2004	<i>Wilson PEREZ: <u>Divide and Conquer: Noisy Communication in Networks, Power, and Wealth Distribution</u></i>
KTHC	34.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI (lxviii): <u>The Economic Value of Cultural Diversity: Evidence from US Cities</u></i>
KTHC	35.2004	<i>Linda CHAIB (lxviii): <u>Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison</u></i>
KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI (lxviii): <u>Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context</u></i>
KTHC	37.2004	<i>Kristine CRANE (lxviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u></i>
KTHC	38.2004	<i>Kiflemariam HAMDE (lxviii): <u>Mind in Africa, Body in Europe: The Struggle for Maintaining and Transforming Cultural Identity - A Note from the Experience of Eritrean Immigrants in Stockholm</u></i>
ETA	39.2004	<i>Alberto CAVALIERE: <u>Price Competition with Information Disparities in a Vertically Differentiated Duopoly</u></i>
PRA	40.2004	<i>Andrea BIGANO and Stef PROOST: <u>The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?</u></i>
CCMP	41.2004	<i>Micheal FINUS (lxix): <u>International Cooperation to Resolve International Pollution Problems</u></i>

KTHC	42.2004	<i>Francesco CRESPI</i> : <u>Notes on the Determinants of Innovation: A Multi-Perspective Analysis</u>
CTN	43.2004	<i>Sergio CURRARINI and Marco MARINI</i> : <u>Coalition Formation in Games without Synergies</u>
CTN	44.2004	<i>Marc ESCRHUELA-VILLAR</i> : <u>Cartel Sustainability and Cartel Stability</u>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL</i> (lxvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u>
NRM	46.2004	<i>Signe ANTHON and Bo JELLESMARK THORSEN</i> (lxvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u>
NRM	47.2004	<i>John MBURU</i> (lxvi): <u>Wildlife Conservation and Management in Kenya: Towards a Co-management Approach</u>
NRM	48.2004	<i>Ekin BIROL, Ágnes GYOVAI and Melinda SMALE</i> (lxvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transitional Economy</u>
CCMP	49.2004	<i>Gernot KLEPPER and Sonja PETERSON</i> : <u>The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects</u>
GG	50.2004	<i>Scott BARRETT and Michael HOEL</i> : <u>Optimal Disease Eradication</u>
CTN	51.2004	<i>Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG</i> : <u>Simple Priorities and Core Stability in Hedonic Games</u>
SIEV	52.2004	<i>Francesco RICCI</i> : <u>Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory</u>
SIEV	53.2004	<i>Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON</i> : <u>Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?</u>
NRM	54.2004	<i>Ingo BRÄUER and Rainer MARGGRAF</i> (lxvi): <u>Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams</u>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN</i> (lxvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</u>
NRM	56.2004	<i>Tom DEDEURWAERDERE</i> (lxvi): <u>Bioprospection: From the Economics of Contracts to Reflexive Governance</u>
CCMP	57.2004	<i>Katrin REHDANZ and David MADDISON</i> : <u>The Amenity Value of Climate to German Households</u>
CCMP	58.2004	<i>Koen SMEKENS and Bob VAN DER ZWAAN</i> : <u>Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios</u>
NRM	59.2004	<i>Valentina BOSETTI, Mariaeater CASSINELLI and Alessandro LANZA</i> (lxvii): <u>Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management</u>
NRM	60.2004	<i>Timo GOESCHL and Danilo CAMARGO IGLIORI</i> (lxvi): <u>Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon</u>
CCMP	61.2004	<i>Barbara BUCHNER and Carlo CARRARO</i> : <u>Economic and Environmental Effectiveness of a Technology-based Climate Protocol</u>
NRM	62.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH</i> : <u>Resource-Abundance and Economic Growth in the U.S.</u>
NRM	63.2004	<i>Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ</i> (lxvi): <u>Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis</u>
NRM	64.2004	<i>E.C.M. RUIJGROK and E.E.M. NILLESEN</i> (lxvi): <u>The Socio-Economic Value of Natural Riverbanks in the Netherlands</u>
NRM	65.2004	<i>E.C.M. RUIJGROK</i> (lxvi): <u>Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method</u>
ETA	66.2004	<i>Giannis VARDAS and Anastasios XEPAPADEAS</i> : <u>Uncertainty Aversion, Robust Control and Asset Holdings</u>
GG	67.2004	<i>Anastasios XEPAPADEAS and Constadina PASSA</i> : <u>Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach</u>
GG	68.2004	<i>Michael FINUS</i> : <u>Modesty Pays: Sometimes!</u>
NRM	69.2004	<i>Trond BJØRNDAL and Ana BRASÃO</i> : <u>The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications</u>
CTN	70.2004	<i>Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT</i> : <u>On Coalition Formation with Heterogeneous Agents</u>
IEM	71.2004	<i>Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA</i> : <u>Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants</u>
IEM	72.2004	<i>Alessandro LANZA, Matteo MANERA and Michael MCALEER</i> : <u>Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns</u>
SIEV	73.2004	<i>Margarita GENIUS and Elisabetta STRAZZERA</i> : <u>The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests</u>
CCMP	74.2004	<i>Rob DELLINK and Ekko van IERLAND</i> : <u>Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment</u>
ETA	75.2004	<i>Rosella LEVAGGI and Michele MORETTO</i> : <u>Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach</u>
CTN	76.2004	<i>Salvador BARBERÀ and Matthew O. JACKSON</i> (lxx): <u>On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union</u>
CTN	77.2004	<i>Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERA and Fernando VEGA-REDONDO</i> (lxx): <u>Optimal Information Transmission in Organizations: Search and Congestion</u>
CTN	78.2004	<i>Francis BLOCH and Armando GOMES</i> (lxx): <u>Contracting with Externalities and Outside Options</u>

CTN	79.2004	<i>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE</i> (lxx): <u>Merger Performance under Uncertain Efficiency Gains</u>
CTN	80.2004	<i>Francis BLOCH and Matthew O. JACKSON</i> (lxx): <u>The Formation of Networks with Transfers among Players</u>
CTN	81.2004	<i>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO</i> (lxx): <u>Bicameralism and Government Formation</u>
CTN	82.2004	<i>Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT</i> (lxx): <u>Potential Maximization and Coalition Government Formation</u>
CTN	83.2004	<i>Kfir ELIAZ, Debraj RAY and Ronny RAZIN</i> (lxx): <u>Group Decision-Making in the Shadow of Disagreement</u>
CTN	84.2004	<i>Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ</i> (lxx): <u>Economics: An Emerging Small World?</u>
CTN	85.2004	<i>Edward CARTWRIGHT</i> (lxx): <u>Learning to Play Approximate Nash Equilibria in Games with Many Players</u>
IEM	86.2004	<i>Finn R. FØRSUND and Michael HOEL</i> : <u>Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power</u>
KTHC	87.2004	<i>Elissaios PAPYRAKIS and Reyer GERLAGH</i> : <u>Natural Resources, Investment and Long-Term Income</u>

- (lix) This paper was presented at the ENGIME Workshop on “Mapping Diversity”, Leuven, May 16-17, 2002
- (lx) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by the Fondazione Eni Enrico Mattei, Milan, September 26-28, 2002
- (lxi) This paper was presented at the Eighth Meeting of the Coalition Theory Network organised by the GREQAM, Aix-en-Provence, France, January 24-25, 2003
- (lxii) This paper was presented at the ENGIME Workshop on “Communication across Cultures in Multicultural Cities”, The Hague, November 7-8, 2002
- (lxiii) This paper was presented at the ENGIME Workshop on “Social dynamics and conflicts in multicultural cities”, Milan, March 20-21, 2003
- (lxiv) This paper was presented at the International Conference on “Theoretical Topics in Ecological Economics”, organised by the Abdus Salam International Centre for Theoretical Physics - ICTP, the Beijer International Institute of Ecological Economics, and Fondazione Eni Enrico Mattei – FEEM Trieste, February 10-21, 2003
- (lxv) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications” organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
- (lxvi) This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation” organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL), Venice, August 28-29, 2003
- (lxvii) This paper has been presented at the international conference on “Tourism and Sustainable Economic Development – Macro and Micro Economic Issues” jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
- (lxviii) This paper was presented at the ENGIME Workshop on “Governance and Policies in Multicultural Cities”, Rome, June 5-6, 2003
- (lxix) This paper was presented at the Fourth EEP Plenary Workshop and EEP Conference “The Future of Climate Policy”, Cagliari, Italy, 27-28 March 2003
- (lxx) This paper was presented at the 9th Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004

2003 SERIES

CLIM	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
GG	<i>Global Governance</i> (Editor: Carlo Carraro)
SIEV	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KNOW	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSR	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRIV	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>

2004 SERIES

CCMP	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
GG	<i>Global Governance</i> (Editor: Carlo Carraro)
SIEV	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KTHC	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSR	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRA	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>