

Papyrakis, Elissaios; Gerlagh, Reyer

Working Paper

Natural Resources, Innovation, and Growth

Nota di Lavoro, No. 129.2004

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Papyrakis, Elissaios; Gerlagh, Reyer (2004) : Natural Resources, Innovation, and Growth, Nota di Lavoro, No. 129.2004, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/117998>

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,
Innovation, and Growth**
Elissaios Papyrakis and Reyer Gerlagh

NOTA DI LAVORO 129.2004

OCTOBER 2004

NRM – Natural Resources Management

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=609764>

The opinions expressed in this paper do not necessarily reflect the position of
Fondazione Eni Enrico Mattei
Corso Magenta, 63, 20123 Milano (I), web site: www.feem.it, e-mail: working.papers@feem.it

Natural Resources, Innovation, and Growth

Summary

This paper investigates the connection between resource abundance and innovation, as a transmission mechanism that can elucidate part of the resource curse hypothesis; i.e. the observed negative impact of resource wealth on income growth. We develop a variation of the Ramsey-Cass-Koopmans model with endogenous growth to explain the phenomenon. In this model, consumers trade off leisure versus consumption, and firms trade off innovation efforts versus manufacturing. For this model, we show that an increase in resource income frustrates economic growth in two ways: directly by reducing work effort and indirectly by inducing a smaller proportion of the labor force to engage in innovation.

Keywords: Natural resources, Growth, Innovation

JEL Classification: O13, O31, Q33

Address for correspondence:

Elissaios Papyrakis
IVM/VU
Institute for Environmental Studies
Vrije Universiteit
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

Recent empirical evidence and theoretical work provides strong support to a resource curse hypothesis; i.e. natural resource wealth tends to impede rather than promote economic growth (Auty 1994, Sachs and Warner 1995, 1997, 1999a, 1999b, Leite and Weidmann 1999, Rodriguez and Sachs 1999, Gylfason 2000, 2001a, 2001b, Papyrakis and Gerlagh 2004). The expectations of many early development economists (Nurkse 1953, Rostow 1960, Watkins 1963) that natural capital would be an important pillar to build economic development proved at odds with outcomes. Resource riches such as oil reserves, fish banks and fertile land became associated with a slowdown in economic growth across the world during the last three decades. One of the most striking examples and manifests of the resource curse hypothesis is the disappointing performance of the oil cartel countries. Over the last four decades, the OPEC countries as a whole experienced a negative rate of GDP per capita growth (Gylfason 2001b). Venezuela ranked among the ten wealthiest nations at the beginning of 19th century, but despite its vast oil reserves, it is downgraded to the level of a developing country (Jones 2002). Similarly, Alaska is the only U.S. state with a negative growth rate over the last two decades, despite its extensive oil reserves and fishing industry.

Several theories have been developed and tested to explain the resource curse paradox. The main focal point of these analyses lies in the crowding-out effects of resource wealth, as resource wealth decreases the perceived need for growth supporting policies, prudent long-term planning and efficient management of available resources (Ascher 1999, Auty 2001, Gylfason 2001b, Usui 1997). Resource abundance retards economic growth by crowding-out its determinants (Sachs and Warner 2001). Resource rich countries tend to suffer from

currency appreciations and loss of competitiveness (Corden 1984), inefficient allocations of resources (Corden and Neary 1982, Robinson and Torvik 2004), enhanced corruption and rent-seeking (Baland and Francois 2000, Krueger 1974, Torvik 2002), bad-decision making (Sachs and Warner 1999b, Auty 2001), increased public spending (Ross 2001) and political instability (Collier and Hoeffler, 1998, Olsson 2003).

The scope of this paper is on a crowding out effect of resource abundance mostly neglected in the literature: the crowding out of innovation or entrepreneurship. Sachs and Warner (2001) point out that wage premia in the resource sector may encourage innovators to engage in the primary rather than the R&D sector, but they do not further develop this idea. Since ultimately, technological progress and the discovery of new ideas and inventions drive growth, the effect of natural resources on R&D deserves particular attention. We develop a variation of the Ramsey-Cass-Koopmans model with endogenous growth, where individuals trade off consumption and leisure in terms of utility. We show that an increase of the resource base in the economy induces a reduction in the steady-state labor supply. Resource rents allow individuals to reduce their work effort (and related disutility) and use the resource revenues to pay for extra consumption. We show that the subsequent decline in labor intensity has two successive implications for economic growth. First, resource abundance reduces the total hours worked and total output. Secondly, resource abundance affects growth indirectly by inducing a smaller proportion of the labor force to engage in innovation.

The paper is organized as follows. Section 2 provides empirical evidence to the negative correlation between resource-abundance and different measures of innovation. Section 3 is devoted to a formal description of the endogenous growth Ramsey-Cass-Koopmans model,

while section 4 derives the dynamic equilibrium and main propositions linking resource abundance to poor economic performance. Section 5 concludes.

2. EMPIRICAL EVIDENCE: RESOURCE-ABUNDANCE AND INNOVATION

Figures 1 to 4 show scatter plots that illustrate the correlation between different measures of innovation and natural wealth. Data on R&D expenditures are provided by the United Nations (2002). Natural wealth is defined as the share of natural capital in the total capital stock, calculated by the World Bank (1997). The estimated regression line and adjusted R^2 is quoted at the right-top corner of each scatter plot. Although earlier observations on natural capital would be preferable in order to avoid endogeneity of the independent variable, 1994 is the only year for which data on natural capital are available. Gylfason (2001) argues that the share of natural capital is still a good proxy for resource-abundance, since it is rather stable over time. Indeed, the results in all figures can be reproduced by using alternative measures of resource abundance, such as the Sachs and Warner (1995) measure of the share of primary exports in GDP in 1971 or the share of agricultural production in GDP for the same year.

Figure 1 shows a cross-country scatter plot of 42 observations (single countries) relating R&D expenditure as a share of GDP between 1990-2000 and the World Bank measure of natural wealth. The negative relationship between the two variables is significant at the 1% level. As can be seen, there is not a single country with a natural capital share above 10% having a share of R&D expenditures above the 2% level.

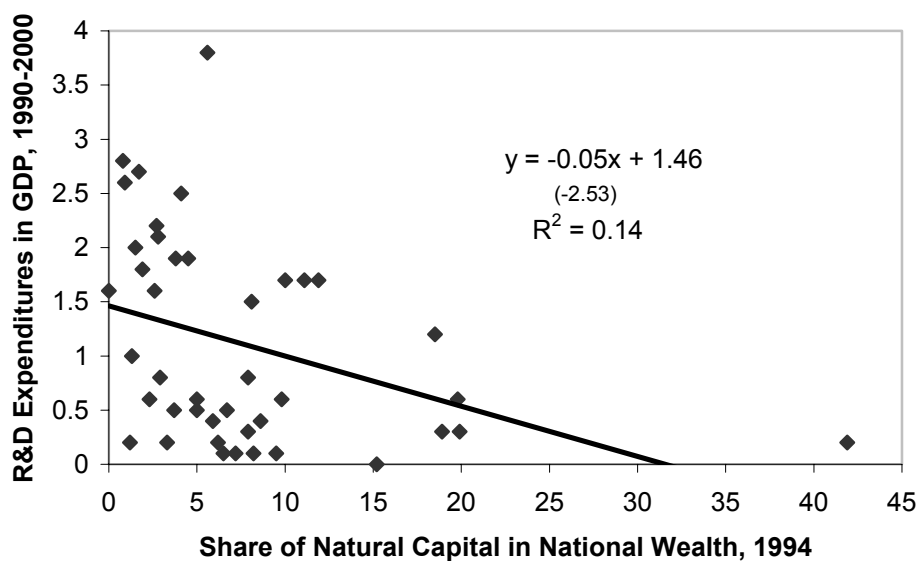


Figure 1. *Resource-Abundance and R&D Expenditure (Cross-country Sample)*

Figure 2 demonstrates a similar pattern between resource abundance and innovation for a sample of 52 countries. As a measure of innovation, we now consider the numbers of researchers and engineers employed in the R&D sector. Data on R&D employees are provided by the United Nations (2002). The scatter plot indicates a highly significant correlation between natural resources and employees in the R&D sector. The Central African Republic and Guinea-Bissau have a share of natural capital around 30 and 40%, respectively, and can be seen at the bottom-right side of the scatter plot having almost no researchers and engineers employed in the R&D sector.

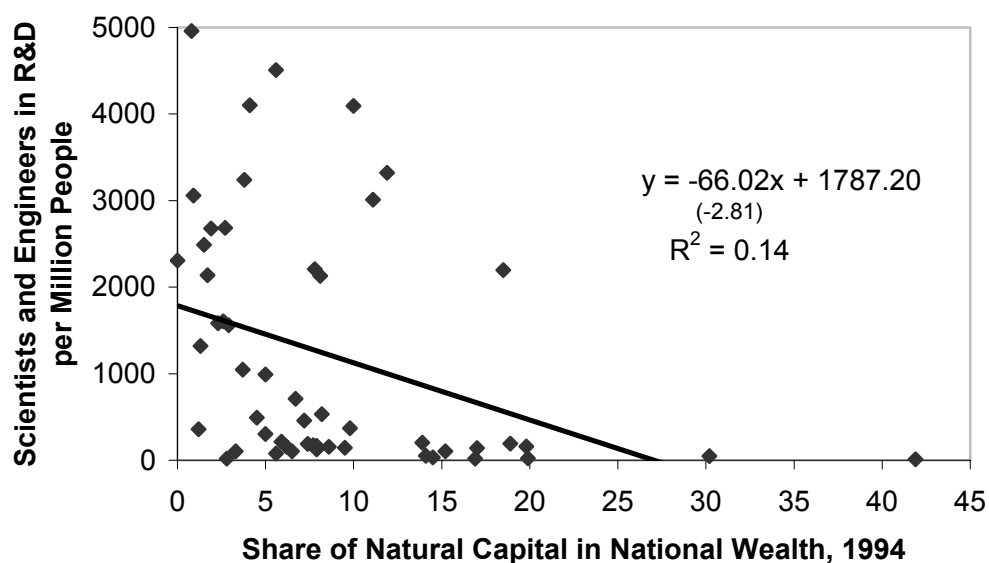


Figure 2. *Resource-Abundance and R&D Employees*

Figure 3 focuses on the number of patents granted in 1998 as a proxy for innovation. Whereas Figures 1 and 2 measured innovation based on available data on the inputs needed in the R&D sector, Figure 3, instead, examines a proxy for the output of R&D. Data on patents are provided by the United Nations (2002). The scatter plot reveals again a negative statistical relationship between innovation measured as patents and resource abundance for a sample of 31 countries. The two countries with the highest number of patents granted were the resource scarce countries Japan and South Korea.

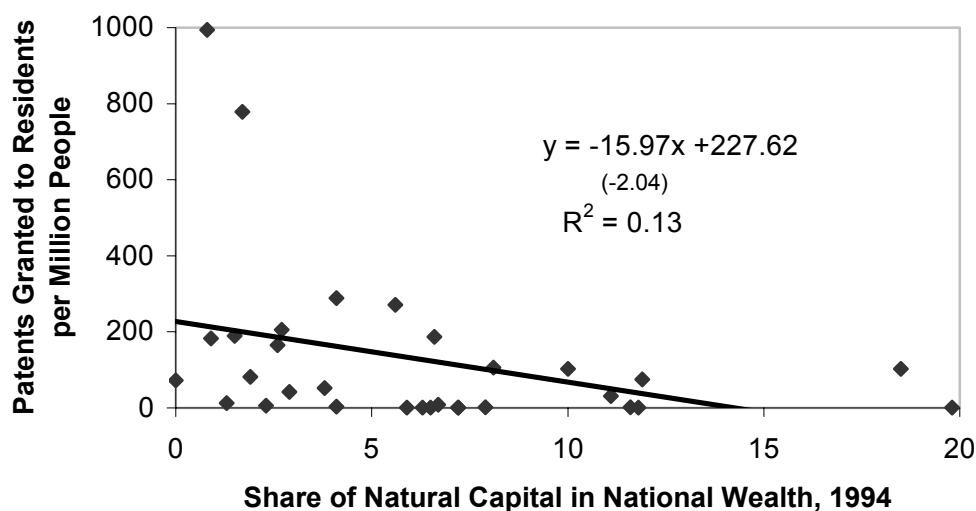


Figure 3. *Resource-Abundance and Patents*

Finally, we turn from a cross-country to a cross-state comparison within the US. As a measure of resource abundance we use the share of the primary sector's production in Gross State Product (GSP), which is the state equivalent to GDP. As a proxy for innovation we use the share of R&D expenditures in GSP. Data on natural resources and R&D are compiled from the Bureau of Economic Analysis (2003) of the U.S. Ministry of Commerce and the Industry, Research and Development System (IRIS) of the National Science Foundation (2003), respectively. Figure 4 shows that the negative correlation between resource abundance and innovation carries over to the state level. We notice that Alaska and Wyoming have the most extensive primary sectors in the U.S. and the lowest amount of funds allocated to research.

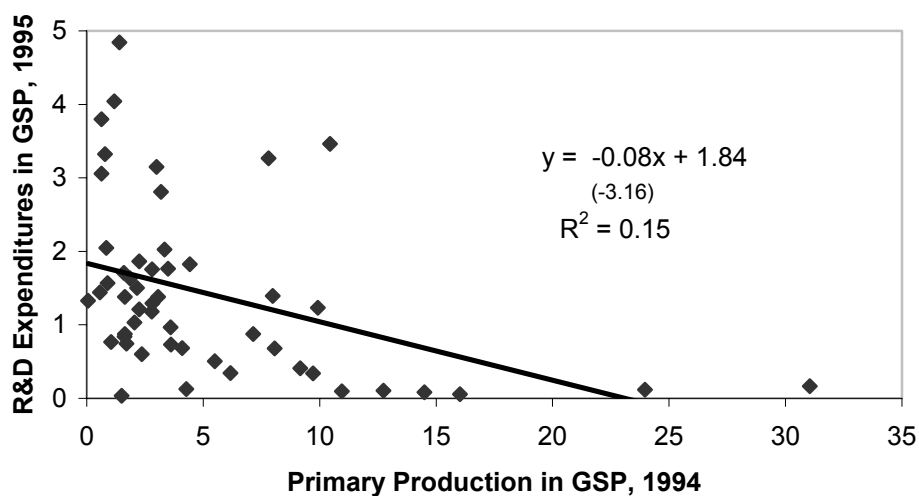


Figure 4. *Resource-Abundance and R&D Expenditure (Cross-state Sample for the U.S.)*

The figures above demonstrate a tendency of resource-abundant countries and states to innovate less. We should, though, keep in mind that it is likely that our data underestimate the magnitude of the negative correlation between natural resources and innovation. Most resource abundant countries are relatively poor and do not provide data for any R&D activities. Therefore, many resource abundant countries are excluded from the samples. Secondly, not all ideas are patented. To the extent that some ideas are not patented or not produced in the R&D sector, some innovation is not captured by our dataset. Furthermore, the people engaged in R&D are not equally productive and talented nor are all patents of the same value. Therefore, our data measure innovation in a rather quantitative than qualitative manner.

3. MODEL SET UP

3.1. Consumers

In this section we analyze a Ramsey-Cass-Koopmans type of model, where infinitely-living households choose over time both the level of consumption and the share of time devoted to leisure in order to maximize their intertemporal utility. We also incorporate in our analysis an endogenous growth channel, where returns to technology investments (which can alternatively be conceived as knowledge or labor quality) depend positively on the level of labor input in the economy. The intuition is straightforward. Innovation and education become more productive when work effort increases. In other words, the harder we work, the more efficient, innovative and knowledgeable we become.

We assume that the economy consists of identical infinitely-lived agents. Population $N(t)$ remains constant at each point in time. Thus,

$$N(t) = N. \tag{1}$$

For the type of model we employ, a stable population level is a convenient assumption that precludes an ever-increasing growth rate for income per capita and allows the economy to converge to a balanced growth path.

Individuals divide their available time between work and leisure. A proportion $l(t)$ of their time is devoted to work and the rest to leisure activities. Therefore, the level of labor input $L(t)$ in the economy is determined respectively by:

$$L(t) = l(t)N. \tag{2}$$

Each representative household maximizes the following inter-temporal utility function:

$$U = \int_0^{\infty} u[c(t), l(t)] e^{-\rho t} dt, \quad (3)$$

where $c(t) = C(t)/N$ denotes consumption per person at time t , $C(t)$ stands for total consumption, ρ is the rate of time preference and it is assumed to be time-invariant and positive, implying that agents value future utility less comparatively to current utility. Thus, $U(t)$ is a weighted sum of all future discounted utility flows $u[c(t), l(t)]$, where $u[c(t), l(t)]$ represents the instantaneous utility function (also referred to as felicity function) of each agent at a given date.

We assume that the instantaneous utility function $u[c(t), l(t)]$ is separable with respect to its two arguments and depends positively on the consumption level $c(t)$ and negatively on the work intensity $l(t)$. In other words, we assume that there is a disutility of working effort and agents obtain satisfaction from leisure activities. For convenience, we assume a logarithmic consumption utility function and a labor disutility function with constant elasticity σ . Also, we omit any time references for the rest of the analysis, unless there is need for clarification.

$$u(c, l) = \ln c - l^{1+\sigma}. \quad (4)$$

Each household faces the following budget constraint when maximizing utility:

$$\dot{v} = wl + \frac{Q}{N} + rv - c, \quad (5)$$

where $v=V/N$ stands for total value of assets hold per person, the dot denotes the derivative over time, wl and Q/N stand for wage and resource income per person, and r for the real interest rate obtained per unit of asset value. Each household, thus, maximizes utility subject to the budget constraint of equation (5). Therefore, we set up the following Hamiltonian:

$$H = \int_0^{\infty} (\ln c - l^{1+\sigma}) e^{-\rho t} + \mu [wl + \frac{Q}{N} + rv - c]. \quad (6)$$

The first order conditions with respect to the control variables c and l and the dual variable μ lead to the Ramsey Rule (7) and equation (8), which describe the evolution of consumption over time and the substitution possibilities between consumption and leisure respectively:

$$\frac{\dot{c}}{c} = r - \rho \quad (7)$$

$$(1+\sigma)l^\sigma/c = w \quad (8)$$

3.2. Producers

It is assumed that there are four sectors in our economy. First, there is a manufacturing sector with constant returns to scale with respect to its inputs labor and intermediates. The price of the final good produced in the manufacturing sector is normalized to unity. Following Romer (1990), we adopt the conventional specification of a continuum of intermediate capital goods, indexed by $i \in [0, A]$. Each intermediate capital good i represents a distinctive design, and the amount of designs A measures the total stock of knowledge. All designs are imperfect

substitutes, the level of substitution captured by a parameter $0 < \alpha < 1$. Together, this leads to the following Cobb-Douglas production function for the manufacturing sector:

$$Y_M = (\gamma L)^{1-\alpha} \int_0^A x_i^\alpha di, \quad (9)$$

where $0 < \gamma < 1$ is the share of laborers working in the manufacturing sector, and x_i is the input of capital of type i .

Firms in the manufacturing sector produce competitively and choose the level of labor and intermediate capital goods that maximize their profits:

$$\max_{\gamma L, x_i} (\gamma L)^{1-\alpha} \int_0^A x_i^\alpha di - w\gamma L - \int_0^A p_i x_i di, \quad (10)$$

where w and p_i denote the labor wage (in the manufacturing sector) and the price of durable good i , respectively. The first order conditions imply that each firm in the manufacturing sector faces the following demand for labor and durable goods:

$$w = (1-\alpha)(\gamma L)^{-\alpha} \int_0^A x_i^\alpha di = \frac{(1-\alpha)Y_M}{\gamma L} \quad (11)$$

$$p_i = \alpha(\gamma L)^{1-\alpha} x_i^{\alpha-1} \quad (12)$$

The first order conditions, given by equations (11) and (12), illustrate that firms pay labor and capital the value of their marginal products.

Secondly, there is a capital goods sector, where all capital intermediates are produced. Every durable good x_i is produced by a distinct firm using a distinct patent (idea). This implies

that all manufacturers of intermediate goods can exert monopolistic power, since their goods are imperfect substitutes, whose characteristics are determined by a specific design. Patent and copyright laws are allowing the specific firm that purchases and owns the design to use exclusively the corresponding idea and produce the related intermediate good. After incurring the fixed cost of innovation or the design purchase, each firm in the intermediate sector produces each durable good proportional to its capital input. In this way, intermediates can also be understood as durables, implying that $K = \int_0^A x_i di$, where K is a measure of the total capital stock.

Firms producing in the intermediate-goods sector buy the ownership for a design at price P_A , and after incurring the fixed cost of the design purchase, maximize profits π :

$$\max_{x_i} \pi_i = p_i(x_i)x_i - rx_i, \quad (13)$$

where $p_i(x_i)$ is the demand function for each durable good from the side of the manufacturing sector firms, as shown in equation (12). Therefore, $p_i(x_i)x_i$ equals the revenues of each firm operating in the intermediate-goods sector. The second part of the maximization represents the interest cost firms face when producing each durable good x_i . As stated above, each firm in the intermediate sector transforms one unit of raw capital into one unit of intermediate good.

The first order condition with respect to x_i provides us with:

$$\frac{dp_i(x_i)}{dx_i} x_i + p_i(x_i) = r,$$

and after taking account of the demand function for durables (12), we can see that the monopoly price of each durable good is a mark up over marginal cost that is equal for every design:

$$p_i = p = r/\alpha \quad (14)$$

As equation (14) reveals, all intermediate capital goods sell at the same price. Since the demand function (12) refers to each individual intermediate good produced, equation (14) implies that each durable good is purchased and employed by the manufacturing sector by the same amount x . Therefore, we have:

$$K = \int_0^A x_i di = Ax \quad (15)$$

The profits make the ownership of a design a valuable asset with price P_A , and, as such, they constitute a return to this asset value:

$$rP_A = \pi + \dot{P}_A . \quad (16)$$

On a balanced growth path, the equation simplifies to $rP_A = \pi$.

Third, we assume an R&D sector where designs for new intermediate goods are produced as in Romer (1990). This sector adds to the knowledge base. It employs a fraction $1-\gamma$ of the labor input, which is the remainder of the labor force not employed in the manufacturing sector. The production function of knowledge has constant returns to scale with respect to labor. This specification abstracts from duplication of effort; nor is there a positive spillover

between researchers in the R&D sector. Furthermore, the production of designs depends positively on the stock of knowledge already discovered, on a one-to-one base. This implies that the growth rate of innovation (the rate of design accumulation) is independent of the level of knowledge. The stock of knowledge is freely available to all researchers in the R&D sector as a public good, and this fosters innovation. Thus, designs evolve according to:

$$\dot{A} = A(1-\gamma)L. \quad (17)$$

Knowledge is produced in the innovation sector, where labor earns its marginal value. Every design invented is sold to a firm in the intermediate-goods sector for a price P_A . Marginal productivity of labor in the innovation sector thus becomes:

$$w = AP_A. \quad (18)$$

Last, we assume there is a resource sector exploiting the natural resource endowments of the economy (e.g. oil reserves, mines, fishing banks, timber etc.). The production of the resource sector Q depends on the resource endowment available G (for instance the oil reserves discovered or the stock of fish) and the stock of physical capital K . The first component is obvious. The larger the resource base available, the larger is the potential to process and exploit the resource endowment. Resource booms make a larger amount of natural resources available for the resource sector to be exploited. The second component assumes that as a side effect of capital accumulation, natural resources are exploited more effectively. We take the simple proportional production function,

$$Q(K, G) = GK. \quad (19)$$

3.3. Closure

The production function for the manufacturing sector, after taking account of the capital-intermediate identity (15), becomes:

$$Y_M = (\gamma L)^{1-\alpha} A x^\alpha = (A \gamma L)^{1-\alpha} K^\alpha \quad (20)$$

Equation (20) reveals that production in manufacturing resembles the neoclassical Solow model. The commodity flows are closed by setting total output, or income, Y , from the manufacturing and resource sectors, equal to consumption C plus capital accumulation \dot{K} :

$$Y = (A \gamma L)^{1-\alpha} K^\alpha + KG = C + \dot{K}. \quad (21)$$

4. ANALYSIS

4.1. Dynamic Equilibrium

In this sub-section, we determine the equations that govern the dynamics for consumption, the capital stock, labor supply and the share of labor involved in innovation.

First, we determine the share of labor employed in the manufacturing sector versus the innovations sector. We compare wages for labor employed in the innovation sector and manufacturing sector, and the rate of returns to the two assets, knowledge A and capital K .

Labor arbitrage between the manufacturing and innovation sector ensures equal wages. Thus (11) and (18) make:

$$AP_A = \frac{(1-\alpha)Y_M}{\gamma L} \quad (22)$$

Next, we determine the level of the interest rate r for capital K . From the demand function (14), we know that the interest rate is the product of the parameter α and the durables price p . After substituting for the price p from (12), the amount of each durable demanded and produced x from (15) and taking account of the production function in the manufacturing sector (9), we know that the level of interest rate r is proportional to the ratio of the manufactured output to capital:

$$r = \alpha^2 \frac{Y_M}{K}. \quad (23)$$

We then proceed to calculate the interest earned on knowledge.

The immediate profits of each firm in the intermediate-goods sector can be calculated by incorporating equations (12), (14) and (15) into (13):

$$\pi_i = \pi = \alpha(1-\alpha)(\gamma L)^{1-\alpha} x^\alpha = \alpha(1-\alpha) \frac{Y_M}{A} \quad (24)$$

Taking account of equations (24) and (16) determining the price of patents P_A and the level of monopolistic profits π , in balanced growth, equation (22) becomes:

$$r = \alpha \gamma L. \quad (25)$$

After incorporating equation (23) into (25), we can express the share of the labor input engaged into the manufacturing sector in terms of the ratio of the output (in manufacturing) to capital:

$$\gamma = \frac{\alpha Y_M}{L K} = \frac{\alpha Y_M}{IN K} \quad (26)$$

For the analysis of dynamics, it is useful to write equations in intensive forms. From equation (21), we can derive the intensive form of total income in the economy by dividing the left-hand-side by labor in effective terms AL :

$$\hat{y} = \gamma^{1-\alpha} \hat{k}^\alpha + G \hat{k}, \quad (27)$$

where lower letter variables with hats denote variables expressed relative to effective labor supply, $\hat{y} = Y/AL$, $\hat{k} = K/AL$, $\hat{c} = C/AL$.

Substituting for the output in the manufacturing sector from equation (20) into (23) allows us to express the interest rate in terms of capital per effective labor,

$$r = \alpha^2 \hat{k}^{\alpha-1} \gamma^{1-\alpha}, \quad (28)$$

and the share of laborers in the manufacturing sector from (26) as

$$\gamma = \left(\frac{\alpha}{IN} \right)^{\frac{1}{\alpha}} \hat{k}^{\frac{\alpha-1}{\alpha}}. \quad (29)$$

We rewrite equation (7) in its intensive form, and substitute (17) and (28):

$$\frac{\dot{\hat{c}}}{\hat{c}} = r - \rho - \frac{\dot{A}}{A} - \frac{\dot{l}}{l} = \alpha^2 \hat{k}^{\alpha-1} \gamma^{1-\alpha} - \rho - (1-\gamma)lN - \frac{\dot{l}}{l} \quad (30)$$

Subsequently, we rewrite equation (21) in its intensive form substituting (27):

$$\frac{\dot{\hat{k}}}{\hat{k}} = \gamma^{1-\alpha} \hat{k}^{\alpha-1} + G - \frac{\dot{c}}{\hat{c}} - \frac{\dot{l}}{l} - (1-\gamma)lN. \quad (31)$$

These two equations show that consumption and capital dynamics depend on labor supply dynamics. To solve for \dot{l}/l , we first express the level of labor wage in terms of capital per labor k . From equation (11) and (20), we can calculate:

$$w = (1-\alpha)k^\alpha \gamma^{-\alpha} A^{1-\alpha}. \quad (32)$$

Combining equations (8) and (32), provides us with the following equation:

$$(1+\sigma)l^\sigma c = (1-\alpha)k^\alpha \gamma^{-\alpha} A^{1-\alpha}, \quad (33)$$

which can be expressed in terms of effective labor as:

$$(1+\sigma)l^{1+\sigma} \hat{c} = (1-\alpha) \hat{k}^\alpha \gamma^{-\alpha}. \quad (34)$$

Together, we have four equations that determine the dynamics for \hat{c} (30), \hat{k} (31), and the levels of γ (29) and l (34). For use in the steady state analysis, we also derive equations that describe the labor supply l and use γ dynamics. Equation (34) implies that l evolves according to:

$$\frac{\dot{l}}{l} = \frac{\alpha}{1+\sigma} \frac{\dot{\hat{k}}}{\hat{k}} - \frac{1}{1+\sigma} \frac{\dot{\hat{c}}}{\hat{c}} - \frac{\alpha}{1+\sigma} \frac{\dot{\gamma}}{\gamma} \quad (35)$$

From equation (29) we can see that γ evolves according to:

$$\frac{\dot{\gamma}}{\gamma} = \frac{\alpha-1}{\alpha} \frac{\dot{\hat{k}}}{\hat{k}} - \frac{1}{\alpha} \frac{\dot{l}}{l} \quad (36)$$

Combining equations (35) and (36), we see that l evolves according to:

$$\frac{\dot{l}}{l} = \frac{1}{\sigma} \left(\frac{\dot{\hat{k}}}{\hat{k}} - \frac{\dot{\hat{c}}}{\hat{c}} \right) \quad (37)$$

4.2. Steady State

Along a balanced growth path, capital K , consumption C , output Y and technology A grow at the same rate, which implies that the levels of \hat{k} , \hat{c} and \hat{y} remain constant along the path. It can be seen from equations (36) and (37) that the working intensity l and the labor input share γ remain constant as well. Therefore, along the balanced growth path equations (30) and (31) become:

$$\alpha^2 \hat{k}_{ss}^{\alpha-1} \gamma_{ss}^{1-\alpha} - \rho - (1-\gamma_{ss})l_{ss}N = 0 \quad (38)$$

$$\gamma_{ss}^{1-\alpha} \hat{k}_{ss}^{\alpha-1} + G - \frac{\hat{c}_{ss}}{\hat{k}_{ss}} - (1-\gamma_{ss})l_{ss}N = 0, \quad (39)$$

where the subscript SS denotes the steady-state value of each variable along the balanced growth path.

Equations (29) and (34) evaluated at the steady-state, give the following levels for labor supply l and the share of laborers employed in innovation,

$$(1 + \sigma)l_{ss}^{1+\sigma} \hat{c}_{ss} = (1 - \alpha) \hat{k}_{ss}^{\alpha} \gamma_{ss}^{-\alpha}, \quad (40)$$

$$\gamma = \left(\frac{\alpha}{l_{ss} N} \right)^{\frac{1}{\alpha}} \hat{k}_{ss}^{\frac{\alpha-1}{\alpha}} = \left(\frac{\alpha}{N} \right)^{\frac{1}{\alpha}} l_{ss}^{-\frac{1}{\alpha}} \hat{k}_{ss}^{\frac{\alpha-1}{\alpha}}. \quad (41)$$

Along with equations (38) and (39), these two equations constitute a system of four equations depending on the four steady-state levels \hat{c}_{ss} , \hat{k}_{ss} , l_{ss} and γ_{ss} . Substitution of these four equations produces one equation linking resource income to labor supply l_{ss} :

$$G = \rho \frac{1 + \alpha}{1 + \alpha N} \frac{N}{\alpha} + \frac{1 - \alpha}{1 + \sigma} \frac{N}{\alpha} l_{ss}^{-\sigma} - \frac{1 + \alpha}{1 + \alpha N} \frac{N^2}{\alpha} (1 - \alpha) l_{ss} \quad (42)$$

The right-hand-side of equation (42) is strictly decreasing in labor supply, l_{ss} , so that there is only one steady-state value, and we can derive that

$$\frac{dl_{ss}}{dG} = \left[-\sigma \frac{1 - \alpha}{1 + \sigma} \frac{N}{\alpha} l_{ss}^{-1-\sigma} - \frac{1 + \alpha}{1 + \alpha N} \frac{N^2}{\alpha} (1 - \alpha) \right]^{-1} < 0 \quad (43)$$

This shows that an increase in resource abundance as captured by G results in a decrease of labor intensity at the steady state. Individuals trade off consumption and leisure in terms of

utility. An increased amount of resource wealth gives them the opportunity to enjoy the same level of utility for a reduced labor effort. In other words, resource abundance increases leisure and reduces man-made output. We state this finding as the first proposition:

PROPOSITION 1. *The steady state level of labor supply l_{ss} is decreasing in the resource base G .*

The rate of knowledge accumulation at the steady-state is given by equation (17). We label the steady state rate of knowledge accumulation by $\chi_{ss} = (\dot{A}_{ss} / A_{ss})$,

$$\chi_{ss} = (1 - \gamma_{ss}) l_{ss} N \quad (44)$$

From equations (41) and (51), in the appendix, we derive the ratio of the labor force engaged in the R&D sector ($1 - \gamma_{ss}$):

$$1 - \gamma_{ss} = 1 - \frac{N + \rho l_{ss}^{-1}}{1 + \alpha N} \quad (45)$$

Equation (45) implies that a decrease in labor intensity at the steady-state due to an increase in resource endowments, as indicated by equation (43), decreases the ratio of the labor force engaged in the R&D sector. Therefore, the accumulation of knowledge decreases for two reasons. First, the reduction in labor intensity directly retards knowledge accumulation. Secondly, the decrease in labor intensity reduces the rate of knowledge accumulation indirectly by lowering the percentage of the labor force engaged in the R&D sector. From

equation (44), we can see that technological progress depends negatively on the level of resource endowments (both directly and indirectly):

$$\frac{d\chi_{ss}}{dG} = \left[(1 - \gamma_{ss})N + \frac{\rho}{(1 + \alpha N)l_{ss}} \right] \frac{dl_{ss}}{dG} < 0, \quad (46)$$

where the derivative $\frac{dl_{ss}}{dG}$ is negative from equation (43).

Therefore, a resource-abundant country with a large natural resource base G will experience a lower labor intensity l_{ss} at the steady state and a lower rate of knowledge accumulation χ_{ss} . The economy will grow at a slower pace. This is our major finding:

PROPOSITION 2. *Steady state economic growth χ_{ss} is decreasing in the resource base G .*

5. CONCLUSIONS

During the past decades, economists tried to explain why resource abundant countries embark on a development path that leads to stagnation and economic decline rather than affluence and prosperity. Resource wealth did not prove to be the panacea to underdevelopment. On the contrary, resource dependence exacerbated poverty and retarded economic growth over the past three decades. With a few exceptions, such as those of Botswana, Norway and Iceland, resource-abundant countries tend to belong to the list of development failures.

Several indirect mechanisms through which natural resources frustrate income growth have been identified in the literature. Resource wealth can deteriorate the terms of trade, reduce human capital accumulation, increase corruption and rent-seeking, increase public spending and result in political instability. In this paper, we investigate a transmission channel not extensively discussed in the literature: the relationship between resource abundance and innovation. Innovation is undoubtedly one of the main determinants of economic growth, by enhancing the productivity of labor and capital. The pursue of innovators for new ideas and designs is motivated by their interest in profiting from them. In our model, natural resources reduce the incentives of innovators to engage in R&D. This happens for two reasons. First, the discovery of resource reserves reduces the need to support consumption through labor income and therefore increases leisure and reduces work effort. Secondly, resource wealth negatively affects the allocation of entrepreneurial activity between the manufacturing and the R&D sector in favor of the former.

Extensions of the analysis should take into account the possibility that work effort may also be allocated in the primary sector, as suggested by Sachs and Warner (2001). In this case, the share of the labor force employed as researchers in the R&D sector will be directly affected by the amount of resource rents, rather than indirectly (through labor intensity) as happens in our model. Furthermore, a more extensive database should identify the correlation between resource abundance and innovation for a more extensive sample of countries and potentially disentangle the effect of natural resources into its components. It is possible that specific categories of natural resources, such as minerals and ores have stronger (or weaker) crowding-out effect on innovation than others.

APPENDIX

Incorporating equation (41) into equations (38), (39) and (40) yields:

$$l_{ss}^{\frac{\alpha-1}{\alpha}} \hat{k}_{ss}^{\frac{\alpha-1}{\alpha}} \left(\frac{\alpha}{N} \right)^{\frac{1}{\alpha}} (1 + \alpha N) - \rho - l_{ss} N = 0, \quad (47)$$

$$l_{ss}^{\frac{\alpha-1}{\alpha}} \hat{k}_{ss}^{\frac{\alpha-1}{\alpha}} \left(\frac{\alpha}{N} \right)^{\frac{1-\alpha}{\alpha}} (1 + \alpha) + G - \frac{\hat{c}_{ss}}{\hat{k}_{ss}} - l_{ss} N = 0, \text{ and} \quad (48)$$

$$\hat{c}_{ss} = \frac{N(1-\alpha)}{\alpha(1+\sigma)} l_{ss}^{-\sigma} \hat{k}_{ss}. \quad (49)$$

Incorporating equation (49) into (48) yields:

$$l_{ss}^{\frac{\alpha-1}{\alpha}} \hat{k}_{ss}^{\frac{\alpha-1}{\alpha}} \left(\frac{\alpha}{N} \right)^{\frac{1-\alpha}{\alpha}} (1 + \alpha) + G - \frac{1-\alpha}{1+\sigma} \left(\frac{\alpha}{N} \right)^{-1} l_{ss}^{-\sigma} - l_{ss} N = 0. \quad (50)$$

Rearranging equation (47) yields:

$$\hat{k}_{ss}^{\frac{\alpha-1}{\alpha}} = (\rho + l_{ss} N) \left(\frac{\alpha}{N} \right)^{-\frac{1}{\alpha}} (1 + \alpha N)^{-1} l_{ss}^{\frac{1-\alpha}{\alpha}}. \quad (51)$$

Incorporating equation (51) into (50) solves for the steady-state value of labor intensity in equation (42).

REFERENCES

- Ascher, W., 1999. *Why Governments Waste Natural Resources: Policy Failures in Developing Countries*. The John Hopkins University Press, Baltimore.
- Auty, R.M., 1994. Industrial policy reform in six large newly industrializing countries: The resource curse thesis. *World Development* 22, 11–26.
- Auty, R.M., 2001. *Resource Abundance and Economic Development*. Oxford University Press, Oxford.
- Baland, J., Francois P., 2000. Rent-Seeking and resource booms. *Journal of Development Economics* 61, 527–542.
- Bureau of Economic Analysis, 2003. U.S. Ministry of Commerce, 2003. Data on Gross State Product (GSP) and the primary sector. Available at <http://www.bea.doc.gov>. Washington: BEA.
- Collier, P., Hoeffler, A.E., 1998. On economic causes of civil war. *Oxford Economic Papers* 50, 563–573.
- Corden, M.W., 1984. Booming sector and Dutch disease economics: Survey and consolidation, *Oxford Economic Papers* 36, 359–380.
- Corden, M.W., Neary P.J., 1982. Booming sector and de-industrialisation in a small open economy. *Economic Journal* 92, 825–848.
- Gylfason, T., 2000. Resources, agriculture, and economic growth in economies in transition. *Kyklos* 53, 545–580.
- Gylfason, T., 2001a. Natural resources, education, and economic development. *European Economic Review* 45, 847–859.

- Gylfason, T., 2001b. Nature, power and growth. *Scottish Journal of Political Economy* 48, 558–588.
- Jones, C.I., 2002. *Introduction to Economic Growth*. Norton, New York.
- Krueger, A.O., 1974. The political economy of the rent-seeking society. *American Economic Review* 64, 291–303.
- Leite, C., Weidmann, J., 1999. Does mother nature corrupt? Natural resources, corruption and economic growth, IMF Working Paper No 99/85. International Monetary Fund, Washington.
- National Science Foundation 2003. Industry, Research and Development System (IRIS) of the National Science Foundation. Data on R&D expenditure. Available at www.nsf.org. Arlington, Virginia: NSF.
- Nurkse, R., 1953. *Problems of Capital Formation in Underdeveloped Countries*. Cambridge University Press, New York.
- Olsson O., 2003. *Conflict Diamonds*. Working Papers in Economics 86, Göteborg University.
- Papyrakis, E., Gerlagh R., 2004. The resource curse hypothesis and its transmission channels. *Journal of Comparative Economics* 32, 181–193.
- Rodriguez, F., Sachs, J.D., 1999. Why do resource-abundant economies grow more slowly?, *Journal of Economic Growth* 4, 277–303.
- Robinson, J.A., Torvik R., 2004. White Elephants. *Journal of Public Economics* (forthcoming).
- Ross, M.L., 2001. Does Oil Hinder Democracy? *World Politics* 53, 297–322.

- Rostow, W.W., 1960. *The Stages of Economic Growth: A Non-communist Manifesto*. Cambridge University Press, Cambridge.
- Sachs, J.D., Warner, A.M., 1995. Natural resource abundance and economic growth. NBER Working Paper No 5398. National Bureau of Economic Research, Cambridge, Massachusetts.
- Sachs, J.D., Warner, A.M., 1997. Fundamental sources of long-run growth, *American Economic Review* 87, 184–188.
- Sachs, J.D., Warner, A.M., 1999a. The big push, natural resource booms and growth. *Journal of Development Economics* 59, 43–76.
- Sachs, J.D., Warner, A.M., 1999b. Natural resource intensity and economic growth, in: Mayer, J., Chambers B., Ayisha F., (Eds.), *Development Policies in Natural Resource Economics*, Ch.2. Edward Elgar, Cheltenham, UK.
- Sachs, J.D., Warner, A.M., 2001. Natural resources and economic development: The curse of natural resources. *European Economic Review* 45, 827–838.
- Torvik, R., 2002. Natural resources, rent seeking and welfare. *Journal of Development Economics* 67, 455–470.
- United Nations, 2002. *Human Development Reports*. Data on R&D expenditure, Researchers and Engineers employed in the R&D sector and patents. Available at www.hdr.undp.org/reports. New York: U.N.
- Usui, N., 1997. Dutch disease and policy adjustments to the oil boom: A comparative study of Indonesia and Mexico. *Resources Policy* 23, 151–208.

Watkins, M.H., 1963. A staple theory of economic growth. *Canadian Journal of Economics and Political Science* 29, 142–158.

World Bank, 1997. Expanding the measure of wealth: Indicators of environmentally sustainable development. *Environmentally Sustainable Development Studies and Monographs Series 17*. Washington D.C.: World Bank.

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 Reyner 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 Glocalizing 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. STREBULAEV (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>Tajji 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 (I xv): <u>Merger Mechanisms</u></i>
PRA	8.2004	<i>Wolfgang AUSSENEGG, Pegaret PICHLER and Alex STOMPER (I xv): <u>IPO Pricing with Bookbuilding, and a When-Issued Market</u></i>
PRA	9.2004	<i>Pegaret PICHLER and Alex STOMPER (I xv): <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 (I xv): <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 (I xv): <u>Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders</u></i>
PRA	12.2004	<i>Ohad KADAN (I xv): <u>Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values</u></i>
PRA	13.2004	<i>Maarten C.W. JANSSEN (I xv): <u>Auctions as Coordination Devices</u></i>
PRA	14.2004	<i>Gadi FIBICH, Arieh GAVIOUS and Aner SELA (I xv): <u>All-Pay Auctions with Weakly Risk-Averse Buyers</u></i>
PRA	15.2004	<i>Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (I xv): <u>Competition and Cooperation in Divisible Good Auctions: An Experimental Examination</u></i>
PRA	16.2004	<i>Marta STRYSZOWSKA (I xv): <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 (I xv): <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 (I xvii): <u>Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly</u></i>
NRM	21.2004	<i>Jacqueline M. HAMILTON (I xvii): <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 (I xvii): <u>Land, Environmental Externalities and Tourism Development</u></i>
NRM	23.2004	<i>Pius ODUNGA and Henk FOLMER (I xvii): <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 (I xvii): <u>Tourism, Trade and Domestic Welfare</u></i>
NRM	25.2004	<i>Riaz SHAREEF (I xvii): <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 (I xvii): <u>Tourism and Economic Growth in Latin American Countries: A Panel Data Approach</u></i>
NRM	27.2004	<i>Raúl Hernández MARTÍN (I xvii): <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 (I xvi): <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 (I xvi): <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 (I xviii): <u>The Economic Value of Cultural Diversity: Evidence from US Cities</u></i>
KTHC	35.2004	<i>Linda CHAIB (I xviii): <u>Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison</u></i>
KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI (I xviii): <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 (I xviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u></i>
KTHC	38.2004	<i>Kiflemariam HAMDE (I xviii): <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 (I xix): <u>International Cooperation to Resolve International Pollution Problems</u></i>
KTHC	42.2004	<i>Francesco CRESPI: <u>Notes on the Determinants of Innovation: A Multi-Perspective Analysis</u></i>

CTN	43.2004	<i>Sergio CURRARINI and Marco MARINI: <u>Coalition Formation in Games without Synergies</u></i>
CTN	44.2004	<i>Marc ESCRHUELA-VILLAR: <u>Cartel Sustainability and Cartel Stability</u></i>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL (lxvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u></i>
NRM	46.2004	<i>Signe ANTHON and Bo JELLESMARK THORSEN (lxvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u></i>
NRM	47.2004	<i>John MBURU (lxvi): <u>Wildlife Conservation and Management in Kenya: Towards a Co-management Approach</u></i>
NRM	48.2004	<i>Ekin BIROL, Ágnes GYOVAI and Melinda SMALE (lxvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transitional Economy</u></i>
CCMP	49.2004	<i>Gernot KLEPPER and Sonja PETERSON: <u>The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects</u></i>
GG	50.2004	<i>Scott BARRETT and Michael HOEL: <u>Optimal Disease Eradication</u></i>
CTN	51.2004	<i>Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG: <u>Simple Priorities and Core Stability in Hedonic Games</u></i>
SIEV	52.2004	<i>Francesco RICCI: <u>Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory</u></i>
SIEV	53.2004	<i>Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON: <u>Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?</u></i>
NRM	54.2004	<i>Ingo BRÄUER and Rainer MARGGRAF (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></i>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN (lxvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</u></i>
NRM	56.2004	<i>Tom DEDEURWAERDERE (lxvi): <u>Bioprospection: From the Economics of Contracts to Reflexive Governance</u></i>
CCMP	57.2004	<i>Katrin REHDANZ and David MADDISON: <u>The Amenity Value of Climate to German Households</u></i>
CCMP	58.2004	<i>Koen SMEKENS and Bob VAN DER ZWAAN: <u>Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios</u></i>
NRM	59.2004	<i>Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA (lxvii): <u>Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management</u></i>
NRM	60.2004	<i>Timo GOESCHL and Danilo CAMARGO IGLIORI (lxvi): <u>Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon</u></i>
CCMP	61.2004	<i>Barbara BUCHNER and Carlo CARRARO: <u>Economic and Environmental Effectiveness of a Technology-based Climate Protocol</u></i>
NRM	62.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH: <u>Resource-Abundance and Economic Growth in the U.S.</u></i>
NRM	63.2004	<i>Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ (lxvi): <u>Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis</u></i>
NRM	64.2004	<i>E.C.M. RUIJGROK and E.E.M. NILLESEN (lxvi): <u>The Socio-Economic Value of Natural Riverbanks in the Netherlands</u></i>
NRM	65.2004	<i>E.C.M. RUIJGROK (lxvi): <u>Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method</u></i>
ETA	66.2004	<i>Giannis VARDAS and Anastasios XEPAPADEAS: <u>Uncertainty Aversion, Robust Control and Asset Holdings</u></i>
GG	67.2004	<i>Anastasios XEPAPADEAS and Constadina PASSA: <u>Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach</u></i>
GG	68.2004	<i>Michael FINUS: <u>Modesty Pays: Sometimes!</u></i>
NRM	69.2004	<i>Trond BJØRNDAL and Ana BRASÃO: <u>The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications</u></i>
CTN	70.2004	<i>Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT: <u>On Coalition Formation with Heterogeneous Agents</u></i>
IEM	71.2004	<i>Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA: <u>Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants</u></i>
IEM	72.2004	<i>Alessandro LANZA, Matteo MANERA and Michael MCALEER: <u>Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns</u></i>
SIEV	73.2004	<i>Margarita GENIUS and Elisabetta STRAZZERA: <u>The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests</u></i>
CCMP	74.2004	<i>Rob DELLINK and Ekko van IERLAND: <u>Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment</u></i>
ETA	75.2004	<i>Rosella LEVAGGI and Michele MORETTO: <u>Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach</u></i>
CTN	76.2004	<i>Salvador BARBERÀ and Matthew O. JACKSON (lxx): <u>On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union</u></i>
CTN	77.2004	<i>Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERA and Fernando VEGA-REDONDO (lxx): <u>Optimal Information Transmission in Organizations: Search and Congestion</u></i>
CTN	78.2004	<i>Francis BLOCH and Armando GOMES (lxx): <u>Contracting with Externalities and Outside Options</u></i>
CTN	79.2004	<i>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE (lxx): <u>Merger Performance under Uncertain Efficiency Gains</u></i>
CTN	80.2004	<i>Francis BLOCH and Matthew O. JACKSON (lxx): <u>The Formation of Networks with Transfers among Players</u></i>
CTN	81.2004	<i>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO (lxx): <u>Bicameralism and Government Formation</u></i>

CTN	82.2004	<i>Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT (lxx): <u>Potential Maximization and Coalition Government Formation</u></i>
CTN	83.2004	<i>Kfir ELIAZ, Debraj RAY and Ronny RAZIN (lxx): <u>Group Decision-Making in the Shadow of Disagreement</u></i>
CTN	84.2004	<i>Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ (lxx): <u>Economics: An Emerging Small World?</u></i>
CTN	85.2004	<i>Edward CARTWRIGHT (lxx): <u>Learning to Play Approximate Nash Equilibria in Games with Many Players</u></i>
IEM	86.2004	<i>Finn R. FØRSUND and Michael HOEL: <u>Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power</u></i>
KTHC	87.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH: <u>Natural Resources, Investment and Long-Term Income</u></i>
CCMP	88.2004	<i>Marzio GALEOTTI and Claudia KEMFERT: <u>Interactions between Climate and Trade Policies: A Survey</u></i>
IEM	89.2004	<i>A. MARKANDYA, S. PEDROSO and D. STREIMIKIENE: <u>Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?</u></i>
GG	90.2004	<i>Rolf GOLOMBEK and Michael HOEL: <u>Climate Agreements and Technology Policy</u></i>
PRA	91.2004	<i>Sergei IZMALKOV (lxx): <u>Multi-Unit Open Ascending Price Efficient Auction</u></i>
KTHC	92.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI: <u>Cities and Cultures</u></i>
KTHC	93.2004	<i>Massimo DEL GATTO: <u>Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution</u></i>
CCMP	94.2004	<i>Pierre-André JOUVET, Philippe MICHEL and Gilles ROTILLON: <u>Equilibrium with a Market of Permits</u></i>
CCMP	95.2004	<i>Bob van der ZWAAN and Reyer GERLAGH: <u>Climate Uncertainty and the Necessity to Transform Global Energy Supply</u></i>
CCMP	96.2004	<i>Francesco BOSELLO, Marco LAZZARIN, Roberto ROSON and Richard S.J. TOL: <u>Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise</u></i>
CTN	97.2004	<i>Gustavo BERGANTIÑOS and Juan J. VIDAL-PUGA: <u>Defining Rules in Cost Spanning Tree Problems Through the Canonical Form</u></i>
CTN	98.2004	<i>Siddhartha BANDYOPADHYAY and Mandar OAK: <u>Party Formation and Coalitional Bargaining in a Model of Proportional Representation</u></i>
GG	99.2004	<i>Hans-Peter WEIKARD, Michael FINUS and Juan-Carlos ALTAMIRANO-CABRERA: <u>The Impact of Surplus Sharing on the Stability of International Climate Agreements</u></i>
SIEV	100.2004	<i>Chiara M. TRAVISI and Peter NIJKAMP: <u>Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents</u></i>
SIEV	101.2004	<i>Chiara M. TRAVISI, Raymond J. G. M. FLORAX and Peter NIJKAMP: <u>A Meta-Analysis of the Willingness to Pay for Reductions in Pesticide Risk Exposure</u></i>
NRM	102.2004	<i>Valentina BOSETTI and David TOMBERLIN: <u>Real Options Analysis of Fishing Fleet Dynamics: A Test</u></i>
CCMP	103.2004	<i>Alessandra GORIA e Gretel GAMBARELLI: <u>Economic Evaluation of Climate Change Impacts and Adaptability in Italy</u></i>
PRA	104.2004	<i>Massimo FLORIO and Mara GRASSEN: <u>The Missing Shock: The Macroeconomic Impact of British Privatisation</u></i>
PRA	105.2004	<i>John BENNETT, Saul ESTRIN, James MAW and Giovanni URGA: <u>Privatisation Methods and Economic Growth in Transition Economies</u></i>
PRA	106.2004	<i>Kira BÖRNER: <u>The Political Economy of Privatization: Why Do Governments Want Reforms?</u></i>
PRA	107.2004	<i>Pehr-Johan NORBÄCK and Lars PERSSON: <u>Privatization and Restructuring in Concentrated Markets</u></i>
SIEV	108.2004	<i>Angela GRANZOTTO, Fabio PRANOVI, Simone LIBRALATO, Patrizia TORRICELLI and Danilo MAINARDI: <u>Comparison between Artisanal Fishery and Manila Clam Harvesting in the Venice Lagoon by Using Ecosystem Indicators: An Ecological Economics Perspective</u></i>
CTN	109.2004	<i>Somdeb LAHIRI: <u>The Cooperative Theory of Two Sided Matching Problems: A Re-examination of Some Results</u></i>
NRM	110.2004	<i>Giuseppe DI VITA: <u>Natural Resources Dynamics: Another Look</u></i>
SIEV	111.2004	<i>Anna ALBERINI, Alistair HUNT and Anil MARKANDYA: <u>Willingness to Pay to Reduce Mortality Risks: Evidence from a Three-Country Contingent Valuation Study</u></i>
KTHC	112.2004	<i>Valeria PAPPONETTI and Dino PINELLI: <u>Scientific Advice to Public Policy-Making</u></i>
SIEV	113.2004	<i>Paulo A.L.D. NUNES and Laura ONOFRI: <u>The Economics of Warm Glow: A Note on Consumer's Behavior and Public Policy Implications</u></i>
IEM	114.2004	<i>Patrick CAYRADE: <u>Investments in Gas Pipelines and Liquefied Natural Gas Infrastructure What is the Impact on the Security of Supply?</u></i>
IEM	115.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA: <u>Oil Security. Short- and Long-Term Policies</u></i>
IEM	116.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA: <u>Social Costs of Energy Disruptions</u></i>
IEM	117.2004	<i>Christian EGENHOFER, Kyriakos GIALOGLOU, Giacomo LUCIANI, Maroeska BOOTS, Martin SCHEEPERS, Valeria COSTANTINI, Francesco GRACCEVA, Anil MARKANDYA and Giorgio VICINI: <u>Market-Based Options for Security of Energy Supply</u></i>
IEM	118.2004	<i>David FISK: <u>Transport Energy Security. The Unseen Risk?</u></i>
IEM	119.2004	<i>Giacomo LUCIANI: <u>Security of Supply for Natural Gas Markets. What is it and What is it not?</u></i>
IEM	120.2004	<i>L.J. de VRIES and R.A. HAKVOORT: <u>The Question of Generation Adequacy in Liberalised Electricity Markets</u></i>
KTHC	121.2004	<i>Alberto PETRUCCI: <u>Asset Accumulation, Fertility Choice and Nondegenerate Dynamics in a Small Open Economy</u></i>
NRM	122.2004	<i>Carlo GIUPPONI, Jaroslaw MYSIAK and Anita FASSIO: <u>An Integrated Assessment Framework for Water Resources Management: A DSS Tool and a Pilot Study Application</u></i>
NRM	123.2004	<i>Margaretha BREIL, Anita FASSIO, Carlo GIUPPONI and Paolo ROSATO: <u>Evaluation of Urban Improvement on the Islands of the Venice Lagoon: A Spatially-Distributed Hedonic-Hierarchical Approach</u></i>

ETA	124.2004	<i>Paul MENSINK: <u>Instant Efficient Pollution Abatement Under Non-Linear Taxation and Asymmetric Information: The Differential Tax Revisited</u></i>
NRM	125.2004	<i>Mauro FABIANO, Gabriella CAMARSA, Rosanna DURSI, Roberta IVALDI, Valentina MARIN and Francesca PALMISANI: <u>Integrated Environmental Study for Beach Management: A Methodological Approach</u></i>
PRA	126.2004	<i>Irena GROSFELD and Iraj HASHI: <u>The Emergence of Large Shareholders in Mass Privatized Firms: Evidence from Poland and the Czech Republic</u></i>
CCMP	127.2004	<i>Maria BERRITTELLA, Andrea BIGANO, Roberto ROSON and Richard S.J. TOL: <u>A General Equilibrium Analysis of Climate Change Impacts on Tourism</u></i>
CCMP	128.2004	<i>Reyer GERLAGH: <u>A Climate-Change Policy Induced Shift from Innovations in Energy Production to Energy Savings</u></i>
NRM	129.2004	<i>Elissaios PAPYRAKIS and Reyer GERLAGH: <u>Natural Resources, Innovation, and Growth</u></i>

- (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>