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ENVIRONMENT BASED INNOVATION: POLICY QUESTIONS*

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ABSTRACT

Natural resources and physical cultural resources, termed in this paper as “Environmental Resources”, can be important assets for regional competitiveness and innovation. In recent years, these kinds of assets are being more considered in regional development strategies, because they can be a source of differentiation and of new competitive advantages. However, innovation policies and its instruments are largely shaped for knowledge-based innovation. On the contrary, policies towards environmental resources are usually focused on environment protection.

In this paper we discuss the role of environmental resources in regional innovation policies. We begin by relating environmental resources with regional development and by emphasizing some opposite views in what refers to the function of environmental resources in regional development. Next we deal with the relationship between regional competitive advantages and innovation strategies. The specificities and problems that arise when the aim is to construct competitiveness advantages through environmental resources valorisation are the core of section 3. In that section, we highlight the characteristics of environmental resources and we check the applicability of the “natural resource curse” to the dynamics based on the valorisation of environmental resources. The reasons that justify the public intervention as well as difficulties concerning the adequate level of intervention (local / regional / national) are also examined. The paper ends with some conclusions and policy implications.

KEYWORDS: Competitiveness; Environment; Innovation; Innovation Policies; Regional Development.

JEL codes: O3, Q0, Q2, Q5, R5.

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INOVAÇÃO BASEADA EM RECURSOS AMBIENTAIS: DESAFIOS PARA A POLÍTICA

RESUMO

Os recursos naturais bem como os recursos culturais físicos, globalmente designados na nossa análise por “recursos ambientais”, podem constituir importantes activos para a competitividade regional e a inovação. Observa-se uma tendência crescente para a consideração destes activos nas estratégias de desenvolvimento regional já que eles podem ser uma fonte de diferenciação e de novas vantagens competitivas. Contudo, as políticas de inovação e os seus instrumentos estão essencialmente formatados para promover a inovação baseada no conhecimento. Por outro lado, as políticas que incidem sobre os recursos ambientais centram os seus objectivos na preservação do ambiente.

Neste artigo discutimos o papel dos recursos ambientais nas políticas regionais de inovação. Começamos por relacionar recursos ambientais e desenvolvimento regional, considerando algumas perspectivas opostas quanto a essa relação. Seguidamente, evocamos a relevância das estratégias de inovação na criação de vantagens competitivas regionais. As especificidades e problemas associados à construção de vantagens competitivas através da valorização de recursos ambientais são o objecto central da análise desenvolvida na secção 3. Entre outros aspectos, procuramos clarificar as características económicas dos recursos ambientais e discutimos a aplicabilidade da “maldição dos recursos naturais” às dinâmicas assentes na valorização de recursos ambientais. As razões que justificam a intervenção pública bem como dificuldades relevantes decorrentes do nível apropriado de intervenção (local / regional / nacional) são igualmente examinadas. O artigo termina com um ponto de conclusões no qual evidenciamos as implicações em matéria de política.

PALAVRAS-CHAVE: Competitividade; Ambiente; Inovação; Políticas de Inovação; Desenvolvimento Regional.

Códigos JEL: O3, Q0, Q2, Q5, R5.

1. ENVIRONMENTAL RESOURCES AND REGIONAL DEVELOPMENT

In growth theory, seen as the set of macro-models aiming to explain economic growth at the aggregate level, the reference to natural resources has nearly disappeared. In the Harrod / Solow debate (Harrod, 1939, 1948; Solow, 1956, 1957), per capita growth was attributed to exogenous and unexplained technical progress. Human capital accumulation became also considered a relevant source of economic growth, under perspectives such as Robert Barro works on the determinants of the level of the so-called steady-state product (Barro, 1991; 1997) or Lucas model of endogenous growth (Lucas, 1988). Then, in the second generation of endogenous growth models, the “engine” of per capita growth is technical knowledge (Romer, 1990; Aghion and Howitt, 1992), the accumulation of knowledge being endogenous.

In fact, natural resources *strictus sensus* cannot be accumulated and so they tend to be seen as an exogenous constraint to growth, as actually they were considered by classic authors like Ricardo (1817). However, natural resources as an exogenous constraint to growth can be evaluated in quite opposite terms. While some social scientists and historians (see for instance Wright, 1990) tend to view the natural resources as an endowment of nature that represents an advantage over regions where such resources are in short supply, other look to natural resources as a “curse” (Sachs and Warner, 2001)¹.

An analogous evaluation concerning a lack of attention as a factor of economic growth can be made for cultural assets. Culture is a wide concept – which comprehension falls far outside our present analysis – and cultural assets can include immaterial elements such as traditions, norms and values that compose a “group identity”, as well as symbolic elements that play a function of “meaning”. But cultural assets also include physical objects, like art objects and other human built patrimony, including for instance human built rural or urban landscape.

Some immaterial aspects linked around the concept of institutions have been considered in economic analysis of growth, within an institutionalism framework (Commons, 1931; North, 1990) or even in mainstream neoclassic contributions. For instance, the already quoted Barro’s works include quality of institutions as an element determining the level of the steady-state product of economies. However, these analyses stress the role of norms and culture in understanding and explaining institutions such as firms and markets, what is related

¹ For a synthetic discussion of the relationship between natural resources and economics see Pearce and Turner (1990, part I)

but not coincident with the idea of cultural assets as a source of economic value. Moreover, physical cultural assets are clearly outside considerations concerning the role of institutions in growth and development.

Nevertheless, the consideration of natural and cultural assets in development analysis is present under the “sustainable development” perspective. The concept of “sustainable development” was first brought to widespread public attention by means of the work of “the Brundtland Commission”, the United Nations World Commission on Environment and Development (see WCED, 1987)². The Commission’s report not only argues that a healthy economy depends on a healthy biosphere and vice versa, but also has launched the idea of sustainability as a means of integrating economic and ecological concerns in long-term development strategies, and so contributing to the emergence of a new sub-discipline, termed ecological economics. A key contribution of the ecological economics was the concept of natural capital (El Sarafy, 1991), a form of capital distinct from fixed and human capital and open to analysis, taking account of its particular properties using the common instruments of capital theory. One of the distinctive aspects of natural capital was seen by ecological economists to be precisely its sustainability properties (Costanza and Daly, 1992).

So, the concept of natural capital forms the basis for thinking about sustainable development – “the management of natural resources in a way that provides for the needs of the present generation without compromising the capacity of future generations to meet their own needs” (WCED, 1987, p. 43). The elements of natural capital comprise renewable and non-renewable resources, the ecosystems that support and maintain the quality of land, air and water, and the biodiversity.

In the early 1990s, another UN Commission, the World Commission on Culture and Development (WCCD, 1995) extended the idea of sustainability to the dominion of culture³. Although the impact of this Commission on the public consciousness has been more reduced than the Brundtland one, it raised questions about the relationship between culture and development in to some extent analogous conditions and placed them in the sustainability ground.

Since then, the concept of cultural capital is slowly but surely taking form (Throsby, 1997, 1999, 2003; Shockley, 2004). A piece of cultural capital can be described as an asset that

² For other earlier influential works, see Barbier (1987) on the concept of sustainable economic development and O’Riordan (1988) on the politics of sustainability.

³ This Commission is also known as the “Péres de Cuéllar Commission”.

embodies or gives rise to cultural value in addition to whatever economic value it might possess. An example makes this intuitively clear: a heritage building may have some commercial value as a piece of real estate, but its true value to individuals or to the community is likely to have artistic, spiritual, symbolic or other elements that may transcend or lie outside of the economic calculus. These values can be called the building's cultural value. Cultural capital defined in this way may exist in tangible form as buildings, locations, sites, artworks, artifacts, etc., or in intangible form as ideas, practices, beliefs, traditions, etc.

Others highlight the direct interactions between culture and the environment (Nassauer, 1997; Garcia Mira *et al.*, 2003). While a complete assessment of this fruitful literature is outside our present paper, in terms of environmental and economic policy, these paradigms imply interpreting the management of cultural capital and natural capital as a matter of defining sustainable development paths for the economy under a variety of assumptions (Solow, 1986; Hartwick, 1995).

In the above quoted contributions, natural capital includes both non-renewable and renewable resources and cultural capital includes physical and immaterial elements. In our analysis we will deal mainly with natural renewable resources and physical cultural resources and their relevance to economic growth and, in particular, to regional development. As we will discuss further in section 3, renewable natural resources and physical cultural assets have common characteristics (in terms of rivalry and sustainability proprieties) that apart them from exhaustible natural resources (subject to rivalry in its use) and from intangible cultural resources (these last being, like knowledge, completely non-rival). We will also avoid the term capital, because "capital", in a more strict sense, refers to something that was formed by economic agents under an investment intention, which is the case for physical and human capital but not for natural or cultural resources. So, we will term the set of natural renewable resources and physical cultural assets as "environmental resources".

Although neglected in growth theory and in aggregate analysis of economic dynamics, environmental resources are at the centre of many successful cases of sector and regional growth and a growing attention is being given to them in relevant policy makers' instances. At the regional development level it is not difficult to find cases in which the economic valorisation of environment resources plays a major role in economic growth. Concerning physical cultural assets, an obvious reference of their impact in regional and urban development can be found in many city-regions in Italy, including Rome, where

“investments” made centuries ago – for home or infrastructures purposes – go on producing positive externalities and generating economic value today.

Based on natural resources endowment or in a combination between natural and cultural resources, several European laggard regions had experienced in the last decades successful evolutions driven by tourism and related activities. For instance, Algarve and Madeira were in the 60’ two of the poorest regions in Portugal and in Europe; they are now two of the three Portuguese regions with a highest GDP per capita and, at the end of the Third CSF period, ceased to be Objective 1 regions.

At the sector level, we all are aware that tourism, an activity clearly based on environment resources, is a fast growing activity with a great relevance in jobs creation. In world terms, between 1950 and 2004, the number of tourists has been multiplied by 30 (World Tourism Organization). Following certain estimations, tourism industry could represent, in 2000, 11% of world GDP and 8% of world employment (Rita, 2000).

Cultural industries linked to art, music, museums, literature and so on represent already in the EU more than 7 millions of jobs (MKW, 2001). Culture industry can be defined as the activities related with production and distribution of symbolic goods, whose value derives from their function of “meaning” (O’Connor, 1999). More recently, the new category of creative industries is receiving a wide attention as an important “filiere” of activities, integrating the cultural sector but also media and other technological activities for which creativity and culture are the main source of added value creation.

Policy makers are also dedicating much more attention to the economic value of environment resources, seeing them not only as a constraint but also as a relevant asset for growth and development. For instance, in a recent report on the pro-active management of the impact of cultural tourism upon urban resources and economies, Besson and Paskaleva (2005) summarize 33 best practices cases in different European regions.

The European Commission, in its recent task of preparation of a Maritime Policy for the Union, declared the need for a wide maritime policy aimed at developing a maritime economy, in an environmentally sustainable manner. Such policy should be supported by excellence in marine scientific research, technology and innovation. In the same report, the European Commission estimates that between 3 and 5% of Europe’s GDP is generated by marine based industries and services, without including the value of raw materials, such as oil, gas or fish (Commission of the European Communities, 2006). Maritime industries should

observe in the future a strong growth, namely due to the growth potential of activities such as cruise shipping, ports, aquaculture, renewable energy, submarine telecommunications and marine biotechnology (Douglas-Westwood Limited, 2005).

In what follows we will develop the idea that environmental resources can be important to build regional competitiveness advantages and regional innovation strategies but, at the same time, the use of environmental assets in this process appeals to some difficult policy questions.

2. REGIONAL COMPETITIVE ADVANTAGES AND INNOVATION STRATEGIES

In a recent report of the European Commission with the appealing title “Constructing Regional Advantage”, a group of European experts highlight the distinction between comparative advantage, competitive advantage and constructed advantage (Cooke *et al.*, 2006). While comparative advantage corresponds to the Ricardian concept that perceived competitiveness in a static manner, as the result of production factors endowments, the competitive advantage concept was introduced by Porter in order to capture the dynamics of competitiveness. Competitive advantage rests on “making more productive use of inputs, which requires continual innovation” (Porter, 1998a, p. 78, quoted by Cooke *et al.*, 2006).

In Porter analysis as well in other relevant analysis concerning competitiveness, competitive advantage is seen as a highly localized process or a contextual process. Other than Porter’s contribution (1990, 1998b), the analyses structured around the marshallian concept of industrial district, renewed by Becattini (1979), or the more recent set of analysis around the regional innovation system concept (Cooke, 2001) also stress this local dimension. However, the consideration of business interactions and networks, knowledge diffusion and collective learning mechanisms and so on are not sufficient to distinguish the competitive advantage concept from a related one, the constructed advantage concept. As discussed by Cooke *et al.*, talking about constructed advantages evokes the idea that competitive advantages also need to be consciously and pro-actively be constructed, namely through a “more dynamic role of the public sector (...) generally and government and governance specifically” (Cooke *et al.*, 2006, p. 74-74). In the same sense and in our opinion, the concept of constructed (competitive) advantage can be a useful one for regional development analysis because, in many cases, not only the support to innovation in the business sector and the promotion of interactions between different agents should be in

mind in the policy framework but also collective actions and a public coordination role should integrate the core of policy actions.

The regional innovation system (RIS) concept is recent but will probably become one of the most influent one, in the next years, namely for the design of regional development policies. First, there is no doubt that the RIS concept was in great part derived from the former concept of National Innovation System (Freeman, 1987 and 1995; Lundvall, 1992; Nelson and Rosenberg, 1993). Following Saviotti (1997), an innovation system can be defined as a set of actors and interactions that have as the main objective the generation and adoption of innovations. This definition recognizes that innovations are not generated just by individuals, organizations and institutions but also by complex patterns of interactions between them. So, within an innovation system we can define their elements, the interactions, the environment and the frontier.

As referred by Cooke (2001), the recent idea of RIS results from some convergence between works of regional scientists, economic geographers and national systems of innovation analysts. RIS have its relevance based on the fact that proximity plays a major role on networks and interactions density; this fact is in general attributed to the tacit nature of a relevant part of knowledge. Tacit knowledge “is best shared through face-to-face interactions between partners who already share some basic commonalities: the same language, common “codes” of communication and shared conventions and norms...” (Asheim and Gertler, 2005, p. 293). The regional dimension also generates a more “focused” knowledge basis, as a cumulative result of the clustering of economic and innovation oriented activities. Asheim and Gertler develop analogous arguments and do not hesitate to stress that “the more knowledge-intensive the economic activity, the more geographically clustered it tends to be” (Asheim and Gertler, 2005, p. 291).

Besides the cognitive and normative dimensions of RIS, that can present different degrees of intensity, the political dimension should however not be excluded. Cooke (2001) refers “region” as a key component of a RIS, considering it as a meso-level political unit set between the national or federal and local levels of government that might have some cultural or historical homogeneity but which at least had some statutory powers to intervene and support economic development, particularly innovation. This political dimension has a major relevance on the perspective, discussed above, of constructing regional competitive advantages and we will keep in mind this aspect on the later discussion concerning innovation policy based on the valorisation of environmental resources.

Regional innovation policies should be aware of differentiation of regional paths. Even within a strict knowledge-based economy perspective, regional differentiation is important because the knowledge base of the existing productive sectors is not the same everywhere. Also, some knowledge “focus” in the Science and Technology public institutions is needed. As pointed out by many, cumulateness and path dependency are important characteristics of technological capabilities.

Another source of differentiation of regional development paths can rely on environmental resources endowment. Contrary to capital, which is a generic resource, environmental resources present specificities and so they can be a source of regional competitive advantages. The economic valorisation of environmental resources and its combination with knowledge can lead to specific innovation paths. However, regional innovation policies and instruments are shaped in a quite generic way to knowledge based innovation, with an emphasis on cognitive aspects. Because the nature and use of environmental resources presents some singularities, their economic valorisation also appeals to some specific features concerning innovation policies.

3. CONSTRUCTING COMPETITIVE ADVANTAGES THROUGH ENVIRONMENTAL RESOURCES VALORISATION: SPECIFICITIES AND PROBLEMS

Environment resources present some specific characteristics that must be considered when these resources are used. So, we begin by discussing the scope and characteristics of environment resources, focusing on rivalry, sustainability and substitutability dimensions.

Because the economic history of the last two centuries shows mixed evidence about the effects, on growth and development, of natural resources endowment, we proceed addressing the reasons for such contradiction. As a matter of fact, during the nineteenth century and the first half of the twentieth century, several countries went through development experiences in which natural resources seem to have been the engine of economic growth. The most notable cases include Australia, Scandinavia and the United States (see, among others: Wright, 1990; Blomstrom and Meller, 1990). However, it is hard to find successful experiences of such development in the second half of the twentieth century. Indeed, in many countries the natural resources sector has been the alleged responsible for the underdevelopment or slow growth of the economy. So, the idea of a “curse” of natural resources has emerged, and an important

question arises: Are the mechanisms that generate this “curse” present when development is based on the economic valorization of environmental resources?

Building competitive advantages depends not only on making more productive use of inputs but also on the dynamic effects over the economy. So, the third part of this section deals with externalities caused by environmental resources use. In the presence of externalities, or when we face public goods, economic theory calls for public intervention. But, building sustained development paths through the use of environmental resources puts another not less important question: what is the appropriated level of public intervention? Is it the local / regional or the national level? So, this section ends with a short reflection about this question.

3.1. Scope and characteristics of environmental resources

A key element of the above mentioned concept of “sustainable development” perspective when applied to natural resources is the concept of equity in the treatment of different generations over time, i.e. the principle of intergenerational equity (Pearce and Turner, 1990). But, in addition to intergenerational aspects, the notion of ecological sustainability also implies several other principles, including attention to equity within the present generation, the maintenance of biodiversity, and observance of the precautionary principle that is taking a risk-averse attitude when confronted with decisions that may cause irreversible change (O’Riordan and Jordan, 1995). Similar principles can be applied to cultural resources; because the stock of cultural assets, both tangible and intangible, embodies the culture we have inherited from our ancestors and which we transmit to future generations⁴.

It can be argued that just as natural ecosystems support the real economy, so also cultural systems, viewed as networks of cultural relationships and institutions, which spread through societies, are essential to sustain economic activity. In other words, when cultural systems function well, human productivity can be increased and economic growth can be enhanced. But there is another parallel between natural and cultural resources: both are related to wealth that have been inherited from the distant or recent past, the former provided as an endowment

⁴ Overall, the approach adopted in specifying a sustainable development path raises again the well-known debate about whether the intergenerational aspects of sustainable development are a matter of efficiency in intertemporal resource allocation, or whether they are matters of fairness or equity in the present generation’s treatment of its successors. It might be observed that the admission of cultural value as an additional element in the picture does not change the basic propositions involved. The preservation of cultural resources for the benefit of future generations can be just as much a question of efficiency or equity in the allocation of resources producing cultural benefits as it is in the case of economic return.

of nature, the latter deriving from human creativity. However, in spite of these similarities some heterogeneity is perceptible when we look to both types of resources. On the one hand, we must distinguish between renewable and non-renewable natural resources and, on the other, a division exists between tangible and intangible cultural resources.

As already mentioned, this paper deals with “environmental resources”, defined as the set of natural renewable resources and physical cultural assets. What are the reasons for such procedure? As it is apparent from table 1, which presents the similarities and differences between natural and cultural assets, the reasons are associated to the main characteristics of each one type of resources. While non-renewable natural resources, like mineral resources, are rival goods, renewable natural resources, like sun or landscape are partially non-rival in use. This latter attribute characterizes also tangible cultural assets. On the other hand, culture in general is intangible like knowledge, and so has the property of non-rivalry.

In economics terms, a sustainable development path can be defined as a situation where aggregate consumption is less than or equal to net domestic product. Consequently sustainability implies at least to maintain the total stock of resources. If the stock of resources referred to is extended to include human, cultural and natural assets as well as physical capital, the question arises as to whether different types of assets can simply be aggregated, such that a decline in the level of one type of resources can be compensated for by an increase in another. In other words, this raises the issue of substitutability between forms of assets⁵.

In the literature on the substitutability between natural resources and human-made capital two main paradigms have emerged (Neumayer, 2003). The first, which can be called “weak sustainability”, derives from the original work of Solow (1974a, 1974b) and Hartwick (1977, 1978)⁶. These authors investigated the question of investing the rents from exhaustible resources in the presence of the need for intergenerational equity. In its simplest form this model portrays an economy in which the competitive rents from current use of the exhaustible resource are reinvested in human-made capital goods, enabling society to maintain a constant consumption stream; the accumulation of physical capital exactly offsets the decline in natural non-renewable resources.

As is apparent, the “weak sustainability” paradigm assumes that natural resources and human-made capital are perfect or good substitutes in the production of consumption goods and in

⁵ Considering the sustainability of natural resources there are two standard divergent positions: on the one hand Dasgupta and Heal (1979) representing a strictly neoclassical approach, and, on the other, Pearce and Turner (1990) who support the non-substitutability case. An outline is supplied in Victor (1991).

⁶ An indicator of “weak sustainability” is provided in Pearce and Atkinson (1993).

the direct provision of utility for both present and future generations. This perspective entails a concept of sustainability that is completely different from the ecological one. It is the aggregate capital stock that matters and not what it encompasses; in other words, it doesn't matter if the present generation uses up exhaustible resources as long as sufficient new physical capital can be provided to future generations by way of compensation.

But, how can one apply the “weak sustainability” paradigm to cultural assets? It is a fact that some of the economic functions provided by a historic building could as well be provided by another structure without cultural content. However, since by definition cultural wealth is distinguished from physical capital by its embodiment and production of cultural value, there would be zero substitutability between cultural assets and physical capital in respect of its cultural output, since no other form of capital is capable of providing this sort of value. In other words, because cultural assets give rise by definition to two sorts of value, namely economic and cultural, only the economic value could find a substitute.

Table 1. Natural and cultural assets

	Natural resources		Cultural resources	
Origin	Endowment of nature		Human creativity	
Types	Non-renewable	Renewable	Tangible	Intangible
Core	Mineral resources	Natural ecosystems	Physical cultural assets	Networks of cultural relationships
Main characteristic	Rival	Partially non-rival	Partially non-rival	Non-rival
Substitutability <i>between</i> forms of resources	“Weak” Sustainability	“Strong” Sustainability	“Strong” Sustainability	N.A.

So, not only the natural renewable resources but also the tangible cultural resources are associated to the “strong sustainability” paradigm, that is, both forms of resources are regarded as being strictly non-substitutable for human-made capital, a view deriving in part from the unique life-supporting properties of global air, land and water systems⁷. Proponents of “strong sustainability” argue that no other form of wealth is capable of providing the basic functions that make human, animal and plant life possible. Moreover some forms of natural renewable resources cannot be reconstructed once they are destroyed; for example, the

⁷ The strong sustainability hypothesis takes for granted that the functions of natural resources cannot be replicated no matter how spectacular future technological advances might be.

destruction of biodiversity is a loss of natural wealth that cannot be reversed and even climate change could result in ecosystem damage that is irreversible.

3.2. Is the 'natural resource curse' applicable to environmental resources?

The idea that natural resources might be more a curse than a good thing started to become known in the 1980's. From then on, the 'resource curse' began refer to the apparent irony that countries with an abundance of natural exhaustible resources have less economic growth than countries without such endowment⁸. The negative effects of the alleged natural resources abundance are explained by both political and economic arguments.

Firstly, in political terms, based in Krueger's (1974) argumentation that natural resources provide an easy way of receiving rents, and lead to rent-seeking competition rather than productive activities, other authors (Sachs and Warner, 1995; Gray and Kaufmann, 1998; Ascher, 1999; Leite and Weidmann, 1999, Rodriguez and Sachs, 1999; Gylfason, 2001a; Torvik, 2002) highlight the fact that natural resource rents stimulate economic agents to corrupt the administration in order to gain access and so, natural resources are often associated with the emergence of politically powerful interest groups that attempt to influence politicians prone to corruption in order to adopt policies that are against the general public interest (Mauro, 1998).

Secondly, natural exhaustible resource abundance is taken to pressure some variable or mechanism 'X' that obstructs or delays growth (see Sachs and Warner, 2001). Since abundance of natural resource provides a continuous stream of future wealth, it decreases the need for savings and investments. Yet, world prices for primary commodities tend to be more volatile than world prices for other goods. Therefore, an economy based on primary production will easily shift from booms to recessions and this creates uncertainty for investors in natural resource economies (Sachs and Warner 1999b). But the variable 'X' may be either the manufacturing sector, or education, or even openness. Natural resource wealth reduces the potential share of manufacturing sector for which human capital is an important factor of production. Sachs and Warner (1995) also argued that natural resource abundance creates a

⁸ The term 'resource curse thesis' was first used by Auty (1993) to describe how countries rich in natural resources were not able to use that wealth to boost their economies and how, counter-intuitively, these countries had lower economic growth than countries without an abundance of natural resources. See also Auty (1994; 2001).

false sense of confidence: ‘easy riches lead to sloth’. An expanding primary sector does not need a high-skilled labor force, and there is no pressure to increase spending on education. The need for high-quality education declines, and so does the returns to education (Gylfason 2001a). This restricts the future expansion of other sectors that require educational quality (Gylfason, 2000, 2001a, 2001b; Sachs and Warner, 1999b) and the technological diffusion in the economy (Nelson and Phelps, 1966). Natural resource abundance reduces the openness of an economy and hurts its terms of trade. Since natural resources weaken the manufacturing sector, policy makers may impose import quotas and tariffs that, in the short run, protect domestic producers (Auty, 1994; Sachs and Warner, 1995). In the long run, such measures harm the openness of the economy and its integration into the global economy.

Finally, a phenomenon known as the “Dutch Disease” (Sachs and Warner, 1995; Gylfason, 2000, 2001a, 2001b; Rodriguez and Sachs, 1999) occurred under a natural resource boom, cause a move in factors of production from the manufacturing sector towards the booming primary sector in response of the increased rents in the latter. Often, the manufacturing sector is characterized by increasing returns to scale and positive externalities. A decrease of the manufacturing sector further decreases the profitability of investments, accelerating the decrease in investments (Sachs and Warner, 1995, 1999a; Gillis *et al*, 1996; Gylfason, 2000, 2001a). Additionally, natural resource booms increase domestic income and the demand for goods, generating inflation and an overvaluation of the domestic currency. The relative price of all non-traded goods increase, the terms of trade deteriorate, and exports become expensive relative to world market prices and, consequently, decline.

Although resource curse arguments have been explained at national economy aggregate level, and where related mainly with non-renewable resources, they are in some measure extensible to the regional context and to the use of environmental resources. Because the expansion of activities based on environmental resources can occur in an extensive way, without efficiency gains, some crowding-out effects over other activities submitted to competition can arise. Typically, in some small touristy regions, the boom of tourism and related activities has contributed to the decline of former activities such as agriculture or manufacturing. In these cases, the crowding-out effects have worked mainly through the labor market and the land market, because the “booming sector” has generated a strong increase in labor and land prices.

So, in order to avoid or minimize these crowding-out effects, the use of environmental resources must be appropriately linked with dynamic efficiency concerns and with innovation.

This will allow a less extensive use of environmental resources and will base competitiveness not only on an initial resource endowment but also on innovation. This will also increase the set of activities related to the environment-based ones, incorporating more knowledge-based activities in this set.

3.3. Externalities and the need of public intervention

Environmental resources are a source of positive externalities: economic benefits for individuals that did not contribute for its production or preservation. But, on the other hand, unless cautiously managed, environmental resources use could result in negative externalities such as increased pressure on fragile environments, erosion of sites, unwelcome socio-cultural effects, road congestion or the crowding out of activities of other sectors. So, next we show some positive and negative externalities, namely using the tourism industry as an illustrative example.

Investments based on the use of environmental resources are typically interdependent. For instance, in rural tourism each investor will benefit from the fact that several sites or farms are available within the region, because this will increase the perception for external visitors and will have a positive impact on landscape. In maritime regions, a lot of complementarities exist between hotels, restaurants, beach facilities, recreational nautics and so on.

Environmental resources use can also have positive economic benefits or externalities over all the community, such as greater awareness of the environment and local culture, conservation of monuments and wildlife preservation (Tisdell, 1983, 1987). Additionally, the economic use of environmental resources may employ other resources that are charged for, but which have a cost to the economy that is less than this amount because some are not previously fully employed. If external visitors are willing to pay more the use of a particular natural or cultural asset than the rate at which the community currently values it, this is effectively a net gain to the community. Thus, if tourism lessens unemployment because it increases the demand for labor, there will be a net gain as long as the price of this labor is greater than the cost to the economy of making it available.

Partly because of the above focused interdependence, investments based on environmental resources can also produce negative externalities. Tourism at any destination is closely interlinked with the host community and its way of life and has a symbolic dimension that

differentiates each destination. So, individual projects that do not fit with cultural or symbolic values will have negative effects that will affect all the others.

While tourism supports employment, services and facilities, it may also impose various pressures on the host community during growth phases. Because the environment has traditionally been regarded as a free public good it is frequently associated to excess demand and over-utilization of environmental resources (Buhalis and Fletcher, 1995). Major negative social impact of tourism includes congestion, crowding, noise, pollution, crime and increases in prices (Brown and Giles, 1994). This is particularly so during the development phase as local involvement gives way to external developer interests and pressures. An increasing ratio of visitors to locals may encourage a decline in tolerance towards tourist and a high temporary workers population, particularly during peak seasons, adds to the discomfort. Problems also occur when tourism declines because this may put at risk the economic and social future of the destination area⁹.

The environmental concerns have led to moves towards the development of sustainable tourism in recent years, particularly as the numbers of tourists have increased. Sustainable tourism may be defined as the optimal use of natural and cultural resources for national and regional development on an equitable and self-sustaining basis to provide a unique visitor experience and an improved quality of life. Others have considered sustaining tourist numbers to be the objective. Whatever the case, it is clear that tourism has important economic, social and environmental implications that should not be overlooked in evaluating the impacts of the tourist industry on a region. Such developments have included the definition of a sustainable tourism, the use of eco-labeling, for example the use of ecotourism, and the raising of taxes on tourists in order to raise the revenues to correct the environmental damage caused.

Consequently, visitors will have some impacts on local public goods, such as roads, parks and recreation facilities. These may be supplied free to users, and be financed by income taxes. Additional use of them by tourists may add to costs, through congestion and increased costs of maintenance, but tourists may not contribute to the costs of provision. This would constitute a cost imposed by additional tourism. However, local governments worldwide are

⁹ An example of tourism decline due to environmental degradation caused by tourism is Lake Balaton in Hungary, a place where Hungarians traditionally go fishing (Hunter and Green, 1995). Increasing water pollution from tourism caused a decline in fishing, which in turn has led to a downturn in visitor numbers.

moving towards covering these costs by requiring tourism enlargements to contribute to local infrastructure, and tourists will thus be paying indirectly for their use of local public goods¹⁰.

A number of these effects are likely to be quite small for countries with well-developed markets. Taxes and profit on most goods and services are not high, tariffs are moderate and declining, and supply elasticities for most tourism products are quite high, thereby limiting the potential for price increases. While externalities can be large or small and the size of employment effects is difficult to quantify, the overall net gains from additional tourism expenditures is likely to be significantly less than the total expenditure (Dwyer and Forsyth, 1993).

Additionally, the danger of some crowding-out effects always exists. Tourist booms increase local income and the demand for goods. The relative price of all non-traded goods increases, as well as the relative price of land and the relative wage rate, which makes less attractive the agriculture and the manufacturing activities. Increased visitor expenditure generally increases employment within tourism sector firms, but employed losses may occur elsewhere in the economy, particularly if resources are drawn away from other export-oriented industries. This is true where labor substitution between industries arises owing to a demand for similar sets of skills that are in short supply.

3.4. Local or global public goods? What is the appropriate level of policy intervention?

The public goods problem highlighted by Samuelson (1954) led to Tiebout's 1956 response. While Samuelson highlights the non-excludability of public goods and its more important consequence, namely that a decentralized mechanism to achieve their optimal provision cannot be found¹¹, Tiebout (1956) argued that there was a class of public goods, the local public good, for which a decentralized mechanism for achieving optimal allocations did indeed exist. His paper, along with others published in reaction to Samuelson's article, focused on the fact that many public goods are subject to congestion. This is especially true, it

¹⁰ Tourism has been shown to have significant impacts on the environment, through a number of impact pathways. Economic instruments, such as tourist eco-charges, present one possible means of addressing the negative aspects of tourism, both through changing behaviour and by providing funds for environmental improvement. Such charges have been applied in a number of countries, including the Balearic Islands, Bhutan and Dominica.

¹¹ That is, it is not generally possible to find a way to get individuals to reveal their true valuation for public goods.

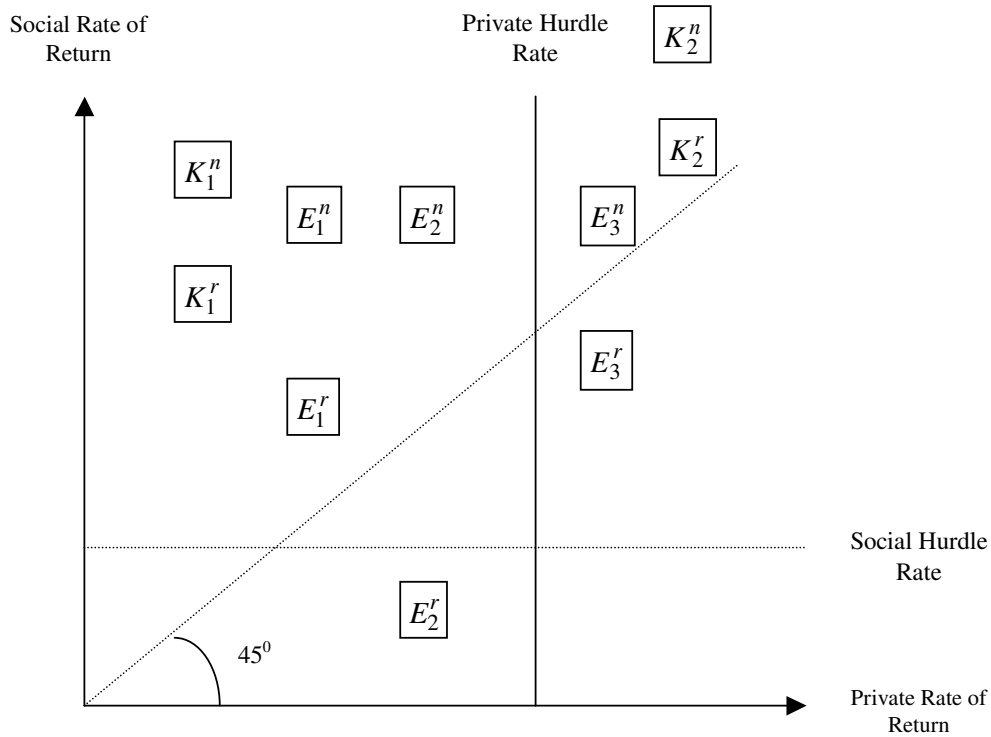
was argued, of public goods provided by local governments. These are available to everyone in the community, but for any given level of infrastructure the more people who use the facility the more crowded it becomes and the less it is available or useful to others. Using Musgrave's terminology, local public goods exhibit non-excludability but not non-rivalry; they are partially rival (or partially non-rival).

As discussed above, environmental assets have characteristics that in some way are similar to local public goods, because an over use or a bad use can generate a lesser availability for each user. In a more specific assessment, a major question arises from the fact that, in the case of activities based on environmental resources, social costs (crowding, congestion, erosion, environmental degradation, visual pollution caused by new buildings, etc.) tend to be internal to the region while social benefits can be partially external. The Venice example is paradigmatic of a case where the social costs are internal to the region, but social benefits can be partially external¹².

The answer to this problem is not easy. Figure 1 can help us to precise better this problem of social evaluation, considering that will be differences between national and regional social evaluation. Innovation policy tends to consider that in typical knowledge based investments only social benefits can exceed private benefits but there will be no negative externalities. So, knowledge based investments will appear, in Figure 1, always above the 45 degrees line. Even if social benefits at national level will exceed social benefits at regional level, this could imply some articulation between regional and national policies but will be not a great dilemma. For instance, K_1 can illustrate a public investment in basic research, where the private return is low but social return can be very high; in this case, external benefits will spread not only inside the region but also outside, including the international level. Regional subvention to this investment could be sub-optimal from a national point of view and so, some articulation with national funding could be useful. On the same logic, K_2^n and K_2^r could represent the social evaluation, respectively at national and regional level, of a profitable private investment based on knowledge that generates positive externalities at regional level and even more at national level.

¹² Venice is world famous, among others for its preserved architecture, St Mark's Plaza, its museums, romantic atmosphere, the gondolas, Carnival and the Biennale of Arts. Too many people visit Venice (on peak days around 200,000 visitors), a fact that endangers its long-term preservation, and because the island is so small, it leads to "competition" between visitors and residents for the use of public space. Unfortunately, the type of tourism developed (excursionists or people who stay in the suburb) means that the town loses a lot on possible or expected benefits of tourism. The definition of a carrying capacity in a town like Venice where many tourists come to just "soak in" the atmosphere proves difficult and has to rely on social economic factors rather than on the amount of people visiting attractions.

Figure 1. Private and Social Evaluation of Projects



Because investments that use environmental resources can generate both positive and negative externalities, points in Figure 1 representing them can be above but also under the 45 degrees line (in this last case this means that negative externalities prevail over positive externalities and so social return will be smaller than private return). Additionally, because in this kind of investments social costs are internal to region but social benefits can spread outside, the vertical distance between the points designated by the superscripts r and n tends to be greater. For instance, E_2 can illustrate the case of a national infrastructure (let's say a highway road) that would be of great national interest but environmental costs at local level are so high that regional social evaluation is clearly negative. Less dramatic but still relevant cases would be represented by E_1 and E_3 : they are both always above the social hurdle rate but while E_1 should receive support from regional or national authorities, E_3 should receive some incentive under a national perspective but some disincentive under a regional assessment.

In practice, things can be even more unclear because the perception of social costs and benefits is everything less objective and subject to several social pressures. For instance, one

should think that a private investment with high local environment costs (for instance, a residential and golf resort that crosses a protected biodiversity area) should have a negative social evaluation at local level but could have a positive national evaluation considering global effects on tourism. However, in this kind of investments we frequently see the opposite: local governs want to authorize and to support the investment while national regulations can stop it. This can be due to several reasons that we will mention but will not discuss further: local benefits can be perceived as immediate while local costs will fall after the local political cycle; local promoters will have capacity of lobbying near the local govern but not near the national govern and so on.

However, it is clear that differences between local / regional and national social evaluations do exist and could be a major problem for innovation policies based on the valorisation of environmental resources. To overcome this problem surely implicates coordination between national and regional policies.

4. POLICY IMPLICATIONS AND CONCLUSIONS

Our analysis has focussed on the relationship between environmental resources and regional development. The term environmental resources has been applied to both natural and cultural resources. In a more specific definition, the term refers to non-exhaustible natural resources and to tangible cultural assets. They have in common the property of being partially non-rival in their use. Also, they must be seen within a “strong sustainability” perspective, because human-made capital cannot substitute their destruction.

Environmental resources can play a major role in constructing regional competitive advantages and in differentiating regional development strategies. However, considering the specificities of environmental resources, some policy implications must be considered. One first general idea is that the process of economic value creation based on the use of environmental resources must also incorporate knowledge and innovation. This is important to avoid an extensive use of environmental resources and the crowding out of former or potential new activities; it will also ensure sustainability of the environmental resources and, furthermore, will generate economic opportunities for the science and technology system. So, while growth of environment-based activities supported on an extensive use of environmental resources correspond to a logic of comparative advantage based on factor endowment, environment based innovation will be a source of new competitive advantages.

A second general idea is that when using environmental resources, social costs and social benefits of private investments often overpass private costs and benefits. So, public intervention is needed as well as a combination between taxes and incentives. While taxes should be operated in order to reflect the extent of environmental costs, incentives should be closely linked to the innovative intensity of private investments. However, the use of environmental resources appeals not only for generic policy arguments based on the market failures concept but also on coordination failures.

Innovation policy under a Regional Innovation System perspective seems to be the appropriate framework to manage the economic valorisation of environmental resources. Conventional instruments for innovation policy had little to do with the RIS perspective. The basic foundations for standard innovation policy rely on the idea that R&D activities are a source of technology spillovers¹³. In the empirical front, several authors also show the importance of the R&D social returns¹⁴. Because the private return to innovative activities is less than the social return, governments need to subsidise R&D. Governments at national level have traditionally used direct funding of basic and applied research and indirect methods such as the patent system and research tax credits to help mitigate market failures and the resulting underinvestment problem.

Under the knowledge economy perspective, the RIS concept is inspiring regional development policies and the construction of regional competitiveness advantages, leading to innovation policies much more territorially based than in the past. Although policy priorities may change following different typologies of RIS, the focus is clearly put on network-based support and on strengthening the region's institutional infrastructure. Because the RIS perspective emphasises innovation as a highly localised process favoured by interactions (Asheim and Gertler, 2005), policy instruments are often based on the idea of public-private partnership (PPP) involving several local actors. For instance, the support to R&D and technological innovation projects promoted by firms in consortium with public entities of the Science and Technology System is already a typical PPP in innovation policies. Also, programmes aiming to promote technological start-ups are almost always based on institutional networks involving public agencies, universities, technology centres, research institutes, financial organizations and entrepreneurial associations and other non-profit institutions. Of course, technological PPP can be also present in national innovation policies,

¹³ In this direction, Arrow (1962) argued that a positive spillover results from any new technological knowledge; more recently, it has become generalized the idea that knowledge has the attributes of non-rivalry and dynamic feedback (Romer, 1990 and 1993; Jones, 1995).

¹⁴ See Griliches (1992) and Jones and Williams (1998).

as related by Stiglitz and Wallsten (1999, 2000). However, the above mentioned relevance of proximity in the innovation process suggests that effectiveness of technological PPP will often be greater at local level or under local or regional management.

As we have discussed elsewhere (Silva and Rodrigues, 2005a and 2005b), PPPs can bring important benefits on their own, as a specific instrument for innovation policy as well as for other public policies. In comparison with more traditional instruments of policy like direct funding of public agencies and direct subventions to firms, PPPs rely on some distinct and eventually more advantageous principles like (i) contractual funding, (ii) private and public resources gathering and (iii) subsidiarity and decentralisation. As a general instrument for public policies, the use of PPP converges with the spirit of the so-called New Public Management, and it is not hard to foresee that, in several contexts, PPP can bring more efficacy and efficiency to public policies.

When applied to innovation policy, the main argument in favour of the use of PPP is not different from the general argument for public intervention: PPP must be seen as an instrument to assure or reinforce the provision of relevant productive services to firms when simple market mechanisms do not afford an adequate provision of them. So, the main argument in favour of technologic PPP is, as pointed out by Stiglitz and Wallsten (2000), the existence of market failures linked to positive externalities of technological activities. However, PPP correspond, by definition, to a collaborative effort between several public and private agents. So, we can look at PPP as an adequate instrument not only to solve market failures but also co-ordination failures. Co-ordination malfunctions (see Hoff and Stiglitz, 2001) mean that decisions of different agents are interdependent and that a co-ordination effort can anticipate efficiency benefits and avoid social costs¹⁵.

The economic use of environmental resources appeals for a strong coordination, namely because investments are interdependent but also because environmental resources are partially rival goods, their endowment and regeneration (or re-creation) depending a lot on collective actions. As explained before, constructing competitive advantages and sustainable development paths based on both natural renewable resources and tangible cultural resources largely depends on the capability of taking advantage on externalities concerning both

¹⁵ The argument of coordination failures as support to development policies is not a new one. The “Big Push” theory formulated by Rosenstein-Rodan (1943) can be considered an earlier illustration. The need of a coordinated “Big Push” is based on the idea that moving out of a low-level steady state requires co-ordinated and simultaneous investments in a number of different areas. The precise mechanism that generates profit functions of this form depends on the model in question. Murphy *et al.* (1989) develops models in which the complementarity arises from demand spillovers across final goods produced under scale economies or from bulky infrastructure investments. Rodriguez-Clare (1996), and Rodrik (1996) present models in which the effect operates through vertical industry relationships and specialised intermediate inputs.

technical and symbolic knowledge and on increasing returns generated by interdependence between investments. At this level, and converging with the RIS perspective, regional and local levels of policy implementation seem to be unavoidable and instruments of PPP kind will be much more effective than a simple system of taxes and subventions.

When using environmental resources, social costs are mainly internal to the region while social benefits can spread outside. So, some kind of coordination between regional / local and national policies is needed. For several reasons, that we did not discuss entirely, the convenient articulation between national and regional / local policies, at this level, remains unclear and coordination costs could be high.

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