INTERGOVERNMENTAL INTERACTIONS BETWEEN TAXATION OF OIL AND GAS AND ENVIRONMENTAL PROTECTION

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Introduction

The supply chain of oil and gas represents a major and multifaceted tax base to be exploited by governments. At the same time, oil and gas have a huge environmental impact related, first, to production operations and, then, to the use of their products. Two distinct sets of taxes are applied: upstream and downstream taxes.

Upstream taxes are used almost exclusively for extracting the rent and don't have an intended direct environmental impact. Taxes referred to the exploration and extraction phases could be used directly for controlling environmental damages, but their use is almost inexistent at the present time.

Downstream taxes have, in addition to their predominant fiscal motive, also an environmental aim, because they reduce emissions and waste in so far as they reduce the use of oil and gas. Some countries, mainly the Scandinavian ones (Sumner, Bird and Smith, 2009), have also introduced an environmental targeted tax - the carbon tax - on oil and gas products. However, the tax base of these taxes is consumption of oil and gas products and not the level of emissions (although it is possible to translate the specific tax rate on consumption – Euros per liter - in terms of tax rate on, average, emissions: Euros per quantity of CO2 emissions).

Broadly reasoning, this assignment of targets to upstream and downstream taxation makes sense. Usually extraction of oil and gas takes place in a country that is different from that of consumption. When so, producing countries have no incentives to control the environmental externalities, save the global ones, of consumption taking place in other countries. Also, using upstream activities to control the environmental impact of oil and gas products by acting on consumption is quite inefficient, because of the length of the chain going from the extraction of crude oil and gas to the final use of oil and gas products.

Furthermore, some upstream taxes, such as export taxes, can even have some negative environmental impact on the producing country that levies them. This is because export taxes lower the domestic price of crude oil and gas thus favoring the expansion of consumption. Argentina, which will be examined here, provides an interesting example.

Consuming countries are clearly more interested in the control of the environmental damages deriving from consumption, because a great share of the damages from consumption is primarily local.

Within this broad framework the present paper has a narrower focus being concentrated exclusively on the environmental impact deriving from the production of oil and gas and not from their consumption.

This impact can be controlled by using taxing and regulatory instruments. In the present international practice governments use almost exclusively regulatory instruments to control the environmental impact of production operations.[1]

The incentive to use regulations and their impact depends, of course, on the level of government to which the regulatory responsibility is assigned. It also depends on the assignment, between levels of government, of the upstream tax instruments. This is essentially because environmental control has a cost in terms of production and, hence, of upstream taxes. A simple but immediate policy recommendation can be derived: the assignment of environmental responsibilities has to be matched by the assignment of the revenue of upstream taxes.

This is an area somewhat neglected in the literature and in the policy-making area. This neglect is excessive in view, for example, of the coming on stage of the so-called non conventional hydrocarbons, such as shale oil and gas and in view, also, of the technological progress that allows exploration and development activities at much greater depths. In both cases there is a huge potential for the expansion of the production affecting a broader number of countries, including the European ones. At the same time new hydrocarbons and greater depths present huge environmental risks, many of these are primarily local. Hence, there may be, and there is frequently, a conflict of interest between, on the one hand, the national government, for which the increase in domestic production of energy sources is an important priority and, on the other, local governments and communities, which are more interested in reducing the local environmental impact, especially if they have no access through the rent to the benefits of expanded production that could compensate them. A traditional tenet of literature - saying that industrial countries are substantially able to manage decently the environmental impact of their oil and gas operations – may be increasingly challenged. In fact, as we will see in this paper, it is already challenged in Italy.

The paper is structured into two main sections. The first one explores the potential of upstream oil and gas taxation to control the environmental impact of production operations. The second one explores the interactions between the assignment of the proceeds of upstream taxation among levels of government and residents and the effective use by these levels of the responsibilities for environmental policy assigned to them. Two countries, Argentina and Italy, are used to illustrate some of the arguments advanced.

1. Upstream taxes as imperfect environmental taxes

1.1. The environmental impact of oil and gas producing operations

The environmental impact associated has distinct spatial dimensions. The production of crude oil and gas and the use of hydrocarbons products have both a local and a global impact. For example, gas flaring from oil wells is a global public bad, contributing to

1 See, for example, Joint E&P Forum/UNEP Technical Publication, 1997.

CO2 emissions. The local (on the producing areas) impact is more intense and immediate. Think, for example, of the lighting effect of gas flaring and the number of toxic substances burned and released. The Nigerian River Delta represents possibly the worse example. Spills from offshore oil production may also reach global catastrophic dimensions, while examples of the local impact of oil spills are the soiling of beaches, and the reduction of local fishing stock, such as the Louisiana crabs.

The list of environmental damages deriving from production operations is very long, and it includes, for onshore activities, pollution of water, release into soil and air of toxic substances metals and chemicals, accumulation of waste and perennial damages to the biosphere and degradation of landscape. Most of these effects are local, but some of them are also felt worldwide -such as the extinction of fauna and floral species.

The same overlapping of local and global impact characterizes the use and consumption of oil and gas products and also their production by refineries and transportation. The local impact is associated, for example, with the particulate produced by diesel fuel. The global impact is exemplified by CO2 emission of gasoline and other fuels.

1.2. The main upstream taxes

Taxes on oil and gas are regrouped into two wide categories: upstream taxes and downstream taxes. Figure 1 provides a graphic illustration of the taxation system. Upstream taxes apply to the stages of exploration and extraction of crude oil and natural gas and are about sharing the rent between the government and the investor[2]. They are levied by producing countries.

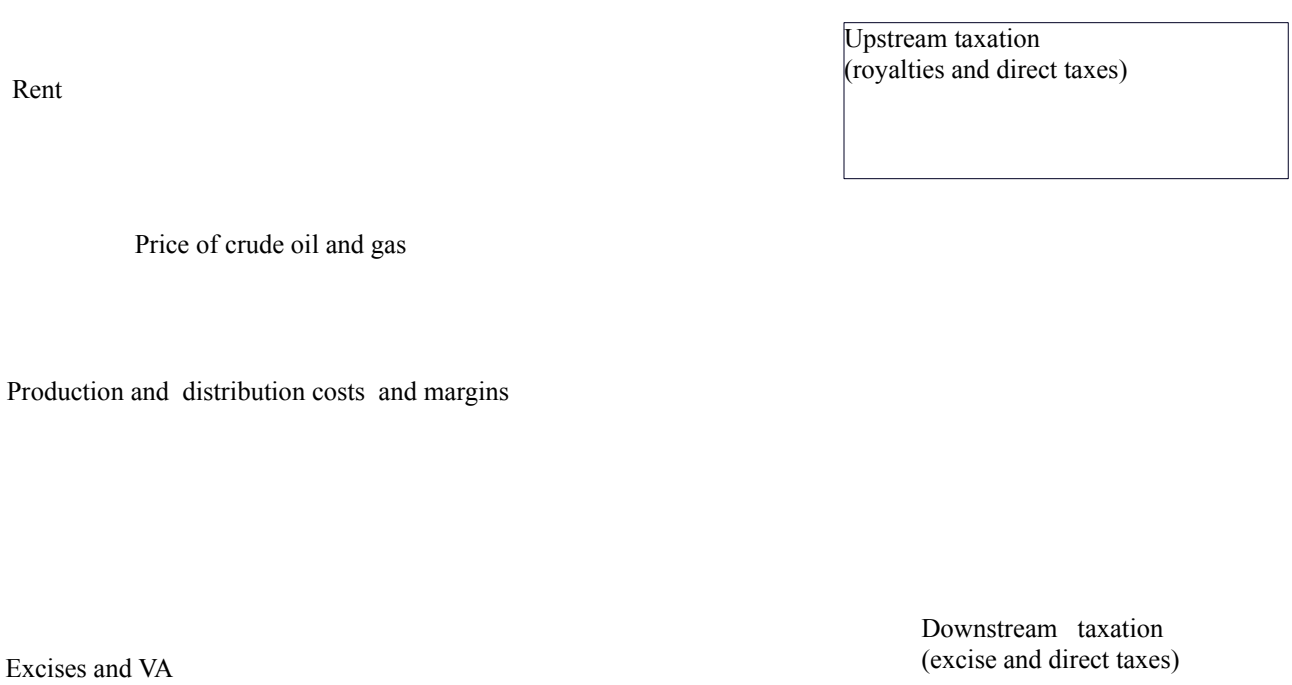
Upstream taxes are not officially considered as environmental taxes. This agrees also with the theory. The idea of environmental taxes rests, basically, on their effective impact on behaviour. By increasing producer and/or consumer prices they should reduce environmental damages, through the relevant elasticities.[3] Although the dominant

2 The separation between upstream and downstream taxes is somewhat more complicated for natural gas because of transportation and processing (i.e.liquefaction) of gas. This requires more infrastructure whose use generates rent and quasi rent. The literature generally calls midstream taxes those referred to the transportation and liquefaction phases (Kellab, 2010).

3 This is also the argument used by international organizations for denying the status of environmental instruments to upstream taxes. The EU say that taxes on extraction of minerals and oil "do not influence prices in the way other environmental taxes, i.e. taxes on products do" (EU, *Environmental Taxes, A statistical guide*, Luxemburg, 2001 page 9). The OECD, IEA and the European Commission have agreed to define as *environmentally related taxes* any compulsory, *unrequited* (meaning that tax due is not related to the benefits from policies) payment to general government levied on tax-bases deemed to be of particular environmental relevance. The relevant tax-bases include energy products, motor vehicles, waste, measured or estimated emissions, natural resources, etc. The OECS/EU guidelines of 2001 clarify that the definition refers to the "potential effect of a given tax in terms of its impact on costs and prices". However, the EU recognizes that the reasons for non including upstream taxes in the environmental category are also expedient, such as difficult comparability between taxes levied in

objective of upstream taxation is the collection of revenue, of immediate revenue, many of them have some *de facto* and mostly unintended environmental impact, via the reduction of production.

Figure 1. **Taxation of oil and gas**



This is clearly the case of royalties and severance taxes. Presently levied royalties display a huge variety of types. The more complex types

different countries and high fluctuations in their revenue distorting the time series of revenue.

of royalties are in effect mimicking a simplified profit tax.[4] The most common royalty is the gross royalty, whose tax base is the market value of output and is levied on an *ad valorem* basis (with a flat rate, or a progressive rate increasing with price or quantity of production). Even this simple *ad valorem* tax can affect production by leading to the premature closing, or delay of operations. The reason is straightforward: extraction will take place until revenue covers cost. With a royalty the cost is increased by the royalties, while the revenue cannot increase, if as it is the common case, the price of oil and gas is internationally determined. When oil fields or mines are of different quality the royalties can lead to the abandonment of those with higher cost. In other words, extraction is not completed. This is called the higher grade problem and is derived from mining activities where the mines with lower ore content are more affected by the royalties. The equivalent for oil fields would be those in their late phase of extraction where water or steam has to be pumped to help the escape of oil. Or the fields located at a higher distance from ports or more in general from markets. The higher the tax rate, the larger the "cutoff" grade, which is the quantity of oil or mineral, left in the ground.

Royalties can also affect future exploration and extraction via their impact on profitability and the anticipations of their effects. In other words, not only current royalties can impact on production, but also and especially future levels of royalties. The explanation is simple: royalties force producers to choose between producing today and paying today, or producing tomorrow and pay tomorrow. What is important is not the level of the royalty today, but if its present value is higher or smaller. This can lead to anticipation of production, if it is technically feasible. For example, an *ad valorem* royalty will accelerate extraction if the price of oil is expected to grow faster than the interest rate, because by extracting more today the firm pays less royalty than tomorrow. It can delay production if the expected price is lower than the present price (see, for a review, Boadway and Keen, 2010).

Also the extraction path is not affected by the royalty if the latter grows at the discount rate of the extracting firm.

A long term effect of royalties is that, being they levied at the extraction phase, they do not take into account the sunk costs of exploration and development phase. As a consequence, they can discourage exploration and development and lead to reduction in the production.

Taxes on profits are neutral*, i.*e. they do not originate distortions for existing oil fields and mines. However, if exploration costs are not fully deductible, these taxes reduce the present value of oil fields, and lower the incentives to explore new fields. Hence, future production is impacted. To avoid this number of countries have introduced specific resources rent taxes. These are cash-flow based taxes where all expenses incurred in

4 This was, for example, the UK royalty on oil which has been eliminated in 1983. It consisted of a simplified profit tax, since most costs were deductible from revenue. It acted as an advance payment for the Petroleum Rent Tax with the aim of subjecting to taxation also operators that were lot liable to direct taxes (Nakhle, 2009).

exploring; developing and producing the fields are immediately and fully deducted from revenue. Ideally, when the net cash-flow is negative the losses are carried forward at an appropriate rate of interest. The rationale of these taxes is to achieve absolute neutrality, thus avoiding any negative impact of taxes on exploration and production activities, while at the same time allowing the state to extract, if it intends to, the totality of the rent.

Export taxes are also widely used for the extraction of the rent and their environmental impact depends, as for any tax, on how they affect relative prices though changes in production and, at the end, on the price elasticity of oil product consumption.

The main examples are Russia (Goldsworthy and Zakarova, 2010) and Argentina (Mansilla and Zeballo, 2009, Brosio and Jimenez, forthcoming). In fact, they serve a variety of purposes. First, as well as the royalties they serve as a substitute to the profit tax where the tax administration is not developed enough to implement that instrument. Secondly, they are an instrument used by the central government to cut to its benefit the taxing space of its subnational governments when the latter are entitled by the constitution to levy royalties (or other taxes). This is clearly the case of Argentina, where the federal government has introduced an export tax (*retenciones*) on top of the royalties levied by provincial governments, pre-empting in this way the space for further increases of the tax rate by the provinces. The third purpose of export taxes is to favour domestic consumers putting a wedge between the international and the domestic price and to encourage domestic processing of oil. The fourth purpose, which applies only when there is a monopolistic supplier (a country, or a cartel), is to increase the international price and hence the amount of the rent obtained by the producing country.

In fact, export taxes, and import taxes as well, are situated at the frontier between upstream and downstream taxation.

A few recent proposals suggest to exploit the monopolistic power of suppliers, notably OPEC, to introduce an export tax on oil with the double aim of reducing consumption through an increase in the price of crude oil and of financing with its proceeds a number of internationally environmentally friendly actions, such as to compensate the countries that have decided to postpone exploration and production activities in environmentally critical areas, such as the Amazonian forest, to finance projects aimed at mitigating the impact of climate change and to finance the development of alternative eco-sustainable energies and techniques.[5] Although these taxes are labelled as eco-friendly they have no environmental impact at the production level and, presumably, a small impact at the consumption level, since it is unlikely that producing countries would accept a tax rate that would severely curtail their production. The label is, rather, associated with the suggested use of the proceeds of the tax , which is not enough to qualify them, as also the

5 One of these proposals, labelled the *Daly-Correa Eco tax*, has been presented to the OPEC annual meeting of 2001 by a leading ecologist, Herman Daly, and the current President of Ecuador, following the proposal by the latter of postponing oil production in the Amazonian region of the Yasuní National Park in Ecuador in exchange of compensation for the lost revenue.

definition used by the EU and the OECD suggests ("unrequited payment") see footnote 2 .

There are a few examples of specific upstream taxes officially labelled as environmental. However, despite the label their environmental impact is quite limited. The most notable example are the extraction taxes levied in the European Union on aggregates, such as gravel, rocks and sand, which are the most important non renewable resource in the Union. Their main environmental impact is on landscape. In practically all the countries royalty type taxes are levied on aggregates, the tax base being the volume, or the price with generally modest tax rates. Only in the UK and Sweden the tax rates are substantial aiming at reducing production and encouraging re-use of materials. The revenue is generally going to local governments to be used for compensating the offenses to the landscape. The US use a petroleum tax on oil sold to refineries – called *Tax for oil spill liability trust fund* - and on imported oil. Its revenue is used to clean toxic sites. The tax itself has no environmental impact on the producing operations, since all oil is taxed with no consideration on where it is produced. As any other excise on oil, it can reduce the environmental impact coming from consumption.

As mentioned in the introduction the prevailing choice in almost every country is to use regulation, instead of taxes, to control for production externalities, despite the potentiality of tax instruments The preference for regulation may be explained with at least a couple of reasons. The first one is the high number of harmful effluents that would require a panoply of taxation instruments with likely huge un-expected interactions if the instruments are not very carefully crafted. The second reason is related to information needs. Regulation, that is the introduction of standards, requires soft information, more specifically measurement of effluents only at points of time, while taxes require hard information: meaning continued measurement of effluents flows.

2. Looking at interactions between environmental policy and sharing of rents

2.1. The analytical framework

If there is economic rationale to the use of regulation to control production externalities, there are also different options concerning the level of government to be assigned with the environmental responsibility. The intensity and effective use of regulation will depend on the benefits and the costs of regulation. Insofar as the costs include reduction of production and, hence, of rents, the intergovernmental allocation of upstream taxes contributes to determine the environmental impact of production. This is the main argument of the present paper and it will be developed within a simplified analytical framework.

Individuals derive utility from environmental protection and are subject to its costs. They also derive utility from appropriating and using the rents from natural resources. In principle, one has to assume that the cost of exploration and exploitation of the latter is positively related to the level and implementation of environmental standards. The

higher the standards and their implementation, the lower is the rent, since it is calculated as the difference between the value of the production and its cost.

In its simplest form, the utility function for individual *i* can be written as:

$U_i = m_i\, a_i\, Q_j + \; b_i\, l_j\, R_i$

where:

m_i is his/her preferences for a cleaner environment, which in turn are a function of $k_{i,}$

k_i is a parameter expressing the distance between the place of residence of the decision-makers and the area of production: $m_i = f(k_1)$.

a_i is a parameter that transforms the reduction of pollution into utility.

Q_j is the reduction/prevention of environmental damages brought up by the environmental standard implemented by government *j*.

In turn, Q_j can be expressed as a function of the instruments chosen, *S*, with an efficiency transformation *g*; that is, $Q_j = g\, S_j$, where *g* is an efficiency factor applied to the instruments chosen by government *j*.

b_i is a parameter that transforms the level of appropriated rent into utility.

l_j is a parameter representing the efficiency/timeliness in the spending of the rent by the concerned level of government.

R_i is the level of appropriated rent through some instrument of upstream taxation.

i refers to the individuals, who can be either resident of the oil producing region or of the rest of the country.

j refers to the level of government, it can be either central or local (or regional and local).

An increase in environmental protection increases the individuals' utility, through higher environmental quality:

$\delta Q / \delta S \geq 0$

At the same time, an increase in regulation decreases utility through a reduction of the rent appropriated:

$\delta R / \delta S \leq 0.$

Thus, there is for each individual an optimal level of the environmental policy that maximizes his/her total utility and that is determined by equating marginal benefits from environmental regulation policy with marginal costs. In turn, this level is dependent, in our specific case of oil production, on the proximity of the environmental impact to the residence of individuals, and on the efficiency with which the rent is spent.

To highlight the main issues and for brevity sake, we introduce a number of simplifications:

a) the country has two Regions: *A* and *B*. *A* is bigger than *B* in terms of population. This means that when decision-making is centralized preferences of *A* will prevail. *B* has oil, while *A* has no oil.

b) the environmental policy consists of introducing, monitoring and enforcing standards.

c) this policy is assigned either to central or to the regional governments.

d) there is no overspill of oil and gas between Regions and all production externalities impact only on the environment of the producing Region. To make an example this could mean that if *A* resorted to gas flaring, fumes would be contained in *A*. This requires that *B* is remote from *A*.

e) the environmental impact of production operations is also felt by citizens who are residents of other Regions. This requires some consideration referred to the influence of distance. It is necessary in this framework to explore briefly the issue (see later).

f) preferences concerning the environment and other goods are homogenous within each Region and non homogenous between Regions. This is the typical fiscal federalism hypothesis, which is increasingly questioned by empirical evidence.

2.2. Some discussion of the parameters

Preferences for the environment (m_A and m_B)

Most of the literature considers that a cleaner environment is as a superior good, its demand generally increasing when people become richer. (See Duroy, 2005; Martinez-Alier, 1995; Magnani, 2000, for short reviews). Hence, environmental preferences differ by Region: $m_A \neq m_B$.

However, in the present context distance is very relevant in shaping differences of preferences and requires some consideration that refers to the different components of the environmental impact.

The physical impact of production takes place and is mostly felt locally. Drilling and extraction create air pollution, send effluents into (drinking) water, produce oil spills,

create congestion in infrastructure of all kinds, and may have major effects on flora and fauna, etc. This physical impact is mostly local and residents are immediately and directly affected, while the impact on neighbors should decrease with physical distance. Also the cost of the physical impact can in principle be calculated. In other words, it is possible to make a market valuation. As for most environmental externalities, also the physical impact depends, in its total amount, on the density of the concerned areas. This is, politically, a relevant fact.

Non residents are also directly affected by the physical impact of production activities, when they make actual use of the affected areas, as tourists, hikers, hunters, fishermen. In this case distance may impact. We have to refer to effective, economic distance and not simply to geographical distance; *i.e.* we have to refer to distance determined in terms of costs and time.

Non residents can also be affected by the environmental impact, even when they don't make actual use, but believe they will be able to make it in the future. In this case there is an option value. Furthermore, both residents and non-residents may be affected even if they don't make actual use of the areas and are also presuming they will never make use of the concerned areas in the future, but if they are moved by bequest motives, meaning that they want to protect the areas affected by producing activities to ensure benefits to future generations.

Finally, there is satisfaction for both residents and non-residents from conservation of the landscape, which is affected by the producing operations. This of course applies especially to grand scenic wonders, to unique and fragile ecosystems, and/or to huge threats to vast eco-systems. In those cases, as John Krutilla explained in a widely influential paper: "preservation and continued availability are a significant part of the real income of many individuals" (1967, p.779).

Interest in and satisfaction from conservation are not related to use and thus are not observable through economic activities. The estimation of their value – alternatively termed in the literature as existence value, passive use value and non use value - is based on surveys that are based on the use of hypothetical markets. There is a growing, huge literature on this subject. It shows, despite potential problems deriving from the difficulty of eliciting consumer preferences through questions about hypothetical situations, a notable consistency of results. With reference to damages from oil (in fact from transportation and not production of it) an ambitious study (Carson et al. 2003) was conducted by the State of Alaska when preparing to sue the Exxon company for the Exxon Valdez spill claiming not only compensation for reparation damages, but also compensation for lost passive use.

The study asked how much respondents were ready to pay for setting up a program[6] to avoid the spills. Willingness to pay shown by the results is substantial and even greater than the sum Exxon finally agreed to pay. The study is also interesting because it is referred to the Alaska National Wildlife Refuge, whose location is extremely remote from the residence of all respondents and represents a good case for the evaluation of a scenic area based on non-use of the resource.

Similar results have been found in previous studies referred to other high scenic sites. For example, Schultze *et al*. (1983) try to estimate the existence value of preserving the environmental quality at the Great Canyon in Arizona and at other national parks located in the proximity. Two main results emerge. The first one is that distance does play a role in explaining willingness to pay, which appears to be unrelated with the prospects of ever visiting the sites. The second result is that existence value is much bigger than user value: the number of people committed to preservation is much bigger than the number of people who make actual use. Similar results, that have to be taken with a grain of salt because actual use is compared with hypothetical evaluations, have been found with reference to the damages done by coal surface mining (for example, Howard 1971).

In all these cases distance does influence willingness to pay as it has to be expected since actual use of the area is not even contemplated by respondents. In general, however, these studies solicit conservation preferences with reference to world class and/or world known and promoted areas and landscapes, such as the Grand Canyon and the Artic Refuge. When less top sites are the focus of the analysis, the distance does influence the willingness to pay. For example, Ahtiainen (2007), who estimates the willingness to pay to avoid oil spills in the Gulf of Finland, finds out that willingness to pay decreases with the distance from the Gulf. This is a quite reasonable and to be expected behavior: it is rationale to be ready to pay and to believe in a large existence value for top sites.

Transformation of the change in pollution into utility ($a_{i.}$)

While *m* determines the quantity of the environmental impact that is felt by individuals, *a*, transforms this into utility. While *a* has surely different values for distinct individuals, there is no ground in the present framework for arguing that *a* should vary between Regions.

The choice of the instruments ($S_{j.}$)

Even with reference only to regulation, the same level of pollution abatement, can be obtained with quite different instruments, $Q_j = g\ S_j$. Textbooks range S_j in two categories: i) bargaining/institutional solutions, such as the codification of liability; ii) command and control instruments, such as controls on inputs, controls on outputs, imposition of a specific technology, output quotas, ceilings on emissions, planning and location controls Each instrument has a set of attributes. It can be more cost efficient or

6 By which large tow CoastGuard ships would have escorted every tanker to prevent accidents or, in the case where an acccident would have occurred ,to contain the spread of oil into waters.

less cost efficient; it impacts in various ways on the distribution of income and wealth and has a different incentive structure. For example, the imposition of a specific production technology is considered by a majority of experts as having non favourable long term effects, since firms stick to the imposed technology and disregard the options that could enhance their long run competitiveness.

Regulation is introduced by any level of government including the supranational sphere. As for any public good the assignment should in principle be dictated by the benefit principle, meaning correspondence between the geographical area where the environmental impact is felt and the area defined by the political borders of the jurisdiction that is responsible for the policy in question. Hence, as an example, global warming would the competence of a world government, while exhaust emissions are a local function. Mobility and information make the use of the benefit principle less clear cut. For example, as we just saw, users of amenities can be residents of both *A* and *B,* although the former make more intense use than the latter. The existence value applies again to residents of both *A* and *B*, with possibly more intensity to *B*. Interconnection of interests explains while, frequently, a plurality of levels of governments is involved in environmental regulation. This is the case of Argentina, for example, where environmental responsibility, is shared between the federal government and the Provinces (see the Annex for more detail). Italy represents a discarding voice: the last constitution assign the legislative responsibility on the environment only to the national parliament. . The existence of a huge rent, as in the case of oil, complicates the issue by amplifying the cost of environmental policy. Efficient assignment of regulation has to be accompanied by efficient, in this respect, assignment of the rent.

The transformation of rent into utility: (b_i)

This is a crucial parameter because it determines the shape and type of the utility curve and, in turn, contributes to the choice of the environmental standard. Obviously, it makes no sense to assume that people of different regions have different utility functions. However, assumptions about the shape of the utility function may have an impact on the choice of the appropriate level of environmental regulation.

To be more specific, if utility is proportional to income the choice of the level of environmental regulation will not be influenced, at different levels of government, by the level of the (lost) rent. This is because the, marginal, cost of regulation in terms of utility of lost income will be the same at all levels of income. At the contrary, if utility increases less (or more) than proportionally to income (case of risk aversion), the choice will be influenced. This is because the cost of regulation in terms of utility of income will depend on the level of income, which depends on the rent appropriated individually. In turn, individual rent depends on number of claimants that differs from the case where the rent is appropriated by the central government to the case where the rent is appropriated locally. To simplify things we assume that utility is proportional to income.

The efficiency/timeliness in the spending of the rent by the concerned level of government: (l_j)

Governments can differ by their efficiency and timeliness in spending. What is at a stake here is that the completion of infrastructure projects. It may involve lengthy times because, in addition to red tape, of the involvement, in the consultation process, of a large number of stakeholders, including all levels of government. Delays and inefficient (high cost) in spending of the rent reduce its value for the residents of the beneficiary subnational jurisdictions, amounting to a lessening of the rent sharing rate. This has, obviously, crucial implications for the choice of the intensity of environmental policy. The literature (see for a review, Ahmad, Brosio, Tanzi, 2006) shows no difference between levels of government. However, a low level of efficiency in spending reduces the value of the rent (and it can make the payment of direct cash transfers to individuals more attractive).

The political mechanism

This paper does not enter into the realm of the political economy of environmental regulation and is based on two alternative hypotheses about the political mechanism. The first, and the main one, assumes simply that governments maximize a utilitarian social welfare function, such as:

$W = \Sigma^{n}_{i=0} U_i$. Hence, environmental regulation and oil production are not constrained, among other factors, by the pressures coming from the concerned firms. This is clearly a very strong assumption, considering the enormous influence that can be exerted by firms in the oil and gas sector.

The alternative assumption, we only mention, is that governments are revenue maximizers, which implies that they will try to expand as much as possible the production of hydrocarbons.[7] Of course, they could maximize the rent by increasing the level of taxation, which would be the most obvious way, but this alternative is not explored in the present paper.

7 However, in a democratic setting governments are constrained by voters, or more precisely by what can be termed as political competition. This implies that governments have to maximize the difference between revenue, R, and expenditure, E, for the minimum level of public services requested by citizens. The difference can be termed, as in the bureaucratic and managerial literature, as slack and it can be spent for uses that give utility to elected and non-elected officials without implying necessarily corruption. In autocratic systems slack is maximum because of the lack of political competition. It tends to disappear in a truly competitive system – for example in the "consensual democracy" as defined by Mc Guire and Olson (1996). In this situation all tax proceeds will be spent on the public goods.

2.3. Interplay between assignment of responsibilities for environment and of rent

The interplay is illustrated in figure 2. There are four quadrants, corresponding to the number of possible combinations. On the vertical axis of each quadrant are represented the benefits and costs of the environmental policy accruing to the individuals that are responsible for the decision. To be more precise, when the responsibility is assigned to the central government the costs and benefits are those borne/accruing to residents of region *A* (constituting the majority of voters); when the responsibility is assigned to the local level costs and benefits are those borne/accruing to all residents of region *B*. On the horizontal axis is reported the level of environmental regulation that is enforced (the level of production is strictly related to it).The benefits include all those kind that have been illustrated above; namely direct and future use, option and bequest motives and existence value.

Finally, we assume that the area where the production takes place is not a particularly renowned area, which is the most frequent case and, as a consequence, it solicits moderate attention from outsiders, such as the residents of region *A*.

First quadrant: both the environment policy and the rent are assigned to the central government

In this case, little benefit from the environmental policy is accruing to those that make the decision (Region *A*) because of small use and existence value, hence the demand will be quite low (the demand curve lying very close to the horizontal axis), while the cost – in terms of missed rent – is relatively high (depending on the population of *A*) and the cost curve lays relatively close to the horizontal axis. The equilibrium point will be close to the origin of the axes, signaling a very low level of environmental care. This leads residents of region *B* to resist any increase of oil production, leading possibly to conflicts. In terms of equation (1), the first component of the right hand member is very small, if not close to zero and all utility derives from the rent.

Second quadrant: the environment policy is local and the rent goes to central government

In this second case, (almost) all the benefits from the environmental policy accrue to the residents of the producing region, hence their demand will be high (the demand curve is lying distant from the horizontal axis), while the cost for them– in terms of missed rent – is zero. The equilibrium point will be very distant from the origin of the axes, signaling very high – actually the highest - level of environmental care. This will surely impact negatively on production because of the environmental constraints, leading also possibly to a stop of the production.

In terms of equation (1), we have the reverse case compared with the first one; the first component of the right hand member has a huge value, while the utility derived from the rent is zero.

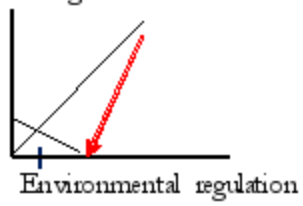
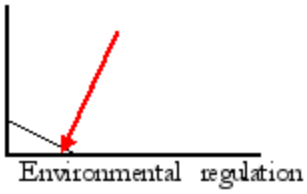
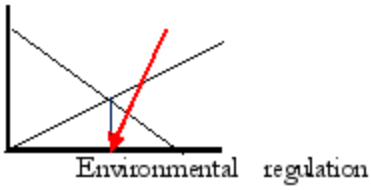
Third quadrant: the environment policy is central and the rent goes to local producing government

In this case, as in the first one, the benefits from environmental regulation are minimal originating a very low demand for it and also its cost is minimal, because the rent is going to the local government. Hence, the level of environmental policy that will be chosen will be higher than in the first case, but still quite low and much lower than in the second case.

Fourth quadrant: both environment policy and rent are assigned to local government

This is clearly the most efficient case in terms of environmental policy, leading to optimal choice of level. The choice will also be influenced by the efficiency with which the local government utilizes the rent. If the use of the rent made by the local government is inefficient, the cost of the environmental policy for residents will be smaller and they would ask for more regulation. The effectively chosen level would then be higher than in the fourth quadrant, but still lower than in the second one. Increasing inefficiency would hence make local residents increasingly recalcitrant to the production of oil and especially to its increases.

This also suggests that if local governments are revenue maximizers, they have to be efficient in their spending.

	Responsibility for enforcing standards	
	Central	Local
Assignment of the rent: Central	Benefits and costs for the responsible government  **1. A_{cc}**	Benefits and costs for the responsible government  **2. A_{lc}**
Assignment of the rent: Local	Benefits and costs for the responsible government  **3. A_{cl}**	Benefits and costs for the responsible government  **4. A_{ll}**

In two cases out of four –the second and the third one - the combination of the assignment of responsibility and of the rent produces corner solutions, with a very little or a very large level of environmental regulation. In all the four cases the solution is socially inefficient because of the exclusive assignment of the regulation responsibility to only one level of government, while the costs of the regulation impinge on all levels.

This explains why very frequently constitutions assign concurrent responsibilities, usually with the central government imposing minimum standards and the subnational governments being responsible for increasing those standards (without infringing commerce clause, or imposing an unfair burden on residents of other jurisdictions).

Even when concurrent responsibility is introduced, the possibility of having production will still depend on the assignment of rents also to the subnational government. This is obvious and the rent has to be big enough as to compensate the local damaging from production activities.

Finally, when the local jurisdiction affected by production is small, even a relatively small sharing rate should be enough to compensate the damages and to induce local residents to agree with production. However, this is not frequently the case, as the increasing evidence of the Amazonian regions in Bolivia and Ecuador, among others, show. This is also the case of Italy where, as we mention in the Annex, access by local residents to the rent is not enough to calm fears and to assuage opposition to production. This may be due to a host of reasons. For example, in Italy it seems to be due to inefficient and delayed spending of the rent by the beneficiary governments. This has the effect of reducing the cost of denying production. Also, the density of population may be a factor. High density increases cost of production and opposition, while low density reduces both. The case of Argentina also reported in the Annex illustrates this occurrence.

Conclusions

The paper has looked at the interaction between taxes on oil production and environmental policy.

Upstream taxes are used almost exclusively for extracting the rent and don't have an intended direct environmental impact. Although taxes referred to the exploration and extraction phases could be used directly for controlling environmental damages, their use is almost inexistent at the present time. Governments prefer to use regulatory instruments to control the environmental impact of oil and gas production activities.

The efficiency and intensity of these policies depend on many factors included the assignment of the policy to the proper level of government. There may be conflicts between the central and the sub national governments about the allocation of the costs and the rewards from oil and gas production. In general, central governments have a large interest in production, while subnational governments have concerns about the environmental impact of production. This latent conflict is going to become more frequent and acute, as new reserves emerge that have a potentially higher environmental impact, such as shale oil and gas and deep onshore and offshore wells.

The assignment of the environmental policy responsibilities should be based on the benefit principle, taking also into consideration the assignment of the revenue from upstream taxes. This is because environmental policies impact on production and, consequently, on the level of these taxes. From the environmental point of view, efficiency is reached when its responsibility and the rent are assigned to the same subnational government level. The paper shows also that punctuality and efficiency in

the spending of the rent by the beneficiary governments is crucial to allow the choice of the optimal level of environmental regulation.

ANNEXES

Argentina

Production

Argentina is the third Latin American producer of oil. A large and increasing part of it is used for domestic consumption. Oil production is geographically very concentrated. Argentina has also the third largest proven reserves of natural gas in Latin America. Part of it is exported. As for oil, also gas production is heavily concentrated in just 3 Provinces.

Table 1. **Argentina: Oil production and exports. 2003-2010**

	Production	% change on previous year	Exports	in % of production	Production for use	
	thousands barrels per day					
2003	828,6				472	
2004	828,6	0,0			470	
2005	755	-8,9			483	
2006	745	-1,3			535	
2007	745	0,0	470,0	63,1	587	
2008	790,8	6,1	339,9	43,0	594	
2009	790,8	0,0	339,9	43,0	580	
2010	792,3	0,2	314,4	39,7	618	
Source: *Cia FactBook*						

Provincial governments have access to a substantial share of these rents through royalties on gas and oil. Royalties are levied with a flat rate of 12% on the well price, but with renegotiated or new contracts this tax rate can be increased. The federal government is entitled to levy the profit tax (*impuesto a las ganancias*) and, since 2002, a special tax (*retenciones*) on exports of oil and gas.

Retentions, or export taxes, were introduced in that year by the so called Public emergency and reform of foreign currency exchange system law (*Ley de Emergencia Publica y Reforma del Regimen Cambiario*) that introduced export taxes on a set of commodities, including oil and gas. The present progressive schedule is based on three different rates; namely, a) a rate of 25 % applies to the cut price (42 US$); b) a rate of 45% applies on the part of the price corresponding to the difference between a **price of**

60,9 US$ (referred to in the legislation as the reference price) and the cut price and, c) a 100% tax rate applies on the part of the price exceeding the 60,9 US$.

Retentions are levied in addition to the royalties, implying that for prices up to 42 dollars the effective tax rate is 37,5 %, while for high prices most of the rent is collected by the government. In other words the introduction of retentions has been a massive change in the taxation of oil, clearly not for environmental purposes.

In fact, since oil and gas are sold on a competitive domestic and international market, the export tax has put a ceiling on the domestic price of oil and gas, which is basically equal to the difference between the international price and the export tax. This has safeguarded the share of rents going to domestic consumers. Argentina's consumers pay one of the lowest prices for petrol in the world, because of the combination of a low input price (oil) and comparatively low downstream taxes.

Clearly, oil and gas producing companies lament that they are the net losers, having had to relinquish all the increase of the (absolute) rent deriving from the increase in this decade of the international price of oil and gas. Since retentions absorb the whole difference between the international price and the domestic price when the former exceeds 60,9 US$ per barrel, it becomes more profitable for producers to sell their oil on the domestic market when prices exceed 60,9 US dollars. Producers also lament that, since the size of the rent for them is lower for exports than for sales on the domestic market, the incentive to expand production (and exploration) has been practically curtailed to zero after retentions. The domestic market is in fact limited, while the international market, being competitive, is by definition of unlimited size.

However, the recent announcement by REPSOL of the discovery of huge reserves of oil and gas seems to contradict the former pessimistic statement (El Mundo, Nov. 8, 201; ABC, Nov.8, 2011).

The distribution of the oil rent

If we assume, as most of the literature does, a cost for oil production of 15 US$ per barrel (see Mansilla, 2006), then we can proceed to an estimate of the sharing of the rent between the main stakeholders, meaning: a)consumers; b) the public sector that in turn is divided between the federal government and the provinces, and, c) the producers.[8]

8 Our method reproduces essentially that developed by Diego Mansilla (2006).

The rent is approximated by the difference between the international price of oil and the cost of production, but we distinguish between the domestic and the international market. The introduction of the export tax has brought a ceiling to the domestic price: without it the domestic consumers would have had the pay the international price. This implies that the rent to the consumers is positively related to international price. More precisely, it is equal to zero when the domestic price is equal to 42 US$, then it increases. Consumers appropriate the rent by not having to pay the international price, but only the domestic price, determined by the difference between the international prices and the retentions, as already mentioned. In other words we are referring, for consumers, to a virtual rent.

For producers the absolute value of the rent stays always the same because of the ceiling (42US$) on the domestic price. There is no rent accruing to the federal government on top of the retentions.

Table 2. **Argentina: allocation of the rent on domestic sales of oil.**

WTI price	Cut price	Production cost	Total Rent	Allocation of the rent: values			Allocation of the rent: values: % shares		
				Royalties (Provinces)	Domestic consumers	Producers	Royalties (Provinces)	Domestic consumers	Producers
(u$s per barrel)							*(%)*		
42,0	42,0	15,0	27,0	5,0	0,0	22,0	18,5	0,0	81,5
45,0	42,0	15,0	30,0	5,0	3,0	22,0	16,7	10,0	73,3
50,0	42,0	15,0	35,0	5,0	8,0	22,0	14,3	22,9	62,9
55,0	42,0	15,0	40,0	5,0	13,0	22,0	12,5	32,5	55,0
60,0	42,0	15,0	45,0	5,0	18,0	22,0	11,1	40,0	48,9
65,0	42,0	15,0	50,0	5,0	23,0	22,0	10,0	46,0	44,0
70,0	42,0	15,0	55,0	5,0	28,0	22,0	9,1	50,9	40,0
75,0	42,0	15,0	60,0	5,0	33,0	22,0	8,3	55,0	36,7
80,0	42,0	15,0	65,0	5,0	38,0	22,0	7,7	58,5	33,8
85,0	42,0	15,0	70,0	5,0	43,0	22,0	7,1	61,4	31,4
90,0	42,0	15,0	75,0	5,0	48,0	22,0	6,7	64,0	29,3
95,0	42,0	15,0	80,0	5,0	53,0	22,0	6,3	66,3	27,5
100,0	42,0	15,0	85,0	5,0	58,0	22,0	5,9	68,2	25,9

Enviromental discipline

The constitution of Argentina (art 41) shares the legal discipline between the federal parliament and the Provincial councils. "The Nation shall regulate the minimum

protection standards and the provinces those necessary to reinforce them, without altering their local jurisdictions".

The control of the environmental impact of production is done exclusively with regulatory policy, basically with the imposition of an Environmental Impact Assessment for each exploration and extraction project. This assignment, together with the allocation of a substantial part of the rent to the Provinces through the royalties, should ensure an efficient level of environmental control on the production activities. In fact, there seems to be no major lamented problem with actual production. However, it is also possible that the absence of major problems can be traced out to the low population density of the production areas.
In fact, the production of hydrocarbons takes places in Argentina in very depopulated areas, such as the province of Nequén, Chubut, Santa Cruz, with densities of less than 5 inhabitants per square km. Only in the province of Mendoza density is somewhat higher: about 10 inhabitants per square km.

Italy

Production

Italy is a modest producer of hydrocarbons: nationally produced oil and gas are 6 and 10 percent of domestic consumption and should rise to 10 percent for oil in the coming years after the exploration of new fields. However, the granting of new exploration permits could possibly expand the level of production. In fact, a new round of allocation of permits took place in April 2011 and it is expected that, as a consequence, the production will considerably increase in the coming years, covering almost 10 per cent of domestic consumption.

There is also a wide perception, especially among foreign companies, that production could be easily expanded if more exploration activities (and more foreign participation) were allowed. The production is fairly geographically concentrated: about 80 percent of national production of oil and about 50 percent of national production of gas are concentrated inside the Basilicata region (representing about 3 percent of total area of the country and 1 percent of its population). In addition, only a tiny portion of the territory of a tiny Region - basically the Val d'Agri - is affected.

The central government has an obvious interest to expand the production, because it will reduce the dependence of the country from imports. Environmental groups have become particularly active in the region, also because their activity is enhanced by participatory procedures leading to the granting of permits and to expenditure planning. The groups argue that oil extraction in the region has high environmental impact, in all its phases, research, processes, transport and refining, with serious risks in terms of air pollution, of pollution of groundwater of the hydrological disruption, the seismic risk, not to mention the problems related to waste disposal and impacts on biodiversity.

Assignment of responsibilities and rent

Oil policy is de facto a central government responsibility, despite a constitutional mandate that provides for concurrency of powers. Environmental legislation is central responsibility according to the constitution, while administration is a concurrent responsibility. According to constitutional experts, however, regional governments have the power, in the framework of their broad legislative powers, to supplement national legislation, by introducing for example stricter standards, when this does not run counter the national interest.

Italian oil and gas producing Regions and Municipalities are assigned with a share of the rent collected by the public sector. More precisely, seven tenths of the royalties on oil and the entirety of the royalty on gas are allocated to subnational governments according to the sharing rates that allocate most of the rent to them. The remaining three tenths are distributed directly to residents of the producing areas.

Additional funds are also accruing to the producing areas through specific agreements between the oil companies and the concerned subnational governments. The average yearly per capita allocations to Basilicata amount approximately to one/tenth of the expenditure of its regional government, which is substantial. Four municipalities within the region – namely, Viggiano, Grumento, Nova, Calvello and Montemurro – have received more than 1.000 euros per capita. More specifically, the municipality of Viggiano has received almost 12.000 euros per capita. This ranks this small (3.000 inhabitants) Italian municipality on a par with the most oil gifted local governments around the world.

To spend these considerable sums the regional government has set up a rather complex planning process that entails the participation of the local governments and of a wide range of social actors (Brosio,Vannini, 2011 and Vannini, 2011). The aim is to generate a wide consensus about the spending and to show the social usefulness of having oil in your own territory and of deriving rents from it. Money has been allocated to a large number of projects covering different areas, such as basic infrastructure, environmental protection, job creation, and the improvement of the quality of public services. However, this participatory planning process is taking its toll in terms of delays in spending. In fact, after six years after the beginning of the planning process only 30 percent of the allocations have effectively been disbursed, meaning that residents have only a vague perception of the advantages of having oil.

On the other hand, one can easily understand the environmental concern of local residents. Clearly oil exploration and production does not have the devastating impact on the environment that is normally observed for mining activities. However, the issue is a very sensitive one in Basilicata, considering that oil activity is taking place in an area adjacent to a recently (2007) instituted National Park (*Parco Nazionale della Val d'Agri* e *del Lagonegrese*). Intensive oil extraction in the area could contribute to a clear degradation of local fauna and flora. Such effects are not easy to predict but could have a lasting impact on the regional environment. Understandably, local people view this as a huge barrier to the development of agriculture and tourism in the region. Also, the creation of jobs by oil activities has been quite slow, also because of the lack of the specific skills needed locally by the oil industry. How closely the local residents feel they are represented by their regional government is not easy to ascertain. Clearly the

impact is very local and the allocation of a substantial part of the rent is not a decisive factor, because of the delays and inefficiencies in spending.
In fact the recent (2009) decision of the central government to allocate directly to residents its share of the royalty was clearly meant to assuage possible opposition to increases in production, by making immediate and more tangible the advantages deriving from it.

Table. 2**. Italy: production, domestic consumption and imports of oil and gas. 2008-2009**

	Oil *(10^6 tons)*		**Gas** *(10^6 oil equivalent tons)*	
	2008	**2009**	**2008**	**2009**
Production	6,59	6,21	10,90	10,27
Imports	128,38	128,65	90,56	88,75
Exports	36,18	35,73	0,25	0,16
Change in stocks	-1,22	-0,87	1,21	-1,14
Domestic consumption	**100,00**	**100,00**	**100,00**	**100,00**

Source: authors' estimates frhttp://dgerm.sviluppoeconomico.gov.it/dgerm/ben/ben_2009.pdf

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