Fiscal revenues from the extraction of hydrocarbons: Potential socioeconomic impacts for the Canary Islands

Carmen D. Álvarez

University of La Laguna

The potential discovery of hydrocarbons in the Canary Islands poses the question on the potential socioeconomic impacts caused by these activities. This paper focuses on the impacts arising from additional fiscal revenues earned by the region. The analysis of the fiscal dimension is crucial as it entails the main benefit for oil-producing economies. In this respect, the appearance of Dutch disease episodes is a main concern as it could seriously damage tourism, the main economic sector of the region. In this respect, estimated fiscal revenues suggest that there is no danger of Dutch disease. Moreover, the local government should design a plan to allocate fiscal revenues from hydrocarbons to promote job creation, finance social spending and achieve a more equitable income distribution.

1. Introduction

About three years ago, the tourism region of the Canary Islands was shaken by the potential discovery of offshore hydrocarbons in its waters. The granting by the Spanish government of an exploration license to a private oil company, and the starting up of works, faced the strong rejection of society and the local government (Gobierno de Canarias, Cabildo de Fuerteventura & Cabildo de Lanzarote, 2013; 'La encuesta del Gobierno revela que tres de cada cuatro canarios está en contra el petróleo *[The Governement survey reveals that three out four canarians reject oil]*', November 11, 2014). For gaining acceptance, the central government and also the oil company insisted on the advantages of developing a new sector, involving further economic activity and jobs. More importantly, knowing that fiscal revenues constitute the main benefit for producing economies (Sunley, Baunsgaard & Simard, 2003), the Spanish government also expressed its intention of introducing specific taxation on hydrocarbons production in favor of the region ('Soria dice que los beneficios fiscales para Canarias si hay petróleo rondarán los 300 millones anuales.' *[Soria says fiscal benefits for the Canary Islands will be around 300 million euros a year]*', July 21, 2014). Promised additional revenues entailed a kind of compensation for environmental risks associated to these activities, which could damage the tourism sector that represents around 31% of GDP.

Though the exploration was finally abandoned by the oil company, the starting over of works in a future context of rising oil prices should not be discarded (De la Peña Fernández-Garnelo, January 26, 2016). This possibility raises the question on the socioeconomic impacts of this type of activities in a region whose economy is mostly based on tourism.

Indeed, the extensive literature on non-renewable resources shows that they can become a blessing or a curse (Van der Ploeg, 2011). The blessing comes from the creation of economic activity and employment, but mainly from tax revenues. Remarkably, this latter aspect foregrounds fiscal policy management as the way of channeling fiscal revenues from exhaustible resources into productive investments, thus conducing to sustained growth and the improvement of living standards.

The literature has identified three main threats leading to a resource curse. The first threat is related with the environmental risks (Chang, Stone, Demes, & Piscitelli, 2014),

a major concern for a tourism economy. The Dutch disease (e.g. Corden, 1984, Ismail, 2010; Sachs and Warner, 2001) is the second one, causing a real appreciation and losses of external competitiveness, which may shrink the tourism sector (Corden, 2012; Forsyth, Dwyer & Spurr, 2014). Lastly, corruption and rent seeking are found to be tightly related to the production of non-renewable resources (e.g. Leite and Weidmann, 1999; Arezki & Brückner, 2011). All in all, case studies reveal that the quality of institutions greatly determines the final outcome, whether a blessing or a curse (Mehlum, Moene, & Torvik, 2006; Iimi, 2006; Thurber, Hults & Heller, 2011).

No doubt, these considerations should be carefully analyzed in the case of the Canary Islands. In this paper, we address an important one, namely the potential fiscal revenues from hydrocarbons production and the socioeconomic impacts of its allocation by the local government. This issue is a major concern since fiscal revenues might trigger a Dutch disease episode that could harm the economic engine of the region: the tourism sector. To establish whether this could prove to be the case, it is necessary to evaluate the flows of fiscal revenues during the life cycle of the hydrocarbons project, which is the first objective of the present work. As a second task, we survey the literature to draw lessons about the efficient management of fiscal revenues from hydrocarbons by oil-producing regions. Ideally, a local government should allocate those revenues to achieve the highest socioeconomic impacts. In this respect, we finish our analysis by placing our estimates in the context of the Canary Islands economy, and identifying those dimensions that should benefit from the additional fiscal revenues.

The remainder of the paper is organized as follows. Section 2 offers an overview of public revenues from hydrocarbons production. Section 3 describes the experience of the Canary Islands as a potential oil-producing region. Section 4 estimates fiscal revenues from hydrocarbons for the Canary Islands. Section 5 surveys the literature on the socioeconomic impacts of fiscal revenues from non-renewable resources, and discusses the dimensions of the Canary Islands economy that should benefit from oil fiscal revenues. Section 6 concludes.

2. Public revenues from oilfields: An overview

In the majority of countries, the ownership of hydrocarbons resources in national territory corresponds to the state (Van Meurs, 2009), so rents from their exploitation should accrue to the population (Taylor et al., 2004). At the world level, 90 percent of the reserves are controlled by national oil companies, which can act directly as producers or as supervisors of private oil companies (Tordo, Tracy & Arfaa, 2011). In the latter case, governments lease the right of exploitation to oil companies (OCs) in exchange of a portion of the economic rent generated. The oil economic rent is defined as the value of the resource minus economic costs of producing it, including the normal rate of return on investment (opportunity cost of investment). Uncertainty is present in all phases of an oil project —exploration, development and production—, not only due to oil price volatility (revenues), but also because of uncertainty in geological exploration, input costs and political environment (Cotarelli, 2012).

In this context, the government has the mandate of collecting the largest portion of these rents and transferring them to society. Public revenues from oil rely on a government ability to attract investors and, importantly, on its bargaining power with OCs. Indeed, both the government and OCs want to maximize its portion of economic rent while minimizing its burden of the risk associated to the project. A wide variety of fiscal instruments, which shape an oil fiscal regime, is used to share out the rents between the government and OCs. It is worth stressing that the government should not extract the totality of rents, but a "reasonable" share must be kept by OCs to remunerate

the risk assumed. Otherwise, incentives to undertake a project could be destroyed (Taylor et al., 2004; Cotarelli, 2012).[1]

Oil-producing countries must also design mechanism to distribute oil revenues between sub-nationals levels, including oil-producing regions (Ahmad & Mottu, 2002; Bauer, 2013; Arellano-Yanguas & Mejía-Acosta, 2014). For oil regions these revenues could be a significant percentage of the public budget, what calls for a good management of fiscal policy (Bauer, 2013).

In this section we offer an overview of these questions.

2.1 Oil fiscal regimes

The design of an oil fiscal regime (OFR) must find a balance between public revenues and investment incentives, as fiscal instruments themselves modify project profitability and hence the potential rent to be extracted. After surveying OFRs in a large sample of oil-producing countries, Sunley, Baunsgaard and Simard (2003) and Cotarelli (2012) conclude that there is not an optimal regime on a general basis, but the combination of fiscal instruments depends on the cost structure, size and quality of oil reserve, risks perceived by investors and institutional features of the oil-producing country. This consideration explains the wide variety of OFRs in the world, which allows governments to extract around 65-85 percent of oil economic rent. Despite the impossibility of defining an optimal regime for all countries, Cotarelli (2012) argues that any OFR that extracts less than these average figures should be deeply reformed. Next, we shortly describe the main instruments used in OFRs as surveyed in the aforementioned studies.

Royalty/tax instruments are present in most OFRs. Royalties can be specific or ad-valorem taxes, and have the double advantage of being easy to administer and generating revenues during the whole phase of production. In fact, ad-valorem royalties constitute the most prevalent instrument in OFRs.[2] However, royalties modify marginal costs and hence introduce distortions in investment and production decisions. A less distortive option is the resource rent tax (RRT) that levies a share of economic rent —including the normal return on investment— whenever the accumulated cash flow of the project is positive. A major difficulty in designing this tax is to accurately choosing the normal rate of return. The income corporate tax (ICT) is a key instrument in all OFRs, though some countries introduce modifications for a better treatment of deductions and the interaction with other fiscal instruments. Lastly, bonuses or lump-sum payments linked to particular events —such as contract signature, exploration, discovery or production— are usual fiscal instruments in OFRs. They are easy to administer and ensure early public revenues.

Nonetheless, there are two additional public options for extracting oil economic rents. In the production sharing contracts (PSCs) the government and the OC sign a contract in which the investor agrees to bear the costs of exploration and development in exchange of a share of oil production; additional production is shared out between the parties. In some cases, the government decides to become a shareholder of an oil project (state equity). Apart from profit participation, there could be other reasons for this option such as nationalism, the facilitation of technological transfers or ensuring a tighter public control on the project.

[1] In this respect, sunk costs —such as geological and environmental studies, oil wells, pipelines and decommissioning— should be highlighted, since they entail a large proportion of total costs (Manzano & Monaldi, 2008; Cotarelli, 2012).

[2] In a large sample of developing countries, Sunley, Baunsgaard and Simard (2003) report royalty rates ranging between 2 and 30 percent and between 5 and 10 percent for most of them.

In conclusion, an optimal OFR must seek to extract the maximum economic rent, while keeping the incentives for developing oil projects. Fiscal stability and credibility are at the core of this objective, since they contribute to reduce the risks faced by investors.

2.2 Oil revenue assignments to sub-national levels

The literature has identified four main problems linked to the decentralization of oil public revenues, what calls for some degree of centralization (Ahmad & Mottu, 2002; Bauer, 2013; Arellano-Yanguas & Mejía-Acosta, 2014). First, the central government can better deal with oil price volatility since national tax bases are much broader than local ones. Second, decentralization could give raise to an interregional inefficient factor allocation as long as oil-producing regions can afford tax reductions, thus offering a more tax-friendly environment for firms than other regions. Third, the central government can contribute to a more equitable redistribution of oil rents. Lastly, revenues from oil cannot be viewed as a sustainable strategy for local development owing to the exhaustible nature of the resource.

After assessing the pros and cons of several types of designs, Ahmad and Mottu (2002) conclude that centralization together with the assignments of stable tax bases and transfers to local governments seems to be a preferred arrangement. Oil revenue sharing becomes the less preferred arrangement since it detracts large amounts from the central government, which complicates macroeconomic management and transfers the volatility of oil revenues to local governments. In line with this view, in most countries the bulk of oil revenues are collected by central governments and a portion of them is transferred to sub-national levels (Bauer, 2013).

Revenue demands from oil rich regions are a central issue in the design of assignment systems, because these regions suffer directly the negative externalities caused by hydrocarbons extraction. Indeed, oil spills, pollution, etc. could greatly affect the environment and the development of other economic activities, besides harming the population well-being. Public revenues from hydrocarbons production could be viewed as a form of compensation for potential negative impacts. As a relevant aspect in this regard, Arellano-Yanguas and Mejía-Acosta (2014) found that the extent of transfers —taking the form of royalties, participation in CIT, etc.— relies more on political issues than on economic considerations.[3]

2.3 Oil revenue management by oil regions

The literature has paid special attention to study fiscal policy management in oil-producing countries (e.g. Engel & Valdés, 2000; Barnett & Ossowski, 2002; Cologni & Manera, 2013; Azhgaliyera, 2014), while much less has been said at a regional level. The analysis at the sub-national level is pertinent, as long as local governments face more constraints and hence have less room for maneuvering than the state. In a comprehensive analysis, Bauer (2013) found four main distinctive challenges facing local governments.

The first challenge is related with unpredictable or/and discretionary transfers from national administration, which hinders the budget planning and may result in poor management of fiscal policy at the regional level. The solution entails well-defined and transparent sharing rules that must be renegotiated to better cope with changes in the political and economic environment.

[3] In a sample composed of Bolivia, Brazil, Peru, Nigeria, Colombia, Mexico, Indonesia, Ecuador, Ghana and Papua New Guinea.

The second challenge refers to volatility of oil price and production that makes difficult to forecast oil revenues in the short-medium term. Uncertainty may lead to pro-cyclical fiscal policy, with rising public spending in the event of windfall revenues followed by a sudden cut in spending when revenues are reduced. Moreover, temporary windfall revenues can be viewed as permanent, thus creating incentives for inefficient spending. The impacts on the public budget and the rest of the economy depend on a government's ability to efficiently allocate additional spending and the capability of private businesses to undertake contracted public projects. This ability is determined by the size of skilled labor supply, the access to credit and the quality of institutions in the oil region. A low absorption of additional public spending by the economy can cause inflation, besides the entry of foreign businesses and workers. A sudden decline in oil revenues may give rise to social and economic instability because of demand contractions, unemployment, outflows of capital and public deficits.

Owing to the exhaustible resource nature of oil, the third challenge for a government is to develop a long-term plan to optimally allocate public spending over time so as to maximize social welfare of current and future generations. A long-term plan must pursue the achievement of economic and social development objectives, so oil revenues should finance human capital investment, productive infrastructures and other type of spending conducive to enhance productivity, economic growth and social welfare. The existence of a well-designed plan is crucial as the economy should avoid entering into a depression after the oil reserve has been depleted. To this aim, public spending and long-term policy should be focused on diversifying the economy, in order to ensure sustainable growth and the maintaining of living standards of the population. Noticeably, public savings play a crucial role in any long-term strategy.

Spending oil revenues efficiently entails the fourth challenge. There may be serious obstacles to reach an optimal outcome, including fiscal rules imposed by the national administration —such as limitations on public regional savings or spending obligations—, lack of qualified staff to evaluate public projects and, importantly, poor institutional quality at the regional level.

Bauer (2013) also offers policy recommendation for good fiscal policy management. To manage revenue volatility a government should smooth public spending through time by delinking it from ups and downs of oil revenues. Potential options to cope with oil revenue windfalls are an increase in spending, a tax cut, a reduction of public debt and public saving; while the opposite would apply to address a fall in oil revenues. The chosen options depend on fiscal rules imposed by the national level —such as the prohibition of borrowing or a reduction in the next year oil revenues by the unspent part of the current transfer—, the economic situation and social needs —related with public deficit, indebtedness, inflation, public services, etc.— and the quality of institutions.

Delinking policies needs fiscal rules as, for instance, establishing a limit to current public spending and investing the remainder oil revenues in a regional wealth fund. This type of funds entail a preferred choice by many oil regions (Taylor et al., 2004); they are used for fiscal stabilization in the short-medium term, and also to enable an efficient allocation of public spending in the long-term. Yet, additional problems could emerge related with the management of these funds. Good governance —involving professional and independent management, transparency, oversight and accountability— is crucial for the policy success, which is obviously related to the quality of institutions.

Therefore, wealth funds are not an adequate option for oil regions unable to properly manage them, because of institutional weakness or/and lack of qualified managers. Public debt can be then used for fiscal stabilization, i.e. the government borrows when there are fiscal deficits and uses public surpluses to pay down public debt. However, the

latter option can lead to excessive public borrowing that might cause a severe debt crisis. The reason for this problem lies in the fact that oil revenues can be used as collateral, so a local government could borrow at a lower cost than the market interest rate.

3. A tourism region becoming a producer of hydrocarbons: The Canary Islands

The Canary Islands is a Spanish region located 95 Km from the southern coast of Morocco and 940 Km from the European continent. Because of the extra costs associated to remoteness, the archipelago enjoys the favorable condition of outermost region of the European Union (EU), thus benefiting from additional funds from the EU and the Spanish state. The region lacks the resources —such as water and arable land— and scale economies for developing a competitive agriculture and industry. Evidently, the extra costs linked to transport constitute another obstacle to development. Even so, mild weather and natural heritage have made the region a successful tourism destination internationally. In fact, the tourism sector represents about 31% of GDP and 35% of employment of the region (Exceltur & Gobierno de Canarias, 2015). The high dependence on tourism was precisely what caused a strong rejection of hydrocarbons exploration in the region.

3.1 The search for hydrocarbons and the reactions to exploration

In November 2014, the OC Repsol began exploration works in ultra-deep waters (3,100 m) at around 50 Km from Fuerteventura and 61 Km from Lanzarote, in the area showed in Figure 1 (*zona exploratoria*). It did not come as a surprise, since the license request process backs to late 2001 (Gobierno de Canarias et al., 2013). The area is close to the Moroccan coast, where oil exploration has taken place actively in the past and is expected to continue in the future (Al-Sharqui, March 14, 2014; "Marruecos encuentra "indicios de gas" en Tarfaya, frente a Fuerteventura" *[Morocco finds "gas traces" in Tarfaya, off Fuerteventura]*", October 1, 2015). The information provided by the company to the general public highlighted the safety of the project from an environmental point of view, and also the benefits for both the region and the nation. More specifically, during the exploration phase the company intended to invest 350 million dollars, 15% of which would remain in the archipelago. Furthermore, in case of discovery, the regional economy could profit in terms of job creation and higher economic diversification, while the nation could save 10% of oil imports during 10 to 20 years (Repsol, n.d.). Not less important, the Spanish Minister of Industry, Energy and Tourism Mr. Soria stated that, in the event of discovery and subsequent production, the Canary Islands would benefit from the introduction of specific taxation on these activities. This taxation, similar to the Italian one (Rocchi et al., 2015), could yield additional fiscal revenues for the region of about 300 to 400 million euros per year ('Soria dice que los beneficios fiscales para Canarias si hay petróleo rondarán los 300 millones anuales', July 21, 2014).

Figure 1. Hydrocarbons exploration area in the Canary Islands

Source: Repsol (n.d.), Proyecto de investigación en Canarias, *[Research Project in the Canary Islands]*, Infographic.

Expectedly, the OC did not welcome this new taxation, consisting in a royalty of 8%, mostly aimed to generate fiscal revenues for the region. Even the company manifested its view that the tax would never be introduced. It seems that the aim of this taxation was no other than to overcome the strong social and institutional opposition to these activities in a region highly dependent on tourism ('Industria impondrá a Repsol un impuesto del 8% al petróleo que extraiga en Canarias *[Industry will introduce a tax of 8% on oil extraction by Repsol in the Canary Islands]*', September 11, 2014). Indeed, from the very beginning of the license request the local authorities have litigated against the national government to stop the project.

The arguments against hydrocarbons development were exposed in a public document signed by the Canary Government and island councils of Fuerteventura and Lanzarote, (Gobierno de Canarias, et al., 2013). The aim of this document was to inform the population on the potential negative impacts of hydrocarbons exploration and production, that we will be summarized later on. Even the local government conducted an opinion poll that revealed the rejection of three out of four citizens ('La encuesta del Gobierno revela que tres de cada cuatro canarios está en contra el petróleo *[The Government survey reveals that three out four Canarians reject oil]*', November 11, 2014).

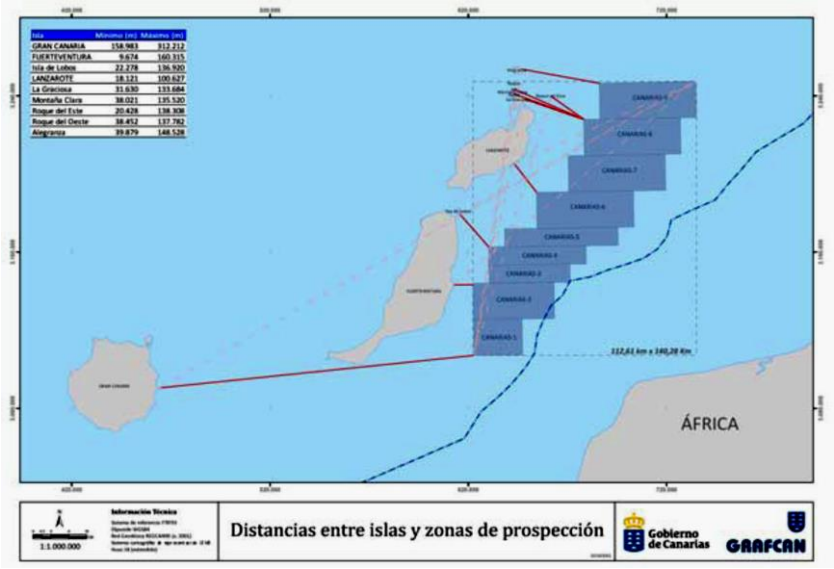
Although the authorities failed in their goal of stopping exploratory drillings, the project finally turned out to be short-lived. The exploration works were expected to last for four months, but after two months the OC decided to abandon them, sealed the well and gave up the exploration license. The company informed that gas and oil did not have the required quality to be exploited ('Repsol finaliza el sondeo exploratorio en Canarias *[Repsol ends up exploratory probe in the Canary Islands]*', January 16, 2015).

The crucial question is then whether there is a possibility that explorations will be resumed in the future.

3.2 The chance for future explorations

Notwithstanding the clear-cut statement of the OC, there are reasons for not ruling out future exploratory drillings. Indeed, the company had permission to probe three areas, but only one of them was explored. Moreover, the whole offshore area with potential hydrocarbon resources does not limit to the aforementioned three ones, but is much wider, including the nine grids showed in Figure 2 (the explored area was placed in the grid *Canarias 4*). The search for hydrocarbons continues in the Moroccan offshore, to the right of the dashed line in the figure.

Figure 2. Potential hydrocarbons exploration areas in the Canary Islands



Source: Gobierno de Canarias, Cabildo de Fuerteventura & Cabildo de Lanzarote (2013). Argumentario general. Prospecciones petrolíferas en Canarias. *[General arguments. Oil exploration in the Canary Islands]*, p. 14.

It seems also logical to relate the hasty departure of the company with falling oil prices in international markets, which significantly reduce the profitability of hydrocarbons projects. The company denied that this was a reason for giving up the exploration license ('Repsol abandona la exploración al no encontrar gas de calidad *[Repsol leaves exploration, not finding gas of enough quality]*', January 16, 2015), but this is undoubtedly a powerful one. Thus, the resumption of explorations could be expected in a context of rising oil prices.

According to the president of the Spanish Association of Companies of Research, Exploration and Production of Hydrocarbons (ACIEP), the exploitation of national hydrocarbons reserves is in the interest of the Spanish economy, as the country imports 99% of gas and oil it consumes. This expert asserts that geological estimates point to a large hydrocarbons reserve in the country of 2.500 million cubic meters of gas (amounted to national consumption during 70 years) and over 2.000 million barrels of oil (around 20% of national consumption for 20 years). In addition to the generation of economic activity and jobs, under the new Spanish law of hydrocarbons of 2015 these activities could allow a substantial increase of national fiscal revenues (De la Peña Fernández-Garnelo, January 26, 2016). These benefits suggest that, in case of discovery, gas and oil will be exploited.

The previous considerations seem to suggest that explorations could be retaken in the future.

3.3 Estimate of an oilfield production profile in the Canary Islands

Although the existence of a hydrocarbons reserve with enough volume and quality to be exploited is uncertain, there are estimates for the whole country, including the Canary Islands, carried out by ACIEP (2013). For reliability, we opt by considering these estimates performed under rigorous geological criteria.

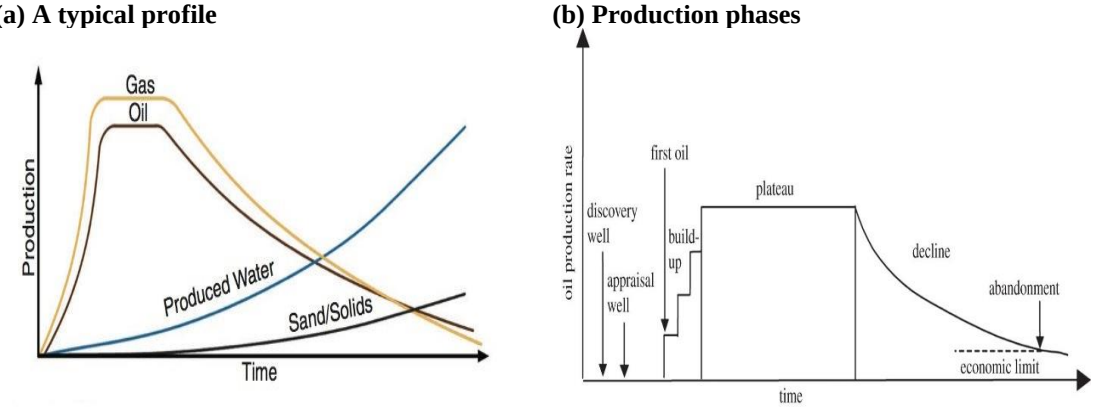
The study by ACIEP (2013) divides the Spanish territory in 24 domains, where domain 7 corresponds to the Canary Islands. For this domain, it has been estimated a

reserve of conventional hydrocarbons[4] of 1,200 million barrels of oil (MBO) and 226 billion cubic meters (BCM)[5] of natural gas. These figures indicate that the bulk of conventional hydrocarbons reserve in Spain would concentrate on the Canary Islands. More specifically, for oil and natural gas the archipelago would have 61.73% and 55.12% of national conventional reserves, respectively. According to the classification of offshore oilfields, this is a large reservoir. Indeed, an oilfield is considered as giant when it has ultimately recoverable resources (URR)[6] greater than 500 MBO or, alternatively, it produces more than 100,000 barrels per day for more than one year (Höök, Soderbergh, Jakobsson & Aleklett, 2009).

The lack of additional information hinders our goal of estimating fiscal revenues for the region, as it would require constructing the production profile. As we will expound later on, the fiscal figure in the Spanish law involves production which, obviously, is far from being stable through time. Figure 3 displays a typical oilfield production profile (Bedwell, Das & McCall, February 27, 2015) and its phases (Höök et al., 2009). After phases of discovery and appraisal, the figure shows the build-up phase along which production grows up to reach the plateau of maximum production. The plateau is much narrower for smaller giant fields —even of a single year— and is generally reached when about half of the reserve has been extracted (Hubbert, 1956; Campbell & Laherrère, 1998). For offshore oilfields, production starts to decline after about 13 years (Höök et al., 2009).[7] Lastly, the field is abandoned when it becomes economically unprofitable.

Figure 3. An oilfield production profile

(a) A typical profile **(b) Production phases**



Source: (a) Bedwell, I., Das, S., & McCall, E. (February 27, 2015). Extending the life cycle of mature facilities. SPE; (b) Höök, M., Soderbergh, B., Jakobsson, K., & Aleklett, K. (2009). The evolution of giant oil field production behavior. *Natural Resources Research*, 18(1), p. 42.

Our estimates of a production profile for the oilfield in Canary Islands in Figure 4 rely on theoretical and empirical literature on this topic.

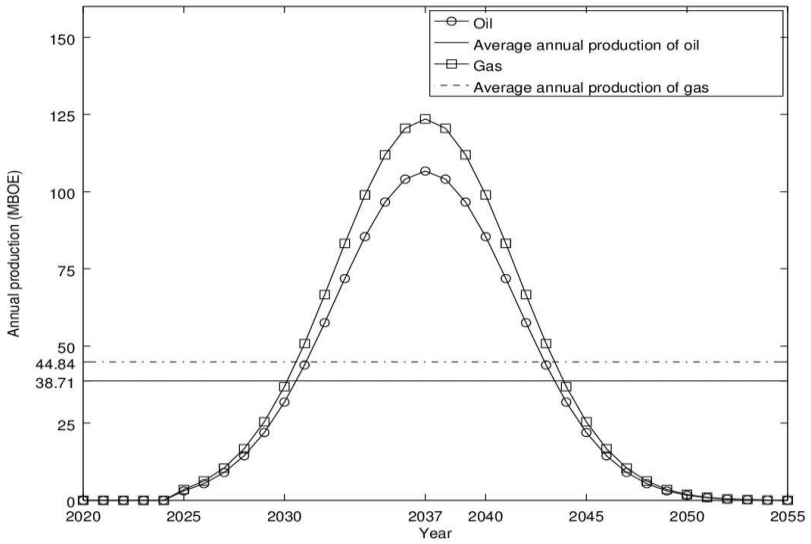
[4] Conventional production does not use *fracking*.

[5] 1BCM=1,000 million cubic meters.

[6] The URR is an estimate of the total amount of hydrocarbons that could be recovered and produced from an oilfield.

[7] Production weighted average.

Figure 4. An oilfield production profile for the Canary Islands



Source: Laherrère (2000), Höök et al. (2009), Repsol (2015) and own elaboration.

Note: The Gauss formula (Laherrère, 2000) is $P = 0.4U/s\ e^{-(tm-t)^2/(2s^2)}$, where P is production, $U = \{1{,}200,\ 1{,}389\}$ is URR for oil and gas (MBOE), $tm = 13$ is the date at peak and $s = 4.5$ is the standard deviation. One barrel of oil amounts to 162.6 m3 of gas (Repsol, 2015). Thus, 226 BCM amount to 1,389 million barrels of oil equivalent (MBOE).

We consider an empirically reasonable time span for production of 31 years, where we assume that the first oil/gas takes place in 2025. Production reaches a maximum at period 13, i.e. in 2037, with 106.67 MBOE and 123.56 MBOE for oil and gas, respectively. Also, at period 13 the cumulated production amounts to 54.31% of URR for both oil and gas. Average annual production of oil and gas are equal to 38.71 and 44.84 MBOE, respectively.

4. An estimate of oil and gas fiscal revenues for the Canary Islands

The next step in the analysis consists in computing the fiscal revenues from the hydrocarbons production that would earn the region. We proceed in three stages to accomplish this task. Firstly, we revise the Spanish law on the hydrocarbons sector, which includes taxation. Secondly, we consider several scenarios on the future evolution of international prices of oil and gas. Lastly, taking into the results from the previous stages, we estimate annual fiscal revenues during the oilfield life cycle.

4.1 The Spanish law on the hydrocarbons sector

The current Law 8/2015, amending Law 34/1998, introduces new tax and non-tax measures on the activities of research, exploration and production of hydrocarbons.

The Law establishes the public property of hydrocarbons deposits in national territory. The Spanish state can assign their exploitation to private operators through concessionary administrative titles. These activities face high commercial risk, but can also enjoy higher returns than other economic sectors. Thus, the tax figures introduced by the law pursue a balance between risks and returns to ensure economic profitability for operators and a flow of economic rents for society.

The social benefits of hydrocarbons sector, namely ensuring energy provision and wealth generation via economic activity and tax revenues, are explicitly highlighted.

Moreover, the sector must fulfil established environmental standards. The Law adds to the previous general principles, the social compromise of both the private operator and the state with the regions and local communities hosting oilfields, in order for these activities to be compatible with socioeconomic development. In this line, these regions and municipalities will benefit from subsidies financed with fiscal revenues arising from three tax figures established by the Law. These payments entail a form of compensation for potential damages and a remuneration to their contribution to the nation's wealth. The three fiscal figures refer to the Tax on the Value of Extraction of Gas, Oil and Condensate (TVE), and Tariffs 3 and 4 included in the Surface Canon (SC).

The TVE is a progressive ad-valorem royalty levied annually on the value of hydrocarbons produced in national territory. The tax schedules appear in Table 1. A price of reference is used to value production, which is computed as a monthly average of prices in the most representative markets for each product. Taxpayers must self-assess tax in April following the taxable year, but must make a pre-payment of TVE in October of the taxable year.

The SC taxes the rights of usage of the public dominion of hydrocarbons, in relation to the grant of exploration, research and exploitation licenses. The SC includes four tariffs: (1) research permissions; (2) exploitation licenses; (3) exploratory drillings; and (4) seismic studies. The Tariff 3 establishes a payment of 600.000€ and 125.000€ for each offshore and onshore exploratory drilling, respectively. Regarding Tariff 4, it establishes payments of 0.0003€/m2 and 0.3€/m for 3D and 2D seismic studies, respectively.

Table 1. Tax schedules in the Spanish TVE

Oil and condensate		
Number of barrels (B)	Tax rate (%)	
	Onshore	Offshore
$B \leq 365{,}000$	2	1
$365{,}0001 \leq B \leq 3{,}650{,}000$	6	5
$B > 3{,}650{,}000$	8	7

Gas			
Volume (V) in BOE	Tax rate (%)		
	Offshore	Onshore	
	Conventional	Conventional	Unconventional
$V \leq 202{,}029.5$	1	3	1
$202{,}029.5 < V \leq 1{,}010{,}147.6$	3	4	3
$V > 1{,}010{,}147.6$	4	5	4

Source: Ley 8/2015 del Sector de Hidrocarburos *[Law 8/2015 of the Hydrocarbons Sector]*.

Note: The cubic meters of gas are converted in BOE using the conversion factor in Figure 4. Grayed if applicable to the Canary Islands.

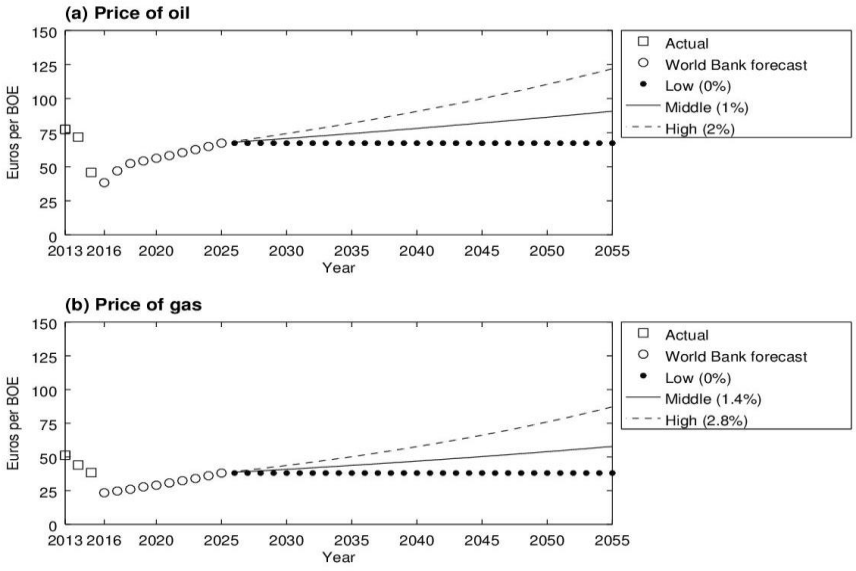
4.2 Scenarios for oil and gas prices

The World Bank (July 2016) forecast on the future evolution of oil and gas prices shows an increasing trend from 2016, reaching 67 real 2015 euros a barrel for oil and 38 real 2015 euros per BOE of gas in 2025 (Figure 5). These estimates contrast with current low prices of oil and gas —in Europe in the latter case—, falling by 41% and 25%, respectively, between 2013 and 2015. In line with the World Bank forecast, De la

Peña Fernández-Garnelo (January 26, 2016) states that current low prices correspond to cyclical downswing, and hence a change of trend should be expected. This expert argues that there is currently an oversupply situation due to several factors. Among supply-side factors, the development of unconventional hydrocarbons (*fracking*) in the U.S., together with the expansion in production due to political reasons, have pushed prices down. In addition, demand contractions due to the international economic crisis reinforce the fall in prices. Obviously, this situation is not in the interest of oil-producing countries, as most of them rely greatly on oil and gas revenues to run their economies. Low prices could also harm *fracking* projects, as some of them may become unprofitable. These considerations point to a harsh reduction in production in the future and, consequently, a rise in prices.

We rely on these arguments to construct the scenarios on the future evolution of oil and gas prices shown in Figure 5. More specifically, we consider the World Bank (July 2016) forecast on spot prices in nominal US$, starting in 2016 and ending in 2025. Using conversion factors and the current exchange rate, we express prices in euros per BOE. In addition, we use the CPI of the Canary Islands, base year 2015, (INE) and assume an annual inflation rate of 1%. From 2025 onwards we define three scenarios. In the scenario "Low" prices in real terms remain constant during the entire time span. The scenario "High" considers that real prices grow at roughly the same pace than the figures predicted by the World Bank adjusted for inflation, which implies growth rates of about 2% and 2.8% for the real prices of oil and gas, respectively. Lastly, in the scenario "Middle" the real prices of oil and gas are assumed to grow at the constant rates 1% and 1.4%, respectively.

Figure 5. Scenarios on the evolution of oil and gas prices (real 2015 euros)



Source: World Bank (July 2016), Repsol (2015), USFOREX, INE and own elaboration.

Note: The scenarios "Low", "Middle" and "High" have been constructed applying the annual growth rates between parentheses. The price of gas from the World Bank is expressed in dollars per million British thermal units (MMBTU). 1.04 MMBTU amounts to one thousand cubic feet (MCF); one barrel of oil amounts to 5.615 MCF of gas (Repsol, 2015). These conversion factors allow us expressing the price of gas in dollars per BOE. Lastly, from 2016 onwards we apply the current exchange rate of 0.9 euros per dollar and an inflation rate of 1% in the economy of the Canary Islands.

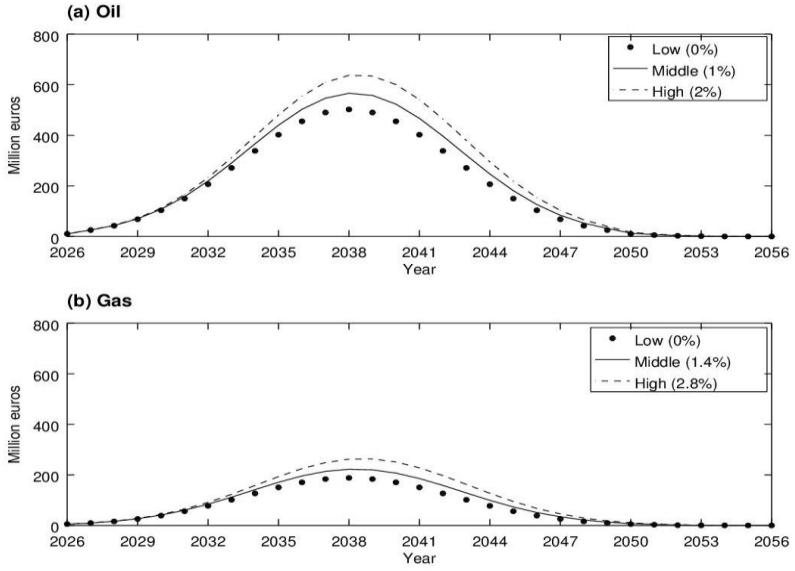
Regarding our scenarios, it is important to realize that prices should be high enough in the future in order for hydrocarbons exploration and extraction to be economically

profitable. Accordingly, we consider two upward trends, but also a trendless scenario from 2025. The scenario "Low" can be justified by the long time span considered. Indeed, it could be argued that technological change and the development of new energy sources, mainly renewable ones, could restrain price rises in the future. The view is reinforced by the international agreements aiming at reducing greenhouse gas emissions (Nordhaus, 2010; Wüstenhagen & Menichetti, 2012). Moreover, it is pretty clear that the assessment about future fiscal revenues greatly relies on our assumptions on price evolution. In this respect, we opt by setting moderate price expectations, in order not to overestimate fiscal revenues.

4.3 Fiscal revenues from oil and gas

In our analysis we only take into account the TVE as it generates the bulk of fiscal revenues, while Tariffs 3 and 4 yield much smaller revenues. The results in Figures 4 and 5 together with the tax schedules in Table 1 allow us to compute the total fiscal revenues from oil and gas, which appear in Figure 6.

Figure 6. Estimated fiscal revenues from the TVE (real 2015 euros): Oilfield of the Canary Islands



Source: Sources in Figures 4-5 and Table 1, and own elaboration.
Note: The TVE is payable in the next year of the taxable year.

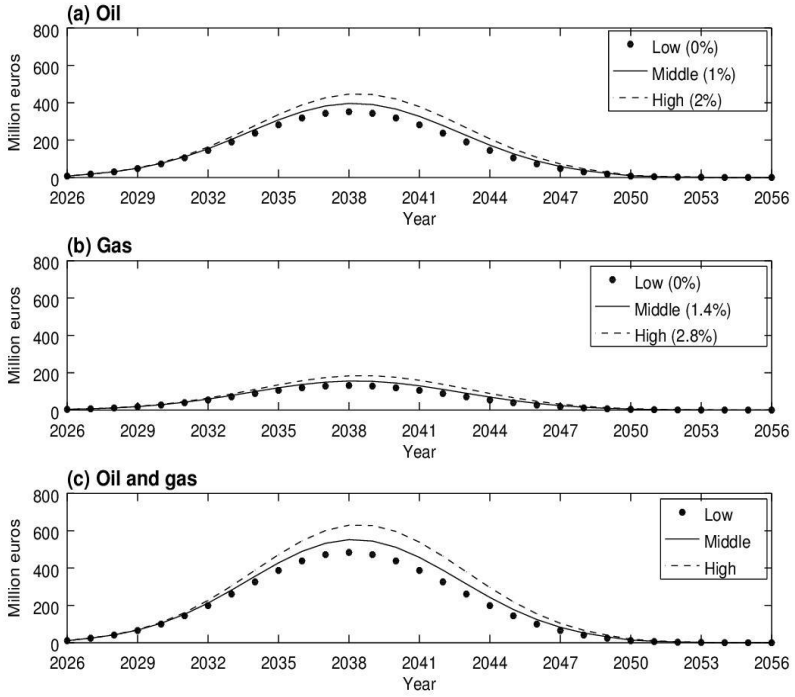
Overall tax revenues from oil during the life cycle of the reserve amount to 5,639.4, 6,362.2 and 7,182.9 million euros for scenarios "Low", "Middle" and "High", respectively, being the revenues in the peak year 2038 of 502.5, 566.23 and 637.29 million euros. In the case of gas, overall revenues are 2,115.4, 2,505.3 and 2.971.3, while those corresponding to 2038 amount to 188.12, 222.27 and 262.02 million euros.

However, the Spanish law states that producing regions will benefit from subsidies financed with the TVE which, of course, does not mean that the regions will earn the totality of tax revenues. This fact forces us to make assumptions about the distribution between the state and the Canary Islands. As shown by the literature (Arellano-Yanguas & Mejía-Acosta, 2014), this distribution could rely more on political issues than on economic questions. Indeed, political affinity or discrepancy between ruling parties in the state and the region, and also lobbying activities of local agents should not be minimized. Guessing the evolution of these relationships during such a long period of

time is far from being easy, so we opt by considering the distribution in the Italian oil region of Basilicata. This European case seems suitable for our analysis as the Spanish government gave this example in its proposal for a new taxation on hydrocarbons production ('Soria dice que los beneficios fiscales para Canarias si hay petróleo rondarán los 300 millones anuales.' July 21, 2014).

Similar to what might happen in Spain, in Italy 80% and 50% of oil and gas production is concentrated in the Basilicata region, although it is an onshore oilfield. The local government receives 70% of overall royalty revenues while the remaining 30% goes to the state (Iacono, 2015). With this distribution, the regional government of the Canary Islands would receive the fiscal revenues shown in Figure 7.

Figure 7. Estimated fiscal revenues for the Canary Islands from the TVE (real 2015 euros)



Source: Sources in Figures 4-5 and Table 1, Iacono (2015), and own elaboration.
Note: The TVE is payable in the next year of the taxable year. It is assumed that the Canary Islands receive 70% of TVE revenues.

The figure shows quite large fiscal revenues. Indeed, total estimated revenues from oil and gas during the time span considered amount to 5,428, 6,207 and 7,108 million euros in the scenarios "Low", "Middle" and "High", respectively, while earnings at the peak year 2038 become equal to 483, 552 and 630. These figures give average annual fiscal revenues of 175, 200 and 229 million real 2015 euros. Therefore, our estimates roughly match with the 300 million nominal euros annually announced by the Spanish minister in mid-2014 ('Soria dice que los beneficios fiscales para Canarias si hay petróleo rondarán los 300 millones anuales.' July 21, 2014).

5. The potential socioeconomic impacts of fiscal revenues from hydrocarbons for the Canary Islands

Our previous estimates of fiscal revenues for the Canary Islands are fairly speculative, besides entailing a quite long time span. Therefore, predicting the potential

socioeconomic impacts of revenue allocation is far from being straightforward. To begin with, the empirical literature on this topic can be a helpful guide to overcome these difficulties, as it provides us with empirical assessments that use econometric and general equilibrium models (Aragón, Chuhan-Poleb & Landb, 2014). Thus, in this section we first survey some relevant experiences of oil regions, as valuable lessons can be extracted from them. We close this section with an overview of the economy of the Canary Islands, focusing on how additional fiscal revenues and their public allocation could contribute to reinforce their strengths and mitigate their weaknesses.

5.1 Empirical evidence at the regional level

A main channel through which non-renewable resources can impact on a local economy is the change in comparative advantage and specialization, in the sense of sectoral shifts. This impact is related with the Dutch disease, entailing a resource reallocation towards the hydrocarbons sector, thus shrinking other traded sectors. Even if such a resource reallocation does not take place, a windfall of oil fiscal revenues could produce a real appreciation and hence and loss of external competitiveness, which is especially damaging for tourism activities (Corden, 2012; Forsyth, Dwyer & Spurr, 2014). However, a Dutch disease episode requires of a substantial amount of revenues, entailing a significant percentage of regional GDP (Brahmbhatt, Canuto & Vostroknutova, 2010). Moreover, the larger the amount of revenues the more probable the emergence of corruption and rent seeking, which would worsen the situation. From this perspective, fairly modest revenues could be viewed as a "blessing". Moreover, the local government could use them to spur local demand which, via multiplier processes, would generate economic activity and job creation. This virtuous dynamics would promote economic growth and development, thus improving the livings standards. It is then pertinent to look at empirical findings regarding the expected regional dynamics triggered by fiscal revenues from non-renewable resources.

Aragón et al. (2014) survey the quite sparse econometric studies on the impacts at a local level. For developed countries as the U.S. and Canada, there is a negative relationship between resource abundance and economic growth (James & Aadland, 2011), but the impact on total factor productivity is statistically insignificant (Allcott & Keniston, 2014). As temporary effects during the boom period, the empirical evidence finds an expansion in nominal income and wages and, as a result, an expansion in local demand that is reinforced by immigration. There is no evidence of negative impacts on the rest of the economy (Dutch disease), but job creation in other sectors is found to be scarce. The results regarding real income are mixed, due to price rises (Michaels, 2011; Marchand, 2012; Allcott & Keniston, 2014). Nonetheless, most effects vanish when extractive activities cease to exist. What is worse, the negative effects following the exhaustion —lower nominal income and wages, demand contraction, population losses and higher unemployment— persist for a long time (Jacobsen & Parker, 2016). In the case of developing and emerging countries, such as Brazil and Peru, royalties received by local governments have little impact on the living standards —no improvements in education and health services, housing or public transfers to households—. In these countries the positive impacts come more from the market than from the government, mainly due to mismanagement of public revenues and corruption (Aragón & Rud, 2013; Loayza, Mier y Teran & Rigolini, 2013).

The previous revision has provided us with the local impacts that would be expected on a general basis. Nonetheless, it is pertinent to focus on a closer region, like Basilicata, which was the example given by the Spanish minister. Basilicata is a southern Italian region with a population of about 577 thousand inhabitants and GDP of

10,630 million euros in 2015 (Istat). There are several empirical studies that assess the socioeconomic impacts of the allocation of oil fiscal revenues in Basilicata using different methodological approaches (Florestano, 2013; Iacomo, 2015; Viccaro, Rocchi, Cozzi, & Severino 2015). All of them reach similar conclusions.

As expounded by Viccaro et al. (2015), onshore oilfields started producing in 1997 and from then no substantial socioeconomic improvement has taken place, despite receiving 990 million euros between 1997 and 2013 in royalties. On the contrary, the poverty rate doubles the national rate and there have been severe declines in productivity. This situation, together with the authors' complain about the opacity in revenue allocation, are indicative of mismanagement. Indeed, in the distribution of the 990 million euros, the bulk (73%) belongs to the unspecific category "Other actions". The second main category (19%) is the expenditure operating plan POV, aimed at promoting economic development and living standards in the areas near the oilfields. The POV finances the enhancement of local resources, public infrastructures, productive system and the population's life quality. The "Environmental compensation" constitutes the third category (5%) that finances the efforts to mitigate the potential negative impacts of hydrocarbons production. In this respect, it must be stressed that the oilfields are located in areas of high natural value, and also near the main water provision area of south Italy. The last category finances the "Natural gas distribution network".

Using a multi-sector model based on a social account matrix for Basilicata region, Viccaro et al. (2015) found much higher impacts in terms of output, households' income and employment from the POV than from "Other actions". These results agree with Bauer's (2013) recommendation that, for taking advantage of additional fiscal revenues, the government must design a spending plan that targets those areas and activities that yield the highest socioeconomic impacts.

5.2 Oil and gas revenues in the socioeconomic context of the Canary Islands

A deeper analysis of the potential socioeconomic impacts of the allocation of public revenues from oil and gas would certainly require of an elaborated and rigorous analysis, involving the input-output table and a social account matrix for the region.[8] We do not perform such an analysis, but simply place our estimates of fiscal revenues in context of the economy of the Canary Islands. To do so, we rely on the socioeconomic features summarized in Table 2. This information can serve as a guide to identify strengths and weaknesses of the region, and hence gives an idea of a suitable revenue allocation in the region.

The strong rejection of the local government to the hydrocarbons sector was based on two central arguments (Gobierno de Canarias et al., 2013). Firstly, the environmental negative impacts can damage tourism, the leading sector of the archipelago. Looking at the tourism figures in Table 2, this is not a minor concern since a tourism contraction would seriously affect the whole economy. Secondly, the hydrocarbons sector will have little impacts in terms of economic activity and job creation, as offshore drilling is performed by a quite reduced number of skilled workers. Moreover, capital income will be earned by foreign shareholders. Thus, most capital and labor income generated by the sector would go abroad. Importantly, the government also complained about the lack of a clear fiscal proposal (tax law) for the region. This gap was filled with the new law on hydrocarbons of 2015.

[8] The available input-output table for the region is obsolete, since it refers to 2005.

Table 2. Socioeconomic features of the Canary Islands

	Canary Islands	Regional ranking (19)	Spain
Socio-demographic features			
Population (inhabitants)[a]	2,100,299 (1)	7	46,524,943 (1)
Life expectancy (years)[c]	82.17 (3)	15	82.98 (3)
Average schooling years[b]	10.45 (4)	14	10.97 (4)
Income distribution			
Gini index[d]	0.3465 (5)	2 (6)	0.3359 (5)
Poverty rate[d]	0.3222 (5)	5 (6)	0.2126 (5)
Social spending			
Social public spending PC (€)[e]:	5,252.5 (4)	17 (6)	6,230.2 (4)
- Education	846.1 (4)	15 (6)	914.9 (4)
- Health	1,332.2 (4)	13 (6)	1,356.9 (4)
- Social protection*	3,074.4 (4)	17 (6)	3,958.4 (4)
Economic features			
GDP (M€)[a]	42,317 (1)	8 (6)	1,081,190 (1)
GDP PC (€)[a]	19,900 (1)	13 (6)	23.200 (1)
Unemployment rate (%)[c]	27.3 (2)	3	20.0 (2)
Inflation rate (%)[c]	1.0 (1)	19	1.7 (1)
Trade in goods			
Exports of goods (%GDP)[a]	5.81 (3)	16 (6)	23.6 (1)
Imports of goods (%GDP)[a]	8.73 (3)	15 (6)	26.0 (1)
Trade balance (%GDP)[a]	-2.91 (3)	14 (6)	-2.39 (1)
Public sector			
Public deficit (%GDP)[a]	-0.54 (1)	17 (6)	-5,08 (1)
Public debt (%GDP)[a]	15.7 (1)	17 (6)	99.30 (1)
Tax revenues (M€)[f]	2,636.9 (3)		
Current public spending (M€)[f]	5,614.04 (3)		
Tourism sector			
GDP (% regional GDP)[g]	35.9 (3)		
Employment (% reg. empl.)[g]	31.4 (3)		
Tax revenues (% reg. tax rev.)[g]	30.4 (3)		
Tourism exports (M€)[g]	8,831 (3)		

Source: [a]Expansión (2016); [b]Bancaja Foundation & Ivie (January 2014); [c]INE; [d]Málaga & Mayo (2014); [e]Fundación BBVA & Ivie (May 2015); [f]Istac; [g]Exceltur & Gobierno de Canarias (2015).

Notes: (1)2015; (2)IIQ 2016; (3)2014; (4)2013; (5)2012; (6)Out of 17 regions (excluded Ceuta and Melilla); *Unemployment insurance and pensions provided by the state.

The second argument of the regional government —which seems quite reasonable— and our estimates of the fiscal revenues allow discarding a Dutch disease episode in the archipelago, which is a good new for the tourism sector. Indeed, the region would receive a maximum of 7,108 million real 2015 euros in a time span of 31 years, which entails an annual average of 229 million euros. According to Table 2, this annual average amounts to 0.54% of GDP, 8.67% of tax revenues and 4.08% of public spending.

The challenge would be then to efficiently allocate this mount of additional resources in order to achieve the highest socioeconomic impacts. As previously mentioned, good governance is crucial to reach this goal. In this respect, the figures in the table show that the local government has performed a rigorous and tight control on public deficit. Indeed, the Canary Islands is the Spanish region with the lowest public deficit over GDP and ratio of public debt to GDP. We interpret this fact as indicative of good

governance, which seems to suggest that the local government would be able to allocate efficiently additional fiscal revenues.

Notwithstanding, the archipelago presents severe weaknesses that directly affect the well-being of the population: lower per capita income, larger unemployment, higher poverty rate, and more reduced social public spending that other Spanish regions. Thus, any allocation plan should prioritize job creation, income distribution and social spending.

6. Conclusion

The potential development of hydrocarbons production in the Canary Islands poses the question on the fiscal revenues earned by the region, and their allocation in order to reach the highest socioeconomic impacts. This issue is of special interest to a region highly dependent on tourism, since a large amount of fiscal resources could lead to the so-called Dutch disease, which could seriously damage the tourism sector.

Our estimations of the potential fiscal revenues for the archipelago leads us to conclude that no Dutch disease episode would be expected. Moreover, a literature review on fiscal policy management in oil-producing regions shows that, in order to reach the highest socioeconomic impacts, a government must design a plan to efficiently allocated public revenues according to regional needs. Otherwise, most potential positive impacts from additional public resources will be lost. In the case of the Canary Islands, this plan should prioritize job creation, income distribution and social spending, since the region lags far behind the rest of the country in these dimensions.

A more elaborated and rigorous analysis, involving the input-output table and a social account matrix, is certainly required for a better assessment of the potential socioeconomic impacts of fiscal revenues from hydrocarbons production. Such an analysis is left as future research.

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