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A FISCAL FRAMEWORK FOR OFFSHORE OIL AND GAS ACTIVITIES IN ROMANIA*

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SUMMARY

The discovery in 2012 of a significant natural gas reservoir in the Romanian offshore sector of the Black Sea, followed by other encouraging findings, offers an opportunity for the Romanian government to update the fiscal legislation concerning taxation and royalties for oil and gas activities in order to attract more investment in this vital sector.

This study analyses the opportunity of replacing the current revenue-based royalties that apply to all types of oil and gas projects with a resource-rent tax (RRT) in the offshore sector. A RRT is the most efficient way for the government to collect a share of the rents or surplus generated by the exploitation of non-renewable resources. However it can be difficult to implement a RRT for small extraction projects that are hard to monitor. We recommend that the new legislation distinguish between conventional onshore and offshore projects, primarily because offshore production entails larger investment expenditures, higher risks, and longer times to build and then to recover costs, than conventional onshore projects.

A resource rent tax (RRT) should be adopted for offshore oil and gas projects because it could provide greater incentives to invest in exploration and development than royalties based on revenues from oil and gas production. Under a resource rent tax, a firm can deduct all of its operating and capital expenditures from its current revenues from a project. If the operating and capital expenditures exceed current revenues, which will generally be the case in first few years of a project, the firm can carry these expenditures forward at a specified interest rate and deduct them from future revenues.

The base for a resource rent tax is the difference between the present value of the revenue stream from a project and the present value of its operating and capital expenditures or, in other words, the present value of the economic rent generated by the project. The average effective tax and royalty rate (AETRR) is the share of the economic rent generated by a project that is captured by the government through taxes and royalties. The marginal effective tax and royalty rate (METRR) measures in percentage terms the wedge that the tax and royalty system drives between the gross-of-tax rate of return earned by a marginal investment and the net-of-tax rate of return. The METRR is a measure of the disincentives to invest in oil and gas projects that are created by the tax and royalty system.

We estimate that replacing the current 13 per cent royalty with a 45 per cent RRT would maintain the current AETRR and reduce the METRR for exploration and development activities in the Romania offshore sector by more than 12 percentage points, from approximately 18 per

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cent to less than six per cent, resulting in a significant reduction in the distortions created by the tax and royalty system. This switch would generate approximately the same, or perhaps even more, revenue for the Romanian government, as our analysis of a prototype offshore natural gas project illustrates.

If it adopts a RRT for the offshore projects, the Romanian government should consider the adoption of a RRT rate that varies with the price of oil or the price of natural gas. The variable RRT rate means that, as the price of the resource increases and more economic rent is generated, the government is able to capture a larger share of a larger pie. Having an explicit formula for how the RRT rate will vary with the price of the resource also reduces uncertainty about future RRT rates if prices are different in the future.

In order to smooth its revenue stream from offshore projects and to improve public acceptance of the adoption of a resource rent tax, the Romanian governments could retain a royalty on revenues from offshore production in the initial years of a project, which would be credited against the project's future RRT liabilities. This would change the time profile of the government's revenue stream, relative to a pure RRT, but the present value of the revenue stream would remain the same.

Another complimentary fiscal instrument that can be used to achieve a similar goal as the RRT is to award exploration rights through competitive auctions. The more geological information is available to potential investors, the closer their bids will reflect the expected rent from developing the resource, allowing the government to capture without distortions a significant portion of the rents generated by oil and gas extraction projects.

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UN CADRE FISCAL POUR LES ACTIVITÉS PÉTROLIÈRES ET GAZIÈRES EXTRACÔTIÈRES EN ROUMANIE*

Daria Crisan

SOMMAIRE

La découverte en 2012 d'un important gisement de gaz naturel dans le secteur extracôtier de la Roumanie, dans la mer Noire, suivie d'autres découvertes encourageantes, constitue pour le gouvernement roumain une occasion de mettre à jour la législation fiscale qui gère le régime d'imposition et de redevances pour les activités pétrolières et gazières en vue d'attirer plus d'investissements dans ce secteur crucial.

Dans la présente étude, on analyse la possibilité de remplacer les redevances basées sur le revenu actuelles qui s'appliquent à tous les types de projets pétroliers et gaziers par une taxe sur les bénéfices tirés des ressources (Resource Rent Tax – RRT) dans le secteur extracôtier. Une RRT est le moyen le plus efficace à l'usage du gouvernement pour percevoir une part des rentes ou du surplus générés par l'exploitation de ressources non renouvelables. Il peut toutefois s'avérer difficile de mettre en application une RRT pour de petits projets d'extraction qui sont difficiles à superviser. Nous recommandons que la nouvelle législation fasse la distinction entre les projets extracôtiers et infracôtiers classiques, surtout du fait que la production extracôtière comporte des dépenses d'investissement plus importantes, de plus grands risques et des délais de construction et de recouvrement des coûts plus longs que les projets infracôtiers classiques.

On devrait adopter une taxe sur les bénéfices tirés des ressources pour les projets pétroliers et gaziers extracôtiers parce que cela pourrait constituer une mesure incitative à l'investissement dans l'exploration et la mise en valeur plus importante que les redevances basées sur les revenus provenant de la production pétrolière et gazière. En vertu d'une taxe sur les bénéfices tirés des ressources, une entreprise peut déduire toutes ses dépenses d'exploitation et d'investissement des recettes courantes qu'elle tire d'un projet. Si les dépenses d'exploitation et d'investissement dépassent les recettes courantes, ce qui est en général le cas au cours des premières années d'un projet, l'entreprise peut reporter ces dépenses à un taux d'intérêt spécifié et les déduire des recettes futures.

La base d'une taxe sur les bénéfices tirés des ressources est la différence entre la valeur actuelle du flux de rentrées provenant d'un projet et la valeur actuelle des dépenses d'exploitation et d'investissement afférentes ou, en d'autres termes, la valeur actualisée de la rente économique générée par le projet. Le taux moyen effectif d'imposition et de redevances (TMEIR) est la part

* Cette recherche a été soutenue financièrement en partie par le gouvernement du Canada via Diversification de l'économie de l'Ouest Canada.

de la rente économique générée par un projet qui est perçue par le gouvernement par l'intermédiaire d'impôts et de redevances. Le taux effectif marginal d'imposition et de redevances (TEMIR) mesure en termes de pourcentage l'écart que le régime d'impôts et de redevances crée entre le taux de rendement avant impôt obtenu par un investissement marginal et le taux de rendement après impôt. Le TEMIR est une mesure des facteurs désincitatifs de l'investissement dans les projets pétroliers et gaziers qui sont créés par un régime d'impôts et de redevances.

Nous estimons que le remplacement de la redevance actuelle de 13 pour cent par une RRT de 45 pour cent maintiendrait le TMEIR actuel et réduirait le TEMIR pour les activités d'exploration et de mise en valeur dans le secteur extracôtier de la Roumanie de plus de 12 points de pourcentage, d'environ 18 pour cent à moins de 6 pour cent, ce qui entraînerait une réduction importante des distorsions créées par le régime d'impôts et de redevances. Cette transition générerait environ les mêmes recettes, peut-être même plus, pour le gouvernement roumain, tel qu'illustré par notre analyse d'un prototype de projet de gaz naturel extracôtier.

S'il adopte une RRT pour les projets extracôtiers, le gouvernement roumain devrait envisager l'adoption d'un taux de RRT qui varie en fonction du prix du pétrole ou du prix du gaz naturel. Un taux de RRT variable signifie que, à mesure que le prix de la ressource augmente et qu'une rente économique additionnelle est générée, le gouvernement est en mesure de percevoir une plus grande part de ces revenus accrus. Le fait d'avoir une formule explicite pour la manière dont le taux de la RRT varie en fonction du prix de la ressource réduit également l'incertitude à propos des futurs taux de RRT si les prix sont différents dans l'avenir.

Afin de régulariser son flux de revenus en provenance des projets extracôtiers et de rehausser l'acceptation par le public de l'adoption d'une taxe sur les bénéfices tirés des ressources, le gouvernement roumain pourrait conserver une redevance sur les revenus provenant de la production extracôtière au cours des années initiales d'un projet, laquelle serait créditée en regard des futurs impôts à payer du projet. Cela changerait le profil temporel du flux de revenus du gouvernement, par rapport à une RRT pure, mais la valeur présente du flux de revenus demeurerait la même.

Un instrument fiscal complémentaire qu'on peut utiliser pour atteindre un objectif semblable à celui de la RRT est d'accorder des droits d'exploration par enchères concurrentielles. Plus il y aura d'information géologique à la disposition des investisseurs potentiels, plus leurs soumissions refléteront la rente attendue de la mise en valeur de la ressource, ce qui permettra au gouvernement de percevoir sans distorsions une part importante des rentes générées par les projets d'extraction des ressources pétrolières et gazières.

INTRODUCTION

Romania has a long history of onshore oil and gas production, spanning more than 150 years. In 2012, an important natural gas discovery was made in its offshore sector of the Black Sea, followed by other encouraging findings. Despite its proximity to the energy-hungry European market, the Black Sea remains relatively unexplored to this day and the discovery in Romania's Neptune block in 2012 has triggered the hope that with the help of modern technology, the Black Sea may become the next North Sea. However, technology is expensive and access to the Black Sea is challenging,[1] which means that countries in the region need to create a friendly business climate with predictable fiscal and regulatory frameworks in order to attract the large players that they need in the offshore sector.

Romanian authorities have announced their intention to reform the fiscal framework for oil and gas activities, which are governed by the Petroleum Law introduced in 2004. This paper analyzes the current fiscal system in Romania in terms of average and marginal effective tax rates on investment in the oil and gas industry, following with suggestions for a more efficient taxation of this sector, inspired in part by the taxation of oilsands activities in Alberta and the offshore sector in Atlantic Canada. We argue that a resource rent tax (RRT) system for Romania's offshore sector could encourage this sector's development by lowering the marginal effective tax rates on exploration and development activities without raising average effective tax rates. Ultimately, this would benefit not only Romania, but the whole region, through positive externalities generated by any new discovery made in the Black Sea.

We begin with an overview of the Romanian oil and gas industry, the potential for offshore production of oil and gas, and the current fiscal regime for oil and gas. Then, we introduce and discuss the advantages of a resource rent tax. We follow with an introduction of the concepts of average and marginal effective tax and royalty rate and calculate them for the current fiscal system and with a resource rent tax. The final section contains our recommendations, namely that the new fiscal legislation in Romania should (1) distinguish between conventional onshore and offshore projects, (2) adopt a resource rent tax framework for the offshore oil and gas projects, (3) adopt a competitive bidding process for the allocation of exploration and development permits and (4) encourage some form of revenue sharing among central and local authorities.

THE ROMANIAN OIL AND GAS INDUSTRY

Romania is the seventh largest of the 28 EU countries by population, the ninth largest by area and the 13th largest by Gross Domestic Product.[2] It is also one of the largest oil

[1] Access from the Black Sea to the world ocean follows the Bosphorus Strait, the Sea of Marmara, the Dardanelles Strait, the Aegean Sea and the Sea of Crete to reach the Mediterranean Sea, which connects to the Atlantic Ocean through the Gibraltar Strait. Particularly challenging for navigation purposes is the Bosphorus Strait, which is the world's narrowest strait used for international navigation, only 700-3,420 metres wide, 13-110 metres deep and 31 kilometres long. Bosphorus is part of the border separating Europe from Asia, and crosses a heavily populated region that includes the city of Istanbul (population over 14 million).

[2] In purchasing power parity terms.

and gas producers in Central and Eastern Europe, with a long tradition in this field of over 150 years. In fact, Romania was the first country in the world to officially register oil production, in 1857 (with 275 tonnes.) Also in 1857, the first refinery in the world was built in Romania with American financial investment.[3] Other significant milestones in the history of this sector include the first well drilled in Romania (seal-the-wood and hoe-type drill to a depth of 150 m) in 1861; the first production of natural gas in the world (1909); the first European gas transmission pipeline, in Transylvania (1913); and the first marine drilling platform located on the continental shelf in the Black Sea (1975).[4]

At the beginning of the 20th century, Romania was the third largest oil producer in the world with an annual production of approximately 1.9 million barrels. By 1937, Romania ranked as the fifth oil exporter in the world.[5] Romanian oil fields were highly prized objectives during the Second World War for both sides of the conflict. After the war, Romania continued to develop its petroleum industry and reached its peak oil production of 14.7 million tonnes (107.4 million barrels) in 1976, declining gradually in the subsequent years. By 2013, oil production declined to 4.0 million tonnes (29.2 million barrels), only 43 per cent of its consumption of 9.3 million tonnes. Even with the decreased production rates, Romania is still the fourth largest oil producer in the European Union. In terms of natural gas, peak production occurred at the height of the industrial production during the communist era, with 36.3 billion cubic metres produced in 1986, declining to 11.3 billion by 2013. At the beginning of 2014, Romania had proved oil reserves of 60 million tonnes and proved natural gas reserves of 150 billion cubic metres, which at current consumption and depletion rates could be exhausted in 23 and 14 years respectively.[6]

Part of the communist legacy is the existence today in Romania of an extensive refinery system, the largest in Central and Eastern Europe, consisting of 10 crude oil refineries with a total refining capacity of approximately 34 million tonnes per year. As of 2014, only four of these refineries were still operating at a total capacity of 12 million tonnes per year, above domestic consumption, allowing Romania to export its surplus of petroleum products.[7]

In 2004, the state-owned oil company Petrom SA was privatized through the sale of a 51 per cent participation to OMV Group of Austria. On this occasion, the previous petroleum legislation from 1995 was replaced by Petroleum Law 238 of 2004. The Petrom privatization contract included a stability clause for a duration of 10 years, which expired at the end of 2014 and which fuelled public expectation that the entire fiscal regime for oil and

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3 From http://www.150deanidepetrol.ro/history.html and http://www.epmag.com/deepwater-black-sea-shale-top-romanias-oil-gas-agenda-788881

4 Natural Agency of Mineral Resources website, http://www.namr.ro/petroleum-law/general-presentation-oil/

5 From http://furcuta.blogspot.ca/2009/10/romanian-petroleum-history.html which presents a very detailed history of the oil and gas industry in Romania.

6 Oil and gas production and reserves data from the *Energy Strategy of Romania* draft published by the Department of Energy at http://www.econet-romania.com/files/document-2014-12-5-18755546-0-strategia-energetica-analiza-stadiului-actual.pdf

7 Ibid.

gas should be revised.[8] The Romanian government has confirmed repeatedly its intention to revise the fiscal terms for oil and gas activities,[9] but the process has not been finalized yet.

Romania's Offshore Sector

Romania started its offshore exploration in the Black Sea in 1975, and oil offshore production began in 1987.[10] In 2012, a consortium formed by ExxonMobil (50 per cent) and OMV Petrom (50 per cent) made the biggest offshore discovery to date in the Black Sea. The Domino 1 natural gas field is estimated to hold 70 billion cubic metres (2.5 trillion cubic feet) of dry natural gas, which is equivalent to almost half the current proved reserves of natural gas of Romania. In July 2014, a second deep-water well was drilled at a depth of approximately 800 metres to assess the commercial viability of the Domino gas field.[11] While still evaluating the data from the drilling activity in the Neptune block, in October 2014, OMV Petrom and ExxonMobil started drilling a third deep-water well in the Black Sea, the Pelican South-1 well about 155 kilometres offshore (also in the Neptune block.)[12] In addition to the Domino discovery, in July 2014, the exploration well Marina 1 drilled by OMV Petrom in the Istria XVIII perimeter (shallow water) found oil with potential production per well of 1,500-2,000 barrels per day.[13]

In February 2011, a consortium formed of Lukoil Overseas and Vanco International signed a five-year concession agreement with the National Agency of Mineral Resources (NAMR) for two 1,000-square-kilometre sectors, Est Rapsodia and Trident.[14] In October 2015, Lukoil Overseas Atash, in partnership with PanAtlantic Petroleum (formerly Vanco International) and the Romanian national gas company Romgaz, announced a large natural gas discovery in the Trident sector, which potentially could hold more than 30 bcm (1 tcf) of gas, to be confirmed by further appraisal drilling planned for 2016.[15]

Besides its existing conventional onshore activities and its offshore potential, Romania appears to hold significant shale gas reserves. A U.S. Energy Information Administration 2013 study on shale gas potential estimates that Bulgaria, Romania and Ukraine have significant prospective shale gas and oil reserves in three basins with technically recoverable shale resource potential estimated at 195 trillion cubic feet of shale gas and 1.6 billion barrels of shale oil and condensate.[16] However, these are unproven estimates and

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8 R. Dudau, *Principles of a Flexible and Stable Petroleum Fiscal Framework*, Energy Policy Group Commentary, http://www.enpg.ro/details-211-Principles_of_a_flexible_and_stable_petroleum_fiscal_framework_by_Radu_Dud_u.html

9 Reuters, http://www.reuters.com/article/romania-energy-tax-idUSL5N0YG15120150525

10 http://furcuta.blogspot.ca/2009/10/romanian-petroleum-history.html

11 Reuters, http://www.reuters.com/article/2014/07/21/exxonmobil-omv-blacksea-idUSL6N0PW1A420140721

12 Reuters; http://www.reuters.com/article/2014/10/27/romania-gas-idUSL5N0SM0HG20141027

13 http://www.offshoreenergytoday.com/omv-strikes-oil-in-black-sea-romania/

14 http://business-review.eu/featured/lukoil-plans-to-drill-two-oil-wells-offshore-romania-by-yearend-82991

15 Offshore Magazine, http://www.offshore-mag.com/articles/2015/10/lukoil-discovers-potential-giant-gas-field-offshore-romania.html. On the other hand, in February 2016 the three partners have decided to cease operations in the Rapsodia block due to disappointing results obtained in this sector (http://www.oilvoice.com/n/Romgaz-LUKOIL-and-PanAtlantic-Petroleum-to-relinquish-EX29-Est-Rapsodia-Block-in-the-Black-Sea/2fc6977bdaea.aspx.)

16 EIA/ARI, *World Shale Gas and Shale Oil Resource Assessment*, X-2, http://www.eia.gov/analysis/studies/worldshalegas/pdf/chaptersviii_xiii.pdf

the actual amounts will remain unclear as long as even the exploration activities for shale gas are very controversial in Europe.[17] Nevertheless, given the shale gas boom in the North American market in recent years, the potential for future shale gas developments in a region as thirsty for energy as the Black Sea area cannot be excluded.

Any of the recent natural gas discoveries that will materialize in new developments would be welcomed not just by the country itself, but the whole region. As recently as 2008, Romania imported approximately 28 per cent of its natural gas needs from Gazprom. However, a significant drop in natural gas demand from large industrial consumers, coupled with a slight increase in domestic production in 2014 and 2015, have resulted in imports estimated at only three per cent of domestic consumption in 2015, and possibly an end of natural gas imports in 2016.[18] New natural gas field developments could strengthen Romania's newfound natural gas independence and may also contribute to increased stability in the natural gas market in Central and Eastern Europe, one of the most vulnerable parts of Europe in terms of energy security.

The European energy reality is quite complex. The European Union's energy dependence rate (net imports as share of gross inland consumption) has exceeded 50 per cent for all of the last 10 years. In 2013, the energy dependence rate for all energy products was 53 per cent, but it exceeded 65 per cent for natural gas.[19] The main source of natural gas imports was Russia, which supplied 39 per cent of EU natural gas imports in 2013. About half of these imports transit Ukraine, and conflicts between Russia and Ukraine that resulted in supply disruptions in the past are a major source of concern in Europe. Notwithstanding the European focus on green energy and energy efficiency, the demand for natural gas in the EU is expected to increase in the next decades, and the domestic supply to decrease, thus increasing the EU's dependency on natural gas imports, including from Russia.[20]

The EU and non-EU countries of Central and Eastern Europe are even more dependent on Russian gas, due to insufficient domestic production[21] and lack of import alternatives. Gazprom has not been shy to use this situation to its advantage by charging significantly higher import prices in Central and Eastern Europe than in Western Europe.[22] In part

17 Under public pressure, Bulgaria has adopted a law that forbids shale gas exploration; in Romania, exploration is not forbidden but Chevron was prevented from exploring in 2013, even though they acquired all permits that current legislation requires. After some exploratory drilling in Romania in 2014, Chevron announced its decision to abandon operations in Romania in February 2015, after similar exit decisions from Ukraine, Lithuania and Poland.

18 http://www.icis.com/resources/news/2015/09/21/9925337/romania-likely-to-end-natural-gas-imports-by-2016-anre/

19 Eurostat statistics available at http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_production_and_imports

20 J. Henderson and T. Mitrova, *The Political and Commercial Dynamics of Russia's Gas Export Strategy*, The Oxford Institute for Energy Studies, University of Oxford, OIES Paper NG 102, 2015.

21 In 2013, all of Romania's neighbours imported more than half of their natural gas needs: Bulgaria 93 per cent, Hungary 72 per cent, Ukraine 51 per cent, Moldova 97 per cent and Serbia 88 per cent.

22 According to data from the Quarterly Reports on European Gas Markets published by the European Commission's Directorate General for Energy, in the first four months of 2013, Bulgaria's wholesale import price for Russian natural gas was 32.92 euros per megawatt/hour (348 euros per 1,000 cubic metres), compared to 28.65 euros per megawatt/hour (302 euros per cubic metre) in Romania and 28.30 euros per megawatt/hour (299 euros per 1,000 cubic metres) in Germany. Thus, Bulgaria paid a premium of approximately 4.6 euros per megawatt/hour over Germany, which was still lower than the premium of almost 13 euros paid in 2012. By the third quarter of 2014, natural gas import prices decreased significantly in most European countries, but unequally so, with Bulgaria paying 28.12, Romania 24.96, and Germany 21.06 euros per megawatt/hour. All other countries in the region, particularly the former communist countries, pay premiums over the German import price, typically correlated to their degree of dependency on Russian gas, but also Russian geopolitical interests.

as a result of these premiums, in April 2015, the European Commission announced its intention to file antitrust charges against Gazprom, accusing the Russian company, among other things, of using its dominant market position to impose unfair prices in five Eastern European countries: Bulgaria, Estonia, Latvia, Lithuania and Poland. A priority for the European Union at the moment is the creation of a unified energy market, with each country having access to at least two sources of natural gas imports. To this end, several interconnectors are currently being planned or proposed between European countries, including between Romania and some of its neighbours, providing an easily accessible market for any potential surplus of natural gas production in Romania.

Romania's Current Fiscal Regime for Oil and Gas

The current fiscal regime for oil and gas was established by Emergency Ordinance 47 of 2002 and included in Petroleum Law 238 of 2004, and is expected to be reviewed this year. Essentially, Romania practises a system of gross royalties for both oil and gas, with rates varying from 3.5 per cent to 13.5 per cent of revenues from oil production and 3.5 per cent to 13 per cent of revenues from natural gas, based on field productivity. The royalty regime is valid for the duration of a concession agreement, which is up to 30 years with the possibility of an extension for up to 15 years. The existing fiscal framework does not distinguish between conventional and unconventional activities, onshore and offshore, despite the substantial difference in costs, risks and time frame between these types of activities. One of the expectations from the new petroleum legislation is that it will differentiate between conventional onshore and offshore projects and will tailor their fiscal treatment to their specific characteristics.

The most relevant taxes for the oil and gas sector are summarized in Table 1 below. Other significant fiscal provisions with an impact on petroleum projects include the depreciation rules and environmental provisions. Expenses related to the location, exploration, development and other preparatory activities for oil and gas projects are recovered in equal amounts over five years, starting with the month when these expenses are incurred. Expenses related to the acquisition of exploitation rights for natural resources are recovered as the resources are being exploited, in proportion to the recovered value relative to the estimated value of the resource. Buildings and constructions used in the resource extraction are depreciated per unit of production, with production factors recalculated every five years. Titleholders of petroleum agreements must create a tax-deductible provision for environmental recovery calculated as one per cent of the difference between revenues and the expenses related to the extraction, processing and delivery of the resource, over the entire period of exploitation. An additional tax-deductible provision for dismantling of wells equal to 10 per cent of the same difference must be set up for offshore operations at depths exceeding 100 metres.[23]

[23] Depreciation and environmental provisions information from Ernst & Young, Global Oil and Gas Tax Guide 2015, http://www.ey.com/GL/en/Industries/Oil---Gas/EY-2015-global-oil-and-gas-tax-guide.

TABLE 1 THE FISCAL REGIME FOR OIL AND GAS IN ROMANIA

Type of Tax	Rate
Corporate Income Tax	16%
Royalties	• Oil: 3.5% to 13.5% of gross production, based on field productivity • Natural gas: 3.5% to 13% of gross production • 3% of revenue derived from underground storage of gas • 10% of revenue for transportation/transit through the national system of pipelines, and operations made through state-owned oil terminals Note: Reference prices for oil and gas established by authorities
VAT	20% starting Jan. 1, 2016 (24% previously); to be reduced to 19% starting Jan. 1, 2017
Withholding tax	16% of a foreign company's profit from a permanent establishment in Romania
Special/windfall taxes (since 2013)	• Natural gas: 60% fee on supplementary revenues obtained from the deregulation of prices in the natural gas sector • Oil: 0.5% of revenues for companies exploiting natural resources, with the exception of natural gas
Special construction tax (since Jan. 1, 2014)	• For constructions and assimilated assets other than buildings • Initially set at 1.5% of the accounting value of qualifying constructions (as of Dec. 31 previous year) minus the value of buildings (e.g., pillars, ramps, concrete platforms) in 2014 • Reduced to 1% since Jan. 1, 2015 • Starting Jan. 1, 2015, offshore constructions attributable to the oil and gas sector are exempt • The tax will be eliminated for all industries starting in 2017

Source: KPMG, A Guide to Romanian Oil and Gas Taxation, 2013 edition, and Ernst & Young, Global Oil and Tax Guide 2015.

A RESOURCE RENT TAX: A SUPERIOR WAY OF COLLECTING RESOURCE RENTS

In recent years, economists have promoted the adoption of a resource rent tax (RRT) or rent-based royalty[24] as an alternative to royalties that are levied on revenues or the production of oil and gas. See for example, Lund (2009), Boadway and Keen (2010), Land (2010), Daniel et al. (2010), and Boadway and Dachis (2015). The advantage that resource rent taxes have over gross royalties is that they apply to a project's economic rent — the difference between the market value of the revenues produced by the resource and the opportunity costs of all of the inputs, including the opportunity cost of capital invested in the project.

Under a resource rent or cash-flow tax, a firm is able to deduct all of its operating and capital expenditures from the current revenues generated by the project in determining its tax liability for the year. During the development phase of a project, when capital and operating expenditures typically exceed revenues, generating negative cash flows for the firm, in theory the resource rent tax or rent-based royalty would require that the government refunds the loss at the RRT rate. This may be politically undesirable and/or infeasible in jurisdictions where governments face significant liquidity constraints.

[24] A resource rent tax/rent-based royalty is a levy on economic rents generated by a project. The designation of "tax" or "royalty" is a matter of choice, but ultimately irrelevant for its impact. In part of the literature, traditional royalties applied to gross revenues or production are simply designated as "royalties" and the term "tax" (as in "special tax" or "petroleum tax") is used when the tax base is the economic rent. Alternatively, the first can be called gross (or gross revenue) royalty, while the second is the rent-based royalty, sometimes also referred to as net or net revenue royalty. In our paper, we will use the terms "resource rent tax" and "rent-based royalty" interchangeably.

An alternative to immediate loss refundability is to allow the loss to be carried forward at a rate of interest. The uplift interest rate that is used to carry forward unused deductions and credits is a key parameter in the design of a RRT and the appropriate level of this rate is sometimes controversial. Investors tend to argue for a rate of interest similar to the discount rate they use in their project evaluation. However, since a RRT essentially implies that the government is already sharing the costs and the benefits of the project with the firm, thus the risk, the uplift interest rate should be a risk free interest rate,[25] assuming that the firm will be able to fully utilize the loss carryover in the future. To the extent that the utilization of the loss deductibility in the future is uncertain, the interest rate should reflect the risk that the firm will not be able to claim these deductions.

Therefore, in practice, it is more common during the initial years of a project when the operating and capital expenditures exceed current revenues, to allow firms to carry the expenditures forward at a specified interest rate and deduct them when the project begins to generate revenues.

The two approaches are equivalent since the base of a RRT is essentially the difference between the *present value* of the revenue stream from a project and the *present value* of the operating and capital expenditures, or in other words, the *present value* of the economic rent generated by the project. Any tax that raises the same amount of revenues in present value terms as the RRT is basically equivalent to the RRT. More than 15 countries have adopted various forms of resource rent taxation for mineral and oil and gas projects. For example, in Canada, the province of Alberta uses a variant of a resource rent tax for the oilsands, which collected more than $5 billion Cdn in revenues in the fiscal year 2013/14 from over 100 large projects.[26]

The advantage of a resource rent tax is that it can reduce the disincentives to invest because the marginal investment earns just enough to cover the opportunity cost of all inputs employed.[27] As a result, the economic rent on the marginal dollar invested is zero, and the RRT payable is also zero. In other words, any investment that would be undertaken in the absence of the RRT is still worthwhile with a RRT. Thus, marginal investments that earn zero economic rents are not taxed, while infra-marginal investments that earn positive economic rents are taxed.

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[25] J. Mintz and D. Chen, *Capturing Economic Rents from Resources Through Royalties and Taxes*, The School of Public Policy University of Calgary Research Papers, vol. 5, issue 30, 2012 and R. Boadway and B. Dachis, *Drilling Down on Royalties: How Canadian Provinces Can Improve Non-Renewable Resource Taxes*, C. D. Howe Institute Commentary, no. 435, 2015.

[26] See *Alberta Oil Sands Royalty Guidelines: Principles and Procedures*, Alberta Energy, Nov. 30, 2006, http://www.energy.alberta.ca/OilSands/pdfs/GDE_osr.pdf and S. Dobson, *A Primer on Alberta's Oil Sands Royalti*es, The School of Public Policy University of Calgary Research Papers, vol. 7, issue 7 for details concerning the Alberta oilsands taxation and royalty regime.

[27] Boadway and Dachis (2015) note that a RRT may affect investment because it is difficult to distinguish between the pure economic rent from a project and the return that a risk-averse investor requires to compensate for risk. D. Lund, *Rent Taxation for Nonrenewable Resources*, SSRN 1342437, 2009, also points out that with imperfect information on the opportunity cost of inputs for a resource project, a RRT creates an incentive to use transfer prices to shift costs from other activities into resource projects, thereby increasing compliance and administration costs and other inefficiencies in the allocation of inputs.

EVALUATING THE FISCAL BURDEN OF A TAX AND ROYALTY REGIME

With many fiscal variables and rules affecting the petroleum sector, it is difficult to gauge the total fiscal burden on this sector and to compare it to other jurisdictions unless a method is developed to aggregate all these provisions into one single value. Two measures of the fiscal burden on the petroleum sector that can be used for this purpose are the average effective tax and royalty rate (AETRR) and the marginal effective tax and royalty rate (METRR).

We begin by computing the AETRR under the current tax and royalty regime versus a proposed resource rent tax for a hypothetical or prototype offshore gas project. The calculation of AETRR requires making a series of assumptions on how a generic extraction project in the Black Sea might look and our results should be interpreted with these assumptions in mind. Even with this qualification, the AETRR remains an essential tool in comparing the fiscal burden of alternative fiscal regimes and its precision can be improved by increasing the complexity of the model and the accuracy of assumptions.

We then follow with a brief introduction of the METRR concept, which we use to compare the fiscal impact of the current and proposed Romanian royalty and corporate income tax system on the incentive to invest in exploration and development in the Romanian offshore oil and gas sector.

The Average Effective Tax and Royalty Rate for a Generic Offshore Natural Gas Project in the Romanian Black Sea Sector

In order to fully evaluate the existing royalty system versus a proposed resource rent tax, it is necessary to compare the amount of revenue that would be raised under the two systems, as well as their impacts on incentives for investment. One way to gauge and compare the amount of revenue that would be collected under either a gross royalty or a resource rent tax is to specify the revenues and costs that would be generated by a hypothetical or prototype project and to calculate the average effective tax and royalty rate (AETRR) under each regime. This is a fairly common way of comparing fiscal instruments, although it has its limitations because it assumes that investment levels, production, revenues and costs are the same, even though the incentives to invest will be different under different fiscal instruments. Nonetheless, with this limitation in mind, it is a useful benchmark for evaluating and comparing fiscal instruments.

Adopting a prototype project means making assumptions regarding the costs and profitability of the project, including the size of the reservoir, the magnitude of exploration, development and operating costs, the production profile, risks, the wellhead price of the resource, etc., all of them over a relatively long-term horizon. These features of the project will determine the magnitude and the timing of taxes and royalties. With the Black Sea region still in the early stage of offshore developments, it is difficult to accurately predict the characteristics of a typical project. Nevertheless, we make some stylized assumptions for what we think a generic natural gas offshore project might look like. We then check the sensitivity of the AETRR measure with respect to some of these assumptions.

Our generic offshore project is a natural gas reservoir to be developed in the Romanian offshore sector, yielding approximately 50 billion cubic metres (1.8 trillion cubic feet) of recoverable natural gas. The project entails three exploratory/assessment wells over three years, followed by four years of development investment, with production starting in year 8. We assume that the wellhead price of natural gas is $280 US per 1,000 cubic metres, while operating costs start at $50 US per 1,000 cubic metres (both in constant 2016 dollars). Production is assumed to remain flat at approximately 5.1 billion cubic metres per year for a period of six years, while operating costs increase at a small and steady rate of two per cent (in real terms). Starting with year 14, production declines at a rate of 20 per cent annually, while operating costs increase at increasing rates. In year 25, the production ceases and a large capital expenditure is incurred with well dismantling and abandonment costs. More details regarding our assumptions and the corresponding cash flow associated with this generic project are included in Appendix A. Given our assumptions about this offshore project, the present value of the stream of revenues is approximately $9.66 billion, the present value of the operating and capital expenditures is $7.16 billion, and the economic rent generated by the project is $2.50 billion.

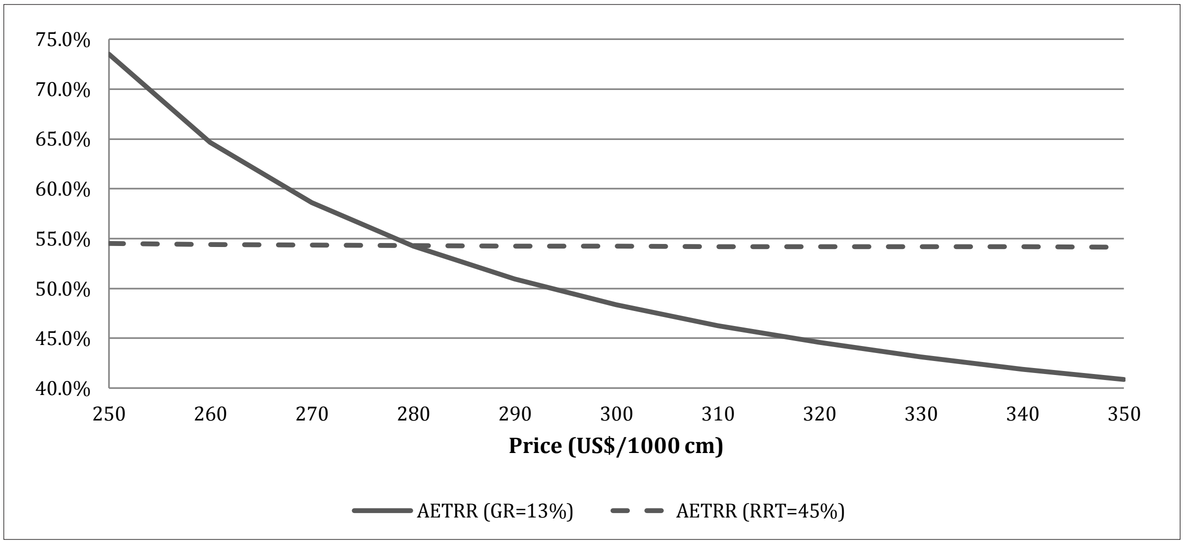
We define the AETRR as the present value of the tax and royalty revenues that flow to the Romanian government as a percentage of the present value of the economic rent generated by the project. With the current tax treatment of oil and gas activities in Romania, including the top tier of the gross royalty rate of 13 per cent, the firm pays $102.5 million in corporate income taxes in present value terms and $1,256.3 million in royalties, for a combined government take of $1,358.8 million, or 54.3 per cent of the size of the economic rent. Thus, we estimate the AETRR for a project with these characteristics to be 54.3 per cent.

The next step is to model the project's cash flow assuming the gross royalty of 13 per cent is replaced by a resource rent tax, and to run simulations that allow us to calculate the level of the RRT that would result in the same tax burden (same AETRR) as the existing gross royalty system. Based on our assumptions and modelling choices, we estimate that a rent-based royalty rate of approximately 45 per cent would result in the same level of average effective tax rate of 54.3 per cent as the current gross royalty rate of 13 per cent. In other words, replacing the current distortionary gross royalty rate of 13 per cent with a less distortionary resource-rent tax of 45 per cent would not change the tax burden for a project similar to the one used in our simulation, or the government take from this project.

These results are based on the assumption that investment and production would be the same under both fiscal regimes. We ignore the impact that switching from a gross royalty to a RRT would have on the level of investment for this particular project, and as a result the level of production, revenues, costs and the amount of economic rent generated by the project. In reality, it is very likely that a 45 per cent RRT would in fact encourage the firm to invest more in this project, expanding production over a longer period of time, and generating more revenues for the government. Moreover, a RRT may encourage more projects to be developed by reducing the fiscal burden on petroleum exploration and development activities, in particular for smaller, less profitable fields. We turn our attention to this issue in the following section, where we analyze the fiscal burden of the current royalty regime in Romania, as well as our proposed resource rent tax, on *marginal* projects.

The magnitude of the AETRR largely depends on the fiscal parameters controlled by the government, but also on circumstances beyond the government's control, like the evolution of the price of oil and project costs. As stated before, our results are derived assuming a natural gas price of $280 per 1,000 cubic metres and operating costs starting at $50 per 1,000 cubic metres. Any change in these values will affect the profitability of the project, and the share of total rents captured by the government through taxes and royalties. Figures 1 and 2 below show the sensitivity of the AETRR to fluctuations in price and operating costs, under the current gross royalty rate of 13 per cent and the proposed RRT of 45 per cent.

FIGURE 1 THE EFFECT OF NATURAL GAS PRICES ON THE AETRR FOR A 13% GROSS ROYALTY VERSUS A 45% RESOURCE RENT TAX



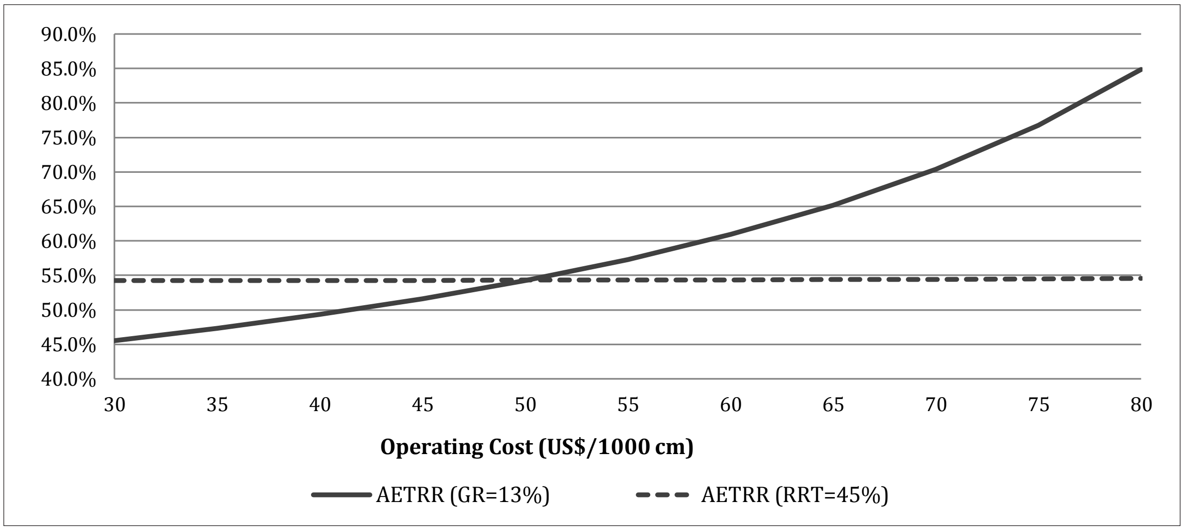
While the AETRR declines as the price of gas (and the profitability of the project) increases under both regimes, the decline is very obvious under the current gross royalty regime, but barely perceptible under the proposed RRT of 45 per cent. We can conclude that the fiscal burden of the project is much more robust under the proposed RRT regime, which is another reason to recommend it. With the current gross royalty in place, a relatively small decline in the natural gas price from a projected $280 per 1,000 cubic metres to an actual $260 by the time the production starts is enough to increase the AETRR from the expected 54.3 per cent to an actual 64.7 per cent. While this may seem good from the government's point of view,[28] it represents a significant risk for investors, who may delay or even cancel some projects when prices are very volatile.

On the other hand, the stability of the AETRR under a RRT with respect to the price of the resource suggests that there may be scope for the government to practise different RRT rates at different prices. This would enable the government to capture a higher share of rents when the market conditions are favourable and extractive projects become more profitable, without dramatically increasing the tax burden faced by firms as measured by the AETRR. We will return to the topic of price-sensitive royalty rates at a later point.

[28] A higher AETRR at a time of lower prices and profitability means that the government collects a bigger share of a smaller pie and thus its revenues do not fluctuate as much.

Similarly, the AETRR is much more sensitive to the level of operating costs under a gross royalty regime than under an RRT, as illustrated in Figure 2 below. The AETRR is the same at 54.3 per cent under both fiscal regimes when the operating cost is equal to the value we have assumed in our simulations, $50 per 1,000 cubic metres. The AETRR increases significantly with the operating costs under the gross royalty regime (since only the revenues are subject to royalties, with no allowance for increasing costs), while the increase is again barely noticeable under the alternative RRT regime.

FIGURE 2 THE EFFECT OF OPERATING COSTS ON THE AETRR FOR A 13% GROSS ROYALTY VERSUS A 45% RESOURCE RENT TAX



In conclusion, a RRT regime is significantly more stable to changes in the product and factor market conditions in terms of the fiscal burden as measured by the AETRR. By reducing the risks that firms face when undergoing such projects, well-designed resource rent taxes or rent-based royalties should encourage investment in the extractive sector compared to gross royalty regimes.

The Marginal Effective Tax and Royalty Rate (METRR)

The METRR is a complementary tool that can be employed in order to aggregate all the taxes, levies and fiscal provisions that apply to oil and natural gas extraction into a single number which indicates the overall impact of the fiscal system on investment incentives in this activity. [29]

The construction of the METRR is complex, but starts from a very simple principle. Firms employ inputs (labour, capital) until the after-tax return on the last dollar spent on each

[29] The METRR discussion is based on Mintz and Chen (2012). See also P. Daniel, B. Goldsworthy, W. Maliszewski, D. Mesa Puyo, and A. Watson, *Evaluating Fiscal Regimes for Resource Projects*, in The Taxation of Petroleum and Minerals: Principles, Problems and Practice, edited by Philip Daniel, Michael Keen, and Charles McPherson, (New York: Routledge Publishing, 2010), 199-201, on the use of the marginal effective tax rate concept in evaluating oil and gas fiscal regimes.

factor equals their after-tax marginal economic cost. The fiscal system can distort the investment decision by affecting either the marginal after-tax return, or the marginal after-tax cost, or both.

An investment has a minimum rate of return that is required by investors, after all taxes have been paid; we will call this the after-tax or net-of-tax rate of return ($\mathbf{R}_n$). This rate depends on the cost of debt and equity on international markets as well as the debt-to-asset ratio of the project. However, for any given fiscal system, an investment must earn a different rate of return before taxes, in order to generate the required after-tax rate of return. We will call $\mathbf{R}_g$ the gross-of-tax rate of return that the project should earn in order to generate the required net-of-tax rate of return $\mathbf{R}_n$.

The METRR simply measures in percentage terms the wedge that the tax and royalty system drives between the gross-of-tax rate of return earned by a marginal investment and the net-of-tax rate of return. In other words, the METRR shows how much larger (or smaller) the pre-tax rate of return needs to be compared to the post-tax rate of return in order to pay all taxes, royalties and other fiscal obligations that are levied on the project:

$$\mathbf{METRR = (R_g - R_n)/R_g}$$

For example, assume that investors require a rate of return of eight per cent net of risk and taxes to invest in a petroleum project. Given the fiscal treatment of this sector, let us also assume that in order for the project to generate this rate of return after taxes, it must earn a rate of return of 12 per cent before taxes and royalties are paid. In this case, R_n is eight per cent, R_g equals 12 per cent and the METRR equals (12%-8%)/12% = 33.3%.

Besides summarizing all taxes, subsidies and other fiscal provisions relevant to the oil and gas activities into a single number, the METRR shows how distortionary the tax system is toward investment in this sector. A positive METRR implies that the tax system discourages investment in oil and gas projects: the marginal investment must earn a higher return, pre-tax and pre-royalty, than the rate required by investors. A METRR equal to zero is said to be neutral towards investment, since the before- and after-tax rates of return on the marginal project are identical. A negative METRR means that the tax and royalty system subsidizes marginal investment- projects with a relatively low pre-tax rate of return may still be pursued because the tax system boosts the rate of return to the level required by investors.

In practice, an extractive project entails many stages, from exploration to assessment and planning, developing, production and decommissioning. Different assets are used in each stage, and different costs are being incurred, each with a specific fiscal treatment. As a result, a different METRR can be calculated for each type of asset, with the aggregate METRR reflecting the weighted average value of all these METRRs. The most significant fiscal parameters that affect the magnitude of the METRR are the corporate income tax rate, the depreciation rules (namely, the present value of tax depreciation allowances for each dollar invested), and the magnitude and type of royalty applied to petroleum activities.

The METRR with the Existing Royalty versus a Resource Rent Tax

Gross royalties are calculated as a share of the output or revenues from oil and gas production and reduce the marginal return from an investment, but not its marginal cost. As a result, there is less investment than what would occur in the absence of royalties, since the marginal investment must generate additional revenues to cover the royalties as well as its costs. Royalty rates that are differentiated by field/well productivity are an attempt to account for the higher per-unit operating costs associated with less productive wells. However, even royalty rates that vary with production can only reduce, but not eliminate, the wedge that they create between the pre-tax rate of return of the investment and the required after-tax, after-royalty return.[30]

The corporate income tax (CIT) also has a major impact on the incentives to invest. The impact of the CIT on the METRR depends, in addition to the statutory CIT rate, on a number of characteristics of the tax system including the ability to deduct interest payments on the debt that is used to finance the project, the rate at which losses can be carried forward or back to reduce CIT liabilities, existing tax credits for investment, the deductibility of royalties and other taxes, and the depreciation allowance on capital assets. The impact of depreciation allowances is subtle and depends on the type of depreciation (straight line versus declining balance, accelerated versus decelerated, etc.), the asset classes, the depreciation rate (or the number of years over which an asset class is depreciated, in the case of straight-line depreciation).

The complexity of this system makes it difficult to quantify the impact of any changes in these rules without additional computations. To summarize the impact of the depreciation rules on the METRR, the first step entails calculating, for each asset type, the present value of depreciations allowed by the tax system. For example, for straight-line depreciation, firms can deduct their exploration and development investment in equal amounts over T years. That means, for every dollar spent on exploration/development, firms can claim 1/T dollars each year for a period of T years, which in present value terms is equivalent to less than the initial dollar invested. Based on our calculations and modelling choices, the present value of depreciation allowances for each dollar spent with exploration and development in the Romanian oil and gas sector is approximately 79 cents.[31]

Our main focus here is to compare the impact of gross and rent-based royalties on the marginal effective tax rate for exploration and development activities. Intuitively, we know that taxing rents instead of gross production or revenues should encourage firms to invest more in the exploration and development of new fields. The METRR calculation can confirm this intuition, and also allows us to estimate numerically the relative tax burden of the two royalty instruments.

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30 Mintz and Chen (2012).

31 For simplification, we assume the firm uses the straight-line depreciation method over a period of T years, which yields a present value of depreciation allowances equal to $Z = [(1+R)^T-1]/[RT*(1+R)^{T-1}]$, where R is the discount rate. We estimate that the average depreciation period for assets used in the extractive sector in Romania is 10 years.

TABLE 2 THE MARGINAL EFFECTIVE TAX AND ROYALTY RATE ON EXPLORATION AND DEVELOPMENT OF OFFSHORE NATURAL GAS FIELDS IN ROMANIA WITH A ROYALTY RATE AND RESOURCE RENT TAX

	METRR with a 13% Royalty	METRR with a 45% Resource Rent Tax
Exploration Expenditures	18.1%	5.7%
Development Expenditures	17.8%	5.3%

Note: Computations assume the existing 16% corporate income tax rate and depreciation allowances.

Thus, replacing the existing 13 per cent royalty with a 45 per cent RRT rate would reduce the METRRs for both exploration and development investment by more than 12 percentage points or more than two-thirds. This illustrates the large potential for reducing the disincentives to invest in oil and gas exploration and development by replacing the current 13 per cent royalty on revenues from oil and gas production with a resource rent tax. Successful exploration in the Black Sea could potentially result in more projects being developed and/or larger scale of operation for offshore projects, generating more economic activity, more rents and ultimately, more government revenues from this sector. However, even unsuccessful exploration activities are beneficial and should be encouraged, since they increase the pool of knowledge regarding the potential hydrocarbon endowment in the region and thus generate positive spillovers for other firms that may be interested in exploration activities in the area in the future. This is particularly important for a region still relatively undeveloped like the Black Sea.

The METRR results reported in Table 2 are based on the assumed values of $280 per 1,000 cubic metres for the price of natural gas and $50 per 1,000 cubic metres for the operating cost. Figure 3 below shows how the METRR for exploration and development would vary with the price of natural gas, under the current regime of gross royalties (solid lines) and the proposed RRT regime (dashed line). As Figure 3 illustrates, the lower the price of natural gas, holding operating costs constant, the higher the METRR for exploration and development under the current fiscal regime. In other words, when the price of natural gas is low and projects are less profitable, a royalty based on revenues creates an even greater disincentive to invest. By contrast, the METRRs for exploration and development with a resource rent tax are independent of the price of natural gas, assuming that the RRT rate itself is constant and does not vary with the price of natural gas.

FIGURE 3 THE EFFECT OF NATURAL GAS PRICES ON THE METRR FOR A 13% GROSS ROYALTY VERSUS A 45% RESOURCE RENT TAX

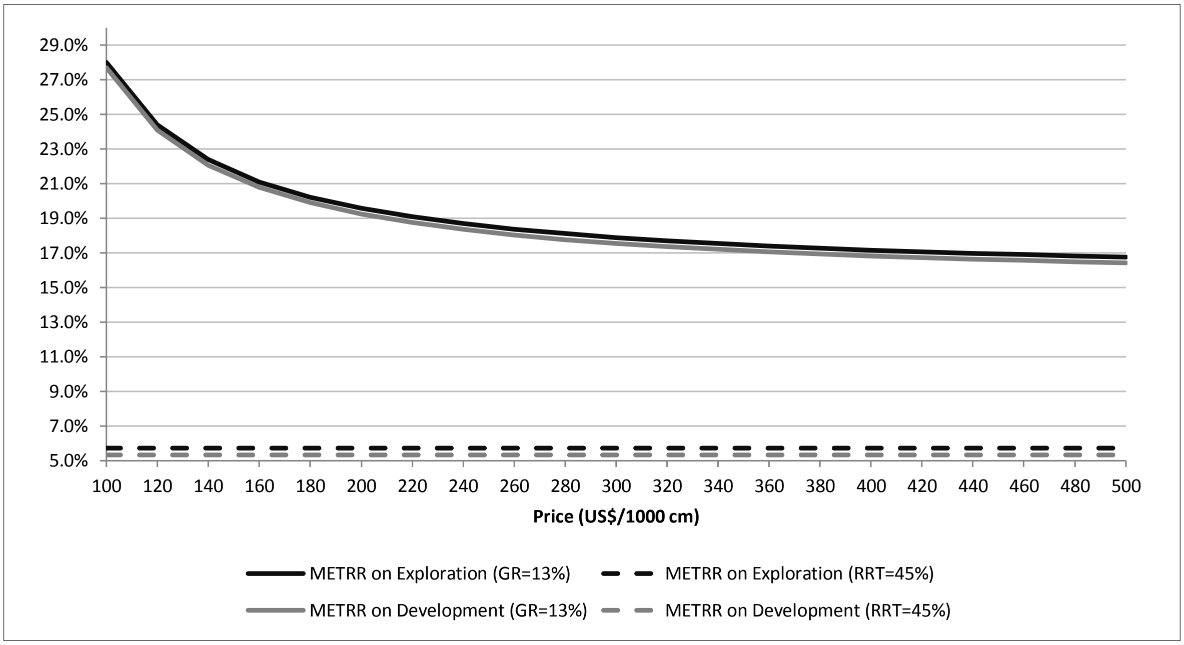
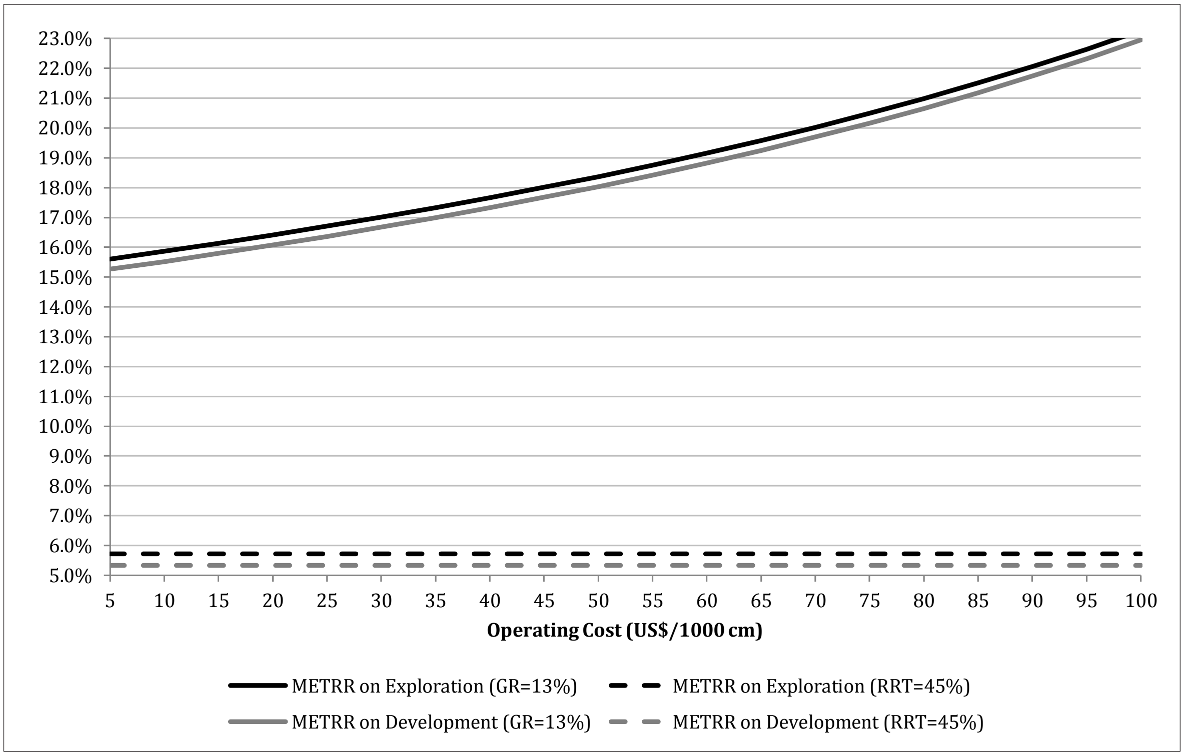


FIGURE 4 THE EFFECT OF OPERATING COSTS ON THE METRR FOR A 13% GROSS ROYALTY VERSUS A 45% RESOURCE RENT TAX



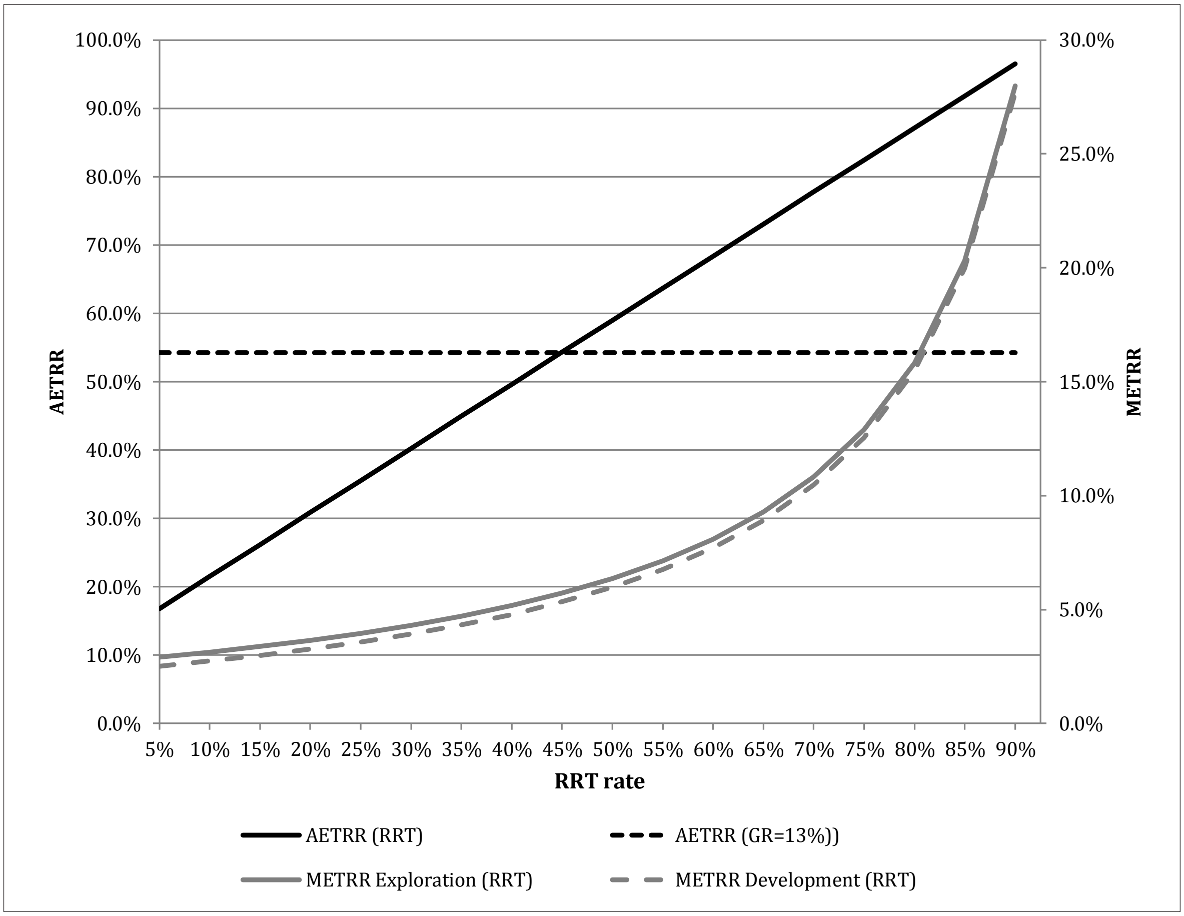
Similarly, as shown in Figure 4, projects with higher operating costs will face higher METRRs under a gross royalty system. Thus, a gross royalty creates a larger disincentive to invest in marginal projects that have higher operating costs. This is one of the major drawbacks of gross royalty systems. By contrast, the METRR under a RRT does not vary with the operating cost of the project. Below, we will discuss the setting of the RRT rate and whether it should vary with the price of natural gas.

The main recommendation of this study is for Romania to switch from a gross royalty regime to a rent-based tax in the offshore sector. Based on our AETRR and METRR computations, we believe that a RRT can be devised to collect the same amount of revenues in a less distortionary way, if that is the government's objective, and even to potentially collect more revenues without increasing distortions. It is difficult to estimate the additional revenues that would be generated by switching from royalties to RRT because we lack solid evidence of the effect of reductions in the METRR on investment in offshore natural gas projects, but it could be a significant increase given the large percentage reduction in METRR on exploration and development investment that would occur with the adoption of a 45 per cent RRT.

It is worth recalling that the recommended 45 per cent RRT to replace the current gross royalty of 13 per cent is simply the RRT rate that would result in the same average tax rate as the current gross royalty for out typical offshore natural gas project. Changing the assumptions made for the prototype project would affect the AETRR of the current royalty regime and also the magnitude of the equivalent RRT that would generate the same fiscal burden. Moreover, there is no reason to assume that the government will necessarily want to maintain the fiscal burden of the typical oil and gas project.

We calculate the AETRRs and the METRRs for our generic project as the RRT rate varies and illustrate them in Figure 5 below. The dark dashed line represents the AETRR under the current system based on gross royalty rates, and is thus independent of the value of the hypothetical RRT. The dark solid line represents the AETRR that would result from adopting a resource rent tax/rent-based royalty system, under various RRT rates. The light lines illustrate the METRR for exploration and development activities under the proposed RRT system, measured on the secondary axis.

FIGURE 5 THE EFFECT OF THE RRT RATE ON THE AVERAGE AND MARGINAL EFFECTIVE TAX RATES



The AETRR lines intersect at an RRT rate of 45 per cent. This confirms that a RRT rate at this level replacing the existing 13 per cent gross royalty would result in the same fiscal burden for our prototype offshore project, as measured by the AETRR. However, the 45 per cent RRT would reduce the METRR for both exploration and development expenditures from the current METRR of approximately 18 per cent (not shown on graph; see Table 2) to slightly above five per cent, encouraging more investment in the sector.

A RRT below 45 per cent would reduce not only the fiscal burden on the margin, but also the average tax burden on our typical offshore project, as illustrated by the black solid line, which would likely boost investment in the sector significantly.

A RRT above 45 per cent would increase the AETRR for our prototype project, but still result in lower METRRs for exploration and development, as long as the RRT rate is not unreasonably large- both METRRs remain under 16 per cent as long as the RRT does not exceed 80 per cent. However, the impact of such a large RRT on investment is less clear. Typically, the average tax burden affects the location of investment, while the marginal tax burden affects the magnitude of investment. A RRT above 45 per cent that results in a higher AETRR will likely determine some potential investors to move elsewhere, while the lower METRR might cause those investors who choose to come to Romania to invest more in exploration and development. In addition, the firms' incentive to use transfer pricing to reduce their RRT base would increase with the RRT rate, which would decrease the government's take from this sector, even if the same investment took place. It is difficult to quantify the overall impact of these reactions, therefore we believe that a RRT that would increase the AETRR should be approached with caution, even in the presence of reduced METRRs.

RRT Design Issues

Our discussion to this point has assumed that RRT has a fixed percentage rate. However, the RRT rate could be on a sliding scale that varies with the price of natural gas or the price of oil. For example, in Alberta, the RRT rate for oilsands projects varies from 25 per cent when the price of West Texas Intermediate (WTI) oil (in Canadian dollars) is $55 per barrel or less and it increases by 0.23 percentage points for each dollar increase in the price of WTI to a maximum rate of 40 per cent when WTI is $120 per barrel. The variable RRT rate means that, as the price of the resource increases and more economic rent is generated, the government is able to capture a larger share of a larger pie.[32]

Table 3 below reports the AETRR for our prototype offshore project under various assumptions for the price of natural gas and a range of RRT rates in order to assess how the tax burden on the project would increase if the government were to adopt rent-based royalties that increase with the price of the resource. At the price of $280 per 1,000 cubic metres of gas and a RRT rate of 45 per cent, the AETRR takes the value we have previously reported, 54.3 per cent. If the price of oil were to increase from the projected value of $280 per 1,000 cubic metres to an actual $360 by the time production begins, the RRT could increase from 45 per cent to 50 per cent and the resulting AETRR would still be below 60 per cent (58.6 per cent based on our simulations). By way of symmetry, the government should practise a lower RRT rate if prices turn out to be lower than projected. Such an approach would imply a higher degree of risk sharing between firms and the government, acting as a stimulant for investment.

TABLE 3 THE AVERAGE EFFECTIVE TAX RATE UNDER DIFFERENT NATURAL GAS PRICES AND RRT RATES

	Resource Rent Tax								
Price ($/1000 cm)	**20%**	**25%**	**30%**	**35%**	**40%**	**45%**	**50%**	**55%**	**60%**
220	21.0%	27.9%	34.9%	41.8%	48.7%	55.7%	62.6%	69.5%	76.5%
240	28.3%	33.6%	38.9%	44.1%	49.4%	54.7%	59.9%	65.2%	70.4%
260	30.1%	34.9%	39.8%	44.7%	49.5%	54.4%	59.3%	64.1%	69.0%
280	30.9%	35.6%	40.2%	44.9%	49.6%	**54.3%**	59.0%	63.7%	68.4%
300	31.3%	35.9%	40.5%	45.1%	49.7%	54.2%	58.8%	63.4%	68.0%
320	31.6%	36.1%	40.6%	45.2%	49.7%	54.2%	58.7%	63.2%	67.8%
340	31.8%	36.3%	40.8%	45.2%	49.7%	54.2%	58.7%	63.1%	67.6%
360	32.0%	36.4%	40.8%	45.3%	49.7%	54.2%	58.6%	63.0%	67.5%
380	32.1%	36.5%	40.9%	45.3%	49.7%	54.1%	58.6%	63.0%	67.4%
400	32.2%	36.6%	40.9%	45.3%	49.7%	54.1%	58.5%	62.9%	67.3%

[32] K. J. McKenzie, *Plucking the Golden Goose: Higher Royalty Rates on the Oil Sands Generate Significant Increases in Government Revenue*, The School of Public Policy University of Calgary Research Papers, vol. 3, issue 3, 2011, discusses the advantages of the variable RRT rate for the Alberta oilsands.

Governments around the world are typically under pressure from the public to increase their take from the extractive sector when the price of resources is high and from the industry to lower their fiscal burden when the price is low. Such changes take time and are often difficult to implement, in particular when the price suffers a downfall.[33] Having an explicit formula or schedule for how the RRT rate varies with the price of the resource would make such changes automatic and transparent and therefore reduce some of the uncertainty for investors if prices were to change significantly in the future. This built-in flexibility adds to the stability of the fiscal system, making it easier for firms to make their long-range planning under different price scenarios. Although increases in the RRT rate, as the price of natural gas increases, will also increase the METRR, Figure 5 indicates that this effect is likely to be modest as long as the upper bound on the RRT rate is not too high. The additional revenues that the government can garner with the higher rate will likely more than offset the slight reduction in marginal investment.[34]

Another issue concerning the adoption of an RRT concerns the timing of the revenues that it generates. A pure rent tax requires that positive and negative cash flows be treated symmetrically. That means, during the initial phase of a project when operating and capital expenditures exceed revenues and the rent is negative, the government should refund royalties to firms rather than collecting them. For obvious reasons, this feature is not very popular with governments around the world and their voters, even though the project may generate substantial government revenues over the entire life of the project.

Appendix B presents two alternative scenarios for collecting rent-based royalties that are equivalent to the pure rent-based tax, in the sense that they generate the same amount of tax revenues for the government in present value terms, while avoiding any royalty refunds during the first years of the project.

In the first scenario, the negative rent-based royalties from the initial phase are not refunded, but carried forward with interest and creditable against the resource rent tax owed once the project starts earning positive rents. In other words, a project does not generate RRT revenue until the accumulated revenues from the project exceed the accumulated operating and capital expenditures. The government thus avoids refunding any negative royalties, but must wait a considerable amount of time until it can finally collect the rent-based royalties. For our prototype project, we estimate that the government will only start collecting the resource rent tax around year 14.

In order to smooth the fiscal revenue stream and to improve public acceptance over the adoption of a resource rent tax, governments may want to receive more revenues up front. One solution is to retain a small royalty on revenues which would be credited against future RRT payable by firms. This is the second scenario illustrated in Appendix B. We assume

[33] C. Nakhle, *Petroleum Fiscal Regimes: Evolution and Challenges* in The Taxation of Petroleum and Minerals: Principles, Problems and Practice, edited by Philip Daniel, Michael Keen, and Charles McPherson, (New York: Routledge Publishing), 112.

[34] It has also been argued that a variable RRT rate will distort the timing of firms' investments. They will have an incentive to increase expenditures in periods when the RRT rate is high because they will be able to deduct these expenditures at a higher rate and reduce expenditures when the RRT rate is low. However, we believe that in the context of large, complex investment projects, such as the Romanian offshore or the Alberta oilsands, most of the capital expenditures occur at the beginning of the project and for technical and logistical reasons, firms have little scope for manipulating the timing of their capital spending based on conjectures about future prices and RRT rates.

that instead of the current gross royalty rate of 13 per cent, the government would opt for a smaller gross royalty rate, say five per cent, during the initial years when accumulated costs exceed accumulated revenues (pre-payout), followed by a RRT at a rate of 45 per cent once the firm has recovered its investment (post-payout.) The small initial royalty rate is intended to balance the government's interest of raising some revenues early on, with the reality that firms undergo significant losses in the initial phase of the project. The government starts collecting some revenues as soon as the project itself generates revenues, starting with year 8 in our model, even though the project does not generate rents until year 14. Thus, during years 8 to 13, the government collects a gross royalty on revenues at a rate of five per cent. During years 14 to 16, even though the project starts earning economic rents, rent-based royalties payable under the RRT are lower than the accumulated gross royalties paid already; thus, the firm continues to pay the same gross royalties as in the previous year. Finally, beginning with year 17, the rent-based royalties payable exceed the gross royalties already paid and the firm starts paying rent-based royalties at the rate of 45 per cent.

Both approaches change only the time profile of the government's revenue stream from the project, relative to a pure RRT, but result in the same present value of these revenue streams, therefore the fiscal burden of these scenarios is equivalent. Thus, with careful design, the investment incentives should not be affected by the introduction or retention of a royalty based on revenues in the initial years, provided that the overall fiscal burden for the firms is the same as under a pure RRT regime. In the Romanian context, this means that the royalty on natural gas production could be retained at a reduced rate, with the gross royalty providing a credit against current or future RRT liabilities.

Some versions of the last scenario are the fiscal regimes that apply to unconventional oil production in Canada. Alberta oilsands projects are classified for royalty calculation purposes as either pre-payout or post-payout. The classification of a project is determined by whether the project has reached its payout date, defined by Alberta Energy as "the first date at which the cumulative revenue of a project first equals the cumulative cost of a project."[35] Cumulative costs of a project include all capital and operating expenditures, rental and royalty payments, and a monthly return allowance calculated using the government of Canada's long-term bond rate. Prior to reaching its payout date, an oilsands project pays a royalty equal to a share of the project's *gross revenues* ranging from one to nine per cent. After reaching its payout date, an oilsands project pays the greater of the gross revenue royalty, or a royalty equal to a share of the project's *net revenues*. Gross royalties paid before payout are treated as a cost in the pre-payout period and therefore postpone the date at which the project moves from pre- to post-payout status, and from the lower gross royalties to the higher rent-based royalties, thus decreasing the net present value of rent-based royalties paid post-payout. The province of Nova Scotia also relies on a combination of gross royalties pre-payout and rent-based royalties/taxes post-payout for offshore oil and gas projects.

In conclusion, our analysis provides some ball-park figures for the range of RRT rates that the Romanian government could consider in replacing the current gross royalty regime for offshore oil and gas projects. A detailed analysis with various potential project profiles, including the type and magnitude of reservoirs expected to be found in the Black Sea, and

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[35] *Oil Sands Glossary*, Alberta Energy, http://www.energy.alberta.ca/OilSands/1708.asp

the tax sensitivity of investment to the METRR is critical in order to calibrate the RRT rate for offshore activities.

RECOMMENDATIONS FOR THE NEW FISCAL REGIME

Having analyzed the main features of the fiscal regime for oil and gas in Romania, we believe there are changes that could be made to attract more investment in this sector. Our main recommendations are as follows:

(1) The new fiscal legislation should distinguish between conventional onshore and offshore projects.

Romania's onshore oil and gas activity consists in a large number of old, low-productivity wells. Their accelerated depletion can be in part counteracted with new technology to enhance oil and gas recovery, but most experts tend to agree that even with substantial investment, future success in conventional onshore developments is likely limited. The hopes hinge mostly on the offshore sector. There may be significant potential related to shale gas as well, but the negative public perception surrounding shale gas makes it hard to anticipate its rapid development in the near future.

Offshore production entails different costs and risks compared to conventional onshore production. Offshore projects are significantly more expensive than onshore projects,[36] with a relatively small number of larger firms involved, particularly in deep offshore drilling. Besides being more expensive, offshore projects also take significantly longer to build and then to recover costs, once again limiting the number of firms willing to undertake such projects.

(2) The new legislation should adopt a resource rent tax for offshore oil and gas projects.

While resource rent taxes are superior to royalties in terms of attracting more investment at the margin, their application is not always practical. Resource rent taxes require strict oversight of the expenses that companies claim as deductions because companies have an incentive to manipulate their reported costs in order to reduce the tax base and the amount of royalties payable. The additional administration costs that the tax authorities have to incur may make it too expensive to apply a resource rent tax system when a large number of low-productivity wells are involved. The high administrative costs of auditing the allowable costs for each conventional well may exceed the efficiency gains from adopting a RRT. This is one of the main reasons why royalties based on gross revenues may still be the preferred method of capturing part of the economic rents generated by conventional onshore hydrocarbon production.

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36 This problem is compounded by the geographic location of the Black Sea with limited accessibility, difficult topography, the highly corrosive anaerobe medium, and ultimately, the limited information available, compared to other heavily developed regions like the North Sea or the Gulf of Mexico.

However, given the scale, time horizon, cost structure, and the relatively small number of large offshore projects, application of a resource rent tax would be feasible and worthwhile, given the benefit of having an efficient fiscal treatment that would encourage more development in this sector. We believe that offshore extraction projects in Romania are very suitable candidates for a fiscal regime based on a resource rent tax.

As outlined in the previous section, replacing the current gross royalty rate of 13 per cent with a resource rent tax of up to 45 per cent would reduce both the marginal effective tax rate for offshore exploration and development and the average tax burden for a typical project, attracting more investment, which in turn would tend to increase production and the revenues that would flow to the Romanian government. With resource rent taxes, investment could also be encouraged in fields that are too small to be developed under a conventional royalty system.[37]

(3) Reform of the bidding process

The objective of a resource rent tax is to capture some of the economic rent generated by oil and gas activities for a government with the minimum disincentive to invest in exploration, development and production. Another complementary fiscal instrument that can be used to achieve the same goal is to award the exploration rights through auctions. In a competitive auction, each firm will bid up to the maximum expected value of the economic rent from the project.

The difference between auctions and resource rent taxes is that the former capture the *expected* or *ex ante* economic rent, while the latter capture a share of the *actual* or *ex post* economic rent. The amount that the winning bidder pays for a lease becomes a fixed cost and therefore does not distort subsequent decisions regarding investment and production. The more geological information potential investors have about the blocks to be auctioned and the fewer risks regarding social, political or fiscal instability, the more accurately the bids will represent the value of the resource being extracted. For this reason, it is very important for the authorities to provide open access to as much geological information as possible and to ensure a stable climate that encourages investment.

Once a project is initiated, the price of the resource, the costs of production and the size of the reserves may depart from the initial expectations, either increasing or reducing the amount of economic rent that will be generated. In response to such changes, a government may be tempted to alter royalty or RRT rates, either up or down. However, abrupt corrections and knee-jerk reactions to changes in market conditions may not be the best response, first because such adjustments necessitate time and require consultations of all parties involved, and second because they may increase the perceived risks for investors. An auction system for exploration and development rights provides precisely the flexibility that the fiscal system may be lacking. Whenever the market conditions improve, the expected profits from developing oil and gas projects increase and firms will naturally

[37] Subject to the parameters used in our prototype model, we estimate that natural gas reservoirs in the range of 34 to 40 billion cubic metres are large enough to generate some economic rent and would probably be developed under a rent-based royalty system, but would be too small to be developed under the current gross royalty rate of 13 per cent, because revenues would be insufficient to cover all the costs, plus the corporate income taxes and gross royalties.

bid more for exploration and development leases, enabling the government to extract more revenues with no change in the royalty system. For this reason, we believe that the combination of a resource rent tax and auctions for exploration and development permits is an efficient way for the government to collect revenues from the hydrocarbon sector.

The province of Alberta uses an auction system to allocate exploration and development permits. A sealed bid auction is held every two weeks and the highest bidder is awarded the permit. Exploration licences are awarded for two to five years and proof of activity is required for renewal. Land leases for development are awarded for five years. In 2014, Alberta collected approximately $1 billion Cdn from bonuses and land leases, compared to $7 billion in royalties. However, at the height of oil and gas activity in 2011-2012, bonuses and land leases brought in approximately $3.3 billion in revenues.

Another jurisdiction cited as an example of a successful petroleum fiscal regime and where the government collects a significant portion of revenues from signature bonuses is Angola.[38] According to IMF estimates and media reports, the Angolan government collected more than $1.1 billion in signature bonuses between 1986 and 2001, more than $3.4 billion between 2001 and 2006, and more than $3.3 billion at the 2006 bidding round, although some institutions question the accuracy of these figures.[39]

(4) Revenue sharing

Public scrutiny of oil and gas companies and the environmental impact of fossil fuels seem to take on new proportions year after year, and public acceptance (the so-called "social licence") has become a crucial element in any successful oil and gas development. Sometimes, public pressure against certain types of activities is so high that they are abandoned completely.[40] By and large, though, the public seems to understand that fossil fuels are an essential element of our civilization without perfect substitutes yet. However, NIMBY[41] attitudes against oil and gas exploration, development or transportation/pipelines will continue to make headlines, and where such obstacles are overcome by investors, success is achieved with significant time and monetary costs.

One possible way to appease public resistance towards resource development is to link the benefits of these activities to the risks incurred by the public. In the United States, for example, the fact that shale gas exploration is widely accepted in many states is undoubtedly related to the fact that private landowners are entitled to mineral rights which can be traded on the market, making risk taking more appealing. With risks must come returns, if those risks are to be incurred.

We do not want to go as far as suggesting that mineral rights should belong to surface owners. The issue of mineral rights is important but controversial, and different countries may opt for different constitutional arrangements regarding these rights, based on

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38 Nakhle, 106.

39 *Oil Revenues in Angola*, Global Witness & Open Society Initiative for Southern Africa-Angola, December 2010, 37, https://www.globalwitness.org/sites/default/files/library/Oil%20Revenues%20in%20Angola_1.pdf

40 As evidenced by the resistance against shale gas developments in Europe.

41 "Not In My Back Yard"

population preferences. But we do want to emphasize that careful attention should be paid to the risks that oil and gas activities entail and how these risks are compensated. A new oil and gas project in a region may generate significant economic activity, create new direct and indirect jobs and increase the demand for local goods, but it may also create problems like pollution, traffic, noise, loss of environmental amenities, etc. The benefits created may not be sufficient incentive for the local population to accept new developments, especially when other significant sources of employment in the region exist. What may be required to garner acceptance is for the local population to share some of the direct benefits generated from oil and gas investment in their region. One avenue to achieve this is to ensure that an appropriate portion of the taxes and revenues collected from these activities return to the host region to compensate for the risks being incurred.[42]

Deciding how exactly revenues should be split between central and local governments is a non-trivial task and beyond the scope of this study. There may be no unique answer, either; each country must decide what is in its best interest, but some degree of revenue sharing between central and local government may be beneficial for everyone. If most/all revenues go towards the central government, it is natural to expect skepticism towards oil and gas investment and its inherent risks in some regions, especially the ones that have sufficient alternative industries they could develop. However, if too much royalty revenue is collected by the local authorities, it may lead to higher inflation in the region, the risk of funds being wasted on projects with little economic merit, and resentment from other, less fortunate regions, which may alter the social cohesion in the country.

CONCLUSION

Besides their theoretical superiority, rent-based royalty regimes come with considerable issues that need to be addressed or at least weighed against the potential benefits of enhanced investment. Some of these issues, in particular the issue of cost oversight, render rent-based royalties too costly for small-scale, conventional onshore projects, and gross royalty systems emerge as the more practical solution. But we argue that for large-scale projects like the anticipated offshore developments in Romania's Black Sea sector, the costs of implementing rent-based taxation are likely small compared to the benefit of attracting additional investment and increasing domestic hydrocarbon production.

An option we propose is for the Romanian government to replace the current 13 per cent royalty on revenues with a resource rent tax of up to 45 per cent, which would maintain the current average effective tax and royalty rate on a typical offshore project, but substantially reduce the marginal effective tax and royalty rate on exploration and development activities, thus significantly reducing disincentives to invest in this sector.

In addition, given the robustness of average and marginal effective tax rates under resource rent tax regimes to changes in the price of resources, the government could consider a

[42] While part of the fiscal revenues generated by oil and gas activities in Romania does go towards local authorities, their share is small and in part discretionarily awarded by the central government. What we argue for is for local authorities to be able to benefit directly from a share of revenues proportional to the local risks incurred.

resource rent tax that varies with the price of oil, allowing it to automatically capture a higher share of economic rents when the price of resources increases.

A rent-based royalty regime implies in theory the refundability of royalties in the initial phase of the project, when rents are negative. We offer two alternative scenarios in which the government collects the same amount of revenues in present value terms, but avoids refundability of royalties. The Romanian government could even retain a royalty on revenues from offshore production at a small rate, provided that this royalty is credited against the project's future RRT liabilities. A combination of an initial gross royalty creditable against future RRT payable would change the time profile of the government's revenue stream, relative to a pure RRT, but not the overall fiscal burden on the project, as long as the present value of the revenue stream remains the same.

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APPENDIX A: A PROTOTYPICAL OFFSHORE NATURAL GAS PROJECT

Our offshore model entails the development of a natural gas reservoir holding approximately 50 billion cubic metres of recoverable natural gas. The project takes 25 years from exploration to abandonment. Exploration and development require seven years; production begins in year 8 and stays flat for six years, after which it declines at a rate of 20 per cent annually, while operating costs increase at an increasing rate. To enhance production, additional capital investment is made in years 13 and 14. A large abandonment cost is incurred in the final year, which is paid for through funds saved under the provisions for environmental recovery and well dismantling. Any balance left is subject to corporate income tax.

The production profile and costs are assumed to be the same[43] under the current gross royalty rate of 13 per cent and the proposed resource rent tax of 45 per cent. The difference consists mostly in the timing and the amount of royalty/resource taxes paid, which in turn influence the corporate income tax payable each year.

The production profile and the cash flow associated with this project are summarized in the tables below. The *average effective tax and royalty rate* represents the share of the economic rent collected by the government as royalties/resource rent taxes and corporate income taxes.

SUMMARY CALCULATIONS OF AVERAGE EFFECTIVE TAX RATES
(IN MILLION US$)

	Current: 13% Royalty Rate		Proposed: 45% Resource Rent Tax	
Revenues	$9,664.1		$9,664.1	
Production Costs	$7,160.2		$7,160.2	
Economic Rent	$2,503.9		$2,503.9	
Government Take	$1,358.8	54.3%	$1,359.7	54.3%
Private Sector Take	$1,145.1	45.7%	$1,144.2	45.7%

43 Although, as we explain in the paper, in reality a resource rent tax may generate additional investment and production.

CASH FLOW SUMMARY- GROSS ROYALTY OF 13% VERSUS RESOURCE RENT TAX OF 45%
(IN MILLION US$, UNLESS STATED OTHERWISE)

					Current: Royalty Rate = 13%			Proposed: Resource Rent Tax = 45%		
Year	Production (million cm)	Gross Revenue	Capital Costs	Operating Costs	Royalties	Corporate Income Tax	After-tax Cash Flow	Resource Rent Tax	Corporate Income Tax	After-tax Cash Flow
1	0.0	0.0	150	0.0	0.0	-3.0	-147.0	-67.5	8.1	-90.6
2	0.0	0.0	150	0.0	0.0	-6.1	-143.9	-67.5	5.3	-87.8
3	0.0	0.0	250	0.0	0.0	-11.1	-238.9	-112.5	7.9	-145.4
4	0.0	0.0	200	0.0	0.0	-15.1	-184.9	-90.0	0.7	-110.7
5	0.0	0.0	1200	0.0	0.0	-38.9	-1161.1	-540.0	50.9	-710.9
6	0.0	0.0	2500	0.0	0.0	-88.4	-2411.6	-1125.0	99.3	-1474.3
7	0.0	0.0	1000	0.0	0.0	-108.3	-891.7	-450.0	-26.8	-523.2
8	5140.0	1439.2	0	257.0	187.1	30.6	964.5	473.5	-5.9	714.7
9	5140.0	1468.0	0	262.1	190.8	33.9	981.1	482.9	-3.8	726.7
10	5140.0	1497.3	0	267.4	194.7	37.2	998.1	492.6	-1.6	739.0
11	5140.0	1527.3	0	272.7	198.5	43.0	1013.0	502.5	3.0	749.2
12	5140.0	1557.8	0	278.2	202.5	48.8	1028.3	512.5	7.6	759.6
13	5140.0	1589.0	350	283.7	206.6	50.6	698.0	365.3	33.4	556.6
14	4112.0	1296.6	350	236.1	168.6	19.9	522.1	267.2	12.1	431.2
15	3289.6	1058.0	0	198.3	137.5	15.9	706.3	344.3	-9.4	524.8
16	2631.7	863.4	0	168.2	112.2	37.0	546.0	278.4	18.0	398.8
17	2105.3	704.5	0	143.9	91.6	37.5	431.5	224.5	23.6	312.4
18	1684.3	574.9	0	124.4	74.7	24.9	350.8	180.4	15.2	254.8
19	1347.4	469.1	0	108.5	61.0	14.7	284.9	144.4	8.4	207.8
20	1077.9	382.8	0	95.4	49.8	6.5	231.1	115.1	2.9	169.4
21	862.3	312.4	0	84.7	40.6	-0.2	187.2	91.2	-1.6	138.0
22	689.9	254.9	0	75.9	33.1	-5.6	151.4	71.7	-5.2	112.5
23	551.9	208.0	0	68.6	27.0	-4.3	116.6	55.8	-2.5	86.0
24	441.5	169.7	0	62.6	22.1	-2.1	87.2	42.9	0.8	63.4
25	353.2	138.5	1000	57.6	18.0	187.8	-1124.9	574.4	104.9	-1598.4
Total	**49987.1**	**15511.3**	**7150**	**3045.5**	**2016.5**	**305.4**	**2994.0**	**2767.1**	**345.4**	**2203.4**
Present Value		**9664.1**	**5304.0**	**1856.2**	**1256.3**	**102.5**	**1145.1**	**1141.3**	**218.4**	**1144.2**

APPENDIX B: TWO ALTERNATIVE SCENARIOS FOR REVENUE COLLECTION

A pure rent tax entails refunding resource rent taxes/royalties in the initial phase of a new project, while cash flows are negative. Two alternative scenarios that avoid royalty refundability are presented below. Under Scenario 1, negative royalties accumulate with interest, and firms pay resource rent taxes only after all their costs plus accumulated negative royalties are recovered. Under Scenario 2, firms pay gross royalties at a small rate (we assume five per cent) as soon as they start incurring revenues, creditable against the rent-based royalties due after the project starts to generate rents. The present value of the revenue stream collected by the government is the same under both these scenarios as in the baseline scenario of a pure rent-based system, making them equivalent.

CASH FLOW SUMMARY-ALTERNATIVE ROYALTY PAYMENT SCENARIOS (IN MILLION 2016 US$)

Year	Baseline Scenario: Negative RRT Refunded	Scenario 1: Negative Royalties Carried Forward with Interest	Scenario 2: Gross Royalty (5%) Pre-payout, Rent-based Royalty (45%) Post-payout
1	(67.5)	0.0	0.0
2	(67.5)	0.0	0.0
3	(112.5)	0.0	0.0
4	(90.0)	0.0	0.0
5	(540.0)	0.0	0.0
6	(1125.0)	0.0	0.0
7	(450.0)	0.0	0.0
8	473.5	0.0	72.0
9	482.9	0.0	73.4
10	492.6	0.0	74.9
11	502.5	0.0	76.4
12	512.5	0.0	77.9
13	365.3	0.0	79.4
14	267.2	153.4	79.4
15	344.3	344.3	79.4
16	278.4	278.4	79.4
17	224.5	224.5	223.70
18	180.4	180.4	180.43
19	144.4	144.4	144.44
20	115.1	115.1	115.08
21	91.2	91.2	91.15
22	71.7	71.7	71.67
23	55.8	55.8	55.80
24	42.9	42.9	42.90
25	574.4	574.4	574.40
Total	2767.1	2276.5	2191.9
Present Value	**1141.3**	**1141.3**	**1141.3**

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