Income equivalence and a proposed resource rent charge

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ARTICLE INFO

ABSTRACT

We demonstrate the equivalence of various income-based charges when perfect certainty prevails, as well as deviations from equivalence under uncertainty. Some of these equivalences are known but the derivations of others, such as cases for two types of free equity, are not. These equivalences lay the foundation for a proposed Accrued Rent Charge (ARC) as an alternative to Resource Rent Taxes (RRT), both as proposed and implemented. We argue that the ARC may be preferred to the RRT because the timing of returns to investors (owners of reproducible capital) and owners of natural assets coincide. That is, returns accrue to owners of natural assets earlier in time with the ARC relative to the RRT. In addition, we argue that, while both charges are inefficient when there is uncertainty, the ARC may be relatively more administratively and economically efficient. Finally, we use simulations to compare the ARC to the RRT and to standard income charges and discuss the results.

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1. Introduction

Two objectives are served by this paper. First, we review a number of profit-based charges typically imposed on natural resource projects, and expand the number of charges that are equivalent relative to particular assumptions. This analysis is then used as the basis for a proposed "Accrued" Rent Charge (ARC) as an alternative to the Resource Rent Tax (RRT) and to other methods such as production sharing that are claimed to collect rent.[1]

How governments collect revenue from natural resource projects[2] has been long debated.[3] As well, mineral contracts between governments that own the resource base and producing entities have grown from relatively simple royalty-profit tax arrangements to complicated documents containing a range of instruments including royalties,[4] production shares, RRTs, local employment requirements, and allocations of output for the domestic market.[5] The increase in the complexity of contractual structures is correlated with economic criticisms about the claimed inefficiencies of royalties, which are traditionally based on

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[1] As Conrad et al. (2017) argue, the RRT is a poor instrument for capturing natural resource rents, however defined, because absent a royalty the RRT may distort extraction. Our purpose here is to propose a risk-sharing scheme that can be administered and that increases the likelihood that a resource-owning government is compensated for bearing a part of the risk associated with natural resource extraction projects.

[2] It is common to speak of taxation of rents, as in Garnaut and Clunies Ross (1983). We refrain from the use of this terminology, in part, because we believe the term has ambiguous meaning, particularly when the state owns the minerals in-situ. Some of the literature, such as Otto et al. (2006), contains distinctions between Ricardian and Hotelling rents (or user costs). Furthermore, studies such as Adelman (1990) and Tilton (2003) provide evidence supporting the view that user costs (or the scarcity value of natural resources) are either low or zero. These claims are based on evidence about the behavior of natural resource producers who behave as if there is no forgone value from increased current extraction. Recently, however, this view has been questioned, particularly by Conrad et al. (2017) who note that such behavior by the firm is simply the result of the resource producer having no claim to the residual value of either the reserves or the real property that holds the reserves. This is not the case for the resource owner, however, who faces a tradeoff between the reduced value of the property, even absent physical exhaustion of the reserves, and increased payments for the use of the resource, including the right to extract. From this perspective, there is no economic difference between natural resources from other scarce productive factors such as capital and labor, making a "royalty" equal to the marginal value of the factor payment; effectively the wage paid for the use of the natural resource.

[3] Helpful reviews of the large body of literature on this subject include Lund (2015), Otto et al. (2006), and Daniel et al. (2010), among others.

[4] See Conrad and Hool (1981) and the references cited therein for some of that literature. It should be noted that Conrad and Hool state that the distortionary effects of the royalty should be considered only after full costs, including the payment to the reserve owners, are included in the mining firm's cost structure. Later summaries of distortionary effects of royalties include Otto et al. (2006) and Boadway and Keen (2010) in addition to the criticisms of Garnaut and Clunies Ross (1983).

[5] See Lund (2015) and Alexeev and Conrad (2009) for some analysis of contractual structures.

either value or volume of extraction. The introduction of the Indonesian production sharing contract in the late 1970s and the RRT proposed by Garnaut and Clunies Ross (1983) that has been used in various forms since its inception (originally in Papua New Guinea and recently in Australian mining), are important markers for the change in both perception and application. The original Garnaut and Clunies Ross formulation was claimed to be based on risk aversion by producers and it appears that risk aversion on the part of citizens of a resource-endowed country was not considered. Economists now generally agree that the RRT is not neutral if for no other reason than the fact that the government does not engage in proportional risk sharing.[6] The RRT and similar taxation approaches can be structured to be equivalent to a carried interest where there are incentives for the agent (the government in this case) to better align its objectives with those of the principal.[7] By deferring compensation to later in the contract period and basing the compensation on some measure of surplus, the agent has an incentive to allow the principal to maximize the surplus. Economic rent is shared in a perfectly certain situation but there is asymmetric risk sharing because the agent's lower bound for compensation is zero. The lack of appropriate risk sharing has led to proposals to use a more traditional Brown tax that is equivalent to an income tax with perfect loss offsets.[8] Another concern about the RRT is that the payments to the government accrue, if at all, only after the investor has accrued a risk-adjusted return on a cash flow basis. The use of immediate expensing and full cost recovery, if undiscounted, is also a common feature of production sharing contracts. Such a result could leave the owner of a scarce productive factor, i.e., reserves, with little or no compensation in present value terms.

The ARC proposed here preserves the equivalence between economic rent and profit in a perfectly certain situation, similarly to the RRT, but payments to the government as the resource owner accrue more rapidly because the ARC is essentially equivalent to the resource owner taking an equity position in the mining project. In effect, the resource owner is contributing the reserves to the project in exchange for an equity interest. Like under the RRT, an equity participant is now at risk for the value of contributed capital. Such an interpretation might be made for the RRT as well, but the essential difference between the two approaches is that the resource owner's payments are equivalent to dividends as opposed to a carried interest. This interpretation is possible because of the equivalence between the net present value of cash flow and the net present value of "profit" measured on an accrual basis. Switching from cash flow to accrual will speed the payments to the resource owner because, like shareholders, the government will not have to wait until the investor's (the other equity participant) capital is repaid (i.e., the adjusted basis of the assets becomes zero) before receiving a portion of income.

We begin our analysis by reviewing the equivalence between the net present values of cash flow and accrued income. We discuss the fact that the RRT in a perfectly certain situation is but one of a class of profit-based instruments – including the ARC, purchased equity, one particular type of free equity, a carried interest, and a particular type of withholding tax – that yields identical results. Although some of these equivalences are known (see, for example, Daniel et al. 2010), we believe the derivations for two types of free equity have not been previously demonstrated. We also discuss other commonly used tax instruments, such as the traditional profits taxes and withholding taxes, as well as various types of equity participation by the

government. This discussion is central to our proposition that the RRT is but one of a series of instruments capable of yielding identical results, depending on the conditions. In addition, we believe it is important to separate form (production sharing relative to the RRT or a free equity share) from economic substance. We believe that it is the economic substance that matters for the design of policy. For example, one issue raised by the equivalences is that it may not be reasonable for governments to impose two or three different charges (for example, profits tax and RRT as is done in Australia). If there is one particular instrument that yields an equivalent result at lower administrative costs, then there may be gains to all parties.

Uncertainty is what distinguishes the various instruments and so we then turn to risk sharing and our proposed Accrued Rent Charge (ARC). As noted above, payments under the ARC are equivalent to dividends, properly measured, and so is a return to the invested capital of the resource owner.[9] We describe the ARC and use simulations to demonstrate the potential usefulness of the approach. It is shown that the resource owner begins to obtain revenue earlier in a mine's life relative to the RRT, in general to coincide with the timing of income payments (dividends) to equity. In addition, holding the discount rate constant, the expected value of revenue to the government is greater with the same risk borne by the government. If the population of the resource-producing country is more risk averse relative to investors, then the ARC may be a more efficient instrument relative to the RRT. The analysis is completed by a summary and discussion.

2. Basic accounting identities

Define a special purpose entity (SPE) (for example, a mine) operated by one shareholder (for convenience) and financed with equity (for simplicity). The shareholder's cash flow in any time period, t, is:

$$CF_{s,t} = -I_t + N_t + D_t \tag{1}$$

Where:

$CF_{s,t}$	= Cash flow to shareholder
I_t	= Investment in SPE
N_t	= Repayments of capital from SPE
D_t	= Dividends paid by the SPE

In this framework, cash flow for the SPE in any time period t is zero because it is a conduit for the investor and is defined as:

$$CF_{spe,t} = R_t - C_t - p_K K_t + I_t - N_t - D_t = R_t - C_t - p_K K_t - CF_{s,t} = 0 \tag{2}$$

Where:

$CF_{spe,t}$	= Cash flow to SPE
R_t	= Revenue
C_t	= Operating cost
K_t	= Investment in capital goods during the period
p_K	= Price of capital goods[10]

Note that by definition:

$$R_t - C_t - p_K K_t = -I_t + N_t + D_t \tag{3}$$

What is not invested by the special purpose entity is distributed, or otherwise accrues, to the shareholder. The left-hand side of Eq. (3) will be defined as free cash flow for our purposes. In addition, $R_t - C_t$

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[6] The government does not bear any of the downside risks with an RRT, where downside risks are defined as the part of the distribution of outcomes where the net present value of the project is non-positive. Under proportional risk sharing, risks would be borne in proportion to the share of gains (losses) between the government and the investor. See Lund (2009) for a review of this literature.

[7] Traditional production sharing where costs are recovered before any surplus is shared is equivalent to an RRT with a zero discount rate (see Daniel 1995 and the discussion below).

[8] Lund (2009).

[9] We note that although the ARC simulates equity participation by the government, actual equity participation in a particular project might be difficult to administer in the absence of highly liquid equity markets.

[10] The price of capital goods p_K is assumed to be constant across time for convenience. No capital gains or losses are created by the change in the relative price of capital goods.