On Capturing Rent from a Non-renewable Resource International Monopoly: Prices Versus Quantities

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Abstract In this paper we model the case of an international non-renewable resource monopolist as a dynamic game between a monopolist and \( n \) importing countries governments, and investigate whether a tariff on resource imports can be advantageous for consumers in importing countries. We analyse both the case of a price-setting monopolist and the case of a quantity-setting monopolist. We find that a tariff is advantageous for consumers, even when there is no commitment to the trade policy and importing countries do not coordinate their policies. Using a numerical example, we find that a tariff is more advantageous for the importing countries if the monopolist chooses the quantity instead of the price and that the optimal temporal path when the monopolist chooses the price is consistently below the optimal temporal path when the monopolist chooses the quantity for the entire period of exploitation of the resource. Nevertheless, the variation in total welfare between the two regimens is small.

Keywords Tariffs · Non-renewable resources · Depletion effects · Price-setting monopolist · Quantity-setting monopolist · Differential games · Linear strategies · Markov perfect Nash equilibrium

1 Introduction

An issue that is very important to Western countries is how to react optimally to the existence of a non-renewable natural resource cartel or monopoly. The OPEC vs. the West is still a good example. One option that the Western countries have is to strategically use a tariff on resource imports to affect the extraction behaviour of the monopolist and the international price of the resource, allowing them to capture part of the seller’s rent.\(^1\) Our paper analyses

\(^1\)The idea that rent can be extracted from a foreign monopolist was presented for the first time by Katrak [11] and Svedberg [23].

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this issue, solving a differential game between a resource monopolist and the governments of large importing countries.

We assume that consumption takes place only in the importing countries which are not endowed with the resource and that the utility function is linear-quadratic.\(^2\) The monopolist extracts the resource at an average cost that is constant with respect to the extraction rate but increasing with respect to the accumulated extractions (depletion effects) and sells it in an integrated international market.

In this framework, we address two cases. In the first case, the monopolist sets the price and the market sets the extraction rate, whilst the governments of the importing countries fix a tariff on resource imports. In the second case, we assume that the monopolist sets the quantity. For the first case, we find that for the Markov perfect Nash equilibrium in linear strategies the optimal tariffs are not zero, i.e. in other words, to fix a tariff on resource imports is advantageous for consumers in the importing countries, something that does not occur in a static setting.\(^3\) The optimality of the tariff is explained by the existence of an indirect strategic relationship that is not present in the static setting. For the case of a non-renewable resource, we can distinguish two types of strategic relationship between an importing country government and the monopolist, a direct or intratemporal relationship and an indirect or intertemporal relationship. The direct strategic interdependence, characterising the static model, appears because the consumer’s welfare depends on the monopolist price, and the monopolist’s profits depend on the tariff. The indirect strategic relationship appears because through the tariff, the governments of importing countries can influence the dynamics of the accumulated extractions and hence the costs of extractions and the evolution of the monopolist price. For this reason, in a dynamic context like that analysed in the paper, the governments of importing countries can strategically use a tariff to capture part of the monopolist’s rent. Our results show that, with depletion effects, the tariff decreases throughout the exploitation period of the resource and converges to zero in the long run. On the other hand, the international and consumer prices increase and converge to the choke price.

For the case of a quantity-setting monopolist we also find that a tariff is profitable for the consumers in the importing countries, which extends the result obtained in a static setting to a dynamic setting. When the monopolist chooses the quantity, the indirect or intertemporal strategic relationship between the importers and the monopolist disappears, but the direct or intratemporal relationship is still strong enough to make the use of a tariff profitable. To complete the analysis, the two cases are compared using a numerical example. According to the results of our numerical example, a tariff is more advantageous for the importing countries if the monopolist chooses the extraction rate instead of the price. This is consistent with what we know from the static model, although in our dynamic model, the use of the price does not completely eliminate the effectiveness of the tariff to capture a part of the

\(^2\)Brander and Djajic [3] and, more recently, Keutiben [16] have explored other assumptions. Brander and Djajic [3] analyse a bilateral monopoly, where the resource is an essential input in the production of a homogeneous consumption good in the two countries although only one is endowed with the resource. They find that rent extraction is limited but not eliminated by the exporter’s ability to use the resource domestically. Keutiben [16] shows that, for the case of a monopsonist facing a competitive industry, the presence of the resource in the importing country essentially reinforces the ability of the importer to capture the foreign rent.

\(^3\)As it is well known in a static setting if the monopolist chooses the price, the Nash equilibrium tariff of the game is zero and there is no place to use strategically a tariff. The strategic use of the tariff is not optimal because the only effect of a tariff would be to rise the price and this would further distort consumption in addition to monopolistic pricing. See Alepuz and Rubio [1] for a study of the strategic use of a tariff against a monopolist under an integrated international market in a static framework.