MODULE ADSEA, LESSON 5
PROTENTIAL REVENUES FROM THE EXPLOITATION OF MINERALS IN THE AREA

LECTURE NOTES

Well, hello everybody, and welcome to a deep dive on seabedmining royalties. My name is Dale Squires, I'm with the Department of Economics at the University of California, San Diego. So we'll look at deep seabed mining revenues and royalties from the perspective of the international Seabed Authority and this is opposed to simply contractors or states parties and the organization will set the stage for mining, talk about the royalty regime and the point of valuation and the basis in metal and profit valuate. Setting the stage for mining, it's predominantly in the Clarion Clipperton zone where the polymetallic nodule mining is that the ISA is concerned with, but it's also in the various parts of the Western Central Pacific as well.

Now here's a stylized diagram of how we get the project economic value to be taxed so we can think about mining up here, mining facilities and processing facilities. So when we have mining, there's mining capital expenditures and there's mining operating expenditures and then there's ores that are created through the mining process, and it goes to processing facilities and then there are costs associated with processing operating expenditures and processing capital expenditures. Now from the processing, we have sales of the metal concentrates that creates revenue. Now in ad valorum type financial systems or royalty regimes, that creates project economics value which is subject to the taxes or the royalty regime as well and then there's financing and research costs and residual value and in a profit type system. Well, the revenue would also be subject to costs and CapEx expenditures that occur through processing and mining and we get project economic value which is subject to our royalty regime. Let's turn to this royalty regime. So the royalty regime involves contractor payments, call royalties to the owner of Mineral Resources. It's all humanity of current and future generations represented by the ISA as compensation for exploiting mineral resources of the area.

The royalties are for mineral payments in the area in accordance with the common heritage of mankind principle and the United Nations Conference on Law of the Sea and the implementing agreement. And has to extract 4 metals of four metals of manganese, nickel, cobalt and copper from polymetallic nodules. Let's consider the cash flow approach to the ISA royalty regime. So cash flow is where we look literally at the flow of cash overtime. So we have to think about revenues overtime and we can think about various types of costs. And this is based on a stylized commercial polymetallic nodule mining, since there's currently no actual commercial mining, and there's multiple cash flow models that have been developed. One is by the Massachusetts Institute of Technology by Richard Roth and his associates. One is by China. One is by the African Union, one is by Chris van Najin, and his PhD dissertation at the University of Antwerp, and one has been by

Germany. Now the MIT cash flow model for the ISA royalty regime, as I said, was developed by Richard Roth and his colleagues at MIT and is the main focus at the ISA and is presented in the following slides from Richard Roth's presentation in at the recent meeting in 2023. Now there's if we think about the types of royalty payments under consideration, the first is an ad valorem now with an ad valorem type of royalty regime, royalties are based on the value or revenue of production. Royalties are payable regardless of whether the mine is making a profit or loss and ad valorum pays revenues to the ISA as long as minerals are mined sold.

So let's go back to the stylized diagram. So in this case, we can think about mining facilities and creating we could tax simply the revenue that comes out of them and that is not in this diagram, but we could think of the facilities and just creating, mining, creating revenue and then that's project economic value and taxed; without including processing; and that's what's under consideration now. So again an ad valorem pays revenues to the ISA as long as minerals are mined and sold. So this is a really good thing for the ISA. Doesn't matter whether there's the mining and processing or profitability or profitable or not. It takes away the risk for the ISA and it imposes risk and uncertainty upon the minors and processors, but the ISA, it's a good one for the ISA because of the risk and it's entailed. Now a fixed add valorum royalty regime is a fixed payment rate multiplied by the value of the minerals. So let's say the payment rate was 25%, it would be .25 times, let's say $500 billion. Now a variable at the norm rate, is a royalty regime in which there's the variable payment rate is multiplied by the value of the minerals and a variable payment rate increases overtime as risk and uncertainty clarifies and the money becomes more profitable after initial period losses. Now a second type of royalty payment under consideration, is a blended fixed ad valorem and profit. Now a profit-based royalty is levied at a certain percentage of profit obtained after subtracting mining costs. And so the royalty is paid according to mining profits and this creates economic incentives for the contractor to reduce costs and economic risk in early stage commercial mining.

So that if we go back to this stylized diagram, we have mining facilities, you have order which creates revenue. Now if we subtract the mining CAPEX and the mining operating expenditures, we would then have a measure of profit, which would then be subject to the taxes, of the royalty regime. Now we can also have a blended profit in fixed ad valorem. So in this accommodates both the Authority and the contractors. Now we can think of two stages to the royalty regime. The first is the initial stage, which there's higher risk and uncertainty, high initial costs and lower production in the second stage, the mine produces at a mature rate. The major investment is finished with this investment costs are now some costs and there's lower risk of uncertainty. Now, in one and two stage royalty regimes - in a one stage royalty regime, we have the same royalty rate in all the years. It doesn't matter what how much or is being produced. It doesn't matter about the risk and uncertainty doesn't matter about cost, doesn't matter about prices. Under a two stage royalty regime, the royalty rate changes in a second stage and this reflects the changing nature of mining over time and the purpose is to reduce the minor the contractors economic burden in the early stages of commercial mining when where production is low, costs are very high, basically, investment costs cut CapEx and there's considerable risk and uncertainty.

So now let's look kind of a summary or review of the financial payment system options. So there's four options. We have the fixed ad valorem one stage. The fixed abnorm, which is a two stage. A

blended profit of fixed ad valorem and in the first stage and blended profit and fixed add valorem in the second stage and then the fourth option is a variable ad valorem which is 2 stage. A fixed first stage in a variable second stage. Again, we can think of one versus 2 stages. The one stage we have the same rate in all years, two stage we have the rate changes in the second stage and under these financial or royalty regimes. We have fixed added valorum rate in each stage or variable ad valorem rate, when the rate changes with metal prices and a blended ad valorem and profit. All systems can be designed to be the desired goal, such as revenue to the ISA and effective tax rat we'll talk about shortly or any other goal. And rates can be chosen to make any system meet a stated goal under baseline conditions. However, each system will react differently to changes in metal prices, costs, and other assumptions.

Now there's pros and cons of these different systems and is outlined here in this table. In the first call, we have options for the four different royalty regimes. We have their pros in the middle column and we have their cons in their third call, the one on your far right hand side. So if we think about the first one, first option here on your left hand side fixed add the lower column, well the pros is it's very simple to administer, now con is it does not fully adjust to price and cost changes. So this misses opportunities for increased overall revenue available by staging. Remember, there's gonna be more revenue in the second stage and so the ISA should be able to, if it wants receive more revenue. Now, if we have a two stage fixed ad valorem, that's the second here under options on your left hand side, it's again simple to administer and there's an opportunity to increase the overall revenue through staging a con - it does not fully adjust to price and cost changes because it's fixed. Now, if we think about profit and the ad valorem is third under the options, the pros - it automatically adjusts to changes in metal prices and costs and it divides upside benefits if profits are high, but downside risk if profits are low; cons – it is complex to administer, requiring a full accounting and monitoring or auditing system for profits. Now that's it's actually quite complex, because different countries or states parties to the ISA. Have different kinds of cost systems and they accounting systems, they define costs differently, they measure profits differently, they measure cost differently. And then you also get into a problem of what we call strategy proofness or the contractors truthfully revealing their costs - you can think about this with income taxes. So anything dealing with costs is much more difficult, but anything dealing with revenues is much easier to monitor because we can monitor the ores when they often the mines when they are distributed land brought to land and we have we have prices that from various kinds of metal markets such as the ones metal exchange.

Now finally we have our fourth option, the variable ad valorem, that's relatively simple to administer. No accounting system is needed. Our pros and the cons – it adjusts well to metal price changes, but not to cost changes. Now how can we measure the effectiveness of the different systems and rates? Well, we can think of symmetric metrics – one is the effective tax rate - we have ISA revenues and we have contractor internal rate of return. The internal rate of return is the rate of return that accrues to the contractor if they readjust, the profits from the cash flow at the internal rate of return. And then finally, there's others. There is also behavior under different conditions; there's baseline assumptions, different costs and changes to future metal prices. Now let's consider fairness as a basis for selecting rates. The financial system that is the royalty regime should neither advantage nor disadvantage Deep seabed mining versus land-based mining and that's required by law of the sea. Contractors should be subject to the overall tax burden as the

comparable land-based mines. This gives us the effective tax rate. Now two studies have looked at the range and average effective tax rates. They've used 39.2% and 46.0% and in the baseline analysis used by Richard Roth MIT Associates, they use an average of these given 42.6% effective tax rate. Other studies have looked at the range of royalty rates from 2% to 12%, but these depend on the royalty basis. For example, there's a higher rate for or because you have lower prices with or and a lower rate for the highly processed metals because you have higher process, good intensity of metals now a third topic here is the point of valuation and the basis of metal and profit valuation and there's two candidates for Metal Valuation, one is gross metal value. This is the sum of the value of copper, nickel and cobalt metals, plus the value of manganese oxide ore. Why this approach? Because of global prices, these provide clear arm's length value for these items. There's very well-established metal markets. London Metal Exchange for example. Now the MIT Financial model uses gross metal value because there's currently price indices for the three metals plus manganese ore which is no price index for nodules. A second candidate for metal valuation is the nodule transfer price. There is no existing market yet for nodule. Is difficult to know arms length, transaction prices and its potential future valuations possible only once it fully functioning market for these nodules forms. And there's other relevant assumptions for cash flow model. One is the volume of mined polymetallic nodules or content in polymetallic nodules, recovery rates of metals from polymetallic nodules, relevant costs, exploration, mining, transportation, environment protection, processing risk and uncertainty, which are cost. Definition of costs, which we've already talked about, is transfer prices. There's how you define costs, which costs are included. How do you measure? Forecast and metals prices and the corporate income tax paid to the sponsored state, which is this effective tax rate is some 25%.

The financial system is no longer fair if the tax rate is less than 25%. But we can equalize it through additional fixed rate, royalty profit share or top-up profit share. Thank you so much and I appreciate this opportunity to explain to you.