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THE NEED FOR A SHIFT TO A NEW HYBRID ROYALTY SYSTEM IN ARMENIA: AN ATTEMPT TO MOBILIZE MORE TAX REVENUE?

Introduction

Upon imposing export duties on the companies representing the mining of mineral ores industry in July 2022 and becoming effective in September 2022 [1], thus placing a heavy burden on exporters of concentrates (copper, zinc, molybdenum, and containing gold) and ferromolybdenum [2–4] while exporting to third countries (other than the members of the Eurasian Economic Union), the Government of Armenia canceled these duties and decided to switch to a new hybrid royalty system in June 2022 (effective 1 January, 2023) [5–6]. The previous royalty system functioned from 2012 to 2022. In 2022, the introduced hybrid system combined value-based and/or ad-valorem royalty (with constant (fixed) rate) assessment with profit-based royalty assessment that utilizes two bases and royalty rates.

As each Government is challenged to initiate mining fiscal regime changes to generate higher tax revenues (including duties and payments, namely royalty payments), its decision should not be considered a heavy burden in formulating and designing respective policies. Therefore, the government's decisions (namely those of the government of Armenia) need to be substantiated by various indicators and/or measures and thoroughly analyzed. Hence, the resource rents could be considered a good indicator of the total tax burden that would not prevent the future growth of the mining industry of a given country and could be a burden to be managed by the industry [7]. Based on the proposed methodology, A. R. Makaryan and S. A. Dallakyan (2023) [8] calculated the mineral rents-to-GDP ratios from 2018 to 2022 that varied from 0.61% to 1.37% (p. 8). They stated that variation in mineral rents was primarily explained by the price volatility of the commodities sold on the global market during the given period (p. 87) [8]. The authors concluded that in the case of Armenia, the higher progressivity of the royalty system needs to be ensured to generate higher fiscal revenues (royalty payments) in response to increases in the prices of commodities on the global market [8]. This is substantiated by the fact that the average per-company royalty-to-total taxes paid ratio by the companies representing the mining of metal ores industry ranged from 59.3% to 63.7% from 2020 to 2021 [2].

The next indicator to closely watch before initiating any fiscal regime changes is the measure of tax buoyancy and, in our case, the buoyancy of the royalty assessment method (system). S. Cevik (2018) defines tax buoyancy as the changes reported in tax revenue in year t, divided by the changes in the respective tax base in the given year (measured in real terms), which could vary in the case of developing countries [9].

The Government of Armenia switched to a hybrid royalty system in 2023 from a royalty assessment method effective from 2012 to 2022 to generate more fiscal revenues. However, the decision of the Government was not substantiated by two measures that could justify and rationalize the need to move to a system with higher progressivity in the respective legislative act. According to the mineral rents-to-GDP ratio in Armenia, some progressivity would not be considered a heavy burden for the companies representing the mining of metal ores and would not endanger the growth of the industry (A.R. Makaryan & S.A. Dallakyan, 2023). Moreover, the measure of the royalty buoyancy was neither calculated nor estimated to rationalize the move to a new system. Therefore, authors estimated it with respect to real exports based on the annual data and using the least squares method. Authors found that the measure of the short-run buoyancy was less than one. An increase in real exports of companies representing the mining of metal ores could cause an increase in the royalty payments by only 0.82%, highlighting the need for a more progressive system. The non-buoyant nature of the system could limit its capacity to stabilize fiscal revenues during business cycle fluctuations automatically. With the hybrid system, the exchange rate of the Armenian dram vs. the US dollar would affect the Government's fiscal revenue mobilization efforts, coupled with the mining companies' strategies. Authors proposed a multiple-rates ad valorem system to function as a provisional system alongside the hybrid system during the transition period, with mining companies choosing a system and switching to the proposed one upon completion of the transition period (A. R. Makaryan, 2023). The proposed multiple-rates ad valorem system could be relatively easy to administer, reduce compliance costs, and ensure higher economic efficiency and stability of the legislative framework.

In the case of the royalty system buoyancy, real exports are considered the base. So far, no attempts have been made to estimate or assess the short-run measure of buoyancy from 2012 to 2022, although A. R. Makaryan (2023) [4] calculated the measure for only 2 years, from 2021 to 2022. Overall, the measure of tax buoyancy plays a pivotal role for Governments in designing tax policies for each country, and the measure of short-run tax buoyancy is considered a good automatic stabilizer in stabilizing economies over the business cycles and ensuring that the tax system is functioning well [10]. The measure also allows the Government to closely watch whether its efforts in generating fiscal revenues align with economic activity [10]. A high measure of the buoyancy of the tax system can ensure a higher collection of tax revenues [11]. Moreover, if the short-run tax buoyancy is greater than one, then it could mitigate the economic activity as a good automatic stabilizer, and the measure could help the Government to forecast the possible tax revenues to be generated and analyze the progressivity of a tax system [12].

Hence, in the case of the royalty system, especially in the short run, the measure of buoyancy could help the Government to forecast the possible fiscal revenues to be mobilized, gain insights on how its efforts need to be channeled to assist the mining and quarrying industry over the business cycles and ensure the progressivity of the

royalty system if required. Therefore, assessing this measure of royalty system buoyancy was required before designing and adopting respective legislative changes, particularly the significant factors that could explain the value of the given measure, so as not to hinder the future growth of the mining industry and attract new investors. Moreover, choosing a particular royalty system needs to be substantiated, considering the pros and cons of various royalty systems functioning in various countries and stressing the need to ensure the stability of the legislation by avoiding frequent fiscal regime changes.

Aim of investigation

The main aim of the investigation was to estimate and calculate the measure of short-run royalty buoyancy with respect to exports to rationalize the need for shifting to a new hybrid royalty system in Armenia in 2023 and to identify the significant factors that would be crucial in generating higher fiscal revenues under the new royalty system and to propose a new arrangement to function alternatively for a transition period to ensure the stability of the legislative framework.

Literature review

The contribution of the mining industry to the GDP of Armenia was discussed by A. Grigoryan (2013) [13]. The role of real exports in explaining the changes in the real GDP in the short run was addressed by S. V. Dokholyan and A. R. Makaryan (2022) [14] and D. Galoyan et al. (2024) [15]. A. Mardoyan (2016) [16] discussed the prospects for utilizing mineral resources in Armenia, focusing on industry development opportunities, increasing investment activity, existing challenges, enhancing the efficiency of metallic mineral deposit exploitation, and ensuring the replenishment of the mineral resource base [16]. However, a few attempts have been made to estimate the impact of real exports in generating fiscal revenues (including royalty payments, etc.) for the Government of Armenia. S. V. Dokholyan et al. (2023) estimated the role of real exports in explaining changes in real fiscal revenues generated by the mining companies in the short run [2]. They found that, in general, the increase in real exports would not cause statistically significant positive changes in real fiscal revenues [2]. Concerning the royalty system in Armenia and particularly the assessment method was discussed by M. Genasci (2015) [17], A. Mardoyan (2016) [18], Z. Sh. Mkrtchyan (2020) [19], L. G. Yeghiazaryan (2023) [3], S. V. Dokholyan et al. (2023) [2], and A. R. Makaryan (2023) [4].

Although the term "*royalty*" is often used inaccurately, the core concept thereof is sometimes referred to as a "*severance tax*" (though the term is less common today) remains unchanged, which means that royalty is considered a charge levied directly for the extraction of the resource (R. Boadway & M. Keen, 2010, p. 27) [20]. J. Otto et al. (2006, p. 1) define royalty as "*a tax that is unique to the natural resources sector and one that has manifested itself in a wide variety of forms, sometimes based on profitability but more commonly based on the quantity of material produced or its value*" [21]. J. M. Otto (2017, p. 9) states that in the case of some nations, royalty is considered "*a form of ownership transfer tax (a transfer of mineral ownership from the owner to the miner)*" while in the case of other countries is regarded as "*a fee paid for the right to mine the mineral*" [22]. According to the Armenian Legislation, the royalty payment is a fee paid to the state budget of the Republic of Armenia to compensate for the use of metallic minerals, the profitability accrued from the sale of those minerals, and the products manufactured from their processing as well [23].

Although royalties could take various forms, they are levied based on the value of the mineral sold or the quantities supplied. As mandatory payments, royalties share the features of the excise tax on production and are viewed as fees or charges [20].

The types of royalties can vary significantly from each other, and as a result, their impact does as well, in terms of ad valorem and specific royalties, the bases used to calculate the royalty payments, structures, same rates vs. differentiated rates, etc. [20]. A few fiscal instruments are applied concerning the royalty payments: profit-based (profit-based royalty); output-based (ad valorem, "graduated price-based windfall tax," specific) [24]. As part of the output-based royalties, ad valorem royalty that is levied at a constant rate in terms of a constant percentage of the value of production enables the Government to ensure stability concerning generating fiscal revenues and are relatively easy for investors to calculate and pay (compliance costs) [24]. In the case of output-based (value-based) ad valorem royalty, the rates typically varied from 2 to 10% in various places but mainly fall into a specific range from 2.5 to 5% that is applied to the sales turnover or "*estimated sales value of mineral products*," being more efficient than specific royalties since royalty payments are considered as "*a direct function of commodity prices*" with increasing payment as prices rise and contrary, and being "*the most common type of royalty applied worldwide to base and precious metals and other high-value mineral commodities*" [25, p. 47].

Meanwhile, specific or unit-based royalty is still applied in the case of "*low value, high volume minerals*" and in the case of the variety of other minerals as well, and is levied as "*a constant charge per physical unit of production*" for a given mineral and relatively easy to administer, how they are not automatically being adjusted to price increase on the global market [24, p. 142]. Since the minerals are sold mainly by adding value to the crude ore extracted (mineral concentrates and/or intermediary products, up to refined metals), and from the viewpoint of royalty administration efficiency, while the royalty value base is determined with regard to prices "*realized in the arms-length sale of the first mineral product sold along the value chain,*" and could depend on the point along the downstream value chain (at the smelter, at the mine head (ex-mine), etc.) [25, p. 48]. E. Lilford and P. Guj (2021) propose applying decreasing royalty rates to the sales realized along the downstream value chain [25].

Profit-based royalties, which are levied as a percentage royalty rate applied to the specific measurement of estimated profit as a base, are economically efficient; however, they are complicated to administer in terms of transparency since monthly or quarterly royalty payments are provisional payments subject to adjustments once the measurement of the base is finalized [25].

L. Hogan and B. Goldsworthy (2010, p. 141) state that from the investors' perspectives, the efficiency losses could be minimized by applying one of the modified ad valorem royalties (taxes that are levied at variable rates), namely "*exemption for relatively small or low-income mines.... sliding scale based on sales or production..., sliding scale based on cost..., sliding scale based on price*" [24]. When applying mixed arrangements, the mining companies' royalty administration and compliance costs could be higher than in the case of the basic ad valorem royalty with a constant rate [24].

In the 2000s, various countries started switching to a hybrid royalty system by introducing profit-based royalties combined with ad valorem or specific royalties [24, 25]. However, these systems are not highly efficient (economic) but stable regarding fiscal revenue generation and are rather complicated to administer. Meanwhile, multiple-rates ad valorem systems and/or mixed arrangements are quite appropriate to administer in terms of complexity, with the royalty rates being published regularly (from time to time) by the respective authority [25].

Moreover, the fiscal regime must be stable, especially in the long term, to ensure greater reliance on a given nation's legal framework [26].

Data and research methods

For the given study, authors considered the real exports of the companies representing the mining of metal ores industry as the base and the total amount of royalties paid by these companies as tax

revenues generated and paid to the state budget of Armenia to assess and/or estimated the buoyancy measure.

To calculate the real exports of the mining of metal ores industry S. V. Dokholyan et al. (2023) [2] took the sum of exports of 5 HS sub-headings and/or codes (260300: Copper ores and concentrates; 260800: Zinc ores and concentrates; 261310: Molybdenum ores and concentrates; roasted; 261390: Molybdenum ores and concentrates; other than roasted; and 261690: Precious metal ores and concentrates. However, for this research, authors relied on the real exports of the companies representing the mining of metal ores industry, as D. Galoyan et al. (2024) [15] proposed. The difference between these two approaches is substantiated by the fact that the leading mining company of Armenia, Zangezur Copper Molybdenum Plant (ZCMP), exported ferromolybdenum and paid royalties from export receipts. The exports of ferromolybdenum comprised 30.12% of the company's total exports in 2023 [27] and did not exceed 30% from 2020 to 2022 [15]. Therefore, authors calculated the real exports (expressed in US dollars) of the companies representing the mining of metal ores industry that pay royalties as S. V. Dokholyan et al. (2023) [2] did. All export data at the 6-digit level covering the period from 2012 to 2023 were retrieved from the UN Comtrade database [28].

However, the exports were irregular in the case of two HS sub-headings (261390 and 261690) on a quarterly basis [28], and only the year 2022 could be considered a year in the case of which no missing values of the exports of all HS sub-headings were identified with respect to all four quarters of a single. Therefore, authors took 2022 as the base year (2022=100) and calculated the annual prices (per unit) to be considered base year prices (annual) for each sub-heading (at the 6-digit level of HS codes). Then, by multiplying the respective physical volumes of each year (quantities exported) by the prices of the respective base year and summing up the real amounts of exports of all sub-headings of each year, authors calculated the annual real exports of the companies representing the mining of metal ores industry as S. V. Dokholyan et al. did (2023) [2] proposed.

Authors submitted an official inquiry letter to the State Revenue Committee of Armenia (SRCA) requesting the total royalties paid by all companies representing the mining of metal ores industry for the period 2012–2023. Overall, the data of 7 companies were covered, including Lichkvaz CJSC, the company which was not covered by S. V. Dokholyan et al. (2023) [2] in their study since the company mainly started exporting concentrates containing gold from 2022 onwards (D. Galoyan et al., 2024) [15, 27, 29], although it started the exploitation works in 2020 (Lichkvaz CJSC, 2021) [30] (in 2023, the company acquired Chaarat Kapan CJSC from British Chaarat Gold (Union of Miners and Metallurgists of Armenia, 17 August, 2023) [31]). The SRCA provided all requested royalty data, namely all nominal royalty data of 7 companies representing the mining of metal ores industry in Armenia that were converted into real values (expressed in drams) based on consumer price indices [8] with 2022 as the choice of the basis year was substantiated above.

Authors calculated annual royalty buoyancy (RB) with respect to real exports and estimated the short-run measure of buoyancy as proposed by J. Haughton (1998) [32], S. Cevik (2017) [9], R. C. M. Beyer and L. Milivojevic (2020) [33], etc. Authors utilized the following equation to calculate the annual royalty buoyancy with respect to real exports.

RB = (% Δ Real Royalties paid by companies)/
(% Δ Real Exports of the companies). (1)

Authors estimated the following equation for the short-run tax buoyancy coefficient, as our real variables of interest were stationary at levels, and no stationarity issues were identified. Therefore, authors took the natural log of the variables to include in the following equation:

$$\ln(Rroyalty_t) = \beta_0 + \beta_1 * \ln(Rexports_t) + \varepsilon_t, \quad (2)$$

where $Rroyalty_t$ is the real royalties (sum of royalties paid by the companies representing the mining of metal ores industry of Armenia) transferred to the state budget in period t; $Rexports_t$ is the real exports (sum of real exports of all items (predominantly concentrates of copper, zinc, and molybdenum (roasted and non-roasted) and ferromolybdenum, and concentrates containing gold) exported by the companies representing the mining of metal ores industry of Armenia) of mining companies in period t; β_0 and β_1 are model unknown parameters; ε_t is the error term in period t.

Authors estimated the equation using the Least Squares (NLS and ARMA) method to identify the measure of the royalty buoyancy with respect to the exports of the companies representing the mining metal ores industry in Armenia in the short run. Authors performed all the required tests upon estimating the equation. Authors tested for evidence of autocorrelation and found no evidence thereof, nor did authors find any evidence of heteroscedasticity. Authors found evidence of normally distributed residuals. Specification errors were not identified as well. We also regressed the log of real royalties paid by the mining companies on the log of the real exports of the companies lagged one period (due to the requirements of the Tax code of Armenia).

Results, analysis and discussion

The real royalties paid by the companies representing the mining of metal ores industry were irregular from 2012 to 2019 and only reported an upward trend starting from 2020 (**Table 1**). Overall, the changes in real royalties generated did not reflect the changes noted in the case of the real exports of the companies (see Table 1). This means that an increase in real exports did not always translate into higher royalties generated for the state budget of Armenia, reflecting changes in the prices of commodities sold on the global market (**Tables** 1 and **2**). The increase in quantities supplied was mainly in response to the price drop, while the decline in quantities shipped was associated with the increase in the prices of the commodities (see Tables 1 and 2); the strategies that the companies adopted to fight price decline addressed by S. V. Dokholyan & A. R. Makaryan (2022) [14]. Hence, the key factor in generating higher royalties was the price increase of the commodities sold on the global market. This means that changes in the real exports were not directly associated with higher prices and royalties paid by the companies. This implies that the price volatility on the global commodity market (at the business cycle's peak) did not make the fiscal regime highly procyclical from 2012 to 2022, since the changes in real exports were not directly linked with the price hikes. On the contrary, the increase in copper prices from 2021 to 2023 compared to the price of copper in 2020 led to a decline in real exports (see Table 2). In 2023, the real exports of ferromolybdenum were less than the exports of ferromolybdenum in 2020, although prices were higher than in 2023 (see Table 2). The increase in exports of concentrates containing gold from 2022 to 2023 (see Table 2) was mainly explained by the exploitation of the Lichkvaz-Tey mine by the Lichkvaz LLC [30].

Moreover, the royalties generated and expressed in Armenian drams were affected by the volatility of the exchange rate despite price hikes of commodities on the global market (see Tables 1, 2). In 2022, the companies representing the mining of metal ores industry could have generated even more royalties expressed in Armenian drams than they paid during the same period, in the case of the slight increase in real exports compared to 2021 (see Table 1). Hence, the substantial increase in prices of commodities managed to compensate for the losses that the state budget of Armenia could have suffered owing to a strong appreciation of the Armenian dram vs. the US dollar (see Tables 1

Table 1. Royalties paid and exports of the companies representing the mining of metal ores industry in Armenia and the GDP from 2012 to 2023 [28, 34—37]

Period	CPI	Royalty, Armenian drams		Exports, USD		Exchange rate	GDP, billion AMD	
		Nominal	Real (2022=100)	Nominal	Real (2022=100)	USD vs. AMD	Nominal	Real (2022=100)
2012	102.6	14,405,221,247	19,851,202,242	385,322,705	431,493,285	401.76	4,266,461	6,351,609
2013	105.8	19,161,167,867	24,957,621,209	405,989,782	509,282,823	409.63	4,555,638	6,565,456
2014	103	11,022,414,087	13,938,649,935	400,852,465	543,270,276	415.92	4,828,626	6,717,065
2015	103.7	17,566,601,438	21,421,653,000	421,887,600	721,320,034	477.92	5,043,633	6,798,604
2016	98.6	12,866,819,651	15,913,273,644	462,445,030	870,183,231	480.49	5,067,294	6,816,863
2017	101	17,447,880,194	21,365,330,436	683,108,899	1,004,458,973	482.72	5,564,493	6,963,469
2018	102.5	32,162,933,416	38,423,659,917	682,753,348	930,169,936	482.99	6,017,035	7,157,591
2019	101.4	24,937,058,550	29,379,902,356	806,561,242	1,222,931,621	480.45	6,543,322	7,233,864
2020	101.2	30,563,148,457	35,581,372,928	832,635,227	1,329,953,064	489.01	6,181,903	7,364,550
2021	107.2	40,419,280,186	43,895,338,282	1,111,944,962	1,118,708,129	503.77	6,991,778	7,872,742
2022	108.6	84,970,202,426	84,970,202,426	1,174,233,001	1,174,233,001	435.67	8,501,449	8,501,449
2023	102	40,020,905,212	39,236,181,580	1,083,591,952	1,017,326,367	392.48	9,453,175	9,207,070

Table 2. Commodity prices on the global market and real exports of concentrates and ferromolybdenum from 2012 to 2023 [28, 38, 39]

Period	Prices of metals				Real Exports, million USD					
	Copper	Zinc	Gold	Molybdenum	260300	260800	261310	261390	261690	720270
	($/mt)	($/mt)	($/troy oz)	($/mt)	Copper ores and concent-rates	Zinc ores and concent-rates	Molyb-denum ores and concent-rates; roasted	Molyb-denum ores and concen-trates; other than roasted	Precious metal ores and concentrates; (excluding silver)	Ferro-alloys; ferro-molybdenum
2012	7,962	1,950	1,670	26,455	212.20	27.68	0.00	11.39	14.78	165.45
2013	7,332	1,910	1,411	22,046	279.58	29.53	0.00	11.38	0.00	188.80
2014	6,863	2,161	1,266	24,251	298.76	23.08	0.00	13.13	24.01	184.29
2015	5,510	1,932	1,161	15,432	499.07	22.75	0.00	14.35	26.88	158.27
2016	4,868	2,090	1,249	13,228	641.15	14.90	0.00	3.07	25.08	185.98
2017	6,170	2,891	1,258	17,637	767.95	16.41	2.03	16.41	8.95	192.71
2018	6,530	2,922	1,269	26,455	685.72	20.08	1.64	8.29	12.83	201.61
2019	6,010	2,550	1,392	24,251	907.18	19.57	1.40	29.62	13.68	251.49
2020	6,174	2,266	1,770	19,842	822.92	21.71	3.26	236.49	25.32	220.25
2021	9,317	3,003	1,800	35,274	693.25	19.31	1.37	148.39	25.05	231.33
2022	8,822	3,481	1,801	41,888	662.91	18.91	30.68	124.40	85.40	251.93
2023	8,490	2,653	1,943	40,786	527.39	14.41	48.43	131.78	80.12	215.20

Note: The prices of molybdenum worldwide from 2010 to 2023 were expressed in U.S. dollars per pound. Therefore, they were converted into prices per metric ton. The prices of other commodities are the averages of monthly data per commodity. Authors' calculations.

and 2). Namely, the price increase of molybdenum and the substantial increase in the concentrates containing gold significantly contributed to the vast increase in the royalties generated and paid by the companies (see Tables 1 and 2). In addition to the indicators stated above (mineral rents and the measure of the buoyancy), the Government had to consider two factors while initiating legislative changes to mobilize more royalties to be paid by the companies. Regardless of the efforts of the Government to ensure the progressivity of the royalty system in place, the considerable appreciation of the Armenian dram vs. the US dollar could cause a decline in royalties (expressed in Armenian drams) generated despite the increase in prices of the commodities on the global market as addressed by A. R. Makaryan (2023) [4].

Based on Equation 1, authors calculated the average measure of the buoyancy of the royalty system for the period 2012–2022, which amounted to 0.567 (average of the annual measures), indicating that the royalty system was not buoyant. This implies that the short-run buoyancy was less than 1. Hence, the government of Armenia could

consider ensuring higher progressivity by designing fiscal regime changes. Moreover, the system failed to ensure higher fiscal revenues, as the export volatility did generate more revenues than it could have.

Overall, the real changes in independent variables included in both equations could explain about 30–40% of variations in real royalties paid by the companies representing the mining of metal ores industry in the short run (**Table 3**, Estimates Nos. 1 and 2). This could be substantiated by the strategies adopted by the companies in response to the price volatility on the global market [2, 24].

In general, an increase in the real exports of the companies representing the mining of metal ores industry in period t by 1% could cause a 0.818% increase in the real royalties generated and paid to the state budget in the same period in the short run (see Table 3, Estimation No. 1). Moreover, a 1% increase in the real exports of the mining companies lagged one period could cause a 0.947% increase in the real royalty payments generated in period t in the short run, on average (see Table 3, Estimation No. 2). The estimated measure of the

royalty system buoyancy was less than 1, which means the increase in physical volume exported did not translate into a proportionate increase in the real royalties paid. This indicated that the Government of Armenia had to ensure higher progressivity of the royalty system to generate higher fiscal revenues in the case of price hikes of the commodities on the global commodities despite slight changes in the physical volumes of the exported goods if the Armenian dram had not reported relatively strong volatility vs. the US dollar.

Hence, both mineral rents, namely, the mineral rents-to-GDP ratios calculated by A. R. Makaryan and S. A. Dallakyan (2023) [8] for the period 2018–2022, and the measure of the tax buoyancy of the royalty system for the period 2012–2022 (both calculated and estimated) indicate that Armenia needed to ensure higher progressivity of the royal system.

The new royalty system: The attempt of the Government to generate higher royalty payments.

Before switching to the hybrid royalty system, which became effective on 1 January 2023, the Government applied two rates (a fixed rate of 4% and a variable rate that could vary from year to year) to calculate the combined royalty rate. Then, it multiplied the base by the calculated combined royalty rate to determine the royalty payments due from 2012 to 2022.

$$\text{Combined Royalty Rate (\%)} = 4 + [EBIT/(I \cdot 8)] \cdot 100, \qquad (3)$$

where EBIT = Taxable profit expressed in the Armenian dram before interest and tax, excluding tax losses carried forward from previous years ("*positive difference of the royalty calculation basis and the reductions defined by the RA Law on Profit Tax (except for financial activity costs and tax losses from previous years*")) (M. Genasci, 2015, p. 11) [17]; I = Gross revenue from sales (Sales Turnover) expressed in the Armenian drams (excluding VAT).

According to Z. Sh. Mkrtchyan (2020) [19], compared to many other mining countries, the royalty assessment method in Armenia from 2012 to 2022 was rather complicated since the variable rate of royalty required more careful control and could jeopardize tax revenues by underestimating profits (using transfer prices or any other method of tax evasion practices). Moreover, the royalty payments depended on sales turnover and were payable even when the company's accrued profit was zero or if the company reported losses [19]. Since calculating the variable royalty rate requires measuring profit elements, it could make the administration of royalties rather cumbersome owing to tax evasion practices and risks associated with the transfer pricing [17]. Therefore, royalty payments due were based on the contract prices; they could not diverge by more than 10% compared to London Metal Exchange Prices, a safeguard measure related to reference prices functioning as "*an anti-abuse rule providing the Government with some protection against transfer mispricing*" and using published index prices in calculating the base could make the administration of the royalty payments somewhat simplified (M. Genasci, 2015, p. 16) [17]. Then, 20% was applied from 2018 to 2023 [3, 28, 40]. Although royalty payments in Armenia were calculated based on the metal content in the concentrates sold, the royalty payments neglected the need to incorporate the metal content lost in the assessment method, thus not functioning as an incentive to "*maximize the efficiency of processing than they would face if the royalty were assessed on all mineral content extracted,*" hence, "*imposing the royalty as far upstream as possible—at the first "measurable point"* was stressed (M. Genasci, 2015, p. 17) [17]. Although in the case of various countries, the royalty rates did not exceed 9%, the variable royalty rate could even be higher than 9%; according to some estimates (based on interviews with state officials and observers), the royalty rates were close to 4–5% suggesting that variable royalty mechanism was relatively ineffective, thus stressing the need for better royalty administration (M. Genasci, 2015, p. 18) [17]. According to

Table 3. Estimated models (Method: Least Squares; Sample: 2012−2022)

Dependent variable: LNRROYALTY$_t$	Estimation No.1	Estimation No. 2
LNREXPORTS$_t$ LNREXPORTS$_{t-1}$	0.818 (2.320)**	0.947 (2.738)**
Constant	7.242 (1.000)	4.641 (0.653)
R-squared	0.374	0.484
Adjusted R-squared	0.305	0.419
Included Observations	11	10
Note: statistics values in parentheses. ** denotes significance at a 5 percent significance level.		

A. Mardoyan (2016, p. 115), the royalty rates could vary from 5.25% to 9%, based on the different profitability rates ranging from 10% to 40% [18]. Overall, Armenia's fiscal regime heavily stressing the role of royalty was quite competitive; however, it was not properly administered, which means that Armenia needed to opt for other variable royalty structures (rate adjustments in response to price changes on the global market), or impose higher corporate income tax rates, etc. [17]. According to Z. Sh. Mkrtchyan (2019), Armenia also had a relatively liberal royalty taxation system for companies engaged in the mining industry since the combined royalty rates did not exceed 6–7%, which is relatively low compared to many countries worldwide [19]. Hence, a balanced approach was required when addressing the following dilemma: a higher tax burden (including higher royalty rates) be imposed to generate immediate and significant fiscal revenues for the state budget vs. the sustainable development of the mining industry, which could foster substantial economic growth, infrastructure development, and economic diversification in the long-run [19].

Overall, the combined royalty rates were relatively low. However, the administration of royalty payments was somewhat complicated, stressing the need for a more progressive royalty system and more straightforward administration methods to generate higher fiscal revenues.

To assess the amounts of royalty payments, the Government introduced the new hybrid royalty system to ensure higher royalty payments. The Government introduced a hybrid system that combines value-based and/or ad-valorem royalty assessment (while leaving a constant (fixed) rate of 4% unchanged) with a profit-based royalty assessment that utilizes two bases and royalty rates, thus making the royalty administration even more cumbersome. The Government proposed the following method to assess the royalty payments due:

$$\begin{aligned} \text{Royalty paid in AMDs} &= \text{Royalty Base}_1 \cdot \text{Royalty Rate}_1 (4\%) + \\ &+ \text{Royalty Base}_2 \cdot \text{Royalty Rate}_2 (12.5\%) + \text{Royalty Base}_3 \times \\ &\times \text{Royalty Rate}_3 (15\%) = \text{Sales Turnover} \cdot 4\% + EBIT \cdot 12.5\% + \\ &+ (EBIT - \text{Financial Activity Costs} - (\text{Sales Turnover} \cdot 4\%) - \\ &- (EBIT \cdot 12.5\%) - (\text{Sales Turnover} \cdot 0.15) \cdot 15\% , \qquad (4) \end{aligned}$$

where EBIT is the taxable profit before tax, which is calculated as a positive difference between Sales Turnover and all deductions allowed in the Tax Code (excluding financial activity losses, losses carried forward from previous years, and royalty) (S. V. Dokholyan et al., 2023, p. 91) [2]. Meanwhile, if the Royalty Base$_3$ were negative, the Royalty Rate$_3$ would not have been applied.

According to S. V. Dokholyan et al. (2023), with a new hybrid royalty system in place, the increase in prices of the commodities sold on the global market could generate higher revenues for the Government, thus resulting in a somewhat higher royalty-to-overall taxes paid ratio by a company, representing the mining of metal ores industry that could exceed 70% (on average) [2].

According to L. G. Yeghiazaryan (2023) [3], with the new hybrid royalty system in place, approximately 60–65% of the additional revenue guaranteed by price increases would be generated as fiscal revenue for the Government [3]. Meanwhile, currently, contract

Table 4. Proposed price brackets and royalty rates to be applied in the case of concentrates of the respective metals, reflecting price volatility on the global market

Metal	Price bracket	Price range, USD	Proposed royalty rate
Copper, USD/mt	Bracket 1	≤ 3500	2.75%
	Bracket 2	3,501–7,000	4.25%
	Bracket 3	7,001–10,500	6.25%
	Bracket 4	> 10,500	8.75%
Zinc, USD/mt	Bracket 1	≤ 1.500	2.25%
	Bracket 2	1,500–2,500	3.75%
	Bracket 3	2,751–3,350	5.25%
	Bracket 4	> 3,350	6.75
Gold, USD/troy oz	Bracket 1	≤ 1,350	2.75%
	Bracket 2	1,351–1,750	4.5%
	Bracket 3	1,751–2,350	6.75%
	Bracket 4	> 2,350	9%
Molybdenum, USD/mt	Bracket 1	≤ 15,000	2.25%
	Bracket 2	15,001–30,000	4.75%
	Bracket 3	30,001–47,500	7.25%
	Bracket 4	> 47,500	9%

prices cannot diverge by more than 15% compared to London Metal Exchange Prices as a safeguard measure related to reference prices (using published index prices in calculating the base), and in the case of the price decline of the commodities on the global markets would put the additional tax burden on the companies [3]. Therefore, excluding financial activity losses from the EBIT as an allowable deduction could be considered a tax disincentive for implementing various high-priority projects, particularly those with an environmental focus. Moreover, L. G. Yeghiazaryan (2023) [3] proposed including interests accrued with respect to borrowed funds [3]. However, the fiscal regime for the mining industry is somewhat distinct, since it does not adequately support the sector's sustainable development, as mining organizations expect greater state financial assistance for technological advancements and waste management investments [41].

Overall, the new hybrid royalty system is complicated to administer; compliance costs are quite high. However, the key factors that would be decisive in ensuring higher fiscal revenues are the appreciation of the Armenian dram compared to the US dollar and the strategies of the mining companies in response to price changes [2, 4, 14].

Considering the above-presented discussion, analysis, and methods and approaches for calculating royalties and the need for simplifying royalty administration, reducing compliance costs, ensuring higher economic efficiency and fiscal revenues, and ensuring the stability of the legislative framework, the Armenian Government may apply a multiple-rates ad valorem system and/or mixed arrangement. Authors propose the below-described approach to be used.

Sliding scale based on price would act as a graduated price-based windfall tax. In this case, the Government needs to define four price brackets to be applied to the base, and the respected royalty rates to the base to be applied depending on prices of commodities sold on the global market and the price brackets they would fall into, with higher tax rates being applied, if the price falls in the respective higher price brackets. Meanwhile, the base for the royalty payments would be contract prices, which would not diverge by more than 20% compared to London Metal Exchange Prices, as a safeguard measure related to reference prices (published index prices) to calculate the base (on a monthly basis calculated) and the respective royalty rate would be applied depending on the price bracket the adjusted contract price would fall into as it is

proposed (**Table 4**). The respective authority could review both price brackets and respective royalty rates that fall into that price brackets every 5 years, meanwhile allowing the new (investors) companies to choose the new rates and brackets they would like to comply with for the next 5 years if they wish and then switch to the proposed modification upon completion of the transition period. In the case of companies still operating in Armenia for a period longer than 5 years to ensure higher legislative framework stability, the Government of Armenia could propose applying the given mixed arrangement as a provisional that the company would opt for within 5 years along with the hybrid system, and completely switch to the proposed arrangement upon the transition period of 5 years as A. R. Makaryan proposed (2023) [4].

Conclusions

The Government of Armenia switched to a hybrid royalty system in 2023 from a royalty assessment method that had functioned from 2021 to 2022. The Government's decision, however, was not initially justified by two measures, namely, mineral rents (mineral rents-to-GDP) and royalty buoyancy, to generate more fiscal revenues. Based on the calculations of A. R. Makaryan and S. A. Dallakyan (2023) [8] of the mineral rents-to-GDP ratio, Armenia needed legislative changes to ensure progressivity of the royalty assessment method and mobilize more fiscal revenues, and it would not be a heavy burden for the companies. The Government's decision was not rationalized by either estimate or the calculated measure of the royalty buoyancy to substantiate the shift to a new hybrid system.

Hence, authors estimated the royalty buoyancy with respect to real exports based on the annual data and using the Least Squares method. Authors found that the short-run royalty buoyancy with respect to real exports was less than one. Therefore, an increase in real exports of companies representing the mining of metal ores by 1% could cause an increase in the royalty payments by only 0.82%, on average. This measure highlights the need for a more progressive royalty system to function effectively, as the non-buoyant nature of the system could limit its capacity to stabilize fiscal revenues during business cycle fluctuations automatically. However, the progressivity of the royalty system could be affected by the volatility of the exchange rate of the Armenian dram vs the US dollar (appreciation of the national currency), causing even a decline in royalties paid in the national currency in response to the price volatility on the global commodity market as was addressed by A. R. Makaryan (2023) [4]. Therefore, foreign exchange volatility could cancel the governments' efforts to mobilize higher fiscal revenues, regardless of the companies' adopted strategies in response to price volatility.

To ensure a royalty system that would be relatively easy to administer, reduce compliance costs, increase economic efficiency, and maintain legislative framework stability, multiple-rates ad valorem system was proposed. The system could function as a provisional system for the transition period. It would have four price brackets and respective royalty rates to be applied to the base, depending on the prices of commodities sold on the global market, with higher tax rates applied to the base if the price falls within the higher price bracket. The prices of metals quoted on the London Metal Exchange would be considered, according to which the adjustments would be made to the base contract price. Moreover, the mining companies could choose the system they would like to comply with and would switch to the proposed system upon completion of the transition period, as was proposed by A. R. Makaryan (2023) [4].

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