# THE ROLE OF EXPORTS OF SEMI-MANUFACTURED GOLD, METALIC ORES AND CONCENTRATES IN ENSURING ECONOMIC GROWTH IN ARMENIA IN THE SHORT RUN

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#### Հոդվածը ստացվել՝ 02.04.2022 թ., գրախոսման ուղարկվել է՝ 04.04.2022թ., տպագրության երաշխավորվել է՝ 18.04.2022թ.

*Introduction:* By referring to the World Bank Statistics of 2017, Puntsag (2020) states that the majority of developing nations (more than two-thirds) extensively depends on the earnings from commodity exports that are vulnerable to external shocks i.e. changes in the prices of exported commodities<sup>1</sup>.

In the case of Armenia, the increase in merchandise exports was mainly driven by foreign exchange earnings from exports of mainly metallic ores and concentrates, followed by semi-manufactured gold especially from 2018 to 2021 (see table 1), hence making Armenian merchandise export more concentrated (see table 2). However, not only price volatility (see table 3), but also other factors affected the exports of two major categories exported, namely concentrates of copper ores and semi-manufactured gold. Upon 44-day military conflict with Azerbaijan over the Nagorno Karabakh in 2020, GeoProMining Gold LLC experienced difficulties while operating the Sotk mine and extracting gold owing to border redrawing and as a result thereof some portion of the mine is currently under the control of Azerbaijan. GeoProMining Gold LLC is planning to start operating Armenia's Sotk gold mine via closed-pit mining method from 2025 onwards while continuing openpit mining operations up to the stated period. Meanwhile, switching to the closed-pit mining method could affect the capacity of the mine to extract the same quantities as it could do under the open-pit mining. Hence, unless other mines start their operations in Armenia or the existing ones extract more gold; Armenia will report a decline in gold production starting from 2025. Owing to the inability to service the loan from VTB Bank, Vallex Group transferred Teghut copper and molybdenum mine, the second-largest deposit of copper and molybdenum, to the Bank in September 2018 upon 6-month suspension of operations. The company resumed its operations in 2019; however, the production was suspended again in March 2022, mostly owing to the Western sanctions imposed and/or company renovations works carried out as a result of those sanctions. The company would resume its operation once new export destinations could be found, etc. Therefore, the production decline would again be reported and needs to be compensated by the increase in production by other mines.

Due to the dominance of a single company in the mining sector of Armenia, Zangezur Copper and Molybdenum Combine (ZCMC), the mining sector could be vulnerable to various shocks, both external (sharp decline in world commodity prices of copper and molybdenum, accidents<sup>2</sup>, or respective institution decision to temporarily suspend the

<sup>&</sup>lt;sup>1</sup> Puntsag, D. (2020). Mongolian mineral export basket risk: A Portfolio theory approach. Resources Policy, 68, 101691. p.1 doi:10.1016/j.resourpol.2020.101691

<sup>&</sup>lt;sup>2</sup> Swedish Geological AB, SLR Consultants Ltd, AVAG Solutions Ltd, AUA Centers for Responsible Mining, and Turpanjian Center for Policy Analysis. (2016). Armenia: Strategic Mineral Sector Sustainability

operations, etc.). In 2021, the ZCMC was forced to temporarily shut down the operations, thus resulting in the inability to export, and somehow the decline in copper ores and concentrates production as well (see table 3).

The other issue preventing to reporting higher revenues by the ZCMC, was the fact that the company could previously sell ore concentrates to the intermediary companies and charge prices much lower than average world prices were even exceeding the F.O.B. prices more than 3 times.

Hence, estimation of the statistically significant impact of real exports (commoditylevel) on the economic growth is of *relevance*, especially in terms of Western sanctions imposed on Russia. The study results will allow the government to set priorities and initiate respective policy changes that would increase the role of mining sector exports in ensuring economic growth.

One of the first attempts to estimate the impact of the mining sector on the economic growth in Armenia based on the annual regional level data (2004-2010) was done by Grigoryan (2013)<sup>1</sup>. However, no study so far has addressed commodity-level real exports' impact on the real GDP (i.e. copper and molybdenum ores and concentrates, and semi-manufactured gold). Therefore, the *main purpose* of the article is to estimate the role of real exports of copper and molybdenum ores and concentrates, and semi-manufactured gold at the 6-digit level of HS system codes in explaining changes in the real GDP in the short run, based on quarterly data covering the period January 2013-September 2021 and using ordinary least-squares (OLS) estimation method; and to provide respective recommendations on mining sector development priorities based on the estimation results and computed concentration indices, etc. Hence, the following *objectives* have been set to achieve the above-stated goal:

- To compute various merchandise export concentration indices using categories of HS system codes at the 4-digit level;
- To calculate price per unit of exported commodities in order to transform nominal values into real ones and conduct the required estimations based on the quarterly data;
- To identify and substantiate respective policy recommendations to increase the role of mining and quarrying industry-related exports in ensuring economic growth in Armenia.

*Literature review:* By estimating the impact of the mining sector on the economic growth in Armenia based on the annual regional level data covering the period 2004-2010, Grigoryan (2013) finds that a percentage point (p.p.) increase in the mining sector's real value-added-to-GDP ratio would lead to a 4.418 p.p. in growth, with approximately 50% of sector's contribution to the economic growth accruing to Syunik marz<sup>2</sup>. Grigoryan finds that the contribution of the mining sector's value-added-to-GDP ratio to economic growth accruing to Syunik marz<sup>2</sup>. Grigoryan finds that the contribution of the mining sector's value-added-to-GDP ratio to economic growth was the highest compared to the coefficients of the value-added-to-GDP ratios of agriculture (0.996), construction (1.598), and services (2.122), and concludes that the growth of mining industry could ensure economic growth due to "much capacity in mining

Assessment. Energy & Extractives, the World Bank. Washington, DC: World Bank. p.102. Retrieved from: https://openknowledge.worldbank.org/handle/10986/24756 (Date of access: March 16, 2022)

<sup>&</sup>lt;sup>1</sup> Grigoryan, A. (2013). The impact of the mining sector on growth, inequality, and poverty: Evidence from Armenia, the AUA Acopian Center for the Environment. Yerevan, Armenia: American University of Armenia. 21p. Available at: https://newsroom.aua.am/files/2013/04/mining\_grigoryan.pdf (accessed: February 16, 2022)

<sup>&</sup>lt;sup>2</sup> Ibid., pp.14-15.

to boost growth" (p.15.). Nevertheless, the author finds that the future growth of the mining sector could likely increase the poverty rate and make the income distribution more unequal (pp.16-19).

Based on the estimation results using annual data that spanned from the period 1960-2001 and decomposing Chile's exports data into two main categories (mining (mainly copper) and manufactured goods exports). Siliverstoys and Herzer (2007) find evidence of bidirectional Granger causality between the mining exports and the non-export  $\text{GDP}^1$ . By interpreting the estimation results, the authors find evidence of "productivity-limiting effects of mining exports" (p.165) that are explained by fluctuations in copper prices, and conclude that mining exports contributed to the Chilean national income<sup>2</sup>. Using annual time series data covering the period 1981-2010 and based on the estimation results, Sahoo et al. (2014) find that unidirectional short run causality exists running from economic growth to mineral export, meanwhile, long run causality exists as well that runs from economic growth and industrial production to mineral export in the case of India<sup>3</sup>. Their findings suggest "the growth induced export" (p.33) that could be possibly explained by the role of mineral exports as a source of foreign exchange<sup>4</sup>. Koitsiwe and Tsuyoshi (2015) based on empirical evidence and using quarterly data from 1994 to 2012 conclude that the mining sector plays a significant role in the economy of Botswana<sup>5</sup>. The authors find evidence of unidirectional causality that runs from real mining revenue to real GDP, and real mining revenue granger causes real government consumption as well<sup>6</sup>.

Gochero and Boopen (2020) using annual data covering the period 1988–2018 and based on empirical evidence find that in the case of Zimbabwe, foreign direct investments (FDI) in the mining sector have a significant and positive impact on the economic growth both in the long run, and short run, however at lower extent while compared to the long run impact<sup>7</sup>. In the long run, a 1% increase in FDI in mining sector has contributed to a 0.512% increase in the real GDP, while compared to a 0.166% increase in the real GDP in the short run, *"implying that FDI in the mining sector takes some time for its full impact to ripple through the economy*" (p.13)<sup>8</sup>. Aguirre Unceta (2021) finds that Zambia, as a mainly copper exporter, has experienced modest development returns from extracting mineral sources, although mining resources have induced macroeconomic growth<sup>9</sup>. Otchia (2015) by investigating the mining-based growth impact states that mining-based growth has had a positive impact on the GDP of the Democratic Republic of Congo and concludes that the

<sup>&</sup>lt;sup>1</sup> Siliverstovs, B., & Herzer, D. (2007). Manufacturing exports, mining exports and growth: cointegration and causality analysis for Chile (1960–2001). Applied Economics, 39(2), 153–167. doi:10.1080/00036840500427965

<sup>&</sup>lt;sup>2</sup> Ibid., p.165.

<sup>&</sup>lt;sup>3</sup> Sahoo, A. K., Sahoo, D., & Sahu, N. C. (2014). Mining export, industrial production and economic growth: A cointegration and causality analysis for India. Resources Policy, 42, 27–34. doi:10.1016/j.resourpol.2014.09.001

<sup>&</sup>lt;sup>4</sup> Ibid., p.33.

<sup>&</sup>lt;sup>5</sup> Koitsiwe, K., & Adachi, T. (2015). Relationship between mining revenue, government consumption, exchange rate and economic growth in Botswana. Contaduría y Administración, 60, 133– 148. doi:10.1016/j.cya.2015.08.00

<sup>&</sup>lt;sup>6</sup> Ibid., p.143.

<sup>&</sup>lt;sup>7</sup> Gochero, P., & Boopen, S. (2020). The effect of mining foreign direct investment inflow on the economic growth of Zimbabwe. Journal of Economic Structures 9:54. doi:10.1186/s40008-020-00230-4. Available at: <u>https://journalofeconomicstructures.springeropen.com/track/pdf/10.1186/s40008-020-00230-4.pdf</u> (accessed: February 16, 2022)

<sup>&</sup>lt;sup>8</sup> Ibid., pp.11-13.

<sup>&</sup>lt;sup>9</sup> Aguirre Unceta, R. (2021). The economic and social impact of mining-resources exploitation in Zambia. Resources Policy, 74, 102242. doi:10.1016/j.resourpol.2021.1022

mining sector would drive the growth of exports in the long run, however, wouldn't be possibly considered as the key source of growth, since GDP growth is lower in the long run than in the short  $run^{1}$ .

Nguyen et al. (2021) state that in Vietnam mineral mining industry plays a pivotal role in generating tax revenue and ensuring economic growth, and with trade agreement with a China on minerals the government would likely support the increase in mineral production in the future<sup>2</sup>. They provide forecasts for the period 2019-2029 with respect to the production of 8 minerals and conclude that it would report growth<sup>3</sup>. Puntsag (2020) by applying Modern Portfolio Theory to study the Mongolian minerals export basket finds that in the case of highly concentrated commodities exports, with coal being the most price volatile commodity and the main source of exports earrings, while compared to copper, zinc, gold, molybdenum and etc., the existing export mix wouldn't be significantly improved<sup>4</sup>. Hou (2019) finds that China has affected the economic growth of the Latin American and Caribbean (LAC) countries, and, in general, Chinese demand for LAC products (primary commodities such as oil, iron ore, copper, etc.) led to LAC growth (as a region), however, differences among various countries have been reported<sup>5</sup>. The estimation results using annual data for the period 1987-2014 of 35 countries indicate that China's demand has delivered significantly higher growth to the exporters, however, Hou (2019) is concerned with the possibility of the LAC countries maintaining the reported export rates of primary commodities owing to the shift in the Chinese growth pattern: from exports and investments to domestic consumption<sup>6</sup>.

According to Laing (2019), gold production increase especially between 2006 and 2016 driven by small and medium-scale gold producers, and increase in gold prices resulted in higher revenues for the mining industry, thus fueling the economic growth in Guyana<sup>7</sup>. Over that period average GDP growth amounted to 4.2%, while the mining sector's growth comprised 15%<sup>8</sup>. Davis and Vásquez Cordano (2011) find some evidence that the more closed mining economies have reported higher economic growth rates than the open mining economies have done owing to underinvestment in education<sup>9</sup>.

**Research Methods:** To determine the role of real exports of commodities of interest in explaining the statistically significant changes in the real GDP in the short run, we define our model as follows:

Real GDP = f (real exports of semi-manufactured gold, real exports of copper ores

<sup>&</sup>lt;sup>1</sup> Otchia, C. S. (2015). Mining-based growth and productive transformation in the Democratic Republic of Congo: What can an African lion learn from an Asian tiger? Resources Policy, 45, 227– 238. doi:10.1016/j.resourpol.2015.06.003

<sup>&</sup>lt;sup>2</sup> Nguyen, B. N., Boruff, B., & Tonts, M. (2021). Looking through a crystal ball: Understanding the future of Vietnam's minerals and mining industry. The Extractive Industries and Society, 8(3), 100907. doi:10.1016/j.exis.2021.100907

<sup>&</sup>lt;sup>3</sup> Ibid.

<sup>&</sup>lt;sup>4</sup> Puntsag, D. (2020). Mongolian mineral export basket risk: A Portfolio theory approach. Resources Policy, 68, 101691. doi:10.1016/j.resourpol.2020.101691

<sup>&</sup>lt;sup>5</sup> Hou, Y. (2019). Latin American Growth and Exports to China. International Economic Journal, 33(3), 537– 559. doi:10.1080/10168737.2019.1626470

<sup>&</sup>lt;sup>6</sup> Ibid., p.558.

<sup>&</sup>lt;sup>7</sup> Laing, T. (2019). Small man goes where the large fears to tread: Mining in Guyana: 1990-2018. Resources Policy, 63, 101426. doi:10.1016/j.resourpol.2019.101426

<sup>&</sup>lt;sup>8</sup> Ibid., p.6.

<sup>&</sup>lt;sup>9</sup> Davis, G. A., & Vásquez Cordano, A. L. (2011). International Trade in Mining Products. Journal of Economic Surveys, 27(1), 74–97. doi:10.1111/j.1467-6419.2011.00695.x

and concentrates, real exports of molybdenum ores and concentrates, and) (1)

The original dataset included 35 observations covering the period 2013q1- 2021q3 (quarterly data). The nominal monthly values of all variables were converted into real ones (2013=100). Monthly nominal values of exports of commodities at the 6-digit level were retrieved from the UN Comrade Database<sup>1</sup> and then average quarterly data on physical volumes exported and prices per measurement unit were computed. The average quarterly prices per measurement unit were used to calculate the real exports of commodities of interest in constant prices expressed in USD. Nominal quarterly GDP data<sup>2</sup> were retrieved from the Statistical Committee of Armenia (SCA) and then real values were calculated and expressed in AMD. All computed real values of variables of interest were seasonally adjusted by using the moving average method, and then the log of those variables was taken.

Then upon performing the Augmented Dickey-Fuller test on the variables of interest and finding the evidence on non-stationarity, we took the first difference. Afterward, we tested for the existence of multicollinearity and found no evidence of it. Then we estimated the following equation by incorporating lagged variables using the ordinary least squares (OLS) method.

 $dlrgdpsa_{t} = \alpha_{0} + \alpha_{1}*dlr710813sa_{t-8} + \alpha_{2}*dlr260300sa_{t-3} + \alpha_{3}*dlr261390sa_{t-5} + \varepsilon_{t}$ (2) Where:

 $dlrgdpsa_t$  is the first difference of the log of the seasonally adjusted value of the real GDP in period t.

 $dlr710813sa_{t-8}$  is the first difference of the log of the seasonally adjusted value of the real exports of semi-manufactured gold lagged eight periods.

 $dlr260300sa_{t-3}$  is the first difference of the log of the seasonally adjusted value of the real exports of copper ores and concentrates lagged three periods.

 $dlr261390sa_{t-5}$  is the first difference of the log of the seasonally adjusted value of the real exports of molybdenum ores and concentrates (other than roasted) lagged five periods.

 $\alpha_0$ ,  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$  are model unknown parameters.

 $\varepsilon_t$  is the error term in period t.

Upon estimating the equation, all required tests were performed. We tested for the evidence of serial correlation, and heterosckedasticity, and found no evidence thereof. We found evidence of normally distributed residuals as well. Specification error wasn't identified; hence our model could be correctly specified.

Siswana and Phiri (2020) by consulting the United Nations Conference on Trade and Development database to compile export concentration data for various countries for estimation purposes relied on Herfindahl-Hirschman Index that was calculated at the 3-digit SITC product level<sup>3</sup>. Owing to the data availability issue, we constructed Herfindahl-Hirschman Index using categories of HS system codes at the 4-digit level, retrieved from the external trade database of the SCA<sup>4</sup>, and computed 2 other measures of concentration as well (the Entropy and Ogive indices) as proposed by Samen (2010) among other

<sup>&</sup>lt;sup>1</sup> Trade Statistics Branch of the United Nations Statistics Division (2022). UN Comtrade Database. Retrieved from https://comtrade.un.org/data/ (Date of access: March 11, 2022).

<sup>&</sup>lt;sup>2</sup> Statistical Committee of Armenia (2022). "Expenditure of GDP (by main consumption elements)" quarterly database according to SNA 2008. Retrieved from: https://www.armstat.am/en/?nid=202 (Date of access: March 21, 2022).

<sup>&</sup>lt;sup>3</sup> Siswana, S., & Phiri, A. (2020). Is Export Diversification or Export Specialization Responsible for Economic Growth in BRICS Countries? The International Trade Journal, p.9. doi:10.1080/08853908.2020.1842823

<sup>&</sup>lt;sup>4</sup> Statistical Committee of Armenia (2022). External trade database according to the Commodity Nomenclature at 4-digit level. Retrieved from: https://www.armstat.am/en/?nid=148 (Date of access: March 9, 2022)

measures to estimate the export concentration of various nations<sup>1</sup>.

*Analysis, Results, and Discussion:* The major commodity exported: copper ores and concentrates reported about a 3-fold increase in exports over the period 2013-2021 (see table 1). Switzerland emerged as one of two major export destinations along with China, followed by Bulgaria (see table 1). In the case of molybdenum ores and concentrates (other than roasted) a sharp, about an 18-fold increase in the exports was explained by the fact that China emerged as a major partner, importing Armenian molybdenum concentrates (see table 1). Upon reporting a stable, a 3-fold increase in exports of semi-manufactured gold between 2013 and 2020, the commodity's export sharply declined in 2021 compared to the value of 2020, owing to border redrawing (see table 1). The exports of semi-manufactured gold over the period 2013-2021 reflected the change in a single major export destination: i.e. the growth was mainly driven by exports to Canada from 2013 to 2016, being replaced by Switzerland from 2017 to 2020, with India emerging as the principal trade partner in 2021 (see table 1).

Table 1

Commodity	Partner	2013	2014	2015	2016	2017	2018	2019	2020	2021
260300: Copper ores and concentrates	World	279.91	235.87	316.64	370.05	571.48	525.47	626.67	604.41	769.28
	Bulgaria	150.66	84.59	78.53	163.04	281.21	213.92	205.83	149.57	195.55
	China	64.79	138.01	138.93	68.18	115.89	94.74	174.42	193.43	286.16
	Switzerland	12.42	0.00	14.84	23.54	84.14	130.75	191.55	261.41	287.57
261390:	World	6.65	8.74	6.16	0.94	7.76	6.54	16.96	102.09	121.40
Molybdenum ores	China	0.00	0.00	0.00	0.00	0.00	0.00	2.42	88.61	99.80
and concentrates;	Netherlands	6.65	8.74	5.76	0.94	6.38	0.00	0.00	0.00	0.00
other than roasted	Switzerland	0.00	0.00	0.00	0.00	0.00	0.00	6.87	6.72	10.97
	World	73.58	81.90	98.07	140.80	144.48	170.97	215.33	253.86	130.66
710813:Metals;	Canada	73.32	81.54	96.92	124.12	0.00	0.00	0.00	0.00	0.00
gold, semi-	India	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.97	126.15
manufactured	Switzerland	0.00	0.32	0.00	16.68	144.48	169.44	214.96	132.16	0.00
	UAE	0.00	0.00	1.11	0.00	0.00	1.53	0.37	48.73	4.51

Exports of commodities by destination (million USD)<sup>2</sup>

An increase in exports of copper and molybdenum ores and concentrates over the period 2013-2021 resulted in an increase in the share of metallic ores, slag and ash in merchandise export of Armenia, thus making the exports more concentrated (see table 2). If the share of metallic ores, slag and ash in merchandise export accounted for 20.52% in 2013, then it reached 30.55% in 2021 (see table 2). The shift, in its turn, led to an increase in the values of three major concentration indices: i.e. Herfindahl-Hirschman, Ogive, and Entropy indices (see table 2). In the medium term, Armenian merchandise export can become more concentrated owing to the Western sanction imposed on Russia in the first quarter of 2022.

In the period 2014-2016, the strategy of miners to fight declining prices was to manufacture and supply more Armenian copper ores and concentrates (see table 3), in general. Although prices per ton were rising in the period 2017-2018, the physical quantities supplied by Armenian miners declined owing to temporarily suspension of operations by Teghut mine in 2018 (see table 3). In 2019, the mine resumed its operations;

<sup>&</sup>lt;sup>1</sup> Samen, S. (2010). A Primer on Export Diversification: Key Concepts, Theoretical Underpinnings and Empirical Evidence. Growth and Crisis Unit, World Bank Institute Washington DC: World Bank, pp. 16-17.

<sup>&</sup>lt;sup>2</sup> Trade Statistics Branch of the United Nations Statistics Division (2022). UN Comtrade Database. Retrieved from https://comtrade.un.org/data/ (Date of access: March 11, 2022).

the price decline was addressed through an increase in the physical quantities supplied (see table 3). Upon exports decline in 2020 owing to COVID-19 restrictions, the export of copper ores and concentrates increased due to price hike, although physical volume reported about 16% decline compared to the quantities supplied in 2020 (see table 3), somehow explained by the fact of suspension of its operations by the ZCMC and its inability to export.

Table 2

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Herfindahl-Hirschman Index	0.199	0.164	0.215	0.211	0.259	0.222	0.244	0.243	0.243
Ogive Index	48.78	40.92	53.49	56.40	76.54	65.25	70.53	71.32	70.34
Entropy Index	4.849	4.946	4.791	4.827	4.780	4.994	4.851	4.905	5.021
Categories (4-digit level) exported	645	638	656	724	784	812	780	796	782
Exports of metallic ores, slag and ash (million USD)	303.5	291.2	366.0	400.5	598.7	557.1	665.1	733.4	923.2
Share of metallic ores, slag and ash in	20.52	18.82	24.64	22.35	26.76	23.09	25.11	28.91	30.55
merchandise export (%, total)									
Total merchandise export (billion USD)		1.55	1.49	1.79	2.24	2.41	2.65	2.54	3.02

#### Armenian merchandise export concentration indices<sup>1</sup>

Table 3

Exported volumes of commodities and average per measurement unit prices (USD)<sup>2</sup>

Commodity	Measurement Unit	2013	2014	2015	2016	2017	2018	2019	2020	2021
260300: Copper ores and concentrates	price per ton	1,616	1,274	1,024	919	1,201	1,237	1,115	1,186	1,791
	thousand tons exported	173	185	309	403	476	425	562	510	429
261390: Molybdenum ores and concentrates; other than roasted	price per ton	8,526	9,711	6,264	4,461	6,895	11,502	8,352	6,297	11,934
	tons exported	780	900	984	210	1,125	568	2,030	16,212	10,172
710813: Metals; gold, semi-manufactured	price per gram	26.8	22.6	33.9	32.7	32.4	35.1	38.2	45.1	35.1
	kilograms exported	2,747	3,620	2,889	4,312	4,457	4,865	5,637	5,633	3,723

Overall, the physical quantities supplied by Armenia in the case of molybdenum ores and concentrates (other than roasted) varied from 2013 to 2018 (see table 3). The sharpest decline in the physical volumes was reported in 2016 while compared to 2015, about an 80% decline, owing to the fact that the prices dropped (see table 3). Although the values of exports increased in the period 2019-2021, the price increase was associated with the decline in physical volumes supplied and vice versa (see table 3).

Upon increase of gold prices in 2015 compared to 2014, the average prices remained nearly at the same level, followed by the price rise from 2018 to 2020 and accompanied by the increase in physical volumes, although the physical volume exported in 2020 almost remained at the same level as in 2019 (see table 3). The border redrawing affected the

<sup>&</sup>lt;sup>1</sup> Statistical Committee of Armenia (2022). "Expenditure of GDP (by main consumption elements)" quarterly database according to SNA 2008. Retrieved from: https://www.armstat.am/en/?nid=202 (accessed: March 21, 2022). Statistical Committee of Armenia (2022). Note: Authors own calculations

<sup>&</sup>lt;sup>2</sup> Trade Statistics Branch of the United Nations Statistics Division (2022). UN Comtrade Database. Retrieved from https://comtrade.un.org/data/ (accessed: March 11, 2022). Note: Authors own calculations.

operations of the Sotq mine, thus resulting in the decline in physical volumes exported by about 34% in 2021 compared to the physical volume of 2020 (see table 3).

Overall, the real changes in the independent variables included in the equation could explain about 51% of variations in the real GDP in the short run (see table 4).

Semi-manufactured gold: An increase in the real exports of semi-manufactured gold lagged 8 periods by 1%, could cause a 0.133% statistically significant increase in the real GDP in period t in the short run, on average (see table 4). This means that positive gains from the increase in exports of gold could be experienced only after 2 years, in general. The positive impact on the GDP could be explained by the fact that in the period 2013-2020, the increase in prices per-gram reflected the growing demand, in general (with some exceptions), thus resulting in an increase in supplies of gold by Armenian miners (see table 1, 3). While meeting the global demand Armenian producers generated more taxes as well, hence leading to an increase in budget revenues. Therefore, the inability to export (i.e. decline in the physical quantities extracted and exported) could have a statistically significant negative impact on the real GDP. This means that the sharp decline in real exports of semi-manufactured gold in 2021 compared to the 2020 amount (see table 1) had a statistically negative impact on the real GDP. Hence, the increase in the quantities could be reported either by an increase of products by the existing mines and/or by the exploitation of new mines. With GeoProMining Gold switching to closed-pit operations methods, the company would start reporting lower volumes extracted starting from 2025, in addition to those losses owing to border redrawing experienced in 2021 compared to physical volumes of 2020.

Table 4

Dependent variable:	Estimation 1:					
$Dlrgpdsa_t$	Sample: 2013Q1-2021Q3					
	Adjusted: 2015Q2-2021Q3					
$dlr710813sa_{t-8}$	0.133					
	(4.317)***					
$dlr 260300 sa_{t-3}$	-0.146					
	(-2.868)***					
dlr261390sa <sub>t-5</sub>	-0.006					
	(-2.461)**					
Constant	0.008					
	(1.083)					
R-squared	0.571					
Adjusted R-squared	0.513					
Included Observations	26					

Estimated Model (Method: OLS)

Note: value of t statistics in parentheses.

\*\* significant at 5%; \*\*\* significant at 1%.

*Copper ores and concentrates:* An increase in the real exports of copper ores and concentrates lagged 3 periods by 1% could cause a 0.146 % decline in the real GDP in period t in the short run, on average (see table 4). The negative impact on the real GDP could be explained by the fact that not always increase in prices was associated with an increase in physical volumes exported over the same period of the previous year owing to the inability to export and etc. Interesting to note, that although in nominal terms an increase in the export revenues was reported in 2021 compared to the value of 2020,

however, real exports declined. When the demand is rather high, the decline in exported physical volumes could be compensated by an increase in taxes. With the new duties introduced by the government in 2021, additional tax revenues were generated in 2021. Early in March, 2022, it was announced that the government was working on the draft of a bill that would aim to make the distribution of the export earnings more equitable, especially between the Armenian citizens and mining companies. This stresses the importance of having the opportunity to increase supplies of copper ores and concentrates when especially the global demand is rather high and ensuring higher budget revenues for the government and smoothing the losses when the prices would decline. If global prices would continue increasing, and new legislation would be in place, the negative impact of the real exports might be reversed in the medium term, especially if there is no barrier to extracting and exporting copper ores and concentrates (no forced closure of the mine, and/or temporary shutdown).

*Molybdenum ores and concentrates (other than roasted):* A percent increase in the real exports of molybdenum ores and concentrates (other than roasted) lagged 5 periods, could cause a 0.006% statistically significant decline in the real GDP in period t in the short run, on average (see table 4). A negligible but still negative impact on the real GDP could be explained by the fact that the sharp increase in the physical volumes exported was reported from 2019 onwards (see table 1, 3), and it hasn't translated yet into positive gains, i.e. positive contributions to the real GDP. Hence, if these trends continue, and with the increase of the original sample size, the sign of statistically significant impact would change, and would become positive.

If we compare our empirical evidence with findings, results, and conclusions (with respect to other nations as presented in the Literature Review Section) on mining sector, and namely exports (in the case of Chile (Siliverstovs and Herzer, 2007), Bostwana (Koitsiwe and Tsuyoshi, 2015), Zambia (Aguirre Unceta, 2021), Democratic Republic of Congo (Otchia, 2015), Vietnam (Nguyen et al., 2021), Latin American and Caribbean (Hou, 2019), Guyana (Laing, 2019) and the role foreign direct investments in the mining sector (in the case of Zimbabwe (Gochero and Boopen, 2020)), we find that mining resources induced economic growth was reported in the case of those countries, while in the case of Armenia the exports of not all mining and quarrying industry-related major products could have a statistically significant positive impact on the real GDP in the short run. In the case of Armenia, we found that, in general, the changes in exports of 2 major products related to the mining and quarrying industry (namely: copper and molybdenum ores and concentrates) could cause a statistically negative impact on the real GDP in the short run, while in the case of semi-manufactured gold increase in the real exports of gold in the current quarter would only cause a statistically positive increase in the real GDP only after 8 quarters.

If we compare our findings with the empirical evidence and statement of Grigoryan (2013) on the mining sector induced economic growth in Armenia due to "*much capacity in mining to boost growth*" (p.15.), we find that "*capacity constraints*" (inability to export owing to Western sanctions, or forced shutdown and/or suspension of operations) play a pivotal role. The further decline in the real exports of semi-manufactured gold, especially from 2025 onwards could have a negative-impact on the real GDP, while the increase in the real exports of copper ores and concentrates is explained by the strategy of the mining companies to overcome price decline could have a statistically significant negative impact on the real GDP, hence decline in physical volumes accompanied by price hike is more favored, in contributing to the economic growth. Although the government started the

process of reviewing the fiscal regime, especially with respect to copper and molybdenum ores and concentrates, and introduced duties in 2021, however, the draft of the bill is not available yet, and is currently virtually impossible to access the impact of the legislative changes to be drafted. Regardless of the legislative changes, the role of "*capacity constraints*" is stressed as well, especially when the increase in the quantities would compensate for the decline in prices.

By taking into account the increase of the share of metallic ores, slag and ash in the total merchandise export over the period 2013-2021 that led to more concentrated merchandise exports, and the estimated coefficients of three major mining and quarrying industry related commodities (copper and molybdenum ores and concentrates, and semi-manufactured gold), the more concentrated exports would drive the growth of foreign exchange earnings owing to the macroeconomic situation in Russia (as the leading trade partner: exports to Russia accounted for about 28% of total merchandise exports in 2021<sup>1</sup>) caused by Western sanctions imposed in the first quarter of 2022. Therefore, in the short-run, and medium-term the role of export concentration in ensuring the economic growth is stressed, along with addressing the "*capacity constraints*".

*Scientific Novelty:* Based on the econometric estimation results, the impact (both positive and negative) of real exports of copper and molybdenum ores and concentrates, and semimanufactured gold on the real GDP in the short run. Respective recommendations have been designed that would ensure effective growth of the mining and quarrying industry in Armenia.

*Conclusions and Recommendations:* Owing to the economic situation in Russia caused by the Western sanctions imposed in the first quarter of 2022, the merchandise exports would become more concentrated in the medium term. Hence, the increase of the share of mining and quarrying industry related chapter: metallic ores, slag and ash in the total merchandise exports reported over the period 2013-2021, as the computed concentration indices of Herfindahl-Hirschman, Ogive, and Entropy proved, could continue in the medium term as well. Therefore, we estimated the role of real exports of three major mining and quarrying sector related commodities at the 6-digit level of HS system codes in explaining statistically significant changes in the real GDP in the short run using quarterly data spanning from January 2013 to September 2021 and based on OLS estimation method. An increase in the real exports of semi-manufactured gold lagged 8 periods by 1%, could cause a statistically significant increase in the real GDP of 0.133% in period t, on average, while in the case of an increase in the real exports of copper ores and concentrates lagged 3 periods by 1%, could cause a 0.146 % decline in the real GDP in period t. In the case of molybdenum, we found that an increase in exports would cause a negligible negative impact on the real GDP. We find that "capacity constraints", i.e. inability to extract and export play a crucial role. The decline in the real exports of semi-manufactured gold to be expected from 2025 onwards could cause a statistically significant negative impact on the real GDP. The increase in the real exports of copper ores and concentrates mostly driven by the tactics of mining companies to fight global price decline could cause a statistically significant negative impact on the real GDP in the short run. Hence, the decrease in the physical volumes associated with the price hike would be more favored.

Hence, the Government's priorities need to be the followings in the short run and the medium term:

<sup>&</sup>lt;sup>1</sup> Statistical Committee of Armenia (2022). External trade database by country. Retrieved from: https://www.armstat.am/en/?nid=717 (Date of access: March 30, 2022)

- Initiate actions that would be aimed at the increase in extraction and exports of semi-manufactured gold (measures either to boost the production increase by existing mines or establishment of new mines by attracting new, either foreign and/or local investors);
- Since Teghut is the second largest copper and molybdenum deposit, the Government's actions with respect to avoiding a prolonged temporary suspension of operations once the renovation works are over and to keep more than a thousand jobs open could be the followings:
  - Assist the mine to find new markets other than the EU member states to export copper and molybdenum ores and receive other currencies (i.e. Chinese Yuan Renminbi, etc.);
  - By negotiating with the Moscow-based VTB Bank the possibility of either merger and/or acquisition deal by finding a new investor for the mine;
  - By negotiating with the Moscow-based VTB Bank the possibility of transferring the stocks of the company to a third party, i.e. the Government of Armenia by signing a shares management trust agreement.
- Regularly review the export duties introduced in 2021 on a quarterly basis. In the case of price hikes, an increase of duties could compensate for the decline in physical volumes exported, meanwhile decrease of duties could compensate for possible loss of tax revenues when the prices fall, since the mining companies would be urged to extract and export more.

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## ՀՀ-ՈՒՄ ՏՆՏԵՍԱԿԱՆ ԱՃԻ ԱՊԱՀՈՎՄԱՆ ԳՈՐԾՈՒՄ ԿԻՍԱՄՇԱԿՎԱԾ ՈՍԿՈՒ, ՄԵՏԱՂԱԿԱՆ ՀԱՆՔԱՔԱՐԻ ԵՎ ԽՏԱՆՅՈՒԹԻ ԱՐՏԱՀԱՆՄԱՆ ԴԵՐԸ ԿԱՐՃԱԺԱՄԿԵՏ ԺԱՄԱՆԱԿԱՀԱՏՎԱԾՈՒՄ

## Սերգեյ Վլադիմիրի Դոխոլյան Աննա Ռուզվելտի Մակարյան

Համառոտագիր։ 2022թ.-ի առաջին եռամսյակում Ռուսաստանի նկատմամբ կիրառված արևմտյան պատժամիջոցները կարող են միջնաժամկետ հատվածում մեծացնել ՀՀ-ից ապրանքների արտահանման կենտրոնացվածության աստի-Ճանը։ Այսպիսով՝ մետաղական հանքաքարի, խարամի և մոխրի տեսակարար կշռի մեծացումը ապրանքների արտահանման կառուցվածում, ինչը նաև արձանագրվել էր 2013-2021թթ.-ին, շարունակվելու է նաև միջնաժամկետ ժամանակահատվածում։

**Հոդվածի արդիականությունը։** Գնահատել իրական արտահանման (ապրանքների մակարդակով) վիճակագրորեն նշանակալի ազդեցությունը տնտեսական աճի վրա, հատկապես Ռուսաստանի նկատմամբ արևմտյան պատժամիջոցների պայմաններում։ Հետազոտության արդյունքները կառավարությանը թույլ կտան սահմանել առաջնայնությունները և նախաձեռնել համապատասխան քաղաքականությանն ուղղված փոփոխությունները, որոնք կբարձրացնեն հանքագործական արդյուանբերության արտահանման դերը տնտեսական աճի ապահովման գործում։

Հոդվածի նպատակը։ Գնահատել պղնձի և մոլիբդենի հանքաքարի, խտանյութի, ինչպես նաև կիսամշակված ոսկու իրական արտահանման դերը (ԱՏԳ ԱԱ համակարգի կոդերի 6-նիշ մակարդակում) իրական ՀՆԱ-ի վիձակագրորեն նշանակալի փոփոխությունների բացատրման գործում կարձաժամկետ ժամանակահատվածում՝ եռամսյակային տվյալների հիման վրա (2013q1-2021q3) նվազագույն քառակուսիների (OLS) գնահատման մեթոդով, ինչպես նաև ներկայացնել համապատասխան առաջարկություններ՝ հանքագործական արդյունաբերության զարգացման առաջնայնությունների վերաբերյալ գնահատման արդյունքների և հաշվարկված արտահանման կենտրոնացվածության աստիձանի ինդեքսների հիման վրա և այլն։

Վերոնշյալ նպատակին հասնելու համար դրվել են հետևյալ *խնդիրները*։

- Հաշվարկել ապրանքների արտահանման կենտրոնացվածության աստի- ձանը գնահատող տարբեր ինդեքսներ՝ ԱՏԳ ԱԱ համակարգի ծածկագրերի կատեգորիաների 4-նիշ մակարդակում,
- Հաշվարկել արտահանվող ապրանքների մեկ միավորի գինը՝ անվանական արժեքները իրական դարձնելու նպատակով, ինչպես նաև եռամսյակային տվյալների հիման վրա անհրաժեշտ էկոնոմետրիկ գնահատում իրականացնելու նպատակով,
- Բացահայտել և հիմնավորել ՀՀ տնտեսական աձի ապահովման գործում հանքագործական արդյունաբերությունը ներակայցնող արտահանման դերի բարձրացման վերաբերյալ քաղաքականությանը վերաբերող համապատասիան առաջարկություններ։

**Գիտական նորույթը։** տնտեսաչափական գնահատման արդյունքների հիման վրա բացահայտվել է պղնձի և մոլիբդենի հանքաքարի և խտանյութի, ինչպես նաև կիսամշակված ոսկու արտահանման ազդեցությունը (թե՛ դրական, և թե՛ բացասական) իրական ՀՆԱ-ի վրա կարձաժամկետ հատվածում։ Մշակվել են համապատասխան առաջարկություններ, որոնք կնպաստեն հանքագործական արդյունաբերության արդյունավետ զարգացմանը ՀՀ-ում։

**Բանալի բառեր՝** արտահանում, հանքագործական արդյունաբերություն, պղնձի հանքաքար, խտանյութ, մոլիբդենի հանքաքար, խտանյութ, կիսամշակված ոսկի, արտահանման կենտրոնացվածություն, տնտեսական աձ, Հայաստան

## РОЛЬ ЭКСПОРТА ПОЛУФАБРИКАТОВ ИЗ ЗОЛОТА, МЕТАЛЛИЧЕСКИХ РУД И КОНЦЕНТРАТОВ В ОБЕСПЕЧЕНИИ ЭКОНОМИЧЕСКОГО РОСТА В АРМЕНИИ В КРАТКОСРОЧНОЙ ПЕРСПЕКТИВЕ

#### Сергей Владимирович Дохолян Анна Рузвелтовна Макарян

Аннотация: Западные санкции, введенные в отношении России в первом квартале 2022 года, могут повлиять на уровень концентрации экспорта товаров из Армении в среднесрочной перспективе. Таким образом, увеличение доли металлических руд, шлака и золы в общем объеме товарного экспорта, о котором сообщалось в период 2013-2021 годов, может продолжиться и в среднесрочной перспективе.

Актуальность статьи: Проведена оценка статистически значимого влияния реального экспорта (отдельно взятых товаров) на экономический рост Армении, что особенно значимо в условиях, когда в отношении России введены западные санкции. Результаты исследования позволят правительству определить приоритеты и инициировать соответствующие изменения в экономической политике, которые повысят роль экспорта горнодобывающего сектора в обеспечении экономического роста в стране.

**Цель статьи:** оценить роль реального экспорта медных и молибденовых руд и концентратов, а также полуобработанного золота на 6-значном уровне кодов системы ТН ВЭД в объяснении статистически значимых изменений реального ВВП в краткосрочной перспективе на основе квартальных данных, охватывающих период с января 2013 года по сентябрь 2021 года и с использованием метода наименьших квадратов (OLS); и предоставить соответствующие рекомендации по приоритетам правительства для развития горнодобывающего сектора на основе результатов оценки и рассчитанных индексов уровня концентрации и т.д.

Для достижения вышеуказанной цели были поставлены следующие задачи:

- Рассчитать различные индексы уровня концентрации экспорта товаров с использованием категорий кодов системы ТН ВЭД на 4-значном уровне;
- Расчет цен на единицу экспортируемых товаров с целью преобразования номинальных значений в реальные и проведения необходимой эконометрической оценки на основе квартальных данных;
- Определить и обосновать соответствующие рекомендации по повышению роли экспорта, связанного с горнодобывающей промышленностью, в обеспечении экономического роста в Армении.

*Научная новизна:* На основе результатов эконометрической оценки выявлено влияние (и положительное, и негативное) реального экспорта медных и молибденовых руд и концентратов, а также на полуобработанного на реальный ВВП в краткосрочной перспективе. Разработаны соответствующие рекомендации, которые могли бы способствовать эффективному развитию горнодобывающей промышленности в РА

**Ключевые слова:** Экспорт, горнодобывающая промышленность, медные руды и концентраты, молибденовые руды и концентраты, полуобработанное золото, концентрация экспорта, экономический рост, Армения

### THE ROLE OF EXPORTS OF SEMI-MANUFACTURED GOLD, METALIC ORES AND CONCENTRATES IN ENSURING ECONOMIC GROWTH IN ARMENIA IN THE SHORT RUN

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**Abstract:** The Western sanctions imposed on Russia in the first quarter of 2022, could make the merchandise export of Armenia more concentrated in the medium term. Therefore, the increase of the share of metallic ores, slag and ash in the total merchandise exports reported over the period 2013-2021 could continue in the medium term as well.

**Relevance of the article:** Estimation of the statistically significant impact of real exports (commodity level) on the economic growth, especially in terms of Western sanctions imposed on Russia. The study results will allow the government to set priorities and initiate respective policy changes that would increase the role of mining sector exports in ensuring economic growth.

*The purpose of the article:* is to estimate the role of real exports of copper and molybdenum ores and concentrates, and semi-manufactured gold at the 6-digit level of HS system codes in explaining changes in the real GDP in the short run, based on quarterly data covering the period January 2013-September 2021 and using ordinary least-squares (OLS) estimation method; and to provide respective recommendations on mining sector development priorities based on the estimation results and computed concentration indices, etc.

The following *objectives* have been set to achieve the above-stated goal:

- To compute various merchandise export concentration indices using categories of HS system codes at the 4-digit level;
- To calculate price per unit of exported commodities in order to transform nominal values into real ones and conduct the required estimations based on the quarterly data;
- To identify and substantiate respective policy recommendations to increase the role of mining and quarrying industry related exports in ensuring economic growth in Armenia.

*The Scientific Novelty:* Based on the econometric estimation results, the impact (both positive and negative) of real exports of copper and molybdenum ores and concentrates, and semi-manufactured gold on the real GDP in the short run. Respective recommendations have been designed that would ensure effective growth of the mining and quarrying industry in Armenia.

**Keywords:** Exports, mining and quarrying industry, copper ores and concentrates, molybdenum ores and concentrates, semi-manufactured gold, export concentration, economic growth, Armenia