Dynamics and Trends of Mining in Tanzania: A Cointegration Approach, 1966-2023.

Godius Kahyarara[†]

Abstract

This paper examines trends and dynamics of the Mining sector of Tanzania over a time span of 100 years. To do so, econometrics analysis is used to estimate cointegration model for trends within the span of time from 1966 till 2023. Qualitative analysis is also undertaken and empirical findings confirm five distinct regimes of mining sector performance since 1898 namely; the gold boom from 1898 till 1950, diamond boom from 1950 up to 1966, drastic fall from 1966 till 1997, recovery from 1997 up to 2010 and gold boom from 2010 to date. Tracing from 2000 when Vision 2025 was adopted, paper estimates show that the mining sector performance has been extraordinary from 1 percent in 1997 to 10 percent share of GDP by 2023 and export contribution has increased from US dollar 26 million in 1997 to 2.9 billion by 2023. Legal, regulatory and institutional frameworks at sectoral and macro level substantially influence the observed performance. The paper shows that the error correction term is correctly signed and statistically significant and, the coefficient of minerals export is statistically significant such that a 1 percent increase in mineral export will lead to a 0. 43 percentage increase of total export in the long run, with 77 percent speed of convergence to equilibrium. In terms of contribution to GDP, the results show that 1 percent increase in minerals production lead to 0.16 percent increase of GDP. Further analysis of the paper demonstrates high intensity of the correlation, integration and linkages effects between mining sector with other sectors particularly manufacturing. Thus, mining sector generally has potential to maximize gains from economic and social development whereas discovery of huge deposits of rare earth elements in Tanzania and availability of wide range of industrial mineral in nearly all regions of Tanzania have a potential of becoming a new backbone of Tanzania and enable manufacturing contribution over 30 percent of GDP.

Keywords: Mining sector; Tanzania; Cointegration; Error Correction Model

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[†] The Author is a Professor of Economics from the University of Dar es Salaam. He is currently seconded to the Government of the United Republic of Tanzania. He was Regional Administrative Secretary of Geita where the fourth largest Gold Mine in Africa GGML and with the largest production of Small-Scale miners. Currently he is a Permanent Secretary in the Ministry of Transport.

1. Introduction

This paper examines trend and transition of mining sector of Tanzania over a long period extending to 100 years. In so doing it contributes knowledge on the role of mining sector in Tanzanian economy in the context of where and when did the mining activities started. Furthermore, it displays trends and dynamics of the sector from the colonial times when a first gram of mineral was mined in Tanzania all the way to the period after independence, during implementation of Arusha Declaration, era of economic crisis, periods of reforms and adjustment and concludes with the recent development. The paper also examines recent development in terms of rapid increase in prospecting, exploration and development of rare earth elements and other critical minerals in relation to their possible contribution to industrialization. Tanzania Vision 2025 sets out target for mining transformation goal to reach at least 10 percent by 2025. Hence the paper asks the question whether and to what extent such goal has been achieved.

The paper is justified for a number of reasons that are provided in this paragraph. Most notably, Tanzania is endowed with a wide range of mineral types which can act as a catalyst of attracting state of the art modern manufacturing processes along the entire value chain to transform these elements into highest value finished products. This is especially the case for rare earth elements. Traditionally other industrial minerals have provided raw materials for manufacture of construction materials such as cement, tiles, ceramic products, fertilizer, iron and steel glasses to mention a few. Precious stones such as gold, diamond, and all ranges of gemstones processed at a certain degree are the major source of foreign currency, employment, forward and backward impacts on various chains of the economy and ultimately economic growth.

Hence, genesis of the paper traces the journey of industrialization taking more emphasis from the 1960s import substitution all the way to the Basic industrialization attempt and sustainable industrial development. In relation to macroeconomic performance, it is evident that in 1998 mining sector contributed about 1 percent of GDP while manufacturing sector contributed 8.1 percent. Nearly twenty years later, the Mining Sector contribution to GDP stands at about 10 percent whereas Manufacturing sector is at between 7 and 8 percent. This shows that mining sector contribution has increased by 10 times over and above contribution of the manufacturing sector. This trend has more economic puzzle than simply the observed performance.

Furthermore, recent development of mining sector globally and regionally provides new opportunities. Tanzania is one of the 9 African Countries that are heavily endowed with rare earth elements. These are very crucial for modern high technology industrialization. In this area Tanzania has high-graded, large enough deposits of rare earth minerals to make mining exploitation economically feasible. The other countries are Namibia, South Africa, Kenya, Madagascar, Malawi, Mozambique, Zambia, and Burundi. These elements are also used as phosphors in many consumer displays and lighting systems and are vital for many defense technologies, including precision-guided munitions, targeting lasers, communications systems, airframes and aerospace engines, radar systems, optical equipment, sonar, and electronic counter measures. In 2021, global demand for rare earths reached 125,000 metric tons. By 2030, it is forecast to reach 315,000 tons.

After this introduction the second section described the mineral wealth and endowment for Tanzania in terms of existing geological surveys mineralogic and other scientific information. The third section discusses evolution, dynamics and trends of mining sector of Tanzania. The discussion begins from 1989 when gold mining started for the first time under Germany colonial Government, to the diamond boom during the British regime up to mid-1960s, mineral sector performance during and after Nationalization in 1967, the economic recovery reforms and recent development. The fourth section provides methodology and empirical evidence on the long run economic behavior of the mining sector

based on time series Cointegration Models. Summary, Conclusions and Recommendations are given in section five.

2. The Mineral Wealth of Tanzania

In terms of minerals, Tanzania is among the richest countries in the World. A wide range of mineral varieties come from mineral deposits embodied in geological systems namely; Craton, Nyanzian, Proterozoic, Ubendian, Usagaran, Karagwe-Ankolean, Bukoban, Karroo and Cenozoic sediments along with volcanics. Based on this geological systems, Tanzania is famously known to house metallic minerals of all ranges such as Gold, Iron, Silver, Copper, Platinum, Nickel and tin. Gemstones of high quality such as diamonds, tanzanite, ruby, garnet, emerald, alexandrite and sapphire are substantially found with significant economic value. In addition, Tanzania is very rich in terms of a wide range of industrial minerals. This provides a critical economic base for import substitution and normalization of balance of payments especially through producing a range of industrial minerals that are currently imported. These include Kaolin, phosphate, lime gypsum, diatomite, bentonite, vermiculite, and salt and beach sand. Development has over time evolved through encouragement of quality housing which requires adequate construction materials.

The industrial minerals available in Tanzania also include building materials such as stones, aggregates, sand and materials for manufacturing cement tiles and other construction related products. Tanzania is also endowed with energy minerals of various form including uranium and coal. It is also worthwhile noting that nearly in all regions of Tanzania mineral wealth is found the only difference is on the type and degree of economic exploitation. Finally, new development of discovery of rare earth and critical elements is an economic base that supports further development in recent times. In summary mineral wealth of Tanzania occur in different areas as follows: -

(a) Gold in the greenstone belt south, east and west of Lake Victoria;
(b) Diamonds in kimberlite pipes in central and south of Tanzania and southern part of Lake Victoria Goldfield;
(c) Nickel, Cobalt, copper, tin, and tungsten minerals in north–western Tanzania;
(d) Titanium, vanadium and iron in south-west of Tanzania;
(e) Coal in south-west of Tanzania;
(f) Uranium in central and southern Tanzania;
(g) Soda ash, salt, gypsum, travertine and trona (evaporites) in the rift valley and along the coast; and
(h) Kaolin, mica, phosphate, magnesite, beach sand, diatomite, stone aggregates, dimension stone and sand in different parts of Tanzania.

In as far as rare earth elements are concerned, Tanzania is one of the 9 African Countries that are heavily endowed with rare earth elements. In terms of varieties and availability the science provides for 17 namely scandium (Sc), yttrium (Y), lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), and lutetium (Lu). The most recent discovery is located approximately 147km from the city of Mbeya in southern Tanzania and on the edge of the East African Rift Valley, the Ngualla Project. This is one of the largest, highest grade and lowest cost Neodymium and Praseodymium (NdPr) rare earth projects in Southern Africa, with an estimated resource of 176 million tones at a grade of 2.24% total rare earth oxides (TREO). There are unconfirmed reports on coexistence between gold and rare earth elements at Nyanzaga.[1]

[1] The Nyanzaga Gold Project situated, approximately 60km southwest of the city of Mwanza, 60km east of the Geita Gold Mine (AngloGold Ashanti) and 30km northeast of the Bulyanhulu Gold Mine (Barrick Gold), comprises the Special

Montero commenced exploration activities on the Wigu Hill Rare Earth Element project located near the town of Kisaki in the Morogoro region.[2] Canada's first rare earth miner, signed a project development and option agreement with Montero to acquire and develop the Wigu Hill project. specialization in manufacturing of high value addition and processing of rare earth elements to manufacture smartphones, hard drives, hybrid vehicles, TV flat screens, computers, batteries for speakers, mobile phones, video camera, high-strength magnets for wind turbines, defense devices such as guidance systems, lasers, radar and sonar systems.

Overall, endowment of minerals of various types and use give Tanzania a competitive age and comparative as well as competitive advantage to diversify the economy. Recent trends have confirmed how mining sector contribution to total export has grown spontaneously from just US Dollar 26 million in 1997 which by then constituted about 1 percent of total exports to US Dollars 2.9 billion by 2023 which is over 50 percent of total merchandize exports. The precious minerals led by gold have been a major contributor with gold making over 80 percent of this value. In addition, the sector provides millions of direct and indirect jobs along the value chain. High forward and backward linkage in the sector is also observed. Besides Tanzania has a huge deposit of industrial minerals that are potential drivers of high technology industrialization. Experience from the Four Tigers South Korea, Singapore, Taiwan and Hong Kon have shown how specialization in mineral based industrialization via semiconductor electronic industrial economic zones resulted into growth of modern industrial base that managed 30 to 40 percent GDP contribution of manufacturing. Rare earth minerals along with other types of industrial minerals are found in nearly all regions of Tanzania as per the mineralogic map. Hence there is a potential to strategically exploit mining sector as an innovative back up as economic back borne and source of industrial growth.

Mining Licence (SML) which covers 23.4km^2 and encompasses the Nyanzaga and Kilimani deposits and other exploration prospects. In accordance with the Tanzanian Mining Act, the Government of Tanzania holds a 16% free-carried interest in Sotta Mining Corporation Limited, a subsidiary of OreCorp Limited and the holder of the SML.

[2] Montero Mining & Exploration Ltd. is a mineral exploration and development company focused primarily on the exploration, discovery, and development of properties in Chile. Montero has discovered rare earth elements in Tanzania.

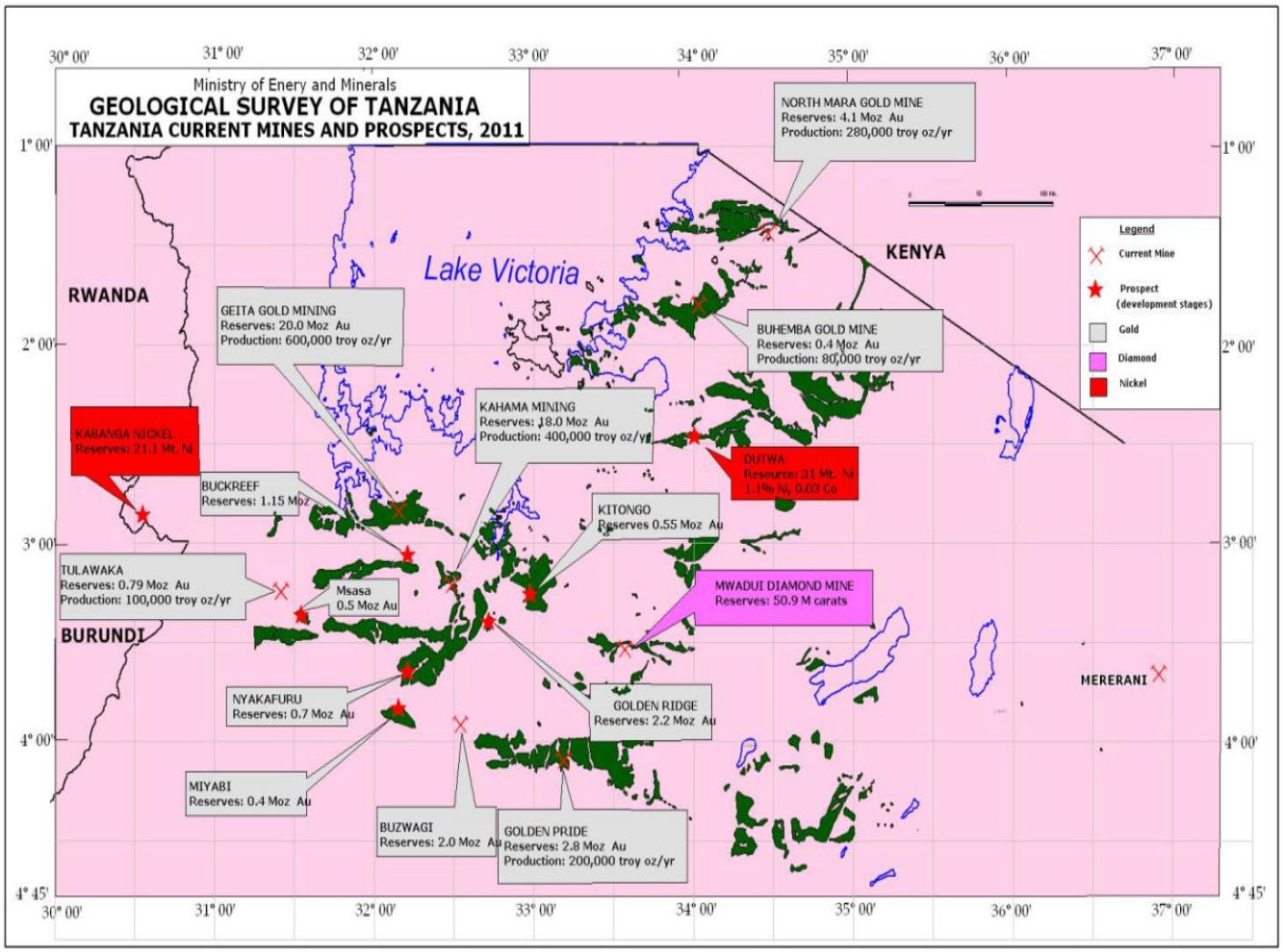


Figure 1: Mineralogic Map of Tanzania

3. Evolution, Dynamics and Trends of Mining Sector in Tanzania

Much have been said and written about the time when mineral wealth of Tanzania was discovered on one hand, and when it became an economically exploited productive sector. According to Chachage (1995) the availability of economically exploitable mineral wealth of Tanzania was explored by the Germans in 1898 after the discovered huge gold reserves in in the Greenstone belt in the area known today as Geita. Efforts to economically exploit mining resources started around the time the sector began to make significant contribution in the economy. However, eruption of World War First led to ceasing of all commercial mining activities until 1920 under the transition from German to British rule when a range of activities resumed. Such period witnessed emergency of major gold rush in Lupa in Mbeya. More active role and participation in the economy was motivated by the introduction of Mining Ordinance of 1929. Small scale miners along with investors mainly from British administration proposals became active. The Later capitalized on the former German gold mines around Lake Victoria Gold Fields.

The other area which gradually became the source of mining activities during the era of colonial times was Ufipa. The discovery of minerals and gradual rush and permanent settling of organized miners led to the growth of Iron Smelting center also developed during the Germany era. Various reports that suggest that by then Tanganyika was among the leading mineral producers in the Southern Africa. Before defeat of the Germans they made efforts to prepare Tanganyika Mineralogic map and undertook efforts to establish Geological Survey of Tanganyika (GST) that was officially introduced

during the transition from Germany to British from 1920 till 1950. The highest production of gold before independence reached up to 4 tons annually and was at the tame gold was contributing over 80 percent of mineral exports. In terms of production as indicated Gold was the leading mineral production of all times. The production between 1930 till 1944 reached to a peak of 4.41 tons in 1941. The disruptions caused by the World War saw production falling massively to 1 ton and gradually recovered. It raised up to 3.21 tons in 1960. During the British rule economic development was not a top priority but rather creation of trade links especially sourcing and export of agricultural processed raw materials (coffee, sisal, tea, cotton, tobacco, cashew) was the main focus. This led to a shar decline of production of minerals and contribution of mining to the economy. The only addition in the mining after the British is perhaps emergency of Williamson Diamond mine in Mwadui. When Mwadui mine became operational within short period of time Diamond became the major source of mining sector contribution and the leader in foreign exchange contribution as well as sector contribution to GDP Growth.

The other remarkable change in the sector set in after Independence. Initially there were no marked changes but from 1967 when Arusha declaration became prominent, major means of production including mines were placed under state-controlled institutions. Like in other sectors of the economy, Arusha declaration aimed to consolidate state control in the mining sector. State Mining Corporation (STAMICO) emerged as a monopoly and state holding company to oversee mineral sector development in Tanzania. The company-controlled 50 percent of Williamson Diamond mine, 100 percent of Diamond Cutting enterprise, 83 percent of Nyanza Salt Mines Limited, 100 percent of Portland Cement Company and 57 percent of Tanganyika Meerschaum Corporation. Other companies acquired or set up as new establishments were Backreef Gold Mining, Minjingu Phosphates Company, Songwe Kiwira Colliery, Kahama Gold Mines and Pugu Kaoline.

Thus, in brief the implementation of the Spirit of Arusha Declaration of 1967, the state led STAMICO, progressively took over the national mining related activities to the extent that by the late 1970s the foreign investors along with the Private sector had all disappeared in this sector. Even after the changes following implementation of Arusha declaration Diamond remained the leading mineral for quite some time. As indicated above STAMICO was owning 50 percent of the shares of Mwadui. The remaining 50 percent was owned by Willcroft Company Limited of Bermuda a subsidiary of the South African diamond and trading giant De Beers Consolidated Diamond Mines Limited. While the Management was 100 percent Tanzanians the Board was 50 percent Willcroft nominees. Initially there were some continuities of good performance but in a short while the mine started experiencing problems of production. This sets in period of prolonged annual losses accumulated in consecutive years. The years were in span of 5 to 10 years leading to acute production crisis.

Table 1: Trends in Mining Production 1975-1985

Mineral	Measure	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Diamond	000 Gram	89.6	86.3	101.6	59.0	68.4	54.2	56.9	59.4	42.9	55.3	43.4
Salt	000Tani	44.3	46.4	39.1	34.0	34.4	37.0	42.2	32.1	29.7	29.9	31.6
Precious Stone	00 Gram	13.9	280.0	95.1	31.3	1,011.4	1,042.6	1,202.9	5.6	10,121.1	388.8	218.3
Tin	Tan	32.3	1.6	-	13.8	18.8	10.6	17.6	10.0	2.2	0.3	1.8
Gold	000 Gram	2.5	0.3	-	-	8.9	2.1	5.5	6.9	24.1	39.3	42.3
Ulanga	Tan	6.2	9.9	5.4	14.7	8.6	3.7	6.5	1.2	1.3	1.0	0.3
Gypsum	000 tan	12.8	57.1	1.2	23.3	10.0	9.7	12.3	16.0	6.8	7.6	14.4
Kaolin	000 Tan	1.0	2.4	-	7.3	1.2	7.4	2.7	2.8	1.6	1.7	1.6
Calcite	000 Tan	5.4	6.8	13.0	1.1	1.2	2.7	2.5	2.2	2.3	2.2	3.5
Coal	000 Tan	0.9	0.8	2.0	6.6	5.6	2.4	6.1	10.8	10.0	8.2	6.6
Magnesite	000 Tan	-	19.0	-	23.0	10.0	-	-	-	-	-	-
Luhi na vito vya naksi Artistone	Tan	31.9	1.2	9.5	84.9	148.0	-	-	-	-	-	-
Anmathystone quarts	Tan	70.1	2.5	3.2	3.0	53.0	-	-	-	-	-	-
Fenda iliyochuja	000 Gram	-	-	-	-	-	-	-	-	-	-	-
Tungstem Concentrates	Tan	0.1	-	-	-	-	10.4	17.6	-	-	-	-
Bentonite and Sepiolite	Tan	-	-	-	-	-	-	-	-	-	-	-
Meerchaun	tani	-	-	-	-	4.0	-	-	-	-	-	-
Glass Sand	000 Tani	28.9	9.2	-	10.7	4.5	17.4	14.8	11.5	4.2	10.0	9.3
Lime	000 Tani	0.5	5.9	5.5	5.8	22.0	6.8	5.2	449.3	260.1	138.8	247.0

Nationalization of the mining sector and STAMICO in particular was facing challenges in many areas, for instance Tanzania Saruji Corporation- a parastatal that was responsible for overseeing three cement plants Tanga Cement, Wazo Hill and Mbeya Cement was in difficult condition. Production in all these plants was also facing series of challenges to the extent that it failed to supply some traditional markets including exports. There were many reasons but in short economic crisis of the mid 1970s till early 1980s led to sustained production problems that emanated in the form of frequent closure due to lack of foreign exchange to buy spare parts, electricity and water shortages along with other economic problems. In the efforts to diversify and sustain import substitution strategy, Government subsidiary companies for producing construction materials such as Ceramics in Morogoro, Sheet glass Mbagala, and container glass Nyanza as well. Likewise, series of production and market related challenges faced ambitious projects of Saruji in this area. The production relied on imported soda ash and cullet. The major economic crisis of the 1980s was associated with huge shortage of foreign exchange. Hence production was disrupted by lack of raw materials as there was no foreign exchange to import such raw materials. Besides declining economic activities in other sectors of the economy also added to the observed challenges. Most of the projects that were major source of the market for construction materials stopped by postponement, delay or even suspension after the economic crisis. A major constraint to glass production is the lack of a domestic supply of soda ash and cullet, which have to be imported.

Therefore, production of gold in post-independence did not fare well. Following closure of private mines and consolidation of all mines to STAMICO production fell sharply to less than 1 ton and hit the lowest production in the early 1980s. The problem in the gold sub sector had two dimensions internal and external. While the internal factors were closely the same observed in managing other parastatals, the external factors were mainly driven by dynamics an unpredictability of the global market. The crush of gold standards following the Israel, Egypt War, Oil crisis of 1970s and introduction of Petro dollar System But immediately during the same period of early 1970s gold went onto the open market and this led to skyrocket rise in the price of gold almost nine-fold reaching all-time high of 27.41987 USD per gram in 1980. The absence of local capacity and preparedness gold production in Tanzania could not benefit from the dramatic increase in real price of gold. Instead by 1989 the registered official registered gold was just 116 kilograms (0.01 Tons). Immediately there was rapid growth of smuggling, black markets of precious stones and emerging mineral rushes in areas that were historically earmarked as potential mining areas including the greenstone gold belt in the Lake Zone.

The mineral baseline survey by Phillips *et al* (1997) estimated that Smuggling of Gold was at about 6 tones from mine rush that employed between 300,000 to 500,000 thousand in a wide range of mining sites in Tanzania. Though one would argue about economic impact in terms of livelihood improvement and sources of income for the people involved in mineral rush the Macro economic impact was not e reflection of the national wealth. There was a denied huge sum of foreign exchange, Government Revenue in form of various forms of taxes fees and other duties. In an effort to fight smuggling and mobilize gold the Bank of Tanzania in from April in the year 1990 embarked on gold buying business based on the parallel price. Such policy allowed the Bank of Tanzania to buy gold directly from miners and licensed dealers conditional that sellers were allowed 70 percent retention of foreign exchange as long as would sell at least 100 grams. The aim was to eliminate the black market, stimulate artisanal miners to graduate to the level of small scale and organized medium scale miners. However, there was lack of preparedness and experience to operate in mining sector as the Bank frequently faced the challenge of buying fake gold with huge economic loss hence this business was suspended. In mid 1990s especially during the third phase Government it was agreed that Mining sector be one of the potential avenues of economic diversification. One of the key arguments for this innovative economic turn -around was that despite low level of economic contribution to the sector, the performance was not reflecting declining deposits but rather weak institutional set up, policy and

legal framework. It was established that in nearly are areas previously mined minerals did not reach to extension but rather it was due to price mis alignment and other problems related to production management and administration that equally affected most of the parastatals at that time. Hence the Government under the Leadership of President Benjamin William Mkapa embarked on Mineral Sector Reform Program.

Following poor performance of mining sector in particular and economy as a whole, Government introduced major economic reforms from the mid-1980s. This is the period marked by comprehensive economic reforms, aimed at moving away from state control towards a market economy. These reforms were far reaching and entailed acritical review and drastic change in economic management as well as social and political changes aimed at encouraging liberal participatory and encouraging all actors of the economy to participate in economic transformation social and political activities. The mining sector was particularly influenced by reform measures such as decentralization of mineral prospecting, exploration, exploitation and overall private sector participation. In the above section we saw how STAMICO monopoly was prominent and widespread over two decades from early 1960s. The economic activities within the sector were concentrated or consolidated to STAMICO from the mid-1960s hence led to expansion of activities which were highly controlled under one umbrella-STAMICO. Marketing of gemstones, cutting, and export went through state-controlled system. Poor performance and consecutive huge losses of the parastatals charged with mining activities was partly the reason why government had to frequently subsidize activities of STAMICO and the related organizations. Since one of the major reform measures was to cut subsidies to parastatals, most of them including mining related parastatals could no longer sustain themselves leading to either shut down, sale of shares, privatization or wholly sold out. Besides the reforms invited more private sector participation from both local and international companies.

The reforms targeted ending state control in all markets including foreign exchange market controls by allowing interbank foreign exchange market that allowed market-based exchange rate determination instead of fixed exchange rate. Such measure influenced mineral market in different ways. Empirical studies see for example Sezinga, 1997. Phillips 1998 indicated how black market was too big in mineral marketing partly due to foreign exchange misalignment and significant difference in prices within official and black market for foreign exchange. Liberalization of product market allowed free movement of goods within and across Tanzania which changed expenditure patterns of mineral dealers and brokers. To ensure a conducive environment for private sector participation the government formulated Mineral Policy of 1997 followed by the Mineral Act of 1998. The mineral Act provided legal basis for liberalization of opportunities in the mineral sector investment. In particular it provided special incentives to investors in the mineral sector, assurance investment protection and insurance by observing and abiding to internationally acceptable investment regime. Despite this mineral sector specific investment climate Tanzania also assured international business community conducive investment climate by enacting Investment policy of 1996. Sequentially all sector specific policies and Acts were changed to catch up with new thinking and approach to economic management that was outward oriented, liberal, private sector led and well-defined government role in business and economic management while providing expectations from the private sector. Finally, the Development Vision 2025 was introduced as a road map to implement Tanzania long term development objectives. Trade liberalization has been aimed at increasing market competition for mineral products, and this may affect profitability, productivity and efficiency, all aspects that might also affect size of the sector measured by different attributes such as share to GDP, Foreign exchange contributions and other measures. Previously government could subsidize loss-making firms to the extent that a mineral related company contribution to the economy had little link with its profitability and overall performance. In the absence of subsidization, increased competition has encouraged and benefits some

well-established and experienced mineral firms (productive, efficient and competitive ones) and harms some (less productive, inefficient and uncompetitive ones) through affecting their ability to compete and some have been forced by economic and market forces to exit the mining sector. Following new direction of the entire economy and a series of reforms adopted especially in the mid-1990s the mineral sector of Tanzania adjusted to catch up with the changes. In particular the sector set a new vision of 25 to 30 years as; aim to have a strong, vibrant, well organized private sector led large and small-scale mining industry that observe environmental safety and sustainability. In terms of economic contribution, the mineral sector vision was set to ensure contribution to the share of GDP in excess of 10 percent, a well-developed gemstone Centre for Africa and having mining sector that provide reliable employment.

In many respects there are evidences of remarkable positive impact of the reforms. Following liberalization and promotion of large scale mines the sector has benefited from macroeconomic impact as well as linkage and forward -backward indirect effects. The sector contribution has increased from about 1 percent before the reforms to nearly 10 percent recently and export contribution has increased from us dollar 26 million in 1997 to 2.9 billion by 2023. Besides mining sector contributes the largest share of taxes with Geita Gold Mine among the largest tax payers. Apart from attracting large scale multinational investors the reforms also targeted improvement of artisanal and small-scale miners. The impact is also quite substantially positive. Improved mineral market has enabled increased volume of small scale production. To date they contribute around 40 percent of gold.

Lastly, recent development of rate earth and critical minerals has enabled conclusion of attracting some major projects. The Ngualla Rare Earth Project (Ngualla Project), whose construction is expected to cost approximately $320 million (about Sh736 billion), has received impetus to begin implementation after the company signed Contract 2022. Also Tanzania has signed agreements worth a total of $667m with three Australian companies for the development of rare earth minerals and graphite projects, further signed with Evolution Energy Minerals, Ecograf and Peak Rare Earths agreements that form part of Tanzania's efforts to advance negotiations on long-delayed mining and energy projects. Evolution Energy Minerals has signed agreements related to the arrangements regarding the ownership and development of its Chilalo Graphite Project. EcoGraf has signed an agreement with the Tanzanian government for the development and operation of the Epanko Graphite Project. It follows therefore that, after focusing on agro processing industrialization for a while now we have a backup from mineral based industrialization.

Qualitative analysis of trends in production of mineral products is provided in tables 1, 2 and 3. Table 1 indicates production from 1975 till 1985. Taking Gold and diamond as reference products it is observed that production of gold fell drastically from 2 tons in the late 1950s reaching just 2.5 Kilograms in 1975. The highest production in 10 years was in 1985 when it reached 42 kilograms. Diamond production was also at 106 Kilograms.

Table 2: Trends in Mining Production 1998-2007

Mineral	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Diamonds	Carats	97830	235000	354388	254271	239761	236582	303920	219639	272204	282786
Gold	Kgs	4270	4890	15060	30088	43320	48018	48176	52236	39750	40193
Gemstones	Kgs	48518	95200	150800	96866	195842	1531547	1613848	1936618	2493133	2063272
Salt	Ton	75000	35893	70000	65000	71200	58978	57062	135410	34798	35224
Phosphate	Ton	1431	7250	5100	4000	1182	3738	6570	7096	2881	8261
Limestone	000 Ton	1181	1241	1500	2269	2857	1206	1391	2780	1608	1322
Tin Ore	Ton	-	-	-	-	-	-	-	-	-	-
Gypsum	Ton	59066	21195	60000	72000	73000	33232	59231	63377	32798	2730
Coal	Ton	45073	75044	79184	77789	79210	54610	65041	74800	17940	27198
Pozolana	Ton	-	2274	57014	41468	52000	105910	152679	163499	129295	184070
Kaolin	Ton	-	-	-	-	-	-	-	-	-	1020
Silver ore	Kgs	-	-	-	6681	7669	7986	13216	12891	14906	12381
Copper	Pound	-	-	-	5832158	9309812	8191035	9348181	7632959	7241639	7222390
Bauxite	Ton	-	-	-	-	-	-	-	1640	5373	5003

Source: Minerals Department
* Provisional data
- Not available
Carat = 0.205 gms

Table 2 which corresponds to the reform era reveals that production of gold was 4.2 Tons, increased rapidly reaching 40 tons in 2007. Diamond also increased steadily from 97,830 carats in 1977 up to 282,830 carats in 2007. The most recent trends from 2015 till 2022 are very impressive in nearly all mineral products. Gold production has reached about 60 tons which represent 15-fold or 1,500 percentage increase. Diamonds production by 2022 has reached 442.016 carats which is 4.5-fold increase from 1997 or 450 percent. This partly explain why share to GDP contribution of mining sector has jumped from about 1 percent during the pre-reforms reaching 10 percent in recent years. Recent move of economic diplomacy and investment promotion led by Her Excellency Samia Suluhu Hassan has turned around the Mining Sector. Most of the investors have responded to assurance and encouragement of private sector amid the implementation of economic diplomacy. Hence we have witnessed new investment and completion of investment within the value chain such as Gold refinery. We have witnessed increased investment in Value addition via setting up of Mwanza Precious Metal Refinery, Geita Gold Refinery. Total production of Gold is estimated at over 60 tons annually. Hence there is a potential for Tanzania becoming a Regional Centre of Gold Mining and Processing.

In connection to recent development mentioned above, there is a new mine between Geita and Sengerema (Nyanzaga) is under preparation. This will be one of the largest Gold mines in Africa. The combined Probable Ore Reserve is 40.08 Mt at 2.02 g/t Au for 2.60 Moz. The production schedule of 42.51 Mt @ 2.07 g/t gold for 2.83 Moz contained gold, comprising the Probable Ore Reserve plus Inferred Mineral Resources of 2.42 Mt at 2.95 g/t for 0.23 Moz contained gold. Reforms in small scale mining have also been part of the turnaround strategy of Her Excellency Dr Samia Suluhu Hassan. Specifically setting up of laboratory, provision of prospecting services to small scale miners and improvement of market for small scale miners. This is set to increase even further in future if consistently exploration and prospecting dedicated to small scale miners shall continue. There is also need for science and technology institutions particularly vocational, technical and universities to design pragmatic programs for intervention in improving productivity in small scale mining as poor methods of mining and equipment leads to over 60 percent wastes or losses.

Table 3: Trends in Mineral Production 2015-2022

Mineral	Measure	2015	2016	2017	2018	2019	2020	2021	2022
Diamond	Carat	216,491	237,685	304,456	381,302	416,750	147,191	62,454	442,016.26
Gold	Kg	43,293	45,155	43,490	39,304	48,408	55,805	59,368	56,942.98
Tanzanite raw	Kg	-	-	-	-	-	51,542	177,144.50	14,487.48
Tanzanite processed	Carat	-	-	-	-	-	118,773	120,458	57,864.28
Gemstones	Kg	1,872,915	2,554,932	1,185,697	284,321	1,929,714	23,564,525	7,197,217	12,752,079.67
Salt	Tan	92,158	145,718	100,017	36,392	99,510	83,974	112,995	181,818.07
Phosphate	Tan	222,800	23,358	1,351	-	-	28,376	24,493	26,596.79
Limestone	000 Tan	2,945	4,170	3,301	2,944	5,527	6,788	8,506	7,741,287.64
Tin	Tan	179	138	91	8	24	47	211	538.17
Jasi	Tan	239,302	213,744	123,645	241,260	256,529	443,926	498,053	604,407,91
Coal	Tan	257,321	276,030	563,053	627,652	712,136	689,959	976,319	2,511,419.40
Pozolana	Tan	342,628	230,045	79,085	91 ,645	263,064	160,078	216,934	226,038.26
Kaolin	Tan	1,953	656	13,816	129,383	15,343	98,454	100,950	46,973.44
Silver	Kg	15,569	17,984	10,911	12,041	12,550	13,187	9,324	13,602.43
Bronze	Pound	14,252,341	15,762,430	2,933,941	-	-	3,761,086	3,352,630	6,827,930.74
Iron	Tan						28,431	78,190	51,071.14
Bauxite	Tan	204,956	72,779	12,090	7,140	-	25,995	38,142	40,920.98
Concrete	000 Tan	12,960	15,460	5,601		20,188	31,892	32,304	37,498.03
Other industrial							2,161	1,037	14,471.17
Metallic	-	-	-	-	-	-	-	-	60,074.75
Iron wastes	-	-	-	-	-	-	33,377	-	2,013.26
Copper ore	-	-	-	-	-	-	1,205	-	6,623.58

Note: (-) means not available.

4. Methodology and Data Analysis Techniques

This section set out to establish the long run correlation between mining and economic development by considering an array of macroeconomic indicators. Main objective as highlighted before is to ascertain to whether and to what extent trends and dynamics that influenced long run behavior of the mining sector of Tanzania had an implication on observed economic growth and development of the sector specific and generally the national development generally. One of the major aspects of mineral sector development is the capacity to influence development of associated sectors. The discussion above has shown how Gold was the major contributor to mineral export and balance of trade equalizing factor during the Germany era, then how Diamond took over during the British and some few years after independence, and the recent come back with a big bang of Gold after the reforms and currently when Gold remain the major exporter of mineral products as well as total exports.

Recent development in industrial minerals have seen emerging mineral-based manufacturing that are at global standards, such as glass making factories, fertilizers, cement, and others. The recent entrance of RARE Earth elements as upcoming source of raw materials and new investment venture in mining sector of Tanzania brings in an important question, Thus, using mining products as raw materials in manufacturing it is most likely to observe rapid growth of manufacturing sector based on industrial minerals. This is possible if we can establish any long run correlation between mining and manufacturing. Given data availability and need to manage precision of coefficient estimates we consider the relationship between mining, export and manufacturing in relation to GDP. Long span of data available be is from the national bureau of statistics of Tanzania. In terms of specification the section uses an economic growth model framework to estimates the Error Correction Model [ECM].

4.1 Theoretical Framework

In this section, the paper descries a theoretical framework that displays the whole concept of cointegration. This is in turns, helps the subsequent estimates of the paper. To describe the framework, let $(y_{it}, \dots, y_{nt})'$ denote an $(n \times 1)$ vector of I (1) time series is cointegrated if there exists an $(n \times 1)$ vector $\beta = (\beta_1, \dots, \beta_n)'$ such that:

$$\beta' Y_t = \beta_1 y_{it} + \cdots + \beta_n y_{it} \sim I(0) \qquad (1)$$

In other words, the nonstationary time series in Y_t are cointegrated if there is a linear combination of then that is stationary or I (0). If some elements non-zero coefficients is cointegrated. The linear $\beta' Y_t$ combination is often relationship. The intuition is that I (1) time series Y_t with a long-run equilibrium relationship cannot drift too far apart from the equilibrium because economic forces will act to restore the equilibrium relationship. In this paper a long run relationship between export and growth is assessed with the possible cointegration between the two variables in mind.

In practice there are various forms of cointegration. The most significant that might be relevant for this paper are two; the normalization and the fact that cointegration can exhibit a common trend. In the case of cointegration one might consider the cointegration vector β is not unique since for any scalar c the linear combination $c\beta' Y_t = \beta^{*\prime} Y \sim I(0)$, Hence, some normalization assumption is required to uniquely identify β. A typical normalization is

$$\beta = (1, -\beta_2, \dots, \beta_n)'$$

so that the cointegration relationship may be expressed as:

$$\beta' Y_t = y_{it} - \beta_2 y_{2t} - \cdots - \beta_n y_{nt} \sim I(0)$$

Or

$$y_{it} = \beta_2 y_{2t} + \cdots + \beta_n y_{nt} + \mu_t \qquad (2)$$

Where $\mu_t \sim I(0)$. In (2), the error term $\mu_t$is often referred to as the disequilibrium error or the cointegrating residual. In long-run equilibrium, the disequilibrium error $\mu_t$is zero and the long-run equilibrium relationship is:

$$y_{it} = \beta_2 y_{2t} + \cdots + \beta_n y_{nt}$$

In the case of multiple cointegration relationships, if the $n \times 1$ vector y_t is cointegrated there may be $0 < r < n$ linearly independent cointegrating vectors. For example, let n = 3 and suppose there are r = 2 cointegrating vectors $\beta_1 = (\beta_{11}, \beta_{12}, \beta_{13})'$and $\beta_2 = (\beta_{21}, \beta_{22}, \beta_{23})'$. Then, $\beta_1' Y_t = \beta_{11} y_{1t} + \beta_{12} y_{2t} + \beta_{13} y_{3t} \sim I(0)$, $\beta_2' Y_t = \beta_{21} y_{1t} + \beta_{22} y_{2t} + \beta_{23} y_{3t} \sim I(0)$ and the (3×2) matrix

$$B' = \begin{pmatrix} \beta_1' \\ \beta_2' \end{pmatrix} = \begin{pmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \end{pmatrix}$$

forms a basis for the space of cointegrating vectors. The linearly independent vectors $\beta_1$and $\beta_2$in the cointegrating basis B are not unique unless some normalization assumptions are made. Furthermore, any linear combination of $\beta_1$and β_2, e.g. $\beta_3 = c_1\beta_1 + c_2\beta_2$, where c_1 and $c_2$are constants, is also a cointegrating vector. This cointegration relationship may be represented as as:

$$y_{it} = \beta_2 \sum_{s=1}^{t} \varepsilon_{1s} + \varepsilon_{3t}$$

$$y_{2t} = \sum_{s=1}^{t} \varepsilon_{1s} + \varepsilon_{2t}$$

The common stochastic trend is $\sum_{s=1}^{t} \varepsilon_{1s}$. Notice that the cointegrating relationship annihilates the common stochastic trend:

$$\beta' Y_t = \beta_2 \sum_{s=1}^{t} \varepsilon_{1s} + \varepsilon_{3t} - \beta_2 \left(\sum_{s=1}^{t} \varepsilon_{1s} + \varepsilon_{2t} \right) = \varepsilon_{3t} - \beta_2 \varepsilon_{2t} \sim I(0)$$

In this paper a long run relationship between mining activities and observed economic performance is assessed with the possible cointegration between the two variables in mind. As we saw during the Germany era Gold was a driving force of Exports, the collapse of Gold and emergency of Diamond during the British Rule and a few years after Independence show robust impact of diamond on total Exports. Shrinking of the Mining Sector during the period of economic crisis highly reflect fall in Exports while the recent rapid growth and good performance in manufacturing indicates how Gold has been a driving force of our overall merchandize exports. These are some of the features we expect to influence the estimated

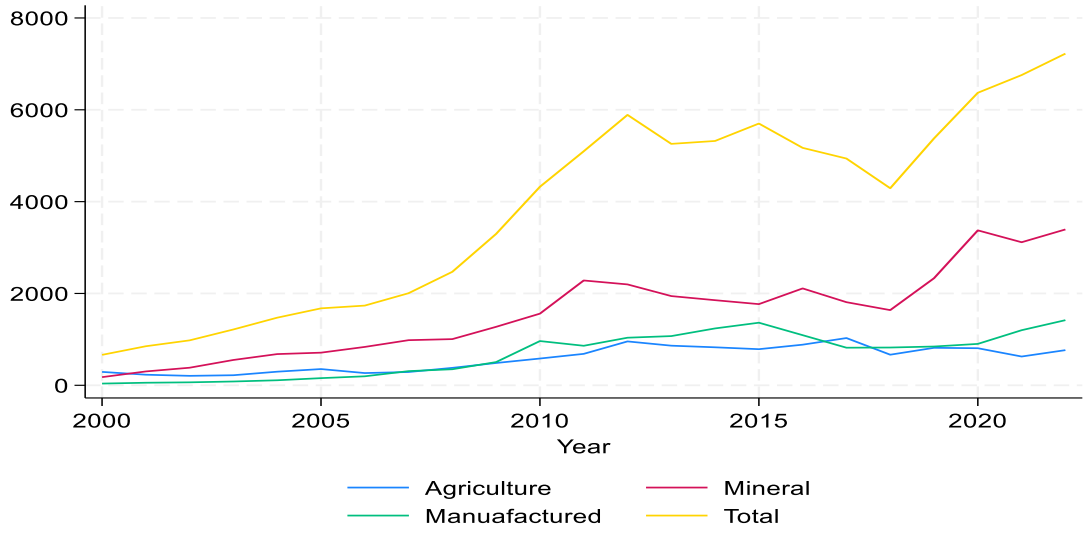
5. Empirical Results and Discussion

The previous sections have so far made use of qualitative and descriptive statistics to track trends and evolution of mining sector in Tanzania. In this section we use time series data from 1966 up to 2022 to estimate time series econometrics models. In so doing we first aim to establish a long run relationship -Cointegration between Mineral Exports with Total Exports, and also examine long run relationship between Mining Sector Contribution to GDP and Total GDP

5.1 Data analysis and interpretation

In figure 2 below, the paper presents graphical comparison and assessment of trends in sectors related to mining in the economy, namely; agriculture, manufacturing and mining. Trends confirm extraordinary growth in export contribution of mining exports. It will be recalled that prior to reforms in 1997 mining sector contributed to just 1 percent to total export. Growth in mining activities witnessed in the past two decades has seen jump in export contribution. Currently mining export provides over 50 percent of total merchandize export hence the leading export. In recent years, there has been a rise in mineral exploration in a number of regions around the country. The market has seen a significant influx of fresh investment from outside in mineral development exploration, while domestic investment has surpassed one billion dollars. Recent discoveries of nickel, helium, graphite, uranium, and coal have piqued the curiosity of financial backers to a greater degree.

Figure 2: Trend of Agriculture export, manufactured export, minerals export, and total export



Source: Authors computation from Bank of Tanzania's data.

5.2 Long run relationship -Cointegration between Mineral Exports with Total Exports

The results in tables 4 and 5 indicate that there is significant long-run and short-run relationship between minerals export and total export. From table 4, the regression results indicate that we can reject the null hypothesis, such that, the coefficient of minerals export is statistically significant at all levels which means a 1 percent increase in mineral export will lead to a 0.427 percentage increase of total export in the long run. The coefficient of the error correction term (ECT) is -0.772. The residual term shows the speed of convergence to equilibrium, such that any disequilibrium in the economy will be corrected in the long run by 77.2 percent.

Table 4: Long run regression results

Log Total Export	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
log Mineral	.427	.044	9.76	0.000	.336	.519	***
log Manufactured	.239	.037	6.42	0.000	.161	.317	***
Log Agriculture	.267	.046	5.86	0.000	.172	.363	***
Constant	1.875	.24	7.81	0.000	1.372	2.378	***

Mean dependent var	8.034	SD dependent var	0.745
R-squared	0.997	Number of obs	23
F-test	1875.004	Prob > F	0.000
Akaike crit. (AIC)	-72.258	Bayesian crit. (BIC)	-67.716

*** p<.01, ** p<.05, * p<.1

Table 5: Error correction model regression results

D.logTotal	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
D.logMineral	.397	.058	6.82	0.000	.274	.52	***
D.logManufactured	.277	.048	5.73	0.000	.175	.379	***
D.logAgriculture	.242	.049	4.96	0.000	.139	.345	***
ECT_1	-.772	.248	-3.11	0.006	-1.295	-.248	***
Constant	-.002	.014	-0.12	0.904	-.031	.028	

Mean dependent var	0.109	SD dependent var	0.125
R-squared	0.888	Number of obs	22
F-test	33.788	Prob > F	0.000
Akaike crit. (AIC)	-68.187	Bayesian crit. (BIC)	-62.732

*** p<.01, ** p<.05, * p<.1*

Table 6: Estimates of Manufacture vs Agriculture

log Manufactured	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Log Agriculture	1.987	.192	10.33	0.000	1.587	2.387	***
Constant	-6.333	1.204	-5.26	0.000	-8.836	-3.83	***

Mean dependent var	6.057	SD dependent var	1.175
R-squared	0.836	Number of obs	23
F-test	106.721	Prob > F	0.000
Akaike crit. (AIC)	34.152	Bayesian crit. (BIC)	36.423

*** p<.01, ** p<.05, * p<.1*

5.3 Correlation

Table 7: Correlation between Variables

Variables	(1)	(2)	(3)	(4)
(1) lnTotal_GDP	1.000			
(2) lnAgric_GDP	0.999	1.000		
(3) lnMine_GDP	0.993	0.990	1.000	
(4) lnManu_GDP	1.000	0.999	0.993	1.000

From Table 7, the Pearson correlation coefficient shows a strong correlation between manufacturing, mineral, and agriculture on economic growth variable.

5.4 Long run relationship between Mining Sector Contribution to GDP and Total GDP

The results in Table 8 show that there are both short-run and long-run relationships. In the short run, the main driver of the performance of GDP was revealed to be agriculture. Using the t-test statistic, which is the test for individual significance of the variable, agriculture is statistically significant at 5 percent, which leads to rejection of the null hypothesis that there is zero significant relationships between the two. This means that a percentage change in Agriculture GDP will lead to an increase in Total GDP by 0.311 percent in the short run. This seems to be a very small impact, but it is true that the growth in agriculture is gradually evolving. The contribution may be very small from time to time, but it is significant. This may be due to the nature of agriculture production that is being practiced, i.e., informal agriculture and therefore making it hard to be counted in the GDP growth.

In the long run, as well the minerals sector has a significant effect on GDP. It is statistically significant at 1 percent significance level. The 1 percent increase in minerals production causes an increase of 16.3 percent in GDP. From the results in Table 8, the coefficient for the error-correcting term (**ADJ** *lnTotal_GDP*) is -0.344, and statistically significant at 5 percent. This means the system is adjusting from disequilibrium to equilibrium and the speed of adjustment towards equilibrium is about 34.4 percent. It may take longer to adjust, but it will come to rest at the equilibrium, which is why it is called a long-run equilibrium.

Table 8: ARDL Error Correction Model Results

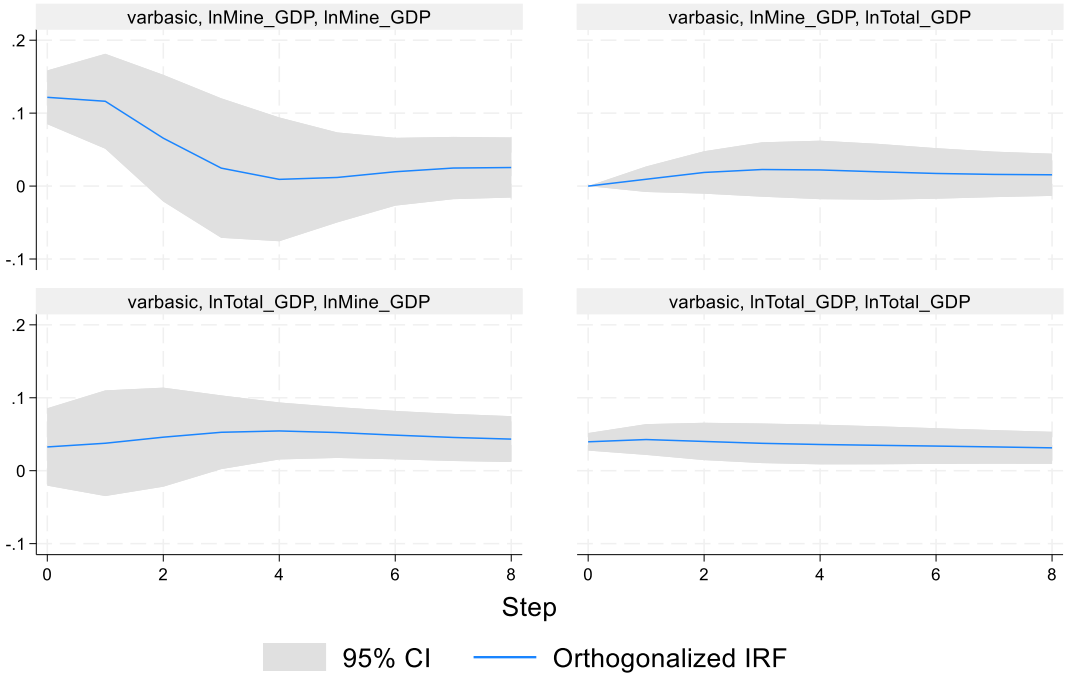
VARIABLES	ADJ	LR	SR
lnAgric_GDP		0.757***	
		(0.105)	
lnMine_GDP		0.163**	
		(0.0718)	
L.lnTotal_GDP	-0.344**		
	(0.129)		
D.lnAgric_GDP			0.311**
			(0.132)
Constant			1.047***
			(0.340)
Observations	22	22	22
R-squared	0.884	0.884	0.884

5.4 Impulse response function

These models do not provide any helpful information regarding the dynamic response of one variable to unit shocks in another variable.[3] Despite the fact that the ARDL models are presented as a dependable method to investigate the co-integration between variables, these models do not provide any such information. We make use of the impulse response function so that we may get around this constraint (IRF).

[3] Lütkepohl, H. *Introduction to Multiple Time Series Analysis*; Springer Science & Business Media: Berlin, Germany, 2013

Figure 3: Impulse Response Function



The IRFs graph places one impulse in each row and one response variable in each column. The horizontal axis for each graph is in the unit of time that the VAR is estimated in, in this case is years. Hence, IRFs graph shows the effect of shocks over a 1-year period. The vertical axis is in unit of the variables in the VAR; in this case, everything is measured on percentage points, so the vertical units in all panels are percentage point changes.

The first row shows the effect of a one-standard-deviation impulse to the mining GDP equation. The minerals GDP decrease until 5 period and then elevated. The minerals GDP rises for about 4 periods, peaking about nearly 0.01 percentage point increases, before declining slowly.

Table 9: ARDL Error Correction Model Results

VARIABLES	ADJ	LR	SR
L.lnManu_GDP	-0.209*		
	(0.118)		
lnAgric_GDP		0.965***	
		(0.0386)	
D.lnAgric_GDP			0.413***
			(0.131)
Constant			-0.0728
			(0.193)
Observations	22	22	22
R-squared	0.857	0.857	0.857

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

This section presents results for assessing whether or not there is a long run relationship between observed mining sector GDP share and growth in Tanzania GDP. The data available for the assessment is from Annual Surveys of Industrial Production of Tanzania supplemented with other sources especially the statistical abstracts issued by the National Bureau of Statistics. The data are from 1966 till 2023. The findings in the table below provide a unit root test for stationarity. The tests consider both the level and the differences of all key variables in the model estimated. The paper employs the famous Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) unit- root tests. Based on the results indicated in the table below the paper fails to reject the existence of unit roots. In this respect it is an evidence of non-stationarity, at least in the levels of the log of Mining share to GDP, Log of GDP growth, Log of Manufacturing GDP and Log of Agriculture GDP. This call for considering the second level differences that confirms stationarity. In the table 10 the paper introduces the Phillips –Perron (PP) unit-root test. Using this test it is easier to see that all the variables are stationary in both levels and differences. It follows therefore that the variables in the model estimated are integrated of order 1.

Table 10: DF-ADF Unit Root Tests for Stationarity

		DR		ADF (1)	
Variable	**Levels or First Diff.**	**Without Trend**	**With Trend**	**Without Trend**	**With Trend**
Log GDP	Levels	-0.40	-2.16	-0.22	-2.66
	First Diff.	-5.52	-5.33	-2.18	-2.10
LMinerlGDP	Levels	-2.91	-4.06	-2.39	-5.63
	First Diff.	-3.09	-3.18	-3.11	-3.56
	Second Diff	-4.99	-5.36	-5.76	-5.27
L.ManufGDP	Levels	-3.65	-2.11	-2.09	-2.34
	First Diff.	-3.28	-2.42	-2.17	-1.73
	Second Diff	-5.14	-6.38	-4.34	-4.04
Log Exp	Levels	-0.89	-2.22	-0.90	-2.53
	First Diff.	-5.12	-5.10	-2.22	-2.85
LMiner Exp	Levels	-3.18	-2.00	-3.53	-2.63
	First Diff.	-4.39	-5.55	-2.20	-2.30
L.ManufExp	Levels	-0.11	-2.20	-0.46	-2.42
	First Diff.	-3.73	-3.99	-2.98	-2.18

Notes:

(i) 96% critical values for DF & ADF statistics (variables in level) -3.01 (without trend) 7 -3.65 (with trend).

(ii) 95% critical for DF & ADF statistics (variables in first df.) = -3.02 (without trend) &-3.66 (with trend).

Table 11: DF-ADF Unit Root Tests for Stationarity

Variable	Levels or First Diff.	Constant No Trend	Constant Trend
Log GDP	Levels	-0.56	-2.82
	First Diff.	-5.85	-5.00
	Levels	-2.37	-2.75
LMinerlGDP	First Diff.	-2.73	-3.88
	Second Diff	-5.33	-5.39
	Differences		
	Levels	-3.69	-2.10
L.ManufGDP	First Diff.	-2.05	-2.89
	Second Diff	-6.11	-6.44
	Differences		
	Levels	-0.77	-3.55
Log Exp	First Diff.	-5.57	-5.12
	Levels	-2.83	-1.79
L.ManufExp	First Diff.	-5.38	-6.28
	Levels	-0.95	-1.53
	First Diff.	-4.88	-4.48

Note: (i) The critical values for PP statistic at 95 per cent level are -2.90 (for constant and no trend) and -3.46 (for constant and trend).

It will be recalled that in the previous stage the paper focused on assessing whether or not the variables in our model are integrated. The findings were that all the six variables are integrated of order one. Since the variables are integrated estimation of ordinary least square result into biased estimates as we do not correct for errors that lead to reporting spurious regressions. We avoid that by estimating Error Correction model as presented above.

7. Summary, Conclusion and Recommendation

This paper set out to examine evolution of mining sector of Tanzania over the period extending from 1898 till recent times with cut off dates of year 2022. To do so, both quantitative and qualitative information combined with descriptive and analytical models were used to establish long run behavior and relationship of mining variables within the observed economic performance for the entire study period. Assessment of the origin of mining activities in Tanzania confirms that mining started in 1898 when Germany colonial Government found economically feasible deposit of gold in Geita but declined after World War 1. When Tanzania got independence economic management system changed seven years later to adopt Socialism as the main mechanism for economic management. In mining sector STAMICO (State Mining Corporation) was formed. All large-scale mines were nationalized and small-scale mining disappeared. There was some stability in the first five years but later series of events led to consistent fall in production. Both diamond and gold lost their position in export contribution as traditional agricultural exports emerged as major export earners. Tracing from 2000 when Vision 2025 was adopted paper estimates show that the mining sector performance has been extraordinary from 1 percent in 1997 to 10 percent share of GDP by 2023 and export contribution has increased from us dollar 26 million in 1997 to 2.9 billion by 2023. Estimate of Cointegration models shows that the error correction term is correctly signed and statistically significant and, the coefficient of minerals export is statistically significant such that a 1 percent increase in mineral export will lead to a 0. 43 percentage increase of total export in the long run, with 77 percent speed of convergence to equilibrium. In terms of

contribution to GDP, the results show that 1 percent increase in minerals production lead to 0.16 percent increase of GDP. Further findings are that apart from recent extraordinary performance of mining sector the paper concludes that mining sector generally has potential to maximize gains from economic and social development whereas discovery of huge deposits of rare earth elements in Tanzania and availability of wide range of industrial mineral in nearly all regions of Tanzania have a potential of becoming a new backbone of Tanzania and enable manufacturing contribution to GDP of over 30 percent. Development of mining sector globally and regionally provides new opportunities. Tanzania is one of the 9 African Countries that are heavily endowed with rare earth elements.

One area of concern is limited exploration and prospecting activities in rare earth elements and other minerals. The potential for rare earth elements can be reaped through development of high-technology products such as cell phones, flat screen TVs, electric cars, airplane turbines along with advanced military weapons systems and hardware such as night vision goggles, laser range-finders. Hence the paper suggests that exportation of high value rare earth related manufacturing high tech will be the **GAME CHANGER** to Tanzania road of industrialization with biggest impact on economic and social development. The paper has demonstrated that in all regions of Tanzania there exists mining deposit of some sort. Furthermore, the paper recommends that LGAs be encouraged to invest in structures or shades for Special Economic Zones/ Export processing Zones adjacent and or connected to industrial minerals or rare earth elements, Further more LGAs integrate rare earth and industrial minerals into their priority development areas. To do so it is recommended that LGAs take stock and preliminary feasibility of needs and identify possible activities within value chain of rare earth and industrial minerals with a view of designing intervention for small and artisanal participants. The related recommendation is that Government adopts exploration and research funding on rare earth and industrial minerals as top strategy for promoting availability of raw materials and targeted investment promotion in this area. LGAs might be directed to set aside at least 5 percent of their collection budget.

Finally, the recent development in local capacity to refine gold is the biggest achievement of al times. Geita Gold refinery (GGR) has five international accreditations and collaborates with some of the global commodity exchange markets in United States and UK. This provides an opportunity for the Central Bank of Tanzania to join Value chain of mining and buy gold directly from the mining refinery like this one. It will be recalled that the previous attempt of 1994 to buy gold fell partly due to incidences of fake gold. With the new development know the central bank can purchase gold from the certified refineries and hence increase availability of foreign exchange. In sum the findings of the paper suggest that mining sector transformation will have the largest linkage and multiplier effect to the economy through benefitting all regions and cover numerous aspects of value chains with majority of youth women and other job seekers benefitting from the available opportunities. The industrial minerals, energy minerals combined with other precious stones will be key in attracting international investors to come and settle in Tanzania for value addition maximization. Trade policies are adopted to discourage export of primary products and encourage export of manufactured mineral products.

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