

Domino Effect: Analyzing the Impact of Mining to Regional Economy of Caraga, Philippines

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Abstract: *This study aimed to assess the controversial direct and indirect economic impacts of mining activities in Caraga region. Economic-Base and Input-Output model were used to classify and measures the magnitude of mining's contribution to regional economy as well as its forward, backward and total linkages to other industries. Based on the analysis, mining is a basic sector together with agriculture, electricity and education. The industry is considered as income and employment generating sector which directly and indirectly contributes to the economic growth and development of the region. Mining are strongly link to supply and demand side industries like manufacturing, wholesale, transportation, agriculture and electricity industries suggesting that mining is one of the key drivers of economic growth in the region.*

1. Introduction

The Philippines has been known as one of the largest reserves of equally diverse mineral resources like gold, copper, nickel, chromium, iron, bauxite, marble, and limestone in the world (Rovillos, Ramos and Corpus, 2003; Tujan and Guzman, 2002). The 9 million hectares potential mineral resources drives the government to promote more than 60 mining exploration and processing projects since 2004 which was forecasted to generate billions of dollars in investments (DENR-Mines and Geosciences Bureau Report, 2013).

The industry plays a significant complementary role in attaining industrial development in the country. Mining sector is believed to help in eradicating poverty as gold reserves alone can amount to more than seven trillion pesos or about seventy six percent of the gross domestic product (Senate Economic Planning Office Report, 2013).

However, despite its untapped economic potential, the industry is still surrounded with an avalanche of critics at global, national and local level. Some of the anti-mining groups claimed that the industry has not lived up to its potential. They argued that mining sector's contribution to the economy is negligible providing only less than a single percentage to Gross Domestic Product and to

the total employment (MGB, 2013; Habito, 2011 and Balisacan, 2011). In addition, mining failed to maximize its potentials because of the policies that delimit investments in expense of protecting the environment. This is one of the reasons why Philippines was sometimes ranked 66th out of 72 countries in terms of conduciveness of policies to mining investments (Policy Potential Index, 2009). Meanwhile, numerous local and national organizations (NGOs) in the country are continuously on the heels of mining companies trying to stop or discourage operations because of alleged environmental degradation and pollution that mining creates. Until now, mining are still confronted by many issues. In fact, in Caraga region, mining's contribution has been questioned due to its minimal trickle-down influence to regional employment and regional (Pagaran, 2007). This circumstance leads to a supposition that the region is a microcosm of what the Philippines is, in that it is abundant in natural resources but also in poverty.

These issues emerged due to the *knowledge gap* on mining sector's impacts to the economy. It simply implies that there are no systematic studies conducted in the region to assess and understand the diverse level of mining's contributions. Much of the studies focused only on direct economic impact and less emphasis has been given to indirect and/or induced effects of mining activities. The underlying information gap towards the economic impacts of mining is the center of interest on this study. The novelty of this study is that it considers both the observed and unseen contributions of mining operations to quantify its worthiness as key sector that pushes the community and its people towards bursting development.

2. Objectives

The current investigation is intended to assess the economic contributions of mining activities in Caraga region, Mindanao, Philippines.

Specifically, it aimed to:

- (a) classify mining industry and its impact to employment using the Economic-Based Model;
- (b) estimate the Type I multipliers of mining and its impact in terms of Final Demand

- to Output Multiplier, Total Employment Multiplier, Household Income Multiplier, Output to Output Multiplier;
- (c) estimate the backward, forward and total linkage indices of mining in the region.

3. Methodology

The predictive research design of quantitative research was employed to analyze the macroeconomic impact of mining to the economies of Caraga region. It is an applied form of research that finds out the multiplier effects of mining industry (Polit & Hungler, 1999). A non-survey technique of regional input-output analysis was utilized together with the disaggregated secondary data from the national IO table to generate the components of the regional IO table (Jensen, 1990). This was adopted in the absence of primary data of mining's transactions. All data was taken from the NSCB data bank at www.PSA-NSCB.org.ph. A series of analyses were applied in the assessment of mining's economic impact. This involved the construction of Caraga Region Single-region Input-Output Table; the preliminary analysis using Economic Based Model; the Type I multiplier analysis; and the linkages analysis.

4. Mining Industry Classification

Mining sector in Caraga Region, Philippines is classified as basic sector together with agriculture, electricity and education industries as signified by the relatively high LQ value which is equal to 4.83. This is an evidence of basic employment for mining industry in the region. It would suggest that mining is exporting extra supply of goods to non-local markets when local demand has been met. In addition, the analysis disclosed that the mining industry is composed of local miners, especially small-scales that are totally dependent upon external factors particularly on the inputs and technology requirements used in different stages of production. Lastly, this is a proof that mining products are usually exported-oriented and less dependent on the local demands.

The economic base findings emphasize the need to prioritize, strengthen mining industry to grow and concentrated further as it can be considered as one of the "drivers of economic growth and development" wherein competitive position of the region will establish. This sector has the ability to insulate itself from economic downturns in the region. The LQ assumptions for mining industry are a pre-requisite in the analysis of economic impact and the estimation of employment multiplier. Using the economic-base formula, it was discovered that this sector provide 19,000 jobs in the region of which, 15, 063.86 are basic jobs while the rest or 3,936.14 are non-basic jobs. The region also has a Base Multiplier

of 1.26 which implies that 26 jobs are created for every 100 basic jobs provided by the mining sector. An almost 2 percent multiplier effects of mining activities in the region is enough to consider that it is one of the industries the induced economic growth in Caraga region.

5. Estimated Economic Multipliers

Mining industry posted a 1.69072 final demand to output multiplier. This industry ranked 7 out of fourteen industries that have a greatest impact to the economy of the region. The multiplier suggests that for every 100 million pesos of investment on mining, approximately 169,072,480 million pesos will be added to the total output of the economy. This would mean that almost 70 percent of regional output increase can be attributed to any change in final demand of the industry. This amount probes that mining is a basic sector that has the capacity to help Caraga region improve further its economic pulse. Any policies, projects or programs that are advantageous and conducive to mining sector should be considered to pump up local investments. Example is the implementation of expansionary fiscal policy particularly reduction of tax rates for mineral industry. Obviously, it would directly reduce the government income from tax, however, it will encourage more investors and lessens black markets and therefore, increase regional investments that would show to an almost 70 percent multiple impacts to the region's economic performance.

Mining industry was also found to have an employment multiplier of 0.00008. This would mean that for every 10 billion pesos increase in the investment of mining industry, 25.17 additional employments will be generated. It is also interesting to note that, only 2 or (1.77) jobs will be created in the mining sector while the rest (23) of employment will be created by other industries. This is due to the indirect effects of an increase in mining outputs to the outputs of other industries. In short, as the investment for mining increase, the output of mining will also increase. And, as the mining output increase, their demand for inputs from other industries will goes up. With this, other industries will use more inputs like labor to produce more outputs to meet the demand from mining industry. This estimate supports the findings of Mines and Geosciences Bureau (2009) who found out that for every job generated by mining industry; roughly four to six more jobs were indirectly generated in the upstream and downstream sectors. This finding would demonstrate a strong interdependence of mining to other industries. Thus, mining policies, projects and programs to be created and implemented in the region should be sensitive to and made advantageous to the industry and its associated industries. Multiplier effects (direct + indirect

effects) have to be visited for every plan and actions for mining industry such like the move to stop or delimit its production. This would suggest that not only the mining industry would suffer to the policies restricting its operations but also the other industries or the whole economy of the region.

The sector is an income generating industry in Caraga region with household income multiplier of 0.431. This would mean that household income would increase by 0.431 for every peso increase in the final demand for each key industry towards mining in Caraga region. It was also discovered that a peso increase in the mining's final demand generates 0.293 direct increase in household's income while the rest are attributed to indirect individual effects of agriculture (0.013), Fishing (0.001), Manufacturing (0.109), Electricity (0.014), Transportation (0.014), Wholesale (0.022), Financial Intermediation (0.004), Real Estate (0.005), Education (0.000004), Health (0.0001), Hotels (0.0002) and other industries in the region (0.007). This finding reflects the importance of mining to the regional economy of Caraga. The industry ranked 5 as household income generator industry in the region. The performance of mining would affect the income of the region's labor forces due to its direct and indirect interaction to other industries. This means that the economic benefits of mining was not only enjoyed by the employees of the sector itself but also to those other industry's workforce. This finding conforms to the study of Balanay et al. (2014) which states that mining has yielded a positive influence to income in Caraga region.

It also holds an output to output multiplier effect of 1.46. This would suggest that every peso increase in the output of mining industry generated 1.46 pesos increase in the economy of the region. On this economic change, a 1 peso of this is directly caused by mining itself while 0.46 cents is attributed to the indirect increase of output from other industries. The data further demonstrated the importance of mining industry in improving the economy by its multiplier effects. This would disprove the findings of Habito (2011 and Balisacan (2011) who stated that mining contributed less than a single digit to Gross Domestic Product and less than 1 percent of total employment. This is only true if and only if indirect impacts or the multiplier effects are excluded in the regional accounting.

In general, the economic multipliers for mining industry would illustrate the unseen economic advantage of mining operations in the Caraga region. Based on the findings, mining industry is considered as income and employment generating sector which directly and indirectly contributes to the economic growth and development of the region. The slightly high level of multipliers indicates a strong ability of mining to create multiple impacts in the local economy. This is consistent with the findings of

Dumaua (2010) on her study entitled "Input-output multiplier analysis for major industries in the Philippines" using 2000 accounts.

6. Backward, Forward and Total Linkages

Industry linkages would demonstrate the relative importance and interdependency of supply and demand side sectors in the region's mining operations. The study applied the methods being introduced by Leontief (1953) and Rasmussen (1956) to measure the unweighted and weighted backward, forward and total linkages. The degree of intersectoral interdependence of thirteen industries to mining sector will be described as strong (≥ 1), intermediate ($0.90 < 1$), and weak (< 0.90) linkage.

(a) Backward Linkage

Mining industry is found to have a very strong backward linkage to manufacturing sector with 14.13 weighed linkage index. This is because of the manufactured inputs that are crucial in the operation of mining from exploration down to extraction, processing and distribution of products and its by-products, as supported by Dumaua (2010) reporting that among major industries, the manufacturing industry showed the highest final demand-to-output multiplier.

Mining industry also established a strong market opportunity and linkage to agriculture (1.53), transportation (2.34) and wholesale retail and trade industry (2.79). This proves the importance of agriculture as provider of food stuff for mining operators and its workforce. Transportation sector is also crucial in mining operations as it made all inputs available at the mine areas of the region. In contrast, the real estate industry poses a very weak linkage to mining (0.05) followed by education sector (0.20), fishing (0.26), health (0.34), financial/banking (0.49), hotels and restaurants (0.56), construction (0.69), electricity, gas and water (0.83) and other community industries (0.90). It is also worthy to note that mining sector has a weak intra-linkage with an index of 0.11. The weak backward linkage of these industries implies small effects to mining industry's production of outputs. Thus, there is a need to strengthen the backwards linkage of mining industry to other industries especially to those main input provider. As suggested by Bloch and Owusu (2011), backward linkages can potentially be solidified by the creation and implementation of policy and support measures.

(b) Forward Linkage

Mining industry in the region has a very strong forward linkage to the manufacturing industry sector with an index of 7.40. This would suggest that

manufacturing sector plays a significant role in purchasing the raw materials produced by the mining industry in the region such as sand or gravel. This is consistent with the findings of Maia (1999) who reported that manufacturing industry the specifically machinery and equipment, transport equipment, wood products, fabricated metal products, non-metallic minerals (cement, gravel), chemicals and petroleum products and other related firms benefited from mining industry. For example, basic iron and steel firms of manufacturing industry consumes iron ore while gold are forwarded to jewelry manufacturing industry. It was also revealed that the mining industry has a strong forward linkage to the agricultural sector (1.77), wholesale, retail and trade (1.30) and electricity, gas and water industry (1.21).

The strong link of mining to agriculture sector means that mined products are utilized in the agriculture production. This conforms to the findings of Pearce (2009) who reported that some of the mined minerals such as phosphorus for fertilizer are not just for crop production but for animal feed as well. It was also important to consider that wholesale, retail and trade industry play as a significant market avenue for mining products. Small-scale miners in the region find more comfort and opted to sell their products (ex. Gold) to local and non-local wholesalers and traders as they need immediate income to pay for the borrowed capital and other costs. This is consistent with the results of Reconalla, D. (2015).

On the other hand, education sector (0.09), fishing (0.16), health (0.30), hotels (0.30), real estate (0.49), transportation (0.65), financial (0.87), other community sectors (0.80), and construction (0.00) have a very weak forward link to mining industry. This can be explained by a strong sectoral independence for these industries and mining has a weak economic push for these sectors. In addition, the intra-linkages of the mining industry yielded a weighted linkage index of 0.16 suggesting that there is a weak link between mining players from exploration down to extraction, processing and distribution of products. Weak linkage index to downstream industries suggests that the region's mining output utilized by their relevant forward industries has a weak effect to their intermediate or final product.

(c) Total Linkage

There is a very strong total linkage of mining industry to manufacturing (21.52) as well as wholesale, retail and trade industry (4.09). This implies that these industries play a significant role in either supplying or purchasing mining inputs or outputs from the mining industry. There is also a strong total linkage of mining industry with the agriculture sector (3.29) and also to transportation

(2.99) and electricity, gas and water (2.04). This would imply that the mining industry in the region has a strong effect into these industries establishing a strong direct or indirect capacity to induce economic productivity and activity among these sectors. This is consistent with the findings of Bocuom (2000) revealed that mineral sectors were able to generate great industry inter-linkages and high output.

On the other hand, mining in the region has a weak total linkage with education (0.29), fishing (0.42), health (0.53), construction (0.69), and hotels and restaurants (0.86). This would suggest that mining has a weaker capacity to induce economic activity to these sectors and that these sectors established independence from mining. The total intra-linkage of mining was found to be weak with a total linkage index of 0.26 suggesting a weak total association among mining players at different stages of operation. This is in line with the findings of Larsen, Yankson and Fold (2009) who found out that there is a dearth of linkages between large-scale industrial mining and small-scale or artisanal mining players. Furthermore, key sectors identified are the manufacturing, wholesale, agriculture, transportation and electricity industries. The strong link of these sectors to mining industry would scale up the economic impact of mining to the economy of the region. Each of the associated backward and forward industries along mining industry chain are important multiplying agents in creating the direct, indirect and induced impacts. Bloch and Owusu (2011) noted that linkage of mining activity to domestic firms is rising and should be facilitated and supported because capacities for production and innovation within domestic firms is the core of sustainable industrial development.

However, the extensiveness of inter-industry ties of these sectors to mining indicates an enclaveness wherein benefits are felt and enjoyed only by a few sectors instead of the whole economy. This result conforms to the findings of Bocuom (2000) who discovered a mineral and energy sector enclave in United States, Australia and Chile.

7. Conclusion

The quantitative analysis of the study provides significant information regarding the economic impacts of mining industry in Caraga region. The analysis proves that mining industry in the region is operating as Basic sector with an LQ of greater than one. Prior to that, mining sector are exporting extra supply of goods to non-local market thus resilient or less affected by local economic downturns on the region. The industry generates positive direct and indirect impacts to regional economy based on the estimated Final Demand to Output, Employment, Household Income, and Output to Output multipliers. It was also concluded that the industry is strongly

inter-connected to manufacturing, wholesale, transportation and agriculture industries. Lastly, manufacturing, wholesale, agriculture, transportation, and electricity are considered as key sectors of the region.

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