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Investment in Mining Exploration in Chilean National Accounts*

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Abstract

Mining is the main economic activity in Chile. The country is a world leader in the production of copper, nitrates and lithium, and it has a major participation in the extraction of gold, silver and molybdenum. Accordingly, Chile has become one of the main destinations for mining exploration.

This document describes the general framework related to the measurement of investment in mineral exploration in the Chilean National Accounts, whose explicit identification was started in 2008. The first part of the paper points out the Chilean context for the inclusion of this measurement, while in the second chapter the main results are exposed and analyzed, and the persistent challenges regarding capital, price and volume measures are briefly discussed. Finally, the third part summarizes and draws some conclusions.

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* The methodology and figures contained in this paper have not been published to the date.

I. General overview

1) International definition and classification

a. System of National Accounts

1. The 1968 System of National Accounts (SNA68) treated all expenses related to mineral exploration as intermediate consumption. This recommendation was not seen as an appropriate reflection of the economic reality, since most of the companies involved in the exploration activity did not have a production associated to these expenses, therefore they appeared as operating at a loss for every period of time.

2. In order to correct this situation, the 1993 SNA stated that mineral exploration should be treated as gross fixed capital formation, defined as *"the value of expenditures on exploration for petroleum and natural gas and for nonpetroleum deposits. These expenditures include pre-licence costs, licence and acquisition costs, appraisal costs and the costs of actual test drilling and boring, as well as the costs of aerial and other surveys, transportation costs, etc., incurred to make it possible to carry out the tests"*. The 1993 SNA also distinguishes own account exploration from third party exploration, where a specialized company conducts the exploration activity. In this latter case, the value of the asset is given by the price of the contract, while in the former case the value of the asset should be valued as the sum of its costs of production.

3. "Mineral exploration" should be considered as a separated asset from subsoil deposits, though they are evidently related. Although associated, the lives of both assets may be different: the life of a mineral deposit can be derived from the level of economic resources and the level of production, while the life of the asset "mineral exploration", which has contributed to the stock of knowledge in the economy, is not completely clear.

4. Finally, the 2008 SNA have not provided further details regarding the life of the intangible asset. Basically, it has broadened the definition in order to include expenses in re-evaluation of the reserves after its exploitation has started; hence the asset is renamed as "mineral exploration and evaluation". In addition, a new hierarchy of assets has been defined to explicitly identify a category of intellectual property products, which includes, besides the mining exploration, investment in research and development, computer software and databases, among others intellectual property products.

b. International Accounting Standards Board (IASB)

5. The IASB considers a specific chapter for mining exploration and evaluation, the International Financial Reporting Standard 6 (IFRS6). According to this guideline, companies should include, at least, the next expenses:

- Exploration legal rights;
- Topographical, geological, geochemical and geophysical studies;
- Drilling;
- Digging;
- Sampling;
- Activities related to the evaluation of the technical and economic feasibility of the project.

6. Although IFRS6 defines some of the costs that companies should include as mining exploration, it allows companies to decide which expenses will be considered as part of the exploration project. Furthermore, IFRS6 allows treatment of these costs as gross fixed capital formation or as an expense, depending on the companies' decision. As a result of this flexibility,

it is likely that the amount that a company considers as investment in mining exploration differs from what National Accounts should include as an asset.

2) Chilean context

a. Legal framework

7. Given the relevance of the mining industry in Chile, a specific legal framework has been defined for the activity. Regarding the ownership of the mineral assets, absolute public property over the mineral deposits is constitutionally guaranteed, despite the fact that public or private companies can exploit the mines through a mining concession. However, there is no clear legal statement with regard to the ownership of the knowledge produced by exploration activities.

8. The public organism in charge of providing geological information, among other functions, is the National Geology and Mining Service (Sernageomin by its Spanish abbreviation), which depends on the Mining Ministry. Although the law gives Sernageomin the authority to require information about the activities of the concessionaires of exploration, the legislation is ambiguous as to the specific information they can access and the means to make this requirements effective. In practice, companies do not report to Sernageomin the outcomes of their exploration activities. As a result, there is not publicly available information on mining investment in Chile; hence the basic data for the measurement must be collected from diverse sources.

9. An exception to the previously indicated vague legislation in regards to mining exploration concerns the petroleum and natural gas exploration. In this case, Special Petroleum Operations Contracts (CEOP by its Spanish abbreviation) are arranged between the Energy Ministry and private exploration companies, in order to determine precisely the exploration programs and the amounts of investment involved. Therefore, basic data as regards to hydrocarbons exploration is properly collected by the competent public institution.

b. Business accounting

10. Despite the flexibility allowed by IFRS6 as regards to the treatment of the expenses in exploration, Chilean companies follow in general the same procedure: all costs related to mining exploration are considered as an expense until there is certainty[1] that the project has been successful and therefore future benefits can be associated to the costs. From this moment the costs of the current period are capitalized, but the costs of previous periods remain as expenses. Moreover, the assets for mineral exploration and subsoil deposits are treated as an integrated asset, and its estimated consumption is determined by the size of the deposit and the level of production.

11. Clearly, the procedure followed by Chilean companies diverges from the proposed treatment of the SNA. According to the companies' accounting, and given the usually low success rate of mining exploration, most of the expenses in mineral exploration are considered as loss, ignoring its nature of new knowledge for the economy. In other words, under the companies' logic exploration is merely a mean to reach a new asset, and not an asset itself.

[1] The definition of certainty, and therefore the determination of the period where the expenses are capitalized, depends on the company's policy of risk aversion.

II. Measurement of investment in mining exploration

1) Sources of information

12. As formerly stated, basic information concerning investment in mining exploration is scarce in Chile, either due to the absence of a centralized database disposed by public institutions or due to the flexibility of the companies' accountability. Hence, basic data must be collected from diverse public and private sources, which are briefly described next.

Metals Economics Group (MEG)

13. Based in Canada, Metals Economics Group (MEG) is a world leader consulting group specialized in mining industry, covering various areas such as development, production, acquisitions and exploration, among others. As regards of investments in exploration, MEG publishes the study "Corporate Exploration Strategies" (CES) annually since 1989. In this document, MEG analyses nonferrous mineral exploration budgets, identifying the type of mineral searched, explored region and stage of development of the project, among other criteria.

14. CES has become the primary source of information for exploration trends and strategic analysis, and its definitions are widely used by the mining industry, as well as in the present document[2].

Energy Ministry

15. Data provided by Special Petroleum Operations Contracts with public and private companies is the primary source for investment data in hydrocarbons exploration.

Other public institutions

16. Besides information from the Energy Ministry, there is some general information that can be collected from different public institutions:

National Geology and Mining Service
It provides general statistics concerning the mining concessions, although it does not offer useful data regarding the amounts invested in mining exploration[3].

Environmental Assessment Service
According to the environmental Chilean law, mining exploration and exploitation projects must be evaluated by its environmental impact. At the starting point of this process, companies must report general information related to the project, including estimates budgets of exploration for the entire project.

Foreign Investment Committee
It also offers total budgets for projects of mining exploration conducted by foreign companies; however it does not precise the periods in which the investment is executed.

Mining companies

17. In Chile some minerals such as iron or natural salt brines are extracted by a limited number of companies. In these cases, information concerning exploration can be found in companies' annual public reports.

[2] Metals Economics Group's definitions can be found in this document as annex.
[3] National Geology and Mining Service does provide accurate information regarding mining exploitation, however its statistic system about mining exploration is still limited.

Other sources

18. Finally, there is some exploration activity that is not covered by any of the previous sources. In these cases, specialized press information is considered to estimate the amounts of investment.

2) Results

General outcome

19. The next chart displays the investment in mining exploration in Chile, by type of mineral, estimated for the year 2008[4].

Chart 1
Investment in Mining Exploration in Chile (2008)

Type of Mineral	Share
Metal	**83,0%**
Non-ferrous	80,0%
Iron ores	3,0%
Non-metal	**3,7%**
Chemical and fertilizer minerals	3,6%
Coal	0,2%
Crude oil and natural gas	**13,2%**
TOTAL	**100%**

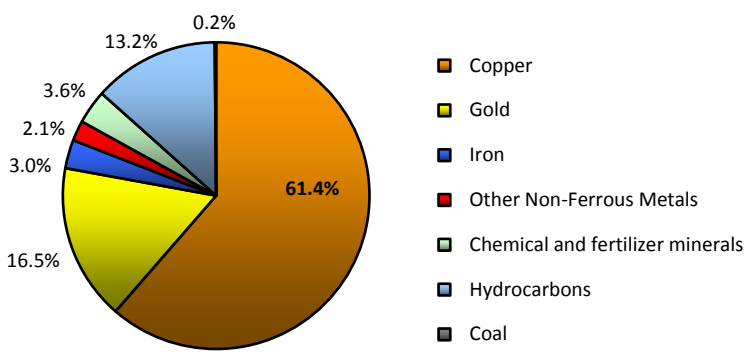
20. It can be seen that most of the investment is focused in non-ferrous metallic minerals, which can be explained by the geological characteristics of the country. More specific results are presented in the next paragraphs.

Specific results

<u>Investment by target</u>

21. Consistently with its leadership in production, copper is the prime target of exploration in Chile, with more than a 60% of the total amount invested in the country.

Chart 2
Investment in Mining Exploration by target

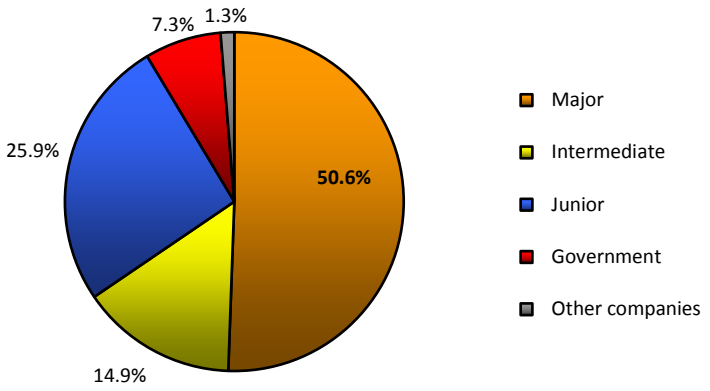


[4] All of the following charts and tables are based on the results of the analysis carried out for the investment in the year 2008.

Investment by corporate classification

22. Opposite to the world trend, investment in mining exploration in Chile is conducted primarily by major companies.

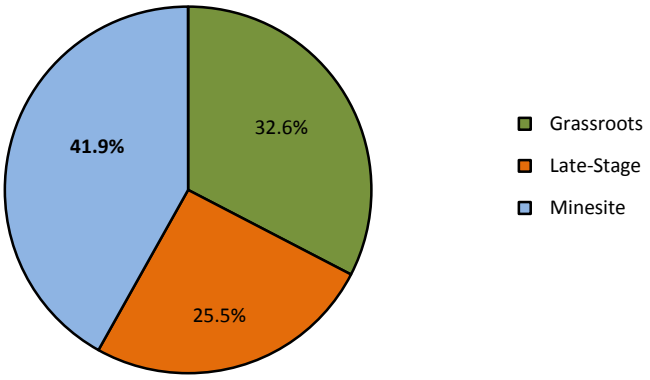
Chart 3
Investment in Mining Exploration by corporate classification



Investment by stage of development

23. Accordingly with the previous result, most of the investment in mining exploration in Chile is carried out at the minesite.

Chart 4
Investment in Mining Exploration by stage of development



Structure of production

24. In order to determine a structure of the production for the exploration activity, particular meetings with the major companies were sustained.

Chart 5
Structure of the Investment in Mining Exploration in Chile

Item	Share
Externalized services	68%
Drilling	26%
Geological studies	21%
Geophisical studies	8%
Other externalized services	12%
Sampling	1%
Salaries	15%
Mining licenses	3%
Others	14%
Total	**100%**

25. It can be observed that the most significant cost item for the exploration activity is the group of externalized services, namely drilling and technical studies. These services are outsourced due to its highly specialized nature, in both equipment and labor. As a result of this externalization, consumption of fixed capital for the investor was considered irrelevant in the structure. In addition, and given the low rate of success of the exploration projects, return to fixed capital was also assumed insignificant for the own-account investors, while it is included in the externalized services for third party exploration.

3) Capital measures

26. One of the major problems in regards of the measurement of mining exploration as an asset is the determination of its consumption in each period. The concept is challenging since it assumes that a service life for the knowledge created by mining exploration must be estimated. As previously stated, neither the SNA nor the IFRS shed enough light concerning this issue. Moreover, companies do not capitalize the expenses unless the exploration project has been successful, which is not the usual case[5]. Therefore, a general estimation of the service life of the exploration asset cannot be derived easily.

27. It is reasonable to relate the expenditures of a successful exploration project to the associated subsoil asset, and therefore depreciate it accordingly to the depletion of the mineral deposit. Nevertheless, the problem remains when a service life for unsuccessful exploration needs to be estimated.

28. The Australian experience has been revised in order to face this problem. According to the Australian Bureau of Statistics (ABS), it is only possible to depreciate unsuccessful mineral exploration at the same rate that recommended for successful exploration, i.e., using average mine lives. The ABS uses a perpetual inventory model (PIM) to estimate the stock of the asset and determines a weighted average service life for mineral exploration using expenditure proportions for each commodity. In line with the Australian practice, the Chilean National Accounts have estimated the same service lives and depreciation rates for both successful and failed exploration, which has been estimated to be 36 years, according to an average of selected OECD countries.

[5] It is assumed that less than 3% of the exploration projects are successful.

29. Within the Chilean Balance Sheets, mineral exploration asset is not identified separately but included as "Architectural, engineering and scientific services"[6].

4) Price and volume measures

30. The distinctive nature of mining exploration activity implies an additional difficulty when price and volume measures need to be applied. The ABS has investigated the feasibility of constructing an output price index for mining exploration, concluding that, though possible, it would be extremely resource intensive to maintain due to the rapidly evolving technology used in the production process.

31. In the Chilean National Accounts, current price estimates for the production are determined using the formerly mentioned sources of information. In order to derive volume measures, current price estimates are deflated using a business activities wage index. Clearly, this method does not capture productivity gains that are likely to be significant in this activity; however, no adjustment is added to the estimation concerning this subject.

III. Comments

32. The explicit inclusion of investment in mining exploration in the National Accounts framework is not a simple problem. Conceptually, the usual treatment that companies running exploration projects give to these types of expenses diverges from the recommendations of the SNA, and additional efforts must be realized in order to collect the basic data. This problem is particularly relevant in Chile, where most of companies are not forced to share detailed exploration information with the specialized public institutions.

33. Nonetheless it is possible to estimate the amount of investment in mining exploration in Chile by using diverse sources, which are indicated in this document. Moreover, it is feasible to analyze the main characteristics of exploration investment in the Chilean context. Therefore it can be said that copper and gold concentrate almost an 80% of total investment; that junior companies have a minor participation in the activity; and that most of the investment is done around an existing mine. It can also be concluded that the exploration activity is primarily realized by third parties.

34. Beyond the outcomes of the estimate, the key dilemmas concerning the measurement have been exposed: capital, volume and price measures. While the resolution of these problems has proven to be matter of discussion where no clear consensus has been reached, the Chilean National Accounts have chosen to follow the international experience that has been suggested to the date.

[6] It mainly consists of exploration services; however it also includes services such as technical support for specialized machinery.

Annex

Metals Economics Group's definitions

a. Corporate classifications

- **Major**: a company with annual nonferrous mining-related revenue of more than US$500 million that is considered to have the financial strength to develop a major mine on its own. Exceptions are made when a company's adjusted[7] revenue figure substantially understates the size of the company.

- **Intermediate**: also based primarily on a company's adjusted annual revenue, with at least $50 million in annual nonferrous revenue but less than the $500 million major-company threshold.

- **Junior**: the company's principal means of funding exploration is through equity financing, although some companies may have limited adjusted annual revenue of less than the $50 million intermediate-company threshold. This category mainly includes pure explorers but also many aspiring producers that have not yet reached the "intermediate" threshold.

- **Government**: wholly government-controlled entities operating primarily in the national or provincial/state interest rather than as private entities. To be included, the entity must be commercially oriented; in general, direct exploration efforts by government-related geological surveys are excluded.

- **Other companies**: all other companies that do not fit the criteria of one of the previous four categories, but to which a specific exploration budget in a given year can be attributed.

b. Exploration stage of development

- **Grassroots**: exploration from the earliest stage through perimeter drilling prior to the quantification of initial resources; also includes reconnaissance and evaluative forays.

- **Late stage and feasibility**: exploration to further define, quantify, and upgrade a previously identified orebody after initial resources have been identified; also includes all feasibility work up to a positive production decision.

- **Minesite**: all exploration (regardless of phase) at or immediately around an existing mine site held by the company (excluding production geology on the orebody being mined, such as geotechnical/rock engineering, reserves estimation, and grade control or confirmation drilling on the producing orebody); includes the search for satellite orebodies within an economical transportation distance of an operating mine, and exploration at or immediately around a project that has been committed to development (preproduction stage).

[7] Adjusted revenue only includes sales from the mining of commodities covered by the CES. Interest, royalty, and smelting income; toll refining; and technology sales are also excluded from revenues reported in the CES.