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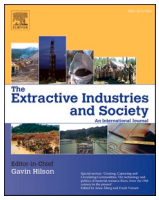

Original article

Models of lithium exploitation in Latin America: Is history repeating itself?

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ABSTRACT

Lithium is among the minerals most demanded for use in driving the energy transition of the global north. However, 61.5 % of world reserves are located in Argentina, Bolivia, and Chile. Based on an Institutional Political Economy approach, the first objective of this paper is to characterize the lithium exploitation models of each country based on analysis of the actors and regimes that configure them. Second, this paper evaluates whether the three countries are applying exploitation models distinct from the (neo)extractivist model, identifying the most decisive regimes and configurations of actors.

The analysis identifies measures that partially diverge from the (neo)extractivist model in Chile and Bolivia. In these cases, the State has played a crucial role in transforming the rules of the game and gradually paving the way for an industrialization agenda based on lithium. In contrast, Argentina shows a greater degree of subordination to transnational capital. Nevertheless, due to the reliance on demand from the Global North, mineral exploitation appears to perpetuate the primary-export model, thereby maintaining center-periphery development patterns. Despite the implementation of supply-side strategies, the absence of a domestic market for electric vehicles represents a structural limitation for these three countries in effectively advancing their own transition processes.

1. Introduction

Lithium, a soft and unremarkable metal found and extracted in remote locations, was until recently more prized by the lubricant, glass, and ceramics industries than for use in high-end technologies. Given that modest track-record, the current geostrategic importance acquired by lithium comes as something of a surprise. According to the United States Geological Survey (USGS, 2024), during the period 2010–2023, lithium carbonate production grew at an average cumulative rate of 15.4 % per year. In absolute terms, world production in metric tons (MT) has doubled in the past five years. Meanwhile, prices have risen at a cumulative annual average of around 18.3 %. In fact, the year 2022 stands out for the highest international lithium prices on record (Fig. 1), reaching as much as US$68,100 per metric ton, or 5.4 times the price in the previous year.

Nonetheless, active industrial policies and investment of private capital for technological development and innovation in the global north as well as the supranational agenda to combat climate change have put electromobility (and, by extension, lithium) at the heart of the energy transition.[1]

Since 2015, lithium has ranked high among essential raw materials for production of electric vehicle (EV) batteries, currently the main technological avenue for replacement of fossil fuels. Even in the most conservative scenario, lithium demand for EV application between 2020 and 2030 is projected to increase by a factor of 7.6 (IEA, 2021). Supply of the metal has unleashed a unique competitive struggle led by transnational companies as well as the governments of China, Japan, and Korea (northeast Asia), Australia, and the United States and Europe (the global northwest). At the same time, 61.5 % of verified reserves (USGS, 2024) are located in the so-called Lithium Triangle, a geographical area that includes deposits in Argentina, Bolivia, and Chile.

In the midst of fierce competition, and with international lithium prices having tripled (even before COVID-19), risks of a return to extractivism are again looming over Latin America. However, the main

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[1] The supranational political agenda to achieve climate neutrality by 2050 (UN, 2022) involves binding political commitments by 196 states (Paris Agreements, COP21) to reduce greenhouse gas (GHG) emissions, especially in the energy industry and transportation. Research and development in cleaner energies are part of the Sustainable Development Goals targets (UN, 2023b), while the European Union has set a 2035 deadline for limiting new fossil fuel vehicles (European Commission, 2023).

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political leaders in the region have adopted a geopolitical stance based on the opportunities offered by lithium to transcend raw material export, instead upgrading to higher value-added activities. With allusions to the region's history of chronic dependence on a primary-export model, calls to not repeat such models have multiplied among politicians and academics.

Given that context, this paper proposes two research questions:

i) How is lithium currently being exploited in Latin America?
ii) Does the current form of exploitation represent an alternative to the (neo)extractivist model?

To answer those questions, two specific objectives are given priority: i) to identify the different exploitation models at play in the countries of the Lithium Triangle, and ii) to analyze and assess any common and/or differentiated patterns with respect to the (neo)extractivist model.

Studies on lithium exploitation in the framework of the energy transition remain limited, although interest has been growing. Articles that characterize trends in international demand and commodity prices predominate (Sterba et al., 2019), as do those that diagnose and study the global value chains (GVCs) related to lithium (Weimer, et al., 2019); (Mu, et al., 2023). Other papers focus on the national level to analyze specific policies implemented thus far, or else policies required to boost future exploitation (Wojewska, et al., 2024; Marmolejo and Garduño, 2022; Barberón, 2022; M. Obaya, et al., 2021; Poveda Bonilla, 2020); some offer a comparative analysis of policies and governance models (Jiménez and Sáez, 2022; Obaya and Pascuini, 2020; Barandiarán, 2019). Our work likewise focuses on comparative analysis at the regional level while adopting an Institutional Political Economy (IPE) approach (Chang and Evans, 2000) from which to examine each model of lithium exploitation through analysis of the institutions and actors involved. Our theoretical and analytical approach allows us to undertake an in-depth analysis starting from a broad conceptualization of these institutions and assuming their endogenous character and explanatory relevance. The principal contribution of the paper lies in discovering whether or not the countries of the Lithium Triangle are currently applying (neo)extractivist measures, identifying any elements of rupture in terms of both institutions and actors.

Our methodology is based on the use of a multiple-case study (Yin, 2003), itself designed on the basis of two elements: i) the theoretical and conceptual approach described below in section 2; and ii) selection of the three cases to be analyzed (those that constitute the Lithium Triangle). This methodology allows for exhaustive comparative analysis between those three cases and the (neo)extractivist model and permits us to fulfill our two proposed objectives. The period of analysis ranges from 2010 to 2022 for both supply and demand data.

In order to achieve its proposed objectives, the paper includes five sections beyond this Introduction. Section 2 presents the methodology and Section 3 the literature review (focused on studies of lithium in Latin America); Section 4 describes the conceptual and analytical framework from which lithium exploitation will be characterized; Section 5 examines the exploitation models on a case-by-case basis, also identifying regimes and actors. From this evidence, Section 6 proceeds to a comprehensive assessment, analyzing both the common and differentiating patterns observed in the countries of the Lithium Triangle with respect to (neo)extractivism. Section 7 presents the conclusions of the study.

Finally, some limitations should be noted: first, the scarcity of data on the Bolivian fiscal regime; second, recent changes in context brought about by several important decisions taken by governments and supranational bodies; and third, the fact that other minerals relevant to the energy transition (cobalt, nickel, manganese) as well as GVC governance are not addressed in this study.

2. Methodology

The aim of this section is to justify and explain the methodology employed.

According to Yin (2003), within the Social Sciences, the primary criterion that should determine the choice of one methodology over another is the research question. When the research question is one of 'how', the case study methodology is most suitable.

This is accepted as true because the case study allows "an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, programme or system in a 'real life' context [….] The primary purpose is to generate in-depth understanding of a specific topic (as in a thesis), programme, policy, institution or system to generate knowledge and/or inform policy development, professional practice and civil or community action" (Simons, 2009, p. 21).

According to (Yin, 2003, p. 45), "A case study is an empirical method that: (i) investigates a contemporary phenomenon (the "case") in depth and within its real-world context; (ii) especially when the boundaries between phenomenon and context may not be clearly evident."

Furthermore, this author considers that two particularities must be taken into account for the design of a case study: that it "benefits from

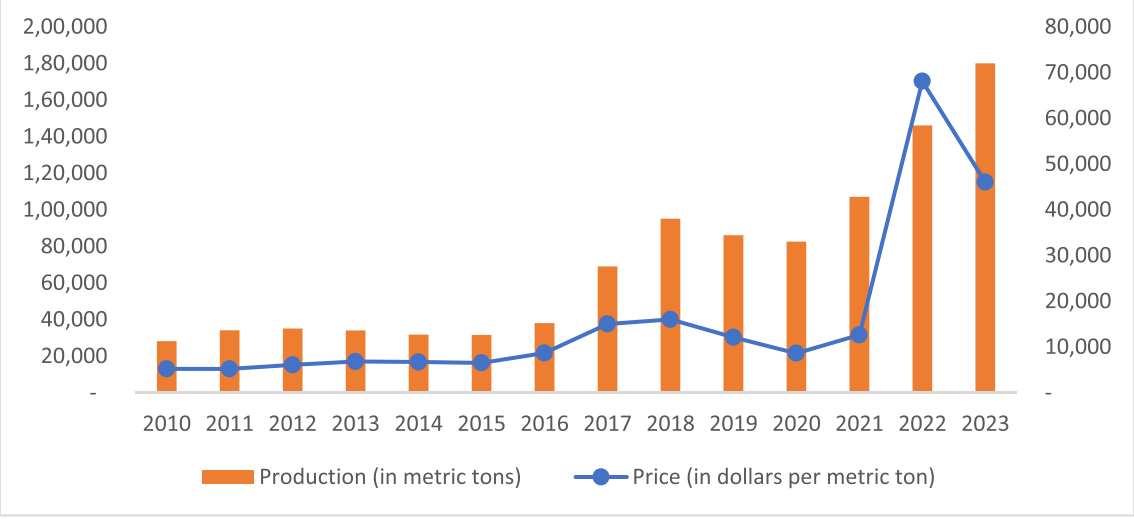

Fig. 1. Evolution of prices (US$) and production (MT) of Lithium Carbonate (2010–2023).
Source: Own elaboration based on USGS, Mineral Commodity Summaries 2011–2024.

the prior development of theoretical propositions to guide design, data collection, and analysis," and that it "relies on multiple sources of evidence." Finally worth noting is that the case study is "useful for exploring and understanding the process and dynamics of change. Through closely describing, documenting, and interpreting events as they unfold in the 'real life' setting, it can determine the factors that were critical in the implementation of a programme or policy and analyse patterns and links between them" (Simons, 2009, p. 23).

The present work opts for a multiple or comparative case study methodology. However, again following Yin (2003), it is important to clarify that comparative or multiple-case studies are not distinct in methodological terms from single case studies, as has been claimed in the literature on Political Science (Lijphart, 1975). Our paper considers studies of both single and multiple cases to be variants within the same methodological framework, and the choice between the two is fundamentally determined by the research question(s). In order to address the research question, we focused on countries with the largest lithium reserves and which (according to previous studies) exhibit distinguishing characteristics in their mineral exploitation models. That is to say, the criteria of relevance and uniqueness were paramount in our selection of cases (Yin, 2003; Simons, 2009). Based on those criteria, we selected for study Argentina, Bolivia, and Chile.

Ultimately, the multiple-case study methodology allows for exhaustive comparative analysis between models of exploitation through a process of closely describing, documenting, and interpreting the set of factors deemed critical and placing them within their real-world context. Such a methodology permits us to fulfil our two aforementioned objectives, and we consider this approach most appropriate for the in-depth analysis of our topic of interest and for answering questions around the 'how' of lithium extraction. Once the methodology had been selected, the research proceeded through a series of tasks summarized in the research guide (Table 1) enumerating the stages undertaken. The period of analysis ranges from 2010 to 2022 for both supply and demand data. Characterization of the exploitation models experienced by the three countries further required recourse to historical references.

Finally, we carried out the analysis of each model of exploitation using the quantitative data and qualitative information obtained (Table 1). Comparative analysis was approached in two ways. On one hand, the exploitation model in each of the three countries was compared with the extractivist model previously specified. On the other hand, comparison was conducted among the three cases with the aims of identifying similarities and differences and developing cross-case conclusions.

Table 1
Case study research guide.

First stage: research questions and methodology selection	Topic of interest	Strategies and policies around lithium exploitation in Latin America Researchs questions: i) how is lithium currently being exploited in Latin America?; and ii) does the current form of exploitation represent an alternative to the (neo) extractivist model?
	Methodology selection	Case study
	Literature review	Previous studies on lithium exploitation in Latin America
	Theoretical and analytical approach	To guide design, data collection, and analysis
Second stage: Case Study	Case study design	Type of Case Study: a multiple or comparative case-study Define the information-collection strategy: multi-modal strategy, combination of quantitative and qualitative resources Quantitative data collection International sources: International Energy Agency, United States Geological Survey, World Bank, United Nations Economic Commission for Latin America and the Caribbean (ECLAC), United Nations Commodity Trade Statistics Database (UN Comtrade) National sources: Yacimientos de Litio Bolivianos, Sociedad Química y Minera de Chile (SQM), Albemarle, Sistema de Información Abierta a la Comunidad sobre la Actividad Minera (SIACAM), Comisión Chilena del Cobre (COCHILCO), Ministerio de Economía y Finanzas Públicas del Estado Plurinacional de Bolivia, Ministerio de Economía de Argentina, Corporación de Fomento de la Producción (Corfo) de Chile. Qualitative Information International sources: United Nations Economic Commission for Latin America and the Caribbean (ECLAC). National sources: Obaya, M., López, A. & Pascuini, P., (2020, M. 2021), Poveda Bonilla, R. (2020, R. 2021), Argento, M. y F. Puente (2019), León, M., Muñoz, C. & Sánchez, J., (2020), Jones, B., Acuña, F. & Rodríguez, V., (2021), Biblioteca del Congreso Nacional de Chile (BNC), Gobierno de Bolivia: Gaceta Oficial. Decreto Supremo
Third stage: Conclussions	Analysing and conclusions	Analysis of the evidence based on the theoretical proposition and using the quantitative data and qualitative information obtained

Source: Authors' elaboration.

3. Literature review

The current fierce interest in lithium transcends the economic activity of competing companies or government development projects and has been arousing increased interest within both the academic community and supranational agencies. Based on the objectives set out in the Introduction, our review of the literature on lithium prompts us to highlight three perspectives: (i) papers with a perspective on international economic relations that analyze the governance of GVCs, geopolitics, technological challenges, and the end-uses of lithium; (ii) studies that while referring to the international sphere focus on the national strategies guiding the exploitation of lithium in the respective developing countries; and (iii) investigations that undertake a comparative regional analysis of the production, public policies, governance, and challenges faced by those countries with lithium reserves.

Within the first perspective, empirical contributions have emerged that focus analysis on global market dynamics that affect the extractive process, analyzing links between the different fields and actors in the lithium market (Zicari, 2015), or for the GVC configuration into which lithium is inserted (Obaya and Cespedes, 2021; Jones, et al., 2021a, 2021b; Rocio and Cancino, 2018); thereby unveiling North-South relations at work in the context of the global geoeconomy (Fornillo, et al.,

2019). Elsewhere, contributions focus on the intersectoral linkages of battery manufacturing with the automotive and energy sectors, under a global production network approach (Bridge and Faigen, 2022), while others warn that the GVC for lithium batteries does not really operate on a global scale in terms of its technological generation, underlining the idea that the regimes and positioning of leading countries are influenced by geostrategy (Moreno Brieva and Merino Moreno, 2020).

Within the second perspective, significant heterogeneity is found. Some early contributions focused on diagnosing the internal value chain from mining deposits to battery-factory pilot projects, as in northwestern Argentina (Fornillo, et al., 2015). Others have considered how the configuration of the Global Value Chain and the regulatory framework have impacted various facets of economic and social development at the national level (Slipak and Argento, 2022). Additionally, they have investigated the role of sustainable finance instruments in shaping the dynamics of these chains and the outcomes for producing countries (Wojewska, et al., 2024). Some articles focus on the analysis of public policies: in the case of Chile, specific government instruments and their regulatory capacities have been identified (Carrasco and Madariaga, 2022), and governance has been characterized across historical stages (Poveda Bonilla, 2020). In Bolivia, researchers have delved into industrialization strategy and the organizational practices of production networks (Bos and Forget, 2021). Some have drawn attention to the sectoral disarticulation of technological and innovation networks with extractive activity, as in Argentina (Barberón, 2022). The literature related to political, social, and environmental conflicts has been equally prolific at the national level. Some works examine the extent to which internal and external political struggles shape the ways in which resource-rich nations participate in global production networks, taking the case of Chile as an example (Irarrazavala and Carrasco, 2023). Other studies highlight the underlying social conflicts in communities where lithium is extracted (Godoy, 2022; Fornillo, 2018; Puente and Argento, 2015) as well as the prevailing perception of lithium extraction among people living around the salt flats (Carpanese and Saxinger, 2024) or the ecological impacts of exploitation and water use (Gómez Lende, 2022). Even the strategies of mining companies in the face of such local conflicts have been analyzed (González and Snyder, 2023).

Finally, within the third (comparative regional) perspective, worthy of note are periodic assessments of processes for lithium extraction as well as their different governance models, the production of various compounds, and their destination countries and final uses (ECLAC, 2023). Some studies delve into the addition of value, highlighting the main advantages and disadvantages related to technology, process costs, investments, and incentives (Jiménez and Sáez, 2022). Other papers analyze how policy differences in the three lithium-rich countries have resulted in different outcomes and forms of industrial development. Obaya and Pascuini (2020), drawing on the methodological contributions of León and Muñoz (2019), classify Bolivia as a hierarchical regime under the strong political control of the central State, Argentina as a market regime, and Chile as a regime in transition from the former to the latter model of governance. According to this characterization, the Bolivian case leads to an autonomous development model but one that is both uncertain and slow, due to the very nature of the learning process. At the other extreme, both Chile and Argentina present conditions that allow for faster and more certain implementation of productive projects by attracting external actors, but at the cost of foregoing opportunities for local technological learning.

Other contributions examine the historical and social framework that generated these development strategies, pointing out how past political arrangements have established an institutional legacy that influences and limits the capacity of today's social actors to drive policy change in the lithium triangle countries (Johnson, et al., 2024). Reflections on the uncertainties and challenges generated by the transition and addition of value from the salt flat to the final battery are of special interest (Fornillo, B; Gamba, M, 2019). Also worth noting is an analysis of relevant debates among stakeholders, identifying diverse socio-technical visions around science, innovation, and development as pertain to mining, in order to legitimize lithium extraction (Barandiarán, 2019).

Some of the authors already cited (such as Obaya and Pascuini (2020); Poveda Bonilla (2020), Argento & Puente (2019), Jorratt (2022), and ECLAC) deserve special mention in this third perspective, due to their notable efforts in systematically compiling and organizing the main milestones of the regulatory framework as well as the positioning within the value chain of the relevant actors in each country, with the purpose of supporting an analysis of governance and productive chains. Our research adopts this third perspective and draws on previous work for the selection of case studies and for qualitative analysis of the regulatory framework, the actors involved, and their strategies. However, two elements set our research apart the theoretical approach and analytical proposal that underpin the study of exploitation models (distinct from public policy analysis or governance analysis); and the comparison with (neo)extractivism. Based on this selected methodology, we next outline the theoretical approach and analytical proposal that guide the case studies.

4. Theoretical and analytical approach

This section delimits: i) our theoretical approach; ii) what we understand by an 'exploitation model' and how to study it (defining its analytical components); and iii) the key elements involved in a (neo) extractivist model, against which we compare the cases of Argentina, Bolivia, and Chile.

4.1. An IPE approach

In this work we opt for an Institutional Political Economy (IPE) approach (Chang and Evans, 2000)[2] as this allows us a "broad" definition of the institutions we consider appropriate to the stated objectives. Indeed, an IPE approach emphasizes the endogenous character of institutions as well as bidirectional interactions between actors and institutions.[3] Moreover, we consider this approach to be most appropriate to our objectives for the following additional reasons: i) it permits us to assume the explanatory relevance of the exploitation models, which justifies the need to examine and characterize them (research objectives); ii) it assists us in understanding the structural bases and endogenous character of the exploitation models as well as the multiplicity of factors that typify them; and iii) it proposes a broad conceptualization of institutions based on their triple nature (constraints, devices, and constitutive elements), which in turn contributes to a clearer understanding of the functionality of the model. All of this fosters our pursuit of in-depth analysis of the exploitation models at play while assuming their endogenous nature as well as their explanatory relevance.

The proposed IPE approach thus considers the traditionally restrictive nature of institutions, initially described by North (1984) and understood as the set of rules, regulations, and moral and ethical precepts of behavior that define the contours that limit the way in which rules and regulations are specified and how their application is carried out (Chang and Evans, 2000). Moreover, a second dimension considers the

[2] The IPE approach, building on the general framework of Political Economy, focuses on analysis of institutions and their relationship with economic performance, thus providing an alternative view to Neoinstitutionalism (Chang & Evans, 2000).

[3] Other frameworks such as the Resource Curse, GVCs, or new international division of labor are suitable for other objectives (*e.g.*, analysis of the link between natural resources and development, upgrading processes, governance of value chains, or a country's positioning in the international division of labor). Our objective differs in that it focuses on the comparative analysis of exploitation models, where an IPE approach is useful in adequately defining institutions.

enabling character of such institutions, referring to devices that allow the possible achievement of certain objectives, advances, or changes based precisely on pre-existing norms, whether formal or informal. A third dimension highlights the constitutive character of certain ideas, worldviews, and interests held by actors, introducing a symbolic dimension generally ignored in institutionalist analyses. In other words, certain institutions are the simultaneous result of the interests and ideas of certain actors, working through a bidirectional link that tends to be mutually reinforcing.

This view of institutions is fundamental to delimitation of the concept of an exploitation model as employed in this study. First, it is noteworthy that the restrictive dimension can visibly manifest (for example) in the mining laws that delimit those geographic areas in which exploration for a mineral can be conducted, as well as in what types of companies can gain access, or the environmental norms to which those companies must adhere. Second, such regulations can enable and/or facilitate the entry of transnational companies into a country under the legal security provided by rights conferred in the awarding of contracts. Third, the constitutive dimension may well be expressed by how permissive (or strict) the environmental regulations for mineral exploitation may be, or by the role assumed by the State in the property regime, reflecting in some way the set of interests, correlations of forces, and predominant ideologies expressed by certain actors.

4.2. Definition of exploitation models and how to study them

Once we have embraced the institutionalist approach described above, the next step is to define an exploitation model and present an analytical proposal that allows us to study such a model in its various forms.

Despite notable contributions in the literature on lithium for characterizing the external and internal contexts that underlie extraction of this metal, the studies referenced in Section 3 do not commence from a prior conceptualization of exploitation models based on IPE approach. A similar approach can be found in the work of Obaya and Pascuini (2020), which analyzes lithium governance regimes, and in Poveda Bonilla (2021), who studies the case of copper in various South American countries. Both studies are based on the definition of governance proposed by León and Muñoz (2019).

We also explore other contributions in the literature on natural resources. Mokrani (2010), proposes three dimensions through which to evaluate hydrocarbon exploitation policies: 1) ownership or participation by the State and/or private actors; 2) economic and fiscal aspects, referring to the effective level of distribution of economic rents; and 3) regulatory measures (Mokrani, 2010). This contribution served as inspiration to delimit the analytical proposals of other relevant research on the hydrocarbon extractive sector, including Ramirez-Cendrero & Paz (2017) and Portillo Riasco (2014). The identification of these three dimensions is, at least partially, consistent with the most recent studies on lithium. For example, Obaya and Pascuini (2020) include an analysis of the property regime, while Jorrat (2022) examines the fiscal regime.

Building on the proposals of those works and integrating them into the IPE approach, this paper defines an exploitation model as the configuration of actors and institutions under which a natural resource is exploited.[4] The straightforwardness of this definition enables us to distinctly identify the two fundamental constitutive elements of an exploitation model. However, the definition is not limited to this statement; it must be contextualized within the IPE approach outlined above. This provides a broader and more far-reaching meaning to the concept of institutions and allows us, in turn, to specify the way they interact with actors, as well as the type of circular causality established, in line with the discussion in Section 4.1. Furthermore, based on the proposed definition, we consider that tin order to develop the study of such configuration, it is useful to differentiate between three regimes :[5] ownership, production, and fiscal aspects. The ownership regime refers to the set of institutions that delimit the access regime and the role and shareholdings assumed by different actors in each of the phases of exploitation of the resource. This definition does not include ownership of the mineral, as all three Constitutions recognize that this belongs to the State.[6] The production regime refers to the supply conditions under which the resource is exploited, such as localization of reserves, production contracts, technology, and local-content measures. The fiscal regime refers to the set of institutions that determines the capture of economic rents by different actors, as well as the final use of those rents, whether in terms of reinvestment, profits, or redirection to the public budget.

Once the regimes have been delineated, following an IPE approach, the analytical proposal for studying the model also requires consideration of the actors involved. Following the literature on development, we deem it necessary to differentiate three actors: the State, Transnational Corporations (TNCs), and National Private Companies (NPCs).[7] This distinction is based initially on the works of (Gereffi and Evans, 1981) and (Evans, 1987) for Latin America, alongside others for Asia (Haggard and Cheng, 1994; Amsden and Chu, 2003) and contributions that comparatively address the two geographical contexts (Amsden, et al., 2012; Kohli, 2004). In all of these, emphasis is placed on the necessity of considering these three types of actors and the different roles they play in various development strategies or models.[8]

Ultimately, an in-depth characterization of these regimes and the roles played by these actors is essential to identifying the extent to which (neo)extractivist practices are reproduced (or not) in lithium extraction activities. Thus, for example, the production regime of a certain economy may anchor a portion of lithium extraction to the development of a value chain (backward and forward) with local companies; or a certain fiscal regime, in addition to capturing greater economic rents from TNCs and financing certain social programs, may promote industrial policies and R&D, obtaining a position to better overcome primary-export patterns (ECLAC, 2022; R. Poveda Bonilla, 2021; Mancini and Paz, 2016).

4.3. Characteristics of the (neo)extractivist exploitation model

Having presented the analytical proposal for studying exploitation models, the final step before addressing the case studies is to outline the

[4] In light of the fact that we are discussing natural resources, it is preferable to use the term 'exploitation' rather than 'production'.

[5] The term "regime" is common in the literature of Political Economy, particularly in International Political Economy (Krasner, 1982), where it typically refers to a set of principles, rules, norms, and procedures that govern international relations. In that context, regime is an "intervening variable" that arises from structural causes and shapes and/or influences outcomes (Krasner, 1982). This approach is consistent with the institutionalist framework adopted here, where institutions (and the regime they constitute) are simultaneously restrictive, facilitative, and constitutive of a vision and/or ideology. On the other hand, this concept of regime assumes the hypothesis that, as a causal factor, "regimes make a difference" (Krasner, 1982: 185).

[6] The Chilean Constitution states that "the State has absolute, exclusive, inalienable and indefeasible ownership of all mines" (Article 19, Section 24); the Bolivian Constitution declares that "natural resources are the property of the Bolivian people and are administered by the State" (Article 19, Section II.2); and in the case of Argentina, "the original ownership of natural resources located within its territory belongs to the provinces" (Article 124).

[7] The State, as the main actor, also encompasses other actors, such as State-owned Enterprises (SOEs), regulatory bodies, etc., whose presence, significance, and functions vary depending on the regime of ownership and control.

[8] In addition to these three actors, the significance of indigenous and environmentalist movements is acknowledged in certain contexts such as Bolivia. Notable contributions in this regard include Obaya and Pascuini (2020), Fornillo (2018), González and Snyder (2023), Gómez Lende (2021), and Godoy (2022).

key elements of the (neo)extractivist model that will serve as a reference for comparative analysis.

This research makes reference to (neo)extractivism, as an exploitation model of natural resources, based on the contributions of Gudynas (2009, 2011, 2015 and 2018), Acosta (2012), Burchardt (2016), and Robinson (2019).[9] All of these contributions state that in the (neo) extractivist model of exploitation, neither extraction of the natural resource *per se* nor the primary-export model is specifically questioned; questioned instead are the institutional conditions under which the resource is exploited (Gudynas, 2009; Acosta, 2012).

The above-cited references make it possible to highlight the key elements of the (neo)extractivist model in terms of actors and regimes:

- As regards actors, there is now unanimous consensus around the greater presence and active role of the State as regulator and through SOEs such as YPFB or ENARSA (Gudynas, 2011) with direct involvement in extraction activities. Nevertheless, governments maintain a certain subordinate role in their relationship with transnational capital (Robinson, 2019).
- As regards regimes, the fiscal is brought to the foreground, given that raising the rents captured by a State to finance social programs has served as the fundamental objective of (neo)extractivism.[10] The production regime is in this case focused essentially on facilitating the rapid extraction of raw materials for export purposes (Burchardt, 2016).

A more comprehensive characterization of (neo)extractivism based on our proposal is succinctly presented in Table 2. Each cell in the table gathers specific elements of comparison to be utilized in Section 5 to address our second stated objective.

Ultimately, under a (neo)extractivist model, the State finds itself in a relatively comfortable position, maintaining control over resource exploitation and garnering a significant share of the rent, which it largely employs to finance social programs (objective of legitimation). Conversely, despite a reduction in control, TNCs are likewise relatively comfortable in that they are permitted an accelerated rate of exploitation – optimal for their own profitability as well as for the State's revenue capture. However, as evidenced by certain references cited before, this model fails to generate structural transformations, the promotion of which would require actors to assume different roles supported by institutions aimed at overcoming the model. This aspect further fortifies the interest in conducting a comparative analysis.

Table 2
(Neo)extractivist exploitation model.

	State	Transnational corporations	National private companies
Property regime	State **controls** natural resource exploitation. Modalities of control: direct (SOEs), indirect (involvement in private companies), regulation	After lease contracts or concessions, **reduce control but keep assets** for exploration and exploitation activities	Local companies **have less presence**. In the countries where they do exist, they are usually beneficiaries of a concession or prior process of privatization
Production regime	State supports new exploration and exploitation projects for export purposes: maintains dependence on global markets	TNCs extract minerals for export. Business strategies focused on profitability increase the rate of exploitation.	**Export extractivism**. These companies usually participate in a low-added-value stage within the value chain
Fiscal policy regime	State **increases the tax burden** (new taxes and renegotiation of contracts) and keeps a greater proportion of the mineral rent; State revenue is mainly allocated to **social programs**	TNCs **reduce their share of mineral rents** (new taxes or renegotiation of contracts with the State)	**Little share of mining income**. LCs often operate under some special taxation or deduction regime

Source: Authors' elaboration based on theoretical contributions by Gudynas (2009, 2011, and 2018), Acosta (2012), Burchardt (2016), and Robinson (2019).

5. Results: exploitation models in the lithium triangle

Based on the theoretical proposal outlined in Section 2, this section examines the exploitation models in Chile, Argentina, and Bolivia.

5.1. Chile

Of the countries comprising the Lithium Triangle, Chile has the most extensive extractive experience, with its main deposit located in the Atacama Desert. The case of Chile offers clear evidence of the influence of political cycles on exploitation of the mineral.

Ownership regime

The current lithium ownership regime in Chile was inherited from a set of reforms around mining deposits and SOEs carried out under the military dictatorship of Augusto Pinochet (1973–1990), which reversed the nationalization process implemented by his socialist predecessor Salvador Allende (1970–1973). In 1979, the military dictatorship issued Decree Law 2886 declaring lithium and its reserves to be of national interest in favor of the State. However, at the same time they enabled necessary exceptions to guarantee rights to individuals who had acquired property in the salt flats prior to the issuance of the aforementioned decree (BCN, 2018).

This *modus operandi* was reflected in the national Constitution approved in 1980, distinguishing between 'dominion' and 'ownership' (BCN, 2016, p. 24). The successive regulatory frameworks of 1982 and 1983 (the Mining Concessions Law and the amendment to the Mining Code, respectively) reaffirmed that, although lithium was not concessionable, those deposits under the control of the State-owned Development Corporation (CORFO) could indeed be so considered.

Between the late 1980s and the early 1990s, CORFO sold its participation in the lithium producing companies (Obaya, M; Pascuini, P, 2020). Initially, joint-ventures were created under public-private management, but gradually all shareholder control was ceded to private companies,[11] giving rise to the two large mining corporations that currently exploit the mineral: the U.S. company Albemarle and the Chilean company Sociedad Química y Minera (SQM).This ownership regime in which the State assumes an exclusive regulatory role over private exploitation continuously conditions and pressures the fiscal and production regimes, reflecting the transnational struggle for the mineral among private capital suppliers. In fact, the erstwhile hegemony of U.S. capital is now being challenged by capital from northeast Asia, especially China, which already owns 22 % of SQM.

[9] It is important to clarify that (neo)extractivism was primarily applied to the exploitation of hydrocarbons.

[10] This framework implied that the funding of social programs was highly dependent on fluctuations in the price and international demand for the natural resource. This resulted in a reduction in the stability of funding for the programmes, challenging the provision of a strategic orientation.

[11] In 1987, the government created the Sociedad Minera Salar de Atacama Ltda. (MINSAL) to concession lithium deposits. CORFO initially participated in this company with a 25% stake, but later MINSAL in its entirety became part of SQM (Cochilco, 2020, p. 37).

Fiscal regime

As a result of the ownership regime, the capture of tax revenue is supported by levies applied to SQM and Albemarle. Two stages can be distinguished, the first marked by neoliberal policies that favored the entry of FDI, and the second by contractual modifications instigated from the upward price cycle (between 2016 and 2018). These modifications were carried out during the second socialist government of Bachelet (2014–2018), who included in the government program a national lithium policy, renegotiating contracts and promoting specific tax reform (SUBDERE, 2013), as a result of a previous electoral alliance with center-left political actors known as the *Nueva Mayoría* (New Majority). In short, we observe here how changes in government (along with the evolution of international prices) generate changes in the fiscal regime (institutions as constitutive elements) that in turn influence company strategies (institutions as devices).

A summary of the taxes applied can be found in Table 3 below.

With the 2016 reform, the tax invariability in force since the dictatorship to attract FDI was eliminated. This figure had proven an impediment to increasing revenues, even in times of emergency such as Chile's 2010 earthquake (BCN, 2020). Tax levies increased substantially, differentiating types of lithium by degree of complexity. In addition, R&D clauses and direct contributions to communities were included to finance investment projects and sustainable and productive development in surrounding areas (CORFO, 2018, pp. 12–13). These measures reflected the intention of the Bachelet government to generate institutions that promote structural changes.

On the other hand, despite its advanced accountability system, Chile does not offer official statistics on lithium-specific collections. Nonetheless, ECLAC estimates have highlighted the vertiginous increase in collections since 2016, attributable to contractual renegotiations and to the increase in international prices. Collections for the 2010–2015 period stood at a monthly average of just US$34.0 million, while for the 2016–2020 period these were nearly eight times higher, at US$260.8 million. The State thus went from capturing 24.4 % (on average) of the economic income generated by Albemarle and SQM in 2010–2015 to 41.0 % in 2016–2020 (Fig. 2).

Production regime

Chile has verified reserves of 11 million MT (USGS, 2024, p. 111), ranking third behind its two neighbors in the triangle. The country's tradition of large-scale production dates back to the first agreement between Foote Mineral (now Albemarle) and CORFO, which produced the first 5000 tons of lithium as early as 1984 (Cochilco, 2020, p. 37). As a result of the ownership regime, after being privatized and assuming relevant leases, SQM began its production of both potassium and lithium in 1993 (SQM, 2018).

Four uninterrupted decades of capital investment have endowed the two corporations operating in Chile with exceptional production capacity. The U.S.-based Albemarle operates in Atacama and La Negra, developing conventional mining and activities for further refining (technical-grade and battery-grade lithium carbonate) in addition to maintaining R&D laboratories (Albemarle, 2023). SQM operates plants for the production of both lithium carbonate and lithium hydroxide (SQM, 2023).

The renegotiated contracts together with rising international prices have led to a substantial increase in production over the past five years, with an average annual production of between 2019 and 2022, 2.2 times higher than that generated during the previous period of 2015–2018. Since 2016, the cumulative annual growth rate has reached 25.3 %.[12] This trend is higher in lithium carbonate, which continues to dominate as an input for EV batteries. However, the sudden surge in international markets for lithium hydroxide, a more complex and efficient derivative for the production of more powerful electric batteries, and for lithium sulphate, used as a raw material for the production of other compounds, has led to a significant shift in production (up to 33 % in 2022) toward these higher value-added compounds (Fig. 3).

In the new contracts, the extraction quotas for the two companies have tripled, but access remains conditional for both corporations on the construction of plants for refining lithium to battery grade. In addition, their R&D contributions must be oriented toward entities that promote innovation in solar energy, lithium salts, or other products in metallic and/or non-metallic mining. In other words, there is a clear incentive to upgrade in terms of adding value to the raw material. In fact, both contracts prohibit the commercialization of low value-added products, specifically crude, concentrated, and/or refined brine (BCN, 2021, p. 3).

Another key aspect is the so-called national value-added incentive. The Chilean State obligates both of these corporations to sell up to 25 % of their production capacity of lithium products at a preferential price to specialized producers, public or private, located (or to be established) in Chile, in order for these to produce value-added products, including lithium cathodes (or components thereof), lithium battery components, and/or lithium salts (CORFO, 2018, p. 16). However, several successive drawbacks have hindered the development of a local value chain, including the location of battery producers and consumers, the type of lithium, and the costs of production (Cochilco, 2020, pp. 43–44). In addition, the incentives to sell abroad (Fig. 3) are significantly higher for the mining duopoly. Between 2014 and 2023, an average of 89.1 % of all lithium carbonate produced in Chile (measured in metric tons) was exported. Indeed, 2022 saw the highest export concentration, at 98.3 % (Fig. 4),[13] coinciding with the peak recorded in international mineral

Table 3
Chile: Tax figures on lithium mining activity.

Tax name	Alicuota
Tax invariability	Fixed rate of 42 % for 10 years
Profit Tax	27 % to companies and 35 % to shareholders
Rental income	Progressive aliquot between 6.8 % and 40 %, depending on the lithium price range
Specific Tax on Mining Activity	Progressive rates based on sales in metric tons. $\leq$ 12,000 MT: exempt 12,000 to 50,000 MT: progressive marginal rate of 0.5 % to 4.5 % of sales $\geq$ 50,000 MT, progressive marginal rate from 5 % to 34.5 %
Mining patent	Remunerates the State on an ascending scale (per hectare under concession) and differentiated scale (according to exploration or exploitation activity)
Contributions to Research and Development ($R + D$)	Albermarle = US$297.8 million between 2017 and 2043. SQM= US$217.7 million between 2018 and 2030.
Contributions to communities	Albermarle = 3.5 % of its sales of Lithium Carbonate and Potassium Chloride to 18 indigenous communities. MCS = 1.7 % of its sales to two regional governments and three municipalities.

Source: Authors' elaboration, based on Library of the National Congress of Chile (2016, 2020, and 2021), Internal Revenue Services of Chile (2023), and CORFO (2018).

[12] The renegotiation of contracts addressed not only fiscal aspects but also those related to production. The extraction quota for both companies nearly tripled, allowing them to intensify their exploitation rates. However, access to these new quotas was conditioned on the two corporations constructing another lithium refining plant. Thus, the renegotiation seemingly accommodated not merely the State's interests (regarding its share in mining revenue and increased investment commitments) but also those of concessionary companies interested in accelerating the pace of exploitation in a context of high prices and high demand.

[13] Conversely, in 2023, this indicator fell to 85.6%, with international prices declining by 32.5%. Lithium carbonate is the reference compound due to its status as the most produced among lithium derivatives, averaging 86% of total production during the period from 2014 to 2023. Additionally, it is the only compound to appear in the statistical tables of physical quantities of export shipments (Cochilco, 2024, pp. 12-26).

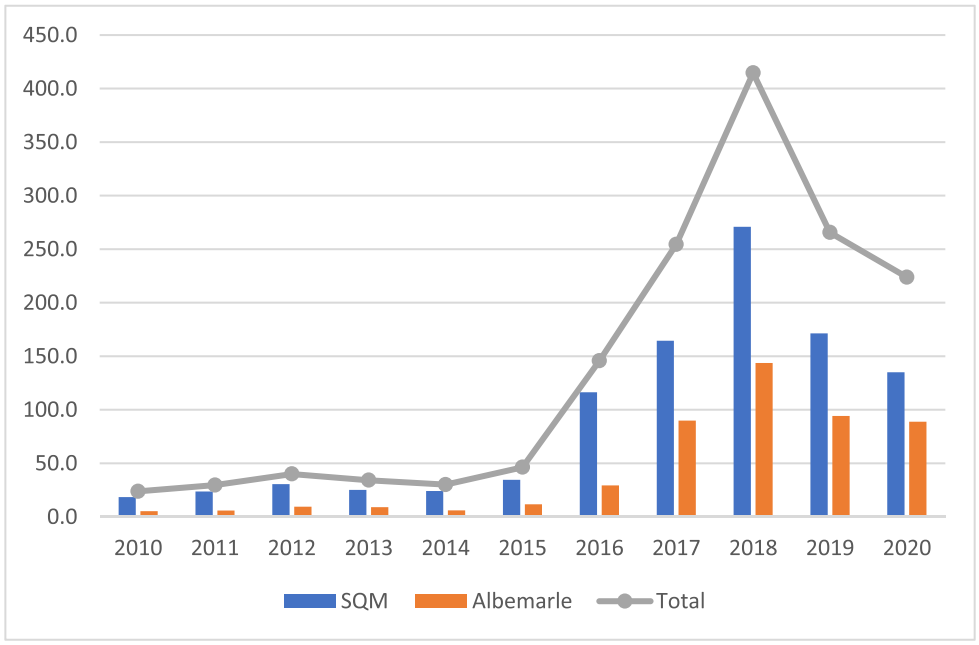

Fig. 2. Chile: collection of taxes for lithium, 2010–2020, millions of dollars.
Source: Authors' elaboration based on estimates by Jorratt (2022).

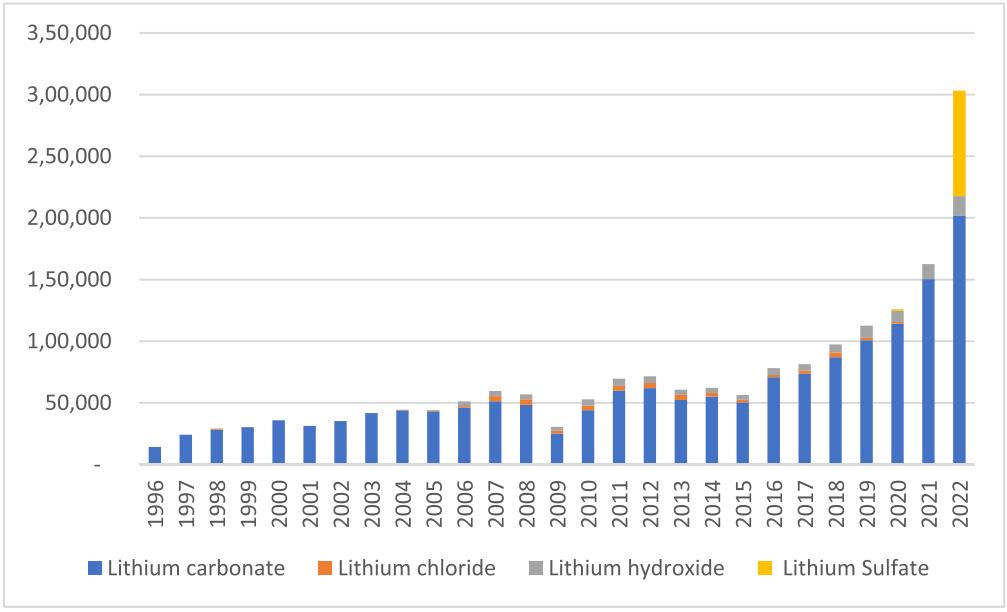

Fig. 3. Chile: Production by type of lithium, 1996–2022, in metric tons.
Source: Authors' elaboration based on SERNAGEOMIN (2023) and COCHILCO (2024).

prices. With the boom in international lithium prices recorded in 2022, the total value of Chilean exports of the lithium carbonate compound increased by 835.5 % compared to the previous year.

During the 2017–2021 period, more than three-quarters of Chilean lithium (76.8 %) was exported to Korea, China, and Japan, this high northeast Asia concentration being a result of GVC configuration. In 2020, SQM signed an agreement with South Korea's LG Energy Solution to supply 55,000 tons of lithium carbonate for the manufacture of EV battery cells (SQM, 2020). Nonetheless, China was the main destination for exports in 2021, concentrating 43.3 % and up to 72.4 % of the total value exported by Chile in 2022. It is no coincidence that the Chinese transnational Tianqi Lithium Corporation acquired almost 22 % of SQM shares in 2018.

5.2. *Argentina*

From the 1940s through to 1960, Argentina carried out initial lithium extractions to meet the demand of the U.S. military industry (Delbuono, et al., 2017, p. 19). But it was not until the late 1980s and early 1990s that large-scale extractive activity began in earnest, configuring the country's current exploitation model.

Ownership regime

Argentina's federal political system has had a significant impact on configuration of the property regime. Article 124 of the Constitution empowers the country's provinces as responsible for ownership of the natural resources present in their territories (Casa Rosada, 2023).

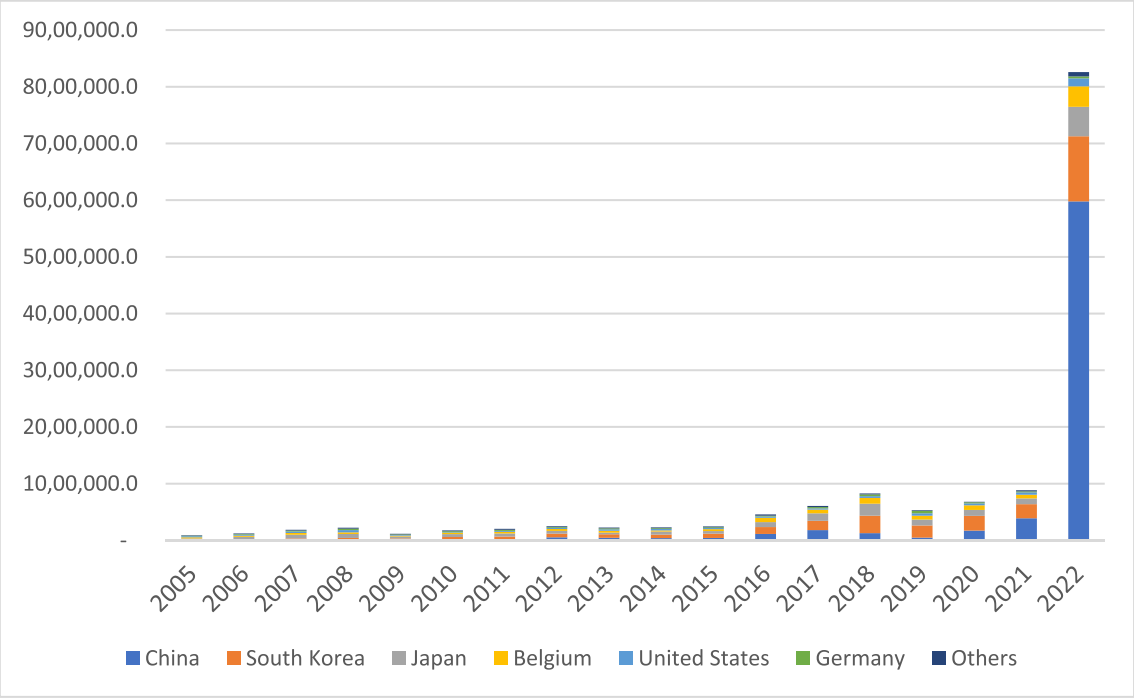

Fig. 4. Chile: Exports of lithium carbonate, by country of destination, 2005–2022, thousands of US$.
Source: Authors' elaboration based on SERNAGEOMIN (2023) and UN Comtrade (2024).

Specifically, this obligates the national government to reach a consensus with the provincial governments – sometimes of opposing parties – on minimum agreements for the exploitation of lithium in the three provinces with deposits (Jujuy, Salta, and Catamarca) through the so-called National Lithium Roundtable (MDP, 2021).

On the other hand, the Mining Code, last modified in 1997 during President Menem's neoliberal era (1989–1999), explicitly established the concessionable nature of lithium, whose mines can only be exploited after concessions granted by the provincial governments (Congreso de la Nación, 2015). However, this context has proven adverse in disputed border territories, as between Salta and Catamarca, both of which have historical claim over lands in the Salar de Hombre Muerto. The provincial governments reached a preliminary agreement in 2021 (SAIJ, 2022), but the dispute has served to delay projects in the zone.

Table 4

Under this private concession regime, four large foreign companies currently exploit lithium in Argentina (Table 5). Until the arrival in 2015 of capital from Northeast Asia and Australia, the U.S.-based Livent corporation operated from a monopoly position for two decades. However, the provincial government of Jujuy has established a national public company (provincial SOE) to participate as a minority shareholder, becoming the only semi-public lithium ownership experience in Argentina.

Fiscal regime

Taking into account the property regime described above, the fiscal regime represents the only tool available to the national government to influence the orientation of activity. The evolution of the fiscal regime reflects the shifting ideological orientations since 1990 of the three national political projects in Argentina.

As regards the figure of tax invariability, the Menem government followed in the footsteps of Pinochet in Chile. For transnationals such as Livent, this tax scheme was extremely advantageous. Unlike in Chile, this tax figure has not been repealed in Argentina, thus affecting the collection of income tax.

Another aspect that has characterized taxation in Argentina is the high volatility experienced by rates depending on whether the center-

Table 4
Chile: Synthesis of the lithium exploitation model.

	State	Transnational companies	National private companies
Property regime	State control as regulator through CORFO and the mining concession regime	Shareholding structure reflects the international struggle for lithium. Albermale is a clear example.	These are beneficiaries of concessions or some previous process of privatization of public companies.
Production regime	The renegotiation of contracts allows for an increase in production. At the same time, the contracts include local-content measures with the purpose of adding value to the raw material.	Exploitation strategy aimed at satisfying international demand with a high concentration of destination. Since 2016, new contracts have forced reinvestments and promoted $R + D$.	SQM maintains an extractive strategy, although it has been escalating toward activities of greater refinement. The promotion of forward and backward linkages with local (non-extractive) companies is foreseen in the regulatory framework.
Fiscal policy regime	After contractual renegotiations, the State increases its share of mining income and conditions its reinvestment in productive development projects at the local level.	Until 2016, tax incentives and low taxation prevailed to attract FDI. Since 2016, the tax burden has increased.	Following a contract renewal in 2018, SQM has had to increase payments to the State and direct investments to communities.

Source: Authors' elaboration.

Table 5
Transnational lithium companies in Argentina.

	Livent - Mineral del Altiplano S. A	Sales de Jujuy	Minera Exar	Posco Argentina
Antecedent	Began extractive activities in 1997 in the province of Catamarca. Brought to Argentina the technology that allowed the leap to large-scale production.	Began operations in 2015. First joint public-private lithium project in Argentina.	Project under construction. As of April 2023, the company reported progress of up to 90 %.	Project under construction. The company plans to start commercial activity by the end of 2023.
Ownership structure	**100 % private** (United States) FMC Lithium Affiliate	**Public-Private Partnership** Orocobre (Australia), 66,5 %; Toyota Tsusho Corporation (Japan), 25 %; JEMSE (Argentina), 8.5 % ownership.	**100 % private** Lithium Americas (United States), 50 %; Ganfeng Lithium (China), 50 %.	**100 % private** Pohang Iron and Steel Company (South Korea)
Concessioned deposit	Salar del Hombre Muerto	Salar de Olaroz	Salar de Olaroz	Salar del Hombre Muerto
Concession time	Nd	Nd	40 years	30 years
Project	Phoenix Project	Olaroz Project	Cauchari-Olaroz Project	Sal de Oro Project
Location	**Catamarca**	**Jujuy**	**Jujuy**	**Salta y Catamarca**

Nd = Not defined.
Source: Authors's elaboration based on websites of mining companies.

left or center-right is governing. The income tax rates approved by 'Kirchnerism' in 2021 were on average ten percentage points higher than those of four years earlier under the center-right government of Macri.

As with Chile, no specific official statistics on lithium extraction revenues are available. However, based on estimates by Jorratt (2022), it can be said that during the 2018–2020 period, the annual average of lithium collections (valued at US$14.3 million) practically tripled in relation to averages recorded in historical series.

The center-right government's tax reform reduced the income tax (ISU) rate (and with it, collection) by >60 %. This reduction was simultaneously compensated for by an increase in export duties after raising their tax rate. In its turn, the center-left reduced the refund, recognizing in 2019 and 2020 only one-third of the tax refunds previously recognized. This levy, being higher than the collection of royalties from the provinces, functioned as a relief mechanism for the companies.

With this tax regime, during the 2010–2020 period, the State appropriated only US$88.3 million from tax collections of the various levies (Jorratt, 2022, p. 45) – a sum that represents just 27.6 % of the economic income generated by the transnational companies exploiting lithium in the three provinces. No legislation currently conditions the use of the rents collected from lithium.

Production regime

Argentina possesses the second-largest verified lithium reserve in the world, estimated at 22 million MT (USGS, 2024, p. 111). As might be expected, the regional relevance of the country's ownership regime along with its high fiscal volatility has ultimate repercussions on the companies' strategies.

For almost 20 years, only one company (Livent) operated under a tax invariance treaty enabled by the national government and a lease secured by a provincial government. The company produced on average between 10,000 and 15,000 tons of lithium per year, mostly for direct export to the United States. However, following the arrival of Japanese and Australian capital in 2015, the first project under a public-private partnership commenced. This joint-venture operates the second-most important salt flat in the country (Salar de Olaroz), increasing installed capacity and boosting annual production.

During the 2000–2015 period, Argentina produced on average 12,000 MT of lithium carbonate per year, but in 2016 average annual production rose to above 32,000 MT (SIACAM, 2023). The cumulative average annual rate of production for the 2000–2022 period was around 16.9 %. The exceptional export performance experienced in 2022 was consistent with the evolution of international prices, which tripled that year. Previously, as shown in Fig. 5, the value of exports had already doubled (since 2016).

Even more relevant is the destination of these exports (Fig. 6). Until 2015, when the Livent company operated as a monopoly, >70 % of lithium exports went to the United States. However, since 2016, with the arrival of new capital from Northeast Asia, an average of 64 % of exports have gone to China, Japan, and Korea (40 % to China alone).

In the period analyzed, there is no common policy of local content requirements in production. However, in the Sales de Jujuy project, it is highlighted that the provincial company JEMSE has sales priority over 5 % of the production (Obaya, M; Pascuini, P, 2020, p. 42). As Barberón (2022) suggests, Argentina has an important track record in lithium research, with extensive participation of institutions from the Science, Technology and Innovation complex, such as YPF Tecnología S.A., the National Atomic Energy Commission, national universities and others research institutes. However, this $R + D$ sector is detached from both the extractive activities in the salt flats and the instances of industrial production. Argentina produces and exports only lithium carbonate, which limits the value of its exports, and there are no active R&D measures or reinvestment in productive development.

5.3. Bolivia

With the coming to power of Evo Morales (2006–2019) and the Movement Toward Socialism - Political Instrument for the Sovereignty of the Peoples (MAS-IPSP), the state's involvement in the economy, both in production and redistribution, was strengthened (MPD, 2007). Within the framework of the Movement's 'Living Well' philosophy, the foundations were laid for a new developmentalist State supported by control over natural resources.

Ownership regime

Bolivia's property regime is based on the Constitution, laws, and decrees that establish State ownership of natural resources. However, worthy of highlight is the relevance of Bolivia's peasant movement MAS, which sought to recover sovereignty over the exploitation of natural resources and whose configuration influenced the initial decrees and measures shaping the ownership regime (Obaya, M; Pascuini, P, 2020, p. 36). The State assumed exploitation of this natural resource in 2008, when the Morales government declared the industrialization of Salar de Uyuni to be a matter of national priority.

Three stages can be distinguished in the country's ownership regime. In the first stage (2009–2016), all phases of the lithium production chain were nationalized. After declaring lithium to be a strategic resource, the State-owned Corporación Minera de Bolivia (COMIBOL) was

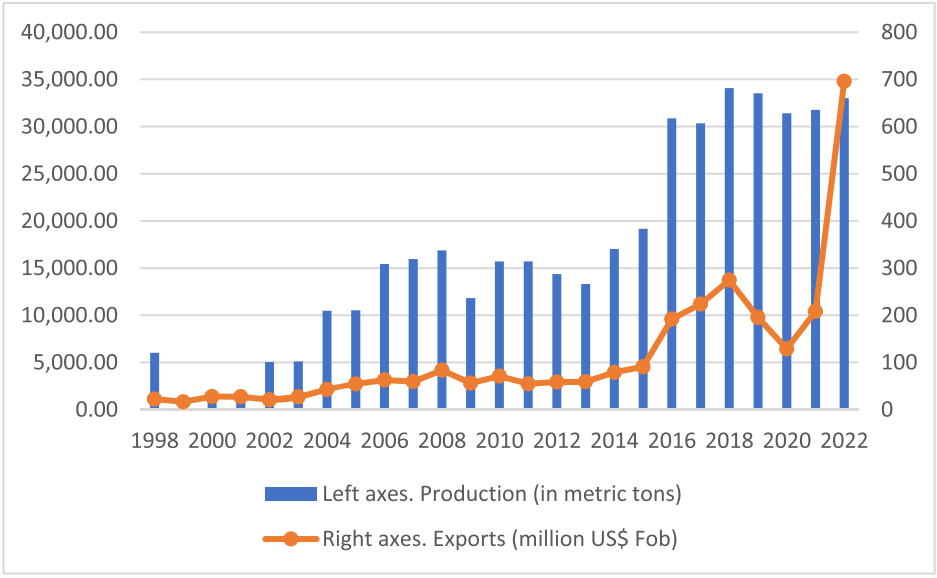

Fig. 5. Argentina: Production volume and monetary value of lithium carbonate exports, 2000–2022.
Source: Authors' elaboration based on SIACAM.

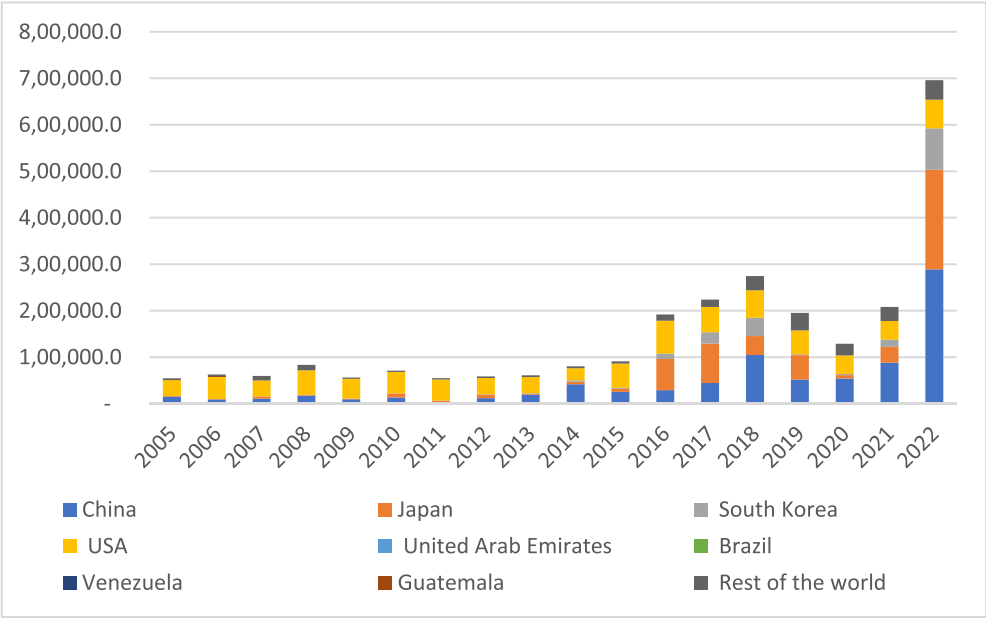

Fig. 6. Argentina: Destination of lithium carbonate exports, 2005–2022, thousands of US$.
Source: Authors' elaboration based on SIACAM (Argentina).

empowered to exploit it, assigning extraordinary funds to build a pilot plant (YLB, 2008).

Both the Constitution and Mining Law of 2009 endorsed these measures, and in 2010 the Bolivian Evaporite Resources Company (EBRE) was created to promote the exploitation of lithium. While the prices of other raw materials were experiencing an upward cycle, the State was able to finance the development of installed capacity for lithium. However, after this boom ended, the government was forced to make changes as a consequence of insufficient financing, access to technology, and international experience. The second stage of Bolivia's ownership regime began in 2017, when all lithium activity was regrouped into a single company: Yacimientos de Litio Bolivianos (YLB). Furthermore, private participation was enabled in stages related to semi-industrialization, industrialization, and recycling (YLB, 2017) while the State maintained a 51 % majority.

The turnaround by the MAS-IPSP government enabled contractual agreements with foreign companies. In 2018, YLB agreed with the German company ACI Systems Germany GmbH to found the joint-venture YLB-ACISA, in a 51–49 % split in favor of the State (Official Gazette, 2018). With this agreement, three lithium hydroxide production plants were built to supply the German EV battery market. In 2019, YLB signed an agreement with Xinjiang TBEA Group Co. Ltd. backed by Chinese capital and specialized in manufacturing electronic components; this alliance was likewise formed at a 51–49 % ratio, with the aim of developing 14 plants (YLB, 2019). Both agreements were later cancelled due to the convulsive political situation that ended Morales' presidency in November 2019. Morales would repeatedly refer to a *coup d'état* orchestrated by U.S. imperialist interests to appropriate Bolivian

lithium.

With the return of MAS-IPSP in November 2020, now under the presidency of Luis Arce, State control of lithium was recovered. However, YLB's management came up against the limitations of the current regulatory framework. In order to secure the required capital, the government renounced its monopoly on exploitation, so far as the foreign capital inflow included an agreement to share technology (Mendoza Reyes, 2022). This amendment marked the beginning of the third stage of Bolivia's lithium ownership regime. In 2021, YLB opened an international call for Direct Lithium Extraction (DLE) for the Uyuni, Coipasa, and Pastos Grandes salt flats (YLB 2022a). Six foreign companies (four Chinese, one U.S., one Russian) were selected and signed memoranda of understanding and confidential agreements (YLB 2022a, pp. 1–2).

Fiscal regime

Regulations provide that SOEs are subject to the ordinary tax regime in force throughout the territory (MPD, 2013), so YLB pays the same general taxes as a private company. Transnational companies that arrived in the country under the 2021 agreements are subject to the same tax regime.

Tables 6 and 7

The Bolivian State taxes extraordinary profits of both public and private companies, but at the same time, tax breaks are permitted for refining stages, to increase domestic value-added. Tax discounts have also been established for investments in the initial stages of exploration, and for environmental protection measures, alongside a system of exemptions for local mining cooperatives (Table 8).

Finally, worth highlighting is the Bolivian State's deficit in fiscal transparency, limiting access to data on disaggregated tax collections by use of public spending.

Table 9

Production regime

Bolivia has the largest lithium reserves in the world, at 23 million MT (USGS, 2024, p. 111) above those of Australia and Chile combined. However, Bolivia's annual production is significantly under that of these two competitors. During the period analyzed, Bolivia barely registered small-scale production and does not currently constitute a major player in the international sphere.

The National Industrialization Strategy (2008–2010) established three phases for lithium exploitation: 1) construction of pilot plants to produce lithium carbonate and potassium chloride; 2) industrial-scale production of both compounds; and 3) production of lithium ion batteries (YLB, 2021). Nonetheless, Bolivia did not manage to develop certain internal production capacity until 2013, when the first pilot plant began operating. Potassium chloride, a compound of lower technological complexity, was the first destined to supply the domestic market (YLB, 2021). Its production began on a small scale, serving in the early years for research work, training of Bolivian technicians, and acquisition of practical knowledge of the production process for lithium carbonate. In 2014, the first lithium battery assembly pilot plant was inaugurated by the Chinese company LinYiDake Co. Ltd. In 2015, another Chinese company, known as China Camc Engineering Co. Ltd. Bolivia Branch, began construction of the first industrial potassium chloride plant, coming into operation in 2018 and thereby ending the pilot phase.

In 2017, YLB began production of the refined carbon compound for national markets and export. Development of the battery pilot plant allowed the State company to sign collaboration and supply agreements for battery packs between 2019 and 2021 with certain emerging companies, with Bolivian private capital, in the electromobility sector (YLB, 2021). Ventures such as Tecnologias de Ecomovilidad Urbana S.A. (MOBI) stand out, dedicated to the development of electric bicycles, scooters, and motorcycles, as well as Quantum Motors S.A., which produces micro electric vehicles (YLB 2022b, pp. 33–34). YLB has also established agreements with QUIPUS, a public company dedicated to the production and assembly of computers. These companies are part of a small but emerging local industry around lithium exploitation.

In 2021, YLB reported 88 shipments or sales packages for export and 24 packages for domestic sales; that is, just over one-fifth of lithium compounds and derivatives were consumed internally. In addition, the State company serves as a driving force for an entire network of local

Table 6
Argentina: Taxes on lithium mining activity.

Tax name	Alicuota
Tax invariability	Fixed rates for 30 years
Provincial mining royalty	3 % mining royalty + Tax of 2 % for Minera Altiplano (Catamarca)
Income tax	Progressive rates between 25 % and 35 %, depending on range of reported profits; 7 % shareholder dividend withholding rate.
Export duty	Ad valorem of 4.5 %
Mining withdrawals	1.5 % of the FOB value of exports

Source: Authors' elaboration based on Ministry of Economy of Argentina (2022, 2023).

Table 7
Argentina: Synthesis of the lithium exploitation model.

	State	Transnational companies	National private companies
Property regime	A concession regime in which State and provincial regulation predominates. Since 2015, a provincial public company has held a minority stake in the concessions granted to transnationals.	Chinese, American, Japanese, South Korean, and Australian capital distributed by four transnational companies, under joint-venture modalities. The concessions are for 30 or 40 years.	There is no presence of local private companies.
Production regime	Regulation does not include special measures on the rate of exploitation or local content.	Exploitation strategy aimed at satisfying the international demand for lithium. Export of the raw material with a high concentration of destination. Refinement only reaches lithium carbonate.	Nd
Fiscal policy regime	The State appropriates only 27.6 % of mining income, and there is no specification that conditions the use of these resources.	These can benefit from the mining invariability law, which also allows important reductions in pre-exploitation stages of lithium.	Nd

Nd = Not defined.
Source: Authors' elaboration.

Table 8
Bolivia: Tax figures in lithium mining activity.

Tribute	Alicuota
Tax on corporate profits (TCP)	Aliquot of 25 % on profits
Supplementary levy to the TCP	Additional rate to extraordinary profits from extractive activities, with 25 %
Additional aliquot to the TCP	Surcharge of 12.5 % on extractive activities
Mining royalty	Specific rate of 3 % for lithium carbonate

Source: Authors' elaboration based on compilation from National Tax Services (2022).

Table 9
Bolivia: Synthesis of the lithium exploitation model.

	State	Transnational companies	National private companies
Property regime	State control over all stages of the value chain as regulator and through the SOE (YLB).	Private capital, with a Chinese majority, operates in the position of minority partners (49 % maximum), especially in the refining stage. As of 2021, these can access the exploitation stage provided that they transfer technology to the Bolivian public company.	These companies are entitled to participate, in a minority position, in the exploitation, refining, and waste stages.
Production regime	The Bolivian State, through YLB, sets the pace of production and prioritizes the development of the value chain. Limited financial, technological, and operational capabilities.	Chinese capital controls the refining and battery plants. Exports with high concentration of destination: China and Russia. TNCs are providing technology to boost large-scale production from 2023. Refinement only to lithium carbonate	Agreements between YLB and emerging companies in electromobilty sector.
Fiscal policy regime	The public enterprise (YLB) is subject to the ordinary tax regime. Tax incentives are applied to promote industrialization.	Subject to the ordinary tax regime; eligible for tax incentives, provided that they contribute to the addition of internal value.	If companies participate in the internal value aggregation, they are eligible for certain tax incentives. Mining cooperatives, which operate in pre-industrial extraction of the salt flats, operate under a special regime of lower taxation.

Source: Authors' elaboration.

suppliers, including equipment rental companies, heavy vehicles, geotextiles, fertilizers, electronic and electrical services, and consultancies, among others (YLB 2022a).

Regarding exports (Fig. 7), although volumes remain less than comparable with those of Chile and Argentina, trends indicate that YLB left its pilot phase after 2021. In fact, in 2022 it reached production of 630 tons for export, with a monetary value of US$37.8 million. The Chinese market has been the main destination for exports in most years, but in 2022, 90 % went to Russia and almost all of the remainder to China (UN, 2023a).

Bolivia's definitive take-off is expected to occur when the Direct Lithium Extraction (DLE) technology begins operation, in compliance with the 2023 agreements with the six aforementioned foreign companies. With the incorporation of this technique – which other countries are already beginning to use – the traditional method of evaporation of brine would be abandoned, significantly reducing production times as well as environmental impacts due to lower water consumption.[14]

6. Discussion: comparative analysis of exploitation models

Having characterized the exploitation models of Chile, Argentina, and Bolivia, we now turn to analysis of any similarities or differences with respect to (neo)extractivism, this being the second objective of our research.

Beginning with the ownership regime, what distinguishes (neo) extractivism is the control exercised by the State as a regulator and through its SOEs. What sets the three cases apart in this regard, and which is closer to or furthest from (neo)extractivism?

Chile has developed a large private-concession duopoly (SQM and Albemarle) that divides its Salar de Atacama deposits. In the period under study, there is no direct participation through SOEs, but control is exercised through CORFO via concession. The Chilean case is an example of endogenous control capacity without ownership, with the State's role being that of a regulator. The reforms implemented in 2016–2018 do not affect the ownership regime or the role of the State, but they do intensify its control over mineral exploitation by guiding fiscal and production regimes towards objectives beyond mere rent capture.[15]

Like Chile, Bolivia has a national lithium policy that considers the mineral a strategic resource. However, unlike its two neighbors, Bolivia opted from the outset to create an SOE, with the State assuming not only a regulatory role but also direct exploitation of the resource. Subsequently, the government was forced to relinquish the State monopoly due to a lack of capital, technology, and the technical expertise necessary to sustain the extractive activity, contrary to the aspirations of the MAS political project and the social movements that initially supported it. Nevertheless, YLB continues to operate to date as a State-owned enterprise maintaining strong control over mineral exploitation.

In line with the above, when the Bolivian State finally made way for participation by both NPCs and TNCs in the refining and recycling phases (2017), the incentives being offered to foreign investors by other countries with lithium extraction were much more appealing. One had only to cross the Bolivia's southern border to encounter three Argentine provinces operating under a concessional regime. In the case of Argentina, the characteristics of its concession regime – yielding longer periods of time and more lenient conditions for mining companies – mark a distance from the State control typical of (neo)extractivism, bringing it closer to a classic extractivist model. The project of one provincial SOE (JEMSE) is not sufficient to escape this categorization, given the residual nature of its shareholding (8.5 % of Sales de Jujuy).

Regarding tax regimes, the most significant (neo)extractivist aspect is related to: i) an increase in State participation in mining revenue (through regulatory changes or contract renegotiation); and ii) an increase in revenue allocated to social policies. Which of these cases comes closest to (neo)extractivism?

While in Chile a center-left government coalition applied successive contractual amendments to the corporate duopoly, allowing the State to almost double the proportion of mining revenue captured, in Argentina the tax situation remained nearly unchanged, and increases in tax collection were generated almost exclusively through increases in

[14] The environmental impact of DLE technology remains a matter of debate. As Jiménez and Sáez (2022: pp. 58) indicate, energy requirements remain high, as does the carbon footprint. Some require large amounts of fresh water, which is not abundant in this part of the world, and so these technologies to develop lithium production in the area are associated with high risk.

[15] The establishment in 2023 of a 100% state-owned National Lithium Company by the left-wing government of Gabriel Boric occurred after the period considered in this essay.

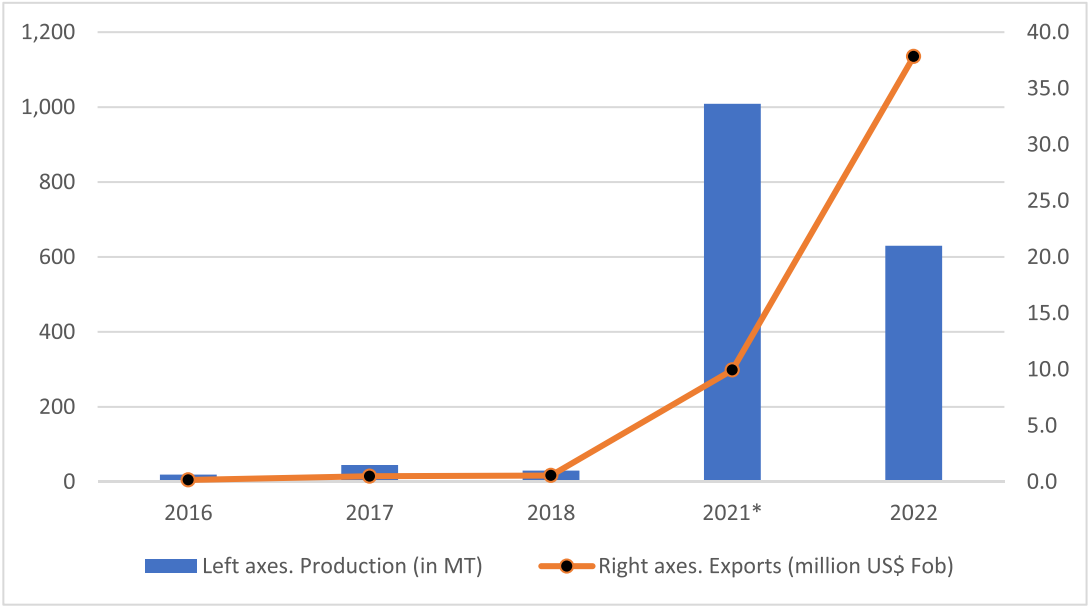

Fig. 7. Bolivia: Evolution of exports of lithium carbonate, 2016–2022, millions of US$ FOB and metric tons (MT).
*Note: The production exported in 2021 includes factory inventory from the previous year.
Source: Authors' elaboration based on UN Comtrade and National Statistics Institute (Bolivia), 2023.

prices. The tax reforms applied in 2018 and 2021, first by the center-right government and then by the center-left coalition, only served to modify the tax obligation in terms of who pays, not how much is owed. Furthermore, the State has maintained a tax invariability law that dates to the neoliberal period of the 1990s. Argentina might therefore be considered the tax haven for lithium, given that the rents captured by the State are almost 20 percentage points below those of Bolivia. Nevertheless, the aforementioned contractual amendments made by Chile during 2016–2018 – while increasing mining income for the State, a classic (neo)extractivist measure – obligate the transnational duopoly to undertake large productive reinvestments at the local level, meanwhile permitting access to operational, financial, and environmental information.

The Bolivian regime taxes lithium the most, and yet it establishes incentives (deductions) for TNCs that opt to continue producing upper links of the chain, toward and including final goods. Nevertheless, published information is opaque and does not reveal the destination of lithium mining revenue.

The production regime also varies across the three countries. One aspect that characterizes (neo)extractivism is that exploitation of natural resources is oriented toward exports; therefore, production rates are highly dependent on prices and on international demand. This has primarily been the case in Chile and Argentina. Increases in international prices have been the principal factor triggering production in both countries, as favored by their property regimes. Bolivia has likewise experienced the boost caused by high international prices, but to a lesser extent than its neighbors, given the operational rigidities derived from YLB's shortcomings.

Transnational companies located in Argentina and Chile are adapting the production of lithium compounds to the needs of their clients, located mostly in Northeast Asia. This reveals a production model based on the export of raw materials, with heavy concentration in terms of ultimate destination. Again, Bolivia has not escaped this trend; in the 2017–2022 period, its exports were destined for either China or Russia.

So far, Chile's two large private corporations are the only ones producing and exporting lithium hydroxide, among the superior refined compounds used in higher-performance EV batteries. This reflects the country's ability to adapt to the needs of those companies that control battery-production GVCs in Northeast Asia. The rise of lithium sulfate also responds to this trend. The Chilean regulatory framework has managed to reflect these changes by conditioning the taxes applied to the type of lithium compound exported: a compound with higher added-value pays higher taxes. Through this scheme of progressive taxation, Chile is the country that collects the most revenues.

A relevant aspect of the production regime that marks a clear break from (neo)extractivism is the addition of local-content requirements. In both Chile and Bolivia, inclusion of these requirements into the regulatory framework reflects the intention to take advantage of lithium exploitation in order to boost local industry.

In Bolivia, networks of NPCs linked to the deposits are State-supported, enabling their participation in public contract processes for the purchase of low-value inputs required in pilot plants. It remains unknown whether YLB's 2021 agreements with Chinese companies include local-content measures. Private projects in electromobility (scooters, bicycles, micro electric vehicles) have received government support and now represent an emerging local industry. In those cases, the State has conditioned the participation of a Chinese company to the direct development of pilot plants for battery production.

In Chile, three contractual aspects of the 2016–2018 renegotiations with the duopoly are especially relevant: (i) boosts to R&D in research centers; (ii) productive development and community infrastructure projects; and (iii) up to 25 % of lithium sales must go to local producers to promote a local value chain. Compliance with these measures engendered conflicts between the State-owned CORFO and the extractive duopoly between 2018 and 2022. Moreover, such a significant increase in international prices represents a clear counter-incentive to the effective implementation of local-content measures. On the other hand, the expansion of extraction quotas for both mining companies was related to pressures to increase the pace of exploitation. Still, even in this case, the Chilean State conditioned authorization for the expansion of salt flats exploitation to the construction of lithium battery plants. In fact, as García Bernal (2021) notes, in case of non-compliance by the companies, stipulations call for a reduction in the lease contract term (in the case of Albemarle) and a reduction in the quota (in the case of SQM).

On the other hand, only Argentina's provincial JEMSE project includes local-content measures. Even so, as Obaya and Pascuini (2020) indicate, this quota amounts to just 5 % of production by the Sales de Jujuy joint-venture, posing difficulties around the attraction of

significant investment. Beyond this, the fragmentation of the country's property regime under provincial tutelage makes the structuring of a national project around lithium significantly difficult, undermining the negotiating capacity of the State vis-à-vis transnational capital.

Finally, technological advancements in extraction techniques are functional to the increase in international demand. The new DLE technology, now in a pilot phase in Bolivia, aims not so much at correcting the environmental liabilities generated by water evaporation from brine but rather at increasing the rate of exploitation. If international demand for this raw material continues to increase at a rate faster than that of internal capacities to add value, it appears likely that Bolivia will relapse into (neo)extractivist tendencies.

7. Conclusions

Our research and analysis permits us to draw the following conclusions.

First, the theoretical-conceptual approach and the methodology employed have proven suitable to in-depth analysis of each model as well as to comparison with the (neo)extractivist model. Thus, our work contributes to the literature with an analytical proposal that can be replicated in subsequent analyses aimed at assessing changes to a model or focusing on other countries with the aim of identifying different ways of exploiting reserves. We find that the multiple-case study was the most appropriate methodology for our research objectives, also being useful in validation of the IPE approach. Analysis of the three cases clearly reveals the endogenous character of institutions as well as their triple nature (constraints, devices, constitutive elements). Furthermore, our analytical proposal based on the study of exploitation models has been shown to provide in-depth and structured insights into the ways lithium has been exploited, facilitating the comparison and evaluation of the various models and strategies.

Second, as regards the second objective of this work, it is possible to conclude that, at least for the cases of Chile and Bolivia, we have identified measures that represent a partial departure from the (neo) extractivist model. Nonetheless, based on the assessment offered in Section 5, it is not possible to conclude *ipso facto* that a complete break with (neo)extractivism has been made. This finding constitutes a contribution to the previous literature on lithium (see Section 3).

Third, as regards the various elements of the exploitation model in relation to the State, our analysis confirms (as indicated in the literature) the differences between the State's centralized (or hierarchical) role in Bolivia and its subordinate (or market) role vis-à-vis private capital in Argentina. In the case of Chile, however, it remains relatively debatable whether the role of the State is intermediate or whether the State simultaneously assumes strong control over resource exploitation (albeit with mechanisms distinct from those used in Bolivia). As regards the State itself – beyond the governance model, whether more or less hierarchical, wielding more or less control – the objectives that it actively pursues are of greatest relevance. For example, in Bolivia, the model can be seen as more hierarchical than in the (neo)extractivist model; however, different objectives are pursued, given that capturing a high share of revenue for social programs is neither central nor subordinate to other objectives, as in the case of (neo)extractivism. Distinction between the three regimes allows us to observe the coherence that must necessarily exist between the role of the State and the ultimate fiscal and productive objectives.

As regards the latter, this analysis has uncovered certain key questions. At what rate should lithium be exploited? Is it preferable to seek a high rate of exploitation, to take advantage of international market conditions and ensure high profitability, or else a low rate, which can facilitate the development of local capacities? In the models here analyzed, and during the period under study, Argentina clearly opted for the first path and Bolivia for the second. Nevertheless, it remains too early for any non-provisional assessment of the results.

Despite the noted differences, it is possible to affirm that all three countries have attempted to articulate some form of development strategy around lithium. Even Argentina, with all the shortcomings indicated, presents a minimum control mechanism in its National Lithium Table. Bolivia and Chile share a common denominator: the State has been essential for transforming the rules of the game and gradually making way for an internal agenda of industrialization. Nevertheless, for attainment of that purpose, private actors with the capacity to promote business ventures in line with the national project have clearly been required. This leads us to propose that a possible revival of old pacts between the developmental State and the local bourgeoisie might well be functional to such purposes. While (neo)extractivism can certainly survive without NPCs, an alternative model cannot.

Fourth, it must be recognized that lithium exploitation in all three countries remains markedly subordinate in nature. Once again, it is specifically the requirement of the global north to obtain a certain natural resource to undertake its energy transition process that has stimulated the configuration of the exploitation models of the Lithium Triangle. In this sense, despite some refutation of the (neo)extractivist model, the inertia toward continuation of a primary-export pattern remains quite strong.

There is a latent risk of reproducing primary-export insertion (and therefore patterns of center-periphery development) in the energy transition, especially due to the structural limitations suffered by countries with lithium deposits to effectively promote their own processes of transition. To begin with, most endogenous impulses (as in the cases of Chile and Bolivia) are concentrated on the production regime, while at the same time the countries of the triangle lack internal demand for electrical vehicles. It is no coincidence that GVCs are concentrated regionally, given that the EV battery tends to be manufactured close to where the final vehicle is destined to be sold (the global northwest and Northeast Asia); hence transnational investors may well be interested in Latin America only for the extraction of lithium.

Fifth, in our consideration, should the countries of the Lithium Triangle ultimately opt not to repeat history, then the escape routes are two in number:

i) Accept accelerated exploitation of the resource as a priority objective, taking advantage of high demand and high international prices – as in the (neo)extractivist model – while seeking to add value in the extractive-refining stage. This option is already underway (at different intensities) in all three countries, and it seems the most pragmatic approach in the face of internal obstacles to industrialization. The three countries could also take advantage of the geostrategic weight of possessing the largest lithium reserves in the world as negotiating power with foreign investors, in order to further increase the capture of income that can then be allocated to R&D and productive development.
ii) Understand that in order to overcome (neo)extractivism, regional integration must be pursued. In this option, integration of production by the three countries would be a *sine qua non* for gradual configuration of a regional value chain within the triangle, with eventual extension to other countries in the region. This option would imply adopting certain modalities regarding packages of subsidies, financing, and tax credits on both the supply and demand sides – similar to those that countries in the global north have been applying for a decade in order to develop an internal electromobility market.

Concerning the second route, one might question the extent to which integration of the different exploitation models is possible. Such integration would imply, at minimum, a process of fiscal homogenization, particularly in Argentina's regulatory framework, in order to eliminate downward competitiveness in fiscal policy. It would also entail limiting the extractive quota of the Chilean duopoly, or at least the conditioning of a greater proportion of the current quota to NPCs – not to mention the lifting of a constitutional veto on new concessions. Furthermore, Bolivia would have to renegotiate stronger conditions for local added-value in

the intensive exploitation of lithium currently proposed by Chinese companies under DLE technology.

The second scenario also would imply a turn inward. Given that none of the countries in the triangle have verified reserves of the other metals considered vital to the energy transition, commercial integration with Brazil (with significant reserves of manganese and nickel) would make sense for the future consideration of higher refining projects (upstream), the escalation toward precursors and cathodes (midstream), and the ultimate production of cells and batteries (downstream). Furthermore, because Brazil and Argentina operate the main automotive industries in South America, new public-private alliances could conceivably open, provided that technological innovations are articulated within the framework of industrial and energy policies.

Under current projections, none of these proposed alternatives would be exempt from immediate sacrifice, in productive terms (in a (neo)extractivist scenario, but with higher refining capabilities), and in fiscal terms (in a scenario of stronger moves into industrialization), as well as in recognition of the ecological and social risks involved in anchoring a development strategy in the continued extraction of subsoil minerals. But as Galeano (1971) once remarked, "Development is a journey with more castaways than sailors."

CRediT authorship contribution statement

Rafael F. Jovine: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **María J. Paz:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization.

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