

Locked in extraction: unveiling the path dependence of Chile's neoextractivist economy in a global transition era

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This article provides a multi-scalar analysis of Chile's development trajectory, demonstrating that its historical dependency on resource extraction has evolved into a resilient and complex financialised extractivist lock-in from 1940 to 2022. Using Bai-Perron structural break analysis and regional Principal Component Analysis (PCA), we reveal how the national economy transitioned from a primary-export model to one where a dependent service sector reinforces the extractive core. This reconfiguration has produced a territorially polarised landscape of extraction and accumulation zones. We argue that this lock-in is perpetuated by a deep-seated rentier logic and modern governance mechanisms like public-private partnerships, which structurally limit diversification.

Keywords: Chilean economy, extractivism, lock-ins, path dependence, resource exploitation

JEL Classifications: R10, P00

Introduction

Path dependence and lock-ins are crucial in understanding the persistence of economic models and institutional structures, particularly in resource-dependent economies (Pierson, 2000; Martin and Sunley, 2006). This paper explores these dynamics in Chile, a nation shaped by a historical dependence on extractivism, especially in mining. As the global economy transitions towards sustainability, resource-rich nations face multiple pressures to diversify their productive fabric. However, entrenched institutional frameworks, economic structures and policy legacies often hinder such transitions. Chile's ongoing dependence on resource extraction — first copper and now lithium — illustrates how historical development patterns constrain policy choices and development alternatives (Arias-Loyola et al., 2025; Weinberg, 2023). Using the concepts of path dependence and lock-ins, this paper analyses Chile's neoliberal extractivist model as a case study to explore how economic and institutional lock-ins constrain policy alter-

natives and development pathways (Newey and Coenen, 2022; Hassink et al., 2019).

Path dependence focuses on the persistence of historical economic and institutional structures, even amid changing external conditions. Institutional and economic lock-ins reinforce these patterns by creating self-perpetuating systems that resist structural change (Martin and Sunley, 2006; Hassink, 2005). These mechanisms are particularly relevant in extractivist economies, where reliance on natural resources becomes embedded in national economic and political systems. The Chilean case illustrates how such lock-ins operate, shaping policy decisions and economic strategies despite shifting global conditions (Barton et al., 2008; Atienza et al., 2021). Chile's extractivist economy has undergone historical transformations, yet remains deeply dependent on resource exports. Policy shifts — from state-led industrialisation to neoliberal market reforms — have reinforced Chile's reliance on mining, with policies favouring extractive industries over diversification efforts (Vergara, 2013; Singh, 2010). Today, as

Received: February 7, 2025; accepted on: August 18, 2025

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lithium becomes a key component of global energy transitions, Chile's extractivist model endures, raising questions about its ability to transition towards a diversified economy (Mejia-Muñoz and Babidge, 2023; Maxwell and Mora, 2020).

This study contributes to the discussion on economic path dependence and resource dependency by analysing Chile's extractivist trajectory from 1940 to 2010. Using the Bai-Perron method to identify historical trend breaks in the mining sector, this paper empirically demonstrates the persistence of extractivist lock-ins. These trend breaks align with major economic and policy shifts, further entrenching the country's dependence on mining. The findings underscore how institutional structures established decades ago greatly shape Chile's development trajectory, limiting economic diversification. The relevance of this study extends beyond Chile, offering insights for other resource-dependent economies facing similar challenges (Burchardt and Dietz, 2014). Understanding these dynamics is crucial for designing policy interventions that break cycles of dependency and foster economic transformation. This research engages with debates on sustainability transitions, examining how structural constraints interact with global environmental and technological shifts.

This paper is structured as follows: The section *Path dependence, lock-ins and extractivism* reviews the theoretical foundations of these concepts, situating the Chilean case within the relevant conceptual debates. This is followed by a historical characterisation of Chile's economic evolution in the section *The historical evolution of Chilean extractivism*, which is supported by a descriptive analysis of key macroeconomic indicators that contextualise the country's long-term trajectory. The section *Analytical framework: a multi-scalar approach to the analysis of lock-in* then details the study's methodology, integrating a national-temporal analysis with a regional-spatial one. The empirical results are presented in *Empirical analysis: identifying trend breaks in Chile's extractivist economy using the Bai-Perron method*, which first applies the Bai-Perron method to identify structural breaks in Chile's sectoral GDP composition and then uses Principal Component Analysis (PCA) to map the territorial footprint of the extractivist lock-in. Finally, the *Conclusions* section synthesises these findings, offers a nuanced definition of financialised extractivism, critically discusses policy implications and outlines avenues for future research.

Path dependence, lock-ins and extractivism

Path dependence and lock-in effects have been extensively explored in economic geography and regional studies, offering a powerful lens through which to analyse how historical decisions shape present and future trajectories,

often constraining the possibilities for structural transformation (Drechsler and Wätzold, 2020; Goldstein et al., 2023). Within evolutionary economic geography, path dependence underscores the role of self-reinforcing mechanisms that anchor regional economies to historically entrenched development trajectories (Zhu et al., 2019). These dynamics are not merely reflections of past decisions but are continuously reshaped through complex interactions between historical legacies, market forces and policy interventions (Allen and Donaldson, 2022).

Lock-ins, as a specific manifestation of path dependence, describe self-perpetuating systems that obstruct the adoption of alternative trajectories, whether technological, institutional, political, cognitive or economic (Erickson et al., 2015; Furtado and Perrot, 2015; Newey and Coenen, 2022). In the context of extractivist economies, these mechanisms become particularly evident, entrenching reliance on resource exploitation and hindering structural economic diversification (Fouquet, 2016). Carbon lock-in, for instance, illustrates how energy infrastructures and regulatory frameworks collectively constrain the transition to renewable energy systems (Furtado and Perrot, 2015). The interconnections between these various forms of lock-in create intricate barriers to change, necessitating strategic policy interventions aimed at fostering adaptability and breaking cycles of structural dependency (Goldstein et al., 2023).

Originally conceptualised within evolutionary economic geography, the concept of lock-in has been adopted across multiple disciplines to explain economic stagnation, technological inertia and the persistence of carbon-intensive industrial configurations (Cho and Hassink, 2009; Cairns, 2014). In Latin America, the study of lock-ins provides a crucial framework for understanding the enduring extractivist model, which continues to define national development strategies despite mounting socio-environmental pressures (Burchardt and Dietz, 2014). These structural rigidities perpetuate cycles of economic dependency and vulnerability (Wilson, 2014). Consequently, recent scholarship has underscored the necessity of expanding the analytical scope of lock-ins to incorporate multi-scalar dynamics that intersect with political ecology and sustainability transitions (Goldstein et al., 2023), as they have demonstrable effects on policy inertia that can render transformation nearly irreversible (Palley, 2017).

The consequences of lock-ins in resource-dependent economies are well-documented. While initial resource booms may generate short-term growth, long-term reliance on extractivism frequently results in structural vulnerabilities and patterns of underdevelopment (Frickel and Freudenburg, 1996). Over time, these regions can become susceptible to 'economic addiction', wherein resource dependence is sustained despite diminishing returns and rising socio-environmental costs (Freudenburg et al., 1994). This lock-in further obstructs economic diversification,

making regional economies highly susceptible to external shocks such as commodity price volatility (Martin and Sunley, 2006). Although strategies like the 'learning regions' framework have been proposed to mitigate these effects, their efficacy remains limited without transformative policy shifts (Hassink, 2005).

The relationship between path dependence and sustainability transitions is thus characterised by deep tensions. Socio-technical regimes frequently exhibit strong inertia, making structural transformations towards sustainable models particularly challenging (Clausen et al., 2017). However, examples such as Germany's Energiewende demonstrate that entrenched carbon lock-ins can be overcome through sustained political mobilisation and institutional recalibration (Buschmann and Oels, 2019). The concept of increasing returns further elucidates how the timing of policy interventions can create path-dependent lock-ins with profound political implications (Pierson, 2000). Emerging technologies, while framed as solutions, also pose risks of creating new lock-ins that reinforce existing systems rather than displacing them (Cairns, 2014). Overcoming these constraints requires not only technological innovation but also deep institutional transformation and critical reflection on the socio-economic power dynamics that underpin contemporary development pathways (Blumberga et al., 2021; Kabeyi and Olanrewaju, 2022).

To move beyond a static conception of these constraints, Evolutionary Economic Geography (EEG) provides a dynamic framework for understanding the creation of new development paths (Hassink et al., 2019). This perspective frames regional transformation as a multi-scalar process emerging from the interplay between endogenous capabilities and external linkages, such as 'strategic coupling' with Global Production Networks (GPNs) (Lee, 2024; Rodríguez-Pose, 2021). Overcoming lock-in is therefore contingent upon a region's absorptive capacity, which is shaped by its institutional quality and the agency of 'institutional entrepreneurs' (Boschma et al., 2017). Integrating EEG with Transitions Studies helps to open the 'black box' of lock-in by conceptualising extractivism as a dominant 'socio-technical regime' that resists change. New industrial paths are consequently forged within protected 'niches' that require deliberate institutional work to be created and scaled (Martin and Sunley, 2015). Such diversification may be 'related', building upon existing capabilities, or more radically 'unrelated', which necessitates stronger agency to break from the established trajectory (Boschma et al., 2017). For a resource-dependent economy like Chile's, the growing global demand for lithium represents a critical juncture where the outcome — either reinforced lock-in or genuine diversification — will depend on the ability of local actors to leverage these global connections for niche creation rather than merely reproducing historical dependencies (Kogler et al., 2023).

The historical evolution of Chilean extractivism

Extractivism in Latin America is best conceptualised as a complex development model and mode of capital accumulation. Critical scholarship defines it as a nexus of 'mutually reinforcing practices, mindsets, and power differentials that underpin and rationalise socio-ecologically destructive ways of organising life' (Chagnon et al., 2022, cited in López Flores and Ranta, 2025). This model, characterised by the intensive exploitation and export of minimally processed natural resources, has been a historical constant, adapting across diverse political and economic contexts. The emergence of progressive 'pink tide' governments at the turn of the twenty-first century gave rise to neoextractivism, a phase marked by a more active state role in capturing resource rents to fund social programmes. Despite this shift in rhetoric and social policy, neoextractivism ultimately failed to catalyse structural economic diversification, often deepening dependency on commodity markets and reinforcing the region's subordinate global position.

The persistence of this model across different political ideologies can be explained through the logic of the rentier society (Warnecke-Berger et al., 2023). The availability of resource rents offers governments a path of least political resistance, making it easier to secure legitimacy through redistribution than to undertake the complex transformations required for productive diversification. This rentier logic functions as a powerful mechanism for path dependence and lock-in, stifling investment in non-extractive sectors and generating a structural heterogeneity where the extractive sector's productivity becomes decoupled from the rest of the economy. This framework is not, however, uncontested; the expansion of the extractive frontier generates intense socio-environmental conflicts, giving rise to resistance movements that articulate struggles for 're-existence' and envision post-extractivist horizons. Within this context, Chile provides a compelling illustration of how rentier logics and institutional legacies have forged a durable extractive lock-in, entrenching structural constraints on diversification across multiple spatial scales.

Chile's extractivist economy is deeply embedded in its history, from the colonial *encomienda* system to the neoliberal expansion of the copper and forestry industries (Romero-Toledo, 2023). This trajectory has consistently generated significant social conflicts, particularly with Indigenous communities, as economic expansion has prioritised resource exploitation over environmental protection and social equity (Schmalz et al., 2023; Calderón-Seguel and Prieto, 2024). The country's peripheral position in the global economy has reinforced this dependency, constraining opportunities for diversification (Barton et al., 2008). The historical reliance on copper, a cornerstone of the national economy since the mid-19th century (Valenzuela,

1992), established a pattern of vulnerability to global commodity markets that persists today (Ffrench-Davis, 2002). Despite policy shifts, including nationalisation debates and neostructural reforms, the underlying reliance on copper exports remained unchallenged, and Chile failed to develop significant industrial clusters linked to its natural endowments, instead modernising its enclave economy (Vergara, 2013; Singh, 2010; Arias et al., 2014; Bas and Kunc, 2009).

Recent developments show a continuity of this model. The expansion of lithium mining, framed as a critical component of the global energy transition, exemplifies how 'green extractivism' can obscure significant socio-ecological costs, deepening historical asymmetries and conflicts over land and water with Indigenous communities (Arias-Loyola et al., 2025; Mejia-Muñoz and Babidge, 2023; Lunde Seefeldt, 2022). This new boom has also created geopolitical dependencies, particularly with China (Sanchez-Lopez, 2023), illustrating a complex reshaping of landscapes and labour dynamics rather than a departure from extractivism (Kingsbury, 2023). Throughout these cycles, economic elites have adapted their strategies to maintain control over resource governance, reinforcing capitalist domination in the face of community resistance (Leiva, 2019; Delamaza et al., 2017).

Chile's contemporary economic structure is profoundly shaped by the neoliberal restructuring of the mid-1970s. Key institutional reforms from that era, such as Pinochet's political constitution and the introduction of market-based water rights, created enduring constraints on resource governance (Hearnea and Donosob, 2005). The resulting hybrid model, which combined market liberalisation with selective state control over key extractive industries, facilitated deeper integration into global commodity markets but also exacerbated environmental degradation (Singh, 2014; Russi et al., 2008). The persistence of these neoliberal governance mechanisms has privileged private interests over public concerns, particularly in mining regions (Gentes and Policzer, 2024). Consequently, institutional lock-ins have limited the effectiveness of environmental and Indigenous rights reforms, maintaining a policy landscape that structurally favours the extractivist development model (Merino, 2020).

This consolidation of the neoliberal extractivist model has been reinforced by international actors. State institutions have consistently prioritised Foreign Direct Investment (FDI)-friendly policies based on low value-added resource exports, which, while fostering economic growth, have conflicted with sustainability and equity goals (Misleh et al., 2024). Regional trade agreements like the Pacific Alliance have further entrenched neoliberal economic logics, limiting policy alternatives (Nelson, 2022). The complex intersection of foreign capital, state intervention and local resistance thus defines Chile's contemporary economic trajectory, with national elites and transnational

actors continuing to perpetuate extractivist dependencies and their associated structural inequalities (Schmidt and Rose, 2017). A critical understanding of these dynamics is therefore essential for assessing Chile's prospects for escaping its extractivist lock-in and advancing towards a more sustainable economic future.

Mechanisms of lock-in: institutional and economic constraints on alternative development paths

Chile's extractivist lock-ins are reinforced by a complex interplay of institutional, legal and economic mechanisms that limit alternative development trajectories. The strategic selectivity of the state prioritises growth-oriented paradigms over sustainability, creating structural barriers that impede the transition towards more diversified and equitable economic models (Misleh et al., 2024). Chile's regulatory framework has further solidified extractivist dominance, favouring elite interests while limiting meaningful policy reform. The Organic Agriculture Law, designed to promote organic food production, paradoxically serves to constrain local sustainable practices by privileging export markets and elite consumers over small-scale agricultural producers (Contesse et al., 2024). Similarly, the neoliberal framework governing hydropower development subordinates other water rights, exacerbating socio-environmental conflicts, particularly for Indigenous communities that have long contested extractive encroachments on their territories (Prieto and Bauer, 2012). These institutional and regulatory constraints, coupled with the enduring legacy of Chile's peripheral position in the global economy, have sustained a pattern of resource extraction that remains deeply resistant to transformation (Barton et al., 2008).

Despite market reforms, state control over key extractive industries persists, reflecting a hybrid model of resource governance that combines neoliberal marketisation with selective state intervention (Singh, 2014). The forestry sector, for example, continues to shape conflicts with the Mapuche people, whose struggle against extractivist expansion exemplifies the broader contestations over land, labour and environmental governance in Chile (Schmalz et al., 2023). Economic elites, aware of growing resistance to large-scale extractive projects, have devised new strategies to mitigate opposition, ensuring the perpetuation of extractivist models even in the face of sustained socio-territorial mobilisation (Leiva, 2019).

The perpetuation of extractivism in Chile is further facilitated by a legal and regulatory framework that prioritises corporate interests over environmental and social concerns. The 1981 Water Code, a product of the Pinochet-era neoliberal reforms, institutionalised private ownership of water resources, creating a legal system that overwhelmingly prioritises opening and/or sustain-

ing mining operations while undermining Indigenous and communal water rights (Camacho, 2012). Although desalination policies have been introduced to address water scarcity, they remain inadequate in the face of expanding mining demands and a regulatory framework that continues to privilege extractivist activities (Alvez et al., 2020).

The neostructuralist state, while adopting certain policy adjustments to address developmental shortcomings, largely preserved the market-driven governance model of mining (Singh, 2010). While environmental policies improved through policy network activism, their implementation was hampered by weak regulatory institutions and corporate influence, rendering enforcement mechanisms largely ineffective (Orihuela, 2014; Armah et al., 2011). Efforts to establish mining clusters as a means of fostering economic spillovers have been largely unsuccessful, as evidenced in the case of the Antofagasta Region, which continues to function as a modern form of enclave (Arias et al., 2014).

Transnational actors, such as corporations and economic elites, play a crucial role in reinforcing extractivist lock-ins, deploying new political technologies and public-private partnerships to consolidate control over resource governance (Leiva, 2019). This process has exacerbated historical asymmetries, deepened oligarchic power structures and constrained the development of democratic environmental policy-making (Pelfini and Mena, 2017; Mejía-Muñoz and Babidge, 2023). The struggles of the Mapuche against forestry extractivism epitomise these broader tensions, highlighting the social and environmental injustices embedded in Chile's extractive economy (Schmalz et al., 2023).

Furthermore, while Chile has benefited from increased trade with China — particularly in raw material exports — its economic model remains vulnerable to the volatility of global commodity markets (Gachúz, 2012; Heine, 2016). This means, for example, that while the Chile's fiscal policy has been stable and countercyclical, it remains highly dependent on fluctuations in commodity prices and geopolitical tensions, creating worrying economic vulnerabilities (Céspedes et al., 2014). This dependence has also shaped investment priorities, leading to an overemphasis on physical capital at the expense of human capital development, reinforcing a reliance on natural resource-based industries (López and Figueroa, 2016).

Efforts to promote export diversification have been largely insufficient, with industrial policy playing only a limited role in fostering new economic sectors (Lebdoui, 2019). While the state has historically intervened in agriculture, mining and income distribution, its ability to generate alternative economic pathways remains constrained by structural dependencies on extractive industries. Moreover, the fiscal benefits of mining taxation have often led to local revenue distortions, with resource windfalls crowding

out municipal revenue collection and affecting regional fiscal behaviour (Oyarzo and Paredes, 2019).

Cognitive and political lock-ins further reinforce the perception of mining as an unavoidable economic activity in Chile. While the industry is widely regarded as a key driver of economic growth, its social and environmental consequences are often downplayed or dismissed in dominant policy discourses (Viveros, 2016). Mining companies exert considerable influence over media narratives, shaping public perceptions and obscuring the more contentious aspects of extractivism (Palma and Alcaíno, 2020). Similarly, Chile's governance model, which prioritises private sector interests, has facilitated a rapid transition to renewable energy. Yet, this shift primarily serves to sustain extractive operations rather than promote genuinely sustainable development (Furnaro, 2020). While Chile has made strides in exploration and environmental innovation, centralised governance and a limited understanding of mining's regional impacts continue to hinder economic diversification (Atienza et al., 2021). These dynamics underscore the enduring structural challenges that must be addressed to break free from the extractivist lock-in.

The public-private partnership model: a new form of extractivist lock-in?

Public-private partnerships (PPPs) emerged under neoliberalism as a central mechanism in reshaping Chile's extractivist economy, redefining the relationships between the state, capital and civil society. Economic elites have strategically deployed PPPs to neutralise opposition to extractive projects, incorporating initiatives such as 'territorial dialogues' and the formation of private-public-social development corporations to manage community resistance (Leiva, 2019). These governance innovations extend beyond traditional resource sectors. Conservation efforts, such as the Route of Parks project, have similarly adopted PPP frameworks, transforming protected areas into spaces of investment and financial speculation rather than prioritising ecological preservation (Beer, 2023). Across Chile, the proliferation of PPPs has intensified socio-territorial conflicts, disrupting the historically centralised nature of environmental disputes and spreading contestation to peripheral regions (Delamaza et al., 2017).

Risk allocation within these partnerships overwhelmingly prioritises economic concerns, often neglecting social and environmental dimensions (Castelblanco et al., 2020). The environmental impact assessment process, meanwhile, has reframed nature as an object of managerial intervention, reinforcing an extractivist logic that privileges economic productivity over ecological integrity (Li, 2018). Ultimately, PPPs have altered power relations in policy formulation and implementation while also enhancing the influence of private stakeholders in governance, often at the expense of democratic accountability (Almeida, 2017).

Although PPPs have been widely promoted as a mechanism for infrastructure development, their role in fostering sustainability remains deeply ambiguous. While they can address budgetary constraints and enhance operational efficiency (Patil and Laishram, 2016), they frequently prioritise financial imperatives over social and environmental goals (Patil and Laishram, 2016; Fell and Mattsson, 2021). The rigidity of conventional PPP structures often limits their adaptability to sustainability requirements, prompting the emergence of hybrid models designed to balance economic and environmental imperatives (Pinilla-De La Cruz et al., 2022). However, institutional change is inherently path-dependent, and the extent to which PPPs can be effectively reoriented towards sustainability varies across contexts (Matos-Castaño et al., 2014).

For PPPs to contribute meaningfully to sustainable development, a shift is required from finance-centric models to those explicitly integrating environmental and social principles (Xiong et al., 2020). This necessitates improved community participation mechanisms (Fell and Mattsson, 2021) and the institutionalisation of sustainability criteria within partnership agreements (Adebayo et al., 2023). Despite ongoing challenges, PPPs remain a potentially viable tool for advancing sustainable development goals, particularly in sectors such as infrastructure, economic growth and international partnerships (Castelblanco and Guevara, 2022). Still, breaking Chile's extractivist lock-ins will require profound institutional and economic restructuring to balance development imperatives with social and environmental justice.

Analytical framework: a multi-scalar approach to the analysis of lock-in

To unpack the complexity of Chile's extractivist lock-in, this study adopts a multi-scalar analytical framework that draws upon evolutionary economic geography. The central premise holds that path dependence is not a monolithic phenomenon but one that manifests through interconnected mechanisms operating simultaneously at national-temporal and regional-spatial scales; a phenomenon whose reproductive webs have grown more intricate over time. Therefore, to open the 'black box' of this lock-in, a dual methodological approach is employed that allows, on the one hand, for the identification of critical junctures in the historical evolution of the national economic structure and, on the other, for the analysis of its territorial footprint and resulting spatial disparities.

At the national level, lock-in is conceptualised as the persistence of an extractivist 'socio-technical regime', sustained by a 'rentier logic' that discourages productive diversification (Warnecke-Berger et al., 2023). The empirical manifestation of this regime is the resilience of the primary sector and the subordination of others, such as the

manufacturing industry. To test this hypothesis and capture the key moments of this regime's reconfiguration, the Bai-Perron method will be applied. This structural break analysis of GDP composition time series (1940–2010) will make it possible to endogenously identify the inflection points where the Chilean economy, rather than diversifying, deepened or reconfigured its dependency, transitioning from a primary to a financialised model of extractivism.

A purely national analysis is, however, insufficient, as this lock-in produces geographies of uneven development. The financialised extractivism model generates a marked territorial polarisation between enclaves of extraction and centres of accumulation and control. To examine this spatial dimension, a regional-level Principal Component Analysis (PCA) will be implemented for the years 1992, 2003, 2015 and 2022, using data from the CASEN surveys. A composite index (PC1) will be constructed, combining educational attainment, income and mining employment to measure the level of socio-economic development associated with the extractive model. Tracking this index will allow for an analysis of the trajectories of regional convergence and divergence, thereby mapping the 'territorial footprint' of the lock-in.

The integration of both methods constitutes a robust analytical framework that connects the historical evolution of the national economic structure with its concrete spatial consequences, offering a comprehensive understanding of the persistence and reconfiguration of extractivism in Chile.

Empirical analysis: identifying trend breaks in Chile's extractivist economy using the Bai-Perron method

Methodologically, this study identifies the key moments of change in Chile's economic structure and its territorial expression through a multi-scalar empirical strategy. This approach combines a temporal analysis of structural breaks at the national level (1940–2010) with a spatio-temporal analysis of regional socio-economic dynamics (1992–2022), using official data from the Central Bank of Chile, CLIOLAB (Pontificia Universidad Católica de Chile), and the CASEN surveys. The entire analytical process was implemented using the R programming language.

The first component of the analysis addresses the national economic structure from 1940 to 2010. To overcome the limitations of using absolute GDP figures and provide a clearer measure of dependency, we constructed key structural indicators. These include the GDP shares of the primary sector (consolidating mining, agriculture and fishing), the manufacturing sector and the tertiary (services) sector. Additionally, we calculated the

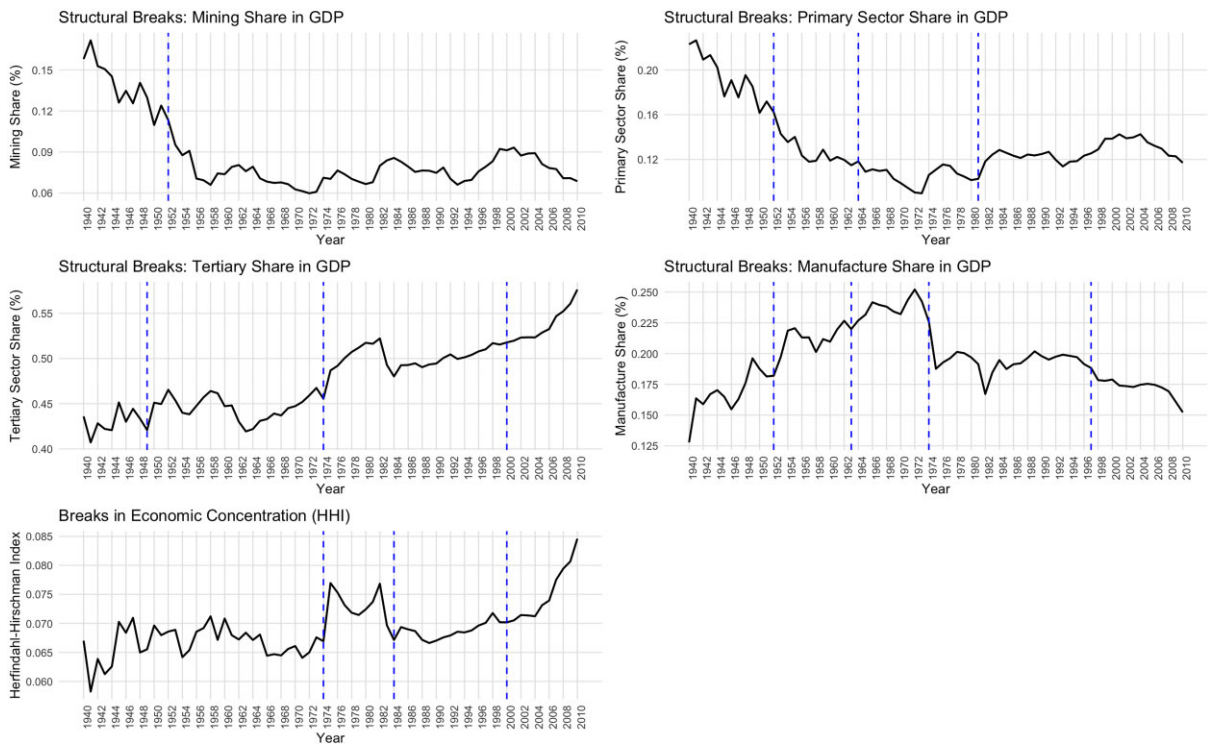


Figure 1. Bai-Perron structural break analysis in Chile, 1940–2010. Source: Authors, based on data from CLIOLAB UC.

Herfindahl-Hirschman Index (HHI) to measure the degree of economic concentration over time. On these time series, we applied the Bai-Perron method, implemented through the *strucchange* package in R, to endogenously detect multiple statistically significant breakpoints. This test identifies the precise years in which the underlying trends of sectoral participation and economic concentration shifted, allowing us to link these changes to historical policy milestones.

The second component examines the territorial dimension of these dynamics between 1992 and 2022. For this, we conducted a PCA using regional-level panel data from the CASEN surveys for the years 1992, 2003, 2015 and 2022. The PCA was built on three standardised variables: mean educational attainment, household autonomous income and the proportion of the workforce employed in mining. This technique allowed us to create a robust composite index (PC1), which synthesises the level of socio-economic development associated with the extractive model in each region and explains 65.5% of the total variance. The evolution of this index was analysed to identify patterns of regional convergence and divergence over the three-decade period.

Finally, the results of both analyses were integrated and visualised to construct a coherent narrative. The structural breaks at the national level are presented in a compos-

ite graph (Figure 1), while the regional trajectories of the PC1 index are displayed in a line graph (Figure 2). To illustrate the spatial implications, the regional PC1 scores were mapped for each of the four years using QGIS, producing a map series (Figure 3) that visualises the consolidation of territorial polarisation. This combined methodological framework provides a robust empirical foundation for assessing the persistence and reconfiguration of Chile's extractivist path dependence.

Results

To contextualise the analysis of path dependence, it is fundamental to outline Chile's macroeconomic evolution. Table 1 summarises key indicators of the country's productive structure and economic activity, organised into three historical periods defined by shifts in political and economic regimes: the Import Substitution Industrialisation (ISI) model (1940–1973), the neoliberal reforms during the dictatorship (1974–1989) and the post-democracy and commodities boom period (1990–2010).

During the ISI phase, the Chilean economy experienced an average real GDP growth rate of 3.8%, with significant impetus from the manufacturing sector, which achieved an average share of 20.6% of GDP. From 1974, the neoliberal reforms marked a turning point: whilst average GDP

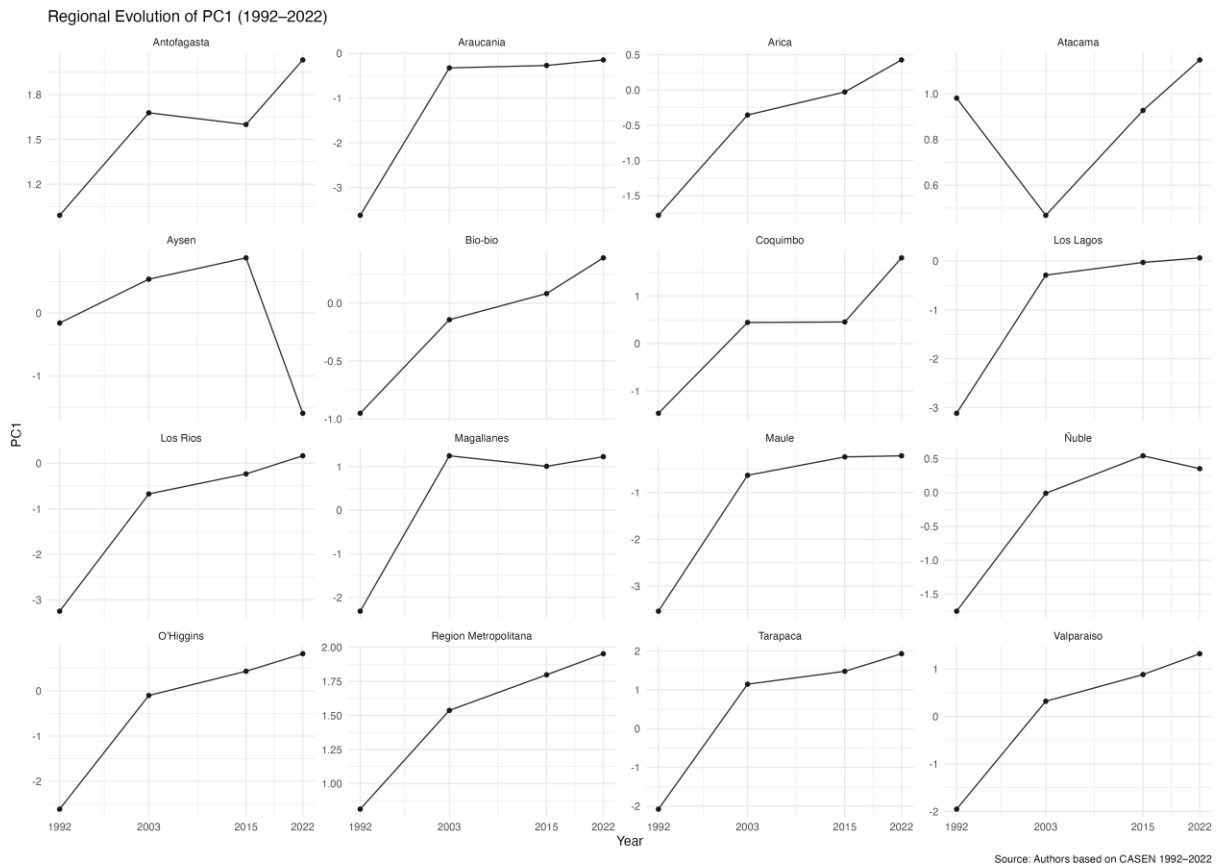


Figure 2. Evolution of the primary principal component, 1992–2022.
Source: Authors, based on CASEN surveys 1992, 2003, 2015 and 2022.

growth was maintained at 3.2%, the productive structure was drastically reoriented towards external markets. The manufacturing industry's share began its decline as the primary sector's role was consolidated, and both capital formation and exports as a percentage of GDP increased significantly. The period after 1990 intensified this trend. Economic growth accelerated markedly (averaging 5.6%), driven by a boom in commodity prices and greater integration into global markets. In this phase, the primary sector reaffirmed its centrality, whilst investment and foreign trade reached their highest levels of the period under review. The analysis that follows aims to nuance these interpretations by framing them within the study of extractivist lock-ins.

Empirical analysis of the Chilean economy reveals that, far from overcoming its historical dependency, the nation has reconfigured its extractivist lock-in. Through a combination of the Bai-Perron method and a regional-level PCA, the results (Figures 1 and 3) demonstrate a transition from a primary extractivism model to one of a financialised and territorially polarised character.

At the national level, the structural break analysis (Figure 1) provides evidence of this inter-sectoral reconfiguration. Whilst the primary sector maintained remarkable resilience, stabilising its GDP share around 25% despite milestones such as the 1964 Agrarian Reform and the liberalisation of the 1980s, the manufacturing industry underwent a systematic 'sacrifice'. Its structural breaks in 1974 and 1997, coinciding with trade liberalisation and the implementation of free trade agreements, mark a sustained decline. This industrial dismantling was offset by an expanding tertiary sector, yet its growth was not autonomous. On the contrary, it consolidated a functional symbiosis with the mining core, as over 60% of its activity is linked to the logistics, financing and trade of natural resources. The HHI confirms this 'superficial diversification': although the index decreased slightly, breaks occurring during moments of crisis (1984) and the commodities boom (2000) reinforced economic concentration around extractivism. In essence, Chile did not overcome its dependency but rather transformed it into a model of financialised extractivism.

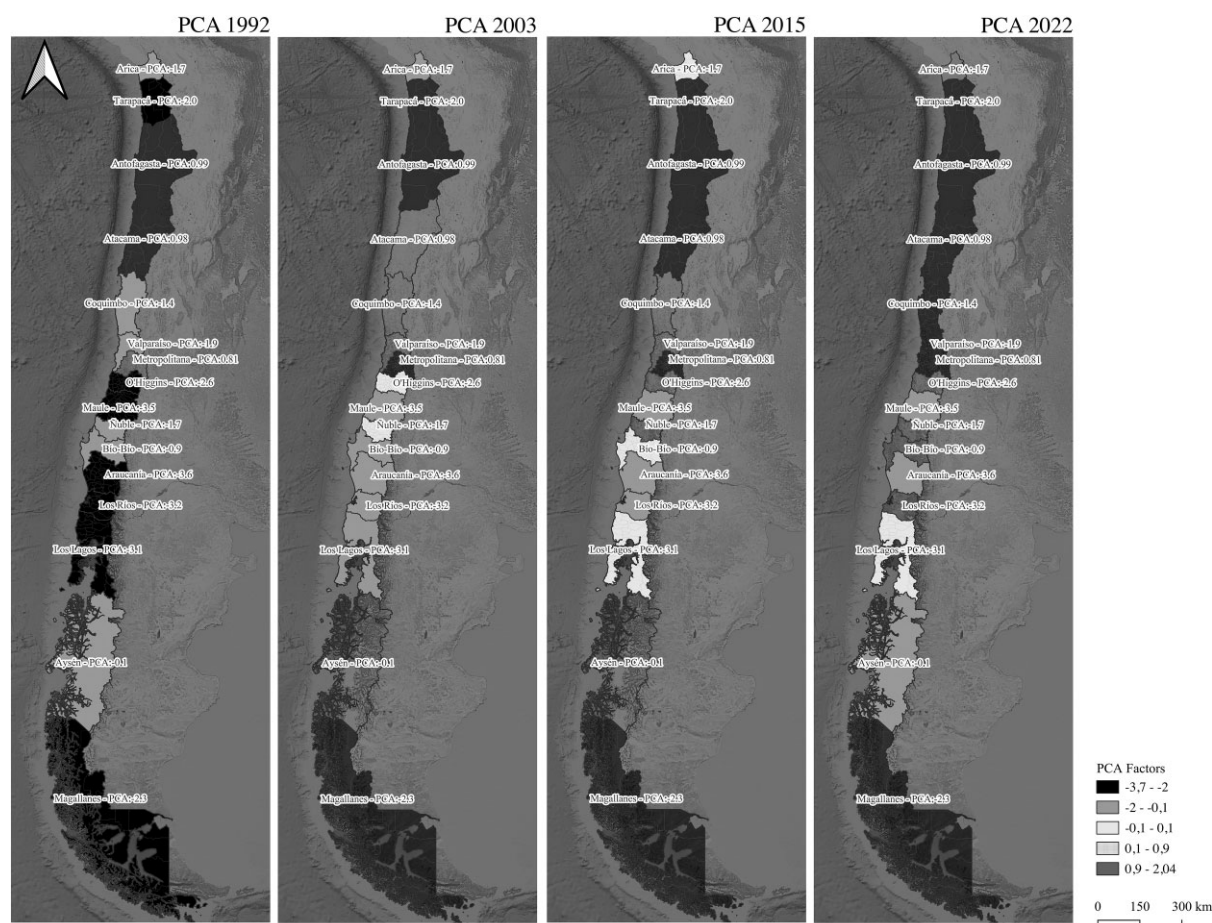


Figure 3. Spatial evolution of the primary principal component by region, 1992–2022.
Source: Authors, based on CASEN surveys 1992, 2003, 2015 and 2022.

Table 1. Macroeconomic indicators for Chile by historical period (annual averages).

Indicator	ISI and state role (1940–1973)	Neoliberal reforms (1974–1989)	Democracy and commodities boom (1990–2010)
Real GDP growth rate (%)	3.80%	3.20%	5.60%
Real GDP per capita growth rate (%)	1.80%	1.60%	4.20%
Share in GDP (%)			
Primary sector	17.50%	20.10%	21.80%
Manufacturing industry	20.60%	18.50%	16.90%
Services	15.20%	18.90%	22.50%
Foreign direct investment (FDI) as per cent of GDP	14.80%	21.50%	31.20%

The territorial dimension of this lock-in was examined through a PCA, which allowed for the construction of a socio-economic development index (PC1) that captures 65.5% of the variance in educational attainment, autonomous income and mining employment. The evolution of this index between 1992 and 2022

(Figure 2) reveals a key dynamic of regional convergence until 2015, driven by the commodities boom, which enabled lagging regions to close the gap. After this point, however, the trend reverses into a notable divergence, whereby territorial disparities have intensified once more.

This dynamic is spatially manifested (Figure 3) in a marked polarisation. The 1992 map displays a clear duality between a prosperous mining north and Metropolitan Region, and a lagging centre-south. Although convergence temporarily softened this contrast, the 2022 map evidences the consolidation of two functional poles that define financialised extractivism: the 'zones of extraction' in the north, established as a high-development bloc, and the 'zone of accumulation and control' in the Metropolitan Region, where corporate and financial services are concentrated. This configuration constitutes the territorial footprint of the lock-in: a system that perpetuates dependency and limits the development of alternative paths for the majority of the country's regions. This reinforces the conclusions of the national analysis and reveals a model whose structural dependency has grown more complex without reducing its vulnerability.

Conclusions

This study has illustrated that Chile's development trajectory, far from overcoming its historical dependency on resource extraction, has been characterised by a persistent and evolving extractivist lock-in. By integrating a multi-scalar empirical analysis, our findings challenge the conventional narrative of economic modernisation and diversification. The main contribution of this paper is to reveal that the Chilean lock-in has not been static; rather, it has transitioned from a model of primary extractivism to a more complex and resilient system of financialised extractivism. This reconfiguration, driven by the mechanisms of path dependence, is the central finding of our analysis.

The structural break analysis (Bai-Perron) and the regional PCA provide robust evidence for this conclusion. At the national level, we identified critical junctures where the decline of the manufacturing sector coincided with the consolidation of a primary-export model functionally coupled with an expanding, yet dependent, service sector. At the regional level, our findings illustrate the territorial footprint of this model: a dynamic of convergence followed by divergence has produced a polarised landscape, organised around northern 'zones of extraction' and a central 'zone of accumulation and control' in the Metropolitan Region. This spatial configuration is the tangible manifestation of the financialised extractivist lock-in, a system where resource rents fuel a sophisticated service economy that, in turn, reinforces the extractive core. This finding nuances the literature on path dependence by showing that lock-in does not necessarily imply stagnation, but can also involve a dynamic reconfiguration that makes breaking from the established path even more challenging.

Based on these findings, we define an extractivist lock-in as a self-reinforcing socio-economic system where institutional, political and cognitive mechanisms create a structural bias that systematically favours resource extraction

over productive diversification. In Chile, this is not merely a matter of economic structure but of a deeply embedded rentier logic (Warnecke-Berger et al., 2023) that shapes policy incentives and societal expectations. PPPs, for instance, have emerged as a key governance mechanism that, under the guise of modernisation, perpetuates this logic by aligning state action with corporate extractive interests.

The policy implications are profound. A critical reflection suggests that conventional industrial policies focused on diversification are bound to fail unless they address the underlying mechanisms of this lock-in. Public policy must therefore move beyond simply promoting new sectors and instead focus on actively unlocking the existing system. This requires a two-pronged strategy: first, reforming the institutional and regulatory frameworks — such as the Water Code and investment regimes — that create a biased playing field favouring extractivism. Second, it necessitates the deliberate creation and protection of 'niches' for alternative development paths, as suggested by research in evolutionary economic geography (Boschma et al., 2017). This could involve targeted investments in green technologies that are decoupled from mining, fostering local innovation systems in non-extractive regions, and redesigning PPPs to prioritise social and environmental justice over purely financial returns.

Finally, this study opens several avenues for future research. A more granular, firm-level analysis could further unpack the mechanisms of corporate influence in policy-making. Longitudinal case studies in regions attempting to break from the lock-in (e.g. through tourism or sustainable agriculture) could provide valuable insights into the specific barriers and success factors. Furthermore, incorporating the political economy of the ongoing global energy transition, particularly the demand for lithium and green hydrogen, is crucial to understanding how Chile's extractivist lock-in may be further reconfigured in the decades to come.

Acknowledgements

The authors wish to acknowledge the financial support that made this research possible. Martin Arias Loyola's contribution was supported by the National Agency for Research and Development (ANID) through the FONDECYT Iniciación Grant No. 11220028. Francisco Vergara Perucich acknowledges the funding provided by the Vice-Rectorate for Research at the University of Las Américas to the Research Nucleus 'Centre for the Production of Space' of the School of Architecture.

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