

**Extractive Industries and Regional Diversification:
A Multidimensional Framework for Diversification in Mining
Regions**

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Extractive Industries and Regional Diversification: A Multidimensional Framework for Diversification in Mining Regions

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Abstract

Economic diversification is seen as imperative for mining regions to achieve an economically sustainable form of development. Yet, existing knowledge is largely drawn from national scale analyses, thereby concealing interregional differences as well as mechanisms between resource extraction and diversification operating at the regional scale. This special issue on ‘Extractive Industries and Regional Diversification’ therefore shows recent work that brings the study of the relationship between extractive industries and diversification to a regional level. In this introductory article, we propose a multidimensional framework that seeks to refine our understanding of mining regions’ (in)ability to diversify their economies by bringing together insights from research on the relationship between resource extraction and development and research on regional diversification in economic geography. We argue that the effect of extractive industries on regional diversification is mediated along three dimensions, that is (1) the regional context conditions, (2) the multi-scalar organization of extractive industries, and (3) the relevance of temporality. The framework is applied to synthesize the key insights of the special issue articles and directions for future research are derived.

Keywords: regional diversification, mining regions, subnational resource curse, Dutch disease, Evolutionary Economic Geography

1 Introduction

Productive diversification is one of the main goals of all mining regions across the world to reduce their dependence on exhaustible resources and achieve a sustainable form of development. A diversified economy offers employment outside extractive industries, reduces the exposure to volatile commodity prices and provides the potential for growth in income and productivity (Gelb, 2012).

Diversification, however, remains “one of the most intriguing and challenging issues in the field of economic geography” (Neffke et al., 2011, p. 241). This sentence is even more true in the case of mining regions at least for two reasons: First the analysis of mining based diversification has been mostly made

at a national scale, based on macroeconomic models such as that of the Dutch Disease (Corden, 1984) and the promotion of mining production linkages (Hirschman, 1981); and second, economic geography analyses on diversification have rarely focused on the case of mining regions where levels of specialization tend to be very high, paying more attention to manufacturing and service areas. Both reasons lead to a theoretical and empirical gap that we aim to fill in this special issue.

There is a widespread agreement that diversification seems to be more difficult in resource dependent economies. Harding and Venables (2016), for instance, calculated that increases in resource revenues lead to the reduction of non-resource exports. In line with this finding, in the period between 1981 and 2014 resource-rich countries were marked by a poorer diversification performance (Lashitew et al., 2020). This is particularly true for the subgroup of oil-producing countries which experienced slower diversification compared to the rest of the world. Notably, during the mining prices supercycle that started in the 2000s these economies even tended to increase export concentration, indicating the increasing struggle to diversify during commodity booms (Ross, 2019).

These findings provide valuable insights for understanding the challenging relationship between extractive industries and diversification. However, analyses are made at a national scale with a predominant attention to Dutch disease effects and can therefore only account for parts of the story. Usually, extractive industries are not scattered equally across a country but tend to be bound to a limited number of places where deposits are found. In other words, the importance of extractive industries varies significantly across regions in the same country. It, therefore, appears likely that extractive industries “can have distinctive effects across local economies, as extractive regions face particular economic consequences unlikely to be observed in non-resource regions” (Fleming et al., 2015, p. 624). While on an aggregated national level a resource rich country might manage to diversify its economy, mining regions in the same country could still face more difficult challenges to develop non-extractive industries (e.g. Syahrir et al., 2020) since their level of specialization is higher and many of the policy instruments that are available at a national level (monetary, fiscal and trade policy) are not at hand for regional authorities. Likewise, mining regions in the same country can diversify away from natural resource extraction with varied success as for instance the case of Vietnamese provinces illustrates (Breul and Nguyen, 2022). It points to the fact, that region-specific context factors matter for mining regions’ (in)ability to diversify.

National scale analyses conceal these interregional differences from which we could learn which conditions favor or constrain diversification in mining regions. We, therefore, argue that there is a need for a subnational broader framework to understand diversification in mining regions that, in the end, could also become a means for national diversification. Based on this gap in existing research, the overall aim of this special issue is to bring the study of the relationship between extractive industries and diversification to a regional level. In this article we propose a multi-dimensional framework – **regional, multi-scalar, and temporal** – that discusses how specific characteristics of mining regions can either constrain or favor diversification. To this end, we introduce insights on regional diversification from different lines of research in economic geography to elaborate how these various features of mining regions could affect their ability to diversify. The contribution of the article is twofold: First, the multi-dimensional framework provides systematic explanations for mining regions’ (in)ability to diversify their economies. It thereby complements existing research on the relationship between extractive industries and diversification largely dominated by national scale analyses by zooming in to the regional level. Second, the elaboration of how specific characteristics of mining regions affect diversification highlights aspects that have not received adequate attention in extant research on regional diversification in economic geography. Including aspects like competitive inter-path relations, critical perspectives on the role of extra-regional actors, the territorial embeddedness of economic activities, as well as the consideration of phases of boom and bust into these conceptualizations would help to refine existing approaches.

In the remainder of the article, we first give an overview of bodies of work that theorize the relationship between extractive industries and diversification. Then key concepts from Evolutionary Economic

Geography (EEG) and new regional path development are introduced. Building on these insights we propose a framework to study diversification along three different dimensions. Finally, the article applies this framework to synthesize the key insights of the articles published in this special issue and directions for future research are derived.

2 Towards understanding diversification in mining regions

2.1 Research on extractive industries and regional diversification

Economic diversification is probably the main challenge for regions that strongly depend on a resource that is exhaustible. In fact, many mining regions have suffered deep and long-lasting recessions when their deposits were either exhausted or lost their economic value due to technological changes that diminished their global demand. From this perspective, economic diversification is imperative if mining regions aim to achieve an economically sustainable form of development. Despite this fact, most analyses of mining-based diversification have taken a national perspective in the context of the controversy around the resource curse thesis (Auty, 1993). Nevertheless, many of the symptoms of the resource curse identified by van der Ploeg (2011) - Dutch Disease; volatility of international commodity prices; poor institutions; rent seeking behavior; and discontinuous and unsustainable policies - have a direct negative effect both on the national and on the regional capacity of diversification. However, the mechanisms working at a subnational scale are different and have been underresearched.

A subnational analysis of how mining regions are able to diversify cannot blindly adopt frameworks and theories developed under methodological nationalism without the risk of falling into the ecological fallacy (Atienza et al., 2021b). The adaptation of national approaches and the identification of specific mechanisms working at a regional scale are crucial not only for a better understanding of how mining regions diversify, but also for designing policies in this direction. Up to now, however, there has not been a systematic approach to diversification in mining regions and contributions come from different theoretical frameworks. Probably, the most influential analysis has been focused on an adaptation of the original Dutch Disease model (Corden, 1984) to the regional scale. The main mechanism in this macroeconomic model is based on how changes in the exchange rate, caused by a raise in mineral prices, inhibit the development of new activities. Since this explanation is purely national (there are no regional exchange rates), regional adaptations of the Dutch Disease model have considered the competition over the production factor labor between the mining industry and other activities as the main mechanism to explain the obstacles that mining regions face to diversify their industry mix. Higher wages in the mining industry - particularly during booms - displace workers from other activities in the region and reduce diversification (Papyrakis and Raveh, 2014; Fleming et al., 2015; Fitjar and Timmermans, 2019; Shao et al., 2020).

Mineral price volatility is an essential trait of mineral economies that also affects diversification. In this sense, van der Ploeg and Poelhekke (2009) and van der Ploeg (2011) argue that the resource curse is fundamentally a problem of volatility. Resource windfalls during mineral prices booms are liquidity shocks that reduce entrepreneurship, investment, and innovation, directly affecting some of the main forces that explain diversification. Considering that the degree of specialization is significantly higher in mining regions than nationwide, the impact of boom-and-bust cycles on diversification should be deeper and require a region-specific approach. While booms can reinforce the effects of the Dutch Disease (Fleming et al., 2015; Rørheim and Boschma, 2021), it can also increase the creation of mining related activities (Atienza and Modrego, 2019; Fitjar and Timmermans, 2019). At the same time, however, mining regions seem to be unable to benefit from resource windfalls to increase education and public goods as preconditions for future diversification and the crowding out of local taxes predominates (Oyarzo and Paredes, 2019, 2021). The diversification and economic sustainability of mining regions is profoundly affected by the temporality of prices cycles. This is particularly so during the decline of

mining activities due to either the depletion of deposits or sharp falls in mineral prices. In these cases, mining regions face the need to diversify and transform their economies and it is uncertain whether they can do it or are doomed to a long-term decline and loss of population.

Other analyses to mining-based diversification have adopted the classical development economics approach based on production linkages (Hirschman, 1981). The increasing externalization of tasks in the mining industry since the 1990s has been considered as an opportunity for countries to strengthen mining backward production linkages (Morris et al., 2012; Farooki and Kaplinsky, 2014). From this perspective, mining linkages development is considered a process of knowledge and technological capabilities accumulation that in the long term would lead to diversification. While this argument can be valid at a national scale, many studies show that opportunities for strategic and technology intensive mining linkages are unevenly distributed across space and tend to benefit the main urban areas. In contrast, production linkages in mining regions remain weak and are often limited to ancillary and generic services, constraining knowledge sharing through linkages and, therefore, diversification opportunities (Breul and Revilla Diez, 2018; Atienza et al., 2021c; Breul and Revilla Diez, 2021; Scholvin, 2021). These results stress the need of adopting a multi-scalar perspective (regional, national, and global) to understand to what extent mining regions can benefit from production linkages as a means for diversification.

One of the more traditional approaches to understand diversification or the lack of it in mining regions refers to the role of institutions and how they affect local agency. Since the proposal of the staple theory by Innis (1930), it is generally agreed that extractive activities shape regional and national institutions. Based on the Canadian experience, Innis argued that resource-dependent regions tend to have: (1) an export-oriented and branch-plant culture that limits the local interest and the entrepreneurial culture to develop new activities; and (2) an oligopolistic industrial structure dominated by large firms - usually multinationals - that are able to control local labor markets, collude with regional elites and install formal and informal rules to their benefit reinforcing the region's initial specialization (Hayter and Barnes, 1990). This power asymmetry is also found at a national level, creating a tension between core and peripheral regions. The latter tend to be seen by national governments as resources exporters and suppliers of fiscal rents. This idea, also crucial in the staple theory, directly affects national industrial policies that do not tend to be interested in the diversification of resource peripheries and create an institutional framework characterized by an "internal colonialism" (Auty and Furlonge, 2019). From this perspective, it is crucial to understand how institutions at different levels affect different agents (international, national and regional) to explain the diversification opportunities of mining regions.

The different bodies of research presented in this section confirm that the diversification in resource-dependent regions is a complex subject. In the next sections, we propose a general framework to analyze from a multidimensional perspective the diversification in mining regions by making use of recent contributions in Evolutionary Economic Geography (EEG) and studies on regional industrial path development.

2.2 Studying diversification on a regional level: an overview of research in Evolutionary Economic Geography and new regional path development

Unlike research on the relationship between extractive industries and diversification, there exists a lively and rapidly evolving body of research in economic geography that studies diversification on the regional level (for an overview see Boschma, 2017 and Hassink et al., 2019). Especially studies in EEG in the past decade have marked this field of research. Here, the diversification of regions is conceptualized as the product of a path-dependent process that is termed 'regional branching'. According to this understanding, regions tend to diversify into industries that develop out of existing related industries or out of the recombination of capabilities from existing industries (Boschma and Frenken, 2011). This is based on the argument that developing new but related activities allows firms or individuals who

establish new firms to draw on related capabilities. Exploiting related capabilities reduces the switching costs and increases the survival of firms in new industries (Boschma and Wenting, 2007). It is argued that this branching process takes place at a regional level because various knowledge transfer mechanisms like firm diversification, labor mobility, social networking, and spinoffs through which the branching operates, are characterized by a local bias (Boschma/Frenken 2011). Regional diversification as a regional branching process underlines the influential role of the regional environment since the existing set of regional capabilities shapes future rounds of diversification. In the last years, an increasing number of quantitative case studies has confirmed that existing regional structures affect the direction of regional diversification (e.g. for Swedish regions (Neffke et al., 2011), Vietnamese regions (Breul and Pruß, 2022) or US metropolitan areas (Essletzbichler, 2015)). Moreover, it has also been shown that the industrial structure on a regional level is more influential for the development of new industries in regions compared to the national level (Boschma et al., 2013).

Besides this main line of EEG research, recent studies on **regional industrial path development** aim for refining this conceptualization of regional diversification of the conventional EEG approaches by taking into account insights from other approaches in economic geography (e.g. global production networks, regional innovation systems) (for an overview see Hassink et al., 2019). We refer to some of these which we perceive as useful for the endeavour of the present article.

First, it has been highlighted that the development of new regional industries relies, beyond the conventional EEG-focus on industrial and knowledge related assets, on a wide set of other assets. MacKinnon et al. suggest applying a **broadier understanding of regional assets** encompassing “natural assets (covering resources); infrastructural and material assets; industrial assets (covering technology and firm competencies); human assets in the shape of labor skills, costs, and knowledge; and institutional endowments of rules, routines, and norms” (2019, p. 122) in order to better understand regional industry emergence.

Second, while above presented EEG conceptualizations tend to foreground the crucial role of endogenous capabilities, recent work stresses the need to also consider the role of **extra-regional assets and linkages** for path creation (Binz et al., 2016; Isaksen and Trippel, 2017; Hassink et al., 2019). Extra-regional assets can complement the limited regional asset base and can provide the potential for the development of industrial paths that are unrelated to the existing regional industrial structure (e.g. Zhu et al., 2017; Breul and Pruß, 2022). Especially in peripheral regions with lacking industrial structures extra-regional assets can play an important role for developing new paths (e.g. Isaksen and Trippel, 2017).

Third, works in this field have increasingly stressed the need to consider other **actors beyond firms** for understanding regional diversification dynamics. **Policy actors as well as the state**, among others, can play crucial roles in this regard promoting changes in pre-existent institutions and the transformation of the regional environment in favor of the creation of new activities (e.g. Hu, 2014; Dawley et al., 2015; Isaksen and Trippel, 2017).

Lastly, recent work on regional industrial path development calls for better accounting for different types of relations between existing and new industries, so-called **inter-path relations** (Frangenheim et al., 2020; Breul et al., 2021). The above presented regional branching conceptualization in EEG concentrates on the facilitating relationship between existing industrial structures and the development of new paths, enabling new industries develop out of existing ones. However, possible negative relationships between new and existing industries as for instance highlighted by resource movement effects (see section 2.1.) are crucial to reveal challenges for diversification (e.g. Steen and Hansen, 2018; Breul et al., 2021).

All in all, the insights from research in economic geography underline the relevance to study diversification on a regional level, paying special attention to context specific characteristics. Bringing the study of the relationship between extractive industries and diversification to a regional level could benefit from considering these insights. At the same time, the recurrent calls for a more comprehensive

conceptualization of regional diversification processes suggest that adding insights from an empirical context like mining regions, that has not received sufficient attention yet but requires the careful consideration of these aspects, could be helpful to refining our understanding of regional diversification. In the following section, we propose a framework for diversification in mining regions by bringing insights from research on the relationship between resource extraction and development as well as research on regional diversification in economic geography together.

2.3 A multidimensional framework for diversification in mining regions

Insights from both EEG and regional industrial path development suggest, in different ways, that both positive and negative effects from extractive industries on other existing and/or potentially new industries do not unfold equally across resource-depend countries and across different points in time. On the one hand, EEG emphasizes the influence of the regional context in shaping diversification which has been largely overlooked by existing research on the relationship between resource extraction and diversification since it tended to remain on a national scale. On the other hand, insights on the nature of extractive industries highlight the importance to consider the transnational and sub-national organization of extractive industries (Atienza et al., 2021c; Breul and Revilla Diez, 2021) as well as considerable fluctuations between boom and bust cycles (Atienza and Modrego, 2019; Rørheim and Boschma, 2021) in order to fully understand the consequences of extractive industries for the diversification of mining regions.

We argue that the effect of extractive industries on regional diversification is mediated by different dimensions. In the following, we elaborate a heuristic framework based on three different dimensions to understand how extractive industries affect regional diversification: (1) the regional context conditions, (2) the multi-scalar organization of extractive industries, and (3) the relevance of temporality (see figure 1).

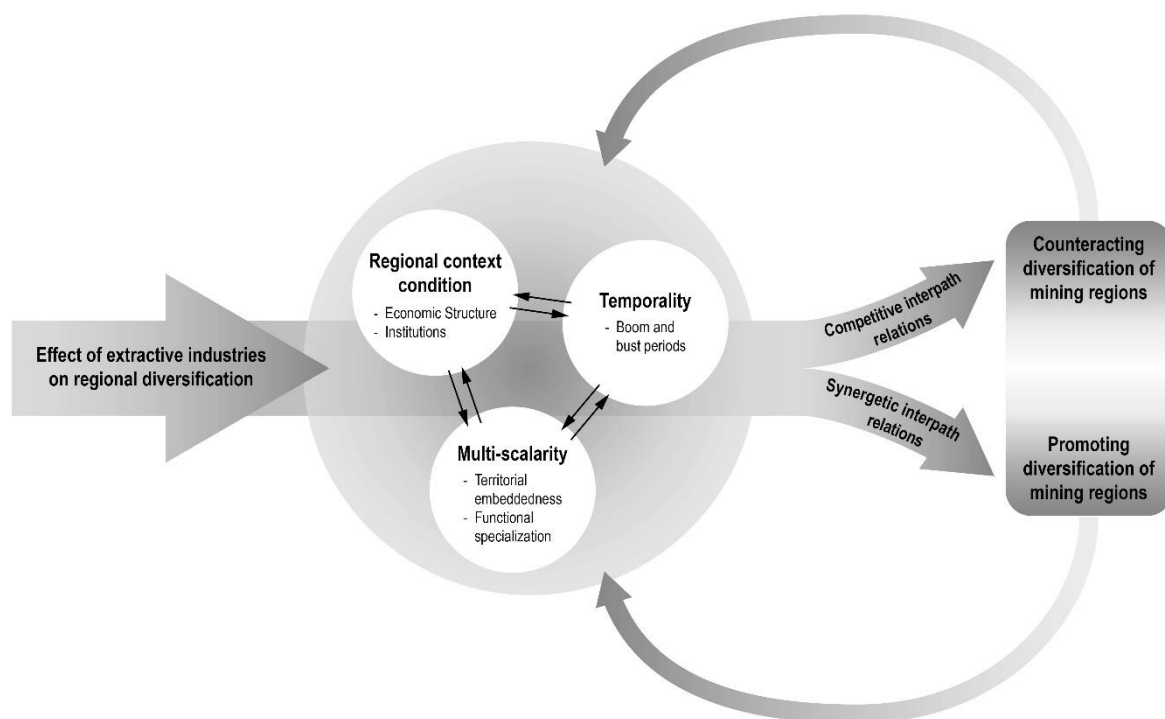


Figure 1: A multidimensional framework for diversification in mining regions

2.3.1 Regional context conditions

The insights from EEG summarized in section 2.2 as well as recent contributions on the sub-national resource curse underline the importance of considering regional context conditions to fully understand the (in)ability of mining regions to diversify. In the following, we discuss the role of the regional economic structure and regional institutions for diversification in mining regions separately.

Regional industrial structure:

According to the insights from EEG studies, existing regional economic structures serve as an enabling and constraining environment for future rounds of diversification (Neffke et al., 2011; Boschma, 2017; Steen and Hansen, 2018). For analytical purposes, we elaborate this in the following by distinguishing into (1) influences by the general regional economic structure of mining regions and (2) influences caused by the regional presence of extractive industries.

(1) Regarding the former, apart from the presence of extractive activities not every mining region is characterized by similar economic structures. The regional ‘landscapes’ of extractive industries, i.e. in which regional context they are located and the size of urban agglomerations, can differ widely ranging from enclave-like company towns in peripheral areas to specialized secondary cities or as part of a diversified metropolitan area (Fernández and Atienza, 2011; Phelps et al., 2015). While many mining regions in the world are located in peripheral areas, there also exist mining regions, such as the Rhenish lignite mining region in Germany (Breul, 2022), Johannesburg (Robbins, 2013), Brisbane or Denver (Fernández and Atienza, 2011), that are situated in diversified metropolitan areas.¹

Building on the insights from EEG, this makes a difference for the diversification potential since the pre-existing regional “capabilities provide opportunities to develop new industries but also set limits to this process of structural change” (Xiao et al., 2018, p. 518). Different types of regions are characterized by different diversification potential (for a detailed discussion on the diversification potential of different types of regions see Isaksen and Tripl, 2018). While the wide heterogeneous set of endogenous capabilities in mining regions with relatively large urban agglomerations offers them more favorable conditions for developing new industries, the diversification opportunities of specialized industrial areas are limited due to a narrower set of regional capabilities. Moreover, peripheral or organizationally thin regions often depend on extra-regional resources for introducing new economic activities due to limited endogenous capabilities (Isaksen and Tripl, 2018).

For the context of this paper, it means that diversification in agglomerated areas that host extractive industries will be less challenging than in resource peripheries characterized by small human settlements, extremely high levels of specialization in extractive industries and a lack of non-extractive industries. Therefore, diversification potentials differ between mining regions (also in the same national context) depending on their remaining economic structure. Thus, to understand the (in)ability of mining regions to diversify, the entire regional industrial portfolio must be considered.

(2) Till this point we discussed the influence of the industrial structure in general. What is common for all mining regions is the regional presence of extractive industries. But how could this shape a region’s environment for developing into new industries? And how can this relationship be analyzed properly? As a point of departure, it is important to consider that mineral deposits are highly concentrated in space and that extractive industries generally have high fixed costs and, consequently, large firms – either multinational or public companies. These features imply that mining regions tend to be highly specialized and present oligopolistic market structures (Perloff, 1960; Ellison and Glaeser, 1997; Fernández and Atienza, 2011). Both characteristics create a relatively unfavorable starting point that could limit the regional diversification potential.

¹ Long term comparative historical studies on the context and circumstances that have allowed these regions to become more complex economies are still needed but are beyond the scope of this special issue.

EEG (section 2.2) and the Dutch Disease (section 2.1) offer two distinct but complementary perspectives on the potential effect of the predominance of extractive industries in the regional industry mix. While the Dutch Disease focuses on competitive relations between extractive industries and other industries, EEG tends to foreground the potential positive influences between pre-existing industries and new activities in terms of linkages and knowledge transfer mechanisms (see also Fitjar and Timmermans, 2019). Thus, it would be too one-sided to only focus on either of them when studying the effects of extractive industries on regional diversification. In order to ensure sufficient analytical openness, it is helpful to study the effects of extractive industries on other existing as well as potential new industries in a region through the perspective of inter-path relations (Frangenheim et al., 2020; Breul et al., 2021). Inter-path relations - in the context of this paper, the relations between extractive industries and other existing and/or potential new industries in the mining region - can be characterized by whether these depend on the same assets or markets (Frangenheim et al., 2020). Targeting same markets or relying on similar assets, especially if these are scarce, can result in competitive inter-path relations as described by the resource movement effect characteristic of the Dutch Disease. Due to their size and productivity, firms in extractive industries are able to pay higher prices for scarce resources such as skilled labor (Corden, 1984; Fleming et al., 2015). On the one hand, this can withdraw other factors of production from established industries (e.g., Xie et al., 2021). On the other hand, increasing prices can also hinder the mobilization of resources required for developing new economic activities. This effect is likely to operate at a regional scale as recent studies suggest (Fitjar and Timmermans, 2019; Haas and Poelhekke, 2019; Xie et al., 2021). Summing up, this competitive kind of relation could hamper the development of existing as well as new industries (Breul et al., 2021).

In contrast to competitive inter-path relations, the use of related or similar assets that are not scarce, as well as serving complementary markets would describe synergetic inter-path relations that could provide the potential for renewing or expanding existing regional industries or even the emergence of new industries in the region (Breul et al., 2021). For instance, the development of extractive industries could import new knowledge and expertise to the region which subsequently contributes to conduct other new economic activities. The connection of large extractive companies to technological centers abroad, can become a channel for knowledge transfer to local firms through external linkages (Breul and Pruß, 2022). Moreover, the regional presence of extractive industries can create new markets for processing the commodities (forward linkages) and for supplying goods and services needed for extractive activities (backward linkages) thereby contributing to related diversification. These latter types of synergetic inter-path relations reflect the potential diversification mechanisms emphasized by the linkage-based approach (Morris et al., 2012).

Summing up, analyzing the effects of extractive industries on regional diversification through the perspective of inter-path relations would acknowledge these variegated consequences, possibly even appearing simultaneously (Figure 1).

For this, a broad understanding of assets that goes beyond the primary focus on the resource movement effect on labor displacement or in EEG on knowledge spillovers should be deployed, because the development of new as well as the operation of existing regional industries relies, beyond human capital or knowledge, on various other types of assets as highlighted by the emerging literature on regional industrial path development (e.g. MacKinnon et al., 2019; Breul et al., 2021). Here the broader asset definition suggested by MacKinnon et al. (2019), that includes in addition to human assets also industrial, infrastructural, natural, and institutional assets, is useful. For instance, a booming mining industry cannot only withdraw qualified labor to the disadvantage of other existing and/or potential new industries (Fitjar and Timmermans, 2019), but it could also withdraw natural assets (e.g. water, land) and lobby to alter institutions in its favor thereby potentially harming other industries. Likewise, when thinking about synergetic inter-path relations not only knowledge-related assets can contribute to the emergence of new industries as foregrounded by EEG. Also, other types of assets, such as the construction of large fix infrastructure to support the development of an export-oriented mining industry can, under the right circumstances, facilitate new economic activities (Morris et al., 2012). At the same

time, as we will see later, the analysis of the potentially competitive and synergetic relationships of the mining activity with other industries, needs to be complemented with a multi-scalar perspective that considers inter-path relations not only within mining regions but also across regions or even globally and how these relations can either promote or limit the diversification potential of mining regions (Frangenheim, 2022).

Regional institutions

The development of new paths is not only the result of the economic structure of regions, the locally available assets and the technological linkages among activities. According to Boschma et al. (2017), the emergence of new paths is strongly dependent on institutions and system-level agency both at a regional, national, and global scale. This is particularly so in the case of extractive industries where new paths can defy nationwide and global companies' vested interests leading to potential economic, social, and environmental conflicts. Recent work on regional diversification and path development emphasizes the crucial role of policy actors (e.g. Hu, 2014; Dawley et al., 2015; Isaksen and Trippl, 2017) and institutions (He et al., 2018), but research about mining regions is still scarce in this respect. The role of institutions and agency in mining regions should be analyzed at least at two levels: (1) how the predominance of extractive activities influence local culture, agency, and informal institutions; and (2) how national institutions can either foster or limit diversification opportunities in mining regions.

From a regional perspective, the presence of extractive industries dominating the local economy has direct consequences on the informal institutions. First, - as Innis (1930) proposed in his seminal work - local agents in mining regions tend to develop a branch-plant culture that constraints the development of the entrepreneurial culture necessary to create new paths, since innovations and highly paid job opportunities are expected to come from mining companies (Chinitz, 1961; Glaeser et al., 2015). Furthermore, resource abundance also affects the culture of local firms. Dependence on resource windfalls and volatility caused by changes in commodity prices reduce the probability of creating new businesses, employment, and investment (van der Ploeg and Poelhekke, 2009; Atienza and Modrego, 2019). Second, the oligopolistic structure of local markets - in many cases dominated by global companies - reduces the capacity of local agents to change institutions. On the contrary, it is not unusual that mining companies collude with regional and national elites to install formal and informal rules to their benefit reinforcing the regional initial specialization (Hayter and Barnes, 1990; Singh & Camba 2021). This political lock-in (Grabher, 1993; Hassink, 2010) limits the promotion of responsible practices that can moderate the resource movement effect and reinforce local spillovers through the creation of local institutions that support knowledge transfer mechanisms and reward new path creation.

At a national level, it is important to remember the usual peripheral position and relatively small size of most mining regions. These characteristics were also stressed by Innis (1930) when analyzing the core-periphery dynamics that characterized resource abundant economies. More recently, Auty and Furlonge (2019) remarked the importance of national institutions to explain the resource curse and the potential to develop new activities through mining. From this perspective, the national institutional setup is generally the result of a rent-seeking process where national elites compete against local agency of mining regions. As a result of the power asymmetries between these two groups of agents, institutions can be characterized by a sort of "internal colonialism", where mining regions are just seen as sources of economic, fiscal, and political rents. In this context, mining-led development policies oriented towards the promotion of mining linkages and knowledge transfer are usually based on spatially blind institutions and policies that do not consider the uneven distribution of assets and capacities across space. Therefore, they tend to benefit core regions to the detriment of mining regions where those capacities are not fully developed (Atienza et al., 2021). In any case, this process is not deterministic and therefore it does not mean that the national government cannot become a driving force for diversification in mining regions when an appropriate institutional design is implemented.

2.3.2 The multi-scalar nature of extractive industries

As noted in section 2.1, extractive industries are organized in geographically fragmented production networks where regions serve different functional roles, both between different regions in the same country as well as on an international scale (Breul et al., 2019; Atienza et al., 2021a; Breul and Revilla Diez, 2021; Scholvin, 2021). This geographical division of labor implies that required assets, such as skilled labor, knowledge or high-tech equipment, are not necessarily sourced regionally in the mining region. Empirical studies from different geographical contexts reveal that often many of these inputs are sourced from outside the resource-rich regions. For instance, in the Australian mining region Pilbara or the Chilean mining region Antofagasta a considerable amount of the workforce is flown in from metropolitan areas in other parts of the country (MacKinnon, 2013; Atienza et al., 2021a). Moreover, mining service suppliers and equipment producers tend to bundle in metropolitan areas outside of the actual areas of extraction as for instance the example of the resource-poor city-state Singapore illustratively shows (Breul et al., 2019; Breul and Revilla Diez, 2021).

Why are these features of the spatial organization of extractive industries relevant for understanding regional diversification dynamics of mining regions? While traditional EEG conceptualizations tended to focus on endogenous dynamics (for a critical appraisal see for instance Hassink et al., 2019 and Yeung, 2021) these features of the spatial organization of extractive industries highlight the need for applying a multi-scalar view that takes into account the role of non-regional resources and influences for adequately understanding regional diversification dynamics of mining regions due to at least two reasons.

Despite the fix nature of mineral deposits, the empirical insights show that mining regions are characterized by different degrees of **territorial embeddedness**. As Phelps et al. (2015) illustratively explain, the territorial embeddedness of extractive industries into regional economies can range from enclaves to industrial districts. While enclaves are characterized by a weak integration into the regional economy (e.g. through a high reliance on imported production factors) and hardly generate any potential to create localization economies (e.g. knowledge spillovers), industrial districts represent the other extreme on the scale. They are associated with thick local labor markets, strong localized buyer-supplier linkages and knowledge externalities. We argue that the more territorially embedded an extractive industry is within a region, the more pronounced are the negative and/or positive effects from extractive industries on existing or potential new industries to materialize.

On the one hand, the extent a region is affected by a resource movement effect depends, among other factors, also on the degree of the localization of inputs. If for instance a large share of labor demand for extractive industries is met via a fly-in-fly-out mode of staff from other regions - a so-called “hollowing out of regional labour markets” (Atienza et al., 2021c, p. 297) – it decreases possible competitive inter-path relations over labor between extractive industries and other existing or potential new industries in the region. Findings of recent work about the role of immigration for the Dutch Disease support this argument. They find that the inflow of workers mitigates the resource movement effect on other industries (Beine et al., 2015; Cappelen and Eika, 2020).

On the other hand, the extent a region can benefit from diversification opportunities originating from synergetic inter-path relations - i.e. different kinds of assets (knowledge, infrastructure, human capital, etc.) created for an extractive industry which is then used by other actors to develop a new non-extractive industry in the region – depends on whether these assets are embedded into the regional economy. In order to develop a new regional industrial path actors need to mobilize different kinds of resources (Binz et al., 2016). When we focus on the key resource knowledge, a core channel for related diversification are different kinds of knowledge transfer mechanisms such as firm diversification, labour mobility, knowledge networks, and spin-offs (Boschma and Frenken, 2011). In an enclave-like setting characterized by low degrees of territorial embeddedness, the potential for these kinds of knowledge

transfer mechanisms is quite limited since knowledge and knowledge-intensive products tend to be exogenous and interactions with the remaining regional economy is largely nonexistent (Phelps et al., 2015). In order to deploy this imported extra-regional knowledge for developing new regional industrial paths it needs to get “accessed by regional actors and subsequently used to transform regional structures” (Binz et al., 2016, p. 178). Thus, it is also an issue of the territorial embeddedness of extractive activities to what extent the regional presence of extractive industries affects other established or newly emerging industries in the region via competitive or synergetic inter-path relations.

Second, the empirical insights show that various functions along extractive value chains – from exploration and extraction to service supply, mining tool manufacture or command and control functions – are **geographically fragmented** across different regions nationally and globally (e.g. Breul and Revilla Diez, 2018; Atienza et al., 2021a; Breul and Revilla Diez, 2021). Thus, while in some mining regions the presence of extractive industries is limited to the only geographically fix function, that is the extraction of natural resources, other mining regions also host additional functions like the manufacturing and repair of extraction tools. In other words, mining regions are specialized in specific functions in extractive value chains rather than the entire industry (Timmer et al., 2019).

This is an important aspect to consider because according to the insights from EEG (see section 2.1) regions tend to develop new economic activities that are related to existing activities in the region since they rely on alike capability requirements (Neffke et al., 2011; Boschma, 2017). However, up to now “the regional diversification literature in EEG has focused on new activities (industries, products, technologies, occupations, scientific fields) rather than new tasks/functions within [Global Value Chains]” (Boschma, 2022, p. 14) as a main EEG proponent has self-critically noted recently. Skills and competencies vary between functions along a value chain; therefore one can argue that the scope for diversification depends on the functions performed in a regional industry rather than the entire industry since many functions of the industry could be geographically fragmented and performed elsewhere. For instance, while it has been found that the export product crude oil in general “inhabits the most isolated sector of the “product space,” making it the single most difficult type of good to diversify from” (Ross, 2019, p. 794), there exist functions within the oil and gas industry that offer substantial potential for diversifying into other non-extractive industries. An example are subsea equipment and installation service firms in the oil and gas industry in Norway. They redeployed their capabilities from the oil and gas industry in order to service the newly emerging offshore wind power industry (Steen and Hansen, 2018). Therefore, research on the diversification of mining regions could benefit from acknowledging the geographically fragmented nature of extractive industries and zooming to the level of functions performed in mining areas rather than entire extractive industries.

All in all, the role of varying degrees of territorial embeddedness as well as the specialization in specific functions along extractive value chains underline the relevance of adopting a multi-scalar approach to understand the diversification of mining regions. This point is particularly relevant when designing policies oriented towards diversification in mining regions. If this multi-scalar perspective is not considered, local diversification programs can become an instrument for promoting new paths outside of the mining regions where more knowledge intensive functions tend to be located. Complementing the existing EEG models by multi-scalar frameworks such as Global Value Chains and Global Production Networks (see also Yeung, 2021) that are sensitive to the fact that economic activities in a certain region are interconnected and interdependent with activities in other regions should therefore be a key issue for future research.

2.3.3 The relevance of temporality

Extractive industries are marked by considerable cyclical industrial dynamics due to volatile global commodity markets (van der Ploeg and Poelhekke, 2009; van der Ploeg, 2011). The regional ‘imprint’ of extractive industries in mining regions is therefore subject to great changes between periods of boom

and periods of bust. Commodity price developments are reflected in the so-called ‘flickering’ of extractive activities in mining regions (Freudenburg and Wilson, 2002). Rising commodity prices lead to the expansion of exploration and extraction activities as well as auxiliary activities. These periods are marked by labor shortages, wage inflation and rises in the cost of living in the region. In contrast, decreasing commodity prices can lead to the closure of existing mines and a stop in exploration activities resulting in disinvestments and layoffs in the mining region (Tonts, 2010; Tonts et al., 2013).

Large fluctuation in demand for labor and other assets will also affect the regional enabling and/or constraining environment for other existing and/or potentially new industries in the region (Steen and Hansen, 2018; Rørheim and Boschma, 2021). In other words, the effects of synergetic (e.g. knowledge transfer mechanisms) and competitive (i.e. resource movement effects) inter-path relationships of extractive industries on other existing and/or potentially new industries in mining regions is likely to differ between times of boom and times of bust.

A boom in a particular extractive industry suggests an increase in demand of certain assets that are required by the extractive industry, such as skilled labor, natural resources, etc. If these are scarce and also required by other existing or potentially new industries the increases in demand by the booming extractive industry will reinforce the competitive inter-path relations (resource movement effect) and therefore aggravate diversification in the region since the extractive industry is able to pay higher prices for production factors (e.g. Fitjar and Timmermans, 2019).

In phases of bust, e.g. through a downturn in commodity prices, firms in extractive industries choke their activities in mining regions. Previously occupied assets, such as skilled labor or firm capacities in general, are released from their previous use (Steen and Hansen, 2018). Rørheim and Boschma argue that this “will make redundant labour flow to local skill-related firms that are not subject to the same business cycle as the principal industry [...]. This will give new impulses to local skill-related industries because wages will go down, and the new recruits will bring in new ideas” (2021, 5). Dismissed employees and entire firms are forced to search for new jobs and new activities. This can stimulate the previously outlined regional branching mechanisms (Boschma and Frenken, 2011) when firms and people apply existing knowledge to new but related contexts (e.g. an oil and gas drilling firm deploys its knowledge to the geothermal industry; an engineer formerly employed in a mining company applies its skills in a manufacturing firm or starts its own business in a related industry field).

Recent studies provide preliminary empirical evidence for these differing effects of extractive industries on other industries between periods of boom and periods of bust. In a study on firm performance in the highly oil-dependent Stavanger region in Norway Rørheim and Boschma find that “skill-related firms seem to experience negative consequences, possibly because of substantial competition for talent and resulting wage pressure from the dominant petroleum industry” (2021, 13) during the oil boom between 2010 and 2013. During the low-oil-price-environment between 2014 to 2016 this negative effect was mitigated partly and skill-related plants augmented their relative performance. A possible explanation is the reduction of the resource movement effect that resulted from a decrease in demand of the oil and gas industry for scarce and competitive assets, such as labor, during the period of crisis.

In a study on the emergence of the offshore wind power industry in Norway, Steen and Hansen (2018) reveal that this new industry development was, among other factors, triggered by a declining oil and gas industry during the late 2000s. Resources in oil and gas firms became redundant and were mobilized to diversify into this new but related business field. However, once the oil and gas industry revitalized, many of these firms withdrew their resources from the emerging offshore wind power industry and reallocated it back. The authors conclude that when the period of bust turned to a period of boom “much of the momentum for the main mechanism for [offshore wind power] path creation—firm branching—was lost” (2018, p. 199).

Both empirical insights illustrate that positive and negative effects from extractive industries on other existing and/or potentially new industries do not unfold equally across different points in time but

depend on boom and bust cycles. This analysis, however, also requires a multi-scalar perspective that has not been considered in the extant studies. Since a significant part of workers and mining related service suppliers are territorially disembedded out of the mining regions, we still know little about how the effect of booms and busts spreads across space and affects diversification opportunities in different regions depending on their functional specialization.

Summing up, the above elaborations highlight that it is crucial to consider the specific context of mining regions along different dimensions in order to refine our understanding of how extractive industries affect regional diversification. In the next section we will apply this framework to the various case studies of this special issue to illustrate the value of considering the various dimensions for studying the effect of extractive industries on regional diversification.

3 Contributions of the special issue

Table 1 provides an overview of the articles in the special issue. They cover a wide range of regions, industrial foci and relate (explicitly and implicitly) to one or more of the conceptual considerations laid out above in our multi-dimensional heuristic framework for diversification in mining regions. In the following, we will summarize some of the key insights and contributions along the dimensions of the framework.

In terms of **inter-path relations**, several articles cast light on competitive inter-path relations resulting from the regional presence of extractive industries thereby pointing to the difficulties of diversification in mining regions. Hernández, Atienza and Modrego (2022) show that the context of the Chilean mining regions tends to limit entrepreneurial activity and reduce the performance of new firms. Breul and Nguyen (2022) find that the regional importance of extractive industries have a hampering effect on the entry of new non-extractive industries in Vietnamese provinces. While not being able to distinguish between synergetic and competitive inter-path relations, both articles show that the regional presence of extractive industries creates challenges for regional diversification. This overall negative effect suggests that the resource movement effects outweigh possible synergetic inter-path relations.

The studies by Irarrazaval and Vale (2022) and Mateo (2022) zoom into specific mechanisms of competitive inter-path relations resulting from the regional presence of extractive industries. The former investigates how resource revenue expenditures of local authorities into infrastructure construction - as one indirect mechanism - can cause a crowding out of existing agricultural activities in Peru and Bolivia due to the high labor demand of construction projects. The latter study reveals how an increase in copper prices has reallocated water rights, a scarce regional asset in Calama (Chile), towards copper mining, thereby constraining existing agricultural activities that traditionally relied on these water sources. The study thereby highlights the value of a broader understanding of assets to fully understand resource movement effects, beyond the classical focus on labor displacement, leading to a broader understanding of the Dutch Disease when analyzed at a regional level. A broader consideration of different asset types is also undertaken by Stihl (2022) in the case of Kiruna (Sweden). Her study also shows that both competitive and synergetic inter-path relations can coexist and mark the relationship between extractive industries and the potential for developing a new non-extractive industry. So, while infrastructure development by the mining industry enabled the emergence of the tourism industry in Kiruna, the competition over scarce local assets like landscape, housing and labor hinders the tourism industry to expand. In a similar vein, Morales and Atienza (2022) show how mining related infrastructure has contributed to the creation of an astronomy path in the region of Antofagasta (Chile).

Two further studies of the special issue investigate whether and how regions can benefit from synergetic inter-path relationships between extractive activities and new related activities, such as in the form of backward and forward production linkages. The viewpoint by Scholvin (2022) uncovers obstacles to achieve diversification through production linkages. Drawing on insights from resource peripheries in Argentina, Bolivia, Ghana and Namibia, the viewpoint points to the limits of benefiting from these kinds

of dynamics locally. In contrast, the article by McGregor and Yeung (2022) presents a success story of oil-related diversification in Singapore and the ‘Straits’ region, where the imported oil refining path laid the ground for subsequent related diversification towards the midstream segment of the value chain.

As this brief summary shows, the studies provide a diverse range of empirical insights on the effects of extractive industries on regional diversification. In what follows, we discuss how the specific context along different dimensions has conditioned these effects.

Table 1: Overview of the articles in the special issue

Authors	Case study (industry and location)	Focus along the conceptual framework
Breul & Nguyen	Vietnamese provinces; Extractive industries	Regional institutions, regional economic structure, inter-path relations
Fernández-Vázquez	Asturias (Spain); Coal mining	Temporality
Hernández, Atienza & Modrego	Chilean functional regions; Extractive industries	Regional economic structure, place-specific conditions, inter-path relations
Irrarrazaval & Viale	Tarija (Bolivia), La Convención (Peru); Natural gas, construction industry, agricultural sector	Regional institutions, place-specific conditions, competitive inter-path relations
Lufin & Soto	Chilean regions; Extractive industries	Production linkages, multi-scalarity
Mateo	Calama (Chile); Copper industry, agricultural sector	Institutions, competitive inter-path relations
McGregor & Yeung	Singapore, Riau Islands (Indonesia), Johor (Malaysia); Oil and gas industry	Synergetic inter-path relations (production linkages), institutions, multi-scalarity
Morales & Atienza	Antofagasta (Chile); Copper industry, mining service industry, astronomy	Regional economic structure, place-specific conditions, institutions, inter-path relations, multi-scalarity
Arias-Loyola, Loginova, Miao, Phelps, Sigler & Zulu	Mount Isa (Australia), Calama (Chile), Chambishi (Zambia); Copper industry	Institutions, multi-scalarity
Scholvin	Argentina, Bolivia, Ghana and Namibia; Oil and gas industry	Synergetic inter-path relations (production linkages), multi-scalarity
Stihl	Kiruna (Sweden); Iron ore mining and tourism	Regional economic structure, change agency, inter-path relations, temporality

The role of **regional context conditions** for moderating the effect of extractive industries on regional diversification is addressed in several articles of the special issue. Hernández et al. (2022) show how related variety promotes regional entrepreneurship in the Chilean non-mining regions while not in the mining ones, where both new firms’ creation and performance in terms of employment and sales are negatively affected by the predominance of large firms in the regional economic structure. The findings by Breul and Nguyen (2022) highlight that apart from the negative effect of the regional presence of extractive industries, the diversification potential of mining regions into new non-extractive industries is significantly shaped by the relatedness to pre-existing regional capabilities. It underlines that diversification in more diversified metropolitan areas that host extractive industries will be less

challenging than in mono-structured resource peripheries, where the narrow scope of regional capabilities sets limits to future structural change. Moreover, the study reveals that suitable **regional institutions** – in this case low entry barriers for new firm foundation – have moderated the negative effect of extractive industries on regional diversification.

The important role of institutions for understanding the effect of extractive industries on regional diversification is probably one of the most relevant results highlighted in many of the articles of this special issue. Irarrazaval and Vale (2022) show that while in both of their case studies, Tarija (Bolivia) and La Convención (Peru), natural gas rents were mainly translated into infrastructure construction, the consequently booming construction sector had varying effects on the agricultural sector in both regions depending on how peasant organizations interact with local governments. In La Convención province, the high demand for workers for construction projects caused a temporary crowding out of agricultural activities. In contrast, in Tarija the active engagement of the peasant organization advocated for direct cash transfer of natural gas rents to farmers. This program avoided the crowding out of the agrarian sector in Tarija. The finding highlights how the local political economy of resource revenue expenditure affects diversification. McGregor and Yeung's (2022) article sheds light on the crucial role of proactive and coordinated institutions and system-level agency to untap synergetic inter-path relationships and develop related activities from extractive industries. In their study on Singapore they show how constantly adapting state strategies have been critical for diversification dynamics to unfold from the initial oil refining path. The article by Mateo (2022) adds the role of institutions to recent conceptualizations on inter-path relations combining EEG with transaction costs economics. Institutions regulate the access to scarce assets and thereby affect the extent of competitive inter-path relations. In the case of Chile, the market oriented 1981 Water Code created institutional mechanisms that have concentrated access to superficial water rights in the municipality of Calama to the benefit of the copper mining industry, hindering the continuation of pre-existent agricultural activity.

These insights so far highlight that the impact of extractive industries on diversification is not felt uniformly across resource-rich countries. Besides macroeconomic effects, there are influences resulting from synergetic and competitive inter-path relations that are operating rather on a regional level and are moderated by region-specific context conditions, such as institutions or the regional economic structure.

However, not all explanations for the (in)ability of mining regions to diversify can be found in the regional context conditions. Insights from the viewpoint by Scholvin (2022) on resource peripheries in Argentina, Bolivia, Ghana and Namibia suggest the need to take into account the **multi-scalar organization** of extractive industries in order to understand the difficulties of benefiting from positive inter-path relationships in the form of backward and forward production linkages. Many of the production linkages – especially more sophisticated ones – are provided by extra-regional actors. Obstacles for local dynamics to unfold range from high entry barriers due to the high capital intensity, to limited territorial embeddedness of production linkages due to lacking regional capacities, as well as the insufficient size of the market created by extractive industries. In a similar vein, in their case studies on Australian, Chilean and Zambian copper mining regions Arias-Loyola et al. (2022) emphasize the influence of the spatial division of labor globally as well as in national urban systems on value capture and the potentials for developing production linkages from extractive activities in mining regions. Morales and Atienza (2022) remark the need of a multi-scalar approach to understand diversification and its contribution to economic development in mining regions. For this purpose, the authors combine ideas from EEG and the Global Production Network approach to propose the concept of “new path capture”. The authors analyze an apparently successful case of diversification in the region of Antofagasta (Chile), where a growing mining service industry has emerged in the last twenty-five years and that has become a world hub of astronomical observation. In both cases, however, when a multi-scalar perspective is adopted, it is found that these new paths are territorially disembedded presenting very weak production linkages with the regional economy, a significant share of workers living in other regions and almost inexistent channels for transferring nonlocal knowledge to regional firms and universities. This type of new path capture by nonlocal agents calls attention to the need of analyzing

not only whether mining regions are able to diversify but also to what extent they are able to capture the value created by new industries.

One of the dimensions of our heuristic framework that has received less attention among the special issue articles is that related to **temporality**. Fernández-Vázquez (2022) focuses on the consequences of mines closure for diversification in the Central Coal Basin of Asturias (Spain). Based on rich historical data on local employment for the period 1978-2018 the author finds an increase in the diversification of the municipalities of the Central Coal Basin when the public subsidies received by the Spanish mining companies were put to an end compared to other Asturian municipalities. This result, however, was not due to the relocation of workers to new activities, but to the dramatic reduction in the size of the local economy where no other new industry was able to emerge to replace coal mining. A different experience is presented by Stihl (2022) in Kiruna (Sweden) where the steel crisis during the 1970's mobilized local agents to find new paths in tourism and space industry. The analysis reveals how the change agency of a single entrepreneur creating the Icehotel, afterwards complemented by system-level agency, was the starting point of a new path formation process for this mining area. Lufin and Soto (2022) present a different approach to analyze the effect of the mining prices supercycle in Chile using an input-output framework to estimate how the impacts of a resource boom are propagated among industries and regions through demand and supply linkages. They simulate the effectiveness of different policies that aim to foster diversification by strategically investing in other key industries at different spatial scales. The authors find that optimal results for diversification and economic growth are found when regional, sectoral, and national levels of policy orientation are combined. This 'large policy' approach is required to induce a process of diversification in mining regions, because the effect of booms otherwise tends to spread across space to the benefit of core regions.

4 Directions for future research

The heuristic framework developed in this introductory article and the special issue articles illustrate how we can bring the study of the relationship between resource extraction and diversification to the regional level. It also highlights the value of this endeavor for developing a more nuanced understanding of industrial dynamics in mining regions. Only through this, suitable policies can be designed that consider how context-specific influences mediate to what extent the economic specialization in resource extraction affects the diversification potential of mining regions. We therefore hope that the heuristic framework proposed in this article will encourage more work to fully capture the mechanisms that underlie mining regions' (in)ability to diversify their economies. Here, we express six promising directions for future research:

First, the multifaceted insights collected in the special issue show the value of ensuring sufficient analytical openness when studying the effects of extractive industries on other existing and/or potentially new industries, instead of focusing either on resource movement effects or mining-related production linkages. These can operate in parallel and also change across the evolution of industries (e.g. Stihl, 2022). Analyzing the effects of extractive industries on regional diversification through the perspective of inter-path relations (Frangenheim et al., 2020; Breul et al., 2021) provides a promising analytical access for future studies that would acknowledge these variegated consequences and contribute to a better understanding of the Dutch Disease at a regional level. These kinds of insights would generate valuable information for designing policies that foster synergies between extractive industries and other (new or established) non-extractive industries and prevent negative effects resulting from resource movement effects.

Second, our heuristic framework implies the need of combining the insights of EEG with other frameworks that allow to incorporate not only the local context conditions but also a multi-scalar perspective that considers how the emergence of a new path is related to the national and global context. Following the recent proposals made by Yeung (2021) and Boschma (2022) combining EEG and GPN

frameworks seems a promising venue for research on the diversification of mining regions acknowledging the geographically fragmented organization of extractive industries and zooming to the level of functions performed in mining areas rather than entire extractive industries. Initial steps in this direction are made in this special issue by McGregor and Yeung (2022) and Morales and Atienza (2022).

Combining different frameworks can also be helpful to develop a third line of research focused on the role of institutions and local agency in the emergence of new industries in mining regions. Many of the works of this special issue have pointed out from different approaches that institutions both at a regional and national level are crucial to either promote or constrain diversification through entrepreneurship, access to local assets, and the design of policies to territorially embed new activities. From this perspective, understanding how the local agency of different actors and organizations can change the pre-existent institutional setup and confront the vested interests of national governments and mining companies creating the conditions for new path development opens a line of research that still needs to be further developed.

Fourth, it is important to shed light on how the impact of extractive industries on regional diversification differs between boom-and-bust cycles. Temporality is the dimension of our heuristic framework that has received less attention among the special issue papers. However, with the help of this nuanced temporal understanding windows of opportunity for the implementation of specific policies could be determined. Future studies could draw on longitudinal data in order to investigate to what extent inter-path relations have changed before, during and after the mining prices supercycle.

Fifth, the diversity of experiences across the world presented in this special issue also calls for the convenience of developing more comparative studies among regions and different types of extractive industries in the line of Arias-Loyola et al. (2022). In this sense, it is important to avoid deterministic approaches to understand why some regions have been able to diversify, while others are not able to benefit from potential forms of diversification opportunities.

Finally, while this article focuses on diversification as one crucial component in the relationship between resource extraction and development, diversification does not automatically translate into beneficial regional economic outcomes. Recent research points to possible ‘dark sides’ of new industrial path development (MacKinnon et al., 2019; Breul et al., 2021; Morales and Atienza 2022). From a policy perspective, not diversification per se should be the aim but the generation of positive regional economic and social outcomes. We therefore suggest that linking questions of diversification stronger to developmental results should be a key agenda for future research to improve our understanding of the conditions under which diversification dynamics contribute to what kind of regional economic and social development and for whom.

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