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Price-making in mineral provisioning systems and social-ecological transformation? The cases of copper, cobalt and lithium

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Cornelia Staritz
Bernhard Tröster
Aleksandra Wojewska

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Austrian Foundation for Development Research – ÖFSE
A Austria, 1090 Vienna, Sensengasse 3, **T** +43 1 3174010
E *office@oefse.at*, **I** *www.oefse.at*, *www.centrum3.at*

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Content

List of Abbreviations

ASM	Artisanal and Small-Scale Mining
CME	Continental Mercantile Exchange
COTR	Commitments of Traders Report
DRC	Democratic Republic of Congo
EV	Electric Vehicle
HKEX	Hong Kong Exchange and Clearing
ICAs	International Commodity Agreements
IEA	International Energy Agency
LME	London Metal Exchange
NGO	Non-Governmental Organization
PRA	Price Reporting Agency
SHFE	Shanghai Futures Exchange

Abstract

Research and debates around mineral extraction in the context of social-ecological transformation have dedicated limited focus on price-making processes. Drawing on the systems of provisioning approach, this paper assesses price-making and related institutions in mineral provisioning as contested processes. We argue that price-making is not an objective or solely technical process taking place on abstract markets; rather, it is, first, reflective of power struggles over specific rules and devices between different actors, embedded in social relations, network practices and institutions and, second, linked to characteristics of specific materialities of commodities and territorial and organizational forms of their provisioning. Empirically, we analyze the 'electric vehicle metals' copper, cobalt and lithium, for which derivative markets are intensifying their role as key price-determination institutions linked to financial actors' interest to get price exposure. The paper criticizes current shifts to benchmark- and derivative markets-based price-determination. This approach primarily focuses on short-term and narrow production costs without considering local producer-region specificities, broader economic impacts and environmental and social costs and risks. Moreover, it fails to address the long-term insecurities related to resource depletion. With financial actors dominating price-determination on derivative markets, prices deviate even from such a short-term and narrow fundamental perspective. Alternative price-making mechanisms are needed for social-ecological transformation, which requires political debates and democratic decision-making. Methodologically, the paper is based on trade and financial data and semi-structured interviews with price-determination institutions, metal provisioning and producer country actors.

Keywords: price-making, provisioning systems, infrastructures, financialization, electric vehicle metals

1. Introduction

Climate change and environmental degradation require a comprehensive social-ecological transformation. This involves the transformation of provisioning systems across various sectors, including the critically important transport sector (IEA 2023). The shift to electro-mobility is portrayed as a central strategy for such a transformation and high hopes are placed on new technologies around batteries for electric vehicles (EVs). This shift has, however, been broadly criticized for being too narrow, since broader mobility shifts away from an individual-based, car-dominated, high-carbon transport system are needed (e.g., Mattioli et al. 2020). The shift to electro-mobility is also in itself contradictory, as the EV provisioning system depends on hardware and infrastructure that are resource-intensive. The projected increase in battery production is a key demand driver of base minerals such as copper and minor metals such as cobalt and lithium (IEA 2023). 'Green mobility' is proclaimed to cause a new "commodity super-cycle" (Home 2021), which triggers new extraction projects.

More minerals extraction is problematic from an environmental, social and economic perspective, as indicated by well-known problems related to resource extraction, ranging from severe environmental and human rights violations at places of extraction (e.g., Prause/Dietz 2022) to macro-economic development challenges related to commodity dependence (Tröster/Küblböck 2020; UNCTAD 2021). There is also a growing body of literature focusing explicitly on the problematic impacts of increased mineral extraction as a result of ongoing 'green transitions' – under the banner of 'green extractivism' or 'green colonialism' (Claar 2022; Dorn 2022; Zografos 2022).

Research and debates around social-ecological transformation, however, overlook price-making processes, especially for 'critical' minerals required for 'green technologies'. Price-making in minerals, and other commodities, involves price-determination of a 'world price' which is used as a benchmark in price-setting in contracts in various purchasing and sales transactions from raw to processed commodities. These price-making processes importantly affect mineral extraction, production, trade and the (un)sustainable use of these exhaustible resources. They further impact the distribution of value, costs and risks among actors engaged in mineral provisioning and co-constitute power and governance structures. This lacuna is particularly problematic as commodity derivatives markets, particularly the London Metal Exchange (LME), are currently intensifying their role as key price-determination institutions for so-called EV metals. As these derivative markets are becoming more financialized in terms of an increased share of financial actors and financialized trading practices by financial and physical actors, this process links the financial and physical spheres of mineral provisioning systems in new ways. In particular, increased short-termism and price volatility increase the risk of uneven and unsustainable outcomes. Hence, it is crucial to analyze price-making processes, and how and by whom prices are determined and set, in order to get a comprehensive understanding of the broader implications of current 'green transitions'.

Drawing on the systems of provisioning approach, this paper assesses price-making and related institutions in mineral provisioning as contested processes. Provisioning systems must not be reduced to technical arrangements of production, distribution and consumption, but they are constituted by political, social and cultural as well as physical elements (Brand-Correa/Steinberger 2017; O'Neill et al. 2018). Hence, provisioning systems feature integrated socio-metabolic and political-economic dimensions (Plank et al. 2021; Schaffartzik et al. 2021). Such an approach also focuses on the processes through which markets are created and sustained and rules and norms constructed, by whom and whose interests are reflected, thereby countering the tendency to treat (financial) markets as 'abstract' and 'objective' places (see also Muellerleile 2018). In this regard, price-making is not an objective or purely technical process occurring in abstract markets that tend towards some equilibrium driven by demand and supply. Instead, we argue, that it reflects power struggles over specific rules and devices between different actors, embedded in social relations, network practices and institutions

(Beckert 2011; Çalışkan 2010; Callon/Muniesa 2005). Additionally, price-making is linked to the specific materialities of commodities and the territorial and organizational forms of their provisioning.

Empirically, we analyze the provisioning and price-making systems of the EV metals copper, cobalt and lithium, which are critical resources for electric-mobility. We examine the current developments around the LME and its changing role in price-determination, wherein struggles between physically-oriented and financial interests are evident (Seddon 2020). The paper criticizes prevailing shifts to benchmark- and particularly derivative markets-based price-determination. Current price-determination focuses on short-term and narrow production costs-focused supply and demand considerations, not taking into account local producer-country or -region specificities, broader economic and even less environmental and social costs and risks, and long-term insecurities related to resource depletion which are paramount for social-ecological transformation. With financial actors dominating price-determination on derivative markets, prices deviate even from such a short-term and narrow fundamental perspective. Alternative price-making mechanisms are needed, ideally through a new round of democratically institutionalized international commodity agreements (ICAs) between producer and consumer countries. This would contribute to politicizing provisioning systems and opening new spheres of democratic decision-making around issues as important as commodity prices.

Methodologically, the paper is based on trade and financial data, industry studies, company reports, as well as 96 semi-structured interviews between 2021 and 2023. Interviews were conducted with price-determination actors (LME, price reporting agencies (PRAs), financial actors and experts); metal sector actors (mining companies, commodity traders, industry associations and experts); and producer country actors (Ministries and other state institutions, sector associations, artisanal mining cooperatives, industry experts, NGOs). Interviews focus on actors in the central metal trading hubs London and Switzerland as well as actors in key African existing and future producer countries for copper (Zambia), cobalt (Democratic Republic of Congo, DRC) and lithium (Zimbabwe).

The paper proceeds as follows: Section 2 discusses our theoretical perspective. Section 3 gives an overview of price-making in copper, cobalt and lithium. Section 4 discusses problems of current price-making related to social-ecological transformation. The last section concludes and provides an outlook on alternative price-making systems.

2. Provisioning systems, (financial) market infrastructures and price-making

Generally, provisioning systems enable a multidimensional perspective on needs satisfaction that goes beyond a reductionist understanding of the economy as composed of market interactions and individual consumption choices (Bärnthaler/Gough 2023). Rather, it stresses the collective role of these systems relevant to the provision of goods and services and for understanding “who gets what, how and why” (Bayliss/Fine 2020). Provisioning systems focus on a “social and processual-historical account as to how the economy is organized and reproduced” (Jo/Todorova 2018: 35), seeing the material basis of society as an outcome of interactions and struggles between different actors, social groups and nature.

Three aspects of this approach are particularly important for our analysis: First, provisioning systems integrate social and ecological spheres and dynamics by intermediating between human wellbeing and biophysical processes, drawing on social-metabolic and political economy perspectives (Plank et al. 2021; Schaffartzik et al. 2021). Second, they combine production, distribution and consumption and how they are interrelated and depend on the systems by which goods or services are provided. They also encompass production processes

from raw materials, where minerals play a crucial role, to all intermediate steps until consumption and 'waste' (Ciccantell/Smith 2009). Third, provisioning systems are not abstract or objective but are politically made based on regulations, infrastructures, institutions, technologies and social and cultural norms. This also highlights the possibility to re-make provisioning systems and opens them up to political debate and contestation (Brand-Correa/Steinberger 2017; Jo/Todorova 2018; O'Neill et al. 2018).

Prices have a crucial role in coordination of consumption, distribution and production processes and they are a key channel of provisioning, with different systems in place to determine and set prices for specific goods and services. Polanyi (1992) stresses that prices and their volatility in market economies are an outcome of particular institutional settings ("price-making markets", ibid.: 36), which did not emerge spontaneously. Polanyi therefore argues for bringing to the fore the questions of market construction and organization in studies of price formation over a focus on "mere random acts of exchange" (ibid.). This links to Veblen (1909) who saw 'price systems' not as abstract supply and demand interactions, but institutions, which serve to organize and coordinate flows of capital and are structurally embody interests of powerful groups (Jo 2016). Pricing is therefore not a process taking place on abstract markets but within the context of the production, distribution and consumption of specific goods and services, constructed and organized by political and social forces, within the material basis of goods and services. Hence, prices are based on contested price-making processes that are reflective of power struggles over specific rules between diverse physical, financial and state actors, embedded in institutional contexts (Beckert 2011).

These perspectives on prices are also discernible in the provisioning systems literature. Jo (2016: 17) argues that "markets and society in general are administered and planned for the sake of those who control the institutions of the price system". Linked to this, Bayliss and Fine (2020) state that there are inherent tensions in pricing processes, due to their distributional impacts. As such, the concept of provisioning rejects the mainstream market price mechanism, on the basis that pricing processes serve to organize and control the material basis of provisioning systems, hence they are highly contextual. Jo (2016: 12) emphasizes "a theory not derived from the actual provisioning process [should] be rejected." In this vein, provisioning systems' scholars have been calling for an alternative theoretical framework that explains how activities are organized, "how resources come into use, how wants arise, and what economic activities mean" (Dugger 1996: 32). As such, studies of price-making should avoid decontextualized generalizations, but rather embrace the particularity of socially constructed power structures within which prices are determined and set in specific provisioning systems.

Less attention has however been paid to the processes, strategies and practices through which prices are actively 'made' and related institutions, infrastructures and actors. This is particularly important for commodities given the dominant use of 'world price' benchmarks that are increasingly determined on financial markets and set in various contracts between physical actors from extraction to processing and end use. Commodity price-making systems are typically described as abstract markets on which prices "are basically determined at each point in time by the intersection of the short-run supply and demand curves" (Radetzki/Wårell 2020: 91). Since the 1980s, derivative exchanges have become the central 'price discovery' institution for commodities. According to the 'efficient market hypothesis', commodity exchanges serve as central marketplaces where multiple actors come together to buy and sell commodities. These exchanges are considered the best venues for commodity price discovery because they efficiently gather and incorporate all available information from multiple actors and locations in a transparent manner (Halland et al. 2015; Radetzki/Wårell 2020; for a critical discussion see Ederer et al. 2016; UNCTAD 2011). In the metal industry, price-determination via derivative markets is deeply engrained not only as a gold standard but also as inevitable. In the words of the Senior Vice President of Market Development at the LME "reference pricing and exchange trading are natural steps in the evolution of a commodities market" (Kusigerski 2018: 4).

This framing is problematic, as it assumes not only a certain 'natural' trajectory of price-making processes, with price-making based on financial markets as the most desirable ('mature') outcome. Such a narrative bypasses the role of institutions, actors and interests who actively shape these very processes as well as the outcomes of (financial) trading on derivative markets on commodity price levels and volatilities. There is ample critical literature, also from the provisioning systems perspective[1], on the financialization of commodity and particularly of food sectors and related outcomes. However, only few articles assess specifically price-making processes in agricultural commodities (Bargawi/Newman 2017; Çalışkan 2010; Purcell 2018; Staritz et al. 2018, 2023), but with less attention on the institutions and infrastructures behind 'world prices.'

We argue that price-making does not take place on abstract markets but is, first, based on struggles between different actors and institutions that favor certain standards, devices and institutions of price-making over others. These price struggles take place at two levels – actors struggle both over (money) prices per se that are settled in acts of exchange, but also over the ability to influence how prices are made and controlled in markets or other venues (see Polanyi 1992). By looking at the processes through which markets are created and sustained, by whom and whose interests are reflected in the material construction of (financial) markets, we counter the tendency to treat (financial) markets as 'abstract' and 'objective' places and more generally global finance as apolitical. Second, price-making is linked to specific materialities of commodities and territorial and organizational forms of their provisioning. Price-determination crucially depends on standardization and commodification, aimed at producing an abstract, homogeneous commodity suited to investors' (speculative) needs (Bernards 2021). Such processes enable the creation of a global, single market in which commodities can be traded in standardized abstract form from raw material extraction to their processed form. However, standardization and de-contextualization of commodities depend on the material complexity of specific resources and production systems (ibid.).

We conceptualize price-making as a contested process, with particular attention to the interconnections between price-making institutions and the provisioning systems of specific commodities. This approach considers the materialities, territorial and organizational forms of provisioning, and financial interests aiming to create a single, global market for simplified financial accumulation strategies. Such a single, global (financial) market stands in strong contrast to the material, political, social and cultural dimensions of specific provisioning systems, and the needs-centered approach of provisioning.

3. Price-making in 'critical' minerals

Establishing prices on a case-by-case basis would be a lengthy and expensive process for actors that deal with physical commodities, including producers, traders, refiners, manufacturers and end users. For many internationally tradable commodities, common quality standards have been agreed, and thus, a price benchmark can be determined on a global level for a standardized commodity and applied in price-setting practices in physical transactions. World prices in these systems are increasingly determined on derivative markets, but PRAs also play a role in determining prices by themselves or providing underlying prices for derivative markets. Price-making processes are however contested and the outcome of struggles between physically-oriented and financial interests in the context of broader financialization processes. They are also impacted by the materiality of specific metals that can create limits to standardization and hence commodification and financialization, and the (changing) territoriality and organizational forms of their provisioning, leading to different power relations.

[1] For an overview see e.g., Bayliss/Fine 2020.

3.1. Derivative markets as dominant metal price-determination institution

The world prices of major metals are determined at specific commodity derivative markets, which are spaces where the financial and physical spheres of commodity markets meet. It is at these markets that commercial actors (commodity producers, international traders, manufacturers) and financial actors (banks, institutional investors, hedge funds) conduct trade in financial derivatives. Derivatives are contracts, whose value is linked to an underlying asset and can therefore constitute a right ('options') or an obligation ('futures') to purchase or sell a particular commodity at a specified point in time in the future, at a predetermined price. Derivative markets perform two key functions for physical actors: (i) 'price discovery' providing global price benchmarks to be used either on spot markets, where metals are traded immediately, or as a reference in term contracts of physical trade and (ii) hedging against price risks that emerge in physical trade. The key function of exchanges is the operation of infrastructures that enable price-determination through the participation of physical and financial actors. Thereby, they also enable exposure to commodity price movements for speculative purposes.

Metal derivative markets are traditionally linked to physical metal trading due to warehouse systems, which ensure that spot prices for metal deliveries from these warehouses are equal to the prices of expiring futures contracts (physical settlement; Adams et al. 2019). For this purpose, physically settled contracts require a standardized materiality that needs to be storable, transportable and substitutable to most users, which is the case for many base metals (Radetzki/Wårell 2020). However, rates of physical settlement are very low (at the LME, less than 5 %), since the majority of members use derivative markets not for physical trade, but for price risk management or speculation (Adams et al. 2019). More recently, metal exchanges also introduced cash-settled contracts. These contracts are paid off in cash upon expiry based on spot reference prices obtained from PRAs. This allows the expansion of derivative trading to minor metals such as cobalt or lithium, which do not fulfill the feasibility conditions due to limited standardization or storability.

There are three major derivate exchanges for metals – LME, Continental Mercantile Exchange (CME) in New York and Shanghai Futures Exchange (SHFE) – that all emerged primarily around copper trade. The LME has the longest tradition being established in the context of surging metal imports to the UK in the 1870s and remains the dominant institution for world price benchmarks of base metals (Seddon 2020). Commodity derivative markets have become financialized in the context of liberalization and deregulation, particularly since the early 2000s, which is understood as the increased presence of non-traditional financial actors on these markets using novel financial trading strategies and instruments (van Huellen 2020). Financialization has resulted in a stronger correlation between market parameters of commodities and other financial markets, including stocks and bonds (Kang et al. 2023). While there is an ongoing debate about the impact of financialization on price levels and volatility, studies indicate that financial trading strategies have accelerated volatility and boom-bust cycles and contributed to a partial detachment from underlying fundamentals (Gilbert 2018; Newman/van Huellen 2022). Moreover, financial trading strategies are integrated into the business models of physical actors, such as international traders and mining companies, who engage in financial activities alongside physical trade (Baines/Hager 2021; Staritz et al. 2018, 2023).

3.2. Price-making in copper

Copper is the key example of price-determination at derivative markets as it is easily standardized and a large number of mining, smelting and refining companies and international traders exist. Copper is mainly extracted in Chile (26 %), Peru (11 %), DRC (9 %) and China (9 %) (Reichl/Schatz 2023). There is a large number of mining companies, of which the Top 5

(Codelco, BHP, Freeport-McMoRan, Glencore, Southern Copper) had a market share of 35 % in 2020 (NS Energy 2021). Smelting and refining are primarily operated by large Chinese companies (ICGS 2023). International traders are present at every stage due to the many actors involved and the different copper products traded globally. Some traders, such as Glencore, Trafigura or IXM, are also engaged in extractive and refining activities. International traders usually manage their activities from centralized trading departments located in logistics and finance hubs such as Switzerland and London (Dobler/Kesselring 2019).

Derivative markets became the central price-determination institution for copper worldwide in the 1980s, with the LME Official Settlement Price of futures contracts on copper cathodes (99.99 % copper content) being the central benchmark price in physical contracts. Copper futures were introduced in 1877 at the LME and widely accepted in international trade, but other price-determination institutions remained important. There were attempts of producer cartelization after World War I and II and independence in Global South copper producer countries to stabilize or raise copper prices at the national and international level (Declercq 2020). Until the 1980s, the North American copper sector operated independently from LME benchmarks, relying on annual price negotiations between miners, refiners and industry users (Mikesell 2018). As the sector became more internationalized and fragmented, the producer price system ended and copper contracts were introduced at the CME in 1988, focusing primarily on intra-regional trade in North America. With China's growing prominence, the SHFE began derivative trading in 1999, primarily targeting intra-China trade (Bain 2021). The LME remained however dominant, obtaining 70 % of global trading volume in copper derivatives in 2021 (LME, CME, SHFE data).

The emergence of the LME price as the dominant global benchmark was closely tied to the hedging requirements of new transnational companies operating in an increasingly fragmented industry. With a multitude of bilateral transactions, hedging became crucial for traders, smelters, refiners, and other independent actors. Traders, in particular, have embraced the ‘agency model’, which includes offering hedging and financial solutions to other physical actors, resembling financial actors. This trend gained traction following the 2008 financial crisis, as commercial banks scaled back their involvement in commodity sectors (Perks 2016). Mining companies, driven by shareholder preferences, are the physical actors least likely to use hedging. However, even actors that do not hedge rely on LME benchmarks. Across the industry, using LME copper benchmarks has become the standard practice for conducting business with major players.

Important struggles at the LME influence price-making of copper. The LME historically had a strong physical trade orientation, which is still reflected in the exchange’s infrastructure today (e.g., daily contract expiries instead of more standardized contracts, open-outcry instead of electronic trading, cash-settled instead of physically-settled futures) (Seddon 2020). This orientation has been contested by financial actors already since the 1980s. Changes in the UK regulatory frameworks and competition from more ‘financial investor friendly’ exchanges accelerated this shift. Financial actors outnumbered industrial members already by the early 1990s, leading to a more financialized exchange infrastructure after the 2001 demutualization (separation of ownership and trading rights) and the 2011 sale of LME holdings to the Hong Kong Exchange and Clearing (HKEX). Seddon (ibid.: 537) describes this process as “market-structural financialization”. Commitments of Traders Report (COTR) data on copper from January 2020 to April 2022 show that financial actors hold the majority of open positions with 70 % of long open positions and 59 % of short open positions (own calculations based on LME data).

The LME copper price is directly used in bilateral contracts between miners, smelters, refiners, end-users, and traders. Even though most contracts are long-term, prices are flexible and typically set as the monthly average of daily LME official settlement prices. Hence, LME prices are transmitted to all different actors that extract, process, trade or use copper as inputs. They

are also used by states as the basis to calculate taxes from extractive industries (Musselli 2019). Thereby these prices determine essential parts of revenues and costs for these actors and impact the distribution of value, costs, and risks.

3.3. Price-making in cobalt and lithium

Cobalt and lithium are considered minor metals due to their specialized uses and smaller market size. In 2021, cobalt mine production amounted to 134.5 thousand metric tons and lithium to 232.5 thousand metric tons, compared to over 21 million metric tons of copper (Reichl/Schatz 2023). The DRC is the leading producer of cobalt (69 % of global supply in 2021; ibid.), of which 18 to 30 % come from artisanal and small-scale mining (ASM) (World Bank 2020). Cobalt concentrate can be processed in two ways – with cobalt metal being used in super alloys and other metallurgical applications (20 % of refined cobalt) or with cobalt hydroxide, oxide and sulfate being used for batteries, catalysts or paint (80 % of refined cobalt; Darton Commodities 2021). Lithium is processed into two forms: carbonate (extracted largely from brines, primarily in South America) and hydroxide (commonly extracted from hard rock). Almost 90 % of lithium comes from just three countries in 2021 – Australia, Chile and China (Reichl/Schatz 2023). However, new extractive frontiers are opening for cobalt (particularly in Indonesia), and over 100 new lithium extractive projects were announced or already being developed in 2022 (Fitch Solutions 2022).

Both provisioning systems are currently dominated by a few large, often vertically integrated actors. In cobalt, Glencore, Eurasian Resources Group and China Molybdenum were the largest producers in 2020 (Darton Commodities 2021). In lithium, the Latin American big four producers – Albemarle, FMC, Tianqi Lithium, SQM – along with Australian companies play a key role (Murray 2021). In both metals, Chinese companies have a growing presence, controlling 35 % of the global mine supply of cobalt and 70 % of global refined cobalt output in 2020 (ibid.). China also dominates lithium refining (LaRocca 2020). International traders have only played a small role due to fewer processing steps and less intermediate products to trade. But market structures are changing linked to the demand shift to lithium-ion batteries that today account for around 60 % of lithium and 30 % of cobalt demand (IEA 2023). Thus, new EV-related actors enter both markets – battery producers (e.g., CATL, LG Energy Solutions) and automakers (e.g., BMW, General Motors), conducting long-term off-take agreements and investing in mining and refining to secure volumes in light of tight supply. In this context, also traders are entering both markets. These developments challenge existing power balances and price-making (for lithium, see Bridge/Faigen 2022).

Historically, in both metals leading producers determined prices. In the 1970s, the state-owned company Gécamines in DRC set the cobalt price as a producer price. Liberalization at the end of the Mobutu regime in 1996 and privatization of Gécamines in 2002 led to the entry of more private mining companies, which used primarily long-term supply contracts but with annual ‘market prices’ (Campbell 2020). Before 2021, the majority of lithium transactions were conducted on fixed prices determined by leading producers (e.g., SQM, Albemarle). However, the demand surge for lithium in 2017 and 2018 led to the emergence of spot markets for one-time transactions which allow for high margins from selling lithium outside of long-term contracts with fixed prices.

In both cases, the changes resulted in more frequent transactions and a need for new price indicators as contract benchmarks, creating opportunities for the entry of PRAs. While the cobalt metal price index of PRA Metal Bulletin (now Fastmarkets) became the global benchmark in the early 2000s, there is not a single dominant PRA index for lithium yet, as this process started only recently. PRAs employ a ‘journalistic price-determination’ method, editing price information polled from different types of industry actors based on their physical transactions as well as from financial actors and secondary sources (Adams et al. 2019). Numerous PRAs exist in metal markets and price assessments are reported for different

frequencies (spot, weekly, monthly) and published for subscribing customers (Johnson 2018). There is criticism regarding the power certain physical and also financial actors have in providing primary data, especially in markets dominated by few large physical actors, and the subjective interpretation of primary data. Hence, while PRAs state their aim as providing transparency on markets and acting as a 'mirror to the trade', they do not just 'mirror' trade, but actively influence its image (Fattouh 2011).

Derivative markets appeared not to be a suitable institution for price-determination after the break-up of the producer price regimes in cobalt and lithium. Volumes in cobalt and lithium are small, with few large companies still dominating extraction and processing that have limited hedging needs, and both metals do not allow for easy standardization due to different intermediate and end products and refined lithium is not simply storable. In a first attempt, the LME nevertheless introduced physically settled futures for cobalt in 2010, which was not successful as the underlying cobalt metal lost its relevance compared to cobalt chemicals used in batteries. Further, the LME could not guarantee that delivery of cobalt from their warehouses is free of child labor from ASM in DRC (Bernards 2021).

The strong interests of financial actors in gaining exposure to EV metals price movements, and LME's and other exchanges' interest to boost trading volumes, has prompted new attempts to establish futures contracts for both metals. As one market commentator explains for lithium: "a lot of people today, if they are expressing a bullish view on growth of the lithium market, they have to buy, for example, Albemarle shares […] But if they can buy lithium futures themselves, that's a more direct way of expressing that view". The LME introduced cash-settled futures contracts for cobalt in 2019 and for lithium in 2021. Cash-settled futures are especially favored by financial actors who do not take delivery or sell physical metal. The objectives behind the new contracts were to attract greater liquidity and establish a venue for price risk management and speculation in cobalt and lithium at the LME.

Yet, physical nor financial actors have taken up the new LME contracts. This is related to the limited hedging interests of leading, vertically integrated physical actors that had considerable power over producer prices and now over PRA prices. This could however change with new actors entering (battery and carmakers, international traders) that have a greater interest in hedging. For cobalt, these actors started trading the CME's cash-settled contracts in 2022 (Spilker 2022) primarily due to their simplified trading structure. However, traditional physical actors see derivative markets increasingly as a necessity in the context of increasing market instability and the demands by banks and other financiers for financial hedging. As one commentator said for established lithium producers "[t]hey can't raise any more money. They can't convince their bankers that there is any certainty over the future price because there is no futures market. Then they come back running [to the LME]".

Cobalt and lithium illustrate the contestation around the establishment of commodity derivative markets. In the case of cobalt, cobalt metals became the underlying due to its historical importance in Europe. However, this choice failed to meet the growing demand for cobalt chemicals of the EV industry. For lithium, the underlying became hydroxide and not carbonate, as the LME expects increasing demand for hydroxide in Europe and the USA (for NMC batteries). However, the carbonate-based battery technology (for LFP batteries) has remained dominant, especially in China. Furthermore, the selection of a PRA for lithium pricing was a contentious matter. The PRA Fastmarkets was chosen as a provider of lithium pricing, it was however not the market leader at that time for lithium. The decision was based on Fastmarkets' methodology and experience, the previous working relationship for other cash-settled futures such as cobalt, as well as the company's size and, significantly, its willingness to provide a weekly price. However, this decision faced criticism, as the lithium market at that time would go through periods of low liquidity during which weekly pricing may not be adequate, as stated by one critic, "[t]hat's just not how the [lithium] market works. These are not liquid spot

markets… There were days and probably weeks when things just wouldn't trade. So where is that number coming from? If there is no trading there…what's the trading price?".

Cobalt and lithium are mainly traded in long-term contacts (70-80 % of total trade), but now increasingly with flexible prices. In addition, more short-term transactions are conducted with prices that rely on PRA benchmarks reported bi-weekly, weekly, and also daily. The increased use of benchmarks in contracts means that dynamics within price-determination processes are transmitted directly to actors and locations involved in cobalt and lithium extraction and processing. An increase in futures trading would not change the use of PRA benchmarks (for cash-settled futures), but financialization dynamics on futures markets can influence PRA prices and thereby impact price-determination indirectly.

3.4. Summary

While the LME is the dominant price-determination institution in copper, PRAs pricing remains predominantly used in cobalt and lithium. Crucially, the materiality of metals, technology and dominant physical actor interests matter. Copper's physical properties make it conducive for physically-settled futures and multiple processing steps and actors involved create exposure to price risks, and therefore, a need for price risk management. Physical actors, however, also pursue speculative strategies as they enable profits beyond physical transactions. In contrast, Cobalt and lithium present challenges in standardization and they have only recently emerged as globally traded commodities. Price-making processes for both have evolved from fixed producer pricing to PRA benchmarks. The recently created derivative markets, linked to financial actors and LME's interests, are not broadly used. Physical actors' interests are crucial in actually enabling such contracts to work, as they bring liquidity. Hedging needs, together with speculative activities, may however increase with new physical actors, and established actors might seek price risk management due to increased instability.

Price-determination institutions have undergone significant changes due to struggles between more physically oriented and financial interests. Although the LME maintains its links to physical metals trade, it has become more financialized characterized by the dominance of financial actors, the introduction of cash-settled futures, the increasing importance of electronic trading and more speculative strategies pursued by physical actors. The cooperation between the LME and PRAs allows for cash-settled futures in which the latter provide benchmarks through journalistic price-determination methods. This shift fundamentally alters the price-determination principle at the LME and enables the inclusion of a broader range of metals. Also, PRAs are not protected from financial interests as their methodologies incorporate opinions not only from dominant physical actors but also from financial actors.

Despite the different levels of relevance of derivative markets for the three metals, for all of them there has been generally a shift towards the use of benchmarks and a tendency towards more short-term pricing strategies, even if contracts remain long-term. This transmits short-term fluctuations of 'world prices' determined at the LME or though PRAs more strongly to actors and locations engaged in extraction and processing.

4. Problems of benchmark- and exchange-based price-making

Price-making has important distributional outcomes, as different price-determination institutions, benchmarks and price-setting practices impact actors and locations in varying ways. The shift to benchmark-based and exchange-based price-determination raises concerns, both generally and specifically for social-ecological transformation. First, recent changes in price-making advance short-termism through more short-term transactions and

price-setting, driven by the availability of short-term price benchmarks (bi-weekly, weekly, daily). These price dynamics are increasingly transmitted to all parts of minerals provisioning systems. While some actors favor exposure to short-term price volatility (shareholders of mining companies, international traders, financial actors) due to new profit opportunities, other actors face higher exposure to short-term price fluctuations with limited access to price risk management. In particular, actors in producer countries often have limited access to any form of price risk management. This includes local mining companies and ASM, state-owned mining companies and the state relying on tax and royalty income. Further, extraction, processing and consumption decisions are more likely to be driven by short-term price and profit considerations. This, in turn, may lead to unsustainable and speculative extractive investment and production decisions.

Second, current price-determination at the LME and through PRAs revolves around short-term supply and demand considerations, neglecting broader economic, social and environmental costs and long-term insecurities related to resource depletion, all of which are paramount for social-ecological transformation. These costs are largely externalized in derivative markets and in PRA assessments. A more comprehensive approach would require metal prices to incorporate all societal costs, including social and environmental costs linked to their extraction and production. This entails changing from a narrow production costs view, typically calculated as costs for inputs (energy, labor) of mining companies (Holland et al. 2016). Moreover, derivative market-based and industry-focused journalistic price-determination face challenges when dealing with high insecurity, especially concerning longer-term scarcity and depletion concerns related to non-renewable resources. The issue lies in financial markets' inability and ineffectiveness in dealing with long-term insecurities and broader economic, social, and environmental considerations that significantly impact commodity fundamentals, and are even more crucial in the context of climate change and environmental degradation.

Third, the increasing influence of financial investors and trading strategies, also among physical actors, weakened the links between metal prices and underlying fundamentals, which may accelerate volatility and boom and bust cycles. This is evident in derivative markets, where institutional changes made these markets more financialized (Chen et al. 2019). Some physical actors expressed concerns about price-determination being heavily influenced by ‘modern speculators’, such as high-frequency traders, and that metal price dynamics become increasingly interlinked with other assets. Consequently, prices may no longer accurately reflect supply and demand conditions in specific metal markets (Cheng/Xiong 2014; see also Chen et al. 2019). Thus, global price benchmarks may even fail to reflect short-term and narrow perspectives on fundamentals. Related to this, their promotion as institutions to address price risks becomes problematic, given that these very institutions may accelerate price risks. Financialization is not as pronounced for PRAs, but financial investors can also play an important role in their methodologies. Further, PRAs enable and benefit from the creation of cash-settled futures, which are favored by financial investors and lead to the integration of more metals and price components into derivative markets.

Fourth, benchmark prices fail to account for local cost structures, making it difficult to consider LME prices as standardized. While the LME defines a particular product characteristic, it disregards the specific standards of production and, thereby, the complexity and reality of local provisioning systems. This has also problematic implications for adopting socially and environmentally sustainable standards, which may and should increase the costs of local production. As these standards together with local differences are not priced in the benchmark, they create competitive disadvantages. Clearly, competition also exists without a price benchmark, but with benchmarks, price negotiations are reduced to discounts and premia. This can be a rather narrow window, especially for mining companies, given that production costs can rapidly change due to technological, natural, environmental, and social factors.

Fifth, the key price-determination institutions (exchanges, PRAs) lack transparency and are closely tied to powerful interests. More generally, they lack democratic legitimacy. Although commodity exchanges are presented as an open marketplace, here exist high entry barriers (know-how, technology, access to finance, costs) which have increased with sophisticated trading strategies (e.g., algorithmic and high-frequency trading). They are dominated by a small number of actors that transitioned from being physically based to being increasingly driven by financial motives. Similarly, PRAs present themselves as passive actors, but they hold significant power through their methodologies and the reliance on the views of dominant industry actors for price reporting. More generally, price-making in metal markets is frequently discussed in relation to the concept of 'maturity'. Mature markets (such as copper) are considered to be those with dominant global benchmarks, standardized contracts and liquid futures, while immaturity is linked to greater discretion of physical actors, benchmarks not being (fully) adopted in contracts or undeveloped derivative markets (cobalt and lithium). As shown, this framing overlooks the role of institutions, actors and interests in shaping these price-making processes, challenging the assumption of a 'natural' trajectory of market maturity.

5. Conclusions

This paper makes three broad arguments. First, understanding existing price-making processes for EV metals is crucial to expanding academic and policy debates on mineral extraction and related distributional outcomes linked to social-ecological transformation. Second, current shifts to benchmark- and exchange-based price-determination are problematic given their focus on short-term supply and demand considerations and a shift away from fundamentals in the context of financialization processes. Third, a social-ecological transformation requires alternative price-making mechanisms that take into account broader economic, social and environmental costs and risks and longer-term insecurity related to resource depletion.

As the previous section outlined, financial markets are not suitable for pricing minerals in a sustainable manner. Re-regulation of derivative markets is crucial to reduce financialization and align prices and trading linked to fundamentals. However, this is not enough, as these markets have intrinsic limitations in determining commodity prices in a sustainable manner. They fail to adequately reflect longer-term and insecure factors and are dominated by certain actors due to high entry barriers. PRAs also possess intrinsic limitations. Furthermore, these institutions do not internalize social and environmental costs, which is even more problematic if these costs are of long-term and insecure nature – just as costs related to environmental degradation and resource depletion are. Addressing these challenges necessitates alternative price-determination mechanisms. These require the involvement of states, ideally through a new round of democratically institutionalized ICAs between producer and consumer countries. This would contribute to politicizing price-making and provisioning systems more generally and opening new spheres of democratic decision-making.

Historically, ICAs were used in many commodity sectors and they could be brought back as sustainable ICAs. As ICAs included already by design an element on 'sustainable pricing', including considerations on balanced extraction into the determination of a price range is thus not far-fetched. Gilbert (1997: 2) notes that the boom of ICAs in the 1970s was not only related to resource sovereignty after decolonization but was also accompanied by discussions on sustainable resource use linked to the scenarios of the Club of Rome (Meadows et al. 1972) on the increasing scarcity of non-renewable resources. However, actual ICAs focused primarily on price stabilization and did not target a strong reduction of commodity extraction and consumption. In bringing together both consumer and producer countries, ICAs of the 21st

century could therefore be complemented with provisions on environmental and social aspects regarding the extraction of minerals.

However, historical experiences with ICAs have demonstrated difficulties in achieving collective decision-making, both between and among producer and consumer countries. Further, ICAs do not guarantee a fair distribution within producer countries. Some legal initiatives such as the Law on Mining Royalties in Peru or Canada, aim to share mining profits with regional governments, municipalities and communities, illustrating potential avenues for local profit distribution (CSE 2021). ICAs as an alternative would need to be democratically legitimated and in a broader way representative beyond national governments. Apart from economic (distributional) aspects and social and environmental concerns, questions of inclusion, representation and democracy as well as recognition of diverse modes of living are important. Currently, the decision-making processes around commodity price-making and resource politics are largely exclusive. The sustainable use of natural resources demands the inclusion of potentially affected people and control over decision-making power and problem-solving (Pichler et al. 2016; Schlosberg 2004). Failure to include these aspects could undermine the objectives of a social-ecological transformation, rendering 'green technologies' inadequate in achieving justice and sustainability.

These are complex issues as they address key justice questions concerning the use and distribution of exhaustible resources between different actors, scales (local, regional, national, global), countries/regions (Global North versus Global South, producer versus consumer countries) and generations. Determining how exhaustible resources are distributed and priced requires discussions about democratic processes to address global issues and rectify existing power asymmetries. Although initiating such debates may currently appear politically challenging, they remain essential. As this paper shows, the current mechanisms for price-making of EV metals through benchmarks and exchanges are inadequate for addressing these critical concerns around social-ecological transformation.

References

Adams, Robin G. (2019): Modern management in the global mining industry. First edition. Bingley: Emerald Publishing.

Adams, Zeno/Collot, Solène/Kartsakli, Maria (2020): Have commodities become a financial asset? Evidence from ten years of Financialization. In: Energy Economics 89, 104769. https://doi.org/10.1016/j.eneco.2020.104769

Bain, Caroline (2021): Guide to commodities. 2nd ed. The Economist.

Baines, Joseph/Hager, Sandy Brian (2021): Commodity traders in a storm: financialization, corporate power and ecological crisis. In: Review of International Political Economy 1–54. https://doi.org/10.1080/09692290.2021.1872039

Bargawi, Hannah K./Newman, Susan A. (2017): From Futures Markets to the Farm Gate: A Study of Price Formation along Tanzania's Coffee Commodity Chain. In: Economic Geography 93(2), 162–184. https://doi.org/10.1080/00130095.2016.1204894

Bärnthaler, Richard/Gough, Ian (2023): Provisioning for sufficiency: envisaging production corridors. In: Sustainability: Science, Practice and Policy 19(1), 2218690. https://doi.org/10.1080/15487733.2023.2218690

Bayliss, Kate/Fine, Ben (2020): Introduction and Background to the SoP Approach. In: Bayliss, Kate/Fine, Ben (Eds.): A Guide to the Systems of Provision Approach: Who Gets What, How and Why. Cham: Springer International Publishing, 1–28.

Beckert, Jens (2011): Where do prices come from? Sociological approaches to price formation. In: Socio-Economic Review 9(4), 757–786.

Bernards, Nick (2021): Child labour, cobalt and the London Metal Exchange: Fetish, fixing and the limits of financialization. In: Economy and Society 0(0), 1–23. https://doi.org/10.1080/03085147.2021.1899659

Bernards, Nick/Campbell-Verduyn, Malcolm (2019): Understanding technological change in global finance through infrastructures. In: Review of International Political Economy 26(5), 773–789. https://doi.org/10.1080/09692290.2019.1625420

Bowker, Geoffrey C./Star, Susan Leigh (1996): How things (actor-net) work: Classification, magic and the ubiquity of standards. In: Philosophia 25(3–4), 195–220.

Çalışkan, Koray (2010): Market threads: how cotton farmers and traders create a global community. Princeton, N.J.

Çalışkan, Koray (2007): Price as a Market Device: Cotton Trading in Izmir Mercantile Exchange. In: The Sociological Review 55(2_suppl), 241–260. https://doi.org/10.1111/j.1467-954X.2007.00738.x

Callon, Michel/Muniesa, Fabian (2005): Peripheral vision: Economic markets as calculative collective devices. In: Organization studies 26(8), 1229–1250.

Chen, Jinyu/Zhu, Xuehong/Zhong, Meirui (2019): Nonlinear effects of financial factors on fluctuations in nonferrous metals prices: A Markov-switching VAR analysis. In: Resources Policy 61, 489–500. https://doi.org/10.1016/j.resourpol.2018.04.015

Cheng, Ing-Haw/Xiong, Wei (2014): Financialization of Commodity Markets. In: Annual Review of Financial Economics 6(1), 419–441. https://doi.org/10.1146/annurev-financial-110613-034432

Ciccantell, Paul/Smith, David A. (2009): Rethinking global commodity chains: integrating extraction, transport, and manufacturing. In: International Journal of Comparative Sociology 50(3–4), 361–384.

Claar, Simone (2022): Green colonialism in the European Green Deal: Continuities of dependency and the relationship of forces between Europe and Africa. In: Culture, Practice & Europeanization 7(2), 262–274. https://doi.org/10.5771/2566-7742-2022-2-262

CSE (2021): Sharing wealth of minerals: Policies, practices and implications.

Darton Commodities (2021): Cobalt Market Review 2020-2021. Surrey, UK: Darton Commodities Limited.

Declercq, Robrecht (2020): Forging cartels. A transatlantic perspective on business collusion and the interwar copper industry (1918–1940). In: Scandinavian Economic History Review 68(3), 204–221. https://doi.org/10.1080/03585522.2019.1663761

Dobler, Gregor/Kesselring, Rita (2019): Swiss extractivism: Switzerland's role in Zambia's copper sector. In: The Journal of Modern African Studies 57(2), 223–245. https://doi.org/10.1017/S0022278X19000089

Dorn, Felix Malte (2022): Green colonialism in Latin America? Towards a new research agenda for the global energy transition. In: European Review of Latin American and Caribbean Studies (114), 137–146. https://doi.org/10.32992/erlacs.10939

Dugger, William M. (2015): Redefining economics: from market allocation to social provisioning. In: Political Economy for the 21st Century. Routledge, 31–43.

Ederer, Stefan/Heumesser, Christine/Staritz, Cornelia (2016): Financialization and commodity prices – an empirical analysis for coffee, cotton, wheat and oil. In: International Review of Applied Economics 30(4), 462–487. https://doi.org/10.1080/02692171.2015.1122745

Edwards, Paul N./Bowker, Geoffrey C./Jackson, Steven J./Williams, Robin (2009): Introduction: an agenda for infrastructure studies. In: Journal of the association for information systems 10(5), 6. https://doi.org/10.17705/1jais.00200

Fattouh, Bassam (2011): An Anatomy of the Crude Oil Pricing System. Oxford Institute for Energy Studies, Working Paper 40

Fitch Solutions (2022): Lithium Global Competitive Landscape And New Project Pipeline. https://www.fitchsolutions.com/mining/lithium-global-competitive-landscape-and-new-project-pipeline-08-08-2022 (05.07.2023),

Gilbert, Christopher L. (2018): Investor sentiment and market fundamentals: the impact of index investment on energy and metals markets. In: Mineral Economics 31(1–2), 87–102. https://doi.org/10.1007/s13563-017-0135-6

Gilbert, Christopher L. (1996): Manipulation of Metals Futures: Lessons from Sumitomo. CEPR Discussion Papers 1537,

Halland, Havard/Lokanc, Martin/Nair, Arvind/Kannan, Sridar Padmanabhan (2015): The Extractive Industries Sector – Essentials for Economists, Public Finance Professionals, and Policy Makers. A World Bank Study. Washington, D.C.: World Bank.

Holland, Emil/Kjeldsen, Chris/Kerndrup, Søren (2016): Coordinating quality practices in Direct Trade coffee. In: Journal of Cultural Economy 9(2), 186–196. https://doi.org/10.1080/17530350.2015.1069205

Home, Andy (2021): Goldman proclaims the dawn of a new commodity supercycle: Andy Home. In: Reuters.

ICGS (2023): World Copper Factbook 2022. International Copper Study Group. https://icsg.org/copper-factbook/ (05.07.2023).

IEA (2023): Global EV Outlook 2023. International Energy Agency. https://www.iea.org/reports/global-ev-outlook-2023 (05.07.2023).

Jo, Tae-Hee (2016): What if there are no conventional price mechanisms? In: Journal of Economic Issues 50(2), 327–344.

Jo, Tae-Hee/Todorova, Zdravka (2018): Social provisioning process: a heterodox view of the economy. In: The Routledge Handbook of Heterodox Economics. Routledge, 29–40.

Johnson, Owain (2018): The price reporters: A guide to PRAs and commodity benchmarks. Routledge.

Kang, Wenjin/Tang, Ke/Wang, Ningli (2023): Financialization of commodity markets ten years later. In: Journal of Commodity Markets 30, 100313. https://doi.org/10.1016/j.jcomm.2023.100313

Kusigerski, Marko (2018): Kobalt an der LME. Presentation: Link (05.07.2023).

LaRocca, Gregory M. (2020): Global Value Chains: Lithium in Lithium-ion Batteries for Electric Vehicles. Office of Industries Working Paper ID-069.Washington D.C.: U.S. International Trade Commission

Mattioli, Giulio/Roberts, Cameron/Steinberger, Julia/Brown, Andrew (2020): The political economy of car dependence: A systems of provision approach. In: Energy Research & Social Science 66, 101486. https://doi.org/10.1016/j.erss.2020.101486

Meadows, Donella H./Meadows, Dennis L./Randers, Jørgen/Behrens, William W. (1972): The Limits to Growth

Mikesell, Raymond F. (2018): The global copper industry: problems and prospects

Muellerleile, Chris (2018): Calming Speculative Traffic: An Infrastructural Theory of Financial Markets. In: Economic Geography 94(3), 279–298. https://doi.org/10.1080/00130095.2017.1307100

Musselli, Irene (2019): Curbing Commodity Trade Mispricing: Simplified Methods in Host Countries. Working Paper No. R4D-IFF-WP08-2019 Centre for Development and Environment (CDE) University of Bern

Newman, Susan/Van Huellen, Sophie (2022): Understanding commodity markets to effectively address price increases and volatility in a post-COVID-19 world. ÖFSE Working Paper No. 70.

NS Energy (2021): Top five largest copper mining companies by production in 2020. https://www.nsenergybusiness.com/features/largest-copper-mining-companies/ (05.07.2023).

Perks, Rachel (2016): I loan, you mine: Metal streaming and off-take agreements as solutions to undercapitalisation facing small-scale miners? In: The Extractive Industries and Society 3(3), 813–822. https://doi.org/10.1016/j.exis.2016.04.007

Pichler, Melanie/Staritz, Cornelia/Küblböck, Karin/Plank, Christina/Raza, Werner/Peyré, Fernando Ruiz (2016): Fairness and justice in natural resource politics. Routledge.

Plank, Christina/Liehr, Stefan/Hummel, Diana/Wiedenhofer, Dominik/Haberl, Helmut/Görg, Christoph (2021): Doing more with less: Provisioning systems and the transformation of the stock-flow-service nexus. In: Ecological Economics 187, 107093. https://doi.org/10.1016/j.ecolecon.2021.107093

Polanyi, Karl (1992): The Economy as Instituted Process. In: The Sociology of Economic Life. Boulder, CO: Westview Press, 29–51.

Prause, Louisa/Dietz, Kristina (2022): Just mobility futures: Challenges for e-mobility transitions from a global perspective. In: Futures 141, 102987.

Purcell, Thomas F. (2018): 'Hot chocolate': financialized global value chains and cocoa production in Ecuador. In: The Journal of Peasant Studies 45(5–6), 904–926. https://doi.org/10.1080/03066150.2018.1446000

Radetzki, Marian/Wårell, Linda (2020): A Handbook of Primary Commodities in the Global Economy. Cambridge University Press.

Reichl, Christian/Schatz, Michael (2023): World Mining Data 2023. Vienna: Federal Ministry of Agriculture, Regions and Tourism.

Schaffartzik, Anke/Pichler, Melanie/Pineault, Eric/Wiedenhofer, Dominik/Gross, Robert/Haberl, Helmut (2021): The transformation of provisioning systems from an integrated perspective of social metabolism and political economy: a conceptual framework. In: Sustainability Science 16(5), 1405–1421. https://doi.org/10.1007/s11625-021-00952-9

Schlosberg, David (2004): Reconceiving environmental justice: global movements and political theories. In: Environmental politics 13(3), 517–540. https://doi.org/10.1080/0964401042000229025

Seddon, Jack (2020): Merchants against the bankers: the financialization of a commodity market. In: Review of International Political Economy 27(3), 525–555. https://doi.org/10.1080/09692290.2019.1650795

Spilker, Gregor (2022): Cobalt Growth in 5 Charts. CME Group. https://www.cmegroup.com/articles/2022/cobalt-growth-in-5-charts.html (05.07.2023).

Staritz, Cornelia/Newman, Susan/Tröster, Bernhard/Plank, Leonhard (2018): Financialization and Global Commodity Chains: Distributional Implications for Cotton in Sub-Saharan Africa. In: Development and Change 49(3), 815–842. https://doi.org/10.1111/dech.12401

Staritz, Cornelia/Tröster, Bernhard/Grumiller, Jan/Maile, Felix (2022): Price-setting power in global value chains: The cases of price stabilisation in the cocoa sectors in Côte d'Ivoire and Ghana. In: The European Journal of Development Research 1–29. https://doi.org/10.1057/s41287-022-00543-z

Tröster, Bernhard/Küblböck, Karin (2020): Unprecedented but not unpredictable: Effects of the COVID-19 crisis on commodity-dependent countries. In: The European Journal of Development Research 32, 1430–1449. https://doi.org/10.1057/s41287-020-00313-9

UNCTAD (2021): State of Commodity Dependence 2021. Geneva: United Nations Conference on Trade and Development.

UNCTAD (2011): Price Formation in Financialized Commodity Markets: The Role of Information- Geneva: United Nations Conference on Trade and Development.

van Huellen, Sophie (2020): Too much of a good thing? Speculative effects on commodity futures curves. In: Journal of Financial Markets 47, 100480. https://doi.org/10.1016/j.finmar.2018.12.001

Veblen, Thorstein (1909): The limitations of marginal utility. In: Journal of Political Economy 17(9), 620–636.

World Bank (2020): 2020 State of the Artisanal and Small Scale Mining Sector. Washington, D.C.: World Bank.

Zografos, Christos (2022): The contradictions of Green New Deals: green sacrifice and colonialism. In: Soundings 80(80), 37–50. https://doi.org/10.3898/SOUN.80.03.2022

About the authors

Cornelia Staritz (Corresponding Author) is Associate Professor in Development Economics at the Department of Development Studies at the University of Vienna and Senior Research Associate at the Austrian Foundation for Development Research (ÖFSE). Her research focuses on development economics and policy, international trade and trade policy, global production networks and value chains, and commodity-based development.

Bernhard Tröster is senior researcher at the Austrian Foundation for Development Research (ÖFSE) with a focus on commodities & development, global value chains and production networks, and international trade.

Aleksandra Wojewska is a doctoral candidate at the Department of Development Studies at the University of Vienna. In her PhD research she focuses on price determination and setting processes in the lithium and cobalt global production networks and the associated outcomes for the mineral producing countries