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Beyond resource frontiers: resource-led industrialisation and manufacturing deepening in resource-dependent developing economies

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ABSTRACT

Resource-dependent developing economies increasingly pursue downstream processing as a pathway toward industrial transformation, yet expanding industrial activity does not necessarily imply deeper manufacturing development. This study examines whether resource-linked economic integration is associated with broad industrial expansion or manufacturing deepening. Using country-year data for 28 resource-dependent developing economies over 2000–2022, the analysis compares industry value added and manufacturing value added through two-way fixed-effects models and extends the evidence to global value-chain participation, economic complexity, and Asian economies. Mineral rents and trade openness are positively associated with industry value added but not with manufacturing value added, while FDI shows no robust baseline association. The GVC and economic-complexity evidence provides no corresponding systematic indication of deeper productive transformation. The Asian results broadly reinforce this distinction. Robustness and instrumental-variable assessments support the stability of the central pattern but do not establish definitive causality. The findings raise a broader concern, captured here as resource-led industrialisation illusion, that visible industrial expansion may create an overly optimistic impression of structural transformation when evidence of deeper manufacturing and productive capabilities remains limited.

1. Introduction

Critical minerals have emerged as a central focus of geoeconomic and geopolitical competition (Kalantzakos, 2020), while changing patterns of mineral supply and demand are reshaping development opportunities across the Global South (Hatcher and Grégoire, 2023). These dynamics are particularly relevant in Asia, where resource-rich economies coexist with highly integrated manufacturing and production networks. Athukorala (2011) shows that production sharing has become a defining feature of East Asian economic integration, connecting economies through cross-border manufacturing linkages and regional production networks. Chang and Andreoni (2020) note that industrial policy has also regained importance among developing and middle-income economies in Asia as governments seek to strengthen productive capabilities in the context of global production. At the same time, the growing importance of critical minerals for clean-energy technologies has intensified attention to mineral supply chains, processing capacity, and supply-chain diversification (IEA, 2026). In Southeast Asia, these developments have created new opportunities for resource-rich economies to pursue downstream processing and greater value creation while also raising questions about the extent to which resource-based industrial expansion can support broader industrial transformation. Indonesia's nickel industrialisation strategy provides one prominent illustration of this regional development challenge, as the country has sought to extend domestic activities from nickel processing toward electric-vehicle and battery supply chains (Pandyaswargo et al., 2021; Schröder and Iwasaki, 2024).

However, the developmental consequences of resource-based industrialisation remain uncertain. Natural resources can generate fiscal revenues, attract foreign investment, support infrastructure development, and create opportunities for downstream processing. Yet these outcomes do not automatically translate into broader productive capabilities, more diversified industrial structures, or sustained manufacturing upgrading. Natural resource endowments may be given, but the capacity to capture and transform the value generated from them is not. Indonesia illustrates this tension. Warburton (2024) shows that nickel downstreaming has expanded Indonesia's processing capacity and its role in global critical-mineral supply chains, while also drawing

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attention to questions concerning ownership, value capture, and the distribution of developmental benefits. Similar questions arise in other resource-rich economies. Lkhagva et al. (2019), examining Mongolia's mining boom, show that mineral revenues can support investment and economic activity, while also highlighting the importance of strengthening non-resource sectors to reduce vulnerabilities associated with resource dependence.

This is where the motivation for this article lies, namely in examining a specific empirical contrast within this broader debate, that is, the difference between broad industrial expansion and manufacturing upgrading. Industry value added and manufacturing value added represent related but analytically distinct dimensions of economic transformation. The World Bank metadata define industry value added, including construction, broadly to cover mining, manufacturing, construction, electricity, water, and gas, whereas manufacturing value added refers more narrowly to manufacturing activities classified under ISIC major division C. This difference matters because industry value added captures the scale of broad industrial activity, while manufacturing value added provides a more focused measure of manufacturing activity. An increase in industry value added may therefore indicate expanding economic activity without necessarily demonstrating that manufacturing capabilities have deepened. For resource-dependent developing economies pursuing downstream industrialisation strategies, this contrast is particularly important because increases in processing capacity and investment may coexist with uncertainty about whether broader manufacturing activity is also expanding. The descriptive pattern of the sample further illustrates this point. As shown in Fig. 1, industry value added remains substantially higher than manufacturing value added throughout the study period, while the two measures do not move identically. This persistent gap provides an initial descriptive indication of why broad industrial activity and manufacturing activity need to be examined separately when assessing resource-led industrialisation and manufacturing upgrading.

The relationship between resource dependence and industrialisation is therefore not necessarily one of either resource abundance or industrial failure. Morris et al. (2012) challenge the view that resource extraction is inherently associated with enclave development, arguing that commodity sectors can generate backward and forward linkages when firms, institutions, and policies create conditions for linkage development. Their analysis shifts attention from the existence of resource extraction to the extent to which resource activities relate to other productive sectors. Morris and Fessehaie (2014) similarly emphasise that commodity-based economies can use backward and forward linkages as a pathway towards industrialisation, although the depth of these linkages depends on technological capabilities, skills, competitiveness, and policy conditions. From this perspective, resource-led industrialisation should be assessed not simply by the expansion of resource-related output, but also by whether resource activities generate connections with wider productive activities.

A related issue concerns the position of resource-dependent economies within global value chains. Integration into international production networks can create opportunities to access markets, technologies, and specialised production activities, but participation itself does not establish the extent of upgrading. Humphrey and Schmitz (2002) show that the way producers are inserted into global value chains affects the opportunities available for local upgrading, particularly because relationships with global buyers can enable some forms of upgrading while constraining others. Gereffi (2019) similarly emphasises that the GVC perspective connects trade, investment, industrial upgrading, and development strategies, while drawing attention to the governance structures through which these processes are organised. Dallas et al. (2019) further show that power within GVC governance can shape the conditions under which value is added, distributed, and captured. These perspectives caution against treating greater trade integration or foreign investment, by themselves, as evidence of deeper productive upgrading.

The depth of structural transformation also depends on the productive capabilities that economies develop alongside resource-based activity. Hausmann et al. (2007) argue that what an economy produces and exports matters for subsequent development because products differ in their associated productivity and knowledge requirements. Hidalgo and Hausmann (2009) develop this perspective through the concept of economic complexity, viewing the diversity and sophistication of a country's productive structure as an indicator of capabilities embedded in its economy. This perspective complements the industry–manufacturing distinction used in this study. Industry value added captures the scale of broad industrial activity, while manufacturing value added and economic complexity provide complementary perspectives on the structure and breadth of productive activity. Examining

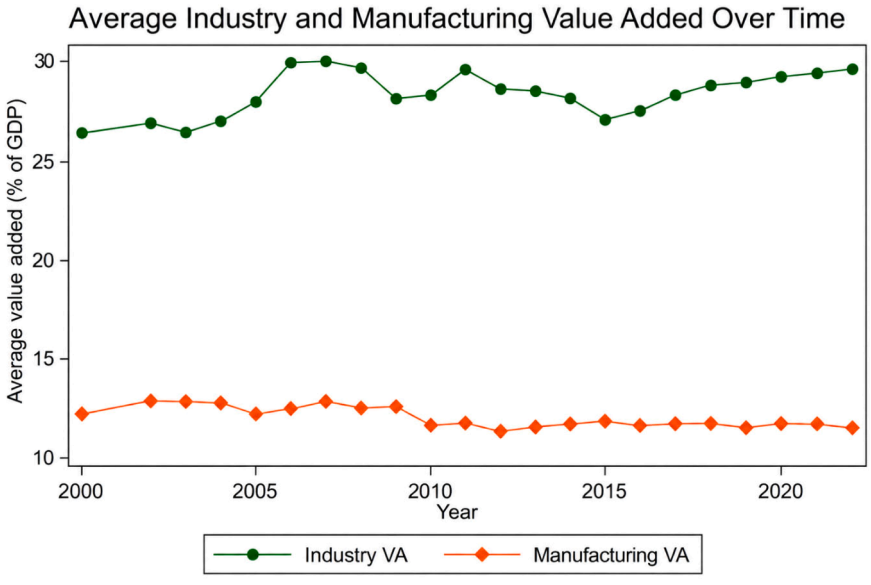


Fig. 1. Average Industry and Manufacturing Value Added in Resource-Dependent Developing Economies, 2000–2022.
Note: Figure 1 presents annual average industry value added and manufacturing value added across the 28 resource-dependent developing economies in the main sample during 2000–2022. Both measures are expressed as a percentage of GDP.
Source: Author's calculation using WDI data.

these dimensions together therefore provides a more cautious basis for assessing whether resource-linked industrial expansion is accompanied by deeper structural transformation.

When the emerging perspectives are examined more closely and considered together, it becomes apparent that resource-led industrialisation needs to be assessed at more than one level. Resource linkages shed light on whether resource-based activities are connected to domestic productive sectors; GVC participation indicates how an economy is integrated into international production; while economic complexity offers an additional perspective on the breadth of productive capabilities. However, these dimensions are not necessarily reflected in broad measures of industrial activity. Existing research has generated important insights into resource dependence, commodity linkages, global value-chain governance, and productive capabilities, but these strands remain analytically distinct across much of the literature. This study draws on these perspectives to frame a common empirical analysis by asking whether the factors associated with broader industrial expansion are also associated with manufacturing upgrading in resource-dependent developing economies.

To examine this question, the study uses a country-year panel of 28 resource-dependent developing economies covering 2000–2022 and compares industry value added with manufacturing value added using two-way fixed-effects models. The analysis then extends the baseline in two directions. First, it examines global value-chain participation through total GVC participation and its backward and forward dimensions, represented by foreign value added (FVA) and domestic value added embodied in foreign exports (DVX). Second, it considers economic complexity as a complementary indicator of productive structure. The analysis also examines the Asian subsample to assess whether the central industry–manufacturing contrast is visible within the regional context that motivates the paper. These extensions provide additional evidence on the depth and composition of resource-linked industrial integration, while the observational design does not by itself establish a causal mechanism from resource dependence to upgrading.

This study makes a bounded empirical and conceptual contribution. Empirically, it distinguishes broad industrial expansion from manufacturing upgrading and extends this comparison with evidence on GVC participation, its forward and backward dimensions, economic complexity, and the Asian subsample. Conceptually, the study seeks to draw attention to what we term resource-led industrialisation illusion. The term reflects a concern arising from the empirical puzzle examined in this study, namely that visible increases in industrial activity may encourage an overly optimistic interpretation of structural transformation when evidence of deeper manufacturing activity, productive complexity, or stronger value-chain positioning remains limited or mixed. The idea is offered as an interpretive lens for distinguishing visible industrial expansion from evidence of deeper structural transformation, rather than as a claim that resource-led industrialisation is inherently unsuccessful or that observed industrial progress is illusory.

The analysis also conducts a supplementary instrumental-variable assessment using predetermined mineral exposure interacted with the global mineral price shock to examine the sensitivity of the mineral-rents relationship to potential endogeneity.

2. Analytical framework

2.1. Resource rents and industrial linkages

Resource-based economies have long been examined through the question of whether natural-resource endowments contribute to or constrain industrial development. Early resource-curse scholarship associated resource dependence with concerns over diversification, institutional dynamics, and long-term growth (Auty, 1993; Karl, 1997; Sachs and Warner, 2001). Later contributions have questioned interpretations that treat these outcomes as inevitable. Van der Ploeg (2011) emphasises that natural resources can support development when resource rents are effectively managed, invested, and converted into productive assets. Brunnschweiler (2008) further distinguishes resource abundance from resource dependence, while Boschini et al. (2007) show that the consequences of natural resources can vary with institutional conditions and the characteristics of the resources themselves. These perspectives shift attention from whether resources are inherently beneficial or harmful towards how resource rents are connected to productive activity.

A central issue in this regard is the development of linkages between resource sectors and other parts of the economy. Hirschman (1958) viewed backward and forward linkages as channels through which the expansion of one sector can stimulate wider productive activity. Morris et al. (2012) challenge the view that resource extraction is inherently associated with enclave development and identify opportunities for linkage development around commodity sectors. Their analysis points particularly to opportunities for backward linkages through local suppliers and related services, while recognising that the depth of linkage development varies across sectors and contexts. Morris and Fessehaie (2014) similarly argue that commodity-based economies can pursue industrialisation through value addition and linkage development, although technological capabilities, skills, competitiveness, and policy conditions influence whether such opportunities can be realised.

This perspective is particularly relevant when broad industrial activity is distinguished from manufacturing activity. Mining and other resource-related activities can coexist with processing, construction, electricity, transport, logistics, and related services. Because these activities may contribute to broad measures of industry value added, resource rents can be associated with an expansion of industrial activity without necessarily indicating comparable growth in manufacturing. As Morris et al. (2012) emphasise, the developmental significance of resource sectors depends partly on whether linkages with other productive activities can be developed and deepened. The analytical question is therefore not simply whether resource rents are associated with industrial activity, but whether resource-linked activity is accompanied by wider productive linkages and a deeper manufacturing base.

The linkage perspective also draws attention to the difference between linkage opportunities and realised transformation. The presence of potential backward or forward linkages does not establish that domestic firms have acquired the capabilities required to participate in them. Morris et al. (2012) discuss capability gaps as factors that can influence the extension and deepening of linkages. Resource-led industrialisation can therefore create opportunities for productive transformation, while the extent to which those opportunities are translated into broader domestic capabilities remains an empirical question.

2.2. Global integration and manufacturing upgrading

Global integration provides another pathway through which resource-dependent economies can become connected to wider production systems, creating opportunities to move beyond existing production frontiers towards higher-value and more sophisticated activities. Trade openness and foreign direct investment can provide access to international markets, imported inputs, capital goods, technology, and production networks. Yet participation in international markets does not by itself establish the extent of productive upgrading. Gereffi et al. (2005) show that global value chains are organised through different governance structures that shape coordination and value distribution. Humphrey and Schmitz (2002) further demonstrate that the form of insertion into global value chains affects the opportunities available for upgrading. Nadvi (2008) highlights the role of standards and governance arrangements in shaping the conditions under which producers participate in global markets.

The question of power further qualifies the relationship between integration and upgrading. Dallas et al. (2019) place power relations at the centre of global value-chain analysis and show how power can influence the organisation of production and the processes through which

value is added, distributed, and captured. An economy may therefore become more deeply integrated into international production while remaining concentrated in activities that provide limited opportunities for domestic capability formation. This distinction is important because participation in a value chain describes a form of integration, whereas upgrading concerns changes in the capabilities and activities undertaken within that chain (Humphrey and Schmitz, 2002; Gereffi et al., 2005).

These perspectives provide the basis for distinguishing the extent of GVC participation from the depth of manufacturing upgrading. In the empirical analysis, total GVC participation captures the degree of integration into international value chains, while its backward and forward dimensions provide information on how that integration is structured. Foreign value added (FVA) reflects foreign inputs embodied in domestic exports, whereas domestic value added embodied in foreign exports (DVX) captures domestic value incorporated into other countries' exports. Together, these measures provide complementary information about an economy's position within international production networks. They do not, however, by themselves establish that deeper manufacturing capabilities have been formed.

The same reasoning applies to foreign direct investment. FDI may contribute to manufacturing upgrading when investment is connected to productive capabilities and domestic linkages. However, aggregate FDI inflows do not distinguish between investment in manufacturing and investment in mining, processing, utilities, logistics, infrastructure, or other activities. Consequently, the developmental significance of FDI depends partly on where investment is directed and how it connects with domestic productive capabilities. This makes FDI relevant to the analysis while providing a basis for interpreting its aggregate association cautiously.

2.3. Institutions and rent capture

Institutions provide an additional perspective on how resource rents are translated into economic activity and how opportunities created by resource-based development are distributed among economic actors. Mehlum et al. (2006) distinguish between producer-friendly and grabber-friendly institutional environments. In producer-friendly settings, incentives favour productive activities, whereas grabber-friendly environments can increase incentives to compete for resource rents. Robinson et al. (2006) similarly emphasise the political incentives created by resource booms and the role of institutions in shaping how resource revenues are managed. Torvik (2002) highlights the possibility that natural resources can redirect economic activity towards rent-seeking rather than productive activities.

This perspective helps explain why similar resource endowments need not produce similar patterns of industrial development. Institutions can influence investment incentives, access to productive resources, public infrastructure, and the distribution of opportunities created by resource-based activity. Where institutional arrangements support productive investment and learning, resource rents may contribute to broader economic linkages. Where incentives favour rent capture, resource-linked activity may remain concentrated among particular actors or activities without generating comparable productive spillovers. Mehlum et al. (2006) therefore provide a useful basis for considering how institutional arrangements shape the way resource rents interact with productive activity.

Institutional conditions also matter for the development of domestic linkages. The existence of potential supplier relationships does not guarantee that domestic firms will enter or move into more demanding activities. Access to finance, infrastructure, skills, technology, procurement opportunities, and reliable institutions can shape whether local firms participate in resource-related value chains. The institutional perspective therefore complements the linkage perspective by drawing attention to the conditions under which productive opportunities are realised. This is consistent with Boschini et al. (2007), who show that the consequences of resource endowments depend partly on the interaction between resource characteristics and institutional quality.

In this study, institutional quality provides an interpretive dimension to the empirical analysis. Government effectiveness is included in the empirical specification, while the broader institutional literature helps contextualise how resource rents may be translated into different patterns of productive activity and value capture. This perspective helps situate the observed empirical patterns within the institutional conditions that may shape the allocation and use of resource rents.

2.4. Productive capabilities and economic complexity

The depth of structural transformation depends not only on the scale of industrial activity but also on the productive capabilities embodied in an economy. Hausmann et al. (2007) argue that what an economy produces and exports matters for subsequent development because products differ in their associated productivity and knowledge requirements. Their perspective shifts attention from the volume of production towards the characteristics of the productive structure. Hidalgo and Hausmann (2009) develop this argument through the concept of economic complexity, which captures the diversity and sophistication associated with an economy's productive structure.

This perspective complements the distinction between industry value added and manufacturing value added used in this study. Industry value added captures a broad range of industrial activities, whereas manufacturing value added provides a more focused measure of manufacturing activity. Economic complexity offers an additional dimension by considering the breadth and sophistication of the productive structure. These measures therefore capture related but different aspects of structural transformation and should not be treated as interchangeable. As Hausmann et al. (2007) emphasise, the composition of production and exports provides information that cannot be obtained from the scale of economic activity alone.

This issue is particularly important for resource-dependent economies. Resource-linked investment and processing can expand the scale of industrial activity without necessarily broadening the range of capabilities embodied in production and exports. Conversely, changes in manufacturing activity and economic complexity can provide additional information about whether productive transformation extends beyond the scale of resource-linked industrial activity. Economic complexity is therefore used in this study as a complementary perspective on productive structure rather than as a direct measure of manufacturing upgrading (Hidalgo and Hausmann, 2009).

The framework consequently places productive capabilities between industrial scale and deeper structural transformation. A resource-dependent economy may record substantial industrial activity while developing only a limited range of new capabilities. Alternatively, resource-linked activity may provide a platform from which technological learning, diversification, and more sophisticated production emerge. Considering economic complexity alongside industry value added and manufacturing value added therefore provides a broader basis for assessing the depth of transformation.

2.5. From industrial expansion to resource-led industrialisation illusion

The preceding perspectives converge on a common analytical issue. Resource rents can expand industrial activity, resource linkages can connect extraction with other productive sectors, global integration can deepen participation in international production networks, and institutions can shape how rents and opportunities are distributed. Productive capabilities, in turn, influence the extent to which these processes contribute to a broader and more sophisticated productive structure. These dimensions may develop together, but they do not necessarily move at the same pace.

The issue is especially important when broad industrial indicators are used to interpret structural transformation. An increase in industry value added can reflect genuine economic expansion, including mining,

processing, construction, utilities, transport, and related activities. Yet such expansion does not necessarily indicate that manufacturing activity, productive complexity, or domestic positioning within value chains has deepened to the same extent. The analytical challenge is therefore to distinguish the scale of industrial expansion from the depth of productive transformation. This distinction follows directly from the earlier linkage and value-chain perspectives, which emphasise that participation and expansion do not necessarily imply deeper productive capabilities (Morris et al., 2012; Humphrey and Schmitz, 2002).

It is this possibility that motivates the term resource-led industrialisation illusion. The concept captures the possibility that visible expansion in resource-linked industrial activity may encourage an interpretation of structural transformation that is stronger than the evidence provided by more specific dimensions of productive development. The concern is not that industrial expansion is illusory or economically insignificant. Rather, it draws attention to the possibility that the scale of visible industrial activity can obscure uncertainty about the depth, breadth, and domestic embeddedness of the transformation.

This interpretive lens is particularly relevant when resource rents or global integration are associated with broad industrial expansion but evidence concerning manufacturing activity, productive complexity, or deeper value-chain positioning remains weaker or mixed. Such a pattern does not establish that resource-led industrialisation has failed. It instead suggests that interpreting industrial progress requires evidence beyond the scale of broad industrial activity. This reading is consistent with the literature showing that resource sectors can create opportunities for industrial development while the depth of realised linkages depends on capabilities and contextual conditions (Morris et al., 2012; Morris and Fessehaie, 2014).

In this study, the interpretive lens is connected to the empirical analysis through the comparison of industry value added and manufacturing value added, complemented by evidence on GVC participation, its backward and forward dimensions, and economic complexity. The purpose is not to collapse these measures into a single indicator of development, but to examine whether resource-linked industrial expansion is accompanied by evidence of broader productive transformation. The concept therefore provides a way of bringing the different analytical perspectives together while keeping the interpretation anchored in the dimensions actually examined by the study.

Taken together, these perspectives suggest several patterns that the empirical analysis examines. Mineral rents may be more closely associated with industry value added than with manufacturing value added because mining and related resource activities are captured within the broader industrial measure. Trade openness may similarly be associated with broader industrial activity through commodity trade, processing, and international production linkages, while its relationship with manufacturing upgrading depends on the depth of domestic participation in those networks. FDI may contribute to manufacturing activity where it is connected to productive capabilities and domestic linkages, although aggregate inflows do not reveal their sectoral composition. Economic complexity provides an additional perspective on whether resource-linked industrial expansion is accompanied by changes in the breadth and sophistication of productive capabilities. These patterns guide the empirical comparisons without presupposing uniform relationships across countries or outcomes.

3. Research design, data, and methodology

3.1. Research design

This study adopts a quantitatively driven comparative panel design to examine whether resource-linked economic integration is more clearly associated with broad industrial expansion or with manufacturing upgrading. The unit of analysis is the country-year observation, and the main sample comprises 28 resource-dependent developing economies observed over 2000–2022. The empirical strategy compares industry value added with manufacturing value added as two related but analytically distinct indicators of industrial activity.

The analysis begins with a baseline comparison of the associations of mineral rents, trade openness, and foreign direct investment (FDI) with industry value added and manufacturing value added. It then extends the analysis in two directions. First, global value-chain (GVC) participation and its backward and forward dimensions are examined using complementary measures of international production integration, including foreign value added (FVA) and domestic value added embodied in foreign exports (DVX). Second, economic complexity is incorporated as a complementary indicator of productive structure. An Asian subsample is also examined to assess whether the central industry–manufacturing contrast is visible within the regional context that motivates the study.

The research design is observational and comparative. The fixed-effects models exploit within-country variation while accounting for time-invariant country characteristics and common year-specific shocks. The estimated coefficients are therefore interpreted as conditional associations rather than causal effects. The analytical framework provides a political-economy basis for interpreting these patterns, particularly in relation to resource linkages, global integration, institutional conditions, and productive capabilities.

3.2. Sample selection and country classification

The country-selection procedure followed a sequential screening process. First, the analysis began with a broad core sample of 162 countries with the required panel-data coverage. Second, countries were screened for resource relevance using a minimum average mineral-rents threshold of 1 per cent of GDP and a minimum of 15 available country-year observations, yielding 30 resource-relevant economies. Third, Australia and Poland were excluded to maintain consistency with the developing-economy scope of the study, resulting in a final sample of 28 resource-dependent developing economies and 579 country-year observations over 2000–2022. Fig. 2 illustrates this sample-construction process from the initial cross-national pool to the final analytical sample.

The term resource-dependent developing economies is used as a working analytical category rather than as an official international

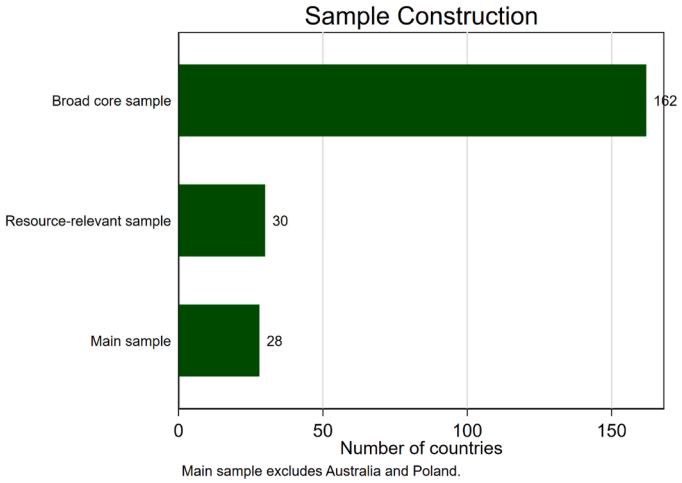


Fig. 2. Sample construction.
Note: The broad core sample comprises 162 countries with the required panel-data coverage. The resource-relevant screen requires average mineral rents of at least 1 per cent of GDP and at least 15 available country-year observations, yielding 30 resource-relevant economies. Australia and Poland are subsequently excluded from this pool to define the final main sample of 28 economies.
Source: Author's construction.

classification. Operationally, countries are classified as resource-relevant for the empirical sample when their average mineral rents are at least 1 per cent of GDP and they have at least 15 available country-year observations. This screening criterion is applied within the developing-economy scope of the study. The resulting classification is therefore designed to identify economies for which mineral-resource dependence is empirically relevant to the analysis rather than to establish a universal definition of resource dependence.

The final sample includes 28 economies across Africa, Asia, Latin America, and Europe. Table 1 presents the countries included in the final sample and their regional classification. This cross-regional composition allows the analysis to examine resource-linked industrialisation beyond an Indonesia-centred setting while retaining particular relevance to Asia. Indonesia is therefore analysed as one country within a broader comparative sample, while the Asian subsample provides a more focused regional assessment.

Alternative sample definitions are used in robustness analysis. These include a broader resource-relevant sample that retains Australia and Poland, income-threshold specifications, and the earlier 20-country sample used during the initial stage of the analysis. These alternative samples are used to assess whether the main findings depend materially on the selected country classification.

3.3. Variables and data sources

The empirical analysis distinguishes two dependent variables that capture different aspects of industrial activity. The primary dependent variable is industry value added, measured as a percentage of GDP. The World Bank defines industry value added broadly to include mining, manufacturing, construction, electricity, water, and gas activities under ISIC Rev. 4 divisions 05–43. It therefore captures the scale of broad industrial activity rather than manufacturing upgrading alone. The second dependent variable is manufacturing value added, also measured as a percentage of GDP. Manufacturing is defined more narrowly as activities classified under ISIC major division C. This measure provides a more focused indication of manufacturing activity, although it does not capture all dimensions of upgrading, such as technological sophistication, product complexity, domestic ownership, supplier participation, or domestic value capture.

Table 1
Final sample of resource-dependent developing economies.

Region	Country
Africa	Botswana
	Burkina Faso
	Democratic Republic of Congo
	Ghana
	Guinea
	Mali
	Mauritania
	Morocco
	Namibia
	South Africa
	Sudan
	Tanzania
	Togo
	Zambia
	Zimbabwe
Asia	Indonesia
	Jordan
	Kazakhstan
	Kyrgyzstan
	Laos
	Mongolia
	Tajikistan
	Uzbekistan
Latin America	Bolivia
	Brazil
	Chile
	Peru
Europe	Ukraine
Total	28 countries

Source: Author's compilation based on the resource-relevance screening criteria and final sample exclusions.

The main explanatory variables are mineral rents, trade openness, and foreign direct investment (FDI) inflows. Mineral rents are measured as a percentage of GDP and capture the estimated economic rent associated with mineral extraction. The World Bank defines mineral rents as the difference between the value of mineral production at world prices and total production costs. The measure covers minerals including tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. Trade openness captures the extent of integration with international markets, while FDI inflows capture foreign-capital integration. These variables are retained as broad country-level measures and are not interpreted as direct measures of manufacturing-specific investment or trade.

For the instrumental-variable assessment, mineral rents are instrumented using an interaction between predetermined mineral exposure, measured as mineral rents in 2000, and the annual global Metals & Minerals price shock. The resulting instrument, denoted as *iv_mineral_shock*, is used to provide supplementary evidence on the sensitivity of the mineral-rents estimates to potential endogeneity. An alternative diagnostic specification using a different predetermined exposure measure is also examined because of its weaker first-stage relationship.

The control variables are GDP growth, log population, and government effectiveness. GDP growth captures annual changes in economic activity, log population accounts for differences in country scale, and government effectiveness captures an institutional dimension relevant to the implementation and administration of public policies and services. Additional controls, including gross capital formation and inflation, are introduced in selected robustness specifications rather than in the baseline model.

Table 2 summarises the operational definitions, roles, measurement forms, and data sources of all variables used in the baseline and extended empirical analyses.

The analysis is further extended using global value-chain (GVC) participation and economic complexity. GVC indicators are constructed from the OECD Trade in Value Added (TiVA) database. Total GVC participation captures the extent to which domestic production is connected to international value chains, while its backward and forward dimensions provide information on the direction of these connections. Foreign value added (FVA) captures the foreign content embodied in domestic exports and represents the backward component of GVC participation. Domestic value added embodied in foreign exports (DVX) captures domestic value that is subsequently incorporated into other economies' exports and represents the forward component. These measures complement conventional trade openness by providing information on the structure of international production integration. The TiVA data used in the analysis are based on OECD's TiVA main-level dataset.

Economic Complexity Index (ECI) is included as a complementary indicator of productive structure. ECI captures the diversity and sophistication associated with a country's export structure and provides an additional perspective on the productive capabilities embodied in that structure. It is therefore not treated as a direct measure of manufacturing upgrading. Instead, it complements industry value added, manufacturing value added, and GVC measures in assessing whether resource-linked industrial expansion is accompanied by broader productive capabilities. The Growth Lab Trade Data used for the ECI are based on the diversity and sophistication of exported products and their global ubiquity.

For robustness analysis, selected variables are winsorised at the 1st and 99th percentiles within the main candidate sample. Winsorisation is applied only in the relevant robustness specifications and does not replace the original variables in the baseline models. Its purpose is to assess whether the estimated associations are sensitive to extreme observations while preserving the underlying sample structure.

Table 2
Variable definitions and data sources.

Variable	Role	Operational definition	Measurement	Data source
Industry value added	Dependent variable	Value added generated by industry, including mining, manufacturing, construction, electricity, water, and gas	% of GDP	World Development Indicators (WDI)
Manufacturing value added	Dependent variable	Value added generated by manufacturing activities classified under ISIC major division C	% of GDP	WDI
Mineral rents	Main explanatory variable	Difference between the value of mineral production at world prices and total production costs	% of GDP	WDI
iv_mineral_shock	Instrumental variable	Mineral rents in 2000 (predetermined exposure) interacted with the annual global Metals & Minerals price shock	Interaction term	Author's calculation based on World Bank mineral-price data
Trade openness	Main explanatory variable	(Exports + imports) as a percentage of GDP	% of GDP	WDI
FDI inflows	Main explanatory variable	Foreign direct investment inflows relative to GDP	% of GDP	WDI
GDP growth	Control variable	Annual growth in GDP	%	WDI
Log population	Control variable	Natural logarithm of total population	Logarithmic transformation	WDI
Government effectiveness	Control variable	Indicator of the quality of public institutions and government effectiveness	Index	WGI
GVC participation	Extended analysis	Overall participation in international value chains through foreign and domestic value-added linkages	GVC measure	OECD TiVA
FVA / backward GVC	Extended analysis	Foreign value added embodied in domestic exports	TiVA measure	OECD TiVA
DVX / forward GVC	Extended analysis	Domestic value added embodied in foreign exports	TiVA measure	OECD TiVA
Economic Complexity Index (ECI)	Extended analysis	Indicator reflecting the diversity and sophistication of a country's export structure and associated productive capabilities	Index	Harvard Growth Lab Trade Data
Gross capital formation	Robustness control	Gross capital formation included as an additional control in selected specifications	% of GDP	WDI
Inflation	Robustness control	Consumer price inflation used in selected robustness specifications	%	WDI
Winsorised variables	Robustness transformation	Selected variables adjusted at the 1st and 99th percentiles	Transformed form	Author's calculation

Source: Author's compilation based on World Development Indicators, Worldwide Governance Indicators, OECD Trade in Value Added (TiVA), Harvard Growth Lab Trade Data, and World Bank mineral-price data.

3.4. Data preparation and sample coverage

The country-year panel covers 28 resource-dependent developing economies over the period 2000–2022, yielding a maximum of 644 potential country-year observations before accounting for data availability. The effective number of observations differs across outcomes because the underlying datasets do not provide complete coverage for every country-year. The baseline industry value-added models use 579 observations, while the manufacturing value-added models use 542 observations. Table 3 summarises the baseline sample coverage and the resulting differences in available observations across the two dependent variables.

The differences in observation counts reflect data availability at the country-year level rather than the exclusion of countries from the analytical sample. The baseline analysis therefore uses an unbalanced panel. The same principle applies to the extended specifications, for which the effective sample size depends on the availability of the relevant GVC, FVA, DVX, and ECI indicators. The number of observations for each extended and robustness specification is reported with the corresponding regression results.

No missing observations are replaced through imputation. Instead, each model uses the observations for which all variables required by that specification are available. This approach avoids introducing imputed values and makes differences in model-specific sample sizes transparent.

Data preparation also includes the transformations specified for individual variables. Log population is transformed using the natural logarithm to account for differences in country size. The baseline models retain the original, non-winsorised variables. For robustness analysis, FDI inflows, GDP growth, trade openness, and inflation are winsorised at the 1st and 99th percentiles within the main candidate sample. Winsorisation is used as a sensitivity check to assess whether the estimated associations are affected by extreme observations while preserving the underlying country-year structure.

3.5. Econometric strategy

The empirical analysis begins with two-way fixed-effects (TWFE) models to examine the relationship between resource-linked economic integration and the two alternative measures of industrial activity. The baseline specifications estimate the associations of mineral rents, trade openness, and foreign direct investment (FDI) inflows with industry value added and manufacturing value added separately. Estimating the two outcomes separately is central to the empirical design because industry value added captures broad industrial activity, whereas manufacturing value added provides a narrower measure of manufacturing activity.

The baseline specification is expressed as follows:

$$Y_{it} = \beta_1 MineralRents_{it} + \beta_2 TradeOpenness_{it} + \beta_3 FDI_{it} + \beta_4 GDPGrowth_{it} + \beta_5 LogPopulation_{it} + \beta_6 GovernmentEffectiveness_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$$

where Y_{it} denotes either industry value added or manufacturing value added for country i in year t. MineralRents, TradeOpenness, and FDI are the main explanatory variables, while GDPGrowth, LogPopulation, and

Table 3
Baseline sample coverage.

Outcome	Countries	Period	Maximum potential observations	Usable observations	Observations not available
Industry value added	28	2000–2022	644	579	65
Manufacturing value added	28	2000–2022	644	542	102

Source: Author's calculation.

GovernmentEffectiveness are control variables. The term α_i represents country fixed effects and captures time-invariant country characteristics, while λ_t represents year fixed effects and captures shocks common across countries each year. The error term is denoted by ε_{it}.

The TWFE specification focuses on within-country changes over time while controlling for time-invariant country characteristics and common year-specific shocks. Standard errors are clustered at the country level to allow for within-country dependence and heteroskedasticity. This specification provides the baseline for comparing whether the explanatory variables are associated differently with broad industrial activity and manufacturing activity.

The empirical strategy then extends the baseline specification to examine whether the industry–manufacturing contrast remains when broader measures of international production integration and productive structure are considered. The extended specifications retain the baseline structure while introducing GVC participation, its backward and forward dimensions, FVA, DVX, and economic complexity in separate specifications, depending on the empirical extension. These models are estimated using the observations available for the relevant indicators and are interpreted as extensions of the baseline rather than as replacements for the central industry–manufacturing comparison.

The Asian subsample is estimated using the same general specification to examine whether the relationships observed in the full sample are also visible among the Asian economies included in the study. The same outcome distinction is retained, allowing industry value added and manufacturing value added to be compared within the regional subsample. This provides a direct empirical assessment of the Asia-related dimension of the study rather than relying solely on the composition of the full cross-regional sample.

The fixed-effects approach reduces concerns arising from time-invariant omitted country characteristics, but it does not by itself eliminate all potential sources of endogeneity. Time-varying omitted factors and reverse relationships may remain. The study therefore does not interpret the baseline coefficients as causal effects. Instead, the coefficients are interpreted as conditional within-country associations, with additional robustness and endogeneity assessments presented in the subsequent subsection.

3.6. Robustness and endogeneity assessment

Several robustness assessments are conducted to examine whether the baseline associations are sensitive to alternative temporal specifications, sample definitions, variable treatments, treatment of unobserved heterogeneity, and inference procedures. These assessments include lagged specifications, first-difference models, alternative sample definitions, additional controls, winsorised variables, correlated random-effects specifications following the Mundlak approach, Driscoll–Kraay standard errors, and leave-one-country-out estimations. Secondary interaction specifications are treated as exploratory analyses rather than as part of the main empirical evidence.

Lagged specifications are used to examine the sensitivity of the results to temporal ordering. The main explanatory variables are introduced with a one-period lag so that current industrial outcomes are related to their preceding values. This specification provides a sensitivity check concerning the timing of the observed associations. However, lagging the explanatory variables does not establish exogeneity or eliminate endogeneity.

First-difference specifications provide a complementary assessment by focusing on changes within countries over time rather than differences in outcome levels. Differencing removes time-invariant country characteristics and allows the analysis to examine whether the main patterns persist when the empirical comparison is based on changes rather than levels. These estimates are interpreted as robustness assessments and not as a complete solution to potential endogeneity.

The stability of the findings is also examined using alternative sample specifications and additional controls. These include the broader resource-relevant sample that retains Australia and Poland, alternative income-based sample definitions, and the earlier 20-country sample used during the initial stage of the analysis. Additional specifications incorporate gross capital formation and inflation as controls. Selected variables are also winsorised at the 1st and 99th percentiles to assess whether the results are sensitive to extreme observations.

Alternative inference procedures are used to assess the sensitivity of statistical inference to the assumed error structure. The baseline estimates use country-clustered standard errors, while Driscoll–Kraay standard errors are used as an additional check that allows for heteroskedasticity, serial correlation, and cross-sectional dependence under the relevant panel-data conditions (Driscoll and Kraay, 1998; Hoechle, 2007). These procedures concern statistical inference rather than endogeneity correction.

Correlated random-effects specifications following the Mundlak approach provide an additional check on the treatment of unobserved country heterogeneity. By allowing country-specific effects to be correlated with the observed explanatory variables, the Mundlak specification provides a complementary comparison with the preferred fixed-effects estimates (Mundlak, 1978; Wooldridge, 2010). It is used as a specification assessment rather than as a substitute for the two-way fixed-effects model.

An additional instrumental-variable (IV) assessment is conducted to examine the sensitivity of the main findings to potential endogeneity of mineral rents. The principal instrument, denoted as iv_mineral_shock, is constructed as predetermined mineral exposure interacted with the annual global mineral price shock. The instrument is intended to provide external variation in mineral rents while exploiting differences in countries' predetermined exposure to mineral resources. The IV models retain country and year fixed effects and country-clustered standard errors.

The first-stage estimates indicate that the instrument is statistically relevant in both outcome-specific samples. For the industry value-added specification, the coefficient on iv_mineral_shock is 0.0206, with a first-stage F-statistic of 9.19 ($p = 0.0053$). For the manufacturing value-added specification, the corresponding coefficient is 0.0190, with an F-statistic of 7.80 ($p = 0.0095$). These statistics indicate statistically significant first-stage relationships, although the F-statistics remain below the conventional benchmark of 10. The IV estimates are therefore treated as supplementary evidence rather than as definitive causal identification.

The second-stage estimates remain consistent with the central industry–manufacturing contrast. The coefficient on mineral rents is positive for industry value added (0.368, $p = 0.096$) but negative and statistically insignificant for manufacturing value added (-0.217, $p = 0.379$). The IV estimates therefore provide supplementary evidence that the positive association between mineral rents and broad industry value added is not reversed when mineral rents are instrumented using the proposed external-shock-based measure, while the manufacturing association remains statistically indistinguishable from zero. Given the moderate first-stage strength and the untestable nature of the exclusion restriction, these results are not interpreted as definitive causal effects.

An alternative instrument based on mineral exposure measured in 2000 was also examined. Its first-stage coefficient is 0.0126, with an F-statistic of 2.72 and $p = 0.1108$. Because this specification provides weaker first-stage relevance, it is not used as the principal IV specification and is treated as an additional diagnostic rather than as evidence supporting causal identification.

Taken together, these assessments provide evidence on the stability of the empirical associations under alternative temporal, sample, specification, inference, and endogeneity-related conditions. The two-way fixed-effects models remain the principal empirical specification, while the additional analyses are used to assess the sensitivity of the findings rather than to establish causal effects. Accordingly, the empirical results are interpreted primarily as conditional associations, with the IV estimates providing supplementary identification-oriented

evidence. Detailed robustness and IV estimates are reported in the Appendix, while the main text focuses on the baseline industry–manufacturing comparison and the principal empirical extensions.

4. Empirical results

4.1. Descriptive evidence

The descriptive evidence provides an initial view of the characteristics of the sample and the differences between broad industrial activity and manufacturing activity. The analysis covers 28 resource-dependent developing economies over 2000–2022, although the number of usable observations varies across variables because of differences in data availability. Table 4 reports the descriptive statistics for the main variables used in the empirical analysis.

The descriptive statistics show a substantial difference between the two measures of industrial activity. Industry value added has a mean of 28.275 per cent of GDP, compared with 11.937 per cent for manufacturing value added. This difference reflects the broader sectoral coverage of industry value added and reinforces the analytical need to distinguish broad industrial expansion from manufacturing activity.

The main explanatory variables also show considerable variation across countries and years. Mineral rents average 3.739 per cent of GDP, while trade openness averages 70.114 per cent of GDP. FDI inflows have a mean of 4.008 per cent of GDP but exhibit a wide range, from −37.173 to 43.912 per cent. These distributions support the treatment of FDI and trade openness as broad country-level indicators rather than as direct measures of manufacturing-specific investment or trade.

GDP growth averages 4.358 per cent, while the mean of government effectiveness is −0.516. Gross capital formation is available for 570 observations, and inflation for 546 observations. Inflation also displays substantial dispersion, with a maximum value of 557.202 per cent, which provides a basis for treating winsorised inflation as a robustness specification rather than relying exclusively on the raw measure. The descriptive evidence is not interpreted as causal evidence. Its purpose is to establish the empirical setting for the regression analysis and to show why industry value added and manufacturing value added provide different empirical tests of resource-led industrialisation.

4.2. Resource-linked expansion and productive structure

The baseline analysis establishes the central contrast between broad industrial activity and manufacturing value added. To examine whether this contrast is also reflected in a broader measure of productive structure, the analysis incorporates the Economic Complexity Index (ECI) as an additional outcome. ECI provides a complementary perspective on the diversity and sophistication of a country's productive and export structure. Table 5 reports the estimated associations of mineral rents, FDI inflows, and trade openness with industry value added, manufacturing value added, and economic complexity.

The results reinforce the central industry–manufacturing contrast.

Table 5
Resource rents and structural transformation.

Variables	(1) Industry VA	(2) Manufacturing VA	(3) Economic Complexity
Mineral rents	0.492***	−0.040	−0.008
	(0.084)	(0.048)	(0.007)
FDI inflows	0.001	0.014	0.003
	(0.034)	(0.020)	(0.005)
Trade openness	0.058***	0.010	0.001
	(0.015)	(0.019)	(0.001)
GDP growth	0.051	−0.009	−0.006**
	(0.082)	(0.043)	(0.002)
Log population	12.466**	8.300***	0.586**
	(4.749)	(2.838)	(0.282)
Government effectiveness	1.887	−0.245	0.092
	(1.566)	(1.124)	(0.078)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	579	542	582
Within R^2	0.319	0.192	0.105

Notes: Standard errors are reported in parentheses and clustered at the country level. All models include country and year fixed effects. The estimates are interpreted as associations rather than causal effects. ** $p < 0.05$, *** $p < 0.01$.
Source: Author's estimation.

Mineral rents are positively and statistically significantly associated with industry value added, with a coefficient of 0.492, whereas the association with manufacturing value added is negative but statistically insignificant. Trade openness shows a similar pattern, with a positive and statistically significant association with industry value added but a small and statistically insignificant association with manufacturing value added. FDI inflows are not statistically significant in either specification. These estimates reinforce the baseline evidence that resource-linked variables are more clearly associated with broad industrial activity than with manufacturing value added. Fig. 3 visualises this central coefficient contrast across the three main explanatory variables. The figure shows the positive association of mineral rents and trade openness with industry value added, contrasted with their statistically weaker associations with manufacturing value added, while FDI shows no statistically significant association with either outcome.

The ECI specification provides an additional perspective on productive structure. None of the three principal explanatory variables is statistically significant in the ECI model. Mineral rents have a coefficient of −0.008, FDI inflows 0.003, and trade openness 0.001. Thus, the positive associations observed for industry value added do not extend to economic complexity in the same specification. This result does not indicate that resource rents or trade openness reduce productive complexity; rather, it indicates that their observed associations with broad industrial activity are not accompanied by statistically detectable associations with this complementary measure of productive structure.

Taken together, the three outcomes provide a more differentiated view of resource-linked industrialisation. Industry value added captures the broad scale of industrial activity, manufacturing value added

Table 4
Descriptive statistics.

	count	mean	sd	min	p25	p50	p75	max
industry_va	579	28.275	6.559	7.369	23.410	26.893	32.082	48.061
manufacturing_va	542	11.937	4.259	2.589	9.017	11.416	14.437	31.953
fdi	579	4.008	4.700	−37.173	1.685	2.975	5.195	43.912
mineral_rents	579	3.739	4.342	0.000	0.820	2.419	5.127	28.813
trade_open	579	70.114	28.050	4.128	50.180	66.686	87.636	175.351
gdp_growth	579	4.358	4.164	−17.669	2.711	4.780	6.673	21.452
ln_population	579	16.620	1.199	14.362	15.746	16.594	17.354	19.428
gov_effectiveness	579	−0.516	0.611	−1.841	−0.929	−0.587	−0.133	1.193
capital_formation	570	24.432	8.319	1.524	18.633	24.055	29.948	58.151
inflation	546	10.643	38.301	−3.233	2.815	5.595	9.373	557.202

Source: Author's calculation. Descriptive Statistics: Main Candidate Sample.

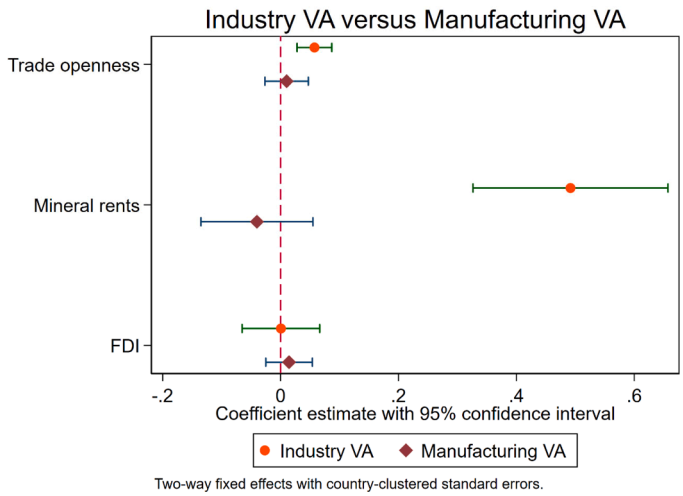


Fig. 3. Coefficient contrast between industry value added and manufacturing value added.
Source: Author's estimation based on the baseline two-way fixed-effects models.

provides a narrower sectoral measure, and ECI provides a complementary perspective on productive structure. The results therefore suggest that evidence of broad industrial expansion should not, by itself, be treated as evidence of deeper productive transformation.

4.3. Global value chain integration

The analysis next considers whether resource-linked integration is associated with participation in global value chains. This extension responds to the limitation of aggregate trade measures by distinguishing overall GVC participation from its backward and forward components. Table 6 reports the estimated associations of mineral rents, FDI inflows, and trade openness with total GVC participation, backward GVC participation measured through foreign value added (FVA), and forward GVC participation measured through domestic value added embodied in foreign exports (DVX).

The results provide a differentiated picture of the relationship between resource-linked variables and global value-chain participation.

Table 6
Resource rents and global value-chain participation.

Variables	(1) Total GVC Participation	(2) Backward GVC (FVA)	(3) Forward GVC (DVX)
Mineral rents	0.031	−0.026	0.056
	(0.055)	(0.053)	(0.052)
FDI inflows	0.024	0.018	0.006
	(0.026)	(0.021)	(0.031)
Trade openness	0.021	0.047	−0.026
	(0.019)	(0.037)	(0.033)
GDP growth	0.019	−0.033	0.053
	(0.063)	(0.057)	(0.038)
Log population	−6.307	−4.400	−1.907
	(8.544)	(10.637)	(4.992)
Government effectiveness	−4.042**	−3.134*	−0.907
	(1.941)	(1.817)	(1.800)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	430	430	430
Within R^2	0.311	0.201	0.272

Notes: Standard errors are reported in parentheses and clustered at the country level. All models include country and year fixed effects. The estimates are interpreted as associations rather than causal effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Author's estimation.

Mineral rents are not statistically significant in any of the three GVC specifications, with coefficients of 0.031 for total GVC participation, −0.026 for backward GVC participation, and 0.056 for forward GVC participation. FDI inflows are likewise statistically insignificant across all three specifications. Trade openness also does not show a statistically significant association with total GVC participation, backward GVC participation, or forward GVC participation.

The absence of statistically significant associations is important when considered alongside the baseline results. Mineral rents and trade openness are positively associated with industry value added, but those associations do not extend to the GVC measures in this specification. This suggests that the expansion captured by the broad industry indicator cannot automatically be interpreted as evidence of stronger integration into international value chains.

The decomposition also provides no statistically significant evidence that mineral rents, FDI inflows, or trade openness are systematically associated with either the foreign content embodied in domestic exports or domestic value added subsequently embodied in foreign exports. The distinction between backward and forward GVC participation therefore adds another layer to the central empirical comparison: industrial expansion, manufacturing activity, and international production integration capture related but different dimensions of economic transformation.

Government effectiveness is the only principal explanatory or control variable showing statistically significant associations across the GVC specifications. Its coefficient is −4.042 for total GVC participation and −3.134 for backward GVC participation, while the coefficient for forward GVC participation is −0.907 and statistically insignificant. These estimates are treated as associations and are not used to infer a causal institutional mechanism.

Overall, the GVC evidence complements rather than replaces the Industry VA–Manufacturing VA comparison. The results do not show that resource rents, aggregate FDI, or trade openness are systematically associated with stronger GVC participation in the analysed specifications. Accordingly, the evidence provides no basis for equating broad resource-linked industrial expansion with deeper value-chain integration.

4.4. Evidence from Asian economies

The analysis next examines whether the central industry–manufacturing contrast is also visible within the Asian economies included in the sample. This regional analysis is important because the study is situated within broader debates on resource-led industrialisation and Asia's role in global production and development. Table 7 presents the Asian subsample estimates for industry value added, manufacturing value added, and economic complexity.

The Asian estimates provide regional evidence that the distinction between broad industrial expansion and manufacturing activity remains relevant. Mineral rents are positively and statistically significantly associated with industry value added, with a coefficient of 0.640, while the corresponding coefficient for manufacturing value added is positive but statistically insignificant. Trade openness is positively associated with both industry value added and manufacturing value added, although the association is stronger and more precisely estimated for industry value added. These results indicate that the relationship between resource-linked integration and industrial activity in the Asian subsample is not uniform across the two outcome measures.

FDI provides a different pattern. FDI inflows are negatively and statistically significantly associated with industry value added, with a coefficient of −0.094, but are not statistically significant in the manufacturing value-added specification. This result differs from the full-sample baseline, where FDI does not show a statistically significant association with either industry value added or manufacturing value added. The Asian estimate should therefore be interpreted as regional evidence of heterogeneity rather than as evidence of a general causal

Table 7
Asian subsample estimates: resource rents and structural transformation.

Variables	(1) Industry VA	(2) Manufacturing VA	(3) Economic Complexity
Mineral rents	0.640**	0.180	0.007
	(0.232)	(0.196)	(0.006)
FDI inflows	−0.094**	−0.011	−0.001
	(0.031)	(0.021)	(0.002)
Trade openness	0.086**	0.053*	0.002
	(0.029)	(0.026)	(0.002)
GDP growth	0.323*	0.043	0.003
	(0.160)	(0.126)	(0.008)
Log population	4.764	13.396**	−0.133
	(7.584)	(5.313)	(0.292)
Government effectiveness	−2.488	−0.940	0.135
	(2.995)	(2.400)	(0.138)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	163	144	163
Within R^2	0.488	0.306	0.359

Notes: Standard errors are reported in parentheses and clustered at the country level. All models include country and year fixed effects. The estimates are interpreted as associations rather than causal effects. * $p < 0.10$, ** $p < 0.05$.
Source: Author's estimation.

effect of FDI on industrial outcomes.

The ECI specification provides a further regional comparison. Mineral rents, FDI inflows, and trade openness are not statistically significant in the ECI model. Thus, the positive association between mineral rents and industry value added in the Asian subsample is not accompanied by a statistically detectable relationship with economic complexity. This reinforces the distinction between the scale of industrial activity and broader productive structure.

The Asian results should nevertheless be interpreted with appropriate caution because the subsample is considerably smaller than the full sample. The models use 163 observations for industry value added, 144 for manufacturing value added, and 163 for economic complexity. The purpose of the subsample analysis is therefore not to establish a separate Asian causal effect, but to determine whether the central empirical contrast identified in the broader sample remains observable within the Asian component of the study.

Taken together, the Asian evidence strengthens the regional relevance of the study. It shows that resource rents are more clearly associated with broad industry value added than with manufacturing value added, while trade openness is associated with both outcomes and FDI displays a distinct regional pattern. At the same time, the absence of significant associations with ECI suggests that these relationships should not automatically be interpreted as evidence of broader productive-capability deepening.

4.5. Lagged specifications

The analysis next examines whether the main findings are sensitive to using preceding-year values of the explanatory variables. The explanatory variables are therefore introduced with a one-period lag, so that current outcomes are related to their preceding values. This specification provides a sensitivity check concerning the timing of the observed associations without assuming that lagging the explanatory variables establishes exogeneity or eliminates endogeneity. The detailed estimates are reported in Appendix Table A1.

The lagged specifications broadly preserve the main pattern observed in the baseline analysis. Lagged mineral rents remain positively and statistically significantly associated with industry value added, with a coefficient of 0.495 ($p < 0.001$), while lagged trade openness is also positively and statistically significantly associated with industry value added, with a coefficient of 0.054 ($p = 0.017$). In contrast, neither lagged mineral rents nor lagged trade openness is statistically significant in the manufacturing value-added specification.

Lagged FDI provides limited evidence of a different pattern. Its coefficient is 0.042 and statistically significant at the 5 per cent level in the manufacturing value-added specification, whereas it is not statistically significant in the industry value-added specification. This result suggests that the association between foreign investment and manufacturing activity may have a delayed component, but the evidence is not sufficient to interpret it as a robust upgrading effect or a causal relationship.

The economic-complexity specification does not show statistically significant associations for lagged mineral rents, FDI, or trade openness. Thus, the lagged specification does not provide evidence that the associations observed for broad industry value added extend systematically to economic complexity.

Overall, the lagged estimates reinforce the central empirical pattern: the positive associations of mineral rents and trade openness are more consistently observed for broad industry value added than for manufacturing value added. At the same time, the lagged specifications should be understood as a sensitivity assessment concerning timing, rather than as evidence that endogeneity has been resolved or that the estimated relationships are causal.

4.6. Robustness and endogeneity assessment

Several robustness assessments are conducted to examine whether the baseline associations are sensitive to alternative temporal specifications, sample definitions, variable treatments, unobserved heterogeneity, inference procedures, and potential endogeneity. These assessments include lagged specifications, first-difference models, alternative sample definitions, additional controls, winsorised variables, correlated random-effects specifications following the Mundlak approach, Driscoll–Kraay standard errors, and leave-one-country-out estimations. Secondary interaction specifications are treated as exploratory analyses rather than as part of the main empirical evidence.

First-difference specifications provide a complementary assessment by focusing on changes within countries over time rather than differences in outcome levels. These models remove time-invariant country characteristics and examine whether the main empirical pattern persists when the analysis is based on changes rather than levels. The first-difference estimates are treated as a robustness assessment rather than as a complete solution to potential endogeneity. The corresponding estimates are reported in Appendix Table A3. The stability of the findings is also examined using alternative sample specifications, additional controls, and winsorised variables. The alternative samples include the broader resource-relevant sample that retains Australia and Poland, alternative income-based sample definitions, and the earlier 20-country sample used during the initial stage of the analysis. Additional specifications incorporate gross capital formation and inflation as controls, while selected variables are winsorised at the 1st and 99th percentiles. These checks assess whether the central industry–manufacturing contrast depends materially on sample composition, additional observable conditions, or extreme observations. The corresponding estimates are reported in Appendix Table A2.

Alternative inference procedures provide further evidence on the sensitivity of statistical inference to the assumed error structure. The baseline estimates use country-clustered standard errors, while Driscoll–Kraay standard errors are used as an additional inference check that allows for heteroskedasticity, serial correlation, and cross-sectional dependence under the relevant panel-data conditions (Driscoll and Kraay, 1998; Hoechle, 2007). These procedures address inference rather than endogeneity itself. Correlated random-effects specifications following the Mundlak approach provide an additional check on unobserved country heterogeneity by allowing country-specific effects to be correlated with the observed explanatory variables (Mundlak, 1978; Wooldridge, 2010). Detailed results from these alternative inference and unobserved-heterogeneity checks are reported in Appendix Table A3. The leave-one-country-out estimates also show that the coefficients on

mineral rents and trade openness remain positive and statistically significant across all 28 specifications (Appendix Table A3).

An additional instrumental-variable (IV) assessment is conducted to examine the sensitivity of the mineral-rents relationship to potential endogeneity. The principal instrument, denoted as iv_mineral_shock, is constructed as mineral rents measured in 2000, representing predetermined mineral exposure, interacted with the annual global Metals & Minerals price shock. The instrument is intended to provide external variation in current mineral rents while exploiting differences in countries' predetermined exposure to mineral resources. The IV specifications retain country and year fixed effects and country-clustered standard errors, with mineral rents treated as the potentially endogenous explanatory variable.

The first-stage estimates indicate statistically significant relationships between the instrument and mineral rents in both outcome-specific samples. For the industry value-added specification, the coefficient on iv_mineral_shock is 0.0206, with a first-stage F-statistic of 9.19 ($p = 0.0053$). For the manufacturing value-added specification, the corresponding coefficient is 0.0190, with an F-statistic of 7.80 ($p = 0.0095$). These results indicate statistical relevance of the instrument, although both F-statistics remain below the conventional benchmark of 10. The instrument is therefore not described as strongly predictive, and the IV results are interpreted as supplementary evidence rather than as definitive causal identification.

The second-stage estimates preserve the central industry–manufacturing contrast. For industry value added, the estimated coefficient on mineral rents is positive at 0.368 and statistically significant at the 10 per cent level ($p = 0.096$). For manufacturing value added, the coefficient is negative at −0.217 and statistically insignificant ($p = 0.379$). Thus, when mineral rents are instrumented using the proposed external-shock-based measure, the estimated association remains positive for broad industry value added but does not extend to manufacturing value added. The IV estimates therefore provide supplementary evidence consistent with the central empirical contrast identified in the baseline analysis.

An alternative instrument based on mineral exposure measured in 2000 is also examined as a diagnostic specification. This instrument produces a first-stage coefficient of 0.0126, with an F-statistic of 2.72 ($p = 0.1108$). Its substantially weaker first-stage relationship means that it is not used as the principal IV specification. The result is reported transparently as a diagnostic assessment and does not provide a basis for causal identification. The detailed instrumental-variable estimates are reported in Appendix Table A4.

Taken together, the robustness and endogeneity assessments support the stability of the central empirical pattern while also clarifying the limits of the identification strategy. Across the alternative specifications, mineral rents and trade openness are more consistently associated with broad industry value added than with manufacturing value added. The IV assessment produces a directionally consistent result for mineral rents, but the moderate first-stage strength and the untestable exclusion restriction warrant caution. The two-way fixed-effects models therefore remain the principal empirical specification, while the additional analyses including the IV assessment are used to evaluate the sensitivity of the findings rather than to establish causal effects. Detailed robustness, alternative estimation and inference, and instrumental-variable estimates are reported in Appendix Tables A2 and A4, respectively.

5. Discussion

5.1. Broad industrial expansion versus manufacturing deepening

The central finding of this study is that resource-linked industrial expansion is more clearly reflected in broad industry value added than in manufacturing value added. Mineral rents are positively and statistically significantly associated with industry value added, whereas their association with manufacturing value added is statistically insignificant. Trade openness shows a similar contrast, with a positive and statistically significant association with industry value added but no statistically significant association with manufacturing value added. These findings suggest that resource-linked economic integration can coincide with an expansion of broad industrial activity without necessarily being accompanied by comparable expansion in manufacturing activity.

This distinction is important for interpreting resource-led industrialisation. Industry value added encompasses mining, manufacturing, construction, electricity, water, and gas, whereas manufacturing value added captures a narrower set of activities. Consequently, an increase in the broad industry measure can partly reflect the expansion of resource extraction and related activities. The positive association between mineral rents and industry value added is therefore consistent with an expansion of industrial activity in a broad sense, but it does not by itself demonstrate that resource-dependent economies are developing a deeper manufacturing base.

This is where the concept of resource-led industrialisation illusion provides an interpretive contribution. The concept does not imply that industrial expansion is false or economically insignificant. Rather, it describes the possibility that visible increases in broad industrial activity may encourage a stronger interpretation of structural transformation than is warranted when more specific indicators of manufacturing activity and productive capabilities are considered. In this study, the contrast between the positive association of mineral rents with industry value added and the statistically insignificant association with manufacturing value added illustrates this distinction. The evidence therefore suggests that the scale of industrial activity and the depth of manufacturing transformation should not be treated as equivalent outcomes.

This finding is consistent with the linkage perspective in the literature. Resource sectors can create backward and forward linkage opportunities, but the existence of such opportunities does not guarantee that domestic productive capabilities will deepen to the same extent. Morris et al. (2012) and Morris and Fessehaie (2014), for example, emphasise that the industrialisation potential of commodity sectors depends on the development of linkages, capabilities, skills, competitiveness, and supporting conditions. The present findings complement this perspective by showing that broad industrial expansion and manufacturing activity can diverge within the same country-year framework.

The finding should therefore not be interpreted as evidence that resource-led industrialisation necessarily fails. Instead, it indicates that its developmental depth cannot be inferred from broad industrial expansion alone. A resource-dependent economy may experience substantial growth in mining, processing, construction, utilities, and related activities while showing weaker evidence of manufacturing deepening. The empirical distinction identified here provides a basis for evaluating resource-led industrialisation in terms of what types of productive activity expand, rather than relying solely on the aggregate scale of industrial activity.

5.2. Global integration, GVC participation, and the limits of aggregate integration

The GVC results provide an important qualification to the role of global integration in resource-led industrialisation. The baseline estimates show that trade openness is positively associated with industry value added, yet this association does not extend to total GVC participation, backward GVC participation, or forward GVC participation. Mineral rents and FDI inflows likewise show no statistically significant associations across the GVC specifications. This pattern suggests that a stronger connection to international markets, as captured by aggregate trade openness, does not necessarily translate into deeper participation in international production networks.

The distinction between aggregate integration and the structure of value-chain participation is particularly important for resource-

dependent economies. Trade openness measures the overall intensity of trade relative to GDP, but it does not indicate whether trade is concentrated in primary commodities, resource-related products, intermediate inputs, or more sophisticated manufactured goods. Similarly, aggregate FDI inflows do not identify the sectors receiving foreign investment or the extent to which foreign-owned activities are connected to domestic suppliers and productive capabilities. The absence of statistically significant relationships between FDI and the GVC measures therefore reinforces the need to interpret aggregate FDI as a broad indicator of international capital integration rather than as direct evidence of manufacturing upgrading.

The decomposition of GVC participation provides further insight into this distinction. Neither mineral rents nor trade openness is significantly associated with the foreign value added embodied in domestic exports or with domestic value added subsequently embodied in foreign exports. Thus, the positive association between mineral rents and broad industry value added cannot be extended to a claim that resource-linked economies are systematically moving towards stronger backward or forward integration in international production. In this respect, the GVC evidence adds an important dimension to the resource-led industrialisation illusion: visible expansion in industrial activity may coexist with limited evidence of deeper integration into international production structures.

This finding is consistent with the GVC literature, which emphasises that participation and upgrading are distinct processes. Humphrey and Schmitz (2002) argue that insertion into global value chains can create opportunities for upgrading, but the form and governance of those relationships influence the opportunities available to producers. Gereffi et al. (2005) similarly show that different forms of GVC governance shape the coordination of production and the possibilities for upgrading. Dallas et al. (2019) further emphasise the importance of power relations in determining how value is added, distributed, and captured within global value chains. The present findings complement these perspectives by showing that aggregate trade integration and broad industrial expansion do not, in themselves, provide evidence of deeper value-chain upgrading.

The negative and statistically significant associations of government effectiveness with total and backward GVC participation should also be interpreted cautiously. These estimates identify an association within the specified country-year models but do not establish a causal institutional effect. They may reflect differences in the composition of participating economies, the structure of their trade and production networks, or other time-varying factors not captured by the model. Accordingly, the GVC results are used primarily to demonstrate that resource-linked industrial expansion and international production integration are analytically distinct dimensions of structural transformation.

Taken together, the GVC evidence strengthens the central argument of the study. Resource rents and trade openness are associated with broad industrial activity, but these relationships do not systematically extend to measures capturing the structure of international value-added linkages. The implication is not that resource-dependent economies are disconnected from global production. Rather, it is that integration should not be equated with upgrading. For the purposes of the resource-led industrialisation illusion concept, this distinction is crucial: an economy can become more industrially active and internationally connected without necessarily demonstrating deeper manufacturing capabilities, stronger domestic value capture, or more advanced positioning within global value chains.

5.3. Productive capabilities, economic complexity, and the asian context

The economic-complexity results provide a further qualification to the interpretation of resource-linked industrial expansion. In the full-sample estimates, mineral rents, FDI inflows, and trade openness are not statistically significantly associated with the Economic Complexity Index (ECI). This contrasts with the positive association between mineral rents and industry value added and suggests that an expansion in the scale of industrial activity is not necessarily accompanied by a measurable change in the diversity and sophistication of the productive and export structure. The ECI evidence therefore reinforces the distinction between the scale of production and the capabilities embodied in an economy's productive structure.

This distinction is particularly relevant to the interpretation of resource-led industrialisation. Resource-linked investment can increase extraction, processing, infrastructure, and related industrial activity without necessarily broadening the range of capabilities embodied in production and exports. Economic complexity captures a different dimension of transformation from industry value added and manufacturing value added, and the absence of statistically significant associations in the ECI specification should therefore not be interpreted as evidence that resource rents reduce productive capabilities. Rather, it indicates that the positive association observed for broad industry activity does not systematically extend to this complementary measure of productive structure.

The ECI results consequently provide an additional dimension to the resource-led industrialisation illusion concept. The potential illusion does not arise simply because industry value added is large relative to manufacturing value added. It also arises when visible industrial expansion is interpreted as evidence of a broader transformation in productive capabilities without corresponding evidence from measures that capture the composition and sophistication of production. In this sense, the ECI results strengthen the conceptual distinction between industrial scale and productive depth. The evidence does not establish that resource-dependent economies are unable to develop greater complexity; rather, it indicates that such development cannot be inferred from the observed expansion in broad industry value added.

The Asian subsample provides an important regional perspective on this argument. The positive and statistically significant association between mineral rents and industry value added remains evident among the Asian economies in the sample, with a coefficient of 0.640, while the association with manufacturing value added is positive but statistically insignificant. Trade openness is positively associated with both industry value added and manufacturing value added in the Asian subsample, although the estimated association is stronger for industry value added. These results indicate that the distinction between broad industrial expansion and manufacturing activity remains relevant within the Asian context, while also showing that the regional pattern is not identical to the full-sample results.

The Asian evidence also demonstrates the importance of avoiding a uniform interpretation of resource-led development. FDI inflows are negatively and significantly associated with industry value added in the Asian subsample but are not statistically significant for manufacturing value added. This differs from the full-sample baseline, where FDI is statistically insignificant for both outcomes. The difference suggests that the relationship between international capital and industrial activity may vary across regional contexts and should not be interpreted solely through aggregate FDI measures. Similarly, the absence of statistically significant associations between the three principal explanatory variables and ECI in the Asian subsample indicates that the stronger industry-level associations are not accompanied by detectable changes in the broader productive structure.

These regional findings are important for the Asian dimension of the study because Asia combines substantial resource endowments with deep manufacturing and production networks. The evidence does not suggest that resource-dependent Asian economies follow a single development trajectory. Instead, it indicates that resource-linked industrial expansion can coexist with different degrees of manufacturing activity, international integration, and productive-capability development. The Asian results therefore reinforce the value of examining resource-led industrialisation through multiple dimensions rather than assuming that industrial expansion necessarily represents movement towards deeper manufacturing and more sophisticated productive

structures.

Taken together, the ECI and Asian evidence extends the central argument beyond the initial industry–manufacturing comparison. The results suggest that industrial expansion, manufacturing activity, and productive complexity represent distinct dimensions of transformation. The fact that these dimensions do not systematically move together is precisely why resource-led industrialisation should be evaluated beyond aggregate industrial scale. In this respect, the concept of resource-led industrialisation illusion provides a useful interpretive lens for understanding why visible industrial progress may coexist with more limited evidence of deeper productive transformation, while recognising that the underlying developmental trajectories remain heterogeneous across economies.

5.4. Robustness, endogeneity, and the scope of inference

The robustness analyses provide broadly consistent evidence that the central industry–manufacturing contrast is not confined to the baseline specification. The positive association between mineral rents and industry value added persists when alternative temporal specifications, sample definitions, variable treatments, and estimation approaches are considered. The lagged specifications are particularly relevant because they show that the positive association between mineral rents and industry value added is also observed when preceding-period values of the explanatory variables are used. At the same time, the manufacturing results remain statistically weaker, supporting the distinction between broad industrial expansion and manufacturing deepening. These findings suggest that the central contrast is not driven solely by the contemporaneous baseline specification.

The first-difference and alternative-specification results provide a complementary perspective by changing how within-country variation is evaluated. These models do not eliminate all potential sources of endogeneity, but they reduce reliance on comparisons in outcome levels and provide an additional assessment of whether the observed relationships persist under different treatments of country heterogeneity. Similarly, the alternative samples and additional controls do not fundamentally alter the central interpretation. Taken together, these results indicate that the distinction between broad industry value added and manufacturing value added is reasonably stable across the principal robustness exercises.

The instrumental-variable assessment provides an additional perspective on potential endogeneity of mineral rents. The principal instrument, based on predetermined mineral exposure interacted with the global mineral price shock, is statistically related to mineral rents in both outcome-specific samples. The second-stage estimates preserve the main directional contrast: the estimated association between mineral rents and industry value added remains positive, whereas the association with manufacturing value added remains negative and statistically insignificant. This directional consistency is relevant because it indicates that the central industry–manufacturing contrast is not reversed when an alternative source of variation in mineral rents is introduced.

However, the IV results also define an important boundary for interpretation. The first-stage F-statistics are 9.19 for the industry specification and 7.80 for the manufacturing specification, both below the conventional benchmark of 10. In addition, the exclusion restriction cannot be established directly from the available data. The IV estimates should therefore be regarded as supplementary evidence that increases confidence in the stability of the observed pattern, rather than as definitive evidence of a causal effect. This distinction is particularly important for interpreting the resource-led industrialisation illusion concept: the concept is supported as an interpretive reading of the observed divergence across indicators, not as a causal mechanism established by the IV estimates.

The combined robustness evidence therefore supports a bounded interpretation of the findings. The results consistently indicate that resource rents are more clearly associated with broad industrial activity than with manufacturing activity, while the GVC and ECI analyses provide no corresponding systematic evidence of deeper value-chain integration or changes in productive complexity. The Asian subsample further demonstrates that this pattern remains relevant within the regional context motivating the study, although the regional estimates also reveal heterogeneity. The evidence consequently supports the argument that the scale of industrial expansion should be distinguished from the depth of structural transformation.

The appropriate interpretation is therefore neither that resource-led industrialisation is inherently unsuccessful nor that industrial expansion is merely illusory. Rather, the findings suggest that visible industrial expansion should be evaluated against multiple indicators of transformation. Industry value added, manufacturing value added, GVC participation, and economic complexity capture different dimensions of economic change. When these dimensions do not move together, an assessment based solely on broad industrial expansion may overstate the extent of productive transformation. This is the empirical boundary within which the concept of resource-led industrialisation illusion is most useful.

6. Limitations

This study has several limitations that should be considered when interpreting the findings. First, the analysis is conducted at the country-year level. The use of aggregate indicators such as industry value added, manufacturing value added, trade openness, and FDI inflows allows for cross-country comparison but does not identify the specific sectors, firms, or production activities through which these relationships operate. In particular, aggregate FDI and trade measures cannot distinguish whether international capital and trade are concentrated in resource extraction, processing, manufacturing, or other sectors. The findings should therefore not be interpreted as evidence concerning the effects of sector-specific FDI or manufacturing-specific trade.

Second, manufacturing value added provides a narrower measure of manufacturing activity but does not capture all dimensions of manufacturing upgrading. The analysis therefore cannot directly establish changes in technological sophistication, product quality, domestic ownership, supplier linkages, or domestic value capture. To address this limitation partially, the study complements manufacturing value added with economic complexity and GVC indicators, including backward and forward value-added linkages. These measures provide additional perspectives on productive structure and international production integration, but they remain distinct from direct firm- or sector-level measures of upgrading.

Third, the availability of GVC indicators is more limited than that of the baseline variables. The GVC specifications therefore use fewer observations than the baseline models. Although this allows the study to examine the structure of international value-added linkages, the reduced coverage limits the extent to which the GVC findings can be generalized to the full baseline sample. The GVC results should consequently be interpreted as complementary evidence rather than as a complete representation of value-chain upgrading.

Fourth, the observational panel design limits causal interpretation. Country fixed effects account for time-invariant country characteristics and year fixed effects account for common year-specific shocks, while the robustness analyses examine alternative temporal and specification assumptions. Nevertheless, time-varying omitted factors and reverse relationships may remain. The instrumental-variable assessment provides additional evidence concerning potential endogeneity of mineral rents, but the first-stage F-statistics are moderate and the exclusion restriction cannot be established directly from the available data. The IV estimates are therefore interpreted as supplementary evidence rather than definitive causal estimates.

Finally, the findings are bounded by the sample-selection criteria and should not be generalized to all developing or resource-rich economies. The study focuses on 28 resource-dependent developing economies

identified through the specified resource-relevance screening and developing-economy scope. The cross-regional design provides comparative evidence with particular relevance to Asia, but the Asian subsample is relatively small. Future research could therefore extend the analysis using sector-level, firm-level, or product-level data to examine more directly how resource-linked investment and trade affect manufacturing capabilities, domestic value capture, technological upgrading, and participation in specific value chains.

7. Policy implications

The findings have several implications for industrial policy in resource-dependent developing economies, particularly in Asia. The central implication is that the expansion of broad industrial activity should not be used as a sufficient indicator of successful structural transformation. Because mineral rents are more clearly associated with industry value added than with manufacturing value added, policymakers should distinguish between increasing the scale of resource-linked industrial activity and developing a broader manufacturing base. Industrial strategies should therefore evaluate resource-based projects not only in terms of output, investment, or processing capacity, but also in terms of their contribution to domestic productive capabilities and wider manufacturing activity.

A second implication concerns the development of domestic linkages. Resource-based industrialisation can create opportunities for backward and forward linkages, but the existence of resource-processing activities does not automatically ensure that domestic firms participate in higher-value activities. Policies can therefore focus on strengthening supplier capabilities, technical skills, infrastructure, technology adoption, and linkages between resource-based firms and domestic producers. The objective is not simply to increase the volume of resource-related activity, but to increase the extent to which that activity generates productive connections with the wider domestic economy.

Third, the findings suggest that trade openness and FDI should be assessed according to their composition and productive linkages rather than their aggregate magnitude alone. The positive association between trade openness and industry value added does not extend systematically to the GVC measures, while aggregate FDI does not show a statistically significant relationship with the baseline industrial outcomes or the GVC indicators. This suggests that greater openness or larger capital inflows should not automatically be interpreted as evidence of manufacturing upgrading. Industrial policy can therefore place greater emphasis on whether trade and investment contribute to domestic supplier development, technology transfer, learning, and participation in more sophisticated production activities.

Fourth, the GVC results imply that policy assessment should distinguish between participation in international production and the depth of value capture. The absence of statistically significant relationships between mineral rents and total, backward, or forward GVC participation suggests that resource-linked industrial expansion does not automatically translate into stronger value-added integration. Policymakers should therefore monitor not only whether economies participate in international value chains, but also the nature of domestic value added, the development of local suppliers, and the capacity of domestic firms to move into more demanding stages of production.

Fifth, the economic-complexity findings suggest that industrial policy should incorporate measures of productive diversification and capability development alongside conventional indicators of industrial scale. The absence of statistically significant associations between the principal explanatory variables and ECI indicates that increases in broad industrial activity should not automatically be interpreted as evidence of greater productive sophistication. For resource-dependent economies in Asia, this implies that downstream industrialisation strategies may need to be accompanied by policies supporting diversification, skills development, technological capabilities, and the emergence of new productive activities beyond resource-linked sectors.

These implications are particularly relevant to Asian economies because the region combines substantial resource endowments with dense manufacturing and production networks. The Asian results show that mineral rents remain more clearly associated with broad industry value added than with manufacturing value added, while trade openness is associated with both outcomes. This suggests that resource-based industrialisation policies in Asia should be evaluated against the specific productive outcomes they generate rather than assumed to produce a uniform pathway towards manufacturing deepening. Regional differences in institutional conditions, industrial capabilities, and integration into production networks should therefore be taken into account when designing and evaluating resource-based industrial strategies.

More broadly, the findings suggest that policymakers should avoid what might be termed an industrialisation illusion in policy evaluation: treating visible expansion in mining, processing, construction, utilities, or related activities as sufficient evidence of deeper structural transformation. The concept of resource-led industrialisation illusion therefore has a practical implication. It calls for a multidimensional policy dashboard that considers industrial scale alongside manufacturing activity, GVC participation and value-added linkages, productive complexity, and domestic value capture. Such an approach would allow policymakers to distinguish between resource-led expansion that primarily increases industrial scale and resource-led transformation that generates broader and more durable productive capabilities.

8. Conclusion

This study examined whether resource-linked economic integration is more consistently associated with broad industrial expansion or with manufacturing upgrading in resource-dependent developing economies. Using a country-year panel of 28 economies over 2000–2022, the analysis distinguished industry value added from manufacturing value added and complemented these measures with evidence on economic complexity, global value-chain participation, and the Asian subsample. The results reveal a consistent distinction between the scale of industrial activity and the depth of productive transformation.

The baseline estimates show that mineral rents and trade openness are positively associated with industry value added, while their associations with manufacturing value added are statistically insignificant. The same distinction is broadly visible in the Asian subsample, where mineral rents remain positively associated with industry value added but are not significantly associated with manufacturing value added. The GVC analysis further shows that the positive associations observed for broad industrial activity do not systematically extend to total, backward, or forward value-chain participation. Similarly, the absence of statistically significant associations with economic complexity indicates that broad industrial expansion should not automatically be interpreted as evidence of greater productive sophistication.

These findings provide empirical grounding for the concept of resource-led industrialisation illusion. The concept does not suggest that resource-led industrialisation is inherently unsuccessful or that observed industrial expansion is economically insignificant. Rather, it highlights the risk of interpreting visible growth in broad industrial activity as evidence of deeper structural transformation without examining manufacturing activity, value-chain positioning, and productive capabilities. The results show why these dimensions need to be distinguished: resource-linked expansion may increase industrial scale while leaving the evidence of manufacturing deepening and broader productive transformation more limited or mixed.

The robustness and endogeneity assessments provide additional support for the stability of this interpretation. The central industry–manufacturing contrast persists across alternative temporal specifications, samples, variable treatments, and estimation approaches. The instrumental-variable assessment produces a directionally consistent contrast, with a positive estimate for mineral rents in the industry specification and a negative, statistically insignificant estimate in the

manufacturing specification. However, the moderate first-stage strength and the untestable exclusion restriction mean that these results should be regarded as supplementary evidence rather than definitive causal identification.

The study contributes to the literature by bringing together dimensions that are often considered separately in discussions of resource-led development: industrial scale, manufacturing activity, global value-chain integration, and productive complexity. Its contribution is therefore not to argue that resource-based industrialisation fails, but to provide a more differentiated basis for evaluating its depth. For resource-dependent developing economies, particularly those embedded in Asia's increasingly interconnected production systems, the evidence suggests that successful transformation should be assessed not only by how much industrial activity expands, but also by whether that expansion is accompanied by broader manufacturing capabilities, stronger productive linkages, deeper domestic value capture, and more sophisticated productive structures.

Ethics statement

This study uses secondary, country-level, publicly available data and does not involve human participants, personal data, interviews, experiments, or identifiable individual information. Therefore, formal ethics approval was not required.

Generative AI disclosure

The author declares that no generative artificial intelligence tools or large language models were used at any point in the preparation, writing, analysis, editing, or revision of this manuscript.

CRediT authorship contribution statement

Ahmad Harakan: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization, Project administration. **Gábor Vigvári:** Supervision, Funding acquisition, Conceptualization, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A1
Lagged specifications.

Variables	(1) Industry VA	(2) Manufacturing VA
Lagged FDI inflows	0.017	0.042**
	(0.062)	(0.017)
Lagged mineral rents	0.495***	−0.005
	(0.082)	(0.047)
Lagged trade openness	0.054**	0.012
	(0.021)	(0.018)
GDP growth	−0.006	−0.029
	(0.072)	(0.039)
Log population	16.091***	7.319**
	(5.530)	(3.258)
Government effectiveness	0.409	−0.377
	(1.591)	(1.122)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	517	517
Countries	28	28
Within R^2	0.342	0.199

Notes: Standard errors are reported in parentheses and clustered at the country level. All models include country and year fixed effects. The explanatory variables of primary interest are lagged by one year, while GDP growth, log population, and government effectiveness are contemporaneous controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Author's estimation.

Table A2
Robustness to alternative samples, additional controls, and variable treatment.

Panel A. Industry Value Added						
Variables	(1) Baseline	(2) Winsorised	(3) Extended controls	(4) All resource	(5) GDPpc <10k	(6) Original 20
FDI inflows	0.001	0.054	−0.066**	−0.002	−0.004	−0.112**
	(0.034)	(0.050)	(0.027)	(0.032)	(0.035)	(0.053)

(*continued on next page*)

Table A2 (*continued*)

Panel A. Industry Value Added						
Variables	(1) Baseline	(2) Winsorised	(3) Extended controls	(4) All resource	(5) GDPpc <10k	(6) Original 20
Mineral rents	0.492***	0.489***	0.505***	0.486***	0.476***	0.384***
	(0.084)	(0.084)	(0.082)	(0.082)	(0.086)	(0.063)
Trade openness	0.058***	0.053***	0.050***	0.059***	0.057***	0.077**
	(0.015)	(0.015)	(0.018)	(0.015)	(0.015)	(0.027)
GDP growth	0.051	0.052	0.035	0.053	0.017	−0.060
	(0.082)	(0.087)	(0.080)	(0.083)	(0.087)	(0.055)
Log population	12.466***	12.651**	10.128**	11.940***	9.550	19.789**
	(4.749)	(4.680)	(4.068)	(4.255)	(6.374)	(8.079)
Government effectiveness	1.887	1.854	1.574	1.948	1.244	0.071
	(1.566)	(1.559)	(1.755)	(1.508)	(2.024)	(0.859)
Gross capital formation	—	—	0.154*	—	—	—
			(0.077)			
Inflation (winsorised)	—	—	0.024	—	—	—
			(0.057)			
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	579	579	537	621	474	410
Countries	28	28	28	30	23	20
Within R^2	0.379	0.316	0.321	0.317	0.323	0.417

Panel B. Manufacturing Value Added						
Variables	(1) Baseline	(2) Winsorised	(3) Extended controls	(4) All resource	(5) GDPpc <10k	(6) Original 20
FDI inflows	0.014	0.016	−0.000	0.005	0.025	−0.066
	(0.020)	(0.038)	(0.019)	(0.022)	(0.017)	(0.064)
Mineral rents	−0.040	−0.039	0.001	−0.042	−0.047	−0.109
	(0.048)	(0.048)	(0.041)	(0.046)	(0.055)	(0.097)
Trade openness	0.010	0.010	−0.008	0.016	0.008	0.029
	(0.019)	(0.019)	(0.014)	(0.018)	(0.021)	(0.028)
GDP growth	−0.009	−0.002	−0.000	0.009	−0.012	0.087
	(0.043)	(0.046)	(0.034)	(0.034)	(0.041)	(0.077)
Log population	8.300***	8.250***	9.067***	6.174*	6.147*	11.448
	(2.838)	(2.859)	(2.505)	(3.397)	(3.357)	(11.892)
Government effectiveness	−0.245	−0.252	0.079	−0.131	−1.337	−1.560
	(1.124)	(1.124)	(1.120)	(1.087)	(1.492)	(1.624)
Gross capital formation	—	—	0.033	—	—	—
			(0.037)			
Inflation (winsorised)	—	—	−0.006	—	—	—
			(0.012)			
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	542	542	510	587	440	409
Countries	28	28	28	30	23	20
Within R^2	0.192	0.192	0.258	0.174	0.141	0.226

Notes: Standard errors are reported in parentheses and clustered at the country level. All specifications include country and year fixed effects. Column (2) uses winsorised FDI inflows, trade openness, and GDP growth at the 1st and 99th percentiles. Column (3) additionally controls for gross capital formation and winsorised inflation. Column (4) uses the broader resource-relevant sample. Column (5) excludes countries with average GDP per capita of 10,000 or above. Column (6) uses the original 20-country sample. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Author's estimation.

Table A3
Alternative estimation and inference checks.

Variables	(1) First Difference	(2) Driscoll–Kraay	(3) Mundlak/CRE	(4) Leave-One-Country-Out
Panel A. Industry Value Added				
FDI inflows	−0.047	0.001	0.001	—
Mineral rents	0.224	0.492***	0.492***	0.452–0.534
Trade openness	0.041	0.058***	0.058***	0.052–0.064
GDP growth	0.084	0.051	0.051	—
Log population	8.719	12.466***	12.409***	—
Government effectiveness	−0.824	1.887**	1.884	—
Observations	492	579	579	28 estimations
Countries	28	28	28	27 per estimation
R^2 (FD) / Within R^2 (DK)	0.202	0.319	—	—
Panel B. Manufacturing Value Added				
FDI inflows	−0.012	0.014	0.014	—
Mineral rents	−0.017	−0.040	−0.039	—
Trade openness	−0.008	0.010	0.010	—
GDP growth	−0.002	−0.009	−0.009	—
Log population	2.312	8.300***	8.309***	—
Government effectiveness	0.078	−0.245	−0.245	—
Observations	490	542	542	—
Countries	28	28	28	—
R^2 (FD) / Within R^2 (DK)	0.051	0.192	—	—

Notes: First-difference estimates use country-clustered standard errors. Driscoll–Kraay estimates use Driscoll–Kraay standard errors with a maximum lag of two. Mundlak/CRE specifications include country means of the time-varying regressors. The leave-one-country-out column reports the range of coefficients across 28 estimations in which one country is omitted at a time. All models include year fixed effects where applicable. Estimates are interpreted as associations rather than causal effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Author's estimation.

Table A4
Instrumental-variable robustness assessment.

Panel A. First Stage Estimates		
Variables	(1) Industry VA	(2) Manufacturing VA
iv_mineral_shock	**0.0206*****	**0.0190*****
	(0.0068)	(0.0068)
F-statistic	9.19	7.80
p-value	0.0053	0.0095
Observations	552	518
Countries	28	28
Country FE	Yes	Yes
Year FE	Yes	Yes
Panel B. Second Stage Estimates		
Variables	(1) Industry VA	(2) Manufacturing VA
Mineral rents	**0.368***	−0.217
	(0.221)	(0.247)
FDI inflows	0.005	0.023
Trade openness	**0.056*****	0.013
	(0.019)	(0.021)
GDP growth	0.039	−0.033
Log population	12.896	8.363
Government effectiveness	1.375	−0.828
Country FE	Yes	Yes
Year FE	Yes	Yes
Observations	552	518
Countries	28	28

Notes: Standard errors are reported in parentheses and clustered at the country level. All models include country and year fixed effects. The endogenous variable is mineral rents, instrumented using iv_mineral_shock. First-stage F-statistics are below 10; therefore, IV estimates are interpreted as supplementary rather than definitive causal evidence. The alternative instrument is reported as a diagnostic specification because of its weaker first-stage relevance ($F = 2.72$, $p = 0.1108$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Author's estimation.

Data availability

This study uses publicly available secondary data from the World Development Indicators (WDI), Worldwide Governance Indicators (WGI), OECD Trade in Value Added (TiVA), Harvard Growth Lab Trade Data, and the World Bank Metals & Minerals Price Index. The processed dataset, variable construction notes, and Stata replication files are available from the corresponding author upon reasonable request.

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