The Role of Natural Resources and Technological Progress in Economic Growth

Reviewer: Prof. Luca De Benedictis (Universitas Mercatorum)

Date: 19/02/2026, 14:39:00

Firmato digitalmente da: Luca De Benedictis
Data: 07/03/2026 19:07:22

Candidate: dr. ZUZANNA ZARACH

Evaluation: PhD Thesis

University: Politechnika Gdanska

General Assesment

• Assessment of the research issues undertaken, the aim(s) of the dissertation, including the research methodology used.
Evaluation: positive assessment.

• Assessment and justification of whether the doctoral dissertation is an original solution to a research problem, an original solution in the application of the results of one's own scientific research in the economic or social sphere.
Evaluation: positive assessment.

• Assessment of whether the doctoral dissertation presents general theoretical knowledge in the discipline or disciplines and demonstrates the ability to independently conduct research work.
Evaluation: positive assessment.

• Assessments, with justification, of whether the doctoral dissertation demonstrates the ability to independently conduct scientific work by the person applying for a doctoral degree.
Evaluation: positive assessment.

Proposal

1. Admission to defend (positive review), which means that the doctoral dissertation in question meets the requirements for doctoral dissertations within the meaning of Art. 187, section 1 and 2 of the relevant Act.

2. The subsequent comments are made to tackle minor internal inconsistencies and must be considered has remarks to increase the probability of transforming the PhD dissertation in different papers to be published in well recognized international scientific journals.

Overall Feedback

Central Claim: The thesis utilizes HS6 product-level trade data to explore how natural resource dependence interacts with technological specialization, suggesting that high resource export intensity can be compatible with productivity growth and diversification, particularly when accounting for heterogeneity across resource types.

Main Areas for Reflection

- **Interpretative scope and causality.** The Introduction of the dissertation frames several hypotheses using causal language, while the empirical strategy relies primarily on cross-country panel estimations. It may be beneficial to clarify the extent to which the results represent conditional correlations versus causal impacts. A brief discussion on the limitations of identification in this setting could help align reader expectations with the methodological design.
- **Validation of export-based indices.** Since the analysis relies on newly constructed export share indices for resources and technology, readers might value a brief comparison against established benchmarks, such as patent intensity. A short note confirming that the exclusion of vanishing HS codes or specific agricultural products does not drive the observed patterns would strengthen the robustness of these measures.
- **Structural links in diversification measures.** Given that the Theil index is a function of export shares, there represents a potential accounting link between the diversification outcome and the resource share regressor. Explicitly detailing the decomposition algebra could clarify which components drive the results. A modest robustness check using a non-resource diversification metric might further reassure readers that the findings reflect underlying economic dynamics rather than mechanical correlations.
- **Contextualizing the contribution.** The manuscript covers a broad range of relationships within the mature resource curse literature. To help the specific novelty of this study to stand out — particularly the heterogeneity across resource types and the role of newly defined technological clusters — it might be helpful to streamline the narrative around these unique stylized facts. Sharpening this focus would distinguish the findings more clearly from prior consensus.

Detailed Comments

1. Unused abbreviations in the list

Quote: > COAL - natural resource taxonomy comprising coal products. DIV - export diversification. FORESTRY - natural resource taxonomy comprising forestry products. FUEL - natural resource taxonomy comprising fossil fuel products. ... RCA - Revealed Comparative Advantage. RT - Relative Theil index. SPEC - export specialization. TECH - products related to the middle- and high-tech products.

Feedback: DIV (export diversification) and SPEC (export specialization) are defined in the List of Abbreviations, but these acronyms do not appear to be used as shorthand in the subsequent text, equations, or tables. To keep the front matter fully consistent with the notation employed, it would be helpful either to remove these entries from the list or to introduce and use the acronyms consistently in the main chapters.

---

2. Framing of the theoretical puzzle in the Introduction

Quote: > Economic theory offers no satisfactory explanation as to why the possession of natural resources should be detrimental (Mellor, 1995; Auty, 2001; Lewis, 2009). Contrastingly, some influential trade theories suggest that commodities are produced more cheaply by the nations that have an abundance of the resources used in their production (Heckscher and Ohlin, 1991), while additional rents coming from natural resource exports allow higher investment and greater opportunities to import capital goods (Auty and Mikesell, 1998).

Feedback: Statement "Economic theory offers no satisfactory explanation as to why the possession of natural resources should be detrimental" initially made me wonder whether you were suggesting that there are no theoretical models at all that produce adverse effects of resource discoveries. After reading Section 2.2, however, it becomes clear that you are echoing the argument of Mellor, Auty and Lewis about the absence of a broad, consensus explanation in mainstream growth and trade theory, and you do go on to discuss Dutch Disease and other mechanisms as partial, conditional channels.

Given that the Dutch Disease framework is widely seen as an important theoretical explanation for some negative resource outcomes, you might consider clarifying in the introduction what is meant by "no satisfactory explanation" (for example, that there is no single, generally accepted or universal theory) and linking this more explicitly to your later discussion in Section 2.2. This could prevent readers from briefly inferring a stronger claim than you intend.

---

3. Contradiction on the novelty of the resource-based decomposition

Quote: > Finally, the role of resource dependence in export diversification trajectories has not been sufficiently addressed, particularly in the case of low-income resource-rich countries, exposed to the risk of excessive export specialization. In particular, to the best of my knowledge, the resource-based decomposition of the export diversification curve, which depicts the relationship between trade structures heterogeneity and economic growth process (De Benedictis et. al., 2009; Cadot et al., 2011a; Parteka and Tamberi, 2013b; Gnidchenko, 2021; Parteka et al., 2025), has not yet been conducted.

Feedback: The quoted sentence asserts that "the resource-based decomposition of the export diversification curve… has not yet been conducted." Later parts of the dissertation, however, indicate that this is not strictly accurate. Section 2.4 explicitly cites Zarach and Parteka (2023a) as an exception that links natural resource dependence to diversification dynamics, and Section 3.4 credits Zarach and Parteka (2023a) (along with Parteka et al., 2025) with decomposing the relative Theil index and the export diversification curve by product groups, using a resource vs non-resource split.

Given that Chapter 5 is based on that co-authored article, and that the methodology of resource-based decomposition is already described there, the Introduction's claim that such a decomposition "has not yet been conducted" overstates the methodological novelty at the time the dissertation is written. It would be clearer to frame the contribution as extending and deepening an existing resource-based decomposition (e.g. by using a longer sample, different country groups, or additional taxonomies), rather than as the first instance of such a decomposition.

---

4. Mismatch between hypothesis H4 and its described analysis

Quote: > H4. The diversification trajectories of resource exporters are determined by technological innovation.

H4 identifies the key factors that influence the relationship between export diversification and natural resource exports. This provides a deeper understanding of diversification trajectories in resource-dependent countries.

Feedback: At first the juxtaposition of H4 and its brief description made the scope of the hypothesis slightly unclear. H4 itself states that "the diversification trajectories of resource exporters are determined by technological innovation," but the overview sentence that follows says more generically that "H4 identifies the key factors that influence the relationship between export diversification and natural resource exports," and section 5.3 then analyses both institutional quality and technological innovation.

After reading the conclusions, it becomes apparent that H4 is intended to be specifically about the role of technological innovation in shaping or mitigating diversification trajectories, while institutional quality is examined as an additional, complementary determinant. It might still help readers if the introduction's description of H4 explicitly restated "technological innovation" rather than the more generic "key factors," and if section 5.3 briefly clarified that the institutional-quality results are complementary to, rather than part of, the formal H4 hypothesis.

---

5. Inconsistent roadmap for the literature review

Quote: > This chapter recaps the current state of the discussion on economic effects of natural resources and provides a comprehensive overview of the literature on topics related to this dissertation's objectives, namely: (1) growth mechanisms in economic theory, (2) structural transformation and diversification dynamics, and (3) the growth effects of technological progress and the modern productivity paradox..

Feedback: The introductory roadmap for Chapter 2 does not align cleanly with the chapter's subsequent structure. The quoted sentence promises coverage of three topics: (1) growth mechanisms in economic theory, (2) structural transformation and diversification dynamics, and (3) the growth effects of technological progress and the modern productivity paradox. In the actual chapter, however, there are four distinct strands, reflected in sections 2.1–2.4, and the order differs:

- 2.1. Growth Mechanisms in Economic Theory
- 2.2. Natural Resources and Growth – the Resource Curse Debate
- 2.3. Growth Effects of Technological Progress and the Modern Productivity Paradox
- 2.4. Resource Dependence, Structural Change and Export Diversification

The resource-curse / "natural resources and growth" debate in section 2.2 is central to the dissertation, yet it is not explicitly mentioned in the Chapter 2 roadmap, unlike in the overall Introduction where it is bundled with "a review of the core economic growth theories." In addition, the roadmap lists structural transformation and diversification before technological progress, whereas the sections appear in the reverse order (2.3 then 2.4).

Clarifying this roadmap so that it transparently reflects the four main strands of the chapter (and their ordering), or explicitly stating that item (1) covers both general growth theory and the NR–growth debate, would make the signposting more consistent with the actual organization and reduce potential confusion for readers navigating a long literature review.

---

6. Misstatement of Ricardo's policy on the Stationary State

Quote: > Finally, the Ricardian model of economic growth, combining all the abovementioned theories, is based on the assumptions of the three factors of production, the labor theory of value, the law of diminishing returns in agriculture, Malthusian population growth, and perfect competition. According to this model, economic growth occurs through capital accumulation, which takes place via investment supervised by [^2]capitalists. ... Ricardo proposed several solutions for the Stationary State, including initiating international trade, repealing laws that benefit only landlords, and *protecting the price of goods* (Eltis, 1984).

Feedback: In the discussion of the Ricardian model of economic growth, there appears to be a contradiction in the description of Ricardo's proposed solutions for the Stationary State. The text mentions both "repealing laws that benefit only landlords" and "protecting the price of goods." Ricardo's well-known position in the Corn Laws debate was to advocate free trade and the repeal of tariffs that kept grain prices artificially high, precisely in order to lower the price of wage goods and sustain profits. As written, the sentence suggests that Ricardo simultaneously supported repeal of protectionist legislation and protection of goods prices, which points in opposite directions. This wording mischaracterizes his policy stance and should be clarified or corrected.

---

7. Misstatement of the Solow-Swan capital accumulation equation

Quote: > On the other hand, the capital accumulation equation describes how capital accumulates over time. According to this equation, the change in the capital stock equals the sum of the actual investment and the break-even investment. The breakeven investment addresses two issues: first, since capital depreciates, it must be replaced to prevent the capital stock from falling; second, since the quantity of effective labor is growing, the capital stock must grow to remain steady (Romer, 2010).

Feedback: The description of the capital accumulation equation for the Solow-Swan model is misleading as written. The text states that "the change in the capital stock equals the sum of the actual investment and the break-even investment." In the standard formulation, whether expressed in terms of capital per effective worker or in aggregate, the change in capital is driven by actual investment minus break-even investment (the amount needed to cover depreciation and to equip new effective units of labor). It would be helpful to correct this sign and, if desired, to clarify explicitly that the discussion refers to capital per effective worker rather than the aggregate capital stock.

---

8. Conflation of production function properties and model assumptions

Quote: > The key assumptions about the production function are that it has constant returns to scale, diminishing marginal returns to all inputs, an exogenous rate of population growth and technological progress, and that it defines all variables at every point in time.

Feedback: At first the phrase "key assumptions about the production function" made it sound as if the exogenous growth rates of population and technology were being treated as properties of the function $F(K,AL)$ itself, alongside constant returns and diminishing marginal products. Then I understood that the list is really meant to summarize the main technological-side assumptions of the Solow-Swan model, mixing properties of F with dynamic laws for L and A. It might nonetheless improve precision to distinguish explicitly between assumptions on the production function (CRS, diminishing returns) and assumptions on the exogenous growth of labor and technology.

---

9. Confusing characterization of the Solow model's growth limitations

Quote: > However, the model does not identify the determinants of technological progress because it treats knowledge accumulation as an exogenous factor. Thus, the Solow-Swan model lacks the prerequisites for long-term growth because it does not characterize the only potential long-term growth accelerator, technological progress (Romer, 2010; Campante et al., 2021).

Feedback: The final sentence of this paragraph seems to overstate the limitation of the Solow-Swan model. Just before, you correctly note that on the balanced growth path all variables grow at constant rates and that output growth is determined by the (exogenous) rate of technological progress. Saying immediately afterward that the model “lacks the prerequisites for long-term growth” reads as if the model cannot generate sustained growth at all, which contradicts the previous sentence. The underlying point appears to be that Solow does not *explain* or endogenize the determinants of long-run growth, since technological progress is treated as exogenous. It would help to rephrase this to emphasize the lack of an endogenous mechanism for *g*, rather than a lack of prerequisites for long-term growth per se.

---

10. Conceptual conflation in endogenous growth theory description (Sec. 2.1)

Quote: > Furthermore, the endogenous growth theory emphasizes the importance of a knowledge-based economy and the fact that investments in new technologies and human capital lead to increases in growth, such as constant return to scale and spillover effect (Helpman, 2004).

Feedback: The sentence “investments in new technologies and human capital lead to increases in growth, such as constant return to scale and spillover effect” risks conflating distinct elements of endogenous growth models. As written, the “such as” clause makes constant returns to scale and spillover effects appear as examples of “increases in growth,” whereas in the standard theory they are structural properties and externalities that allow investment in technology and human capital to sustain long-run growth. It would be helpful to rephrase this passage so that it clearly distinguishes between (i) the drivers of growth (investment in R&D and human capital), (ii) the model features that prevent diminishing returns and generate endogenous growth (e.g. constant returns to accumulable factors, knowledge spillovers), and (iii) the outcome (sustained economic growth).

---

11. Precision on "assumption" vs. "prediction" in Romer model critique

Quote: > Jones (1995a, 1995b) points out that despite the increase in the number of people engaged in R&D, U.S. data lacks evidence of an upward trend in TFP or output per worker. This contradicts the scale effect assumption in Romer's model.

Feedback: At first, the wording “This contradicts the scale effect assumption in Romer’s model” made me think that the scale effect might be treated as a primitive assumption, whereas in the preceding sentence it is correctly described as a prediction of the model. Then I understood from the context that you are using “assumption” informally for the bundle of primitives that give rise to the scale effect. To avoid any impression of conflating assumptions with implications, it may help to use the same term (e.g. “prediction,” “implication,” or “property”) when referring to scale effects in both sentences.

---

12. Mischaracterization of the Jones (1995a) model in Sec. 2.1

Quote: > Furthermore, the argument of population-led growth can easily be overturned since large countries do not necessarily grow faster, and the population of most countries has recently remained constant. Based on these observations, Jones (1995a) proposed a semi-endogenous R&D-based growth model. In this model, economic growth is determined solely by population growth (an exogenous factor) and technology (an endogenous factor). It does not respond to governmental interventions (Acemoglu, 2009).

Feedback: The paragraph summarizing the transition from Romer (1990) to Jones (1995a) could be made more precise in two respects.

First, the sentence "the argument of population-led growth can easily be overturned since large countries do not necessarily grow faster, and the population of most countries has recently remained constant" is potentially misleading. It frames the critique mainly as a cross-country size effect and asserts near constancy of population in "most countries," which is empirically questionable. In Jones's work, the central empirical issue is the lack of an upward trend in TFP despite large increases over time in R&D employment, and this time-series dimension already appears in your previous sentence.

Second, the statement that in Jones's semi-endogenous model "economic growth is determined solely by population growth (an exogenous factor) and technology (an endogenous factor)" is quite loose. It does not explain that the defining feature of the framework is that the long-run per capita growth rate is pinned down by the exogenous population (or R&D-labour) growth rate, while policy only affects the level of income or technology. Since this section introduces the model for the first time, tightening the wording here, and aligning it more closely with the mechanism you describe later in Section 2.3, would help avoid confusion about what "semi-endogenous" means.

---

13. Apparent contradiction on the nature of Schumpeterian innovation

Quote: > Furthermore, these innovation activities are a priori considered "green" (Aghion and Howitt, 2009). In other words, the Schumpeterian contribution does not categorize innovation as either "clean" or "dirty" technologies, while this type of division provides significant insight into the factors influencing endogenous technological growth, particularly when considering natural resources (Acemoglu et al., 2012; Smulders et al., 2014; Witajewski-Baltvilks and Fischer, 2023).

Feedback: The two consecutive sentences on Schumpeterian innovation are difficult to reconcile as written. The claim that "these innovation activities are a priori considered 'green'" suggests that innovation in the framework is assumed to be inherently resource-saving. The very next sentence, introduced with "In other words," states that the Schumpeterian contribution "does not categorize innovation as either 'clean' or 'dirty' technologies," which points instead to agnosticism with respect to environmental characteristics.

Taken together, and especially given the "In other words" connector, the passage seems to say both that innovation is assumed to be green and that the model does not distinguish green from dirty technologies. It would help to clarify what is meant here. For example, you might want to specify whether, in the environmental application of the Schumpeterian model you have in mind, you simply focus on a single, resource-saving innovation margin (without modelling a separate "dirty sector"), or whether the point is that the basic Schumpeterian framework is neutral with respect to clean versus dirty and that this dichotomy is introduced only later in directed technical change models. A modest rephrasing along these lines would prevent readers from perceiving these two sentences as contradictory.

---

14. Characterization of studies on resource abundance effects

Quote: > Nevertheless, examining individual countries reveals that production of natural resources impedes the development of various growth determinants (Buccellato and Mickiewicz, 2009; Oskenbayev et al., 2013; Papyrakis and Gerlagh, 2007; Zhang et al., 2009).

Feedback: Statement "Nevertheless, examining individual countries reveals that production of natural resources impedes the development of various growth determinants (Buccellato and Mickiewicz, 2009; Oskenbayev et al., 2013; Papyrakis and Gerlagh, 2007; Zhang et al., 2009)" seemed to suggest that all four cited papers are single-country or subnational case studies. But it is clear that the intention is more generally to contrast broad evidence of positive growth effects with more country-focused work highlighting adverse impacts on specific growth determinants.

To avoid any risk that readers interpret "examining individual countries" too literally as a statement about the precise sample design of each cited study, you might consider slightly relaxing or clarifying this phrasing (for example, by referring to "country- and region-level studies" or otherwise signalling that the list includes both single-country and more narrowly defined multi-country analyses). This is a minor issue of wording rather than a substantive problem with your synthesis.

---

15. Misplaced argument regarding governance's mediating role

Quote: > Reverse causality, whereby resource deposits are the cause of a lower level of democracy, may also occur (Barro, 1999; Ross, 2001; Jensen and Wantchekon, 2004; Collier and Hoeffler, 2005; Oskarsson and Ottosen, 2010; Arezki and Brückner, 2011; Tsui, 2011; Bjorvatn et al., 2012; Awoa Awoa and Ondoa, 2023). ... Furthermore, Park and Lee (2006) emphasize that African countries must maintain a certain quality of governance to avoid the negative effects of resource exports on economic growth. This effect is exacerbated by their non-democratic and unstable political environments.

Feedback: At first the sentence on Park and Lee (2006) made me think the paragraph was shifting away from reverse causality toward the mediating role of institutions in the resource–growth nexus, because it emphasizes governance as a condition for avoiding negative growth effects. Then I understood that the opening sentence ("The quality and type of governance play a crucial role…") is meant to introduce both channels at once (institutions as mediators and resources affecting political regimes), and that the follow-up clause on "non-democratic and unstable political environments" connects Park and Lee back to the democracy dimension. To avoid the uncertainty about whether this sentence belongs to the mediation or the reverse-causality story, you might consider making that bridging function explicit (for example, by signalling more clearly that you are discussing both channels within the same governance-focused paragraph).

---

16. Contradictory use of Yemen as an example

Quote: > Resource abundance does not always lead to slow growth, as some developing resource exporters (e.g., Botswana, Chile, Peru, and Yemen) have experienced positive economic growth. Importantly, Badeeb et al. (2017), building on Karl (2005), argue that the problem of the resource curse may lie in low natural resource diversification rather than in possessing natural resource deposits.

Feedback: The Introduction cites Yemen (via Badeeb and Lean, 2017) as a "commonly studied" example where the perception of resource-driven failure materializes, whereas Section 2.2, summarizing Badeeb et al. (2017), lists Yemen among developing resource exporters that "have experienced positive economic growth." Because these two uses of Yemen are not accompanied by any indication of time horizon or outcome dimension (e.g., overall institutional/political performance versus periods of GDP growth), some readers may wonder how to reconcile them.

---

17. Potentially confusing summary of meta-analysis on institutions

Quote: > The authors also stress that, while institutional quality plays no significant role in the natural resource-economic growth nexus, its interaction with natural resources is crucial for economic prosperity.

Feedback: The sentence summarizing Dauvin and Guerreiro (2017) that states "institutional quality plays no significant role in the natural resource–economic growth nexus, its interaction with natural resources is crucial for economic prosperity" risks being misread. At first glance, "plays no significant role" can be taken to mean that institutions are unimportant for the resource–growth relationship, which appears at odds with both the prior discussion in this section and the very next clause that labels the interaction term as "crucial."

Given that Dauvin and Guerreiro distinguish direct effects of institutions from effects operating through an NR×institutions interaction, it would be helpful to spell out that their meta-analysis finds the *direct* coefficient on institutional quality to be often statistically insignificant, while the interaction between institutional quality and natural resources is statistically and economically important. Making this distinction explicit would avoid any impression that institutions are irrelevant and would keep the wording fully consistent with the broader narrative that institutional quality conditions the resource–growth relationship.

---

18. Misstatement of the Jones (1995) evidence in Sec 2.3

Quote: > One of the greatest challenges to Romer's model of endogenous technological change is the discrepancy between long-term trends in R&D and productivity, primarily within OECD countries. Even though the number of people engaged in R&D in the US has increased fivefold between the 1950s and the 1990s, there has been no visible upward trend in Total Factor Productivity (TFP) nor in output per worker. (Jones, 1995a, 1995b).

Feedback: The sentence attributes to Jones (1995a, 1995b) the claim that “there has been no visible upward trend in Total Factor Productivity (TFP) nor in output per worker.” This is misleading. In the postwar U.S. data, the levels of TFP and output per worker do exhibit clear upward trends. What Jones emphasizes is that their growth rates have not trended upward (and may even have declined) despite a large increase in R&D inputs. Since the surrounding discussion is about the scale-effect critique, it would be important to clarify explicitly that the puzzle concerns the absence of an upward trend in the *growth rate* of TFP and output per worker, not in their levels.

---

19. Imprecise definitions of technological neutrality in Sec 2.3

Quote: > Within the production, technology can be incorporated as either Hicks-neutral (factor augmenting), Harrod-neutral (labor augmenting) or Solow-neutral (capital augmenting) factor. Initially, technology was seen as a means of improving labor productivity and product quality, as well as generating new, growth-enhancing ideas (Romer, 1990; Jones, 2005; Klump et al., 2007).

Feedback: The phrase “Hicks-neutral (factor augmenting)” is not fully consistent with the standard taxonomy of technical change. In growth and production theory, Harrod-neutral and Solow-neutral changes are specific forms of factor-augmenting technical progress (labor- and capital-augmenting, respectively). Hicks-neutral change is typically represented as $Y = A(t)F(K,L)$ and described as output-augmenting or factor-neutral; it can be seen as a special case of factor-augmenting only when both inputs are augmented proportionally. As written, the sentence blurs this distinction and may give the impression that Hicks-neutrality is synonymous with factor augmentation in general. It would improve precision to separate clearly the general factor-augmenting form from its Harrod, Solow, and Hicks cases and to avoid implying that only Hicks-neutral change is “factor augmenting.”

---

20. Contradictory Numbering of Industrial Revolutions (Sec. 2.3)

Quote: > Finally, the fifth industrial revolution began in the 1970s with the introduction of the microprocessor by Intel and was based on digitalization and computerization.

As mentioned above, significant technological advancements have consistently been associated with increased productivity (Schurr et al., 1960; Crafts, 2004). Therefore, since the

1980s, the impact of information and communication technologies (ICT), an indicator of the third Industrial Revolution, has been intensively analyzed...

Feedback: The passage assigns two different ordinal labels to the same technological episode. The microprocessor-based digital revolution of the 1970s is first described as the "fifth industrial revolution," while the next paragraph refers to ICT as "an indicator of the third Industrial Revolution." Because both sentences clearly refer to the same ICT/digital wave, this shift in numbering, without explanation, is confusing.

It appears that you are drawing simultaneously on Freeman and Perez's framework of five technological "revolutions" or techno-economic paradigms (where the ICT paradigm is the fifth) and on the more standard usage in the growth and productivity literature that labels the ICT wave as the third Industrial Revolution. It would help to adopt a single numbering convention in this section or explicitly distinguish between the Freeman–Perez "fifth technological revolution" and the commonly termed "third Industrial Revolution," so that readers do not have to infer why the same episode is numbered differently across consecutive paragraphs.

---

21. Incomplete summary of Brynjolfsson et al. (2019) on the productivity paradox

Quote: > Brynjolfsson et al. (2019) specifically point to false hopes, overegged optimism, mismeasurement of output and productivity, and the fact that the benefits of new technologies are enjoyed only by a few.

Feedback: The current summary of Brynjolfsson et al. (2019) in this sentence omits one of their main proposed explanations for the modern productivity paradox. They discuss not only false hopes, mismeasurement, and the concentration of gains among a few firms, but also implementation and restructuring lags associated with adopting AI as a general-purpose technology, which they later formalize as a “productivity J-curve.” Given how central this lagged-adjustment mechanism is in their work and in subsequent discussions of the productivity paradox, it would be helpful to add a brief reference to this fourth explanation when citing Brynjolfsson et al. (2019). You might also consider whether “false hopes, overegged optimism” needs to be expressed as two separate phrases, since both refer to the same underlying idea.

---

22. Potential misstatement of Heckscher-Ohlin theorem in Sec. 2.4

Quote: > If a commodity uses a relatively large amount of capital (i.e., primary commodities), then countries with abundant natural resources will have a comparative advantage in producing that commodity (Leamer, 1995).

Feedback: I initially had trouble with the way the link from Heckscher–Ohlin theory to primary commodities is phrased in this sentence. As written, it can be read as saying that if a good is capital-intensive, then countries with abundant natural resources (rather than abundant capital) will have a comparative advantage in it, and it also seems to equate “capital-intensive commodities" with "primary commodities." In the standard HO framework, capital and natural resources (or land) are distinct factors, and comparative advantage in a good follows from relative abundance of the factor that is used intensively in that good's production.

Because of this, the current wording risks suggesting that resource abundance by itself explains specialization in capital-intensive activities, which is not what HO theory implies, and it overstates the identification between "capital-intensive" and "primary" goods. Clarifying the roles of capital versus natural resources in this sentence, and avoiding an apparent equivalence between capital intensity and primary commodities, would make the theoretical reference more accurate and prevent misinterpretation, without affecting the broader narrative about endowments and specialization.

---

23. Contradictory description of the 'diversification curve' in Sec. 2.4

Quote: > Then, as income per capita increases, they undergo a diversification process. They progress through manufactured goods of various levels of advancement, and their export structures finally become more heterogeneous, consisting mostly of advanced products. (Cadot et al., 2011a). ... Some scholars have also postulated a nonlinear relationship and re-specialization at high development levels (Imbs and Wacziarg, 2003; Cadot et al., 2011a). However, this concept is disputed

Feedback: The description of the "stages of diversification" and the diversification curve in Section 2.4 is potentially misleading and internally inconsistent.

The passage first states that as income rises, countries "undergo a diversification process" and "finally become more heterogeneous, consisting mostly of advanced products (Cadot et al., 2011a)." This reads as a monotonic story in which export heterogeneity steadily increases and remains high at advanced stages of development. Immediately after, the text says that "some scholars have also postulated a nonlinear relationship and re-specialization at high development levels (Imbs and Wacziarg, 2003; Cadot et al., 2011a). However, this concept is disputed."

In the core diversification literature, however, the term "stages of diversification" (Imbs and Wacziarg, 2003) and the key result in Cadot et al. (2011a) both refer precisely to a non-monotonic, hump-shaped pattern: countries first diversify and then re-specialize at high development levels. The controversy in later work (e.g. De Benedictis et al., Parteka and Tamberi, Mau, Gnidchenko) concerns the presence and strength of the re-specialization phase, not whether nonlinearity is an adjunct to a separate, monotonic "stages" view.

As written, the section effectively assigns Cadot et al. (2011a) to two partially conflicting narratives (a purely diversifying "final" stage versus a hump with re-specialization) and treats the hump-shaped interpretation as an additional, disputed hypothesis rather than as the standard formulation of the "stages of diversification" concept. This is confusing, especially since the later empirical chapters of the thesis adopt and estimate a hump-shaped diversification curve.

It would be helpful to revise this part of Section 2.4 to (i) clearly define the diversification curve as typically hump-shaped in the main contributions, (ii) explain that the re-specialization segment is empirically debated, and (iii) align the citations to Imbs and Wacziarg (2003) and Cadot et al. (2011a) with this standard usage.

---

24. Clarifying the "between/within" Theil decomposition

Quote: > Cadot et al. (2011a) proposed the decomposition of the absolute Theil index into between and within components (also referred to as extensive and intensive export margins, as in Hummels and Klenow (2005)), by dividing export lines into active and inactive ones.

Feedback: At first, the earlier discussion of Cadot et al. (2011a) describing their “between” and “within” Theil components as corresponding to the extensive and intensive margins made me think that “between” would always carry that extensive-margin interpretation in what follows. Then I understood, from equations (4)–(6) and the accompanying text in section 3.4, that your own decomposition is of a different type: the “between” term reflects inequality between predefined product groups (e.g. resources vs. non-resources), and the “within” terms capture inequality inside each group.

Because “between/within” are standard generic labels in decomposition work, this is not a conceptual problem, and your formulas and verbal explanations in section 3.4 and section 5.1 are correct. Still, you might consider adding a short sentence when you introduce your decomposition (or at the start of section 5.1) to remind the reader that your “between/within” terminology here refers to a group-based decomposition and is distinct from the extensive/intensive margin decomposition of Cadot et al. (2011a) reviewed earlier.

---

25. Clarifying the novelty of the main explanatory variables

Quote: > This dissertation adopts a different approach, where key explanatory variables are created using raw disaggregated export data and newly elaborated product-level taxonomies. These variables include natural resource dependence proxied by the share of natural resources in a country's total exports, and technological specialization, proxied by the share of technologically advanced products in a country's total exports.

Feedback: The quoted passage juxtaposes a critique of “aggregate data” in the prior literature with the definition of your own key variables as country-level export shares. At first this can very briefly suggest that the novelty might lie in the functional form of the variables, whereas the substantive innovation is actually in how those shares are constructed from HS6 BACI data and custom product-level taxonomies, as is made clear in Sections 3.2 and 3.3.

Statement “This dissertation adopts a different approach, where key explanatory variables are created using raw disaggregated export data and newly elaborated product-level taxonomies” thus already points in the right direction, and a careful reader will understand the contribution once they see the subsequent discussion of taxonomies and specialization indices. However, if you want to pre-empt even a momentary ambiguity, you could consider signalling more explicitly here that the variables are standard country-level export shares whose novelty lies in their bottom-up construction from highly disaggregated trade data and refined resource/technology classifications, rather than in the aggregation form itself.

---

26. Confusion over HS Nomenclature in BACI Data

Quote: > The BACI CEPII database supplies product-level data on bilateral trade flows identified at the 6-digit level, which is consistent with the six subsequent Harmonized System (HS) nomenclatures, each of which covers a different time span... The HS96 nomenclature was chosen due to the availability of data and the potential for cross-checking with other data sources.

Feedback: At first, the sentence "The HS96 nomenclature was chosen…" made me think that the BACI database might be being mischaracterized as if the default classification were something else. Then I understood from Appendix A and the references to HS96 6-digit taxonomies that you are simply indicating that all subsequent work is carried out in the HS96 product classification.

To avoid any residual ambiguity for readers who know other descriptions of BACI, it could help to state explicitly that you use the BACI release coded in HS96 at the 6-digit level, and that your resource and technology taxonomies are defined on that nomenclature.

---

27. Ambiguity in Creating the Balanced Product Panel

Status: [Pending]

Quote: > Secondly, the issue of an unequal number of product codes throughout the analyzed timespan was addressed. In order to obtain a balanced dataset, vanishing product codes were deleted. The final database comprises 4747 product codes.

Feedback: The brief description of how you balance the product dimension over time leaves some room for interpretation. The sentence "In order to obtain a balanced dataset, vanishing product codes were deleted" does not specify exactly what counts as a "vanishing" code (e.g. absent in at least one year in the world data, absent for some minimum number of years, etc.) or how many HS96 codes are dropped relative to the full nomenclature, beyond the final total of 4,747.

Clarifying the precise criterion used to eliminate codes, and indicating roughly how large a share of the HS96 product space this affects, would make the construction of the database more transparent and easier to replicate. A short remark that this step fixes the HS96 product universe over 1996–2021, while all extensive-margin dynamics occur at the country–product level within that universe, would also help readers to understand the implications for the diversification measures you compute.

---

28. Data construction may bias diversification measures

Quote: > Secondly, the issue of an unequal number of product codes throughout the analyzed timespan was addressed. In order to obtain a balanced dataset, vanishing product codes[^61] were deleted. The final database comprises 4747 product codes.

[^61]Product codes that were not present in the dataset for the entire 1996-2021 period were removed. This was done to ensure that the number of product codes was consistent across all years, which is a necessary condition for calculating the Theil index.

Feedback: The decision to retain only those HS6 product codes that are present in the data for every year 1996–2021 implies that the Theil indices and their decompositions are computed over a fixed, "always-traded" product universe. This is presented in footnote 61 as a "necessary condition" for calculating the Theil index.

This design choice has substantive implications. It deliberately removes product codes that enter or exit over the sample window, so the diversification measures reflect reallocations across a time-invariant basket of goods (an intensive-margin perspective) rather than capturing extensive-margin dynamics driven by new product lines. For a study that links diversification and structural change to technological progress, this is important, since some product innovation and 4IR/ICT/TECH activity may take the form of new HS6 lines that would be excluded by construction.

Moreover, while a fixed product set simplifies comparability of the RT index across years and avoids technical issues when world export shares are zero, it is not literally a mathematical necessity for computing a Theil index: the standard approach is to define a common universe of HS6 codes and treat non-traded products as zeros. Alternative treatments of changing product sets are therefore possible.

It would be helpful to (i) state explicitly that the analysis is intentionally confined to diversification within a stable set of product codes, and that extensive-margin effects are not modelled; (ii) briefly discuss how restrictive the "present in all years" rule is for the resource and technology taxonomies (e.g. how many codes are lost); and (iii) if feasible, provide a robustness check with a less stringent product-selection rule or with the full, unbalanced product universe. This would make clear that the main findings are not an artefact of the balanced-code restriction.

---

29. Definition of the group-specific relative Theil index

Quote: > For example, the relative Theil index for a group of resource products g = TOTAL NR, would be calculated using the following formula:

$$RT_{NR,c} = \sum_{NR} \left[S_{NR,c} * \ln \left(\frac{s_{NR,c}}{s_{NR,w}} \right) \right]$$

where: - $S_{NR,c}, S_{NR,w}$ - share of TOTAL NR group in a country's c (world's w) total exports.

Feedback: I initially had trouble with the definition of the group-specific relative Theil index because the example for $RT_{NR,c}$ combines a summation sign with terms that are defined as aggregate group shares. As written,

$$RT_{NR,c} = \sum_{NR} \left[S_{NR,c} \ln \left(\frac{s_{NR,c}}{s_{NR,w}} \right) \right],$$

with $S_{NR,c}$ described as "share of TOTAL NR group in a country's total exports," implies summing a constant scalar over products, which is not meaningful. Moreover, the expression $S_{NR,c} \ln(S_{NR,c}/S_{NR,w})$ is the between-group term for the NR aggregate used later in the decomposition, whereas $RT_{NR,c}$ should be a within-group index built from product-level exports in the NR group.

This inconsistency between the formula, the bullet-point definition, and the role of RT_g^c in equation (4) makes it unclear how group-specific relative Theil indices were actually computed. It would be important to correct this example so that $RT_{g,c}$ is explicitly defined as a sum over products in group g, with shares and world benchmarks specified consistently, and to distinguish it clearly from the between-group term $S_g^c \ln(S_g^c/S_g^w)$. Aligning the notation in Section 3.3 with the decomposition in Section 3.4 would remove this ambiguity about the construction of a key variable.

30. Notation in RCA formula (sec: 3.3)

Quote: > The RCA index employed in this dissertation, which is based on the original Balassa index, is computed as the ratio between a share of a specific product in the country's overall exports and the share of this product's global exports in the world's overall exports (Halilbasic and Brkic, 2017):

$$RCA_c = \frac{s_{i,c}}{S_{i,w}} = \frac{\frac{E_{i,c}}{E_c}}{\frac{E_{i,w}}{E_w}}$$

where:

- $S_{i,c}, S_{i,w}$ - share of product i in total exports of country c (world w),

Feedback: In the formal definition of the RCA index, there are two small but noticeable notational inconsistencies. The index is computed for a specific product and country, as indicated by the presence of i and c on the right-hand side (e.g. $E_{i,c}$), so the left-hand side would more accurately be written as $RCA_{i,c}$ rather than RCA_c. In addition, the compact expression uses a lowercase $s_{i,c}$ in the numerator even though the variable list immediately below defines the export shares as $S_{i,c}$ and $S_{i,w}$. Using a consistent subscript structure on RCA and a single symbol (either s or S) for the export shares in both the formula and the definitions would remove this minor source of confusion in an otherwise standard definition.

31. Ambiguity in the definition of the absolute Theil index

Quote: > The absolute (unweighted) version of the Theil index implemented in this dissertation is based on Theil's entropy [77] index (as in Cadot et al., 2011a) and was calculated using the Stata software module EGEN_INEQUAL, which provides extensions to generate inequality and poverty measures (Lokshin & Sajaia, 2006):

$$\text{Theil }_c = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{E_{i,c}}{\mu} * \ln\left(\frac{E_{i,c}}{\mu}\right)\right]$$

where:

- $\mu = \frac{1}{n}\sum_{i=1}^{n} E_{i,c}$
- n-total number of products exported in the analyzed group of countries.

Feedback: At first the definition of n in the absolute Theil formula made me think that you might be using a country-specific n_c (the number of products a given country exports), whereas I am used to seeing the index defined either with n_c or with a fixed product universe. Then I understood from Section 3.1 that you construct a balanced dataset with a common set of HS6 product codes for all countries and years, and that n is intended to denote this fixed number of product lines.

Given that, the definition is internally consistent and the implementation is in principle replicable using EGEN_INEQUAL. It may still help future readers if you spell this out more explicitly here (for example, by stating that n is the number of HS6 product codes in the common universe, constant across countries and years, and whether zero-export product lines are treated as zeros or simply absent). That would fully pin down the normalization of the absolute Theil index without changing your empirical results.

---

32. Minor inconsistencies in Relative Theil index exposition

Quote: > As posited by Gnidchenko (2021) and Parteka and Tamberi (2013a), relative measures are more suitable for analyzing export diversification in a panel data setting because they compare the export structure of a given country to the common benchmark (which is the rest of the countries considered). The relative Theil index for country c and product i is computed following Gnidchenko (2021):

$$RT_c = \sum_{i=1}^{n}\left[S_{i,c} * \ln\left(\frac{s_{i,c}}{s_{i,w}}\right)\right]$$

Feedback: The main definition of the relative Theil index could be made more precise on two small points. The text currently states that it is "for country c and product i," but the formula defines RT_c as a single country-level index obtained by summing over all products i. It would be clearer to describe RT_c explicitly as a country-level measure constructed from product-level data, rather than as an index "for country c and product i."

In addition, there is some notational inconsistency in the way export shares are denoted. In the RCA formula, the main equation uses $s_{i,c}$ and $s_{i,w}$, while the accompanying explanation refers to $S_{i,c}$ and $S_{i,w}$ as the shares. In the relative Theil expression, $S_{i,c}$ appears as the weight and $s_{i,c}$ inside the logarithm, but both terms represent export shares. Although the intended meaning is clear from context and from the explicit definitions in terms of $E_{i,c}/E_c$, using a single symbol for export shares throughout (either all s or all S) would improve notational consistency and avoid any momentary confusion.

---

33. Inconsistent labelling of the "export diversification curve" in Figure 3.1

Quote: > The export diversification curve demonstrates a link between the development level (proxied by output per worker) and the degree of export diversification, plotted across country-year data points (see a graphical representation in Figure 3.1). ... Figure 3.1. Export diversification curve - scheme

Feedback: The definition in Section 3.3 makes clear that RT is an inverse measure of export diversification: higher values of RT mean higher specialization and lower diversification. In Figure 3.1, however, the y-axis is labelled “index of export diversification (RT),” and the text just above speaks of plotting “the degree of export diversification,” which, taken literally, suggests that higher RT corresponds to more diversification. Within the figure, the annotations (“HIGH SPECIALIZATION” at the top, “LOW SPECIALIZATION” at the bottom, and the “DIVERSIFICATION PROCESS” arrow along the downward-sloping part) correctly treat RT as a specialization index, so the graphical logic is internally consistent, and a careful reader can reconstruct the intended interpretation. Nonetheless, the axis label and nearby sentence are out of line with the formal definition and with later figure notes in Chapter 5 where you explicitly remind the reader that RT is inverse diversification. It would be helpful to relabel the vertical axis (and, if you wish, tweak the accompanying sentence) so that RT is consistently described as a specialization or inverse diversification index at the point where the export diversification curve is first introduced.

---

34. Imprecise description of RCA statistic in text

Quote: > High-income economies tend to specialize in fossil fuels, which constitute 85% of all their resource exports. At the same time, rich fossil fuel exporters (including countries such as Saudi Arabia and the United Arab Emirates) reveal a comparative advantage in, on average, 20% of their exported products.

Feedback: The sentence “rich fossil fuel exporters … reveal a comparative advantage in, on average, 20% of their exported products” is somewhat imprecise about the denominator. Table 4.1 and its note make clear that the reported percentages are computed relative to the total number of natural-resource product codes within each resource group (e.g. fuel), not relative to all exported products across the entire HS6 universe. Since this sentence appears immediately after introducing Table 4.1, it would help to state explicitly that the 20% refers to natural resource export product lines (or fuel-related products) rather than to all exported products, to avoid any ambiguity about how broad the underlying RCA measure is.

---

35. Temporal sequence of Pension Fund and fiscal rule in Norway case

Quote: > Thirdly, following the fiscal rule implemented in 2001, the Norwegian government ensured that most oil revenues were saved in the form of the Pension Fund, founded in 1990. Thus, in the event of diminishing petroleum production or fluctuating petroleum prices, current and future generations will enjoy the unchanging benefits of abundant oil resources, which are compensated by the returns from the Pension Fund (Holden, 2013).

Feedback: The sentence describing Norway’s fiscal framework could invite a confusing temporal reading. The current wording (“following the fiscal rule implemented in 2001, the Norwegian government ensured that most oil revenues were saved in the form of the Pension

Fund, founded in 1990") might suggest that the 2001 rule both initiated and governed the saving mechanism, even though the fund itself clearly pre-dates the rule. Clarifying in one place that the Pension Fund was established in 1990, and that the fiscal rule adopted in 2001 subsequently formalized the framework for saving and spending petroleum revenues via this fund, would make the institutional sequence more transparent.

---

36. On the 'most significant cause' of diversification

Quote: > The readiness to diversify exports is not the only factor pushing resource-dependent countries towards more technologically advanced products. The most significant cause is the global shift towards renewable energy sources, which forces them to find an alternative source of income as fossil fuels are abandoned and eventually depleted.

Feedback: The sentence that "the most significant cause is the global shift towards renewable energy sources" makes a very strong, general claim about the drivers of diversification among fossil-fuel exporters. Elsewhere in the dissertation, however, you acknowledge multiple important motives (e.g. declining per capita oil revenues in Saudi Arabia, volatility, Dutch disease, institutional factors), and the empirical work does not attempt to rank these causes.

Given that the period studied (1996–2021) spans years when the energy transition was only gradually gaining prominence, it would be safer to present the global shift to renewables as a major or increasingly important driver, rather than as "the most significant" one, or to frame the statement explicitly as forward-looking. This would keep the substantive point while better matching the range of mechanisms discussed in the thesis.

---

37. Contradiction in Figure 4.5 note

Quote: > Figure 4.5. Re-specialization towards resource exports - selected countries
Notes: countries selected above recorded an increase in the share of resource exports throughout the 1996-2021 period; at the same time, the share of technological exports remained unchanged or decreased.

Feedback: The note to Figure 4.5 states that the selected countries both increased the share of resource exports and had the share of technological exports "remain unchanged or decrease" over 1996–2021. However, using the same underlying data (e.g., Table A.12) and the plotted series, the TECH export share clearly rises between 1996 and 2021 for Iceland and Mozambique, and to a lesser extent for Jamaica.

If "remained unchanged or decreased" is meant literally over the sample period, this wording is inaccurate for these three cases and may confuse readers about the actual selection criteria for Figure 4.5. It would be helpful either to adjust the note to reflect what the figure shows (for example, that TECH shares stayed very low and did not increase commensurately with NR shares) or to drop the condition on technological exports from the note, so that the description unambiguously matches the data in all eight panels.

38. Ambiguity in GMM specification for dynamic panel

Quote: > Therefore, to avoid losing all crosscountry variability, country fixed effects are not included in the regressions (Barro, 2015; Bahar and Santos, 2018). ... Therefore, we use a two-step efficient GMM estimator with a one-year lag of the potentially endogenous variable as an instrument.

Feedback: At this point the description of the estimation strategy makes it difficult to see exactly how the dynamic term and endogeneity are being handled. The model includes a lagged dependent variable and no country fixed effects, yet the text simply refers to a "two-step efficient GMM estimator with a one-year lag of the potentially endogenous variable as an instrument," and the table footnotes indicate that only $NR_{c,\,t-1}$ is instrumented.

For readers familiar with dynamic panel methods, it would help to spell out more precisely which variables are treated as endogenous or predetermined, what instruments are used for each, and which specific GMM implementation is used (e.g. a pooled IV–GMM in levels, rather than difference or system GMM). In particular, given the presence of $y_{c,t-1}$ and the likely existence of time-invariant country heterogeneity, it would be useful to explain why $y_{c,t-1}$ is left uninstrumented and how any resulting bias in the convergence coefficient is assessed relative to the benefits of preserving cross-country variation in the resource share.

---

39. Use of price index as a substitute for time fixed effects

Quote: > Moreover, to account for the volatility of natural resource prices, we include the resource price index $P_{t}^{N R}$ as a substitute for time-fixed effects. Finally, exports of natural resources tend to be highly persistent, as shown in Table A. 14 in Appendix A, due to relatively stable extraction and production levels.

Feedback: In the baseline specification you state that the resource price index P_t^{NR} is included "as a substitute for time-fixed effects." This invites two questions.

First, using a scalar price index instead of a full set of year dummies implicitly restricts the way common shocks enter the model, effectively assuming that the main global forces relevant for productivity growth operate through natural-resource prices. It would be useful to briefly explain this trade-off—namely, that it allows you to identify the impact of global commodity price movements on growth, at the cost of not fully absorbing other year-specific shocks—and, if possible, indicate whether adding full year dummies (and dropping P_t^{NR}) materially affects the estimated effect of $NR_{c,t-1}$.

Second, the notation P_t^{NR} is generic, but the text in Chapter 3 refers to "annual resource price indices of selected natural resources." Clarifying in the main text which specific price index is used in each of the resource-specific regressions (TOTAL NR, FUEL, METAL, MINERAL, etc.), and whether they differ across columns in Tables 4.2–4.3 and 5.2–5.4, would make it easier to interpret the role of P_t^{NR} and the associated coefficients.

---

40. Interpretation of coefficient magnitudes in regression results

Quote: > Other things being equal, a 1 -percentagepoint (p.p.) increase in the share of TOTALNR exports is associated with a $1.685-\mathrm{p} . \mathrm{p}$. increase in the productivity growth rate. ... Ceteris paribus a 1-p.p. increase in the share of fuel exports is associated with a 2 -p.p. increase in the output-per-worker growth rate. Petroleum oils have a similar, albeit slightly stronger, relationship with productivity growth (a $2.37-p.p. increase). Conversely, mineral resources impede the process of catching-up (a 3.14-pp decrease).

Feedback: The marginal effects of the resource and technology share variables appear to be misinterpreted throughout the discussion of the regressions in sections 4.2, 4.3, and 5.2. According to the table notes and the summary statistics, the NR and TECH variables enter the regressions as shares expressed as decimals between 0 and 1, while the dependent variables are either growth rates in percent or log indices. Under this scaling, a coefficient such as 1.685 on NR_{c,t-1} in Table 4.2 implies that a one-unit increase in the share (from 0 to 1) raises the growth rate by 1.685 percentage points; a 1-percentage-point increase in the share (i.e. 0.01) changes the growth rate by only $1.685 x 0.01 approx 0.017$ percentage points. Similar factor-100 discrepancies arise in Section 4.3 for the TECH and NR coefficients in Table 4.4, and in Section 5.2 for the log–level specification ln RT_{ct} in Table 5.2 (where the text also conflates percentage and percentage-point changes). The underlying estimates are fine, but the prose currently overstates the economic magnitudes and mixes up levels and logs; it would be important to recalibrate all verbal interpretations to the documented 0–1 scaling of the regressors and the log specification of the diversification regressions.

---

41. Confusing discussion of interaction term results in Sec. 4.3

Quote: > Additionally, the negative interaction terms suggest that adding technologically advanced products to the resource-based export basket could exacerbate output per worker growth. Nevertheless, these findings are statistically insignificant. The positive influence of technological specialization is only visible in the empirical results with MINERAL resources (see estimation (5) in Table 4.4).

Feedback: The paragraph discussing the interaction terms in Table 4.4 is difficult to parse as written. It first notes that the interaction terms are (mainly) negative and then states that “these findings are statistically insignificant,” before immediately highlighting a “positive influence of technological specialization” for MINERAL resources. While careful reading and inspection of Table 4.4 show that you intend “these findings” to refer only to the negative interactions (which are indeed insignificant) and that the MINERAL case is the single positive, weakly significant interaction, this is not made explicit and can easily be read as contradictory. In addition, the phrase “exacerbate output per worker growth” is ambiguous: given the negative coefficients, it would be clearer to say that adding technologically advanced products tends to *reduce* or *dampen* output-per-worker growth (or exacerbate an existing slowdown). Clarifying the reference of “these findings” and rephrasing this sentence would help readers follow the logic of the interaction results more easily.

42. Unclear instrument choice in diversification regressions

Quote: > Notes: ,, denote significance at the $1 \%, 5 \%$, and 10% levels, respectively; robust standard errors in parentheses; all specifications contain time fixed effects in the form of NR price indices $\left(P_{t}^{N R}\right)$; K-P refers to the Kleibergen-Paap test statistics. Instrumented variable: $\ln D E V_{c, t-1}$. Constant included - not reported.

Feedback: The estimation strategy for equation (10) in Section 5.2 is not clearly specified in the text. The discussion introduces the model and defines NR_{ct}, ln SIZE_{ct}, ln DEV_{c,t-1} and the geopolitical controls, but does not state whether the equation is estimated by OLS, fixed effects, IV, or GMM, nor which regressors are treated as endogenous. Only the notes to Tables 5.2–5.4 reveal that an IV-type estimator is used and that ln DEV_{c,t-1} is instrumented (Kleibergen–Paap statistics are reported), while NR_{ct} appears to be treated as exogenous. Given the mechanical link between export composition and both NR_{ct} and RT_{ct}, and the fact that Chapter 4 treats resource dependence as potentially endogenous, it would be important to explain (i) why lagged development is the only variable instrumented here, (ii) what instruments are used for ln DEV_{c,t-1}, and (iii) why NR_{ct} is not also treated as endogenous in this setting. Without such clarification in the main text, it is difficult for the reader to fully assess the validity of the diversification regressions.

43. Interpretation of log-level regression coefficient in sec:Diversification

Quote: > Regarding the relationship between natural resource dependence and diversification of exports, a $1-\mathrm{p} . \mathrm{p}$. increase in the share of TOTAL NR products in a country's total exports yields a $0.145-\mathrm{p} . \mathrm{p}$. increase in the value of the $R T$ index, ceteris paribus.

Feedback: The sentence interpreting the coefficient on the TOTAL NR share in equation (10) appears to misstate the magnitude and units of the effect. Since equation (10) is specified with ln RT_{ct} as the dependent variable and NR_{ct} as a share between 0 and 1, the coefficient 0.145 implies that a one-unit increase in NR_{ct} (i.e. a 100-percentage-point change in the resource share) is associated with an approximate 14.5% increase in the level of the RT index. A 1-percentage-point increase in the resource share (Delta NR = 0.01) therefore corresponds to only about a 0.145% increase in RT, not a 0.145 “percentage-point” increase in the index itself.

Because RT is a dimensionless index (with mean around 2.9), changes in it are best described in percentage terms or in absolute units (e.g. at the sample mean), rather than in percentage points. Revising this passage so that it reflects the log–level interpretation—either as a percentage change in RT or as the implied absolute change at a reference RT level—would bring the verbal discussion in line with the econometric specification and avoid overstating the size of the estimated effect.

44. Unexplained omission of a dependent variable

Quote: > Due to the characteristics of the INNOV_{c t} variable estimates for model (12) include only two dependent variables, namely, diversification of overall exports (ln RT_{c t}) and the diversification of non-resource exports ln RT_{c, non N R_{t}.

Feedback: The text states that, "Due to the characteristics of the INNOV_{ct} variable," estimates for model (12) are reported only for overall export diversification and for non-resource exports, omitting the diversification of technological exports (ln RT_{c,TECH_t}) that appears elsewhere in the chapter. Since INNOV_{ct} is proxied in part by the share of technologically advanced products in total exports, this exclusion likely reflects a nontrivial identification concern. It would be helpful to add a brief explanation in the main text (in addition to any footnote) of which specific "characteristics" of INNOV_{ct} make it problematic to use ln RT_{c,TECH_t} as a dependent variable in this specification, so that readers can clearly understand the scope and rationale of the reported results.

---

45. Contradictory findings in robustness checks

Quote: > For NR exporters, a 1-p.p. increase in the share of natural resource exports yields a $0.272-p.p. decrease in the value of the overall RT index (eq. (1) in Table B. 27 in Appendix B). This finding suggests that strengthening the dependence on natural resources in countries that are already heavily dependent on them promotes diversification of overall exports.

Feedback: The robustness checks for model (10) report that, in the subsample of NR exporters, a 1 p.p. increase in the share of natural resource exports is associated with a 0.272 p.p. decrease in the overall RT index, and that the relationship between RT and TOTAL NR is also negative (though marginal) for developing countries. These signs differ from the positive full-sample coefficient in Table 5.2, yet they are currently summarized in only one or two sentences and directly interpreted as diversification-enhancing. Given the central role of NR exporters in the thesis, it would be useful to expand the discussion to explain how these subsample results fit with the baseline finding (for example, whether they suggest non-linearity or threshold effects at very high NR shares, or other forms of heterogeneity), rather than presenting them as simple robustness checks.

---

46. Unexplained sign reversal of the main independent variable in Table 5.6

Feedback: The coefficient on NR_{ct} in Table 5.6, Panel A, column (3) is negative and highly significant, whereas in the baseline diversification regression (Table 5.2) and in columns (1)–(2) of Table 5.6 it is positive. This sign change is not discussed in the text, even though NR_{ct} is the main explanatory variable of the chapter.

Because equation (12) includes the interaction (NR x INNOV)_{ct}, the coefficient on NR_{ct} cannot be read as the unconditional effect of resource dependence; it is the partial effect when INNOV_{ct}=0. In the TECH specification, this corresponds to an extrapolated corner case: Table A.7 indicates that the TECH share is strictly positive in all country–years, so TECH=0 lies just outside the observed support. The economically relevant effect of resources within this model is $\partial \ln RT / \partial NR = \beta_1 + \beta_3 INNOV_{ct}$, which combines the main and interaction coefficients.

At first sight, however, a reader comparing Tables 5.2 and 5.6 will see a reversal of the N R_{ct} coefficient in column (3) and may be unsure whether this reflects a genuine change in the conditional relationship once TECH is controlled for, or a by-product of strong collinearity among NR_{ct}, TECH_{ct}, and their product (the reported correlation between ScRC1 and ScTC3 is about −0.48). It would be helpful to add a short explanation of how NR_{ct} should be interpreted in the interaction specification, to note explicitly that the coefficient refers to an out-of-sample value of TECH_{ct}, and to clarify whether — and in what range of TECH_{ct} — resource dependence is still associated with greater export specialization when equation (12) is used.

---

47. Potential misstatement of findings on technology's role in growth

Quote: > Secondly, on average, technological specialization positively affects productivity growth; however, the magnitude of this effect varies depending on the type of technologically advanced products. Additionally, the positive influence of technological specialization is only evident in the empirical results involving mineral resources.

Feedback: The passage summarizing Chapter 4's findings seems to conflate the average effect of technological specialization with its interaction with mineral dependence. The text states that "on average, technological specialization positively affects productivity growth," but then adds that "the positive influence of technological specialization is only evident in the empirical results involving mineral resources."

Looking at Table 4.4, the main effect of technological specialization (TECH_{c,t−1}) is positive and statistically significant for the TOTAL NR, FUEL, and PETROLEUM specifications, while it is negative and insignificant for MINERAL. By contrast, the positive and (weakly) significant result for minerals arises in the interaction term (NR×TECH)_{c,t−1}, which indicates that higher TECH shares mitigate the negative growth effect of mineral dependence, especially at high mineral export shares.

As written, the summary sentence suggests that technology's positive influence on productivity growth is only found in the mineral case, which contradicts the table and obscures the important distinction between the unconditional TECH effect and the conditional, mineral-specific interaction effect. It would help to revise this summary so that it clearly separates: (i) the generally positive main effect of technological specialization on growth (not limited to minerals), from (ii) the additional, mineral-specific mitigating role captured by the interaction term.

---

48. Contradiction in H2 summary regarding technology's effect

Quote: > Technological specialization itself promotes productivity growth, yet again, the significance of this relationship is visible only in estimations involving mineral dependence. Consequently, available evidence is insufficient to reject the null hypothesis, thereby the H2 hypothesis cannot be supported.

Feedback: The summary for hypothesis H2 currently states that the significance of technological specialization's effect on productivity growth "is visible only in estimations involving mineral dependence." This is hard to reconcile with Table 4.4, where the coefficient on TECH_{c,t−1} is positive and statistically significant for TOTAL NR, FUEL, and PETROLEUM, and insignificant for MINERAL. In contrast, it is the interaction term (NR×TECH)_{c,t−1} that is significant only in the MINERAL regression.

It would help to revise this sentence so that the Conclusions clearly distinguish between (i) the direct effect of technological specialization on growth, which appears for several resource groupings, and (ii) the mitigating/enhancing effect captured by the interaction term, which is only statistically supported in the mineral-dependent case. Bringing the wording into line with the pattern reported in Table 4.4 and in Section 4.3 would remove this apparent contradiction and clarify exactly which part of H2 is not supported.

---

49. Potential contradiction in the conclusion for H3

Quote: > The resource-based decomposition of the relative Theil index (presented in Subchapter 5.1) reveals, that at low productivity levels, high export specialization is dominated by the weighted heterogeneity adjustments within the non-resource group of products. ... The outcomes suggest that excessive dependence on natural resources results in stronger specialization of overall, non-resource, and technological exports, thus impeding the diversification process. ... Considering all the results presented in Chapter 5, the evidence is insufficient to reject the null hypothesis, thereby the H3 hypothesis cannot be supported.

Feedback: In the summary discussion of H3 in Chapter 6, the conclusion is difficult to follow. The paragraph first states that the econometric evidence in Chapter 5 shows that higher natural-resource export shares are associated with higher RT for overall, non-resource, and technological exports, which is consistent with the idea that resource dependence slows diversification. It then notes that, according to the decomposition, at low productivity levels the within-non-resource component dominates the RT index. The final sentence nevertheless concludes that "the evidence is insufficient to reject the null hypothesis, thereby the H3 hypothesis cannot be supported."

It is not clear to the reader how these pieces are being weighed. One natural interpretation is that the first clause of H3 (resource dependence slows diversification in general) is supported by the GMM estimates, but that the second clause (responsible for excessive specialization specifically at low development levels) is viewed as not supported in light of the decomposition. If that is the intended distinction, it would be helpful to spell this out explicitly and to say that H3 is only partially or conditionally supported, rather than simply "cannot be supported."

In addition, the phrase “insufficient to reject the null hypothesis” is confusing here. No formal null and alternative are defined for H3, and the reported NR coefficients in equation (10) are statistically significant, so the wording can easily give the impression that there is no significant effect of resource dependence on diversification. Clarifying which hypothesis is being treated as the “null,” and rephrasing this sentence in more standard econometric language, would make the conclusion on H3 much clearer for the intended audience.

---

50. Clarification of GMM estimation strategy and fixed effects

Status: [Pending]

Quote: > Therefore, to avoid losing all cross country variability, country fixed effects are not included in the regressions (Barro, 2015; Bahar and Santos, 2018). ... Finally, the relationship between productivity growth and natural resource exports is susceptible to reverse causality and endogeneity issues (Farhadi et al., 2015). Therefore, we use a two-step efficient GMM estimator with a one-year lag of the potentially endogenous variable as an instrument.

Feedback: At first the combination of omitting country fixed effects and referring to a “two-step efficient GMM estimator” made me think you might be using a standard dynamic panel GMM (difference or system GMM) while at the same time suppressing the fixed effects it is designed to control for. Then I understood from the table notes (instrumented variable, Kleibergen–Paap statistics) that the implementation is essentially a pooled IV-GMM regression without country dummies, in the spirit of Barro-type growth regressions.

It could still be useful to spell this out more explicitly: indicate that you are estimating a pooled IV-GMM model with time effects (via the resource price index), specify which regressors are treated as endogenous, and briefly discuss the trade-off involved in not including country fixed effects in terms of potential unobserved country heterogeneity versus retaining cross-country variation in a highly persistent resource-share variable.

---

51. Discrepancy in country count in Table A.2

Quote: > | Low income (6) | Chad, Democratic Republic of the Congo, Guinea, Mozambique, Sudan, Yemen, Zambia |

Feedback: In Table A.2, "List of natural resource exporters," the header for the low-income group indicates there are 6 countries, but the list that follows contains 7 countries. One of these elements (either the count or the list) must be incorrect. It would be useful to verify which low-income countries actually meet the “natural resource exporter” definition used in the analysis and adjust the table so that the stated number and the list of countries are consistent.

---

52. Undefined variable abbreviations in Table A.7

Quote: > | Indices of export diversification | RT | BACI CEPII ${ }^{1}$ | 4160 | 2.87 | 1.52 | 0.33 | 9.19 | | | | RT_inr_RC1 | BACI CEPII ${ }^{1}$ | 4160 | 3.11 | 1.62 | 0.30 | 9.20 | ... | Share of resource exports in total exports | ScRC1 | BACI CEPII ${ }^{1}$ | 4160 | 0.29 | 0.29 | 0 | 0.99 |

Feedback: In Table A.7, "Summary statistics," many of the abbreviated variable names (e.g. RT_inr_RC1–RT_inr_RC8, ScRC1–ScRC8, RT_int_TC1–RT_int_TC3, ScTC1–ScTC3) are not decoded in the text. While one can infer that RT denotes the relative Theil index, Sc a share, and that RC/TC refer to the resource and technology taxonomies set out in Tables A.4 and A.5, the specific mapping of indices (1, 2, …, 8 for RC; 1, 2, 3 for TC) to named taxonomies is not given, nor is the meaning of the "inr" versus "int" infix. Providing a brief legend that links each RCi and TCj to its corresponding taxonomy and clarifies the "inr"/"int" notation would make Table A.7 much easier to interpret and would aid readers in relating the summary statistics to the concepts and classifications used in the main text.

---

53. Contradictory coefficient sign in Table B.2

Quote: > | $y_{c, t-1}$ | -0.027*** | -0.024*** | -0.028*** | -0.025*** | -0.027*** | 0.024*** | -0.023*** | -0.027*** | | | (0.005) | (0.005) | (0.005) | (0.004) | (0.005) | $\begin{gathered} -0.024^{* * *} \\ (0.005) \end{gathered}$ | (0.004) | (0.005) |

Feedback: In Table B.2, column (6), the entry for the lagged productivity term y_{c,t-1} is internally inconsistent. The first line of the row shows "0.024***", while the second line for that column contains "-0.024*** (0.005)", so the same coefficient is effectively reported twice with opposite signs. Given that all other specifications in the thesis yield a negative, highly significant coefficient on y_{c,t-1} and that convergence theory predicts a negative sign, this is almost certainly a typesetting error. It would be helpful to correct column (6) so that it reports only the intended coefficient and its standard error.

---

54. Missing coefficients in Tables B.7 and B.8

Feedback: In Tables B.7 and B.8 (the specifications using NR rents), several cells contain only numbers in parentheses, which by your conventions denote standard errors, without any corresponding point estimate. For example, in Table B.7 the $NR_{c,t-1}$ row shows "0.054**" for TOTAL, but only "(0.222)", "(0.045)", "(0.033)", and "(0.078)" for COAL, FOREST, OIL, and MINERAL, and the HC_{c,t-1} row for FOREST shows only "(0.293)". Table B.8 has analogous issues for NR_{c,t-1}, TECH_{c,t-1}, and (NRxTECH)_{c,t-1}. As a result, the reader cannot see the sign or magnitude of these coefficients in several columns, which undermines the interpretability of these robustness checks. It would be important to go back to the original estimation output and re-typeset B.7 and B.8 so that every reported standard error is paired with its coefficient, following the format used in the other regression tables.

---

55. Inconsistent definition of significance levels in table notes

Feedback: The notes to Table B.12 (and several subsequent tables) state that *, **, and*** denote significance at the 1%, 5%, and 10% levels "respectively," but the stars in the tables follow the standard convention (*) ***for 1%, ()*** *for 5%,* () for 10%. For example, in Table B.12, column (5), $NR_{c,t-1}$ has $t \approx -1.91$ and is marked with a single star, consistent with 10% but not 1% significance; in column (1), $y_{c,t-1}$ has $t = -4.0$ and is marked ***, consistent with 1% significance. This indicates that the explanatory note has the ordering reversed, while the tables themselves use the usual coding. The legend should be corrected (and harmonized across all tables) so that the stated mapping of stars to significance levels matches the convention actually used.

---

56. Ambiguous scaling of innovation variables in Table B.22

Feedback: Because the regressions are reported without an explicit statement of whether PATENTS has been rescaled (e.g. to thousands of applications, per capita, or log-transformed), it is difficult to gauge the economic magnitude of the interaction effects and to compare them meaningfully with the rest of the results. It would be helpful to clarify exactly in what units PATENTS enters equation (12), and, if a rescaling was applied, to describe it in the notes or data section. Even if no transformation was used, an explicit statement and a short discussion of the implied marginal effects at representative patent levels would make the findings more interpretable.

---

57. Incomplete results in Table B.18

Feedback: In Table B.18 several entries appear to be incompletely reported.

This partial reporting makes it difficult to assess the precision of several estimates and creates ambiguity about whether some regressors were omitted in particular columns or simply not shown. It would be important to regenerate Table B.18 to report coefficients and robust standard errors for all regressors in every column, or to explain explicitly any deliberate exclusion of variables such as NEWST_{ct} or P_t^{NR}.

---

58. Omission of development level control in Table B.29

Feedback: The specification underlying equation (12) includes the lagged development level, ln DEV_{c,t-1}, and this variable is used and instrumented in the main results (Table 5.6). In Table B.29, where the same equation is estimated separately for developed and developing countries, ln DEV_{c,t-1} does not appear in any of the ten columns, and the notes do not indicate that the specification has been altered. Because development level is both theoretically important for export diversification and empirically significant in the main sample, dropping it in the subsample regressions without explanation makes it difficult to know whether differences across Table 5.6 and Table B.29 reflect sample heterogeneity or the change in controls. It would be helpful either to re-estimate Table B.29 including ln DEV_{c,t-

1}, or to explain why it was omitted and, if feasible, to comment on how its inclusion would affect the reported coefficients on NR_{ct}, INNOV_{ct}, and (NR\times INNOV)_{ct}.

---

59. Misstatement of Inada Conditions in fn. 16

Quote: > Apart from these assumptions, the Cobb-Douglas production function satisfies the so-called Inada conditions, which define the shape of a function with well-behaved properties in economic models (Inada, 1963). These conditions are: (1) the function exhibits positive and diminishing marginal products with respect to each input, (2) the function exhibits constant returns to scale, and (3) the marginal product of capital or labour approaches infinity as capital or labour approaches zero and approaches zero as capital or labour approaches infinity. All neoclassical production functions must satisfy all Inada conditions (Campante et al., 2021).

Feedback: Footnote 16 currently treats several different assumptions as if they were all part of the "Inada conditions." In standard usage, "Inada conditions" refer specifically to the boundary behaviour of marginal products. Positive and diminishing marginal products and constant returns to scale are usual neoclassical assumptions, but they are conceptually separate from the Inada limits and are normally not labelled as Inada conditions themselves.

The sentence "All neoclassical production functions must satisfy all Inada conditions (Campante et al., 2021)" also seems too strong if read as a claim about the broader literature, where many "neoclassical" production functions used in macro and trade relax the Inada boundary behaviour. A clearer formulation would distinguish between (i) the standard neoclassical shape restrictions (CRS, positive and diminishing marginal products) and (ii) the Inada boundary conditions, and, if desired, define explicitly that in this thesis "neoclassical production functions" are assumed to satisfy both sets of properties.

---

60. Placement of a key counterargument in a footnote (Sec. 2.2)

Quote: > Additionally, Ross (2001) shows that oil exports are strongly connected with authoritarian rule, an effect that is relevant in all resource-dependent countries, not just Middle Eastern oil exporters[38].

Feedback: The sentence "Additionally, Ross (2001) shows that oil exports are strongly connected with authoritarian rule, an effect that is relevant in all resource-dependent countries, not just Middle Eastern oil exporters[38]" states Ross's result in quite categorical terms, and only the attached footnote makes clear that later work (in particular Oskarsson and Ottosen, 2010) finds no support for this effect and describes the theory as inconclusive. Bringing a brief indication of this controversy into the main text—for example by softening the wording ("presents evidence that…") and signalling that Ross's finding has been challenged—would better reflect the state of the literature. It would also be helpful to ensure that the opening citation list on reverse causality does not implicitly group Oskarsson and Ottosen (2010) together with studies that support a political resource curse, given that they are later described as being "at the other end of the spectrum."

---

61. Definition of Secular Stagnation in footnote 47

Quote: > In broader terms, the concept of secular stagnation is based on four facts: (1) a slowdown in investment despite low interest rates, (2) low productivity growth, (3) high profits, and (4) a growing variance in productivity and profits among producers (Haskel and Westlake, 2017).

Feedback: In footnote 47, secular stagnation is described as "based on four facts" taken from Haskel and Westlake (2017). These four items are important stylized facts about recent advanced-economy performance, but they are not generally regarded as the definitional basis of the secular stagnation hypothesis, which in the modern debate is usually framed around a structural imbalance between desired saving and investment (and, in some accounts, slowing fundamental innovation). It would be helpful to frame the four points more explicitly as empirical regularities highlighted by Haskel and Westlake in the context of the secular stagnation discussion, rather than as the foundation of the concept itself.

---

62. Clarification of singularity types in footnote 48

Quote: > Aghion et al. (2019) distinguish between two types of technological singularity that diverge from steady-state growth: (a) growth explosion, in which growth rates increase without bounds, yet remain finite at any given moment, and (b) growth explosion, in which infinite output is achieved within a finite amount of time.

Feedback: The footnote sets out to distinguish two types of technological singularity, but both (a) and (b) are labelled "growth explosion" even though their verbal descriptions clearly refer to different regimes (unbounded yet finite growth versus infinite output in finite time). This repeated label can momentarily obscure the intended typology. It would help to assign the second case a distinct term, consistent with its description, so that the two types are explicitly differentiated.

---

63. Conceptual distinction between export and geographic concentration in fn 74

Quote: > Export concentration, on the other hand, is predicated on the concept of geographic concentration, which Aiginger and Davies (2004) define as "the extent to which activity in a given industry is concentrated in a few countries". The geographic concentration of economic activity has the potential to engender specialization, as demonstrated in Krugman's models of the New Economic Geography (Krugman, 1991; Krugman and Venables, 1990; Fujita et al., 2001).

Feedback: The footnote that begins "Export concentration, on the other hand, is predicated on the concept of geographic concentration…" moves rather quickly from export concentration to geographic concentration and then quotes Aiginger and Davies's definition of the latter. Since in this chapter export concentration refers to how a single country's exports are distributed across products, while Aiginger and Davies's "geographic concentration" refers to how an industry's activity is distributed across countries, it would help to spell out more explicitly that the analogy is conceptual rather than definitional. As written, the phrase "predicated on" may suggest a stronger equivalence than intended and could briefly confuse readers about which dimension of concentration is being measured.

---

64. Mismatched regression description in Table 5.5 note

Quote: > GMM regression (eq. 3 and eq.4), instrumented variable: ln DEV_{c, t-1}. Standard OLS regression in eq. 1 and eq.2. Constant included not reported. Division into development groups in compliance with Table A.1. in Appendix A.

Feedback: In the note for Table 5.5, the estimation is described as "GMM regression (eq. 3 and eq.4)… Standard OLS regression in eq.1 and eq.2," even though this table is explicitly presented as reporting results for equation (11). Moreover, equations 1–4 in Chapter 3 define indices (RCA and Theil) rather than regression models. As written, the note cannot be reconciled with the current equation numbering and suggests specifications that are not those actually estimated. It would be important to correct the equation references and the OLS/GMM wording in this note so that it accurately reflects that Table 5.5 reports GMM regressions for equation (11) with ln DEV_{c,t-1} treated as endogenous.

Firmato digitalmente da: Luca De Benedictis
Data: 07/03/2026 19:07:22

Luca De Benedictis