The Coalition of Finance Ministers for Climate Action

The Atlas of Economic Complexity: supporting strategic economic planning and green industrial policy in Ministries of Finance

Harvard Growth Lab

Ketan Ahuja, Harvard Growth Lab and University of Oxford; and Muhammed A. Yildirim, Harvard Growth Lab and Koç University

A contribution to the 'Compendium of Practice from a Global Community of Ministries of Finance and Leading Organizations: Economic analysis and modeling tools to assist Ministries of Finance in driving green and resilient transitions'

Topic: Specific analytical tools and approaches relevant to Ministries of Finance

June 2025

Access the full Compendium at www.greenandresilienteconomics.org

---

Introduction

The Atlas of Economic Complexity, developed by Harvard University's Growth Lab, is a data visualization tool and analytical framework that measures countries' productive capabilities. It provides Ministries of Finance (MoFs) with a country's export and import portfolio (and its evolution over time) and complements this with insights into economic diversification, growth potential, and development pathways, for use in economic policymaking.

Economic complexity indices correlate strongly with countries' economic growth, suggesting the process of economic growth involves diversification into more (and more complex) industries. Climate action thereby offers countries an opportunity for green growth by supporting their efforts to diversify into green industries through strategic industrial policy. Many countries are seizing this opportunity (e.g., the United States, with the Inflation Reduction Act). Economic complexity analysis and the Atlas of Economic Complexity can help policymakers formulate green industrial policy around countries' strengths. Applying economic complexity methods to help guide strategic green industrial policy is a particular focus for researchers (including The Growth Lab at Harvard Kennedy School).

The Atlas can help inform MoFs' economic strategy and policy

MoFs will find economic complexity particularly useful in informing industrial policy, economic development, and policymaking around economic growth and strategic economic planning. They can use metrics in the Atlas of Economic Complexity, such as the Economic Complexity Index and Complexity Outlook Gain, to diagnose how their rates of economic growth are related to their structural transformation. Countries' production output changes over time, and MoF's can capture dynamic trends by looking at time-series or annual data around economic complexity, provided by the Atlas of Economic Complexity.

Examples of practical applications include the following:

- Understanding the industries in which a country is competitive, and which parts of green value chains are nearby or are related to a country's economic structure.
- Identifying the emerging sectors with growth potential (for example, products needed for the energy transition) in which a country is competitive, and into which a country could diversify most easily.
- Diagnosing whether a country's economic structure is well-positioned to drive future growth, through, for example, a competitive position in important, highly connected industries, with many capabilities that can be repurposed to other areas of economic activity. Where this diagnosis reveals a country is not well-positioned, strategic industrial policy to diversify into important, complex and growing industries is more necessary.
- Assessing whether a country has been successfully diversifying into new sectors in its recent economic history. If not, policymakers can zoom in to which diversification opportunities have not materialized to identify obstacles to industrial diversification.
- Enabling comparisons between countries, and assessment against a group of peers.

The identification of priority sectors using these tools can help shape economic policy initiatives through, for example, helping target tax incentives, shaping trade policy, coordinating export or investment promotion agencies, and shaping technology investments, with a view to shaping structural drivers of green economic growth and industrial transformation relating to the energy transition.

Navigating the Atlas

MoFs can access the Atlas through the online platform at atlas.cid.harvard.edu. The tool makes it simple to explore and compare country-specific data. A good place to start exploring the Atlas is the "Country Profiles" tab at atlas.cid.harvard.edu/countries/77, which offers an overview of each country in the Atlas. The Atlas also contains learning resources at atlas.cid.harvard.edu/key-concepts, and a step-by-step guide at atlas.cid.harvard.edu/explore.

The Atlas uses Comtrade data on international trade. Countries can augment the Atlas's insights with other datasets on firms, trade, and employment to conduct more nuanced economic complexity analyses. Bringing this analysis in-house can enable MoFs to conduct regional or sub-national analysis and increase their focus on topics of interest. Specific datasets MoFs may benefit from using in economic complexity analyses include the production networks derived from VAT data as well as information that matches workers to industries and occupations, which is often contained in social security databases. MoFs can conduct this analysis in-house by hiring teams with the appropriate skills or by building capacity with training programs (such as the executive education programs the Growth Lab offers).

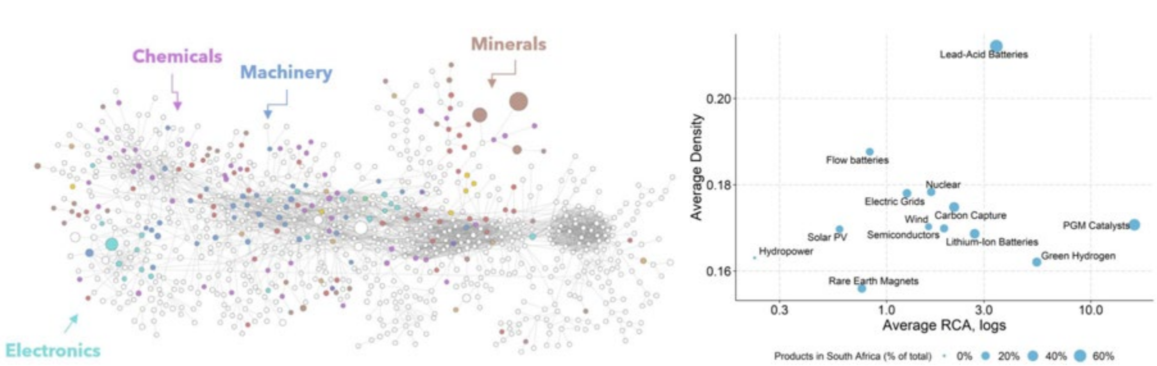
Case studies

The Atlas has been used for strategic economic planning in many different countries, development finance institutions, and other policymaking bodies. Following a recent policy research initiative with the Growth Lab at Harvard Kennedy School, South Africa's Treasury has used the Atlas and economic complexity to identify its best opportunities in green industries, highlighting strengths in the value chains for fuel cells and batteries. Figure 1 (a) shows the green supply chain products in the product space and Figure 1 (b) shows how effective South Africa is in the supply chains and the feasibility of opportunities in the products in which it lacks comparative advantage. Similar approaches have been used in Namibia, the UAE, Morocco, and Mexico.

Figure 1. The green supply chain products in the product space and their density and presence in South Africa

(a) Green supply chain products in the product

(b) The density and presence of green



Notes: (a) The product space captures the relatedness between products. Each node is a product, and the products are connected if they are often co-exported by countries. Here, the green supply chain products presented in part (b) are highlighted. (b) The average density and average RCA for South Africa. Both panels are elaborations based on international trade data from Atlas of Economic Complexity and Growth Lab internal dataset constructed using DoE and IEA green supply chain reports.

Source: Hausmann et al. (2023)

For more information on these case studies, see growthlab.hks.harvard.edu/policy-research#projects.

Understanding economic complexity

Economic complexity measures an economy's embedded knowledge, production capabilities, and patterns of specialization by comparing which economic activities tend to co-occur in different locations (Balland et al., 2022). Complex economies weave different capabilities together to generate a diverse mix of knowledge-intensive products (Hidalgo and Hausmann, 2009). To make an analogy with the game of Scrabble, economic activities (products, services, technologies, or other activities) amount to "words" that require a set of capabilities (which we can think of as "letters") to be put together. The longer or more complex the "word," the more capabilities (or letters) it requires. Similarly, the capabilities that places have (their "letters") shape which economic activities they are able to enter easily (i.e., which "words" they can make).

To demonstrate these ideas, a country may want to manufacture solar panels, wind turbines, or electric vehicles (products that may be thought of as "words"). This requires various capabilities, such as a workforce with the right skills, an appropriate supply chain, and infrastructure that supports these industries (these capabilities may be thought of as "letters"). These capabilities can be industry-specific: some may support the manufacturing of solar panels better than electric vehicles or wind turbines, for example. Certain steps in the solar panel value chain share similarities with semiconductor manufacturing (e.g., casting polysilicon), and so regions with expertise in semiconductor manufacturing will likely have some of the capabilities for manufacturing solar panels but may be less equipped with the capabilities for producing wind turbines. Similarly, places with experience manufacturing airplane bodies or ships have more of the right capabilities to manufacture wind turbines but are less well equipped to manufacture solar panels or electric vehicles.

Unfortunately, it is very hard to enumerate these capabilities. Instead, the economic complexity approach uses methods that try to infer these capabilities by looking at which products or activities tend to occur in the same places. How common are a location's capabilities? How complex is a product? The economic complexity index and product complexity index, respectively, answer these questions.

Economic complexity indices correlate with various measures of economic growth and living standards (Hidalgo, 2021). Countries with higher economic complexity tend to be more productive, richer, and grow faster. Complex economies are better equipped to generate and produce advanced technologies, fostering innovation and creating high-value products. Countries with higher densities are found to experience higher growth in a product and are more likely to enter a product if they are not currently making it (Hausmann et al., 2022).

Economic complexity enables a granular assessment of the economic structure

Many economic analysis methods (such as computable general equilibrium (CGE) models) aggregate economic data and statistics into coarse categories or general "industries" (e.g., agriculture, professional services, or manufacturing), years of education, or value of capital stock. These methods implicitly assume that economic assets or factors of production are relatively fungible across industries and movable across geographies. But capital assets and economically-relevant know-how are non-fungible, activity-specific, and hard to move (Boschma, 2005). Economic complexity methods preserve this granularity in economic structures to offer insights into regional specialization, the relatedness and adjacency of activities, and their relationship with other measures of economic performance (Hidalgo, 2021).

In preserving structures' granularity, economic complexity improves on older analytical methods that try to address similar topics, such as input-output analyses and analyses based on exports and analyses of revealed comparative advantage (RCA). These analyses can offer insights into regional specialization and industry structure but fail to infer underlying regional capabilities in ways that offer insights for future potential (Hausmann and Klinger, 2007). Input-output analyses reveal supply chain linkages for a product (such as which inputs go into a product) but carry little information about which products make sense to produce in similar locations. A solar panel may use silicon, glass, and aluminum, but that does not mean producers should try to make solar panels, glass, silicon, and aluminum all in the same place, as the capabilities needed to produce each of these things may be different, and these materials can easily be shipped. RCA analyses similarly show which products countries are good at making, but do not reveal which products a country *could* be good at making based on the products it *already makes*. Economic complexity metrics, on the other hand, provide projections for future RCA levels as well, thereby linking to the dynamics of the evolution of comparative advantage.

Economic complexity, by contrast, infers underlying capabilities by comparing which products are co-produced. It provides a top-down analysis of these issues that is granular, relatively tractable, and scalable, requiring no industry-specific knowledge or understanding. Economic complexity analysis can be combined with this "bottom-up" or industry-specific analysis to make even better determinations of a country's capabilities and comparative advantages, and to help a country drive industrial transformation, diversification, and progression up a value chain. An effective way to do this is to use economic complexity to diagnose strengths and prioritize sectors or areas of interest and then dive deeper into specific industries and opportunities with contextual industry-specific knowledge.

Frontiers of economic complexity research

Economic complexity is a set of methods for investigating the granular structure of economic activities. It was initially applied to export data, but more recently has been applied to the energy transition as well as technology, research, skills and workforce training, scientific publications, and many other domains of economic activity, opening up avenues for new uses in policymaking.

There are several challenges in using economic complexity methods that policymakers in MoFs should be aware of. Economic complexity methods often group industries using industrial classification codes (such as NAICS and HS codes), which are more aggregated than particular product markets. This means economic complexity analyses can fail to capture the nuance of a product market category or industry. Researchers are attempting to build analyses based on product markets using VAT data to overcome this limitation (Pichler et al., 2023). Economic complexity methods can also be hard to apply or less accurate in service industries, where data is poor.

A particular challenge for MoFs is that economic complexity methods are backward-looking in that they infer industry relatedness from historical data. Applying these backward-looking metrics to industries where the technology and market structure are changing can involve nuance. Researchers are developing bottom-up, or "genotypic," approaches to measuring industry relatedness to counter this challenge. MoFs can overcome this limitation in forward-looking green industrial policy by looking for trends over time that show how a country's capabilities have changed in the recent past, applying frontier "genotypic" measures of relatedness, and combining insights from economic complexity with bottom-up, industry-specific assessments or deep-dives.

Conclusions: integrating the Atlas into strategic economic planning

The Atlas of Economic Complexity offers valuable insights for MoFs in guiding economic diversification and growth strategies, particularly where fine-grained assessment of a country's economic structure is a valuable complement to existing analytical methods. Economic complexity metrics correlate strongly with economic growth and diversification and are therefore useful in diagnosing a country's economic prospects. They are also useful when undertaking policymaking to drive the structural transformation of an economy, particularly in contexts of rapid change such as the energy transition.

References

Balland, Pierre-Alexandre, Tom Broekel, Dario Diodato, Elisa Giuliani, Ricardo Hausmann, Neave O'Clery, and David Rigby (2022) The New Paradigm of Economic Complexity. *Research Policy* 51(3), 104450.

Boschma, Ron (2005) Proximity and Innovation: A Critical Assessment. *Regional Studies* 39(1), 61–74. https://doi.org/10.1080/0034340052000320887.

Hausmann, Ricardo, and Bailey Klinger (2007) *The Structure of the Product Space and the Evolution of Comparative Advantage*. CID Faculty Working Paper 146, Harvard University, Cambridge, MA. https://www.hks.harvard.edu/centers/cid/publications/faculty-working-papers/structure-product-space-and-evolution-comparative-advantage.

Hausmann, Ricardo, César A Hidalgo, Sebastián Bustos, Michele Coscia, Alexander Simoes, and Muhammed A. Yıldırım (2014) *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. MIT Press, Boston, MA.

Hausmann, Ricardo, Daniel P Stock, and Muhammed A Yıldırım (2022) Implied Comparative Advantage. *Research Policy* 51(8), 104143.

Hausmann, Ricardo, Tim O'Brien, Andrés Fortunato, Alexia Lochmann, Kishan Shah, Lucila Venturi, Sheyla Enciso-Valdivia, Ekaterina Vashkinskaya, Ketan Ahuja, Bailey Klinger, Federico Sturzenegger, and Marcelo Tokman (2023) *Growth Through Inclusion in South Africa*. CID Faculty Working Paper 2023.434, Harvard University, Cambridge, MA.

Hidalgo, Cesar A. (2021) Economic Complexity Theory and Applications. *Nature Reviews Physics* 3(2): 92–113. https://doi.org/10.1038/s42254-020-00275-1.

Hidalgo, César A., and Ricardo Hausmann (2009) The Building Blocks of Economic Complexity. *Proceedings of the National Academy of Sciences* 106(26), 10570–10575. https://doi.org/10.1073/pnas.0900943106.

Pichler, Anton, Christian Diem, Alexandra Brintrup, François Lafond, Glenn Magerman, Gert Buiten, Thomas Y. Choi, Vasco M. Carvalho, J. Doyne Farmer, and Stefan Thurner (2023) Building an Alliance to Map Global Supply Networks. *Science* 382(6668): 270–272. https://doi.org/10.1126/science.adi7521.