Research Statement
Oriol Vallès Codina

Facing compounding risks in climate and geopolitics, I employ a range of quantitative methods -including dynamical systems, networks, input-output analysis, statistical inference, and machine-learning- to address foundational ecological questions initially raised by the pioneering 19th-century classical economists as they sought to understand the early capitalist system: are the limits to growth ultimately determined by limited natural resources or rather social inequality? What are the complex dynamics of the metabolic rift between the economy and the environment, and how do these relate to income distribution and gender equality? How closely do evolutionary changes in social reproduction mirror those in biological systems? Is there a conservation law of economic value, and how does it interact with the environment and social inequality? Are there identifiable templates or categories of countries based on their industrial network structures? Can states leverage the dynamics of the economic system to foster environmental sustainability while promoting full employment, societal cohesion, and price stability? Do climate policies centered in the Global North benefit or harm the Global South in terms of growth, employment, and financial stability, maybe requiring compensatory measures in the form of climate reparations? What is the complex architecture of ecological unequal exchange in the face of the climate crisis, as worldwide trade relies on the steady flow from the periphery to the core of labor and natural resources critical for the green transition, and what are its vulnerable points?

In my most recent publications at the *Journal of Economic Behavior and Organization* (attached as writing sample) and the *Jahrbücher für Nationalökonomie und Statistik*, I develop a novel data-driven dynamic model of multi-sector growth incorporating technical change to evalaute how sector-oriented fiscal policies -such as price and quantity controls (e.g. the EU gas price cap) and tax-subsidy schemes (e.g. the US Inflation Reduction Act)- can promote decarbonization while stabilizing inflationary pressures in strategic industries. In a co-authored paper recently accepted with minor revisions at *Ecological Economics*, we survey the social, ecological, and economic impacts of policy interventions aimed at achieving economic circularity within an input-output macroeconomic framework. As a research fellow at the UCL Institute for Innovation and Public Purpose, I published a working paper on the benefits of investing in universal healthcare within the input-output structure of intermediate production in seven middle-income economies (Iran, India, Mexico, Philippines, South Africa, Ukraine, Uzbekistan). Specifically, I examined the supply- or demand-led spillovers driven by sector-level investment in health along their value chains. I also recently co-edited an interdisciplinary, two-volume monograph titled *Multiplicity of Time Scales in Com-*

plex Systems (Springer-Verlag), featuring thirty contributions spanning a wide range of academic disciplines, from mathematics and climate physics to music theory and archaeology.

My work in progress applies data science to explore various dimensions of industrial structure, inequality, and policy impacts. I use a two-region macroeconomic model to investigate how climate policies in the Global North may exacerbate North-South inequalities. I employ input-output and network analysis to explain the global value chains of German energy, describe the core-periphery structure of global trade, and classify prototypes of national industrial structures. I also apply machine-learning techniques to detect regional clusters of European poverty and exclusion.