

A Dynamic Input-Output Model for Evaluating Strategies about Global Development and Sustainability

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Author: Faye DUCHIN

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Abstract. The urgency of today's concerns to reduce both global inequality and environmental degradation, which will entail substantial public and private infrastructure and capital equipment, makes it timely to take on the development of an operational dynamic input-output model. We now have models of the world economy with closure for international trade and databases that complement input-output accounting data with both engineering data and quantification of resource endowments and flows. Existing empirical studies have analyzed a variety of alternative development scenarios, some using a modeling framework in which choices among alternative technologies are endogenous (Duchin and Levine 2011). Only a dynamic model can represent inter-temporal and inter-sectoral consistency throughout extended periods, with each technology characterized by the magnitude and composition of built capital requirements as well as by the kinds of pressures it places on resource use and on the environment.

This paper scopes out and begins to address several types of challenges in creating a dynamic model of the global economy. My starting point is the dynamic model developed by Duchin and Szyld (1985), first implemented to study the impacts of automation on workers in the U.S. (Leontief and Duchin 1986). This model represents a sector's capital stock by two well-defined measures, the maximum output it can provide (its capacity) and a vector representing its composition in terms of sectoral inputs required per unit of capacity output. The price dual must assure that incomes earned in the economy, including returns on capital, cover not only consumption costs but also the costs of putting the new built capital in place. Another consideration is that the mathematical conceptualization must be compatible with the linear programming framework of the choice-of-technology and the world trade models (WTM/RCOT) with which it will be integrated. Finally I describe the data requirements. These cannot be satisfied by existing databases, and I provide ideas for their compilation or estimation that go beyond the kinds of rough estimates made by Leontief and Duchin (1986) three decades ago. This paper describes a dynamic model for a single region with endogenous choice among alternative technologies, where each technology is characterized by both its intermediate and capital requirements.

References

Duchin, F. and S. H. Levine, 2011. Sectors May Use Multiple Technologies Simultaneously: The Rectangular Choice-of-Technology Model with Binding Factor Constraints, *Economic Systems Research*, 23(3): 281-302 (September).

Duchin, F. and D. Szyld. 1985. A Dynamic Input-Output Model with Assured Positive Output, *Metroeconomica*, Vol. 37: 269-282.

Leontief, W. and F. Duchin. 1986. *The Future Impact of Automation on Workers*, New York: Oxford University Press.