Chapter 9
From Meso Decisions to Macro Results:
An Agent-Based Approach of Policy Diffusion

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ABSTRACT

Policy diffusion needs to be studied as a complex phenomenon, since it involves interdependent relationships between autonomous and heterogeneous countries. This chapter aims at developing a simple computational model based on a theoretical model of policy diffusion (Braun & Gilardi, 2006) that helps to explain the emergence of diffusion in a complex system. Based on three simple conditions (ready, choose, change) and a few internal and external characteristics that define countries and their interactions, the model presented in this chapter shows that policies do diffuse and lead to local convergence and global divergence. Moreover, it takes time for a country to introduce the best-suited policy and for this policy to become very effective. To conclude, diffusion is a complex phenomenon and its outcomes, as ensued from the author's model, are in line with the theoretical expectations and the empirical evidence.

1. INTRODUCTION

Social sciences in general and political science in particular study phenomena of interest as complicated but not complex systems. Policy diffusion is a good example of the increasing complication at the methodological level that still cannot explain the process as a whole.[1] In other words, despite their sophistication, most studies are biased toward correlational accounts, and little is said about the process by which policies diffuse. Consequently, the non-linearity that results from the different interdependencies is not taken into account.

Moreover, what is generally missing is an explanatory model that comprehends factors that are internal and external to a country, since both determine the possible interactions in the process. Therefore, based on a largely accepted definition that diffusion is an interdependent process of policy choices between countries (Simmons, Dobbin, & Garrett, 2006), diffusion should be seen as a phenomenon that emerges be-

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tween heterogeneous, adaptive, and autonomous[2] countries characterized by temporal and spatial features. Furthermore, diffusion processes are in play in complex adaptive systems (CAS), which are nonlinear systems composed of interacting agents (Rogers, Medina, Rivera, & Wiley, 2005).

To take into account the non-linearity of the policy diffusion process, methodologically, a computational agent-based model of policy diffusion has been developed, as it is a powerful tool for developing and testing new theories (Davis, Eisenhardt, & Bingham, 2007) and a well-suited tool for the study of non-linear processes (Axelrod, 2003; Bonabeau, 2002; Gilbert, 1998).

The aims of this chapter are twofold. First, the building of a computational agent-based model will be highlighted. More precisely, theoretical underpinnings that lie behind the choice of the parameters to "create" agents/countries and the rules they follow to progress within the world are emphasized. Second, diffusion as an emergent phenomenon will be stressed. In sum, based on the idea that diffusion can be explained as policy change driven by interdependencies (Braun & Gilardi, 2006), "in silico" countries based on a few parameters and conditions for interactions are created.

This chapter is structured as follows. Section 2 gives a definition of computational agent-based modeling and puts some emphasis on existing models that studied diffusion in social and political science. Section 3, policy diffusion will be defined and the theoretical choice of the different parameters will be discussed. With Section 4, the computational implementation of the theoretical factors and the different rules of interactions that shape the interdependencies between agents will be explained, as well as how the model works. Section 5 discusses the main findings. Future research directions and a conclusion will close this chapter.

2. COMPUTATIONAL AGENT-BASED MODELS AND DIFFUSION

Computational agent-based models (CABMs) have several uses. The first that comes to mind is prediction[3]. For our purpose, to demonstrate the emergence of complex behavior arising from simple rules is a more interesting use. For instance, Schelling's segregation model (Schelling 1978) shows that segregated neighborhoods can appear due to simple "thoughts" ("I want 30% of my neighborhood to be composed of neighbors who are like me").

After defining what we mean by computational agent-based modeling (Section 2.1), we will explain some of the significant examples of CABMs developed in social and political science (Section 2.2).

2.1 A Definition of Computational Agent-Based Models

Computational agent-based modeling can be defined as follows:

A computational agent-based model is a system whose dynamics and evolution is fully determined by the set of acceptable initial conditions and transformations rules, rendered as computer programs that specify all formal relationships algorithmically and discover solutions computing algorithms (Luyet, 2011, p. 66).

A computer program basically consists of instructions that can be read by a computer. Furthermore, the strength of a programmed computer lies in its capacity to execute repetitive action (Holland, 1998), since a program consists of a set (or sequence) of instructions that a computer executes indefinitely until a certain condition is satisfied.