Chapter 12
Embedding New Technologies and Extending Time Horizons in Input–Output Analysis

Randall W. Jackson
West Virginia University, USA

Christa D. Court
MRIGlobal and West Virginia University, USA

ABSTRACT

Input-output analysts are often confronted with requests for impacts assessments for economic shocks that stretch uncomfortably the assumptions of standard input-output modeling. This chapter presents an approach to confronting a subset of these challenges straightforwardly in a way that ameliorates some of the more restrictive input-output assumptions, maintains the inter-industry detail of the input-output model, and enhances the representation of certain economic behaviors without the additional complexities of moving to more complex computable general equilibrium or conjoined econometric input-output models. The authors conclude with the observation that direct changes to the input-output framework most often necessitate further modifications requiring additional behavioral assumptions and decisions on the part of the modeler.

1. INTRODUCTION

Faced with requests for economic impacts assessments, analysts must first select an appropriate analytical tool. A wide range of such tools exists, any one of which might be selected for a particular mix of requirements and resources. One general family of models ranges from economic base and Input-Output (IO) models through social accounting matrix and econometric models to computable general equilibrium models. These models form a continuum that runs from simple to complex behaviors, from moderate data requirements through data avarice, from lesser to greater required analytical expertise, from little or no industry specificity to hundreds of sectors,

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from quick turnaround to more extensive response times, and from low to high dollar costs. The IO model might well be among the most commonly used tool for impacts assessments, particularly in the United States (U.S.), in part because it occupies intermediate positions on many of the dimensions of this continuum.

IO analysts are well aware that the model's assumptions make it most appropriate for a well-defined set of problem categories, namely those for which economic shocks are unlikely to change relative prices for capital, labor, or goods markets, shocks whose impacts can be expected to work their way through an economic system in a relatively short—if unspecified—time, and shocks that are not expected to substantially alter the interindustry structure. Impact shock scenarios that violate these conditions stretch the ability of IO models—and indeed of most models—to perform adequately, although different models have differing strengths in each of these assumption areas. Adequately modeling impact scenarios that stretch these assumptions often requires an unconventional approach.

To provide prospective researchers with responses to some of the practical issues that often arise in IO modeling, this chapter presents an example of an increasingly common type of impact scenario followed by a demonstration of how several problematic issues can be resolved effectively. Some of the approaches presented will have been used already by analysts, but to our knowledge have not been presented in the literature in formal, replicable form. There will also often be alternatives to and variations on the solutions we offer here and those alternatives will likely result in different impacts estimates. Ultimately, the choices among competing alternatives will likely be a function of data, time and budget constraints, along with the preferences of the analyst. Empirical testing of alternatives would be ideal, but is left for future research. While some might also indicate a preference for using a different model altogether, the intent here is to describe ways to ameliorate the assumptions of the IO model within its application rather than to present an argument for its use over other modeling alternatives.

The input-output framework that serves as the foundation of the methods described in this chapter is presented in Section 2. In Section 3, we lay out the impact scenario that will serve as demonstration vehicle and identify the specific questions for which resolution options will be provided. The resolutions themselves comprise Section 4, followed by a summary discussion in Section 5.

2. INPUT-OUTPUT FRAMEWORK

The IO framework is likely the most commonly used framework for economic impact assessments. Its popularity is due to its ease of implementation, transparency, and mathematical simplicity, often making it the most accessible and cost-effective option for clients, especially those with time-sensitive requests.

The commodity by industry input-output framework described in Jackson (1998) is used as the basis for the methods introduced in this chapter. This approach is proposed as an accounting framework that is clearly interpreted and provides results that are especially informative for national and regional-level policy purposes. The treatment of imports within this approach focuses the analysis on the impacts of final demand changes to the domestic economy.

Currently, the model specifications are open with respect to households although there are expected to be few, if any, differences in terms of methodology for a model that is closed with respect to households. Equations (1) to (3) describe the basic identities underlying this framework in an economy with n industries and k commodities[1]:

$$\mathbf{s} = \mathbf{U}\iota + \mathbf{m} + \mathbf{e} \tag{1}$$

$$\mathbf{g} = \mathbf{V}\iota + \mathbf{h} \tag{2}$$