Chapter 1

Introduction: Overview of the Book

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This book consists of two distinct components. The first sets out the theoretical foundations for using distance functions as tools for shadow pricing, which is especially useful for the case of non-marketed goods, or where prices are missing or do not reflect opportunity costs. Since distance functions represent technology, our shadow prices are based on those underlying technologies. The second half of the monograph consists of four self-standing applications of the tools introduced in part one, and are organized as a sequence of chapters, which are described below. Thus, the reader interested in a specific application can directly proceed to the relevant chapter(s).

The first application is contained in Chapter 8, authored by Färe, Grosskopf, Shang and Sickles, and titled ‘Pricing Characteristics: An Application of Shephard’s Dual Lemma.’ The authors estimate a Shephard input distance function using stochastic frontier methods, among other variations. The estimates are used via Shephard’s dual lemma to solve for shadow prices of housing characteristics (e.g., land and structures). In turn these shadow prices are used to construct price indexes, including composite housing price indexes. The authors then compare their results to several variations of indexes based on hedonic methods using the same dataset. They find that the Shephard-based shadow price indexes are less volatile than the hedonic indexes and can avoid problems with multicollinearity.

Chapter 9, ‘Shadow Price Estimates of Wetlands in the St. John’s Bayou–New Madrid Floodway’, written by William L. Weber makes use of a directional output distance function, which accommodates estimation of the (mostly non-priced) environmental benefits of wetlands. The approach exploits the duality between the directional output distance function and the revenue function, to estimate the shadow prices of the public lands surrounding the floodway. He estimates the directional distance function in a parametric (quadratic functional form) linear programming framework. The parameters are used to calculate the shadow prices, which reflect opportunity costs and allow the author to provide estimates of the cost of converting wetlands under a proposal by the Army Corps of Engineers to close a gap in the Mississippi levees.

Chapter 10, ‘Pricing Inputs and Outputs in Banking Using Directional Distance Functions’, written by Maryam Hasannasab and Dimitris Margaritis applies the pricing rules introduced in part one of the book to estimate the shadow price of bank equity capital and non-performing loans for US banks during the period 2002–2016. The authors estimate a quadratic functional form parameterization of the directional distance function using the Aigner–Chu method. One advantage of this approach compared to standard finance methods based on the capital asset pricing model is that it prices equity for both listed and non-listed banks since it requires no information on the market price of the bank. The authors obtain some interesting results highlighting the risks of overambitious balance sheet expansions during the period prior to the financial crisis. The estimates show excessive levels of shadow prices for equity capital stemming from highly leveraged bank positions conducive to excessive risk-taking behavior. These findings are quite informative since they provide quantitative assessment of the wedge that presumably existed between the shadow price and market price of risk during the period leading up to the subprime crisis, thereby serving as testament to the risk pricing failures underpinning the subprime crisis. Panel regression results confirm the negative relation between core capital and its shadow price. Similarly, the authors find less diversified banks and banks with a larger share of real estate loans in their portfolio face higher equity capital costs.

In the final chapter, William L. Weber employs a network production framework to shadow price knowledge outputs. The title is ‘Network Production and Shadow Prices of Knowledge Outputs,’ providing a fourth type of application of distance functions to the problem of finding shadow prices.

Thus the four application chapters provide four alternative estimation strategies for estimating shadow prices all based on various distance functions and all exploiting the duality results derived in the theoretical chapters of the book. These can be considered to be complementary to the more familiar hedonic methods to estimate shadow prices.