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# Factor-Specific Technology Choice*

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**Abstract**

This paper analyzes the properties of a two-dimensional problem of factor-specific technology choice subject to a technology menu – understood as the choice of the degree of factor augmentation by a producing firm or the choice of quality of goods demanded by a consumer. The considered general setup encompasses the benchmark cases of Cobb–Douglas, CES and Leontief (minimum) functions. It is shown that the technology menu and the global function (envelope of local functions) are dual objects, in a well-defined generalized sense of duality. In the optimum, partial elasticities of (i) the local function, (ii) the technology menu and (iii) the global function are all equal and there exists a clear-cut, economically interpretable relationship between their curvatures. In particular, the elasticity of substitution of the global function is always above that of the local function. The paper also invokes Bergson's theorem to comment on the consequences of assuming homogeneity or homotheticity, with a particular focus on technology menus constructed as level curves of idea (unit factor productivity) distributions.

**Keywords:** technology choice, technology menu, production function, utility function, duality, envelope, homotheticity.

**JEL codes:** C62, D11, D21, E21, E23, O47.

## 1 Introduction

The current paper deals with decision problems faced by firms which contemplate not just about the demand for production factors – such as capital and labor – but also about the degree of their technological augmentation (see e.g. Atkinson and Stiglitz, 1969; Basu and Weil, 1998; Acemoglu, 2003; Jones, 2005; Caselli and Coleman, 2006). Consider, for example, a firm owner planning to set up a new plant. She may build a traditional manufacture where production is labor-intensive, or a highly automated plant where all routine work is carried out by robots. Imagine that both factory designs require capital and labor inputs to be fed into the production process in essentially fixed, though vastly different proportions (Jones, 2005). Which of the available technologies should she choose? Logically, the higher is the market wage relative to the capital rental rate, the more inclined

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