Chapter 13
Indeterminacy and Sunspots with Constant Returns*

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13.1 Introduction

Recently there has been a renewed interest in the possibility of indeterminacy and sunspots, or alternatively put, in the existence of a continuum of equilibria that arises in dynamic economies with some market imperfections.\(^1\) Much of the research in this area has been concerned with the empirical plausibility of indeterminacy in markets with external effects or with monopolistic competition and which exhibit some degree of increasing returns. While the early results on indeterminacy relied on relatively large increasing returns and high markups, more recently Benhabib and Farmer (1996a) showed that indeterminacy can also occur in two-sector

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models with small sector-specific external effects and very mild increasing returns.\textsuperscript{2} Nevertheless, a number of empirical researchers, refining the earlier findings of Hall (1988, 1990) on disaggregated US data, have concluded that returns to scale seem to be roughly constant, if not decreasing.\textsuperscript{3} While one can argue whether the degree of increasing returns required for indeterminacy in Benhabib and Farmer (1996a) falls within the standard errors of these recent empirical estimates, one may also ask whether increasing returns are at all needed for indeterminacy to arise in a plausible manner. The purpose of this paper is to give a negative answer to this question, and to show how indeterminacy can occur in a standard growth model with constant social returns, decreasing private returns, small or negligible external effects, and standard parameter values that are typically used in the literature on business cycles. Furthermore we will shows that it is possible to realistically calibrate such a model and to obtain a reasonably good match to the moments of aggregate US data.

Indeterminacy or multiple equilibria emerges in dynamic models with small market distortions as a type of coordination problem. Roughly speaking, what is needed for indeterminacy is a mechanism such that, starting from an arbitrary equilibrium, if all agents were to simultaneously increase their investment in an asset, the rate of return on the asset would tend to increase, and in turn set off relative price changes that would drive the economy back towards a stationary equilibrium. One such simple mechanism in one-sector models is increasing returns, typically sustained in a market context via external effects or monopolistic competition. In a multisector model, however, the rates of return and marginal products depend not only on stocks of assets, but also on the composition of output across sectors. Increasing the production and the stock of a capital asset, say due to an increase in its price, may well increase its rate of return. It is possible therefore to have constant aggregate returns in all sectors at the social level, and to still obtain indeterminacy if there are minor or even negligible external effects in some of the sectors. A more detailed intuition for indeterminacy is given at the end of Sect. 13.2 in the case of a simple two-sector model.

Constant social returns coupled with small external effects implies that some sectors must have a small degree of decreasing returns at the private level. This is in contrast to models of indeterminacy with social, increasing but private, constant returns to scale. An implication of decreasing private returns is of course positive profits. In the parameterized examples given in the sections below, these profits will be quite small because the size of external effects, and therefore the degree of decreasing returns needed for indeterminacy will also be small. Nevertheless positive profits would invite entry, and unless the number of firms are fixed, a fixed cost of entry must be assumed to determine the number of firms along the

\textsuperscript{2}Since Benhabib and Farmer (1996a) postulate constant returns at the private level, we can measure increasing returns as the sum of all Cobb-Douglas coefficients minus one. Indeterminacy then, for standard parametrization, requires increasing returns of about 0.07.

\textsuperscript{3}See for example Basu and Fernald (1994a,b), Burnside et al. (1995), or Burnside (1996), among others.