Investment under Uncertainty and the State of Confidence — A Note

Josef Falkinger

Zusammenfassung

Bei echter Unsicherheit ist die Verteilung der erwarteten Nachfrage nicht bekannt, sondern muß erst aus vergangenen Erfahrungen, neuen Informationen und subjektiven Einschätzungen abgeleitet werden. Die vorliegende Arbeit konzentriert sich auf Unsicherheitssituationen, in denen das Vertrauen in die vergangenen Erfahrungen schwach ist und neue Informationen kaum verfügbar sind. Es wird gezeigt, daß in solchen Situationen (z. B. nach Trendbrüchen, in dünnen Märkten, bei innovativen Investitionen) der Einfluß der Profitabilität an Bedeutung gewinnt. Gleichzeitig stellt die Arbeit einen rigorosen Modellierungsversuch des "state of confidence" von Keynes dar.

1. Introduction

"The state of long-term expectation, upon which our decisions are based, does not solely depend . . . on the most probable forecast we can make. It also depends on the confidence with which we make this forecast" (Keynes, 1936, p. 148).

Decision under true uncertainty should take into account the reliability of the decision basis. An attempt to do this for the case of investment decision under demand uncertainty is made in this paper. It shows how the investment decision in an uncertain situation relies on the current state of expectations as formed to the best knowledge of the investors, but depends (regardless of any assumption of risk-aversion) also on the confidence in this state of expectations. The main interest lies in the case where the confidence in past experience vanishes and new information is scarce that is in situations of uncertainty which are typical of sudden revisions after a surprise or a shock, but also in rapidly changing or new (market) environments. Other things being equal, if confidence is weak because the objective basis for the formation of the expectations is small (e. g., after a shock, or in new markets where the investor cannot fall back upon past experience) investment will be lowered unless profitability is high (in a precise sense, see below), in which case low confidence would stimulate investment. In any case, the impact of profitability gains in importance when confidence is weak.

The analysis employs well-known Bayesian concepts and is carried out in the demand-constrained model with fixed coefficients, used by Malinvaud (1980) and also by Costrell (1983) for the determination of optimal capacity (the proposed methods, however, are quite gen-
In Section 2, optimal capacity and investment in a fix-price model with fixed coefficients are described for a given distribution of the uncertain demand. Section 3 analyses in a Bayesian framework the formation of expectations in situations of low confidence in past experience and of scarce new information. Section 4 presents as the main result of the paper an investment function for demand uncertainty after a shock. The concluding section suggests as relevant fields of application: (supposed) trend shifts in the rate of growth, the secular trend towards "thin" markets, and innovation versus expansion.

2. Optimal capacity, investment, and demand uncertainty

Denote by \( x_A = \left( \frac{1}{v} \right) K \) the capacity output corresponding to capital stock \( K \), \( v \) being the fixed capital-output ratio. If demand is \( x_N \), then the saleable output will be \( y = \min(x_N, x_A) \) and employment will equal \( L = a y \), where \( \frac{1}{a} \) is the fixed productivity of labour. (It is assumed that labour is not a limiting factor.) Given the output price \( p \), the wage rate \( w \) and the unit capital cost \( q \), the profit from production with capacity \( x_A \) facing demand \( x_N \) amounts to

\[
P = (p - w a) \min(x_N, x_A) - q v x_A.
\]

Faced with demand uncertainty, where \( x_N \) is distributed according to a distribution function \( F \), the expected profit \( EP \) equals

\[
EP = (p - w a) \int \min(x_N, x_A) \, dF(x_N) - q v x_A
\]

\[
= (p - w a) \left[ \int x_N \, dF(x_N) + x_A (1 - F(x_A)) \right] - q v x_A.
\]

(If not otherwise specified, the limits of integration are the minimum and the maximum value of \( x_N \) respectively.) Maximizing of \( EP \) leads to the following condition for the optimal capacity output \( x_A^* \):

\[
(1) \quad F(x_A^*) = 1 - \left( \left( \frac{q v}{p - w a} \right) \right).
\]

As pointed out above, this model is used in Malinvaud (1980) and Costrell (1983) to which we refer for further discussion (1).

Equation (1) tells us that optimal capacity output \( x_A^* \) and consequently desired capital stock \( K^* = v x_A^* \) depend in a monotone way on

\[
x = 1 - \left( \left( \frac{q v}{p - w a} \right) \right) = \frac{p - w a - q v}{p - w a},
\]

98