The Theory of the Opportunistic Entrepreneur

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ABSTRACT. Most recent theories of entrepreneurship advanced in the literature have been concerned with *de novo* business *starts* involving the entrepreneur in a once-off product decision. The question of the entrepreneur's learning from business experience is therefore ignored (an exception being Jovanovic, 1982). The present paper departs from the literature by providing a theory of entrepreneurial opportunism which allows the individual to receive a *continuous sequence* of projects in each of which he makes a decision to invest or not. Important features of the decision analysed are firstly that acceptance (as well as rejection) of projects has possible costs as well as returns; and secondly that there is scope for learning which products to accept on the basis of past experience of successes and failures. We thus show that it is possible to provide a convincing model of *opportunistic* entrepreneurial behaviour in conformity with the notion of an entrepreneur discussed in Kiam (1989).

The model takes the form of the derivation of an optimal decision rule over project success probabilities which maximises the entrepreneur's expected return given his current knowledge. This rule tells the entrepreneur which projects to accept and which to reject. The optimal reservation probability is shown to be a function of the quality of the entrepreneur's data (the projects coming his way), of his ability to formulate the 'correct' model and to update that model as information accumulates. Finally we show how the optimal reservation probability responds to changes in the observable components of project quality: demand parameters, interest rates, and so on.

1. Introduction

Entrepreneurial skills like most abilities are a product of both Nature and Nurture: some one is born with and some are acquired as a result of experience. Business experience should therefore be significant as a determinant of business success, and indeed this has recently been shown to be the case (Bates, 1989; Evans and Leighton, 1989). Most recent formal theories of entrepreneurship advanced in the literature have however been concerned with the determinants of *de novo* business *starts* and therefore the question of learning from business experience has tended not to arise. (See, e.g., Evans and Leighton (1989), Evans and Jovanovic (1989), Brock and Evans (1986) and Blanchflower and Oswald (1990).)

An alternative approach adopted by Jovanovic (1982) however has emphasised the importance of initial beliefs concerning one's entrepreneurial abilities and the subsequent revision of these beliefs over time in the decisions respectively to start and to quit business. The would-be entrepreneur starts business on the basis of some 'prior' as to his/her ability as an entrepreneur indicating a relative initial advantage in self employment. Experience in business then either reinforces this belief or contradicts it. In consequence the entrepreneur either continues indefinitely or drops out after a trial period.

Whilst the Jovanovic model is rich in testable predictions and constitutes a major advance over previous theories it does not properly deal with other important characteristics of the successful entrepreneur. For example a recent book by a highly successful businessman (Kiam, 1989) emphasises that the nature of the entrepreneur is to be continually awake to profitable opportunities that may arise. The developed awareness of the successful entrepreneur is such that (s)he is rarely satisfied (contra Jovanovic and most other writers) with one investment project (product) in a lifetime but is always on the look out for new opportunities for profit. (See also Kirzner, 1983). New opportunities are scrutinised on the basis of past experience for the characteristic ingredients of success.[1] Kiam is furthermore at pains to emphasise the

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necessity of making mistakes and the need to learn from them.

The present paper attempts to remedy this deficiency in the literature by providing a theory of entrepreneurial opportunism which allows the individual to receive a continuous sequence of projects in each of which he makes a decision to invest or not. Important features of the decision analysed are: firstly that acceptance (as well as rejection) of projects has possible costs as well as returns; and secondly that there is scope for learning which products to accept on the basis of past experience of successes and failures. We thus show that it is possible to provide a convincing model of *opportunistic* entrepreneurial behaviour. Our model thus differs from Evans and Jovanovic by focusing on learning about the characteristics of projects rather than one's own general entrepreneurial ability, and by allowing a sequence of accept/reject decisions rather than simply the decision to enter/quit business.

The theory presented here is, in distinction to the literature, based on a Decision Theoretic approach. (See Savage, 1954.) The approach allows past *mistakes* as well as past successes to impinge on the learning process in conformity with Kiam's message. Both will help to improve the entrepreneur's project selection accuracy over time.

2. The model

Each period the entrepreneur receives a project he can either accept or reject. Once rejected a project is lost forever. A successful project is one which earns positive profits into the indefinite future; a failing project is one which makes losses for one period.[2] The entrepreneur is assumed to be myopic: he looks only one period ahead.

The profit function for the ith project is written

$$\begin{aligned} &\tilde{\pi}_i = \pi_i(\tilde{\theta}),\\ &\tilde{\theta}_i = \theta_H, \theta_L \text{ with } \theta_H > \theta_L,\\ &\pi_i(\theta_H) > 0, \pi_i(\theta_L) < 0, \end{aligned} \tag{1}$$

where $\pi_i(.)$ is an indirect profit function solving the following maximisation problem:

$$\pi_i(\theta) = \max_{\{z_i > 0\}} \pi_i = p(q_i; \theta, \alpha)\, q_i - w_i' z_i \tag{2}$$

subject to $q_i = f_i(z_i)$,

where

$$W_i = (W_{1i}, \ldots W_{ni})$$
$$z_i = (z_{1i}, \ldots z_{ni})$$

an increasing, concave function of inputs z. We assume that operating profit is positive even when demand is low and fixed costs not completely covered.

The indirect profit function has the properties of being increasing in α and decreasing, concave in the w_i. The w_i are assumed to be constants, α and θ represent observable demand parameters.[3] θ is the value of the random variable $\tilde{\theta}$ defined in equation 1.

Note that the dependence of π on α, and w_i has been suppressed.

The above setup effectively assumes the entrepreneur to be a price maker (monopolist/oligopolist) in product markets and a price taker in the market for inputs. We shall furthermore assume that the products identified with these profit functions are independent in the demand sense, i.e., the products are neither complements nor substitutes.[4]

Unobservable consumer preferences are responsible for the values of $\tilde{\theta}$ in the following way. There exists a latent (i.e., unobservable) random variable[5] $\tilde{\theta}^*$ defined by

$$\tilde{\theta}_i^* = \beta' x_i + \tilde{u}_i, \tag{3}$$

where x_i = a vector of observable product characteristics;
β = a vector of unknown parameters;
$\tilde{u}_i$ = a white noise random variable.

θ_i^* can be thought of as random utility[6] of a product with characteristics vector x_i. Expected utility is thus $\beta' x_i$. The product yields positive utility (is a 'success') if $\theta_i^* > 0$ and negative utility (is a 'failure') otherwise.

We assume that the entrepreneur cannot alter the characteristics vector x_i.

Equations 1 and 2 are related by

$$\tilde{\theta}_i = \begin{cases} \theta_H \text{ iff } \tilde{\theta}_i^* > 0. \\ \theta_L \text{ else} \end{cases} \tag{4}$$

The probability of success ($\tilde{\theta}_i = \theta_H$) is then given by the familiar formula

$$\begin{aligned} P(\tilde{\theta}_i = \theta_H | \beta' x_i) &= P(\tilde{u}_i > -\beta' x_i)\\ &= 1 - P(\tilde{u}_i \leqslant -\beta' x_i)\\ &= 1 - F(-\beta' x_i), \end{aligned} \tag{5}$$

where F(.) is the *c.d.f* of $\tilde{u}_i$.

The entrepreneur estimates by Maximum Likelihood methods[7] the taste parameters β yielding estimates $\hat{\beta}$ and an estimated probability of success and failure of the project $\hat{p}_i$:

$$\begin{aligned}\hat{p}_i &= f(\tilde{\theta}_i = \theta_H | \hat{\beta}' x_i) \\ &= 1 - F(-\hat{\beta}' x_i).\end{aligned} \tag{6}$$

This formula can be used with the available data on product characteristics x_i, $i = 1, \ldots$ I associated with successes and failures to estimate in turn the density (likelihood) of $\hat{p}$ conditional on success or failure:[9]

$$f(\hat{p} | \tilde{\theta}_i = \theta_L) = f(\hat{p}, \theta_H)/f_2(\theta_H) \tag{7}$$

and

$$f(\hat{p} | \tilde{\theta}_i = \theta_L) = f(\hat{p}, \theta_L)/f_2(\theta_L), \tag{8}$$

where $f(\hat{p}, \theta)$ indicates the joint density of $\hat{p}$ and θ and $f_2(\theta)$ the marginal density of θ.

Observe that the information in a vector of product characteristics has now been summarised in a scalar probability function of those characteristics. Thus the entrepreneur can be thought of as inferring by successive 'trials' the characteristics p (or x) associated with success and failure. A simple decision rule can now be determined which reflects this learning from past experience.

First note that the expected return to a decision to accept or reject a project depends on a recognition of Type I and Type II errors associated with the decision: In addition to correctly accepting successes and rejecting failures the entrepreneur knows from past outcomes that he may also make the mistakes of *accepting* failures and *rejecting* successes. Each of these errors will incur (known) economic costs.

To get the entrepreneur's return to a accepting (or rejecting) a product we need an interest rate representing the proportional one period opportunity cost of the entrepreneur's funds. Call this r. Then the present discounted values of profits and losses associated with success and failure are respectively

$$V_{iH} = \pi_{iH}/r - F \tag{9}$$

and

$$V_{iL} = \pi_{iL}, \tag{10}$$

where $\pi_{ik} = \pi_i(\theta_k)$ and F is the fixed startup costs of the new product.[10] We assume that the costs of accepting a failure are simply the incurred losses[11] from producing it, V_{iL} (<0), and that the cost of rejecting a success is the foregone equity from doing so, $-V_{iH}$. No costs or benefits are incurred from rejecting a failing product.

A *decision* rule P* on product x_i tells the entrepreneur when to accept a product and when to reject one given the information on past performance of products with characteristics x_i, and the costs and benefits of the various categories of decision.[12] Consider the simple decision rule P*:

$$\text{Accept product } i \text{ iff } \hat{p}_i > p^*. \tag{11}$$

The expected return function for the arbitrary decision rule P* for the ith project is given by

$$\begin{aligned}R = &\int_{p^*} f(\hat{p} | \theta_H) q_H V(\theta_H)\, d\hat{p} \\ &+ \int_{p^*} f(\hat{p} | \theta_L) q_L V(\theta_L)\, d\hat{p} \\ &- \int^{p^*} f(\hat{p} | \theta_H) q_H V(\theta_H)\, d\hat{p},\end{aligned} \tag{12}$$

where q_k is the prior probability of outcome k. The first term on the right-hand side of the equation represents the gain from accepting a successful product; the second and third terms represent the losses from respectively accepting a failing product and rejecting a successful one.

Taking the derivative of this expression with respect to p* yields

$$\begin{aligned}\partial R/\partial p^* = &-f(p^* | \theta_L) q_L V_L \\ &- 2f(p^* | \theta_H) q_H V_H.\end{aligned} \tag{13}$$

An interesting point immediately emerges from the use of the Decision-Theoretic approach here: if $V_L = 0$ 13 is negative, hence optimal $p^* = 0$ and *all products are accepted regardless of quality.* This is simply because *there is no cost to making a wrong decision.* Similarly, if there were no benefits to a right decision (an unlikely but not impossible case)[13] we should find $V_H = 0$ and ((assuming $V_L < 0$) $p^* = 1$, implying that *no* products should be accepted.) The typical case however is where neither V_L nor V_H is zero, and this yields an interior solution to 13:

$$0 = -f(p^* | \theta_L) q_L V_L - 2f(p^* | \theta_H) q_H V_H. \tag{14}$$

This equation says that the optimal reservation probability must satisfy the condition that the expected marginal gain from raising the probability must equate to the expected marginal cost of so doing. The former is reflected in the fact that fewer loss-making projects are accepted, and the latter in the facts that (a) more successful projects are rejected and (b) a smaller number of successful projects are accepted.

Adopting the optimal reservation probability implies the decision rule 11 is now optimal.[14] Note that the accuracy of the decision rule will increase (i) the better the estimated model is specified and (ii) the larger the sample size of projects available (the greater the entrepreneur's "experience" set).

In the special case where the parameters β are judged to be zero on current information except for the intercept β_o, it is easy to show that for the logistic probability function

$$p_i = (1 + e^{-\beta' x_i})^{-1} \tag{15}$$

the estimated probability $\hat{p}_i$ is simply

$$\begin{aligned} \hat{p}_i &= (1 + e^{-\hat{\beta}_0}) \\ &= n_H/(n_H + n_L) \equiv \hat{p}, \text{ all } i, \end{aligned} \tag{16}$$

where n_k = sample numbers in the entrepreneur's 'experience set'

and $\hat{\beta}_o$ = MLE estimate of the intercept term in the vector β.

The optimal reservation rule in this case becomes redundant since products' characteristics are uninformative. Similarly subjective certainty ($\hat{p}_i \cong 1$) that consumers will 'like' the project ($\tilde{\theta}_i^* > 0$ or $\tilde{\theta}_i = \theta_H$) is indicated by an extremely large estimate $\hat{\beta}' x_i$, and subjective certainty that they will 'dislike' the project ($p_i \cong 0$) by an extremely small $\hat{\beta}' x_i$.

Equation 14 gives p^* as a function of the parameters of the model. This value, it must be emphasised, is not static but evolves with information the entrepreneur has accumulated at each stage.

We now briefly examine the influence on this probability of changes in the prior probability of success (q_H), the realised demand parameter θ under success (θ_H), the interest rate (r), startup costs (F) and the wage rate/materials price (w_i). The results obtained from simple differentiation of equation 13 are presented in Table I below.[15]

Intuitively the signs of the comparative statics derivatives are determined by the effect of changes in the relevant parameters on the expected returns to the borderline or marginally acceptable product (quality $p = p^*$). If a parameter change increases the return to this product it now becomes worth investing in. (If the product is accepted and is a success then it is now worth more; if accepted and a failure it now costs less.) Hence more products should be accepted, which can only be the case if the probability cutoff is lowered.

TABLE I
Comparative statics

	∂p^*	$\partial E\tilde{n}$
∂F	+	−
∂r	+	−
∂w	+	−
$\partial \theta_H$	?§	?
∂q_H	−	+

§ +/− as $\partial f(p|\theta_H)/\partial\theta_H \lessgtr 0$.

Note: n = random variable representing the number of projects accepted, E = expectations operator.

Since factor prices are inversely related to profits we should expect a rise in any of them to reduce the amount of entrepreneurial activity, and this is the case. The same logic applies to startup costs: higher entry barriers produce less entry. Since the prior probability of success increases the joint probability of observing p^* and θ_H and decreases the joint probability of observing the opposite values we should expect a rise in q_H to increase the number of products accepted. Finally, the effect of a change in the demand parameter θ_H is anticipated to be ambiguous: its only effect is on the likelihood $f(p^*|\theta_H)$, so that if an increase in θ_H increases the likelihood of observing p^* given θ_H then the expected profitability of the marginal product is raised, thus raising the number accepted. Otherwise it is lowered with the opposite consequences.

3. Summary and conclusions

The model presented above departs from the prevailing literature in modeling the sequence of business decisions implicit in what we have called *opportunistic* entrepreneurial behaviour. The model takes the form of an optimal decision rule based on a success probability cutoff which maximises the entrepreneur's expected return. The optimal reservation probability was shown to be a function of the quality of the entrepreneur's data (the projects coming his way), of his ability to formulate the 'correct' model and of his ability to update it as information accumulates. It was also shown how the optimal reservation probability responds plausibly to changes in observable components of project profitability: input prices, startup costs, interest rates, and so on. An important contribution of the present model is thus that it reflects more accurately the complexities of real-world entrepreneurial behaviour, predominantly concerned, we believe, with a sequence of new product decisions rather than simply business starts or closures.

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Notes

[1] For example, the product should have a 'unique selling point', it should identify a market niche, the market should be 'big enough', costs should be 'low enough', the number of competitors should not be 'too great' to squeeze margins to unacceptable levels, etc.

[2] The decision on the first project can be thought of as the decision to enter business or stay in the alternative state, which is left unspecified. Empirical evidence suggests that almost a third of business starts come from unemployment, and the majority of the remainder from a previous job.

[3] For example θ may represent the intercept and α the slope of a linear demand function. We assume for simplicity that only θ is random.

[4] Whilst this assumption is useful for simplicity, a more general formulation allowing for complementary/substitution is analytically possible and forms the basis of a future paper.

[5] The approach using latent random variables follows the literature on limited dependent variables. See Maddala (1983).

[6] It may seem strange that a utility function should be linear in characteristics. However this is in some sense the utility function of a *representative* consumer. Furthermore, it may be regarded without significant loss of generality as an approximation to the individual (concave) utility function.

[7] We do not assume the reader takes this too literally. A Friedmanian *as if* interpretation of the hypothesis is sufficient for our purposes.

[8] See Maddala (1983) for details.

[9] Here the observations on past performance generate the joint density $f(\hat{p}, \theta)$ which then gives marginal density $f_2(\theta)$ by integration.

[10] These will be primarily the informational costs associated with entering a new market and are thus independent of the output produced even in the long run.

[11] Banks normally require collateral for loans and hence if the firm defaults it will incur loss of assets advanced for this purpose. Also whilst finance theorists often invoke Limited Liability to bound the entrepreneur's losses from below by zero, in practice, and especially for small firms, banks will normally require a Personal Guarantee from the entrepreneur(s) himself (themselves) to advance a loan. Both these facts imply that in reality the firm's losses are at least to some extent the entrepreneur's rather than the lender's and justify our assumption in the text.

[12] For an application of this kind of rule to financial decision-making see Cressy (1991).

[13] This might occur if the 'monopoly' market we have assumed was in fact perfectly competitive!

[14] Amongst the class of single cutoff decision rules.

[15] We assume in deriving these results some elementary results on monopolist Indirect Profit Functions, in particular that the derivative of the indirect profit function with respect to a factor price equals the negative of the input demand. Proofs of these propositions are available from the Author.

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