Tihomir Janicek, Ph.D.
American College for Management and Technology
Dubrovnik

SPECIFIC SPECULATIVE TYPE OF INVESTMENT

UDK/UDC: 336.645
JEL klasifikacija/JEL classification: E22, D84
Pregledni rad/ Review
Primljeno/Received: 20. rujna 2005./ September 20, 2005
Prihvaćeno za tisak/Accepted for publishing: 22. studenog 2005./ November 22, 2005

Summary

This research work has been concentrated on impact of social learning on the investment intensity. The investors can be faced with expected short-run profitability of new investment what can make inadequate influence on investor's incentive to invest. The model what has bee used, supposed social environment of high investment activity thankfully to the speculative motive.

Key words: investment, social environment, speculative motive.

1. INTRODUCTION

The link between social learning and investment is increasingly recognized. Intuitively, entrepreneurs might have an incentive to follow the behaviour of others because early investment is perceived to signal high profitability. But this does not explain the behaviour of early investors, who must invest before the profitability of new investment opportunities has been tested. One strand in the literature looks at how informational externalities influence the option value of delay and shows the irreversible investment opportunities can remain unexploited. In explaining why unambiguously profitable investment opportunities remain un exploited, this conventional view emphasizes the strategic substitutability of investments, the dominant effect of the downside risk associated with investment opportunities, and the negative effect of uncertainty on the incentive to invest.

In the present paper has been tried to understand the interaction between social learning and investment, but we consider the case of reversible investments and highlight the influence of informational externalities on the option value of early investment. The analysis illustrates how social learning might underline the observation of episodes of high investment activity before the profitability of new investment opportunities has been tested.

Investment associated with the dot-com boom is one concentrate example of what the analysis of this paper can refer to. There is a common perception of a powerful first-mover advantage in internet business. But it is not just about staking out a market; it is also about getting the "business model" right, which in turn relies on social learning about financial planning, quality control, a viable billing model and customer service. Furthermore, Internet retailers are willing to incur substantial short-run losses in the hope of being able to exploit their investments' upside potential. Investments associated with the gentrification of

urban areas are another relevant example. It pays to move into a previously depressed neighbourhood before the often potential is revealed through a process of social learning.

This analysis rests on important features of these examples. Specifically, equilibrium model of investment has been considered with the following features. First, new investment opportunities are short lived. This creates an opportunity cost of waiting, which endows early investment with an option value. Second, entrepreneurs can learn about the productivity of new investment opportunities by observing each other's experience. The reversibility of investment decisions makes such information valuable and provides a channel for the expectation of the forthcoming information to influence the option value\e of early investment.

In this context, we show that investment may result from a speculative motive, because it enables entrepreneurs to exploit the investment's upside potential in the event that the forthcoming information indicates that it is profitable to do so. Accordingly, higher degrees of uncertainty raise the incentive to undertake investment opportunities. Furthermore, it is natural to view investments as strategic complements, because the prospect of social learning associated with higher investment levels raises the option value of early investment. Consequently, high investment levels might arise as an equilibrium outcome when they would not be justified on the basis of the expected short-run profitability of new investment opportunities alone. However, to a naïve observer who fails to account for the influence that the prospect of social learning has on the option value of early investment, this type of equilibrium outcome may seem incorrectly, to be characterized rather as an episode associated with irrational exuberance.

2. THE MODEL

Each of N agents must decide whether or not to undertake an investment project that lasts for two periods. Agent i' s one-time cost of the investment is c_i, where $0<c_1<c_2<\ldots<c_n$. The exploitation of the new investment opportunity generates profits $\theta + \varepsilon'_i$, in the first period, where θ is average profitability. In addition, those entrepreneurs who invested in the first period, and only they acquire the option to produce in the second period and collect profits equal to $\theta' = \theta + \varepsilon'_i$, where ε'_i are independent random variables jointly normally distributed, with mean zero and variance δ^2_ε. The critical assumption that waiting is irreversible is a simple device to endow investment with an option value. It will allow us to invest, abstracting from the well understood influence of informational spillovers on the option value of delay.

Entrepreneurs have ex ante probability distribution over the average profitability of the investment project. For simplicity, it is assumed that θ is normally distributed with mean θ'' and variance Σ. At the end of the first period, investors observe the returns to all investment activities. Under these assumptions all payoff-relevant information is summarized by

$$K = \sum_{I=1}^{N} k_i$$

And

$$R = 1/K \sum_{I=1}^{N} k_i (\theta + \varepsilon_i) = \theta + 1/k_i \, \varepsilon_i$$

Where k_i when agent i invests and k_i otherwise, K is the number of investors, and R denotes average profits.

Since θ and R are jointly normally distributed, we know that the conditional distribution of θ' given R is normal with mean.

$E[\theta'/R] = (1 - \Sigma / \Sigma + K^{-1} \delta^2_\varepsilon) \Sigma + \delta^2_\varepsilon$;

And variance $Var[\theta'|R] = (1 - \Sigma / \Sigma + K^{-1} \delta^2_\varepsilon) \Sigma + \delta^2_\varepsilon$

While the updating rules are standard, the important feature is that higher levels of investment activity generate more informative signals. This is reflected in the fact that Var [θ'|R] declines with K.

3. EQUILIBRIUM ANALYSIS

If investment decisions were irreversible, the value of the investment project would be V = 2 θ'', and agent i would invest when $V>C_i$. When investment is reversible, however, the presence of informational spillovers is important because the value of the investment project depends on the expectation about the forthcoming information. In the second period, production will take place when E [θ'|R] =/> 0, since the cost of investment C_i is, then, already sunk. Thus, either all first-period investors produce in the second period or no one does. The value of the investment project is the sum of the expected short-run profitability and the option value of investment,

$V'(K) = \theta'' + E [\max\{0, E[\theta'|R]\}$,

Where K is the expected level of investment, which in equilibrium coincides with actual investment. Since Waiting is irreversible, agent i will invest when $V(K) > c_i$,

Speculative investment

The main implication of the model is that V(K) increases with K. Consequently, investment activities are strategic complements and K going {2,…,N-1} is an equilibrium outcome if and only if $c_k \leq V(K) < V(K+1) < c_{k+1}$. Similarly, K = 0 is an equilibrium outcome if and only if V(1) <= c_1 and K = N is an equilibrium outcome if and only if $V(N) \geq c_N$. Existence of equilibrium follows from Tarski's fixed-point theorem (Milgrom and Roberts1990).

To see why V(K) is increasing with K, note first that an increase in K causes a mean-preserving spread in the distribution of the posterior expectation E[θ'/R]. It is sufficient to note that:

$E[E'(\theta'|R)] = e'[\theta']$, and $Var[E\,\theta'|R] = \Sigma^2 / \Sigma + K^{-1} \delta^2_\varepsilon$,which is increasing in K.

Thus, the posterior expectation becomes more dispersed as K increases. It is worth noting that, as K increase, the signal becomes more precise ex post. Accordingly, recall that Var[θ'|R] declines with K. However, the incentive to invest is influenced by the ex ante distribution of the posterior expectation E[θ'/R] when R is regarded as a random variable; and as K increases, more weight is put on the signal rather than on the prior. Thus, the important feature is that higher levels of investment imply, ex ante, a more dispersed posterior expectation. That V(K) is increasing with K follows immediately from the convexity of max {0,E[θ'|R]}.

This result highlights the speculative nature of investment; by investing, entrepreneurs are, in effect, taking positions in the hope of being able to exploit the investment's upside potential in the event that the forthcoming information indicates that it is profitable to do so. These investments obey a speculative motive in the same sense that inventories that are held in order to avoid stock-outs are speculative. It is worth nothing that, in effect, entrepreneurs behave as if they were risk lovers - even though they are risk neutral by assumption. Intuitively, their incentive to invest rises with higher investment levels, because they indicate that the posterior expectation E[θ'|R] will be more sensitive to the realization of the signal, which in turn raises the option value of investment.

It should be noted that the characterization of investment as speculative is appropriate in this context because informational spillovers influence the option value of investment. For a comparison, consider the alternative scenario where investment is irreversible, in that first-period investors do not have the option not to produce in the second period, but entrepreneurs have the option to wait for one period and invest in the second period. E [max {0,E[θ'|R]}] is now the option value of waiting, whereas the value of investing in the first period is simply V=2θ. Consequently, the expectation of higher "K" lowers the entrepreneurs' incentive to invest, and investments therefore are strategic substitutes.

Two other points are worth noting. First, emphasis is not on investment as a problem of individual learning by experimentation. In particular, our analysis of equilibrium with positive investment goes through if the parameters of the problem are such that $V(1)<c_1$ so that no agent is willing to invest in isolation and, thus, K=0 is always an equilibrium outcome. This will be the case, for example, when θ'' and Σ are sufficiently low[1]. Second, emphasis is also not on the entrepreneurs' ability to strategically influence the behaviour of others, since learning from others is only valuable provided that an agent invested in the first place[2].

a. Coordination

In general, there may be multiple equilibrium, which are Pareto ranked according to K. In particular, coordination failures may occur because the expectation of low levels of investment activity interferes with the flow of information, thereby depressing the option value of investment. This, is turn, makes possibility of low levels of investment in the

[1] V is increasing in θ'' and Σ. The first property follows from the fact that max {0,E[θ'|R]} is a non-decreasing function of θ'', together with the fact that the E[θ'|R], when $\theta'' = \theta_1''$, is stochastically lager than it is when $\theta'' = \theta_2''$, whenever $\theta^{1''} > \theta^{2''}$. The second property follows from the convexity of max {0,E[θ'|R]}, together with fact that an increase in Σ causes a mean-preserving spread in the distribution of E[θ'|R].

[2] See Aghion et al. (1991) for a discussion of individual learning by experimentation and Bolton and Harris (1999) for model of strategic experimentation.

present context is different from that underlying strategic delay (e.g., Charley and Gale 1994). Here, entrepreneurs are not investing because they expect others not to invest, not because they area waiting to learn from the behaviour of others.

A particularly interesting feature of equilibrium behaviour is that the coordination of investment activities becomes more relevant when expected productivity is relatively lower. Comparing the value of the reversible investment project with its value when investment is reversible,

$V'(K) = V + E\,[\max\{0,E[\theta'|R]\}] - \theta''$,

It has been seen that V (K) exceeds V by an amount equal to the value of the forthcoming information. That the value of information is positive follows from Jensen's inequality. When θ'' is sufficiently high, the value of investment stems, in effect, from the high expected productivity and thus from the high value of $v= 2\ \theta''$. In particular, since information is valuable, investment is optimal for agent "i" when $V>C_i$. Therefore. Let suppose that $V<c_i$. For at leas some i=1,…,N. Instead, when θ'' is sufficiently low, the value of investment stems from the value of the forthcoming information. It is then that the possibility of high levels of investment becomes interesting. In particular, a naïve observer who fails to take account of the influence that the prospect of social learning has on the option value of investment then be tempted to incorrectly attribute some equilibrium outcomes irrational exuberance. For example, the expectation of high levels of investment may be self-fulfilling, even though the short-run profitability of investment projects is expected to be negative.

b. Uncertainty

For concreteness, let focus on the equilibrium that achieves the highest level of investment. An implication of the model is that speculative investment becomes more attractive as the level of uncertainty increases. This is reflected in the fact that k is non-decreasing in Σ.[3] The interest of this result lines in its contrast with the conventional view associated with emphasis on the option value of delay, which suggests that increases in uncertainty will discourage investment.[4] The interest of this result lies in its contrast with the conventional view associated with emphasis on the option value of delay, which suggests that increases in uncertainty will discourage investment[5]. The difference is better understood once one notes that an increase in Σ involves simultaneous increase in the downside risk of investment and an increase in its upside potential. When investments are irreversible and entrepreneurs have the option to wait, then the increase in the downside risk is the dominant effect and the increase in Σ raises the option value of waiting. Here, instead, the increase in the investment's upside potential is the dominant effect and the increase in Σ raises the option value of investment. A second difference is that the influence of uncertainty on speculative investment is amplified by the multiplier effect associated.

[3] V is increasing in Σ, as shown in footnote 1. Standard monotone comparative static's (Milgrom and Roberts 1990) indicate that the equilibrium level of investment K must be non-decreasing in Σ.

[4]Has to be seen Bernanke (1983) for an early discussion in a model where the arrival of information is exogenous.

[5] Cooper and John 1988 for an insightful analysis of models with strategic complementarities.

4. EXTENSIONS AND CONCLUDING REMARKS

The coexistence of high levels of investment and negative shot-run return might be thought to depend on the absence of ex post limited liability. In order to address this issue, has to be supposed that legal restrictions ensure that investors can limit second-period losses to L>0. Then the value of investment becomes

$V'(K) = \theta'' + E[\max\{0, E[\max\{-L, \theta''\} \mid R]\}]$.

As L becomes Large, V(K) will be given by equation $V'(K) = \theta''+E[\max\{0,E[\theta'|R]\}]$. As L approaches zero, the option value of investment becomes $E[\max\{0,E[\max\{0, \theta'\}|R]\}] = E[\max\{0, \theta'\}]$, which is independent of K. This is because second-period production becomes a dominant action and thus information has no value when the maximum loss L coincides with the opportunity cost of second-period production, which we have normalized to zero. This indicates the robustness of our results to the presence of limited liability and it underscores the fact that our analysis relies on the presence of some downside risk and the non-trivial option to exploit the upside potential of investment opportunities. Here, because the opportunity cost of second-period production has been normalized to zero, this the case when L>0 and $E[\max\{-L, \theta'\}|R]<0$ for some realization of R, in which case V remains convex and information has positive value.

The main implications of the analysis extend to the more realistic case of multiple investment opportunities. This further illustrates the role of informational spillovers as a coordination device. For simplicity, has to be consider a "traditional" investment opportunity, described by $\{\theta'', \Sigma\}=(\theta''_T, \Sigma_T\}$, and a "new investment opportunity, $\{\theta'', \Sigma\}=(\theta''_N, \Sigma_N\}$, suppose that both projects involve the same cost c_i for i=1,…,N. the two projects particular, entrepreneurs may choose not to invest in either project, in which case they save the cost c_i and enjoy the returns to the project that may be thought as being described by $\{ \theta'', \Sigma\}=\{0, 0\}$. In this context, equilibrium behaviour requires that all investors undertake the same project. To see this, let K_T and K_N denote investment levels associated with each of the projects, with $K = K_T + K_N \leq V (K_N + 1)$ and $V (K_N) \geq V (K_T + 1)$. But, these two conditions are inconsistent with the fact that V is increasing. Thus, investment will be concentrated in only one type of project.

Now let $\theta''_T>\theta''_N$ and $\Sigma_T<\Sigma_N$, so that new investment opportunities are characterized by lower and more uncertain returns. Then consider the influence of an increase in θ''_N on the equilibrium that supports the Pareto-superior level of investment, which is associated with the highest V(K). Suppose that, initially, $K=K_T$, thus, a small enough increase in θ''_N will have no impact on K. When θ''_N becomes sufficiently high, however, there will be a switch to the new investment opportunities and investment will change from $K=K_T$ to $K=K'_T \geq K_{T,\text{ even though average}}$ profitability is expected to fall from θ''_T to θ''_N.

The entrepreneur's incentive has been considered to invest when investors learn from each other's experience, but when early investors must commit resources before profitability has been tested. The analysis has shown how the prospect of social learning might facilitate the emergence of high levels of speculative investment activity, in which case the expected short-run profitability of new investment opportunities might inadequately reflect the entrepreneurs' incentives to invest. As discussed in the introduction, investment associated with the dot-com boom and with the rise of commercial activity in previously depressed urban areas are two concrete examples where our stylized model of investment might be particularly relevant.

This analysis brings attention to the effect of social learning on the incentive to undertake reversible investment opportunities. The effect of informational spillovers on the option value of investment emphasized the strategic complementarily of investments, the dominant effect of the upside potential of investment opportunities, and the positive effect of uncertainty on the entrepreneur's incentive to invest. In contrast, the conventional view has focused on the influence of social learning on the incentive to undertake irreversible investment, accordingly, the effect of informational spillovers on the option value of delay, the strategic substitutability of investments, the dominant effect of the downside risk associated with investment opportunities, and the negative effect of uncertainty on the incentive to invest.

REFERENCES

Aghion Philipe, Patrick Bolton, Christopher Harris, and Bruno Jullien (1991) "Optimal learning by experimentation", Review of Economic Studies 58, 621-654.

Banerjee Abhijit V. (1992) "A simple model of herd behavior", Quarterly Journal of Economics 107, 797-817.

Bikhchandany Sushil, David Hirshleifer, Ivo Welch (1992) "A theory of fads, fashion, custom, and cultural changes as informational cascades" Journal of Political Economy 100, 992-1026.

Branke, Ben S. (1983) "Irreversibility, uncertainty, and cyclical investment", Quarterly Journal of Economics 98, 85-106.

Bolton Patrick and Christopher Harris (1999) "Strategic experimentation", Econometrica 67, 349-374.

Caplin Andrew, John Leahy (1994) "Business as usual, market crashes and wisdom after the fact", American Economic Review 84, 548-565.

Chamley Christophe and Douglas Gale (1994) "Information revelation and strategic delay in a model of investment", Econometric 62, 1065-1085.

Cooper Russell and Andrew John (1988) "Coordinating coordination failures in a Keynsian model", Quarterly Journal of Economics 103, 441-464.

Deaton Angus and Guy Larque (1996) "Competitive storage an commodity price dynamics", Jorunal of Political Economy 104, 895-923.

Milgrom Paul and John Roberts (1990) "Rationalizability, leraning and equilibrium in games with strategic complementarities", Econometrica 58, 1255-1277.

Pekarichick Karin and George Foy (2001) "Alphabet City: ABCs of genetrification", Business Week 11, June, 24E2

Dr. sc. Tihomir Janjicek
American College for Management and Technology
Dubrovnik

POSEBAN SPEKULATIVNI TIP INVESTIRANJA

Sažetak

U ovom se radu istražuje učinak sociološkog saznanja na intenzitet investiranja. Investitori bivaju suočeni sa očekivanom kratkoročnom profitabilnošću nove investicije što može imati neadekvatan utjecaj na investitorov budući poticaj za investiranjem. Model koji je korišten predtpostavlja društveno okruženje za velika investiranja zahvaljujući spekulativnom motivu.

Ključne riječi: investicije, društveno okruženje, spekulativni motiv.

JEL classification: E22, D84