

Financing Mode and Enterprise Innovation: from the Respective of the Secondary Financing in a Start-up Enterprise

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Abstract: the enterprise nature has a close connection with its financing mode. An entrepreneur must distinguish between products and mainstream markets in order to make a positive profit in the competitive market, and he shall be in adequate control of the enterprise assets to execute this differentiation strategy. However, the start-up enterprise usually shall be invested with high capital, which makes the entrepreneur perform the secondary transformation to realize the standardization. Meanwhile the standardization may make the entrepreneur himself replaced by either external managers or internal staff. The paper shows that it generally makes equity financing more profitable than bond financing, and that the financing mode of an enterprise shall finally have an influence on its innovation ability.

Keywords: enterprise financing; differentiation; standardization; innovation ability

1. Introduction

As the core theory of the enterprise finance, the MM theorem (Modigliani-Miller Theorem) shows that the enterprise financing structure has nothing to do with its value. Obviously, this conclusion, the MM theorem, does not accord with the real world. Then the major job in the enterprise financing field is to overthrow the perfect environment hypothesized by the MM theorem one by one, and to try to explain the actual differences between the enterprises' financing structure via imperfect information. The most famous thing is that Modigliani and Miller both admit that the enterprise is more intend to finance with bonds for tax avoidance because of the difference in tax between equity financing and bond financing.

Furthermore, scholars believe that bond financing can better control the enterprise management, and that investor prefers bond investment. Up to now, financial economists in the enterprise seem to try to connect the enterprise capital structure with all the possible factors, including consumers' fear (Titman,1984), the predator theory (Bolton and Scharfstein, 1990), wages bargaining theory (Perotti and Spier,1993) and so on. Basically, in a saturated condition is the research on the enterprise financing structure based on the MM theorem.

This paper, however, explains the decision of the enterprise financing from a respective which is never considered before. The reason why the enterprise exists is that there is a transaction cost in the real world, which can be avoided through the merging between upstream enterprises and downstream enterprises. While the MM theorem does not involve this cost. So the basic question

discussed in the paper is that whether the transaction cost resulting in the enterprise's generation has an influence on the decision of the enterprise financing.

In the traditional enterprise finance, researchers generally hypothesize the enterprise combined by several investment projects with the properties of assets, cash flow and mortgage, but do not explain why these projects are combined into the enterprise. While in the non-enterprise finance field there is much research realizing the relation between the financing mode and the financing nature, including Bhide (Bhide, 2000, 2008), Hellmann and Puri (Hellmann and Puri, 2000, 2002), and Lerner and Malmendier (Lerner and Malmendier, 2010).

The paper shows that the start-up enterprise shall go through two transformations, and this is the main innovation point in the paper.

1) We define the first transformation as "differentiation". During the process of differentiation, the entrepreneur carries on the producing activities different from the mainstream one, hoping to gain excess profits. So his enterprise product or organizational form must be different from the normal enterprises. But there is a big risk in this kind of differentiation transformation.

2) Meanwhile, the start-up enterprise requires plenty of funds, which needs external financing. While the enterprise, where there is a big differentiation, finds it very difficult to gain the recognition of external investors. So the enterprise needs the secondary transformation, which is called "standardization". After that, the human capital of the entrepreneur becomes replaceable,

and the enterprise mobility rises. Although the enterprise still produces differentiation products after standardization, external investors have the chance to get the control right of the enterprise. At this time, good financing environment influences the financing decision of the entrepreneur. The stock market can better finance, for the stock holders pay more attention to the long-term development of the enterprise.

3) Two transformations are difficult to ensure the prospect of the enterprise during financing, for the former cannot be sure the profit gained due to differentiation, and the latter may lead to the problem of the control right due to standardization. So the financing mode of the enterprise has a direct impact on its innovation. Furthermore, the financing environment of a region plays a critical role in the enterprise innovation ability, the enterprise growth and the economic development.

2. The Model

It's difficult for an entrepreneur to gain profits through mainstream products which have been in the model market. Because the enterprise existing has an advantage in the scale, and may produce products through lower costs, so the entrepreneur is required to pioneer and innovate, and try new, different and risky products to make profits and gain production space. This is the process of the differentiation in the start-up enterprise.

But the problem is that it's difficult for the entrepreneur to persuade his partners, such as employees or technicians, to carry out this kind of innovation activity once there is differentiation. Once it fails, the human capital of the differentiation will not worth anything. So the entrepreneur has to persuade his employees to pay enough costs in order to produce differentiation products.

For example, an IT enterprise program, the software using the rare Clips language. The source code of the language programming may make the software more optimal, the speed faster and the volume smaller, but it's more difficult to program. But the problem programmers of the enterprise face the question that the human capital accumulated in the enterprise will be very small once the enterprise fails because the developed languages are usually Java language and C language in the market. In other words, employees in the enterprise face the risk of human capital depreciation.

Consider a two-phase model. In the first phase, the entrepreneur choose δ as the level of the differentiation, and $\delta \geq 0$. The probability of the entrepreneur's success is a function of the differentiation $p(\delta)$. Employees choose the level cooperating with themselves, that is, in which level the employees involve in the risky accumulation of the human capital. The involvement level of the employees is η .

If the enterprise succeeds, its value is $V(\delta, \eta)$. If it fails, the entrepreneur will get nothing, and employees can go to the job market again to sell their human capital. Provided that the employees can get $v(\eta)$.

We display the above function:

- 1) $p_\delta(\delta) < 0$, the bigger the differentiation is, the lower the probability of success is.
- 2) $\frac{d}{d\delta}(p(\delta)V(\delta, \eta)) > 0$, when $\delta = 0$;
 $\frac{d}{d\delta}(p(\delta)V(\delta, \eta)) < 0$, when $\delta = \infty$
- 3) $V_\delta(\delta, \eta) > 0$, $V_{\delta\delta}(\delta, \eta) < 0$,
- 4) $V_\eta(\delta, \eta) > 0$, when $\eta \leq \delta$; $V_\eta(\delta, \eta) < 0$, when $\eta > \delta$; $V_{\eta\eta}(\delta, \eta) < 0$
- 5) $v_\eta(\eta) < 0$, $v_{\eta\eta}(\eta) < 0$
- 6) We neglect the cross second derivative function.

In the above hypotheses, the third hypothesis shows that the involvement level nature of the employees is a coordination problem. Only when the involvement level coincides with the differentiation level of the entrepreneur, the value of the projects may maximize. Because the start-up enterprise is hugely uncertain, we suppose that the contract signed between employees and the entrepreneur is incomplete. After the project is successful, both sides divide the value fifty to fifty through negotiation.

2.1. Differentiation Behavior

2.1.1. The Most Optimal Social Welfare

Consider an optimal condition of the social welfare, which is the maximization:

$$PV(\delta, \eta) + (1-p)v(\eta)$$

The first order condition:

$$P_\delta V + PV_\delta - pv_\delta = 0 \quad \textcircled{1}$$

$$PV_\eta(\delta, \eta) + (1-p)v_\eta(\eta) = 0 \quad \textcircled{2}$$

From the above two formulas, we can see $\eta^{FB} < \delta^{FB}$. In other words, employees do not completely cooperate with the differentiation behavior of the entrepreneur in the situation of social optimization.

2.1.2. Employees Having Critical Assets

Once the project succeeds, the employee will gain $\frac{V+v}{2}$, and the entrepreneur will gain $\frac{V-v}{2}$. Once the project fails, the employee will gain v .

So the employee's optimal choice for cooperation level conforms to:

$$PV_{\eta}(\delta, \eta) + (2 - p)v_{\eta}(\eta) = 0 \quad (3)$$

Compare (2) with (3), the cooperation level paid by the employee owning assets is lower than the social optimal level, for owning assets strengthens the rest bargaining power to the producer. So he will choose to protect the minimum income which can be gained when he fails.

Make a further derivation from (3), and we can get:

$$\frac{d\mu}{d\delta} < 0$$

When the differentiation level increases, the success rate of the project reduces, so does the value of the cooperation level.

Consider the choice of the entrepreneur, the entrepreneur gets maximized.

$$P_{\delta}V + PV_{\delta} - pv_{\delta} = 2v_{\mu} \frac{d\eta}{d\delta}$$

The right end of the equality is greater than zero, so we can see that the entrepreneur chooses the differentiation level which is lesser than the social optimal level. On the one hand, the entrepreneur fails to see that the employee still has a part of maximum income after they fail. On the other hand, the optimal cooperation level of employees reduces, so the entrepreneur chooses a lower differentiation level. It seems that we get:

Theorem 1: When the employee has innovative critical assets, both of their cooperation level and the optimal differentiation level chosen by the entrepreneur are below the social optimal level.

2.1.3. The Entrepreneur Having Assets

The key different point is that when the enterprise fails the entrepreneur may negotiate with the employee how to share the maximum value because of having critical assets. So the entrepreneur and employees get the most

optimal at the same time $\frac{PV + (1 - p)v}{2}$. The first

order condition of employees is $PV_{\eta}(\delta, \eta) + (1 - p)v_{\eta}(\eta) = 0$ and the same as the social optimization. The first order condition of the entrepreneur is

$$\frac{d}{d\delta} \left[\frac{p}{2}V + \frac{1-p}{2}v \right] + \frac{d}{d\eta} \left[\frac{p}{2}V + \frac{1-p}{2}v \right] \frac{d\eta}{d\delta} = 0$$

, and the first half of the second item is the first order condition of the employee, which should be zero. So the first order condition of the entrepreneur is in accordance with the social optimization. It seems that we get:

Theorem 2: When the entrepreneur has the innovative critical assets, the cooperation level of employees and the optimal differentiation level chosen by the entrepreneur equal the social optimal level.

2.1.4. Ownership and Apriori Assets

While an enterprise may have a lot of this kind of critical assets or the entrepreneur can choose a couple of

employees, the entrepreneur should choose to own which kind of assets under this circumstance. Consider the first order condition of the employee, and the cooperation motivation of employees will be weakened at the soonest when v_{η} is very big. Meanwhile, the differentiation motivation of the entrepreneur will be also weakened by v_{η} at the soonest. So the maximum value of assets should be owned by the entrepreneur in the market apart from the enterprise differentiation.

2.2. Bond Financing

Now we consider how the entrepreneur finances. Basically, the financing of the entrepreneur is for two needs. First, he needs the capital to purchase the ownership of employees' critical assets; second, the start-up enterprise needs a large amount of capital to support the innovation. Provided that the entrepreneur undertakes to pay a fixed total amount, D , like a borrower. When the enterprise fails, the enterprise pays the fixed amount, D , then the entrepreneur equally splits the rest of the enterprise value with employees.

The maximization of the entrepreneur is $\frac{p}{2}(V - D)$, and the maximization of the employee

$$\text{is } \frac{p}{2}(V - D) + \frac{1-p}{2}v.$$

The maximal condition of employees is still $PV_{\eta}(\delta, \eta) + (1 - p)v_{\eta}(\eta) = 0$. So as long as the entrepreneur still chooses the optimal differentiation level, employees will also automatically choose the cooperation level of the social optimization.

The first order condition of the entrepreneur is

$$p_{\delta}V + pV_{\delta} - p_{\delta}D + pV_{\eta} \frac{d\eta}{d\delta} = 0$$

We can see that the higher the face value of the bond D is, the more positive the entrepreneur is to perform the differentiation transformation. As the entrepreneur is consistent with the loss when he fails, and the entrepreneur will make profits beyond the face value when he succeeds, the enterprise has the motivation to start up business. In order to reach the social optimization, we can get a bond level from the first order condition of the entrepreneur:

$$D^{FB} = v + \frac{p}{p_{\delta}}V_{\eta} \frac{d\eta}{d\delta}; \text{ that shall be called the}$$

social optimal bond level.

By the nature, the critical mechanism of the external bond lies in that the borrower will equally split the rest of the enterprise value with the employee when the enterprise fails in order to reduce the cooperation motivation of the employee and to further reduce the differentiation motivation of the enterprise. Let us see the bond financing in an economic boom.

Assume that the economy is in a boom, the entrepreneur believes that the success rate is very high, and the borrower also believes so, then in the loan provisions there is no provision that the borrower can

obtain enterprise assets when the enterprise fails under the situation that the borrower believes that the enterprise won't fail. Apparently, the employee will choose $\eta = \delta$. Once the enterprise succeeds, this success will be huge because of good cooperation level of the employee. While the entrepreneur will also choose the highest level of differentiation as he knows that the employee will choose a very high cooperation level. Instead, the actual success rate of the enterprise reduces.

In the irrational economic boom, the economy is easy to rise and fall dramatically, and the failure rate of the enterprise increases, while there are several successful enterprises rising.

2.3. Standardization Behavior

We discuss the relation between differentiation competitive and enterprise financing in the above paper. Consider a three-phase model, and the entrepreneur has established the above mentioned differentiation enterprise in the first phase, then he will choose the standardization level of the enterprise $\gamma \leq 1$.

After the entrepreneur confirms his standardization level, the employee chooses his hard learning level as μ . In the second phase, the enterprise generates the value as $V_E(\mu)$. While in this phase, the employees are likely to replace his employer. If the higher the standardization level of the enterprise is, the easier the employee is to replace the employer. After the standardization level of the enterprise increases, the individualism element of the enterprise reduces, and the difference between the enterprise managed by employees and the enterprise managed by the original entrepreneur reduces.

Therefore, we provide that employees replace the enterprise, and we will get $\gamma V_E(\mu)$. If the enterprise is not replaced by the employee and the entrepreneur retires in the second phase, external professional managers and employees can compete with the ownership of the enterprise at the same time. Provided that the probability that the external manager replaces the enterprise is $q(\mu, \gamma)$, the probability that the internal employee replaces the enterprise is $1 - q(\mu, \gamma)$.

$q_\mu(\mu, \gamma) < 0$, in the first phase, the harder the employee learns, the higher the probability that he replaces the external manager is;

$q_\gamma(\mu, \gamma) > 0$, the higher the standardization level is, the more formal the enterprise is, and the easier it is to find a suitable external manager.

In order to ensure that the model has an answer, we define that $q_{\gamma\mu} < 0, q_{\gamma\gamma} < 0, q_{\mu\mu} > 0$.

Provided that the entrepreneur negotiates with risk investment in the first phase, the entrepreneur transfers a part of stocks, sets aside α for himself, and gets $1 - \alpha$ from risk investment. After the second phase, the new manager can negotiate with the external shareholder, and the external shareholder can threaten to replace the manager.

The manager will get $\frac{V - \gamma V}{2}$, and the external shareholder will get $\frac{V + \gamma V}{2}$.

The timeline of the game is as follows:



Negotiate with the entrepreneur about risk investment; the entrepreneur chooses the standardization level; employees choose the learning level; the profit division between the enterprise and the external investor of risk investment.

The 2nd Phase

Based on the previous standardization level and learning level, the entrepreneur is replaced by the external manager or the internal employee; IPO of the enterprise; the profit division between the new manager and the external shareholder.

The 3rd Phase

All the previous contracts are executed.

Provided that the risk-free rate is r in every phase, the risks everyone has are neutral.

The maximization of the employee is $(1 - q(\gamma, \mu)) \frac{V^C(1 - \gamma)}{2(1 + r)^2} - \mu$. The first half is the revenue probably chosen, and the second half subtracts the learning cost. The first order condition of the employee is $-q_\mu(\gamma, \mu)V^C(1 - \gamma) = 2(1 + r)^2$

The maximization of the entrepreneur is $\frac{V^E(\mu)(1 - \gamma)}{2} + \alpha \left[\frac{V^E(\mu)(1 + \gamma)}{2} + \frac{V^C(1 + \gamma)}{2(1 + r)} \right]$.

The first half is the revenue when he is the entrepreneur, and the second half is the price cashed the rights and interests value he holds. His first order condition is

$$-V^E + \alpha \left(V^E + \frac{V^C}{(1 + r)} \right) + (1 - \gamma + \alpha(1 + \gamma))V^E(\mu) \frac{d\mu}{d\gamma}$$

the first item is the reduced revenue because of replacement, after the entrepreneur increases the standardization level. The second item is that the revenue lost in this part shows in the future stock price, which shall be compensated according to the shareholding ratio of the entrepreneur. The third item is that the competition for the control right probably increase in order to gain more revenue when the entrepreneur negotiates with the controller.

At last, the maximization of the risk investment is

$$(1 - \alpha) \left[\frac{V^E(\mu)(1 + \gamma)}{2} + \frac{V^C(1 + \gamma)}{2(1 + r)} \right]$$

In the frame of the game theory, the entrepreneur sets a lower standardization level than that of risk investment. It is because of this that the risk investment sets aside enough chips in the negotiation so as that the entrepreneur has the motivation to increase the standardization level of the enterprise. So we get:

Theorem 3: In the equity financing, the entrepreneur will set a lower standardization level of the enterprise than risk investment. The risk investment can stimulate the entrepreneur to increase the standardization level through giving up the equity division, and the more the entrepreneur holds stocks, the higher the standardization level is.

2.4. The Comparison of Financing Modes

We can learn from the financing practice that the vast majority of enterprises choose to cooperate with risk investment through the equity financing. First of all, the interpretation widely accepted is that the equity financing makes the risk investment have the ability to negotiate with the entrepreneur, thus a part of the equity financing compensates the high risk and low cash flow of the start-up enterprise. However the model in the paper has a mechanism, which makes the equity more popular than the fixed bond to investors.

Provided that the entrepreneur finances through bonds rather than equity in a risk investment office, he only has a small motivation to perform the standardiza-

tion behavior except that the face value of the bond is very high, for the standardization behavior fails to make its face value higher than the value of the bond and the face value is paid maximally. The price of the equity may increase because of the standardization behavior. As described in the above paper, an entrepreneur has the motivation bond finance the equity under the equity financing circumstance. Thereinafter, his substituent will face a tougher negotiation, and the external shareholder can make more profits. While the interest embodies in the original stock price of the enterprise! This is the critical difference between equity financing and bond financing.

2.5. More Reasonable Equity Financing

In the above frame, equity financing is always prior to bond financing, which seems too extreme. We consider a partial standardized model. An enterprise value still is V^c , just as before. Now there is an investment whose

amount is i^p , and the cash flow returned is v^p . If the entrepreneur finances for this project with equity investment, the total present value of the enterprise will become $\frac{1 + \gamma}{2(1 + r)}(V^c + v^p)$, including that the new

shareholder gets i^p . When $\frac{1 + \gamma}{2(1 + r)}(V^c + v^p) - i^p < 0$,

the original stock equity of the enterprise will be diluted.

Through bond financing, we provide that the size is d^p . If the original bond is with the new bond and the total amount does not exceed the value the employee replaces the entrepreneur, there is no difference between bond financing and equity financing.

When $\gamma(V^c + v^p) < D + d^p$, equity financing has not any advantages. Because the bond is too high, the borrower must involve in core assets. So the threat to the manager resulted in by the equity financing will not exist at all.

Theorem 4: When $\gamma(V^c + v^p) < D + d^p$, the effect of bond financing will excess that of equity financing.

3. Empirical Evidence

Kaplan, Sensoy, and Stromberg (Kaplan, Sensoy, and Stromberg 2009) have found that a majority of innovation advantages reported by the start-up enterprise of risk investment keep steady except management and human capital as time goes on. Meanwhile, 46% of enterprises state that he is different from other homogeneous enterprises in the plan of the start-up enterprise. In the phase of IPO, this figure reduces to 16%. This can be understood as the process in which an enterprise transfers into standardization from differentiation.

Hellmann and Puri (Hellmann and Puri 2002) have found that enterprises of risk investment change CEO more frequently, which interprets that the control right of equity financing threatens the mechanism.

Furthermore, Kaplan, Sensoy, and Stromberg (Kaplan, Sensoy, and Stromberg 2009) have reported in the original plan that the rate of CEO in the start-up enterprise is as much as 77%, while this figure reduces to 38% in the phase of IPO. The series of empirical research shows that the model in the paper has an realistic explanatory power.

4. Conclusion

This paper explains the relation between the enterprise innovation and financing from the enterprise financial perspective which is totally different from the MM theorem. From the thought of Coase's transaction cost theory, this paper explains that how the enterprise innovation ability is influenced through depicting the game relation among the entrepreneur, the employee and the financing party. This paper shows that the ownership of the enterprise impacts the entrepreneur's spirit of adventure and reaches the social optimization only if the entrepreneur owns all the critical assets. When the entrepreneur must finance, generally speaking, he has to realize the standardized transformation and gains the possibility of stocks' IPO. Generally speaking, equity financing of risk investment is prior to bond financing. When the debt is very high, bond financing is prior to equity financing. So there is a remarkable relation between financing and innovation of the start-up enterprise.

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