Cost-Benefit Analysis of Confirming and Factoring Financing Portfolio

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COSTBENEFITANALYSISOFCONFIRMINGANDFACTORINGFINANCINGPORTFOLIO

Strictly as per the compliance and regulations of:

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Keywords: cost-benefit analysis, confirming storage and factoring financing portfolio.

I. Introduction

a) Combined Product Definition

Bank of the borrower to provide advance payment (Bao Duicang), for the upper reaches of the core enterprise procurement of goods, The borrower may sell the goods to the large downstream buyers designated by the bank. Take the downstream buyers account receivable to the bank for factoring financing. Use the money to fill the confirming of factoring financing storehouse financing the acceptance of exposure. After receiving the loan from the enterprise, the bank will deduct the principal and interest of factoring financing. The balance will be returned to the borrower.

b) Analysis of the Product's Demand Motivation

This kind of product mostly suits the needs of large trade companies, both the upstream and downstream customers of which take up strong positions. Take the demand analysis of Jidong cement dealer as an example. Due to the fact that the dealer needs to send the loans to the accounts of cement manufacturer, the needs of advance payment financing exist, and the confirming storage financing business can pay the loans in a lump sum directly to upstream core enterprises in the form of banker's acceptance bill. The downstream dealer acquires low unit purchase price because of the relative large purchase volume. Thus the confirming storage financing is well liked be the dealers and the demand flourish. After picking up goods with the first deposit, the dealer sends goods to the downstream estate agent, obtaining the accounts payable of downstream core enterprises. Apparently the money-borrowing companies have the needs of using factoring financing to pay back the remaining exposure of confirming storage financing. When the banker's acceptance bill is paid back, the money borrowing company delivers all the goods to downstream core enterprises, it has needs for second time factoring financing to release the liquidity pressure and to afford advance payment.

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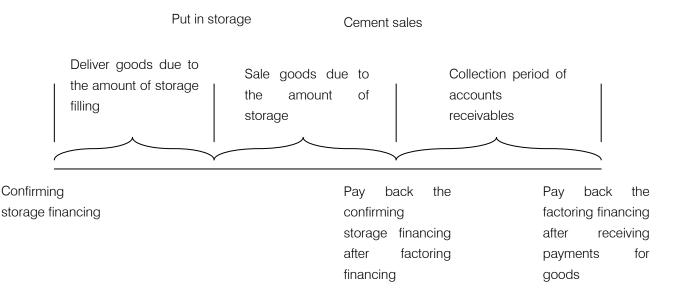The exposure of money borrowers (see diagram 1)

Purchase from advance payment

Put in storage   Cement sales

| Deliver goods due to the amount of storage filling | Sale goods due to the amount of storage | Collection period of accounts receivables |

| Confirming storage financing | | Pay back the confirming storage financing after factoring financing | Pay back the factoring financing after receiving payments for goods |

Diagram 1 Cash exposure of Jidong cement dealer

c)   Product Advantage

The confirming storage and factoring financing portfolio is a typical supply-chain financial portfolio. The bank provide financing service for all the business on the supply chain, ensuring financing of money-borrowing companies on every step on the supply chain such as purchase, transportation and sales, in the meantime they enlarge their user groups. In the supply chain system, as the company's commodity form keeps moving forward from future's drawn right to material form then to accounts receivables, the risk of banks are accordingly released. The rate of return also rises because of the cross selling of financial products. Money-borrowing companies are responsible only for picking orders from downstream enterprises and purchasing from upstream enterprises. The demand for financing is outsourced to banks, thus realizing a win-win situation for bank and the company.

d)   Applicable Users

As for dealers, if both the upstream and the downstream enterprises are core companies, their positions in the supply chain is relatively low, thus the confirming storage and factoring financing portfolio suits the situation when external financing is needed to raise the turnover rate of products. These dealers usually belong to large trade companies, with strong suppliers and strong downstream companies, so they need to pay in advance for purchases while sell on credit. In reality companies in the following supply chains most recently use this kind of product: cement manufacturing plant+cement dealer+real estate enterprise; coal manufacturing plant+coal dealer+power generation
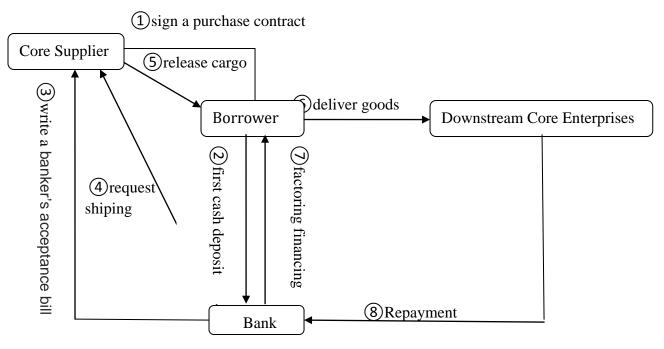
enterprises; rubber manufacturers+tyre dealers+car manufacturers. The objective of this portfolio includes but is not limited to the supply chains mentioned above, but it needs to suit the characteristics of these supply chains, which is core company+dealer+core company, plain speaking the strong+the weak+the strong.

II.   Analysis on a Single Cycle of Confirming and Factoring Financing Portfolio

a)   Introduction of the Single Cycle Business Process

Borrowers are provided with financing from banks to purchase goods from core upstream enterprises, so they can sell products to core downstream enterprises. The accounts receivables factoring financing from downstream companies can serve as deposit for goods. Before the banker's acceptance bill expires, the exposure of confirming storage financing must be fulfilled. Finally core downstream enterprises pay back their loan to factoring accounts specific to banks, thus end the portfolio financing process.

Single cycle business process flowchart of confirming and factoring financing portfolio is depicted in diagram (1-1):

1-1 Single cycle business process diagram of confirming and factoring financing portfolio

The operating mechanism can be depicted as follows: the core upstream suppliers sign purchase contracts with borrowers, while the banks sign confirming storage contracts with both of them as third party. The borrowers store the first deposit in bank as required and agree to provide their future rights of taking delivery of cargo as pledge. The banks issue the bank's acceptance bill and pay directly to the core upstream suppliers. After receiving the bank's acceptance bill, they organize the source of the goods and send out the goods according to bank's instruction. The borrowers, once receiving goods, deliver them instantly to core downstream buyers, who issue proof of receipt. The borrowers provide bank with invoices, proof of receipt and so on from upstream buyers, so that bank can handle factoring financing for them, which is to fulfill the exposure of returning confirmer wharf finance. Finally, the downstream buyers pay back loan into bank's special factoring account, which the bank later pay back to borrowers after tax. Thus the single business process of confirming and factoring financing portfolio is completed.

The combination of confirming and factoring financing has wide application in practice, as its operational process is relatively fixed and its business process specific and clear. Both supply and requisitioning parties should follow the regulations strictly during the process.

b) *Model Assumptions and the Meanings of Parameters*

  i. *Model assumptions*

- The release cycle of upstream enterprises is T_0.

- The core downstream enterprises require borrowers to provide goods before a specific time point and the accounting period is t.

- Confirming storage financing uses banker's acceptance bill, while factoring financing uses current loans.

- Borrowers file applications for factoring financing to banks with income generated by the first deposit before the due date of confirming storage financing.

- Banks should pay deposit interests to companies for the first deposit.

- To maximize their profits, borrowers use all their accounts receivable to apply for factoring financing.

- Risks are temporarily neglected (including market risks and credit risks).

  ii. *Definition of parameters*

Parameters and their meanings are stated as table 1-1.

Table 1-1 : Parameters and their meanings

Parameters	Meanings of Parameters
C	The amount of money of banker's acceptance bill
δ	Margin ratio
β	Ratio of commission charges for creating bills
P_1	Purchase price per unit (confirming storage)
P_0	Purchase price per unit (not confirming storage)
y	Average interest rate of bank loans (annualized)
y_0	Deposit interest rate of first deposit (annualized)
T	Time period of banker's acceptance bill
T_0	Release cycle of upstream suppliers (annualized)
P_2	Selling price
R	Loan rate
λ	Ratio of factoring financing
t	Repayment period of downstream buyers
π_B	Net profit of banks
π_C	Net profit of borrowers

c) *Cost-Profit Analysis of Banks*

Bank's profits mainly consist of two parts, one is the commission charges for banker's acceptance bill in confirming storage financing and the earnings of the deposit during the time period, the other is the earnings of current loans brought by factoring financing. Thus we can calculate the net profit of the bank as in Formula (1-1).

$$\pi_c = C \cdot \delta \cdot \frac{P_2}{P_1} \cdot \lambda \left(R - R_0\right)\left(T + t\right) + C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda\right)^2 \left(R - R_0\right)\left(T - T_0 + t\right) + \cdots C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda\right)^{\frac{r}{r_0}} \left(R - R_0\right)t$$

$$+ C \cdot \beta + C \cdot \delta \left(y - y_0\right)T + C \cdot \delta \cdot \frac{P_2}{P_1} \cdot \lambda \cdot y\left(T - T_0\right) + \cdots C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda\right)^{\frac{r - r_0}{r_0}} \cdot y \cdot T_0 \qquad \text{Formula (1-1)}$$

Obviously, bank's loan profit depends on loan interest rate and borrowing time. Borrowing time is determined by the time that it takes downstream suppliers' to sell on credit and to deliver their goods. The longer the time of delivery is, the lower the profits; the longer the time of the credit sales is, the higher the profits. Profits from deposit are determined by the occupied time of money and its rate difference. The occupied time of money is determined by delivery period. The longer the time of delivery is, the fewer the profits. In order to maximize its benefits, the bank hopes to shorten the delivery period and raise the loan rate.

d) *Cost-benefit analysis of money-borrowing companies*

In the confirming storage and factoring financing portfolio, the cost of borrowers mainly depends on costs of loans paid to banks for factoring financing and the cost of issuing the banker's acceptance bills. The profits come from loans of sales on credit after time t since the delivery of goods. Thus the net profits of money-borrowing companies can be calculated as Formula (1-2).

$$\pi_C = \frac{P_2}{P_1} \cdot C - C - C \cdot \delta \cdot \frac{P_2}{P_1} \cdot \lambda \cdot R(t + T_0) - (1 - \delta) C \cdot \frac{P_2}{P_1} \cdot \lambda \cdot R \cdot t - C \cdot \beta$$
$$+ C \cdot \delta \cdot y_0 \cdot T \qquad \text{Formula (1-2)}$$

Obviously, the net profit of money-borrowing companies mainly depends on the price difference of buy and sell and the interests paid to banks. The bigger the price difference is, the bigger the profits. The amount of interests paid to banks is determined by time period of credit sales and the delivery cycle. As borrowers, both of these factors are expected to be longer, which means fewer interests and more benefits.

e) *Game analysis of banks and companies in the combination of confirming storage & factoring financing and single product selection*

i. *Comparing the difference between different financing methods*

This part compares the method of combination of confirming storage and factoring financing with the method of single factoring financing product, in order to discuss the difference between different financing products and their influential factors.

This part compares the difference between confirming storage and factoring financing with single factoring financing instead of comparing the difference between portfolio financing and single factoring financing, because in reality, factoring financing usually takes the form of banker's acceptance bills, with fewer costs and benefits. In the meantime, if only confirming storage financing is used, the company must wait time t after the delivery of goods to get the loans. The holding time of money is so long that it is no longer consistent with the rule of maximization of profits, thus it happens rarely.

Comparing bank's net profits

To compare bank's net profits between the two business processes during the same period of time:

- According to Formula (1-1) in 1.1.3, the net profits of banks using confirming storage and factoring financing portfolio is:
- the net profits of banks if using single factoring financing is depicted in Formula (1-3):

$$\pi_B(singleness) = \frac{P_2}{P_1} \cdot C \cdot \lambda(R - R_0) \cdot t \qquad \text{Formula (1-3)}$$

Simplify (pi B) to Formula (1-4):

$$\pi_B(portofilo) = C \cdot \frac{P_2}{P_1} \cdot \lambda(R - R_0)(t + \delta \cdot T_0) + C \cdot \delta \cdot y \cdot T + C \cdot \beta \qquad \text{Formula (1-4)}$$

Their difference is:

$$\Delta \pi_B = C \cdot \frac{P_2}{P_1} \cdot \lambda(R - R_0) \cdot \delta \cdot T_0 + C \cdot \delta \cdot y \cdot T + C \cdot \beta$$

Apparently, ignoring the redundant time period T_0, the exceeding profits generated by banks mainly come from the benefits brought by companies' deposit money in confirming storage financing. B is small, thus its profits is relatively low comparing to benefits of deposit money. Thus, $\pi_B(portofilo) > \pi_B(single)$ which leads to the conclusion that banks have higher benefits with confirming storage and factoring financing portfolio than with single factoring financing. Banks will enhance portfolio financing more positively.

Comparing the return on equity of borrowing companies.

To compare the difference between financing methods, it is essential to select a proper indicator. The fact that borrowers invest different capital in single factoring financing and confirming storage and factoring financing makes it inappropriate to compare net profits only. By contrast, comparing return on equity (ROE) can fully reflect the input-output conditions. The formula to calculate return on equity is: ROE=net profits/input capital.

- Return on equity of money-borrowing companies using confirming storage and factoring financing portfolio is depicted in Formula (1-5):

$$ROE(portofilo) = \frac{\frac{P_2 \cdot C}{P_1} - C - C \cdot \delta \cdot \frac{P_2}{P_1} \cdot \lambda(t + T_0) - (1 - \delta) C \cdot \frac{P_2}{P_1} \cdot \lambda \cdot R \cdot t - C \cdot \beta + C \cdot \delta \cdot y_0 \cdot T}{C \cdot \delta + \left[(1 - \delta) C - C \cdot \delta \cdot \frac{P_2}{P_1} \cdot \lambda\right]} \qquad \text{Formula (1-5)}$$

- Return on equity of money-borrowing companies using single factoring financing is depicted in Formula (1-6):

$$ROE(singleness) = \frac{\dfrac{P_2}{P_1} \cdot C - \dfrac{P_0}{P_1} \cdot C - \dfrac{P_2}{P_1} \cdot C \cdot \lambda \cdot R \cdot t}{\dfrac{P_0}{P_1} \cdot C} \qquad \text{Formula (1-6)}$$

Simplify ROE (portfolio) to Formula (1-7):

$$ROE(portofilo) = \frac{P_2 - P_1(1+\beta) - P_2 \cdot \lambda \cdot R(t + \delta \cdot T_0) + \delta \cdot y_0 \cdot T}{P_1 - P_2 \cdot \lambda \cdot \delta} \qquad \text{Formula (1-7)}$$

Simplify ROE (Single) to Formula (1-8):

$$ROE(singleness) = \frac{P_2 - P_0 - P_2 \cdot \lambda \cdot R \cdot t}{P_0} \qquad \text{Formula (1-8)}$$

β (the rate of commission charges of banker's acceptance bill) usually is 0.0005, which is approximately zero, so it's negligible. Confirming storage financing requires volume purchases in advance, thus its price per unit is relatively low comparing to purchase in batches, thus $P_0 > P_1$. Assume $P_0 > P_1$, the numerator of ROE (portfolio) is short of $P_2 * \lambda * R * \delta * T_0$ comparing to ROE (single), while the denominator is short of $P_2 * \lambda * \delta - y_0 * T * \delta$. Because $P_2 * \lambda * \delta >> P_2 * \lambda * R * \delta * T_0$ and P0>P1, ROE (portfolio)>ROE (single)>1, i.e. ROE (portfolio)>ROE (single).

By strict mathematical proof, we can conclude that ROE in confirming storage and factoring financing portfolio is larger than that in single factoring financing, which means portfolio financing uses money more efficiently than single supply chain financing products, with stronger lever amplification and more profits.

According to Formula (1-7), only parameter δ can be determined by companies, while the others depend solely on banks and the market, thus δ is the only variable. We calculate the derivative of it in Formula (1-9) to obtain the maximal value:

$$\frac{\partial(portfolio)}{\partial\delta} = \frac{(y_0 \cdot T - P_2 \cdot \lambda \cdot R \cdot T_0)(P_1 - P_2 \cdot \lambda \cdot \delta) + \lambda \cdot P_2 \left[P_2 - P_1(1+\beta) - P_2 \cdot \lambda \cdot R(t + \delta \cdot T_0) + \delta \cdot y_0 \cdot T\right]}{(P_1 - P_2 \cdot \lambda \cdot \delta)^2}$$

$$\frac{\partial(portfolio)}{\partial\delta} = \frac{P_2^2 \cdot \lambda(1 + \lambda \cdot R \cdot t) - P_1 \cdot P_2 \cdot \lambda(T_0 \cdot R + 1 + \beta) + y_0 \cdot T \cdot P_1}{(P_1 - P_2 \cdot \lambda \cdot \delta)^2} \qquad \text{Formula (1-9)}$$

Because $\lambda * R * T$ 、 $R * T_0$ 、 β are negligible and P2>P1, the derivative is constantly greater than zero, which means that as δ increases, the ROE of money-borrowing companies will go up until factoring financing fill up the rest amount of confirming storage financing. However, as δ increases, financial pressure of the companies also becomes higher. As a result, for strong distributers, banks can increase the ratio of their first deposit.

ii. *Dynamic game analysis of banks and companies*

a. *Model Assumptions*

- In this model, the design of supply-chain financial products takes core companies' credit into consideration, which provides endorsement for

borrowers, making the default risk is relatively low. As a result, the game model of banks and companies has completely information symmetry and we neglect the credit risk.

- The model is dynamic, and companies choose form single factoring financing and confirming storage financing portfolio at first, then the bank decides whether to provide loan or not.

b. *Model analysis*

This model is a complete-information dynamic game. The money-borrowing companies make the first decision between single factoring financing and portfolio financing. The amount of capital that money-borrowing companies store is different in single factoring financing and confirming storage & factoring financing, making it

more appropriate to compare ROE instead of net profits as stated above.

The second step is banks' decision, no matter it is single factoring financing or the combination of confirming storage and factoring financing, they can decide whether to provide loans or not based on the profitability of these products. The dynamic game process between money-borrowing companies and banks construct the tree structure as diagram (1-2):
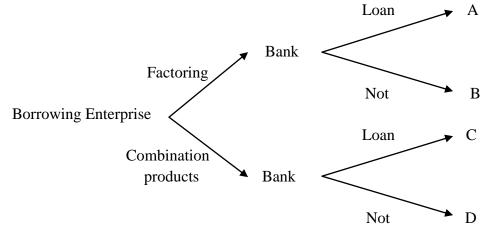
```
                                          Loan        A
                              Bank
                 Factoring                 Not        B

Borrowing Enterprise

                 Combination               Loan       C
                 products      Bank
                                           Not        D
```

diagram (1-2)

The money-borrowing companies have two choices, one is single factoring financing, and the other is confirming storage and factoring financing portfolio. The banks also have two choices, one is to provide the loans, and the other is not to. Thus four results are produced and we illustrate the situations with the choice of products first and then the decision of whether to provide the loans.

By using the backward induction, we analyze from the banks. In the factoring process in cooperation with supply chain enterprises, the credit risk of banks is perfectly reduced due to the endorsement of core companies, making the default risk negligible. Thus what makes the bank loan or not is the ROE comparing to other loans instead of its credit risk. The ROE of factoring financing is not low in bank's loan products for two reasons: banks provide loans mainly for medium and small companies, thus its interest rate is high; banks may enter into business relationships with core enterprises in the process of supply-chain financing, making the upstream and downstream companies its potential clients, thus the total profits are high in the long run. So banks are willing to loan money to companies using factoring financing. In the process of confirming storage and factoring financing, the ROE is much higher than single factoring financing, because the profits come from not only factoring financing, but also confirming storage financing. Thus banks are willing to provide loans to confirming storage and factoring financing clients as well.

Whether money-borrowing companies choose single factoring financing or the combination of confirming storage and factoring financing mainly depends on profits. Although in terms of absolute profits, single factoring financing is better than confirming storage and factoring financing, we shouldn't neglect the fact that they need different initial capital which decreases their comparability. ROE (combination) > ROE (single) thus illustrates that confirming storage and factoring financing has greater profitability and higher leverage ratio comparing to single factoring storage, meaning that the investment is more efficient.

Comparing to single supply chain product, portfolio product brings more profits to both the bank and borrowers, leading to a Pareto improvement. As a result, companies will choose confirming storage and factoring financing portfolio without hesitation instead of single factoring financing, while

Banks will provide loans positively to get returns. The equilibrium position is point C, and two parties achieve mutual benefits.

III. MULTIPLE-CYCLE ANALYSIS OF CONFIRMING STORAGE AND FACTORING FINANCING PORTFOLIO

We consider using the accounts receivable after goods delivery to fulfill the exposure of confirming storage financing, the rest of which will be paid once with in a specific time period by borrowers. Now we consider the multiple cycles of factoring financing and confirming storage financing: goods delivery, financing, repayment, goods delivery again, financing again, repayment again, multiple cycles.

a) Introduction of Multiple-Cycle Financing Business Process

The multiple-cycle financing process flowchart of confirming storage and factoring financing portfolio is depicted as diagram (2-1):

① sign a purchase agreement

Key Supplier

⑤ cargo release

⑥ deliver goods

③ write a bank acceptance

④ notify shipping

Borrower

② cash deposit

⑦ factoring financing

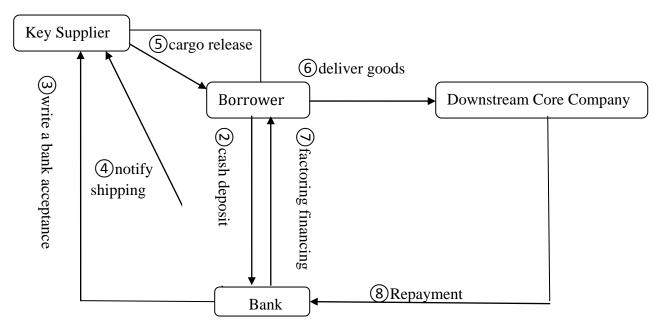Downstream Core Company

Bank

⑧ Repayment

Diagram (2-1) Confirmation warehouse and factoring financial multiple cycle flow chart

The specific process of the multiple cycles of confirming storage and factoring financing can be described as follows:

The borrowers save the first deposit in banks, agreeing to use their future right of taking goods as pledge. Banks sign banker's acceptance bill for borrowers and hand directly to upstream suppliers. Suppliers, after organizing the source of the goods, send out delivery to borrowers, who sell immediately to downstream large buyers. The borrowers apply for factoring financing with the invoice provided by downstream buyers and certificate of receipt. After the borrowers use the money from factoring financing to fulfill the exposure of confirming storage financing for the first time, suppliers send out delivery again and the borrowers sell them to downstream buyers again. The borrowers apply for factoring financing again with the invoice provided by downstream buyers and certificate of receipt. Repayment, delivery, supply, financing and repayment again and again until banks pay back their banker's acceptance bill within the scheduled time and finish the supply of goods. Finally, the downstream buyers remit the loans to the bank account specific for factoring within scheduled time. After taking out the interests, banks will return the rest to borrowers, thus complete the multiple cycles of confirming storage and factoring financing.

b) *Model Assumptions and the meanings of Parameters*
  i. *Model assumptions*
- Save the first deposit, apply for factoring financing after the delivery of goods, use the money of financing to repay the exposure of confirming

storage financing, delivery, financing, repayment, again and again until the exposure is closed.

- During the time period of portfolio financing, the time cycle of delivery remains stable, thus ensures the stability of time cycle of factoring financing, making the time cycle of repaying the exposure of confirming storage financing stable.

- The confirming storage financing is provided in the form of banker's bills, while factoring financing is provided in the form of current assets.

- Banks should pay deposit interests to companies for the first deposit.

- Risks are temporarily neglected (including market risks and credit risks).

Table 2-1 : Parameters and their meanings

Parameters	Meanings of Parameters
C	The amount of money of banker's acceptance bill
δ	Margin ratio
β	Ratio of commission charges for creating bills
P_1	Purchase price per unit (confirming storage)
P_0	Purchase price per unit (not confirming storage)
y	Average interest rate of bank loans (annualized)
y_0	Deposit interest rate of first deposit (annualized)
T	Time period of banker's acceptance bill
T_0	Release cycle of upstream suppliers (annualized)
K_1	The final exposure of deposit (outstanding exposure)
N	The exposure after N times repayment (paid exposure)
K_2	Residue after N times repayment
R	Loan rate
λ	Ratio of factoring financing
t	Repayment period of downstream buyers
π_B	Net profit of banks
π_C	Net profit of borrowers

c) *Cost-Benefit Analysis of Banks*

Bank's profits mainly consist of two parts, one is the commission charges for banker's acceptance bill in confirming storage financing and the earnings of the deposit during the time period, the other is the earnings of current loans brought by factoring financing.

Two possible conditions exist, one is the money from factoring financing cannot fulfill the exposure of confirming storage financing, which means that money-borrowing companies need to repay the financial gap K before the expired date of banker's acceptance bill. The other condition is that the money from factoring financing is enough to fulfill the exposure. Assume that exposure is paid up after N times of factoring financing.

Exposure not fulfilled

If $\quad C\cdot\delta + C\cdot\delta\cdot\frac{P_2}{P_1}\cdot\lambda + \cdots + C\cdot\delta\left(\frac{P_2}{P_1}\cdot\lambda\right)^{\frac{T-T_0}{T_0}} < C$, the

borrowers need to fulfill the exposure K before the deadline, the net profits of banks can be depicted as Formula (5-10):

Simplify it to Formula (2-1):

$$\pi_B = \sum_{i=1}^{\frac{T}{T_0}} C\cdot\delta\left(\frac{P_2}{P_1}\cdot\lambda\right)^{i}\left(R-R_0\right)\left[T-(i-1)T_0+t\right]+C\cdot\beta$$

$$\sum_{i=1}^{\frac{r}{r_0}} C\cdot\delta\cdot y\left(\frac{P_2}{P_1}\cdot\lambda\right)^{i-1}\cdot\left[T-(i-1)T_0\right]-C\cdot\delta\cdot y_0\cdot T \qquad \text{Formula (2-1)}$$

Exposure fulfilled

If $\quad C \cdot \delta + C \cdot \delta \cdot \dfrac{P_2}{P_1} \cdot \lambda + \cdots + C \cdot \delta \left(\dfrac{P_2}{P_1} \cdot \lambda \right)^{\frac{T-T_0}{T_0}} > C$, assume borrowers completely repay the banker's

acceptance bill after N times of factoring financing, the net profits of banks can be depicted as Formula (2-2):

$$\pi_B = C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right)^i \left(R - R_0 \right)(T+t) + \cdots + C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right)^N \left(R - R_0 \right) \left[T - (N-1)T_0 + t \right] + c \cdot \beta + C \cdot \delta \cdot (y - y_0)T$$

$$C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right) \cdot y \left(T - T_0 \right) + \cdots C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right)^{N-1} \cdot y \left[T - (N-1)T_0 + t \right] + K_2 \cdot y \left(T - NT_0 \right) \qquad \text{Formula (2-2)}$$

Simplify it to Formula(2-3):

$$\pi_B = \sum_{i=1}^{N} C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right)^i \cdot R \left[\left(T - (i-1)T_0 \right) + t \right] + c \cdot \beta + \sum_{i=1}^{N-1} C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right)^{i-1} \cdot y \left[T - (i-1)T_0 \right]$$

$$+ K_2 \cdot y \left(T - NT_0 \right) - C \cdot \delta \cdot y_0 \cdot T \qquad \text{Formula(2-3)}$$

Apparently, no matter repay the exposure in time or not, bank's profit from loans is determined by loan interest rate and borrowing time. Borrowing time depends on the time of sales on credit and delivery time, while the loan profits depend on saving time and its saving-loan rate spread. The saving time of loans is determined by goods delivery cycle. The longer the cycle is, the fewer the profits.

To maximize its profits, banks would prefer shorter delivery cycles and high loan interest rate.

IV. COST-BENEFIT ANALYSIS OF MONEY-BORROWING COMPANIES

In the confirming storage and factoring financing portfolio, the cost of borrowers mainly consist of the loan interests paid to banks for factoring financing and the commission charges for the banker's acceptance bill. Its earnings come from the loans of sales on credit after time t since the delivery of goods. We deduce separately from the two possible situations stated above and produce the net profits of money-borrowing companies accordingly.

a) Exposure not Fulfilled

If the exposure is not fulfilled, money-borrowing companies should repay the residue to banks before the expired date of confirming storage financing. The benefit of money- borrowing companies in the whole process is depicted in Formula (1-14):

$$\pi_C = \frac{C}{P_1} \cdot P_2 - C - \sum_{i=1}^{\frac{T}{T_0}} C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right)^i \cdot R \left[\left(T - (i-1)T_0 \right) + t \right] - c \cdot \beta + C \cdot \delta \cdot y_0 \cdot T \qquad \text{Formula (2-4)}$$

b) Exposure Fulfilled

Because the money-borrowing companies fulfill the exposure after N times of factoring financing, thus the money-borrowing banks can gain more from the amount of factoring financing minus the residue of confirming storage financing. Due to the fact that factoring financing is in the Nth step, the amount is relatively small, with the deduction of residue from confirming storage financing, this term is negligible. For the convenience of our study and simplification of the formula, the expected return from this amount of money is not considered. The net profits of the money-borrowing companies are depicted in Formula (1-15):

$$\pi_C = \frac{C}{P_1} \cdot P_2 - C - \sum_{i=1}^{N} C \cdot \delta \left(\frac{P_2}{P_1} \cdot \lambda \right)^i \cdot R \left[\left(T - (i-1)T_0 \right) + t \right] - c \cdot \beta + C \cdot \delta \cdot y_0 \cdot T \qquad \text{Formula(2-5)}$$

Apparently, the net profits of money-borrowing companies mainly depend on the bid-ask spread and the interests paid to banks. The bigger the spread is, the more the profits are. The interests paid to banks are determined by the borrowing time and the goods delivery cycle. As borrowers, the companies would

prefer a longer borrowing time and longer delivery cycle, which means fewer interests and more profits.

During the process of confirming storage and factoring financing, situation where the money-borrowing companies invest less and gain less may exist. In the meantime, the ROE can be either big or small; companies should choose the frequency and each amount of the multiple cycles based on their conditions.

V. Empirical Analysis

a) Case Background

i. Introduction of the company

We study the case of one of Beijing's largest dealer of cement H.

Company H is founded in Jan, 2001, with 20 million yuan as registered capital, in which the legal representative invest 75% (15 million yuan) and other individual shareholders takes up 25%. The company is a company with limited liabilities. Its main business is sales of construction materials, especially cement and wood materials. It also engages in cement transport, sand and gravel transport, etc. The company holds controlling interest of three logistics companies. Its sales volume yearly is above 500 million yuan and more than 400 employees.

The company has a board of shareholders and has not a board of directors. It has one executive director, who can fulfill his obligations according to articles of the company, make development plan and perfect the rules according to the needs of the company. Management has rich experience in relative industries and advanced operation philosophy, the operating system is sound and the operating behaviors are reliable.

ii. The state of production and operation of the company

Cement selling is the pillar business of the company. With the help of two leader companies of cement production in North China, Hebei Jidong Cement Incorporated Company and Beijing Jinyu Cement Incorporated Company, it developed several downstream clients around Beijing, Tianjin, Langfang, Chengde, Zhangjiakou and other places. The company has more than 30 large and medium mixing stations that provide stable cement supply, with its sales volume amount to 1.6 million ton. As high-quality agency for Hebei Jidong Cement Incorporated Company and Beijing Jinyu Cement Incorporated Company, its sales income exceeds 500 million yuan, with enormous potentiality and great market reputation.

As for the state of cooperation with upstream and downstream companies, this company has excellent background and attracts a great deal of companies as members of the supply chain. Its products enjoy high market shares, with its good cooperation with other companies, both parties have the intention to further and wider their current business cooperation. The downstream companies include large real estate agencies, Beijing Subway, China Urban Construction Company and several large secondary distributors of cement.

The financial standing of the company is stable, with sufficient amount of cash flow, large profitability, reasonable assets and liabilities, and security for the repayment of accounts receivable.

iii. Introduction of the state of cooperation of banks and the company

Bank G has specialty in conducting supply chain financing business in Beijing, attracting a great deal of supply chain companies. The state of cooperation of bank G and company H is as follows: company H conducted business in bank G in 2008, with 70 million credit line, among which the credit line for confirming storage 20 million, 30% cash deposit. Beijing Jinyu Cement Incorporated Company provided repurchase for the residue and the company juridical person provided personal joint liability guaranty. From 2013 to date, the company can realize bills amount to 120 million yuan in a year, with daily average 42 million yuan in saving accounts.

iv. State of confirming storage and factoring financing of Company H

a. State of contract signing between Company H and upstream and downstream companies.

- State of contract signing between Company H and downstream companies

Company H has signed a supply contract with Beijing Jinyu Cement Incorporated Company in Feb. 1st, 2014, promised to provide 45 thousand tons of bulk cement labeled 42.5R from March to September in 2014. The agreed price is P2 (300 yuan/ton), the total price is 13.5 million yuan and the date of payment is Feb. 1st, 2015.

- State of contract signing between Company H and upstream companies

Company H has signed a contract with Hebei Jidong Cement Incorporated Company in Feb. 15th, 2014, promised to purchase 45 thousand tons of bulk cement labeled 42.5R from March to September in 2014. The agreed price is P1 (260 yuan/ton), the total price is C (11.7 million yuan), and the type of payment is advance payment.

b. Financing contract between banks and companies

- Hebei Jidong Cement Incorporated Company is a large company directly controlled by the central authorities, an A-share company, the largest cement processing company in North China. Its own power is strong, and the company is an essential client of Bank G, thus Bank G provides confirming storage financing for Company H.

Company H and Bank g signed a confirming storage contract. Because Hebei Jidong Cement Incorporated Company is a strong upstream company, Company H needs advance payment for picking up the delivery of goods. Bank G and Company H signed a confirming storage financing contract, with the ratio of first deposit δ no fewer than 30%, which was issued in the form of banker's acceptance bill and the duration T was half a year. Hebei Jidong Cement Incorporated Company would provide the repurchase warrant for the residue legal representative would provide individual joint liability guaranty.

- Beijing Jinyu Cement Incorporated Company is a wholly-owned subsidiary of BBMG Corporation, one of top 50 real estate companies in China and one of top 10 real estate companies in Beijing, and it has strong power. Beijing has brisk demand for real estate industry as the bellwether of China's first-tier cities and has relatively low operation risks. Jinyu Jiaye Incorporated Company is one of the essential clients of Bank G. Thus Bank G provides factoring financing for Company H.

Bank G and Company H signed a factoring financing contract. Because real estate industry has lone development cycle, the payback period of accounts receivable of Company H is long, but the payback is guaranteed. To get the payback more quickly, the company signed a factoring financing contract with the bank, which ruled that the ratio of financing could be no more than 70% of the accounts receivable, loan interest R was 8%, and the duration could be no longer than a year.

c. *Assignment to parameters*

Parameters and their meanings are as diagram 4-1

Parameter	Meaning of Parameter	value
C	The amount of money on the banker's acceptance bill	11.7 million
δ	The ratio of the first deposit	0.4
β	The ratio of commission charges	0.0005
P_1	Purchasing Price (confirming storage, yuan/ton)	260
P_0	Purchasing price (not confirming price, yuan/ton)	270
y	The loan average revenue rate	6%
y_0	The fixed deposit revenue rate of the first deposit (annualized)	2.5%
T	The time cycle of the banker's acceptance bill (annualized)	1/2
T_0	The delivery time cycle of upstream suppliers (annualized)	0.5/12
P_2	Selling price	300
R_0	Interests of bank savings	2.9%
R	Loan interests (annualized)	8%
λ	The ratio of factoring financing	0.7
t	The payback time cycle of downstream buyers	1/2

Source of material: the Credit Report of Company H, the 2014 annual report of Bank G

d. Cost-benefit analysis of banks and companies

- *Cost-benefit analysis of Bank G*

Calculate bank's net profit as Formula (4-1):

$$\pi_B = C \cdot \delta \frac{P_2}{P_1} \cdot \lambda (R - R_0)(t + T_0) + C(1 - \delta) \cdot \frac{P_2}{P_1} \cdot \lambda (R - R_0)t + C \cdot \delta (y - y_0)T + C \cdot \beta$$

$$\pi_B = 1170 \cdot 0.4 \cdot \frac{300}{260} \cdot 0.7(8\% - 2.9\%)\left(\frac{0.5}{12} + \frac{1}{2}\right) + 1170 \cdot 0.6 \cdot \frac{300}{260} \cdot 0.7(8\% - 2.9\%) \cdot \frac{1}{2}$$

$$+ 1170 \cdot 0.4 \cdot (6\% - 2.5\%) \cdot \frac{1}{2} + 1170 \cdot \frac{5}{10000}$$

$$= 34.358万元 \qquad \text{Formula (4-1)}$$

- *Cost-benefit analysis of Company H*

Calculate the net profits of money-borrowing company H as Formula (4-2).

$$\pi_C = \frac{P_2}{P_1} \cdot C - C - C \cdot \delta \cdot \frac{P_2}{P_1} \cdot \lambda \cdot R(t + T_0) - (1 - \delta)C \cdot \frac{P_2}{P_1} \cdot \lambda \cdot R \cdot t - C \cdot \beta + C \cdot \delta \cdot y_0 \cdot T$$

$$\pi_C = \frac{300}{260} \cdot 1170 - 1170 - 1170 \cdot 0.4 \cdot \frac{300}{260} \cdot 0.7 \cdot 8\% \left(\frac{0.5}{12} + \frac{1}{2}\right) - 0.6 \cdot 1170 \cdot \frac{300}{260} \cdot 0.7 \cdot 8\% \cdot \frac{1}{2}$$

$$- 1170 \cdot \frac{5}{10000} + 1170 \cdot 0.4 \cdot 2.5\% \cdot \frac{1}{2}$$

$$= 139.185万元 \qquad \text{Formula (4-2)}$$

e. Game equilibrium analysis of Bank G and Company H

- *Contrast the different profit of Bank G*

We contrast the different profit of Bank G in the same time period.

According to Formula (5-3), we can calculate the net profits of money-borrowing companies adopting the method of single factoring financing as Formula (4-3):

$$\pi_B(single) = \frac{P_2}{P_1} \cdot C \cdot \lambda (R - R_0)t$$

$$\pi_B(single) = \frac{300}{280} \cdot 1170 \cdot 0.7(8\% - 2.9\%) \cdot \frac{1}{2} \qquad \text{Formula (4-3)}$$

$$= 24.098万元$$

While $\pi_B(portfolio) = 343.58$ thousand yuan, we can conclude that the profit from confirming storage financing is higher than single factoring financing in the past. The main difference lie in the fact that the bank could acquire deposit interest of the first deposit and commission charges of banker's acceptance bill in confirming storage financing, which constitute the major part of bank's profit in confirming storage financing.

- *Contrast the different ROE of Company H*

We calculate the ROE of borrowers and simplify the result as Formula (4-4):

$$ROE(combination) = \frac{\pi_C}{C \cdot \delta + \left[(1 - \delta) \cdot C - C \cdot \delta \cdot \frac{P_2}{P_1} \cdot \lambda\right]} = \frac{139.185}{792}$$

$$= 17.57\% \qquad \text{Formula (4-4)}$$

In the past Company H adopted dingle supply chain financial product for financing (i.e. factoring financing). We calculate the ROE of borrowers as Formula (4-5):

$$ROE(single) = \frac{P_2 - P_0 - P_2 \cdot \lambda \cdot R \cdot t}{P_0}$$

$$ROE(single) = \frac{300 - 270 - 300 \cdot 0.7 \cdot 0.08 \cdot \frac{1}{2}}{270} = \frac{21.6}{270} \qquad \text{Formula (4-5)}$$

$$= 8\%$$

Apparently, borrower's ROE adopting confirming storage financing is far more than that adopting single factoring financing, which is consistent with our theoretical implication.

- *Dynamic game analysis*

According to the dynamic game model under the assumptions and model analysis in a complete information market, we construct the tree structure of bank and company as diagram (4-1) (company chooses first, then bank chooses):

Diagram (4-1) Tree structures of dynamic game between bank and company

We use backward induction and start our analysis from Bank G. Whether the bank loan the money or not is based on the comparison between loan products. Supply chain financing has two outstanding advantages: one is that the risk is comparatively low, the other is that the bank could develop upstream and downstream clients through this core company, which means great potential profits. Thus Bank G will choose to loan. In the meantime, we find out that the bank profit more in portfolio financing, i.e.343.58 thousand yuan>240.98 thousand yuan.

The choice between single factoring financing and confirming storage financing of money-borrowing company H mainly depends on which brings more profit according to the maximization principle of personal interests. Because the initial capital invested is different, the comparison of ROE is more appropriate. After strict mathematical proof and actual computations, ROE(portfolio)>ROE(single), i.e. 17.57%>8%. It illustrates the fact that confirming storage and factoring financing has stronger profitability, higher leverage ratio and higher efficiency comparing to single factoring financing.

As a result, comparing to single supply chain product, the portfolio achieves a Pareto improvement for both the Bank G and the money-borrowing company H increase their profits. Thus Company H will choose confirming storage financing instead of single factoring financing, while the bank will loan its money happily and obtain the expected return. The equilibrium point is C, which is a win-win situation.

VI. SUMMARY

We analyze the single cycle and multiple cycles of confirming storage and factoring financing portfolio and introduce their business process. Then from the perspective of banks and medium and small companies, we construct the model of cost-benefit analysis to figure out the influential factors of the cost and benefit of both parties. Next we compare the ROE of both parties in the single supply chain financial product with that in the portfolio based on the single

cycle of the portfolio. Finally we apply the dynamic game theory to produce the equilibrium point to assist decision making. This study shows that the net profits of both the banks and money-borrowing companies are better in the confirming storage and factoring financing portfolio comparing to single factoring financing, which indicates a Pareto improvement. The ROE of money-borrowing companies increase as the ratio of first deposit increases.

In this chapter, we plug in the statistics of supply chain financial product portfolio in a specific case into the model in chapter 4, 5 and 6. By analyzing the real situation of Company H, we find it highly identical to theoretical results. In the real case of confirming storage and factoring financing, both the bank and the borrower have more net profits than in that of single factoring financing. In the real case of confirming storage and factoring financing, the ROE of the bank and the money-borrowing company are also higher than single factoring financing. Thus the equilibrium point of the bank and the company is: the money-borrowing company chooses the portfolio and the bank chooses to provide the loan.

VII. Acknowledgements

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64

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