Paper Review: Sourcing from Suppliers with Financial Constraints and Performance Risk

Group-3

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Abstract

The original paper attempts to compare two non-asset-based financing schemes under different conditions to address the optimal scheme to finance a supplier under given circumstances. The two schemes compared here are POF (Purchase Order Financing) and BDF (Buyer Direct Financing). The POF analysis involves three parties – the bank, the manufacturer, and the financially constrained supplier. Under BDF, the manufacturer acts as the financier, thus requiring just two parties to be analyzed. The paper finds that when both the manufacturer and the bank have equal information about the capabilities and operational efficiency of the supplier, then both BDF and POF schemes yield similar results. On the contrary, if the manufacturer has additional knowledge of the supplier's cost factor, then he can use the signaling game to his advantage and end up establishing two kinds of equilibria to incur more profits.

1 Introduction

Though the effective channel of financing the suppliers remains the asset-based loans, the financially constrained suppliers face challenges in securing loans against their limited assets. This challenge led to two innovative non-asset-based schemes to finance the suppliers: the POF (Purchase Order Financing) and the BDF (Buyer Direct Financing). The POF scheme involves financing through banks that are professional domain experts. On the other hand, BDF consists of the manufacturer lending the supplier, which may be more efficient in some situations since the manufacturer knows the supplier's intrinsic information better than the banks. Hence, the manufacturer can exercise greater control over financiers through contract terms. Hence, the paper attempts to address two issues:

1. Which scheme, of the two, is better in terms of improving the delivery performance of the financially-constrained supplier?

2. Impact of manufacturer's information/control advantage under BDF scheme for some specific circumstances.

The paper touches upon three different domains – the supply risk management, the contract signaling games, and the supply chain finance.

2 Methodology

2.1 Symmetric Information Case

First, the case of symmetric information under BDF and POF schemes is considered. Stackelberg Game involving three parties is analyzed under the POF scheme.

2.1.1 POF Scheme

The following assumptions are considered for analysis of Purchase Order Financing:

1. All three parties: the manufacturer, the bank, and the supplier are risk-neutral.

2. The demand faced by the manufacturer is known and is normalized to 1.

3. Make-to-order supply chain.

4. Financially-constrained supplier whose assets (a) are lesser than the production cost (p), i.e $a \leq p$.

5. Supplier delivers the order with probability e.

6. Supplier's operational efficiency captured by the cost factor k (> 0). Supplier exerts a cost of effort to increase its delivery probability from 0 to e.

7. The cost factor k is assumed to be known to all the parties. (We eliminate this assumption in the next section considering the asymmetric case information)

8. The lending market in which the bank operates is perfectly competitive.

9. The bank's cost of capital is assumed to be zero.

10. Manufacturer behaves as Stackelberg leader and sets the contract terms for the supplier.

Let p be the contract price to be paid by manufacturer to supplier only upon successful delivery. If delivery is unsuccessful, nothing is paid to the supplier Let v be the emergency channel cost paid to an alternative source if the original supplier fails to deliver. Let i_B be the interest rate charged by bank to lend an amount to the supplier in POF scheme. Then we have the following relations:

$$\Pi_M = v - [ep + (1-e)v] = e(v-p) \tag{1}$$

$$\Pi_S = e[p - (1+i_B)c] - (1-e)a - ke^2 \tag{2}$$

$$\Pi_B = e[(1+i_B)c] + (1-e)a \tag{3}$$

where Π_M is Manufacturer's expected payoff, Π_S is Supplier's expected payoff, and Π_B is Bank's expected payoff

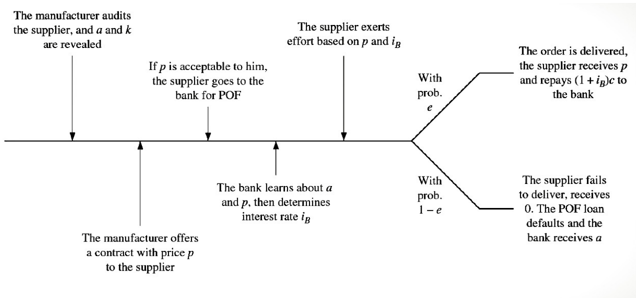

Figure 1. Events Sequence under POF (Symmetric Information Case)

Lemma 1: If we consider a centralized controlled supply chain, then the savings associated with sourcing from internal supplier is $\Pi_C = v - [c + ke^2 + (1-e)v]$. Hence, the manufacturer sources from an external supplier if and only if $\frac{v^2}{4k} \geq c$. The resulting delivery probability is $\frac{v}{2k}$ and the corresponding payoff is $\frac{v^2}{4k} - c$.

Hence, to avoid centralized supply chain cases, we would assume $0 \leq a \leq c \leq \frac{v^2}{4k}$ [Assumption 1].

To maximize the supplier's expected payoff, we solve $\frac{d\Pi_s}{de} = 0$. We get the below conditions in the supplier's best response:

$$e(p, i_B) = \frac{p - (1+i_B)c + a}{2k} \tag{4}$$

$$\Pi_{s_{max}} = \frac{[p - (1+i_B)c + a]^2}{4k} - a \tag{5}$$

Since, we assume made-to-order products, the option for the supplier to sell the produced goods outside is normalized to 0. The supplier's participation constraint becomes: $\Pi_S \geq 0$.

From (5), the above constraint becomes:

$$p \geq (1+i_B)c + 2\sqrt{ka} - a \tag{6}$$

Since, the bank is assumed to operate in a competitive lending market, its expected payoff (given by (3)) is equal to the amount lent. Hence,

$$\Pi_B = e[(1+i_B)c] + (1-e)a = c \tag{7}$$

Substituting optimum value of e from (4) into (7), we get Equilibrium interest rate as:

$$i_B(p) = \frac{p - \sqrt{p^2 - 8k(c-a)}}{2c} + \frac{c}{a} - 1 \tag{8}$$

Also, square root in the above expression gives the Bank's Lending Constraint as: $p \geq \sqrt{8k(c-a)}$. This constraint does show that the contingent price p should be, perhaps, much greater than the actual financing need of the supplier $(c-a)$ for it to secure a loan from the bank under POF scheme.

From equations (8), (4), and the Supplier's Participation Constraint (6), we get the combined constraint for both supplier and lender, called as the **Joint Acceptance Constraint**:

$$p + \sqrt{p^2 - 8k(c-a)} \geq 4\sqrt{ka} \tag{9}$$

Provided this condition is satisfied, the manufacturer's payoff can be calculated from equations (1), (4), and (8) as the following:

$$\Pi_M = \frac{p + \sqrt{p^2 - 8k(c-a)}}{4k}(v-p) \tag{10}$$

The manufacturer optimises the value of to maximise its payoff. Hence, due to the several constraints and maximisation, there are several regions formed under different circumstances. The different regions are explained in the results section with a a vs c plot along with Proposition-1.

2.1.2 BDF Scheme

In this case, only two parties are considered: the financially constrained supplier and the manufacturer. Here the manufacturer also behaves as the lender (instead of the bank in the POF scheme) We analyze this case under symmetric information assumption (i.e., the manufacturer in the BDF scheme has the same knowledge about the supplier as the bank in the POF scheme had). Like the POF case, the manufacturer's cost of capital is assumed to be zero. Also, the manufacturer, here, determines both the contract price p and the interest rate (i_M) at which the lending amount c is to be supplied. The supplier's assets of value a are used to secure the loan (the assets are seized in case of unsuccessful delivery) Since the symmetric information case is considered, the interaction of the supplier with the bank under the POF scheme is analogous to its interaction with the manufacturer (behaving as lender) in the BDF scheme. Hence, from (4), the optimal delivery probability becomes:

$$e(p, i_M) = \frac{p - (1+i_M)c + a}{2k} \tag{11}$$

And, the supplier's participation constraint (from (6)) becomes:

$$p \geq (1+i_M)c + 2\sqrt{ka} - a \tag{12}$$

Here:

$$\Pi_M = [e(v-p)] + [e(1+i_M)c + (1-e)a - c] \tag{13}$$

The manufacturer's payoff under the BDF scheme takes into account its earnings from both – the operational savings (the first term in (13)) and the financial gains from the loan (second term in (13)). The manufacturer maximizes its payoff through optimal values of p and i_M. The rest of the model remains the same as in the POF scheme (symmetric information case). The results under different conditions are explained in the Results Section (3.1) along with Proposition-2.

2.2 Asymmetric Information Case

As observed in the previous analysis, control advantage does not provide the manufacturer with extra benefits in BDF. Now the case when the manufacturer has an information advantage over the bank has been considered.

Here, **she** (manufacturer) knows about the supplier's cost efficiency type i.e. either **he** is efficient (H) or inefficient (L). On the other hand, the **it** (bank) knows only the probability λ with which **he** (supplier) is efficient. For BDF, this does not propose anything new, and optimum price contracts would be the same (Propositions 1 and 2). Hence, only POF is under analysis. $\tau \in (H, L)$ represents the type of supplier

The same signaling game is taken under consideration as that for POF under symmetric knowledge except for the part that after knowing the price p_τ and assets a, the bank offers an interest rate $i_{B,\tau'}$ with the belief that the supplier is of type τ'. Here also PBE has been considered as the equilibrium concept, which poses that two types of an equilibrium can get established:

1. Separating Equilibria (p depends on supplier's type)
2. Pooling Equilibria (p remains same for either types)

To ensure the manufacturer sources from at least one type of supplier, Regions I and II of Proposition 1 have been considered leading to cost c and assets a satisfying

$$\max\left(0, c - \frac{v^2}{8k_H}, \frac{v^2 - v\sqrt{v^2 - 4k_H c}}{2k_H} - c\right) \leq a \leq c \leq \frac{v^2}{4k_H}$$

We will denote this above expression as [Assumption 2].

2.2.1 Separating Equilibria under POF

For the case when the manufacturer offers price p and bank charges interest rate $i_{B,\tau'}$ the best response for the supplier's effort is similar to the previous conclusion i.e.

$$e_\tau(p, i_{B,\tau'}) = \frac{p - (1 + i_{B,\tau'})c + a}{2k_\tau} \tag{14}$$

Under the constraint: $p \geq (1 + i_{B,\tau'})c + 2\sqrt{k_\tau a} - a$

Anticipating the supplier's best response , bank imposes the same interest rate of

$$i_{B,\tau'}(p) = \begin{cases} \frac{p - \sqrt{p^2 - 8k_{\tau'}(c-a)}}{2c} + \frac{a}{c} - 1, & \text{if } p \geq \sqrt{8k_{\tau'}(c-a)} \\ \infty & \text{otherwise} \end{cases} \tag{15}$$

Having these responses from the supplier and bank, manufacturer's best payoff for given $\tau, \tau' \in \{H, L\}$ using (1) is written as:

$$\Pi_M(\tau, p, \tau') = \frac{p + \sqrt{p^2 - 8k_{\tau'}(c-a)}}{4k_\tau}(v - p) \tag{16}$$

Under the constraint: $p + \sqrt{p^2 - 8k_{\tau'}(c-a)} \geq 4\sqrt{k_\tau a}$.

Lemma 2: The given supplier type specific contract is part of Separating Equilibria if the following two conditions are met:

1. Price offered to an inefficient supplier is $p_L = p_L^S$ (similar to the symmetric info case)
2. Price offered to the efficient supplier is p_H satisfying :

$$\Pi_M(L, p_L^S, L) \geq \Pi_M(L, p_H, H) \tag{17}$$
$$\Pi_M(H, p_H, H) \geq \Pi_M(H, p, L) \tag{18}$$

These constraints ensure that when the supplier is inefficient, the bank knows that the manufacturer would have no incentive to convince the bank that it's inefficient as **she** would be better off always if it believes that **he** is efficient.

On the other hand, when the supplier is efficient, firstly, **she** isn't trying to deceive the bank by paying p_H to an inefficient supplier because the payoff would be lesser. Secondly, **she** has the incentive to signal the bank when the supplier is efficient via paying pH because that would be the most profiting scenario for the manufacturer.

Hence, the supplier is paid p_L^S when he is inefficient and p_H otherwise under the separating equilibria case.

2.2.2 Pooling Equilibria under POF

When the supplier's asset value is reasonably low, then **she** may opt to pay a contract price of $p = p_W$ regardless of the supplier type. Hence, the posterior probability of the bank about the supplier being efficient remains λ. Supplier's cost efficiency is then given by:

$$k_W \equiv \left(\frac{(1-\lambda)}{k_L} + \frac{\lambda}{k_H}\right)^{-1} \tag{19}$$

Lemma 3: A contract price p_W is then part of a pooling PBE if and only if

$$\Pi_M(\tau, p_W, W) \geq \max_{p \neq p_W} \Pi_M(\tau, p, L) \quad \text{for } \tau = H, L \tag{20}$$

This highlights that **she** is better off by paying a constant price p_W for all types of the supplier under the bank's belief given by posterior probability rather than paying any other price under the bank's assumption of $\tau' = L$. Further analysis is in the Results section (3.2) along with Proposition 3.

3 Results & Discussions

3.1 Symmetric Information Case

As we saw in section (2.1.1), the manufacturer aims to select the optimal contract price $p^S \in [0, v]$ that maximizes her payoff, as per equation (10). Thus, the optimal contract and corresponding equilibrium outcome can be summarized as follows in a proposition and the diagram (Figure 2):

Proposition 1: When (c, a) satisfy Assumption 1, the optimal sourcing contract p^S under POF and the corresponding equilibrium outcomes can be described as follows:

1. **Region I:** When $a \geq \max\left(\frac{v^2}{16k}, \frac{v^2 - v\sqrt{v^2-4kc}}{2k} - c\right)$,

   (i) the manufacturer offers, $p^S = \sqrt{\frac{k}{a}}(c + a) \equiv p^{SA}$.

(ii) the bank lends to the supplier at interest rate $i_B^S = (\sqrt{\frac{k}{a}} - 1)(\frac{c-a}{c})$.

(iii) the equilibrium delivery probability is $e^s = \sqrt{\frac{a}{k}}$.

(iv) also, the manufacturer's and supplier's payoffs are given as $\Pi_M^S = v\sqrt{\frac{k}{a}} - c - a$ and $\Pi_S^S = 0$.

2. **Region II:** When $a \in [c - \frac{v^2}{8k}, \frac{v^2}{16k}]$,

   (i) the manufacturer offers, $p^S = \frac{v}{2} + \frac{4k(c-a)}{v}$.

   (ii) the bank lends to the supplier at interest rate $i_B^S = (\frac{4k}{v-1})(\frac{c-a}{c})$.

   (iii) the equilibrium delivery probability is $e^s = \frac{v}{4k}$.

   (iv) also, the manufacturer's and supplier's payoffs are given as $\Pi_M^S = \frac{v^2}{8k} - (c-a)$ and $\Pi_S^S = \frac{v^2}{16k} - a$.

3. **Region III:** In this region, we observe that $a < \max\left(c - \frac{v^2}{8k}, \frac{v^2 - v\sqrt{v^2-4kc}}{2k} - c\right)$. Here, the manufacturer does not source from the supplier, implying:

   (i) $p^S = 0, i_B^S = \infty, e^S = 0$.

   (ii) $\Pi_M^S = 0$ & $\Pi_S^S = 0$.

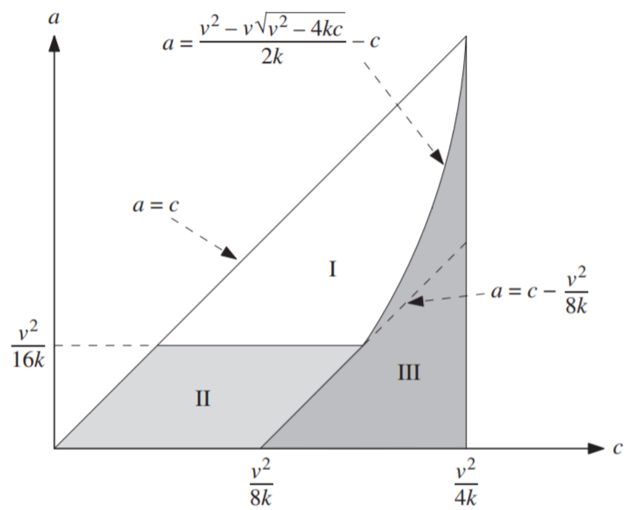

Figure 2. Diagram of Different Regions Under the Optimal POF Contract

Some observations regarding these regions:

- Region I: According to Proposition 1, when the value of suppliers asset lies in this Region, where the asset value a is considerably more significant compared to the loan c, the value of $e^S(p)$ (delivery probability) is also high as the supplier wants to protect his assets. Taking advantage of this, manufacturers set the optimal contract price p^S to be the lowest price acceptable to the supplier such that suppliers payoff is equal to zero and manufacturers payoff comes out to be $\Pi_M^S = v\sqrt{\frac{a}{k}} - c - a$.

  The decline in asset value a leads to a reduction in the delivery probability $e^S(p)$, which further increases the interest rate i_B (8) as now the bank charges higher rates to satisfy their break-even condition and lower the associated risk.

- Region II: As the value of asset a in this Region is low, the interest rate i_B charged by the bank will increase, which reduces the delivery probability $e^S(p)$ of the supplier. So, to keep the supplier's net margin constant, $(p^S - (1 + i_B)c)$ manufacturer has to offer a more significant contract price p^S as compared to the Region I's p^S to keep suppliers payoff $\Pi_S^S > 0$. Hence, as the asset value of the supplier decreases, i.e., it becomes more constrained, the manufacturer's payoff Π_M^S also decreases as he has to offer a higher contract price p^S to compensate for the increased interest rate i_B charged on the supplier by the bank.

- Region III: As $(c - a)$ becomes too large in this Region, a manufacturer can't offer a contract price p^S which can give a manufacturer payoff $\Pi_M^S > 0$ as well as satisfy the Joint Acceptance Constraint (9). Therefore, this type of sourcing from a reliable supplier is not profitable.

From Proposition 1, we can see that when the supplier's asset value a is significantly high, the manufacturer can achieve the first-best benchmark's supply chain profitability and delivery profitability in Lemma 1. However, when the supplier becomes financially constrained, the supply chain profitability and delivery probability decrease according to Proposition 1.

Now, we analyze the methodology used for the BDF scheme under the symmetric case. Finally, we will again formulate a proposition based on section (2.1.2), which is as follows:

Proposition 2: When (c, a) satisfy Assumption 1, the optimal sourcing contract (p^B, i_M^B) under BDF and the corresponding equilibrium outcomes can be described as follows:

1. When $a > \max\left(\frac{v^2}{16k}, \frac{v^2 - v\sqrt{v^2-4kc}}{2k} - c\right)$, the parameters (p^B, i_M^B) are only optimal if and only if $p^B - (1 + i_M^B)c = 2\sqrt{ka} - a$.

2. When $a \in [c - \frac{v^2}{8k}, \frac{v^2}{16k}]$ the parameters (p^B, i_M^B) are only optimal iff $p^B - (1 + i_M^B)c = \frac{v}{2} - a$.

3. When $a < \max\left(\frac{v^2}{16k}, \frac{v^2 - v\sqrt{v^2-4kc}}{2k} - c\right)$, the manufacturer does not source from the supplier.

In this Proposition, we replace the interest rate i_B with i_M as now the manufacturer is in charge of lending funds to the supplier. All the outcomes come out to be the same as Proposition 1, so we can observe that BDF and POF perform with the same efficiency under the symmetrical information case. However, BDF gives a control advantage to the manufacturer as he can set the contract price and the interest rate. The same efficiency is because the manufacturer's optimal performance solely depends on maintaining the $[p - (1 + i_M)c]$ constant as this will determine the supplier's efforts to fulfill the delivery.

3.2 Asymmetric Information Case:

Applying the Pareto dominance and intuitive dominance criterion for the asymmetric case, we do equilibrium refinement to classify cases exclusively for different sourcing contract prices under varying constraints. First, we will formulate a proposition from the methodology discussed in section (2.2). Here are the different regions in Figure 2 are CL (costless), SA (supplier's acceptance), P (pooling), and N (no equilibrium):

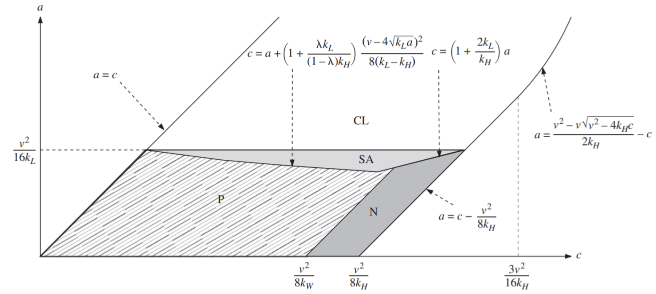

Figure 3. Regions of the Stable Dominant PBE

Proposition 3: For any (c, a) that satisfies Assumption 2, under POF the contract prices under the stable dominant equilibrium are as follows:

1. **Region CL:** When $a \geq \frac{v^2}{16k_L}$, the manufacturer offers the same supply contract as characterized in Proposition 1:
   (i) $p_H^A = p_H^S$.
   (ii) $p_L^A = p_L^S$.
2. **Region SA:** When $a < \frac{v^2}{16k_L}$ and $(c - a) \in \left[\left(1 + \frac{\lambda k_L}{(1-\lambda)k_H}\right) \cdot \left(\frac{(v-4\sqrt{k_L a})^2}{8(k_L - k_H)}\right), \left(\frac{2k_L}{k_H}\right) a\right]$
   (i) the manufacturer offers,
   - if the supplier is inefficient, $p_L^A = p_L^S$.
   - else, $p_H^A = p_{L,H}^{SA} - \epsilon$, where $p_{L,H}^{SA} \equiv 2\sqrt{k_L a} + \frac{k_H(c-a)}{\sqrt{k_L a}}$ and $\epsilon > 0$.
3. **Region P:** In this region, we observe that $(c - a) \in \left[\left(1 + \frac{\lambda k_L}{(1-\lambda)k_H}\right) \cdot \left(\frac{(v-4\sqrt{k_L a})^2}{8(k_L - k_H)}\right) \cup \left(\frac{2k_L}{k_H}\right) a, \frac{v^2}{8k_W}\right]$. Here, the manufacturer offers $p_H^A = p_L^A = p_W* \equiv \frac{v}{2} + \frac{4k_W(c-a)}{v}$ to both types of supplier.
4. **Region N:** When $(c - a) > \max\left\{\left(\frac{2k_L}{k_H}\right) .a, \frac{v^2}{8k_W}\right\}$ the manufacturer does not source from either type of supplier.

Some observations from Figure 3 and Proposition 3 are:

1. For region CL, the asset value is high enough ($a > \frac{v^2}{16k_L}$) that the manufacturer offers prices similar to the symmetric case. This will directly signal the type of supplier without any additional costs because those are already lower than the minimum acceptable price by an inefficient supplier implying no bluff is taking place.
2. When his asset value goes lower than $\frac{v^2}{16k_L}$, with moderate financing needs (region SA), then p_H^S would no longer be a credible signal since he would accept it given the bank's belief that he is efficient. Moreover, the first constraint of Lemma 2 gets violated. Hence she would at max need to offer $p_{L,H}^{SA}$ to an efficient supplier such that it is unacceptable to an inefficient one.
3. When his asset value goes lower (region P), we enter the pooling equilibrium region where the same price p_W is offered regardless of the supplier type. Here, she cannot offer a price which is only to the efficient one.
4. Finally, when his assets are shallow, and the financial needs go too high (region N), no equilibrium is possible & the manufacturer is relatively better off sourcing from external sources at a cost v rather than sourcing from the supplier.

3.3 Advantage of BDF Under Asymmetry

Using the analysis done in Section 3.2 with the Stable Dominant PBE and Proposition 3, we can now study the conditions under which the BDF scheme becomes a more attractive option than POF when there is an information asymmetry, i.e., the manufacturer has an information advantage over the bank.

As the bank remains uninvolved in the BDF scheme, we observe the same payoffs for the manufacturer and supplier as observed in Proposition 2. Only the performance of POF gets affected under an asymmetric situation, and thus, the relative appeal of BDF increases. We also see that when faced with an inefficient supplier, the POF scheme does not get adversely affected. The information advantage of the manufacturer does not help her out in the case of an inefficient supplier. Hence, our primary focus would be on the case when the supplier is efficient.

Observing Proposition 3 closely, we find that the manufacturer will need to bear some extra signal costs under POF due to this information asymmetry. BDF becomes more appealing as these costs increase. We will now see three scenarios that arise out of Proposition 3:

1. In the Region CL, the manufacturer can send a costless and credible signal to the bank, and thus, this does change its payoff under the POF scheme. Therefore, both BDF and POF are equally attractive in this Region.
2. For Region N, Proposition 3 advises not to source from the (efficient) supplier under the POF scheme. BDF scheme is possibly the only option in this Region, where the asset a is quite low, and costs associated with production are high.
3. For the Regions SA and P, POF and BDF both are feasible, but there are some extra costs associated with POF. This is due to either:

(i) In the separating equilibrium, it may cost the manufacturer a lot to signal to the bank that the supplier is efficient (in Region SA).

(ii) In the pooling equilibrium, the bank assumes the average efficiency of the supplier and thus charges a higher interest rate. In order to compensate for this, the manufacturer would need to pay more (Region P).

To analyze benefit in the Regions of SA and P, we introduce a term $\Delta_M = \Pi_M^B - \Pi_M^A$, where Π_M^B denotes the manufacturer's payoff under BDF scheme as seen in Proposition 2, and Π_M^A is the manufacturer's payoff under POF as seen in Proposition 3.

We can formulate a fourth Proposition as follows:

Proposition 4: Under the information asymmetry case, when the supplier's cost c and asset level a lies within Region SA or Region P, one should always prefer BDF over POF ($\Delta M > 0$). Also, ΔM increases when the supplier's asset value a decreases, when the supplier's cost factor k_H decreases, when the percentage of efficient suppliers in the market λ decreases, or when the manufacturer's outside option v increases.

Using this Proposition 4 and earlier discussions, we can come to some key conclusions:

1. BDF is the more attractive option to the manufacturer when the supplier's asset value a is low.

2. BDF is beneficial to the manufacturer when the efficient supplier's cost factor k_H is low, i.e., when the supplier is more cost-efficient.

3. BDF outshines POF in a scenario where the market is dominated with inefficient players, i.e., the λ is quite low.

4. POF becomes more attractive as the manufacturer's outside option, v, becomes more expensive.

5. Under the Region of SA or N, an efficient supplier would strictly prefer BDF over POF (Assuming information asymmetry).

   (i) This is because, in the Region SA, the contract price under POF is lower than that under BOF. The manufacturer must offer a lower contract price to signal to the bank that the supplier is efficient credibly. Thus, the supplier's payoffs get reduced in this Region if he opts for the POF scheme

   (ii) For Region N, the presence of information asymmetry directly suggests the supplier to only procure a supply contract under BDF

4 Conclusions

Two new non-asset-based financing schemes have emerged in recent years, namely BDF and POF. The paper analyzed which financing scheme would be attractive to the three players (supplier, manufacturer, and bank) when there is symmetry and asymmetry of information between the bank and the manufacturer. The paper found no real benefit of choosing either option over the other under the symmetry of information, despite the manufacturer having a control advantage under the BDF scheme. Only when there is a certain amount of asymmetry, we see bifurcating results. When supplier's assets are adequate, signaling information to bank incurs no extra costs, making POF more attractive than BDF. Under the low asset scenario, this signaling becomes expensive, making BDF the optimal choice. BDF becomes the more suitable option when outside options of the manufacturer are low or if most of the suppliers are inefficient. BDF is mainly used in developing countries or when dealing with specialized products (low quantity). Whereas in developed countries or when dealing with new suppliers, the POF scheme is often preferred as there is no real information advantage for the manufacturer.

5 Limitations & Future Research

The authors suggest some limitations of their method. They have outlined some enhancements to their modeling techniques that can increase the generalisability of the paper. These enhancements include taking into account factors such as multiple suppliers, repeated interaction, and endogenous asset level of the supplier. Furthermore, we can observe that the specificity of the product, the credibility, and the size of the purchaser act as potential limitations to the analysis. As specificity increases, it would require outsourcing of certain parts from a small group of existing suppliers. Relevant to the current scenario, where many countries are halting the inter-territorial movement of goods and services, both the manufacturer and the supplier suffer. If such a situation prevails, these smaller suppliers might dissolve entirely and look for different employment opportunities, thus further curtailing the manufacturer's growth. This ordeal has not just rendered the suppliers helpless with low credit and a more extended waiting period but has also stopped the manufacturer's expansion. An analysis into such a scenario could be considered for future research. The paper also mentions that their findings are only confirmed anecdotally, i.e., using examples and case studies from the past. An extension to this paper could be to perform an empirical analysis on some datasets, further solidifying the paper's claims.

References

1. Tang, Christopher & Yang, S. & Wu, Jing. (2017). Sourcing from Suppliers with Financial Constraints and Performance Risk. Manufacturing & Service Operations Management. https://doi.org/10.1287/msom.2017.0638

2. Marak, Zericho & Pillai, Deepa. (2018). Factors, Outcome, and the Solutions of Supply Chain Finance: Review and the Future Directions. Journal of Risk and Financial Management.

   http://dx.doi.org/10.3390/jrfm12010003