

Indian Institute of Management Calcutta Working Paper Series WPS No 838 /March 2020

Financing Models in E-Commerce to Mitigate Disruptions: A Supply Chain Finance Perspective.

Preetam Basu*

Associate Professor, Operations Management Group, IIM Calcutta Phone: 91-9007112099, Email: <u>preetamb@iimcal.ac.in</u>

Prasenjit Mandal

Assistant Professor, Operations Management Group, IIM Calcutta Phone: 91-9831920480, Email: <u>prasenjitm@iimcal.ac.in</u>

Samit Paul

Assistant Professor, Finance & Control, IIM Calcutta Phone: 91-8009982234, Email: <u>samit@iimcal.ac.in</u>

Sambit Brata Rath PhD student, Operations Management Group, IIM Calcutta Phone: 91-7008576593, Email: <u>sambitbr17@iimcal.ac.in</u>

* Corresponding Author

Indian Institute of Management Calcutta, Joka, D.H. Road, Kolkata 700104

URL: <u>http://facultylive.iimcal.ac.in/workingpapers</u>

Financing Models in E-Commerce to Mitigate Disruptions: A Supply Chain

Finance Perspective.

Preetam Basu¹, Prasenjit Mandal², Samit Paul³, Sambit Brata Rath⁴

Abstract:

With exponential growth of e-commerce giants like Amazon and Alibaba and their marketplace platforms, third party sellers also expect a tremendous rise in demand and revenue. In order to meet the requirements of increased demand, sellers need high working capital. So, most of these small and medium sized businesses need financing to support their operations. In the absence of sufficient traditional financing mechanisms, such as bank credit financing (BOF), we suggest a very recent financing strategy called platform credit financing (POF) where the marketplace platform provides the required financing to the cash constrained third party sellers. We compare POF with BOF in the presence of performance risk and design optimal strategies for each supply chain player.

Keywords: E-Commerce, Platform-based Financing, Supply Chain Finance, Game Theory

¹Associate Professor, Operations Management Group, IIM Calcutta, Email: preetamb@iimcal.ac.in

² Assistant Professor, Operations Management Group, IIM Calcutta, Email: prasenjitm@iimcal.ac.in

³ Assistant Professor, Finance & Control Group, IIM Calcutta, Email: samit@iimcal.ac.in

⁴ PhD Student, Operations Management Group, IIM Calcutta, Email: <u>sambitbr17@iimcal.ac.in</u>

online merchants thus jeopardising the viability and success of online B2C marketplace platforms.

To counter this threian8(p)atl(atke)3(t)10(p)-4(la)8(c)-3(e)6(p)-4(lat)10(fo)-5(r)7(m)-3(s

PCF. Therefore, platforms need to figure out an optimal financing strategy that would be acceptable to the seller. Smultaneously, such strategy should minimise the loss of revenue due to unavailability of short-term financing and loss of capital due to bankruptcy of the borrower. The borrower (in this case, the seller) faces bankruptcy when it lacks sufficient resources to pay back the loan amount. There have been some recent studies which focus on online Supply Chain Finance (SOF) in the presence of demand uncertainty (Gong, Liu, Liu, & Ren, 2019; Gupta & Chen, 2019; Wang et al., 2019; Zhen, Shi, Li, & Zhang, 2020). Gong et al. (2019) analysed the value of PCF and established several factors related to price and profit of the stakeholders. Wang et al. (2019) compared BCF with POF in the newsvendor setting. In a similar newsvendor setting, Gupta and Chen(2019) studied loan term and loan seniority. On the other hand, Zhen et al. (2020)

(Retailer based financing) in the dual-channel supply chain. All the above studies focus on platform credit financing under demand uncertainty. To the best of our knowledge, there is no study on online SCF in the context of supply risk, especially the risk for the platform related to sellers not being able to fulfil customer orders because of capital constraints. We try to fill this research gap nder w at cond t ons a seller w ll accept a nv tat on

an coord nate t e supply c a n f not w at add t on al contracts can e ntroduced to coord nate t e f nanc al supply c a n

We develop a stylised game-theoretic model of a monopolistic online marketplace. We analyse a Stackelberg game between the cash-constrained online seller and the lender (bank under BCF, the platform under PCF) with the lender being the first mover. Since the seller is a small capital-constrained business, there is a risk that the seller is unable to fulfil customer orders because of operational inefficiencies. This leads to a double whammy for the platform-on one hand the platform loses financially because the seller defaults on the credit s6s(thi()-9)-98(tr)-4(it hfi)5(n)-4(a)si3()-98(th)-thi(G[(p)-)1(r)373(r)7(m)-0incudgord

(BCF) with PCF in the newsvendor set-up. Gupta & Chen (2019) focused on Ioan term and Ioan seniority in a newsvendor setting. Zhen et al., (2020) studied the

financing) in a dual-channel supply ch

analysis of supply chain contracts under trade credit financing (C H. Lee & Rhee, 2011; Y.-C. Tsao, 2017; Yan, Wang, Cheng, & Huang, 2016; Zhang, Dong, Luo, & Segerstedt, 2014) Y. C. Tsao (2019) designed two composite contracts (buyback and quantity flexibility) under TCF. Cao & Yu, (2018) compared quantity discount contract, revenue-sharing contract and buyback contract in the context of an emission-dependent supply chain. Zou & Tian (2020) designed a two-part trade credit contract. From the review of the existing literature, it is clear that TCF can increase supply chain efficiency through carefully designed supply chain contracts. Our final contribution to the supply chain finance literature is in terms of contract design for PCF. We suggest two new contracts in PCF and test whether they are able to increase the efficiency of the supply chain.

Model formulation:

We consider a supply chain comprising three players: an online seller who is cash-constrained (she), a pure marketplace platform (he), a bank (it) which works in a competitive market. All the three entities are risk-neutral. We assume there is no information asymmetry among the players.

The seller sells her product only on the platform at price p and pays platform of the selling price as referral fee for each unit of the products sold. The referral fee is set as per the product category with no relationship with the mode of financing. It is in line with prevailing practices across e-commerce

Case 1: Bank credit Financing

In bank credit financing, the interest rate is decided in a competitive lending market by the bank. It is a function of the risk of disruption and mortgage value. Here for calculation simplicity, we have expressed mortgage value m as a percentage of the total principal amount available. For the bank, the decision variable is the interest rate and for the seller, the decision variable is price

acd where a mortgage value in term of % of the loan

=

cd r

First, we find the first-order condition of the profit function of the seller. Then we get an optimal price as a function of the interest rate. We replace the price

with the expression for the optimal price and find the optimal interest rate of the BCF. Then we back substitute and find the final optimal price and optimal profit of all the players. As the interest rate is competitively priced, the profit of the bank will be zero. The optimal values from the analysis are given below.

Case 2: Platform credit Financing

In POF, platform decides the interest rate first, and then the seller determines the price that optimises its profit. Here platform is the Stackelberg leader and the seller is the Stackelberg follower. We solve this system of equations in the same manner as in case 1. The equations are given below

cd r_p

kd $cd r_p cd$

Note: This research has been partially supported by research funding from the Indian Institute of Management Calcutta.

References:

- Babich, V., & Kouvelis, P. (2018). Introduction to the Special Issue on Research at the Interface of Finance, Operations, and Risk Management (iFORM):
 Recent Contributions and Future Directions. anufactur ng erv ce perat ons anage ent, (1), 1 18. https://doi.org/10.1287/msom.2018.0706
- Caldentey, R., & Haugh, M. B. (2009). Supply contracts with financial hedging. perat ons esearc , (1), 47 65. https://doi.org/10.1287/opre.1080.0521
- Cao, E, & Yu, M. (2018). Trade credit financing and coordination for an emission-dependent supply chain. o puters and ndustr al ng neer ng, (March), 50 62. https://doi.org/10.1016/j.cie.2018.03.024
- Choda, J. (2017). Inventory, risk shifting, and trade credit. anage en

- Gupta, D., & Wang, L (2009). A Stochastic Inventory Model with Trade Credit. anufactur ng erv ce perat ons anage ent, (1), 4 18. https://doi.org/10.1287/msom.1070.0191
- Haley, C. W., & Higgins, R. C. (1973). Inventory Policy and Trade Credit Financing. anage ent c ence, (4 pt 1), 464 471. https://doi.org/10.1287/mnsc.20.4.464
- Kolay, M., Lemmon, M. L., & Tashjian, E (2012). Spreading the Misery? Sources of Bankruptcy Spillover in the Supply Chain. srn, (6), 1955–1990. https://doi.org/10.2139/ssrn.2019733
- Kouvelis, P., Wu, X., & Xiao, Y. (2017). Cash Hedging in a Supply Chain. srn, (April 2019), 0 20. https://doi.org/10.2139/ssrn.3054701
- Kouvelis, P., & Zhao, W. (2012a). Financing the newsvendor: Supplier vs. bank, and the structure of optimal trade credit contracts. perat ons esearc, (3), 566 580. https://doi.org/10.1287/opre.1120.1040
- Kouvelis, P., & Zhao, W. (2012b). Financing the Newsvendor: Supplier vs. Bank, and the Structure of Optimal Trade Oredit Contracts. perat ons esearc, (3), 566–580. https://doi.org/10.1287/opre.1120.1040
- Kouvelis, P., & Zhao, W. (2017). Who Should Finance the Supply Chain? Impact of Credit Ratings on Supply Chain Decisions. anufactur ng erv ce