IOSR Journal of Economics and Finance (IOSR-JEF)
e-ISSN: 2321-5933, p-ISSN: 2321-5925.Volume 7, Issue 3. Ver. II (May. - Jun. 2016), PP 71-78
www.iosrjournals.org

Trade Credit Networksin the Readymade Garment Industry ofMetiabruz, Kolkata

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Abstract: *We develop a model of strategic trade credit networks observed in the input market in the readymade garment industry of Metiabruz, Kolkata, where suppliers of input (locally known as Mahjans) provide trade credit to those purchasers of inputs cum producerscum readymade garment sellers (locally known as Ostagars) who belong to their direct networks,as well as to those who do not belong to their direct networks provided the loan is guaranteed by the credible guarantors, who belong to their direct networks.We show that when both the input market and the output market are homogeneous, and the lenders and the borrowers are identical within their groups, then the equilibrium network structureis symmetric and complete and strategically stable but has no spillover effect on the payoffs received by input sellers and producers. By contrast if we allow producers to operatein the independent output markets then the equilibrium network structure is still symmetric, complete and strategically stable but will have a significant spillover effect on thepayoffs of both input sellers and producers. This paper also focuses on how the cost of forming a bilateral link affects the network architecture.*
Keywords: *Economic Networks, Trade creditJel Classification Number: D85*

I. Introduction

Trade credit is a common feature among the industryparticipants of the readymade garment industry ofMetiabruz, Kolkata. This is suppliers' side credit in nature, wherebuyers buy part of their total purchases or the entire purchase on credit from the sellers andagainst promises to sellers that they will repay next week or by some pre-specified date. These credit transactions are not backed by formal, legally enforceable contracts; everything is informal and the transacting parties simply keep notes on the amounts and dates. However lenders are successfully able to recover the dues from borrowers. This is informal suppliers'credit in nature.

There are three markets: the market for the input, the market for the output, and the market for sub-contracting where trade credit is seen to be provided by the suppliers in every market to buyers in the same market with whom they have some form of, often long term, connections.

This paper focuses onthe market for input where input suppliers, who are locally known as *Mahajans* and sell non-labour inputs like fabric, thread, etc, provide direct trade credit to input purchasers,who locally known as *Ostagars*.Aninput seller extends direct trade credit to those producers with whom he has strong and long-term business ties. This helps them to form a trade credit network among themselves.

Sometimes aninput seller may extend additional credit to aproducerwith whom the former has no direct business tiesprovidedthe latter produces a guarantor who is closely related to the input seller through business ties. In this industry, aproducer needs extra trade credit when he faces external positive demand shock in the output market. Aproducer acts as a guarantor for another producer if he knows the person very well; knows the creditworthiness of him, and observes whetherthe latter actually faces a positive demand shock in the output market.

However, the amount of loan guaranteed by a guarantor depends on the guarantors' own credit surplus, which is a difference between the credible loan limit of him and the amount of credit that has actually taken by him from his lender.The presence of guarantors enhances the benefit of industry participants by increasing their profit and reduces lenders' risk to extend loan and the adverse selection problem of lenders.

The spillover effect of this trade credit network, which works through the guarantors, is central to our analysis.In particular, our research questions are as follows:

1) What are the incentives of aninput sellerand aproducer, and any twoproducersto form bilateral links between them?
2) What is the architecture of incentive compatible networks? Is it stable?
3) What are the effects of the presence of trade credit links on the pay-offs of the input sellers and producers?

This paper is an addition to the literature of the economics of network regarding the nature of network effects i.e., how does the structure of interaction or network structure affect individual incentives, in turn, shape economic outcomes.What extra benefit does this network structure provide them? There is a rich body of literature which says that network matters (Bala and Goyal, 2000; Bloch and Dutta, 2008; Dutta, van denNouweland, and Tijs, 1998;Goyal and Joshi, 1999; Goyal and Moraga-González, 2001; Jackson and Watts, 2002; Jackson and Wolinsky, 1996; and Kranton and Minehart, 2001).

Kranton and Minehart (2001) studiesthecollaborative networksbetween vertically related firms, whereas the work ofGoyal and Moraga-González(2001) studies collaborative networks between horizontally related firms.Goyal and Joshi (1999) focuses on how the costs of forming bilateral links between firms affect the architecture of strategically stable network in an oligopolistic market framework.

This article's contribution in this literature is that it provides a model of trade credit networks based on the field survey findings on the readymade garment industry, Metiabruz, Kolkata, where trade credit links[1] are undirected and exogeneous in nature. This paper does not focus on the evolution of bilateral links overtime. It takes the history of it as given and studies the impact of the bilateral links on the pay-offs of lenders and borrowers.

We assume that every potential borrower has exhausted every outside option to get credit, say, credit from formal sector, credit from other informal sector, say, from friends, neighbors, moneylenders etc.We further assume negligible cost of forming a particular link and lenders decide independently on the level of trade credit that they are willing to provide.

We consider an imperfectly competitive, but homogeneous input market with two types of players, namely input sellers and producers, who are identical within their groups. Producersproduce homogeneous goods and sell in a homogeneous output market where they face Cournot type of competition. The absence of a direct credit link between two different types of players, i.e., a producer and aninput seller, means that the producer'sreliability as a potential creditor for theinput seller is low.Input sellers do not havecapacity constraint as far as their ability to lend is concerned, but they ration credit just because they think that borrowers will default if they are provided credit above a certain limit. The collection of pair-wise links between an input seller and a producer and between any two producers defines a trade credit network and a trade credit guarantee network, respectively.

Our first result shows that aproducer and aninput sellerhave an incentive to establish direct trade credit links between themas it increases individual profit. Producers have an incentive to form trade credit guarantee links between them as it enables them to have the access of further trade credit, which ultimately raises their profit levels.

In this readymade garment industry,producersform bilateral linksamong themselves to share costly information regarding every detail of credit contracts, violation of credit contracts, information regardingthe state of the nature of business in the output market, and asking for a guarantee from each other if such a need arises.Information sharing among producers becomes important here because aproducer needs to know whether the potential guarantor has a credit surplus that he can use. Conversely, aproduce*r* who has been asked to act as a guarantor would need to know if the person for whom he stands as a guarantor is reliable.

In a similar manner, input sellers forms trade credit links with producers to lock in them so that their profit levels increase. It also help them to solve the adverse selection problem in the credit market as producers have better information about each other's' reliability as borrowers and the business cycles in the output market than input sellers and only act as a guarantor for a borrower who is likely to repay. Likewise, producersare also interested to form direct trade credit links with input sellers as it fulfils their working capital requirements; it gives them the opportunity to purchase input on credit in the current period and repay after the sale of output in the next period.

This implies that an empty network, where players are not connected with each other is notan equilibrium network structure.

Our third result shows thatifboth the input market and the output market are homogeneous and the borrowers and the lenders are identical within their groups then the equilibrium network structure has no spillover effect on the pay-offs of the borrowers and the lenders.However, profit level increases due to the existence of direct trade credit links than the level of profit when there is no trade credit link. However, if we vary the degree of homogeneity by allowing producers to sell in independent markets then this network structure will have a spill-over effect on producers and input sellers.

We first study the formation of network structure where the output market is homogeneous and oligopolistic. Then we will extend our analysis to case where $O_i$type of players operates in independent output markets, where random shocks are uncorrelated, and will show that players will have spill-over effect in this case.

The rest of the paper is organized as follows. The baseline model is presented in the section 2. In section 3 we present the network formation. Section 4 presentsmarket outcomes under equilibrium network structurewhen there is no spill- over effects.Section 5 concludes.

II. Baseline Model

The model starts from a situation when every producerhas exhausted every outside option to get credit, say, credit from formal sector, credit from other informal sector, say, from friends, neighbors, moneylenders etc.

[1]Links are bilateral in nature.

Trade credit and trade credit guarantees are the only sources of trade credit. Each producer can be a potential guarantor or can be a potential borrower here. Each producer is ex ante identical. Suppose a producer takes l_g and l_b amount of trade credit from his input seller when he faces good shock in the output market and bad shock in the output market, respectively. Let $\bar{l}$ be the level of trade credit provided by aninput seller to his buyer. A producer has trade credit surplus when he faces a bad shock in the output market, and a producerwants a credit guarantee over and above $\bar{l}$ when he faces a good shock in the output market. Suppose one producer has trade credit link with onlyone input seller then his trade credit surplus is equivalent to $\bar{\lambda} - l_b$ and demand for credit guarantee is equivalent to $l_g - \bar{\lambda}$. We assume that $\bar{l} - l_b = \hat{l} < l_g - \bar{\lambda}$ where $\bar{l} > 0$. A producer provides trade credit guarantee from his surplus $\hat{l}$, and it is the maximum guarantee that he can provide. Credit guarantee flows from a producer who faces a bad shock to a producer, who faces a good shock.We have assumed that if a producer is in a position to guarantee then he will not decline to guarantee. We further assume thateach potential guarantor may face multiple requests for credit guarantee in each period but he will be willing to act as a guarantor for that producer who has requested him first.

2.1 Network Structure

Let M ={1, 2, …,,m} be the set of input sellers, and O = {1, 2,..., o} be the set of producers. Here the benefit of forming links comes from receiving more credit. The pair-wise relationship between any two players m and o is represented by a binary variable g_{mo} ,where mϵ M and oϵ O. $g_{mo} = 0$ means participants m and o are not linked and $g_{mo} = 1$ means that participants m and oare linked. A network g is then a collection of links $g = \{g_{mo}\}_{m,o\epsilon M \cup O.}$ Let $g - g_{mo}$ denote the network obtained by severing an existing link between participantsm and o from network g, while $g + g_{mo}$ is the network obtained by adding a new link between participants m and o in network g. Let,$N_m(g)$ is the set of players with whom the player mhas trade credit links in the network g, and let $\eta_m(g)$ is the cardinality of the set$N_m(g)$.

2.2 Credit Level and Spillovers

Trade credit networkshelps to reduce the working capital requirement and reduces the cost of capital as neither input sellers nor guarantors charge interest for their credit. Moreover, this is instantaneous and reduces the transaction cost get it. Input sellers provide the credit in terms of input and producers repay when the sale is realized. Hence, it reduces the marginal cost of production in the current period as it reduces the cash purchase requirement of input.Spill-over effect of this network works through the presence of guarantors. We take that $\hat{l}$ = $x\bar{l}$, where $0 < x \leq 1$.We assume that fixed cost of production is zero and the constant marginal cost of production is $\bar{c}$, when there is no credit facility. The presence of credit facility in this network reduces the marginal cost of production from $\bar{c}$, and we define thisnew expected marginal cost of production, Ec_i (g(s)) for any iϵO, and $s \in M \cup O$ as:

$$Ec_i(l_i(g(s))_{i\in O}) = \bar{c} - \eta_i^d(g(s))\bar{l} - p^{\eta_i^{id}}\eta_i^{id}(g(s))x\bar{l} \quad (1)$$

Here, $\eta_i^d(g) \geq 0$ is the number trade credit links that producer i has in the network g(s). $\eta_i^{id}(g)$ is the number oftrade credit guaranteelinksthat producer i has in the network g(s). p is the probability that producer i has requested first to a potential borrower j in the network and hence gets full trade credit guarantee $\hat{l}$ given that j has a trade credit surplus. $p^{\eta_i^{id}}$ is the probability that he gets $\eta_i^{id}(g)x\bar{l}$ amount of trade credit guarantee from $\eta_i^{id}(g)$ number of links. Here, the extent of marginal cost reduction from $\bar{c}$, depends on the summations of total trade credit from trade credit links, $\eta_i^d(g)\bar{l}$ and $p^{\eta_i^{id}}\eta_i^{id}(g(s))x\bar{l}$, total trade credit via guarantor(s). The set of guarantors are different from the set of lenders, i.e. input sellers. The total cost reduction for producer i stems from the number of direct and indirect links he has, which in turn determines the total volume of trade credit.[2]Giventhe number of trade credit links, total cost of getting credit is [$\eta_i^d(g) + \eta_i^{id}(g)] fl_i^2$]. Under this specification, if one wants to get more volume of trade credit from the same person then cost of getting this will be increasing with the volume of credit and f denotes the curvature of it.

2.3 Pay-Offs

A network of trade credit g leads to a vector of trade credit amount $\{l_i(g)\}_{i \in O}$, which in turn defines the producers'marginalproduction costs $\{c_i(g)\}_{i \in O}$. Given these network specific marginal costs, producers operate in the market by choosing quantities $\{q_i(g)\}_{i\in O}$.
The demand for output is assumed to be linear and given by $Q = a - p, a > c$ (2)
In the homogeneous-output market with n number of quantity-setting producers, total output Q is the summation of individual output, i.e., $Q = \sum_{i=1}^{n} q_i$,andthe profit of producer i is given by $\pi_i(g)$:

$$\pi_i(g) = [a - q_i - \sum_{i \neq j} q_j(g) - c_i(g)]\, q_i - f[\eta_i^d(g) + \eta_i^{id}(g)] l_i^2$$

Individual quantity produced by each producer i is as follows:

$$q_i(g) = \frac{a - nc_i(g) + \sum_{j \neq i} c_j(g)}{(n+1)}$$

and the profits of the Cournot competitors are given by

$$\pi_i(g) = \frac{(a - nc_i(g) + \sum_{j \neq i} c_j(g))^2}{(n+1)^2} - f[\eta_i^d(g) + \eta_i^{id}(g)] l_i^2 \quad (3)$$

Aninput seller's netpay-off in this network structure is given by:

$$\pi_m = \Pi_d + [\eta_m^d(g) + \eta_m^{id}(g)]\Pi_m - f[\eta_m^d(g) + \eta_m^{id}(g)],$$

Where,$\Pi_d$is the profit of a input seller m when there is notrade credit and trade credit guarantee links. $\eta_m^d(g)$ is the number of trade credit link that mth input seller has in the network g(s) and $\eta_m^{id}(g)$ is the number of trade credit guarantee links[3] in thenetwork g(s) .[$\eta_m^d(g) + \eta_m^{id}(g)$] Π_m is the profit from having [$\eta_m^d(g) + \eta_m^{id}(g)$] no ofcreditlinks and f[$\eta_m^d(g) + \eta_m^{id}(g)$]is the total cost of forming[$\eta_m^d(g) + \eta_m^{id}(g)$] no oflinks incurred by the mth input seller.

III. Existence of Networks

This section deals with when networks exist and the architecture of the strategically stable networks. The next proposition shows when the equilibrium network structure will have no spill-over effects.

Proposition 1: If borrowers operate in the homogeneous market then the equilibrium network structures produce no spill-over effect.
Proof: If all the producers sell in the same homogeneous output market theeither all are in the need for guarantee or want to give guarantee asrandom shocks are correlated. So, credit guarantee network does not work here, i.e., $p^{\eta_i^{id}}$ = 0 and hence producersdonot have any incentive to build bilateral trade credit guarantee links among them as forming links are costly.
In this case only trade credit networks exist. What this proposition tells us is that spill-over effect will exist if firms operate in independent markets. The next proposition, Proposition 2, deals with the equilibrium network architecture in the absence of spillover effect.

Proposition 2: If demand curve satisfies (2), cost function satisfies (1),producers compete in quantities and sell in the same market and the cost of forming links is $\pi_i(g^e + g_{mo}) - \pi_i(g^e) < f$ then the empty network will be the only strategically stable network.
Proof: See Appendix[4].

[2]The idea of this type of cost function is taken from Goyal and Moraga-González (2001).
[3]These links are basically indirect links.
[4]We have followed the condition for stability stated by Jackson and Wolinisky (1996).

The next proposition, Proposition 2 tells us when complete network will be the only strategically stable network.

Proposition 3: If demand curve satisfies (2), cost function satisfies (1), producers compete in quantities and sell in the same market and the cost of forming links is $f < \frac{(n-1)\bar{l}\{2a-2c+(n-1)\bar{l}\}}{(n+1)^2}$ then the complete network will be the only strategically stable network.

Proof: See Appendix.

IV. Market OutcomesUnder Equilibrium Network Structure

When producers sell in the homogeneous output market thenthere is no spill-over effect as guarantee by guarantors are not allowed by lenders, so $p^{\eta_i^{id}}$ = 0. There are n numbers of producers. Individual trade credit links has no impact on the pay-off of other producers.The pay-offs of producers i are as follows

$$\pi_i(g) = \frac{(a - nc_i(g) + \sum_{j\neq i} c_j(g))^2}{(n+1)^2} - f\,[\eta_i^d(g) + \eta_i^{id}(g)]\bar{l}_i^2$$

$$q_i(g) = \frac{a - nc_i(g) + \sum_{j\neq i} c_j(g)}{(n+1)}$$

Cost function now reduces to $c_i(l_i(g(s))_{i\varepsilon O}) = \vec{c} - \eta_i^d(g)\bar{l}$ (4)

The cost $c_i(g)$ depends on the volume of loan taken from lenders which are again a function of the degree of the existing network η. We consider the complete network of degree $\eta = n-1$. Here, all the producers have the same cost function, i.e. $c_i(g) = c_j(g)$.

$q_i(g) = \frac{a - c_i(g^{co})}{n+1}$ and $\pi_i(g^{co}) = \frac{(a - c_i(g^{co}))^2}{(n+1)^2} = \frac{(a - \vec{c} + (n-1)\bar{l})^2}{(n+1)^2} - f(n-1)\bar{l}^2$

We note that the profit of producers i is an increasing function of the credit level, $\bar{l}$. The first order condition w.r.to $\bar{l}$ is: $\frac{2\{(a-\vec{c}) + (n-1)\bar{l})\}(n-1)}{(n+1)^2} - 2f(n-1)\bar{l} = 0$. Solving for $\bar{l}$ we get:

$$\bar{l}(g^{co}) = \frac{(a-\vec{c})}{f(n+1)^2 - (n-1)};\quad c_i(g^{co}) = \vec{c} - \frac{(a-\vec{c})(n-1)}{f(n+1)^2 - (n-1)}$$

The above result shows that loan amount in any given network is positive if the cost of forming link is greater than $\frac{(n-1)}{(n+1)^2}$.

Profit of *an* input seller m under no-spill-over effect is given by

$\pi_m = \Pi_d + \eta_m^d(g)\, \Pi_m - f\, \eta_m^d(g)$

This suggests the following proposition:

Proposition 4: Suppose producers operate in the homogeneous market. Then

a) the loan amount is an increasing function of the degree of network and decreasing with the cost of forming link and

b) marginal cost of production is decreasing with the degree of network and increasing with the cost of forming link.

Proof: a) To show that loan amount is an increasing function of the degree of networkwe need to show that $\bar{l}(g^k) < \bar{l}(g^{k+1})$. Now, $\bar{l}(g^{k+1}) - \bar{l}(g^{k+1}) = \frac{(a-c)}{[f(n+1)^2 - n][f(n+1)^2 - (n-1)]} > 0.$

This will happen if there is a new entry in the credit market and the member number of the complete network is (n+1). Second part of Proposition 4(a) is trivial.

b) To show cost of production is decreasing with the degree of network we need to show that $\bar{c}(g^k) > \bar{c}(g^{k+1})$.

$$\bar{c}(g^k) - \bar{c}(g^{k+1}) = \vec{c} - \frac{(a-\bar{c})(n-1)}{f(n+1)^2 - (n-1)} - \vec{c} + \frac{(a-\bar{c})n}{f(n+1)^2 - n}$$

$$= \frac{f(n+1)^3 (a-\bar{c})}{[f(n+1)^2 - (n-1)][f(n+1)^2 - n]} > 0$$

Second part of Proposition 4(b) is trivial.

The next section focuses on to explore areas where spill-over effect is possible, which will lead the improvement in social welfare. We start with the case where borrowers operate in the independent markets instead of the same homogeneous market.

Independent Market:

Now we consider the situation where producers sell their products in the independent markets, say, sell output to the different set of buyers, or to the same set of buyers but at different point of time.We assume that the random shocks in these markets are serially uncorrelated. If one producer faces a random shock in one market, it does not necessarily mean that his fellow producers face the same shock in the other markets. We now see whether there is any spill-over effect or not.

Proposition 7: If borrowers operate in the independent markets, and the cost function satisfies (1) then there is spill-over effect.

Proof: If all the producers operate in the different markets then the probability of facing a good shock by the ith producer in his own market is uncorrelated with the probability of facing a good shock by jth producer in the his own market. So, credit guarantee network works here, i.e., $p^{\eta_i^{id}} \neq 0$ and hence producers have any incentives to build bilateral trade credit guarantee links among them is forming links are negligible.

In this market there is spill-over effect as guarantee by guarantors is profitable.In the independent market case, Q = q $_i$.Here, given a network g, producers receive their monopoly profits. Here, different producers have different marginal production cost depending on the level of spill-over. The pay-offs of producers i are as follows:

$$\pi_i(g) = \frac{(a - c_i(g))^2}{2} - f[\eta_i^d(g) + \eta_i^{id}(g)]\bar{l}^2$$

Cost function is: $Ec_i(l_i(g(s))_{i \in O}) = \bar{c} - \eta_i^d(g(s))\bar{l} - p^{\eta_i^{id}} \eta_i^{id}(g(s)) x\bar{l}$

Proposition 8: If cost function satisfies (1), demand function satisfies (2) and borrowers operate in the independent markets and the cost of forming link falls below $\frac{\{2a - 2c + m + (n-1)(m-2)p^{n-1}x\bar{l}\}\{m + m(n-1)p^{n-1}x\bar{l}\}}{(n+1)^2}$ then the complete network will be the unique strategically stable network.

Proof: See the appendix.

V. Conclusion

There is a large body of literature on the formation of strategic network and how the quality of links affects the pay-off structure of the stakeholders. This article deals with the strategic trade credit network formation in the input market in the readymade garment industry, Metiabruz, Kolkata, where input sellers extend trade credit to input purchasers, and sometimes via guarantors. The development of this model is based on field survey findings.

We find that if input purchasers cum producers are Cournot competitors in the output market and are identical within their groups then this trade credit network structure has no spill-over effect on the pay-offs of producers and input sellers. Guarantee is not profitable here.By the contrast, if the producers sell in the independent market then cooperation in terms of exchanging favoursamong the producers results spill-over effect. We have further shown complete networks is the only strategically stable networks irrespective of the presence of spill-over effect if the cost of forming a bilateral link falls below a certain level.. Pay-off and the provision of loan from the network is an increasing function of the degree of the network. In future work we hope to explore the incentive to guarantee, network structure formation under uncertainty in the output market, punishment strategies adopted by guarantors and lenders to prevent default, lenders' capacity constraintin a more general setting.

Appendix:

Proof of the proposition 1:

We first proof that the empty network is the only strategically stable network when the cost of forming link is very high. There is no link available to delete as the network is empty. Therefore the condition (i) of stability is automatically satisfied. We will check the condition (ii) of stability. In an empty network g^e, $\eta_{i}(g^e) = 0$, for any i ϵO. Therefore, producer i has a marginal cost $\bar{c}$ and pay-off $\pi_i = \frac{(a-\bar{c})^2}{(n+1)^2}$. If one producer forms a single link then he will be facing a marginal cost equivalent to ($\bar{c} - \bar{l}$) and payoff $\pi_i = \frac{(a-\bar{c}+\bar{l})^2}{(n+1)^2}$. Now the marginal benefit to form an additional link is $\pi_i(g^e + g_{mo}) - \pi_i(g^e) = \frac{\bar{l}(2a-2\bar{c}+\bar{l})}{(n+1)^2}$ which is less than cost of forming a bilateral link. Therefore, producer o does not have any incentive to form this additional link.

Proof of Proposition 2:

Consider the complete network, g^{co}, where$\eta_{i}(g^{co})$ = m, for any i ϵ O. As this is complete network so there is no link available to add. Therefore, the condition (ii) for stability is automatically satisfied. Now we check the condition (i) for stability, i.e. whether any one has any incentive to delete an existing link. Under$g^{co}$the marginal cost of productionis $c_i(g^{co}) = \bar{c} - m\bar{l}$. Gross pay-offs of producer i is $\pi_i(g^{co}) = \frac{(a-\bar{c}+m\bar{l})^2}{(n+1)^2}$ and the profit of lender m is $\pi_m(g^{co}) = \pi_d + (n-1)\pi_m$. Now consider another network where some i and m are not linked, i.e. $g_{mi} = 0$. So except i and $h \in M$ every member in this network has m number of links and they both have m-1 number of links. In the ensuing network g^{co}- $g_{mi,}$ bothi and m have (m-1) number of links and the rest of the members have m number of links.

$$\pi_i(g^{co} - g_{mi}) = \frac{(a-nc_i+c_j)^2}{(n+1)^2} = \frac{\{a-m[\bar{c}-(m-1)\bar{l}]+(m-1)[\bar{c}-m\bar{l})\}^2}{(n+1)^2} = \frac{(a-\bar{c})^2}{(n+1)^2}$$

Since, $\pi_i(g^{co}) - \pi_i(g^{co} - g_{mi}) = \frac{m\bar{l}\{2a-2c+m\bar{l}\}}{(n+1)^2} > f$, which violates the stability condition (i). A producer has no incentive to delete an existing link. This is also true for an input seller So, g^{co} is a stable network.

Proof of Proposition 8:

Consider the complete network, g^{co}, where $\eta_{i}(g^{co})$ = m+(n-1), for any i ϵ O. As this is complete network so there is no link available to add. Therefore, the condition (ii) for stability is automatically satisfied. Now we check the condition (i) for stability, i.e. whether any one has any incentive to delete an existing link. Underg^{co} the marginal cost of production is $c_i(g^{co}) = \bar{c} - m\bar{l} - (n-1)p^{n-1}x\bar{l}$. The gross pay-offs of producer i before deducting the link formation cost is $\pi_i(g^{co}) = \frac{\{a-\bar{c}+m-(n-1)p^{n-1}x)\bar{l}\}^2}{(n+1)^2}$ and the profit of lender m is $\pi_m(g^{co}) = \pi_d + (n-1)\pi_m$. Now consider another network where some i and m are not linked, i.e. $g_{mi} = 0$. So, except i and $h \in M$ every member in this network has m number of trade credit links andn-1 trade credit guarantee linksand they both have m-1 trade credit links and (n-1) trade credit guarantee links. In the ensuing network g^{co}- g_{mi} , bothi and h have (m-1) number of links and the rest of the members have m number of links.

$$\pi_i(g^{co} - g_{mi}) = \frac{(a - nc_i + c_j)^2}{(n+1)^2} = \frac{[a - m[\bar{c} - (m-1)\bar{l} - (n-1)p^{n-1}x\bar{l}] + (m-1)[\bar{c} - m\bar{l} - (n-1)p^{n-1}x\bar{l})]^2}{(n+1)^2}$$

$$= \frac{\{a - \bar{c} + (m-1)(n-1)p^{n-1}x\bar{l})^2}{(n+1)^2}$$

Since, $\pi_i(g^{co}) - \pi_i(g^{co} - g_{mi}) = \frac{\{2a - 2c + m + (n-1)(m-2)p^{n-1}x\bar{l}\}\{m + m(n-1)p^{n-1}x\bar{l}\}}{(n+1)^2} > f$

, which violates the stability condition (i). A producer has no incentive to delete an existing link. This is also true for an input seller So, g^{co} is a stable network.

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