CESifo WORKING PAPERS

8208
2020

April 2020

Asset Level Heterogeneity, Competition and Export Incentives: The Role of Credit Rationing

Sugata Marjit, Moushakhi Ray

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
· from the CESifo website: https://www.cesifo.org/en/wp

CESifo *Working Paper No. 8208*

Asset Level Heterogeneity, Competition and Export Incentives: The Role of Credit Rationing

Abstract

Firm heterogeneity is mostly discussed in the literature from the viewpoint of productivity differential. In contrast this paper recognizes wealth heterogeneity as an important factor that results in firm heterogeneity. The issue of wealth heterogeneity and export incentive through credit market imperfection over the life cycle of a firm remains largely unaddressed in the literature. This paper studies the dynamics of wealth heterogeneity and export incentive of credit rationed firms through asset building. The theoretical and empirical results indicate that an increase in the initial level of competition implies greater export incentive. However, over the life cycle of a firm, the role of competition is impacted by the intensity of capital accumulation and the initial level of wealth. Greater local competition before the entry of firms in the export market hurts export incentive by limiting cash flows and asset build up. Thus low profits due to competition allows firms to look for export opportunities but lower cash flows hurt such incentives.

JEL-Codes: F100, F140, G100, G200.

Keywords: export incentive, credit market imperfections, technology, competition, asset level heterogeneity.

Sugata Marjit
Indian Institute of Foreign Trade
Kolkata / India
marjit@gmail.com

Moushakhi Ray
Siliguri College
Siliguri / India
rmoushakhi@gmail.com

We thank the participants of the WEAI meetings at NTU, Singapore in 2016, especially Ronald Jones and also that of the 15th Annual Conference on Economic Growth and Development held at Indian Statistical Institute, 2019, New Delhi for helpful comments. We are also indebted to the Centre for Studies in Social Sciences, Calcutta and the Department of Commerce, University of North Bengal for allowing us to avail the Centre for Monitoring Indian Economy (CMIE) database through library and internet access. Sugata Marjit acknowledges research visits to Universities of Kobe, Queensland, New South Wales and FED. St. Louis which facilateted the work on this paper.The usual disclaimer applies.

I Introduction

Firms' behaviour has been studied in various dimensions in the context of international trade. The literature discusses firms' heterogeneity, the degree of competitiveness, productivity, the state of technology, market structure, foreign direct investment (FDI) etc., which determine the performance of firms in the global market. But, generally, the literature on firm behaviour and the role of domestic competition (for example, Clougherty and Zhang (2009), Barua, Chakraborty and Hariprasad (2010), Das and Pant (2006) and Marjit and Ray (2017)), does not discuss the issue of credit market. It largely concentrates on the effects of competition and technology on export profitability of firms without any reference to the dimension of credit market.

Clougherty and Zhang (2009) establish a relationship between domestic rivalry and export performance. Their finding states that a rise in the number of firms competing in both 'home' and 'foreign' markets augments domestic output, and also the country's export share. The impact of a larger number of domestic firms is analysed in three alternative scenarios in the production process of domestic and international outputs: (i) joint economies; (ii) diseconomies, and (iii) the absence of such effects. Similar to the idea of Clougherty and Zhang, however, this paper also starts with the basic surmise that the difference between the local and world prices, (P_L-P_W), is less than the trading cost, which signifies an entry restriction for foreign firms in the domestic market. However, domestic firms are free to sell in the global market. Again, in Clougherty and Zhang, the impact of domestic rivalry occupies a central place in export decisions of a firm. Pushing this spirit ahead, the present paper focuses on the role of competition on export profitability of firms in the presence of credit rationing and asset level heterogeneity. Barua, Chakraborty and Hariprasad (2010) examine the inter-relationship among the entry to the domestic market, the level of competitiveness and the level of export in an oligopolistic market framework. They consider the conventional argument that, in the wake of

economic liberalization, the entry of foreign firms in an oligopolistic industry reduces the domestic market power of the existing firms, thereby reducing the price-cost margins, and augmenting aggregate exports. Similarly, Das and Pant (2006) focus on the impact of the new industrial policy in India on the competitive environment and productivity in the manufacturing sector. Our paper also studies the interrelationship between the degree of domestic competition and export incentive of firms. The novelty of this paper is that it distinctively identifies the effect of competition on export profitability of firms under the consideration of both past and present periods in the lifetime of a firm. Marjit and Ray (2017) establish that higher competition enhances export profitability when the technology is advanced; but it may or may not do so when the technology is backward. In the latter case, there should be a threshold technology beyond which higher competition cannot ensure higher export profitability. Since this category of literature concentrates on the role of the degree of competition and technology on export incentive of firms, the issues of credit market imperfections and asset heterogeneity are largely unattended. In contrast to these studies, the present paper is an interface between the financial constraint of a firm and its involvement in international trade. It closely focuses on the role of competition on export incentives of firms. The present study specifically confirms that higher competition makes firms weaker in terms of their cash flows. In this background, it identifies the threshold level of competition below which export is profitable in a dynamic world. However, technology on the overall level is not significant in our paper.

Again, in the works of Helpman (2006) and Melitz and Redding (2014), a general theoretical framework is used for modelling firm heterogeneity in differentiated product market in the presence of monopolistic competition. In the field of credit market, production and trade, contributions are made by Deardorff (2000), Jones and Marjit (2001), Beck (2003) and Rajan and Zingales (1998) etc. Recently, the impact of financial underdevelopment and credit constraints on export decisions of firms are studied in Matsuyama (2008), Manova (2008),

Meisenzahl (2016), Manova, Wei and Zhang, (2011), Manova (2013), Chaney (2016), Egger and Kesina (2013), Egger, Kunert and Seidel (2018), and Gorodnichenko and Schnitzer (2013). Manova (2013), however, incorporates credit constraints and firm heterogeneity into a static model, *a la* Melitz (2003), to study the aggregate export outcomes of firms. But the heterogeneity is treated mainly in respect of productivity, not in asset as is conceived in this article. His paper suggests that trade-specific effects of credit constraints act both on the extensive and intensive margins of trade. That is, firms face credit constraints in financing of both fixed and variable costs of exporting. The paper empirically concludes that financial frictions impede the export incentives of firms. The underlying assumption of his paper states that firms cannot use past periods profits to finance future operations. Contrary to this assumption, our paper considers that the strength of competition on export incentive of firms is conditional on the stock of capital accumulated in the past periods. This previously accumulated capital stock is used by the firms to cover the entry cost of export. This idea is similar to the paper by Chaney (2016). Chaney (2016) considers that firms are prevented from entering the global market due to their liquidity constraints and the lack of ability to access financial markets and to cover entry costs into foreign markets. His model suggests that financial underdevelopment hinders exports. In line with this study, Egger and Kesina (2013), Egger, Kunert and Seidel (2018) examines, both theoretically and empirically, the role of credit constraints for exports and its welfare implications. Egger and Kesina (2013) focuses on the impact of credit constraints on a firm's propensity to export. He also considers the impact of financial constraints on extensive and intensive margins of firm-level exports by using data of Chinese enterprises. His empirical results confirm that the impact of financial constraint on intensive margin of firm-level export is sufficiently strong, and there exists a negative relationship between export and credit constraint. Egger, Kunert and Seidel (2018) study the consequences of credit constraints for price setting, endogenous mark-ups and welfare in a

model of heterogeneous firms engaged in Cournot competition in an open economy framework. Their findings suggest an increase in credit constraints precludes the least productive firms from securing external finance. Their paper also portrays a negative impact of tighter credit constraints on welfare. Again, Gorodnichenko and Schnitzer (2013) investigate, both theoretically and empirically, the relationship between financial constraints and firm's innovation. Their study validates that financial constraints restrain the ability of domestically owned firms to innovate. In a different context, credit market and trade policy are analyzed by Marjit, Mukherjee and Yang (2015) and Bandopadhyay, Marjit and Yang (2014) to study the implication of credit constraints for the sustainability of product market collusion in a bank-financed, Cournot duopoly model, and in the context of outsourcing under financial crisis. Apparently, the literature on credit market imperfections concentrates on the impact of credit constraints on export profitability of firms. The existing studies do not explain the significance of the degree of market competition and the nature of technology in analyzing the export behaviour of firms.

To fill up this gap in the existing literature, the present paper recognises that in the real world, the credit market is subject to imperfections, and therefore, seeks to analyze the effects of changes in the degree of competition and the state of technology on the performance of credit constrained firms. It examines the behaviour of firms taking into account both the present and past periods so that we can comprehend the role of past accumulated funds in a firm's export decisions through lesser requirement of credit in the present. This would integrate the issue of credit market imperfections and the behaviour of firms, enriching the existing literature. In particular, we investigate: (i) whether better technology and higher competitiveness increase the drive for export of credit constrained firms; and (ii) how the asset level heterogeneity affects the export incentives of firms. This paper ignores firm-level heterogeneity in productivity or

technology, but recognises it in terms of their assets so that the dynamic effects of asset building on the firms' export profitability could be comprehended.

The propositions that this paper seek to prove are like this: exports are more profitable than domestic sales for credit constrained firms, when the credit limit is operative under rationing. In such environment, the export incentive of credit constrained firms increases with a higher level of firms' wealth. Also, an increase in domestic competition in the current period escalates the export profitability of firms. But when we consider past periods the export profitability may increase or decrease with a higher degree of competition on account of the dynamics of past accumulated capital stock. In this scenario, there is a critical level of competition $'\tilde{n}'$ below which export is profitable but beyond the level, export is not profitable .

The rest of the paper is organised as follows. Section II formulates a theoretical model. Section III investigates the export profitability of firms under credit rationing, when only present period is considered. It also highlights the role of the degree of competition in this regard. Section IV evaluates the export behaviour of firms, when both past and present periods are considered. It elaborates on the role of asset building and asset level heterogeneity in firm behaviour. Section V empirically testes the impact of credit constraint along with the degree of market competition and technology, and also the impact of wealth, in determining the exportability of industries. Section VI concludes.

II Theoretical Model

The analytical framework in this paper considers a perfectly competitive market for an industry where a number of firms operate. Those firms sell their products either in the global or in the domestic market. Indeed, the homogeneity postulate ensures that what is valid for a single firm is also applicable to all other firms in the industry. The literature on firm behaviour uses productivity differential as the basis of firm heterogeneity. But this paper highlights asset level

heterogeneity as the most significant component that contributes to firm heterogeneity. However, the export incentive of a firm can be determined from their 'change in profit' function, that is, the difference between the volume of profit with export and that without export. This we evaluate for credit-constrained firms in the presence of rationing. In this framework, the world price level 'P_w' is given, that is, it is exogenously determined by the global market forces, while the domestic price 'P' is endogenously determined in the model. However, in the presence of rationing when a credit constrained firm borrows from bank it is subject to default. We consider that π is the profit of the firm, and k(1+r) is the opportunity cost when the firm lends its wealth 'k' at lending rate of interest 'r'. The rationed amount of credit borrowed by the firm is 'B', such that B(1+R) is the cost of borrowing for the rationed credit. The probability that the firm is caught when it defaults is q, and $q\theta$ is the cost of default. In this situation, the firm will not default when equation (1) holds.

$$\pi - k(1+r) - B(1+R) \geq \pi - k(1+r) - q\theta(k+B) \quad (1)$$

That is,

$$q\theta(k+B) \geq B(1+R) \quad (2)$$

$$q\theta k \geq B[(1+R) - q\theta] \quad (3)$$

$$B \leq \frac{q\theta}{[(1+R) - q\theta]} * k \quad (4)$$

Equation (4) represents that the initial wealth 'k' of the firm determines the amount of rationed credit C(k).

The analytical framework for a credit constrained firm considers 'k' to represent the wealth that the firm inherits. The firm is to borrow C(k), which is the rationed amount of credit that the firm borrows. However, when a credit rationed firm enters the global market to sell its

product it has to incur a fixed cost 'F'. Therefore, [C(k)+k-F] is the total cost of production of the firm, less the entry cost. This the firm has to borrow at the borrowing rate of interest R, so that its cost on this account is [C(k)+k-F](1+R). The cost component of the firm also includes the opportunity cost of using its own fund, which is $k(1+r)$ at the lending rate of interest r. We, however, assume that the borrowing rate of interest is greater than the lending rate of interest, R> r.

The cost function of the firm when it sells in the global market is shown in Equation (5)

$$C = \frac{1}{2} s x_w^2 \qquad (5)$$

The cost function of the firm when it sells in the domestic market is shown in Equation (6)

$$C = \frac{1}{2} s x^2 \qquad (6)$$

In the above equations, 'C' represents the total cost, 'x_W' represents the amount of output sold in the global market, 'x' represents the amount of output sold in the domestic market. The use of the parameter 's' has a special significance in the cost functions (5 and 6). We treat it as a parameter representing the state of technology in a firm. A lower value of 's' implies technological advancement.

Following Aghion and Banerjee (2005), we consider that when the firm has wealth 'k' it gets a maximum credit limit of C(k)[1]. When credit limit is binding the profit function is given as:

$$\pi_2 = Revenue - C(k)(1+R) - k(1+r) \qquad (7)$$

The amount of output produced for export and domestic sales, 'x_W' and 'x' respectively, are determined from the cost function directly. When an individual firm only exports (that is, it

[1] The assumption of proportionality indicates C(k)=ck. This follows from Aghion and Banerjee (2005) where they consider that an entrepreneur is born in period t. In the beginning of life he receives an endowment W_t^i and decides to allocate it between short run investment (K_t^i), long run investment(Z_t^i) and savings in riskless bonds (B_t^i). To ensure a balanced-growth path, we assume that the initial endowment and the costs of short-term and long-term investments are proportional to T_t, and denote with $w_t^i = W_t^i / T_t$, $k_t^i = K_t^i / T_t$, $z_t^i = Z_t^i / T_t$, and $b_t^i = B_t^i / T_t$

also incurs a fixed cost component (F)), its output is calculated from the cost equation of the firm (that is, from Equation 5) by incorporating therein the inherited wealth K and the fixed cost F. In a similar way, the output for domestic sale is calculated (that is, from Equation 6). Akin to Clougherty and Zhang (2009) and Majit and Ray (2017) this paper also assumes that foreign firms cannot enter in the domestic market. To sell in domestic country foreign firms has to bear a transport cost/trading cost (t) such that P_w+t > P. The significance of this assumption lies in the interest of this paper to analyze the impact of local competition in the local market. Equation (9) shows the level of output for sale in the global market, and equation (11) shows the amount of output to be sold domestically.

$$C(k) + k - F = \frac{1}{2} s x_w^2 \qquad (8)$$

$$x_w = \left(\frac{2(C(k) + k - F)}{s}\right)^{1/2} \qquad (9)$$

Similarly, for an individual firm selling only in the domestic market (with F = 0, indeed) the level of output is

$$C(k) + k = \frac{1}{2} s x^2 \qquad (10)$$

$$x = \left(\frac{2(C(k) + k)}{s}\right)^{1/2} \qquad (11)$$

Export incentive of credit constrained firms is guided by several factors, which are largely conditional on the presence of credit rationing and the effect of wealth heterogeneity on asset building of firms. Asset building is however conditional on the consideration of past and present periods in the life-history of a firm. It is, therefore, prudent for us to evaluate the export profitability of credit constrained firms in an imperfect credit market in the presence of credit rationing. This analysis incorporates the effect of increase in competition on the asset building

and export profitability of firms either under the consideration of present period (as discussed in section III), or both past and present periods simultaneously (as discussed in section IV).

III The Presence of Credit Rationing Under the Consideration of Present Period

We propose a very simple demand function. Let Y be the total expenditure on this product in the local market[2]. Then final demand is given by

$$D = \frac{Y}{P} \qquad (12)$$

Individual firm faces the demand $d = \frac{Y}{Pn}$ (13)

In equilibrium

$$Aggregate\ supply = Aggregate\ demand \qquad (14)$$

$$nx = \frac{Y}{P} \qquad (15)$$

$$P = \frac{Y}{nx} \qquad (16)$$

Therefore, revenue generated from domestic sale is given as

$$Px = \frac{Y}{n} \qquad (17)$$

As the country is small, when export possibility arises all firms take P_W as a given world price. In case we do not make this assumption local consumers will pay P_W.

Equation (18) represents the profit (π_2(CE)) of a credit constrained firm whose credit limit is binding and the firm exports, and Equation (19) represents the profit (π_2(CO)) of a

[2] Similar results can be derived with a constant elasticity. For a demand function $D=Y.P^{-\xi}$, the basic essence of the result will remain unchanged for $\xi \gtreqless 1$.

similar firm when it sells only in the domestic market. Here, the rationed credit C(k) that the firm borrows depends on its initial wealth 'k'. The difference in the revenue components in these equations are this: in Equation (18), individual firm's output is adopted straightway while, in Equation (19), the industry's equilibrium output (Y) is divided by the number of firms (n) in the industry to represent the firm-level output. Their cost components differ only in respect of F which the exporting firm alone is to bear. When a firm is able to cover the fixed cost 'F' it sells each unit in the global market and earns higher profit. But if it fails to cover the fixed cost 'F', then it sells each unit of production in the domestic market and bears F=0.

However, when fixed cost 'F' is covered at the beginning of the production the profit functions of a credit rationed firm with export and without export respectively, are given as:

$$\pi_2(CE) = P_w x_w - (C(k) + k - F)(1 + R) - F(1 + R) - k(1 + r) \quad (18)$$

$$\pi_2(CO) = \frac{Y}{n} - (C(k) + k)(1 + R) - k(1 + r) \quad (19)$$

The export incentive of a credit rationed firm is reflected in the difference in profits between such a firm with export and a similar firm without export. Change in profit function due to export may then be represented by[3]:

$$\Delta\pi_2(C) = (P_w x_w - \frac{Y}{n}) - [C(k) + k - F - C(k) - k](1 + R) - k(1 + r) + k(1 + r) - F(1 + R) \quad (20)$$

$$\Delta\pi_2(C) = (P_w x_w - \frac{Y}{n}) \quad (21)$$

$$= P_w Z(k, F) - \frac{Y}{n} \quad (22)$$

where

[3] Here fixed cost 'F' is borne before the output is sold. If 'F' is incurred after the production process is over, the $x_w = (\frac{2(C+K)}{s})^{\frac{1}{2}}$ and 'Change in profit' is $\Delta\pi_2(C) = (P_w x_w - \frac{mY}{n}) - F$

$$Z(k,F) = \left(\frac{2(C(k)+k-F)}{s}\right)^{1/2} \qquad (23)$$

Equation 23 generates the following propositions:

Proposition 1A: With Credit Rationing higher amount of fixed cost 'F' or lower amount of wealth 'k' reduces the relative profitability of export.

Proposition 1B: The extent of loss in export profitability is declining in the level of asset and technology.

Now,

$$Z'(k) = \frac{s^{\frac{1}{2}}}{(2(C(k)+k-F))^{\frac{1}{2}}} \qquad (24)$$

Equation (9) indicates that as 'F' increases, the output produced for sale in the global market falls whereas, a rise in 'k' increases the output produced. In this paper productivity of firms are assumed to be same, and heterogeneity occurs in view of heterogeneous wealth. The effect of 'F' on profit comes through output level.

Equation (24) suggests that if wealth (k) increases in the backdrop of 'bad' technology, the rate of change in profit will be higher than that when technology is 'good'. That is, when a firm has less efficient technology, an increase in wealth can result in higher profitability of firms.

Proposition 2: Increase in the degree of competition increases the export profitability of firms.

Figure 1 displays the relationship between net profit and the wealth of a firm 'k'. Note that the $\Delta\pi_2$- curve is concave downwards since $\frac{\delta^2\Delta\pi_2}{\delta k^2} < 0$. An increase in the degree of competition 'n' results in downward shift of the $\frac{Y}{n}$ curve to $(\frac{Y}{n})^1$. As a result, more firms would

be exporting due to increased competition. In the following diagram, firms start exporting at a lower level of wealth 'k_1' as compared to 'k_2'(in the initial stage) when there is an increase in competition. Again, when fixed cost 'F' increases, the output level falls. This in turn triggers a reduction in export profitability, which is represented by a downward shift in the export profitability curve from EP to EP'. At this stage, firms at a higher level of wealth 'k_3' are interested to export. That is, the range of non-exporters increases to 'OK_3'.

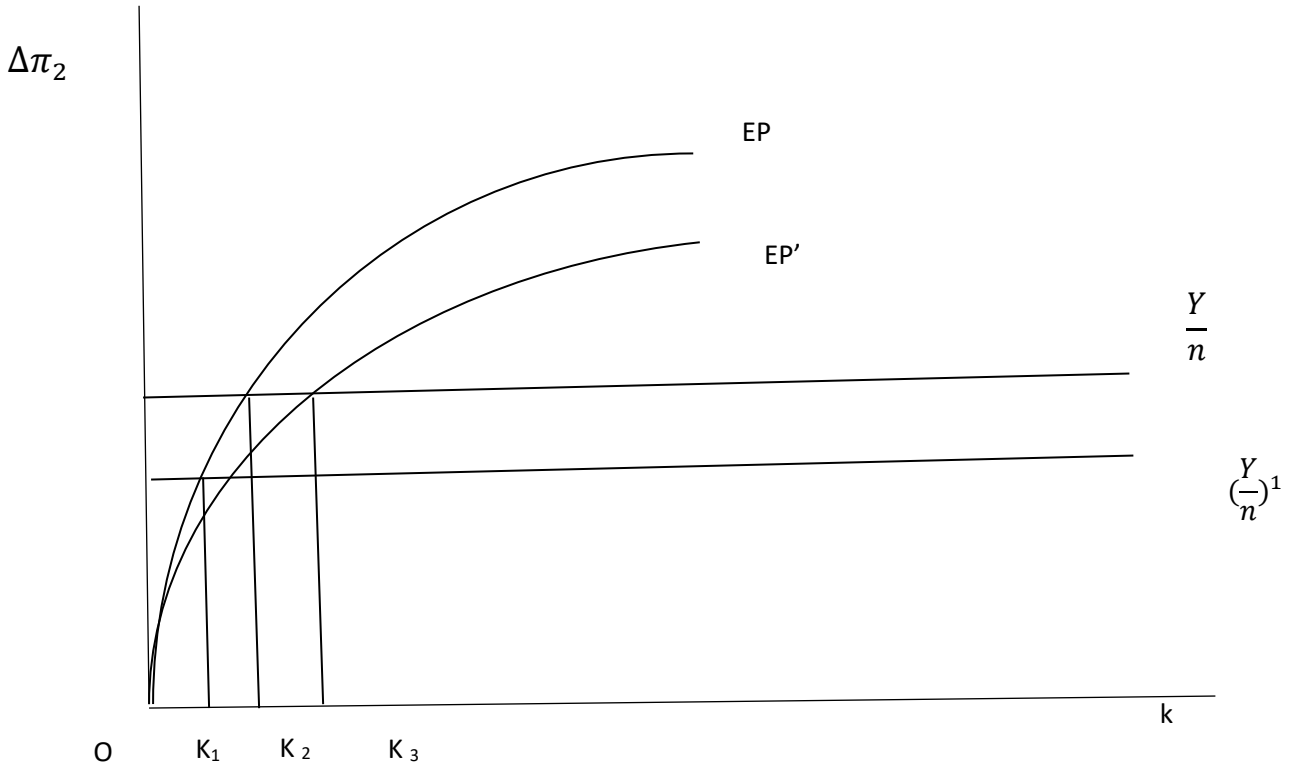

Figure 1: Effect of Competition and Fixed Cost on Export Profitability and Wealth of the Firm

IV The Presence of Credit Rationing Under the Consideration of Both Past and Present Periods

This section focuses on heterogeneity in the asset level of firms which contributes to firm heterogeneity. Asset level heterogeneity in turn leads to asset building of firms. Heterogeneity in the asset of firms is a decisive factor in analyzing its export behaviour. We assume here that 'n' represents the degree of competition in the market. Suppose that the initial wealth of all firms is same. A firm takes the decision to enter the export market at time period 't', while it was in existence in (0,t). Now, if the degree of competition (n) rises in period t, it reduces the share of

domestic profit of a firm. This in turn makes less addition to the capital stock of the firm and thereby less asset building. Therefore, when the degree of competition 'n' rises in period (t-1) and capital stock is already high, firms enter the export market. But, there might be some firms who are not able to enter the export market. The reason may be their low additional capital stock. When competition rises in the t-th period but their addition to capital stock was less in the previous period (t-1), their chance to enter the export market is less in the t-th period. This is the case when 'n' is exogenous. In the following theoretical framework, we discuss the export incentive of firms when both past and present periods are considered. However, we do not consider the case of endogenous 'n' in this model.

Finally, in the t-th period, the firm's decision to enter the export market depends on the difference between revenue generated from sell in export market and that in the domestic market. The change in profit of a firm is given as:

$$\Delta\pi_2(C) = (P_w x_w - \tfrac{Y}{n}) \qquad (25)$$

$$\Delta\pi_2(C) = P_w \left(\frac{2(C(k) + k - F)}{s}\right)^{1/2} - \frac{Y}{n} \qquad (26)$$

When both past and present periods are considered for a firm, the question of change in capital stock is involved. We consider that a portion 'λ' of the domestic revenue (Y/n) is used as retained earnings to build up the capital stock, which influences the export decision of the firm. Therefore, (λY/n) is the cash flow that augments the stock of capital. We also assume that $\sum_{r=1}^{t-1} k_{t-r}$ is the previous years' capital stock assuming that the firms did not export till the last period and k is not depreciating. At a higher level of capital stock accumulation, the firms cover the entry cost into global market and therefore earn higher profit in export. Therefore, the total wealth is

$$C(k) + k = \lambda \frac{Y}{n} + \sum k_{t-r} \qquad (27)$$

Also, a portion of capital stock is used in the production process of the firm. So the total production cost of the firm less the fixed entry cost which the firm bears at the beginning of the production process is given as:

$$C(k) + k - F = (1 + \eta)\left[\lambda \frac{Y}{n} + \sum k_{t-r}\right] - F \qquad (28)$$

Substituting the value from equation (28) in equation (26) we get the change in profit function (β) as

$$\beta = P_w \left[\frac{2\left\{(1 + \eta)\left(\lambda \frac{Y}{n} + \sum k_{t-r}\right) - F\right\}}{s}\right]^{\frac{1}{2}} - \frac{Y}{n} \qquad (29)$$

On differentiating equation (29) with respect to n it follow

$$\beta'(n) = \frac{Y}{n^2}[1 - \lambda(1 + \eta)A(n)] \qquad (30)$$

where

$$A(n) = P_w \left[\frac{2\left\{(1+\eta)\left(\lambda \frac{Y}{n} + \sum k_{t-r}\right) - F\right\}}{s}\right]^{\frac{-1}{2}} \qquad (31)$$

The decision to export then depends on the condition that

$$\beta'(n) \gtreqless 0 \; iff \; [1 - \lambda(1 + \eta)A(n)] \gtreqless 0 \qquad (32)$$

In equation (31), as the degree of competition 'n' rises, A(n) also rises. As a result, A(n)λ(1+**η**) is a rising curve. As 'n' tends to 0, A(n) tends to 0, so that A(n)λ(1+**η**) curve starts from the origin. This is depicted below in figure 2.

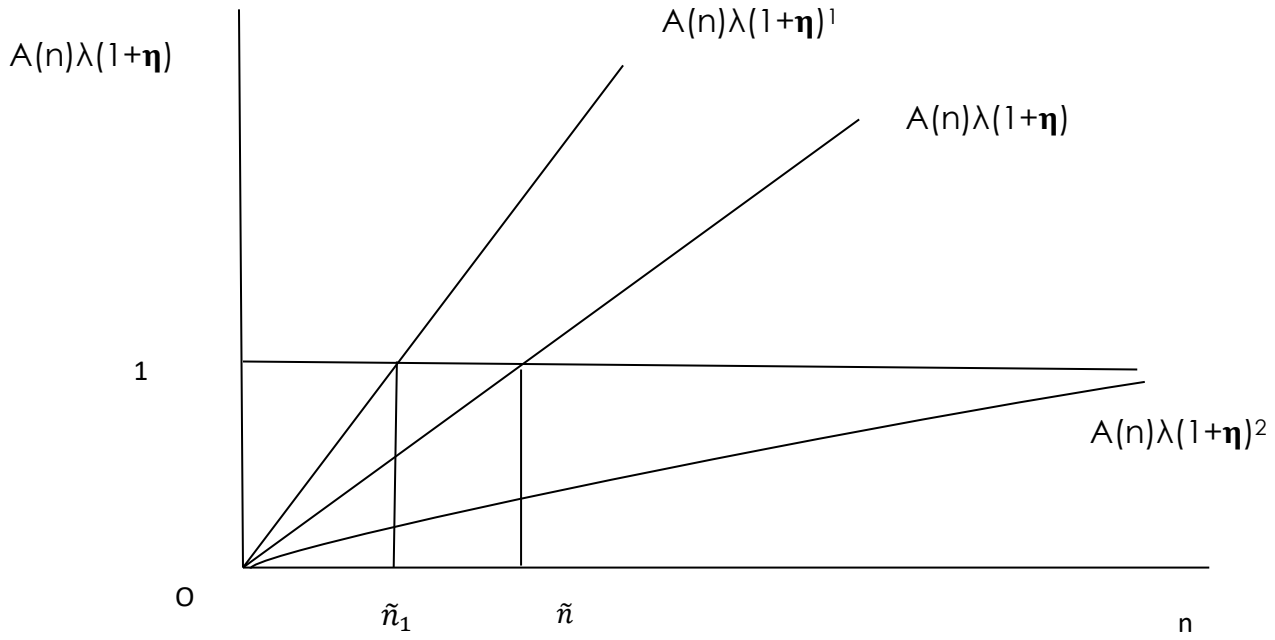

Figure 2: Relationship between Export Profitability of Firms and Degree of Competition

If A(n)λ(1+**η**)<1, i.e., it lies below the horizontal line , then $\beta'(n) > 0$. This indicates that export is profitable. But when A(n)λ(1+**η**)>1, i.e., it lies above the horizontal line, then $\beta'(n) < 0$ and export is unprofitable. However, if A(n)λ(1+**η**) is always below the horizontal line as A(n)λ(1+**η**)^2 , then export is always profitable. This implies that there is a critical n, say $\tilde{n}$, below which export is profitable, and beyond which it is unprofitable. Although, in this paper, all firms are credit rationed, all of them do not have the same amount of past accumulated capital stock. In this scenario, if the degree of competition 'n' rises beyond $\tilde{n}$, there is less accumulation of capital stock so that export may be unprofitable; on the other hand, below $\tilde{n}$ the accumualtion of capital stock is such that export is profitable. However, if the initial capital stock would have been higher, then the value of A(n) should be higher so that the A(n)λ(1+**η**)

curve shifts upwards to A(n)λ(1+**η**)[1]. As a result, the range of non-exporters increases by $\tilde{n}_1\tilde{n}$ in the graph.

That is, an increase in the degree of competition might or might not result in profitable export, when accumulation of asset is considered for the past and present period. The effect of asset building on firms arises only when sales in global market are considered. This is because in order to export, firms require an additional component of fixed cost, which is borne out of the generated asset. But if the firms sell only in domestic market, then building asset is not a necessity for the firms. An increase in domestic competition in the present period is likely to reduce the domestic profitability of firms and there is no effect of past time period. However, an increase in competitiveness raises the export profitability of firms, when only the present period is concerned.

Proposition 3: Proposition 2 can be reversed with credit rationing.

V Empirical Findings

The impact of competitiveness and technology on export profitability of firms and the effect of credit rationing on firm behaviour have been empirically analysed separately in two sets of studies over the years. One set of studies - for example, Clougherty and Zhang (2009) , Barua et al. (2010) , Das and Pant (2006), Marjit and Ray (2017) - use the Herfindahl Index and the index of Price-Cost Margin to analyze the impact of competition and technology on export profitability of firms while the other set of studies - such as Deardorff (2000), Jones and Marjit (2001), Chaney (2016), Manova (2013), Manova and Zhang (2011), Melitz (2003), Marjit et al. (2014) - evaluate the significance of credit market imperfections in firm behaviour. Combining these two aspects together, this paper aims to empirically identify the impact of credit constraint along with the degree of market competition and technology, as also the impact of wealth, in determining the exportability of industries.

Model Specification and Data Base

This empirical exercise considers the following regression models treating the variables in natural logarithm.

$$\ln(ExpProfitability_{it}) = \alpha + \beta \ln(Technology_{it}) + \gamma ln(Competition_{it}) + \delta \ln(Credit\ Constraint_{it}) + \theta \ln(GrossFixedCapitalFormation_{it}) + \varepsilon_{it} \quad (33)$$

$$\ln(ExpProfitability_{it}) = \alpha + \beta \ln(\text{Wealth}_{it}) \quad (34)$$

Here we study the effects of the state of technology, level of competition, credit constraint and previous year's wealth on export profitability. We measure the level of technology by taking the ratio of fixed capital in industries to the wage/salary bills (both expressed in Rs). The degree of market competition in industries is represented by the ratio of value of products to the number of firms (expressed in Rs per firm of the concerned industry) – indeed, higher the value of the ratio, lower is the extent of competition. Credit constraint is, however, represented by the security capital because it is the external source of fund that a firm collects to supplement its internal source of fund. Previous year's wealth is proxied here by previous year's gross fixed capital formation since capital is formed in an industry out of its wealth. The change in the degree of competitiveness of an industry has a significant impact on its domestic earnings, which in turn results in varied degree of its asset building over the years, thereby contributing to wealth heterogeneity. The study ignores firm-level heterogeneity in productivity or technology, but recognises it in terms of their assets heterogeneity so that the dynamic effects of asset building on the industry's export profitability can be analysed. In other words, the paper incorporates the lag value of gross fixed capital formation as a proxy for 'asset building' in order to demonstrate the effect of previously accumulated funds on the present

export decision of an industry. The novelty of this article, indeed, lies in considering the impact of the degree of competition in an industry on its export profitability both in the frameworks of past and present periods.

Our analysis is based on the CMIE dataset. The CMIE provides industry-level data on India's export to the global market. We consider a set of 14 manufacturing industries (food, beverage, tobacco products, textiles, leather, wood and paper, coke and refined petroleum, chemicals, pharmaceuticals, rubber, basic and fabricated metals, computer electronics, machinery and equipments, and motor vehicles) from 1999 through 2015. Thus, our panel data is constituted of 224 observations. We calculate the year based average data for each industry under study. It is clear from the average database that the coke and refined petroleum industry has the highest average export profitability, i.e. Rs. 13,54,204.01, whereas the lowest average export profitability of Rs. 29,581.42 is found for the tobacco industry. However, the arithmetic mean of export profitability is Rs. 411473.8. Similarly, the highest average level of technology and degree of competition is also seen for the coke and refined petroleum industry, that is, 35.51 and 3777 respectively, whereas the lowest average technological performance of 2.09 is seen for the tobacco industry; and the average market competitiveness is lowest, namely 55, for the wood industry. The arithmetic mean of the level of technology and degree of competitiveness is 8.99 and 424.31 respectively.

The basic and fabricated industry shows a value of Rs. 82,257.57 and Rs. 4,31,366.95 as the highest average performances in respect of securities and gross fixed capital formation. On the other hand, the lowest average value of securities and gross fixed capital formation is Rs.

71.35 and Rs. 53124.82 for the tobacco industry[4]. However, the arithmetic mean is Rs. 25563.64 and Rs. 103893.90 for securities and gross fixed capital formation, respectively.

The descriptive nature of the database indicates that coke industry which has highest average values of technology and competition also portrays the highest value of export profitability. It therefore suggests that higher degrees of competition and technological advancement necessarily increase the export profitability of industries. Again, the highest values of gross fixed capital formation and securities are found for the basic and fabricated industry. This indicates that the industries having higher dependence on external funds also have higher levels of internal funds. However, for more precise results, a descriptive analysis of average database is not sufficient. We should rather run a regression model[5] .

To use panel data for regression analysis we have undertaken the Hausman test. The Hausman test for the regression of equation (33) shows a Chi-square value 63.6,1 which is highly significant, namely, at 99 per cent level. This suggests that the fixed effect regression model is appropriate for this data set. Heteroskedasticity in residuals is always a potential problem in such empirical studies. Since the estimation is made using the 'robust estimate' in the Stata software, this problem is duly accounted for.

Our estimation shows an F-value of 199.24 for the regression of equation (33) yielding significance of its p-value at 99 per cent, so that we reject the null hypothesis that there is no explanatory power of our model. We rather accept the alternative hypothesis that our regression model has adequate explanatory power, so that we can safely rely on the estimated relations. The R^2 value is, however, found at 0.429, which indicates that 42.9 percent of the variation in export profitability of industries is explained jointly by the degree of competition in the industry, its

[4] In calculation of the average database, we have dropped an abnormal observation of gross fixed capital formation for the year 2014 in the Manufacturing industry of leather and related products.
[5] See Appendix A (Table 1).

state of technology, the level of credit constraint and the lagged value of gross fixed capital formation.

Our estimation also shows that the t-statistics of the estimated coefficients for the degree of competition, lagged value of gross fixed capital formation and credit constraint are significant at 99 percent. We thus conclude that these variables have significant impacts on export profitability. However, the t-statistic for the estimated coefficient of technology is found insignificant with a p-value at 0.164. That is, an improvement in technology will not have a significant impact on the export profitability of Indian industries under study. This suggests that, unlike the industries in developed countries, Indian industries do not rely significantly on the state of technology to compete in the world market.

The fixed effect regression yields positive coefficients for the degree of competition and gross fixed capital formation and negative coefficients for credit constraint and technology of the industries. These results signify that an increase in the degree of competition reduces the share of profit in the domestic economy and compels the domestic industries to reach out to the world market for higher profitability. This holds good only when the present period is considered. Again, if we consider both past and present period, as has been done in this study, the results suggest that export is profitable for an industry when the value of its previous year's gross fixed capital formation is high. This substantiates the argument that the entry into the world market involves an 'entry cost' which the industry can cover from its past capital formation. That is, there is a positive relationship of the degree of competition and gross fixed capital formation with export profitability of industries. Based on the estimated coefficients in our regression analysis, we can infer that one unit increase each in the degree of competition and gross fixed capital formation augments export profitability by 1.327 and 0.239 units respectively.

The regression analysis, however, suggests a negative relation between securities and export incentives. This implies that, at a higher level of credit constraint, the export profitability of an industry reduces. That is, credit constrained industries have a relatively lower degree of export profitability in relation to the credit unconstrained ones. The estimated coefficient of securities suggests that one unit rise in the securities reduces their export profitability by 0.047 unit.

This inter-relationship between securities and wealth is substantiated by a random effect regression of wealth on export profitability of industries in equation (34). The Wald Chi-Square value of the model is 5.81, which is significant at 95 per cent, indicating that the model has a sufficient explanatory power. The R^2 value is 0.366 so that we infer that 36.6 percent of the variation in export profitability of industries is explained by its level of wealth. The results indicate a positive coefficient of wealth with its z-statistic significant at above 95 per cent. Thus, there is a positive significant relationship between wealth and export profitability. The regression specifies that one unit increase in wealth augments the export profitability by 0.079 unit. We can, therefore, infer that, as securities are inversely related, and wealth is directly related, to the export incentive of industries, higher availability of wealth for an industry would definitely reduce its dependence on securities and thereby improve its export profitability.

The negative coefficient of technology in the regression analysis, as obtained for equation (33), however indicates that an improvement in technology reduces the export profitability of the industries. Technological improvement involves a substantial investment in research and development or import of new technology from abroad. Such investments are difficult to undertake for the credit constrained industries, and for credit unconstrained ones, it would definitely reduce the level of export profitability[6].

[6] See Appendix A (Table 2 and Table 3).

VI Conclusion

This study thus develops a theoretical model on the export incentive of credit constrained firms in the presence of credit rationing. It also carves a relationship among the nature of technology, the degree of competition and the export incentive of a firm in an imperfect credit market. The theoretical underpinning of this study is that exports are profitable to domestic sales for the credit constrained firms, when the credit limit is operative under rationing. Three inferences are drawn in this study. One, higher amount of fixed cost 'F' or lower amount of wealth 'k' reduces the relative profitability of export, in the presence of rationing. Two, the extent of loss in export profitability depends on the level of asset and technology. Three, the increase in the degree of competition increases the export profitability of firms, when only present period is concerned. But, as wealth of a firm depends on past time period, an increase in competition might not escalate the export profitability of firms, when both past and present time period is considered in the life cycle of a firm. The effects of state of technology, level of competition, credit constraint and previous year's wealth on export profitability is also empirically analysed in the paper. The empirical findings suggests that credit constrained firms have a lower degree of export profitability. Although technology does not seem to have a significant impact on export profitability of industries, the level of competition and gross fixed capital formation have a positive relationship with the export profitability of industries.

References

Bandyopadhyay, S., Marjit, S. and Yang, L. (2014), "International Oligopoly, Barriers to Outsourcing and Domestic Employment", *Canadian Journal of Economics* 47, 1372-1386.

Barua, A., Chakraborty, D., and Hariprasad, C. G. (2010), "Entry, competitiveness and exports: Evidence from firm level data of Indian manufacturing", MPRA Paper 22738, University Library of Munich.

Beck, T. (2003), "Financial Dependence and International Trade", *Review of International Economics* 11, 296-316.

Cetorelli, N. and Peretto, P. (2000), "Oligopoly Banking and Capital Accumulation", Working Paper, No. 2000-12, Federal Reserve Bank of Chicago.

Chaney, T. (2016), "Liquidity constrained exporters", *Journal of Economic Dynamics and Control* 72, 141-154.

Clougherty, A. J. and Zhang, A. (2005), "Export orientation and domestic merger policy: Theory and some empirical evidence", *Canadian Journal of Economics* 38, 778–806.

Clougherty, A. J. and Zhang, A. (2009), "Domestic rivalry and export performance: Theory and evidence from international airline market", *Canadian Journal of Economics* 42, 440–468.

Das, S. and Pant, M. (2006), "Measuring market imperfection in manufacturing sector: Theory and evidence from India", *Journal of International Trade and Economic Development* 15, 63–79.

Deardorff, A. V. (2000), "International Provision of Trade Services, Trade, and Fragmentation", Discussion Paper, No. 463, School of Public Policy, The University of Michigan, Ann Arbor.

Egger, P. and Kesina, M. (2013), "Financial Constraints and Exports: Evidence from Chinese Firms", *CESifo Economic Studies* 59 , 676-706.

Egger, P., Kunert, S. and Seidel, T. (2018), "The Competitive Effects of Credit Constraints in the Global Economy", *Economica* 85, 771-792.

Gorodnichenko, Y. and Schnitzer, M. (2013), "Financial Constraints And Innovation: Why Poor Countries Don't Catch Up", *Journal of the European Economic Association* 11, 1115-1152.

Helpman, E. (2006), "Trade, FDI, and organization of firms", *Journal of Economic Literature* 44, 589–630.

Helpman, E. and Krugman, P. (1985), *Market structure and international trade*, Cambridge: MIT Press.

Jones, R.W. and Marjit, S. (2001), "The Role of International Fragmentation in the Development Process", *American Economic Review* 91, 363-366.

Kapoor, M., Ranjan, P. and Raychaudhuri, J. (2012), "The Impact of Credit Constraints on Exporting Firms: Empirical Evidence from India", available at SSRN: https://ssrn.com/abstract=2023068.

Kayalica, O. M. and Espinosa-Ramirez, R. S. (2009), "Brotherhood of competition: Foreign direct investment and domestic mergers", *International Review of Economics and Finance* 18, 63-69.

Manova, K. (2008), "Credit Constraints, Equity Market Liberalization and International Trade", *Journal of International Economics* 76, 33-47.

Manova, K. (2013), "Credit Constraints, Heterogeneous firms and International Trade", *Review of Economic Studies* 80, 711-744.

Manova, K., Wei, S. and Zhang, Z. (2011), "Firm Exports and Multinational Activity under Credit Constraint", NBER Working Paper, No. 16905.

Marjit, S., Mukherjee, A. and Yang, L. (2015), "On the Sustainability of Product Market Collusion Under Credit Market Imperfection", Discussion Papers, 2015-01, University of Nottingham, GEP.

Marjit, S. and Ray, M. (2017), "Export profitability, Competition and Technology", *International Review of Economics and Finance* 47, 35-45.

Matsuyama, K. (2008), "Aggregate Implications of Credit Market Imperfections", NBER Macroeconomics Annual 22, 1-60.

Meisenzahl, R. R. (2016), "Can Financing Constraints Explain the Evolution of Firm Size Distribution?", *Review of Industrial Organisation* 48, 123-147.

Melitz, M.J. (2003), "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica* 71, 1695-1725.

Melitz, M. J. and Redding, S.J. (2014), "Heterogeneous firms and trade", In: R. W. Jones, P. B. Kenen, G. M. Grossman and K. Rogoff (eds.), *Handbook of International Economics*, vol. 4, 4th edition, Amsterdam: Elsevier, pp. 1-54.

Minetti, R. and Zhu, S.C. (2011), "Credit Constraints and Firm Export: Microeconomic Evidence from Italy", *Journal of International Economics* 83, 109-125.

Rajan, R. G. and Zingales, L. (1998), "Financial Dependence and Growth", *American Economic Review* 88, 559-586.

Stiglitz, J. E. and Andrew, W. (1981), "Credit Rationing in Markets with Imperfect Information", *American Economic Review* 71, 393-410.

Appendix A

Table1: Average Database of 14 Industries from 1999-2015

Industries	Export Profitability	Technology	Competition	Securities	Gross fixed cap formation
Food	59,585.22	6.642073013	116	7,065.30	116,716.76
Beverage	53,787.75	10.25281145	181	2251.529412	22,904.39
Tobacco prods	29,581.42	2.087240696	60	71.35294118	5,314.82
Textiles	1,035,724.12	6.06	95	19,570.52	140,225.60
Leather	178,201.86	3.160534491	69	430.2058824	8000.06875
Wood & paper	57,571.59	9.308368817	55	3,529.22	46,737.87
Coke and ref petroleum	1,354,204.01	35.51196118	3,777	57,720.47	159,824.84
Chemicals	432,343.86	12.13639835	273	70,597.38	130,846.31
Pharmaceuticals	424,671.78	5.923430241	233	20,149.88	74,890.31
Rubber & plastic	236,801.28	7.943020462	97	5113.364706	58,696.59
Basic & fab met	690,407.99	12.57	216	82,257.57	431,366.95
Computer&elect	231,090.15	4.767697664	250	10,169.32	27,579.18
Machinery	452,952.82	3.35751636	119	19,365.28	64,067.66

Motor vehicals	523709.4118	6.189087294	400.1490343	59599.56471	167343.2588
Arithmetic Mean	411473.8042	8.993776536	424.3088706	25563.64034	103893.90

Source: CMIE dataset

Table 2: Relevant results of regression of the degree of competition, technology, credit constraint and gross fixed capital formation on export profitability of industries (Equation 33)

	Regression Results
F-stat (4,187)	199.24
Significance level	0.0000
Competition (lncomp)	
Value of coefficient	1.327185
t-statistic	12.50
Significance level	0.000
Credit Constraint (lnsecurities)	
Value of coefficient	-0.0471502
t-statistic	-2.79
Significance level	0.006
Gross Fixed Capital Formation(lngfcf)	
Value of coefficient	0.2389702
t-statistic	4.16
Significance level	0.000

Technology(lntech)	
Value of coefficient	-0.1819403
t-statistic	-1.40
Significance level	0.164

Table 3: Relevant results of the regression of the level of wealth on export profitability of industries (Equation 34)

	Regression Results
Wald $\chi^2(2)$	5.81
Significance level	0.054
Wealth (lnwealth)	
Value of coefficient	0.0794414
z-statistic	2.41
Significance level	0.016