Finance and Innovation: Country-level Evidence on Role of Firm Size and Competition

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Abstract

With the increased globalization, the production processes are fragmented and the size of the firm tends to shrink under more competitive environment all over the world. Intuitively, it is assumed that small firms face much competition than the larger one that could raise innovation and receive less external finance for the same. They together seem to be suggesting a positive relationship between size and innovation. The present study intends to investigate this issue based on the World Bank Enterprise Survey data for 36 countries. It is observed that large firms are found to be more innovative compared to the smaller ones. Moreover, competition plays a positive role in innovation in all the size categories. On the other hand, except bank finance, none of the external sources of finance has significantly contributed to the firm innovation effort. It is also noteworthy to mention that the non-institutional finance, which is supposed to be a potential source of finance for small firms, is so meagre to play a significant role in the innovation process of those firms.

Keywords: Sources of finance, Firm size, innovation, competition and inclusive entrepreneurship

Jel Classification: G21, L25, L26, O31

1.   **Introduction**

The rising globalization and integration put growing pressure on the size or on the boundary of the firm both in developed and developing countries. This has been one of the primary factors for the increased trend of outsourcing within or outside countries (Antras, 2003) and the resultant growth of small and medium-size in the recent period. In the existing literature, such certain transformations of the internal organization of firms have been well document in recent years. Competition and new technologies, especially information technology, are creating a shift from the old integrated firms towards more detailed organizations and outsourcing (Breshanan, 1999; Acemoglu *et al.* 2005). It is not necessarily limited to developed countries but also extended to developing courtiers where the proliferation of small firms is largely seen in the informal and unorganized sector through subcontracting (Guha-Khasnobis and Kanbur, 2006; WTO-ILO, 2009). It is now an important question about whether small firms are more innovative or not. If not, the ongoing transformations are not conducive for productivity improvement and innovation. This issue is still under-researched in the literature. If informal and unorganized firms are small, contemporary evidence does not confirm that they are productive than formal firms. There are some studies which argue that the small firm would be more innovative because of its flexibility to use of low capital investment. Still, this is not a convincing argument. Because the innovative efforts would definitely be restricted by access to finance if they depend on the external sources. Institutional finance would subject to be the availability of collateral and such collateral is expected to be lower for smaller firm compared to the larger. If so, then how could small firms be relatively innovative? The relationship between firm size and innovation in an upcoming issue in the industrial organization literature. Two counteracting factors seem to be working on their innovation effort. One, if the market competition is known to be a motivating force for innovation of a firm, the small firm would essentially do at a larger scale. It is noteworthy to mention here that the grater competitive pressures created by both globalization and advancement of information technology favour smaller firms and more flexible organizations that are conducive to innovation (Feenstra, 1998; Feenstra and Hanson, 1999). One the other hand, finance is another important factor in order to execute innovation effort of a firm and this limits innovation for a small firm because of

costlier external finance. Since the small size firm has a classic problem of getting sufficient collateral for drawing requisite finance for innovation from the formal financial sector, the dependence of those firms on the innovative sources of the non-financial sector has been ideally much. In a country with the underdeveloped financial system, firms face costly external finance. The appearance of efficient financial institutions is expected to deal with these problems and include larger people, particularly small firm, to a greater extent. The current paper attempts to look into this issue using cross-country firm level data.

In a competitive environment, firm innovation is considered to be the best way to survive in the market. A firm needs to diversify the products or to change the production process in order to avoid competitive pressure. Therefore, the predominant literature recommends a direct and linear relationship between market competition and firm innovation suggesting indirectly that the small and competitive firm would be more productive and innovative. However, the direct relationship between competition and firm innovation is not always true in the existing literature (Arrow,1962; Aghion et al. 2006). One group of those researches is of the opinion that a firm spends on R&D activities in order to maintain supremacy in the market. In other words, the relative market power of a firm motivates for higher innovation to keep market share in the economy. Another group says that the relationship between competition and firm innovation is inverted-U shaped (Aghion et al. 2006). So, with the rise of competition, the firm innovates more and after some critical level of competition it gradually comes down. But, such literature has not talked about innovation with respect to the firm size. The immediate question, therefore, appears as follows: do the small firms, who relatively face stiff competitive, compared to the large one, innovate more? If not, how do they survive? Does the external finance help their innovation effort? Therefore, it is essential to understand the innovation behaviour of the small firm and their survival strategy in the market would essentially provide an idea of inclusive entrepreneurship. In the current study, the relative efforts of innovation will be investigated by different firm size based on the country experiences, using firm level information, with a particular interest to see the role of external finance including financial and non-financial sources on the efforts. To the best of our knowledge, the existing studies have not dealt with any relationship between firm size and innovation.

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Another important factor of firm size has been the external sources of funds or finance for the expansion of the capacity. The acquisition of an external firm is not free of cost and the reasons for this costly external finance are: first, asymmetric information between lenders and borrowers (Myers and Majluf, 1984). Since the small firm has a classic problem of getting sufficient collateral for drawing requisite finance in order to support in-house innovation from the formal financial sector, the size of the firm would remain to be at small. However, a large literature suggests that financial development boosts economic growth by disproportionately fostering small firm growth. Since the less wealthy firms face lower credit constraints than large firms face due to greater informational barriers or any other high fixed costs associated with accessing financial systems, the financial development that ameliorates market frictions will exert an especially positive impact on smaller firms (Banerjee and Newman, 1993; Galor and Zeira, 1993; Aghion and Bolton, 1997; Beck et al. 2005). In contrast, other research suggests that most small, less wealthy firms, especially in the less developed countries, cannot afford to receive financial services so that financial development disproportionately facilitates the growth of large firms (Greenwood and Jovanovic, 1990). Although the small firm receives greater benefits from financial development than that of a large firm, the positive relationship of between firm size and access of finance drawn from institutional sources cannot be totally denied. Therefore, this factor in conjunction with the previous relationship between competition and innovation provides a basis to draw some relationship between firm size and innovation.

The paper intends to explore such issues here. This is organized as follows: Section 2 discusses the objectives of the studies based on some recent works. The next two sectors describe the database and results of the database respectively in section 3 and section 4. Section 5 ends up with concluding remarks.

2. Analytical framework:

This section attempts to develop an analytical relationship between size, competition and finance. Let first start to establish the link between competition and innovation. Assume that n number of firms competing in the oligopoly market and face the market demand

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$p = 1 - Q$ where $Q = \sum_{i=1}^{n} q_i$. In case of absence of any innovation each firm pays c per unit of production and needs one unit of labour for each unit of production. Given this framework, the equilibrium output and profit of each firm would be:

$$q_i^* = \left(\frac{1-c}{n+1}\right) \text{ and } \pi_i^* = \left(\frac{1-c}{n+1}\right)^2.$$ Let us also assume that the fixed cost for each firm

would be F and gets zero profit at $\pi_i^* = F$.

Under this competition, a firm has the incentive to adopt a technology which will enable it to reduce the per-unit cost of production. Let's assume that the cost declines form c to

c_L and the profit will be $\pi_{iL}^* = \left(\frac{1-c_L}{n+1}\right)^2$. Since $c_L < c$ we can get $q_{iL}^* > q_i^*$ and $\pi_{iL}^* > \pi_i^*$.

So, the incentive of technology adoption or innovation would be

$$\pi_i^I = \pi_{iL}^* - \pi_i^* = \left(\frac{1-c_L}{n+1}\right)^2 - \left(\frac{1-c}{n+1}\right)^2, \text{ where } c_L = \alpha c, \alpha < 1$$

It is also interesting to note that the incentive of innovation would be more with the increase in the number of competitors. Differentiating this incentive with respective to n,

we get $\frac{\partial \pi_i^I}{\partial n} \geq 0$ as $\frac{d\alpha}{dn} = -\frac{(1-c_L)}{c(n+1)} < 0$. In other words, a firm would intent to reduce

more of α through more innovation in order to retain its profit when the number of competitor rises.

Note that each firm has equation market share or size even if the firms have unequal distribution of wealth in the absence of innovation.

Innovation involves extra investment and it comes from banks when the firm does not have. But, it requires higher investment (say, F_I) to undertake innovation for cost reduction. If the bank gives a loan of amount ($F_I - F$) at market interest rate r, it would be successful when

$\pi_i^I = \left(\dfrac{1-\alpha c}{n+1}\right)^2 - \left(\dfrac{1-c}{n+1}\right)^2 \geq (1+r)(F_1 - F)$. All firms will be able to undertake an innovation in spite of the unequal distribution of wealth.

Now the issue is that the bank would not be able to foresee the exact profit of an innovative firm because of asymmetric information. The information gap between firm and bank tends to be high for the economy with poor and bad institutional and banking environment. If a bank believes that a firm would be able to successfully implement the investment for innovation and derive profit, $\pi_{i\alpha}^*$ with probability p. If not, the firm will earn normal profit without innovation. So the expected profit calculated by the bank be

$\pi_i^e = (p)\left(\dfrac{1-\alpha c}{n+1}\right)^2 + (1-p)\left(\dfrac{1-c}{n+1}\right)^2$. The risk faced by the bank would be

$R = (p)\left[\left(\dfrac{1-\alpha c}{n+1}\right)^2 - \left(\dfrac{1-c}{n+1}\right)^2\right]$ and the bank would prefer to undertake a mortgage of his

asset to cover this risk. If M is the value of the mortgage and ρ is the discounted value, the firm will be able to get the loan if $R < \rho M$. Now the issue of unequal assets will play a detrimental role in the context of innovation and thereby will bring unequal size between the firms.

Let's assume the β share of the firms possess mortgage such that $R < \rho M$ and otherwise for all other firms. Then, these firms would receive a loan and successfully undertake innovation. Each of them will produce $q_{i\alpha}^* = \left(\dfrac{1-\alpha c}{n+1}\right)$ for βn firms and $q_i^* = \left(\dfrac{1-c}{n+1}\right)$

$(1-\beta)n$. It can easily be verified that $\dfrac{q_{i\alpha}^*}{Q_\alpha^*} > \dfrac{q_i^*}{Q^*}$. In other words, the market share of an innovative firm would be higher than that of the rest.

If the firm size is measured in terms of the number of labour used in the firms, then there could be a bit of ambiguity. The number of labour would be $L_{i\alpha}^* = \alpha\left(\dfrac{1-\alpha c}{n+1}\right)$ by

innovative firms $L_i^* = \left(\dfrac{1-c}{n+1}\right)$ by non-innovative firms. We cannot confirm that $L_{i\alpha}^* > L_i^*$

because $\alpha < 1$ but $\left(\dfrac{1-\alpha c}{n+1}\right) > \left(\dfrac{1-c}{n+1}\right)$.

Therefore, we can predict from this analysis that the competition would push firm for more innovation, but the firm who possess higher assets would be more innovative because of the greater possibility of drawing finance from the bank. Firms receive bank finance would have greater market share, but may not be large in size in terms of labour employment. In other words, we infer that the extent of innovation among the firms would be influenced by competition but limited by financial rigidity.

2. Data Description

The study is based on the World Bank Enterprise Survey data of wave II data. The survey in wave-II started in 2006 and still continuing. The survey is based on a stratified random sampling procedure using the size of the economy and sector as strata. The World Bank Enterprise Survey data consists of firm level survey responses of around firms from mainly developing countries (mainly the countries constitute low and middle-income countries). These firms are from manufacturing as well services ssector. There are few from construction sector also. The data is apt for the study as it provides information about the firm engagement in innovation activity and additional firm level attributes also. In addition to information on the innovation behaviour of the firm, the survey also supplies information related to legal status, ownership pattern, age, employment, level of education of workforce and responses to self-explanatory answers on different obstacle faced in current operation, corruption etc. data set not only covers information on above-mentioned parameters but also it provides information at the disaggregated level on innovation i.e. whether the firm is engaged in product or process innovation. The survey data also provide information on competition in terms of a number of competitors. This broad definition allows us to understand the dynamics in a better way.

Given that the study is intended to examine the relationship between sources of finance and innovation we have at first eliminated firms from the study which are not in manufacturing industry. We then eliminate firms for which we do not have information

about innovation variable (i.e. whether the firm innovates or not). The sample left after eliminating the firms for which there is no information on innovation variable have enterprise from 36 countries and three continents South America, North America and Africa; we have divided them according to the continent to understand primarily the distribution property of the firms.

Based on the firm's response to the question, *whether the firm has introduced new or significantly improved product or services*; *whether the firm has introduced any new or significantly improved production processes* we have defined innovation in different ways first; *product innovation*, *process innovation* and *innovation*, where a firm is engaged in product innovation will have value 1 otherwise 0 similarly if the firm is engaged in process innovation it will have value 1 otherwise 0 and if the engaged in either of these two it has been categorized as innovative and will have value 1. Finally, we have constructed an ordered variable for innovation, where value 0 is attached to no innovation 1 for product innovation, 2 for process innovation and 3 for process and product innovation. The reason to distinguish innovation behaviour of firms in terms of product, process and product and process is to distinguish imitation and adaptation from creation.

3. Descriptive Analysis of data

3.1 Innovation

The primary analysis is based on cross-tabulation and three-way tabulation. The sample is comprised of different sized firms and reveals that small-sized firms are predominant in the sample (48.7 %), followed by medium (35.1 %) and finally large-sized firms (16.2 %)[1]. Continent wise distribution of the firms constitutes 44 % from South America, 32 % from North America and 23 % from Africa. Firms which answered to the question on innovation (product or process) 69.62 % of them are innovative and 48.39 % are engaged in both product and process innovation. Firms engaged in product innovation are slightly more in ratio compare to firms doing process innovation with a difference of 4%.

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[1] Firms have been categorized into three sizes: small, medium and large. A firm is small in size if it has less than 20 employee, it is medium sized if the number of employees are 20-99 and large if it employs more than 100 employees.

Table 1: Firms under size, continent and innovation category

Firm Size	Freq.	Per cent
Small	4,105	48.64
Medium	2,961	35.09
Large	1,373	16.27
Continent	Freq.	Per cent
South America	3,756	44.51
North America	2,716	32.18
Africa	1,967	23.31
Innovation Behaviour	Freq.	Per cent
No Innovation	2,561	30.44
Product Innovation	1,059	12.59
Process Innovation	715	8.5
Both Innovation	4,079	48.48

Distribution of innovative firms according to size reveals that around 61.42 % of the small firms are innovative, 75.25 % medium-sized firm is innovative and 81.98 % large size are innovative (see table 2).

Table 2: Firms across the continent according to innovation and firm size

Innovation	Size		
	Small	Medium	Large
No	38.58	24.75	18.02
Yes	61.42	75.25	81.98
Total	100.00	100.00	100.00
Innovation	Continent		
	South America	**North America**	**Africa**
No	18.96	39.99	38.91
Yes	81.04	60.01	61.09
Total	100.00	100.00	100.00
Size			
Small			
No	25.57	50.07	43.05
Yes	74.43	49.93	56.95
Total	100.00	100.00	100.00
Medium			
No	16.29	32.00	35.81
Yes	83.71	68.00	64.19
Total	100.00	100.00	100.00
Large			
No	9.02	26.43	25.76
Yes	90.98	73.57	74.24
Total	100.00	100.00	100.00

If we look at the distribution of the firms according to the continent we find that South American firms are most innovative followed by North American firms and finally African firms (see table 2). We further disintegrate the innovation variable under the category of firms engaged only in process innovation, only in product innovation and both in product and process innovation. From table 3, it is clear that even after redefining the innovation variable under the mentioned category we do not find any change in the firm distribution.

Table 3: Firms engaged in different Innovation activity in a different continent

Innovation	Continent		
	South America	**North America**	**Africa**
No Innovation	19.01	40.07	38.93
Product Innovation	12.83	9.38	16.54
Process Innovation	9.04	9.68	5.85
Both Innovation	59.13	40.88	38.68
Total	100.00	100.00	100.00

Distribution of firms for which we have information on innovation according to continent under different size reveals that within the size category large firms from South American are most innovative with the medium-sized firm of South America are slightly behind them. Majority of the firms are engaged in both product and process innovation through the entire size category (see table 4).

Table 4: Distribution of firms engaged in different Innovation activity in different continent within a different size category

Innovation/Size	Continent		
	South America	**North America**	**Africa**
Small			
No Innovation	25.65	50.22	43.05
Product Innovation	14.43	10.03	18.38
Process Innovation	9.26	10.18	4.83
Both Innovation	50.66	29.57	33.74
Total	100.00	100.00	100.00
Medium			
No Innovation	16.30	32.00	35.88
Product Innovation	12.51	8.69	15.08
Process Innovation	9.51	10.17	6.41
Both Innovation	61.68	49.14	42.63
Total	100.00	100.00	100.00

Large			
No Innovation	9.06	26.49	25.76
Product Innovation	9.68	8.83	10.92
Process Innovation	7.37	7.39	9.61
Both Innovation	73.89	57.29	53.71
Total	100.00	100.00	100.00

3.2 Size, Competition and innovation:

In this section, we will investigate the link between firm size, competition and innovation, where the basic intention here is to understand the relation based on the distribution of firms under different categories and how in presence of competition firms' innovation behaviour is guided. The cross-tabulation results of the firm distribution are interesting as the not only majority of the innovative firms faces a high degree of competition but also the reverse holds true i.e. majority of the firms which are non-innovative are facing a high degree of competition. Taking the descriptive analysis of innovation and competition behaviour of firms within the preview of size we find the size does play a crucial role. Medium and large firms which face a high degree of competition are more innovative, whereas, small firms which are facing a high degree of competition are more non-innovative compare to that innovative.

Table 5: Distribution of firms engaged in different Innovation activity according to the number of competition they have and also according to size

Innovation	Number of Competitor			
	None	**One**	**2 to 5**	**More than 5**
No Innovation	2.47	1.88	9.33	17.73
Product Innovation	0.57	0.53	4.41	7.39
Process Innovation	0.55	0.45	2.64	4.62
Both Innovation	2.43	1.74	16.41	26.87
Size				
Small				
No Innovation	2.32	1.96	11.65	23.38
Product Innovation	0.61	0.48	4.89	8.17
Process Innovation	0.48	0.38	2.49	5.01
Both Innovation	2.24	1.50	12.24	22.19
Medium				
No Innovation	2.73	1.76	7.92	13.04
Product Innovation	0.52	0.67	3.96	7.06
Process Innovation	0.49	0.56	2.73	4.89
Both Innovation	2.35	1.68	19.35	30.30

Large				
No Innovation	2.37	1.91	4.46	8.93
Product Innovation	0.55	0.36	3.83	5.37
Process Innovation	0.91	0.46	2.91	2.55
Both Innovation	3.28	2.73	24.13	35.25

3.2.3 Innovation and Sources of Finance:

The role of finance in growth and development has been discussed at length and also the role of finance has been studied to the extent that we know financial structure of the firms plays a crucial role in determining the investment. It will be interesting and worthy enough to have a primary look at the link between innovation and financial sources of the firm. A higher percentage of funds for investment comes from external sources for an innovative firm. Among the external source, the bank plays a vital role as bank contribution is more than 13 per cent of the investment fund of the innovative firms.

Once the firms are divided according to their size, the role of external finance in general and banking sector, in particular, is more visible with increased contribution of external finance in the investment of firms. Though it is expected that firms will be not much dependent on internal finance as they grow old but primary analysis based on cross-tabulation shows not much variation in dependence on internal and external finance. Summary statistics reveal that private firms are more innovative and among the private, it is foreign which leads domestic firms in innovation. Again, it is the large and private firms which are more innovative compare to others.

Table 6: Innovation behaviour and mean value of investment from different sources of finance according to size

Innovation	Sources of Finance					
	Internal	**Informal**	**Supplier**	**NBFI**	**ED**	**Bank**
No	69.75	2.35	4.95	1.48	0.53	5.04
Yes	60.63	4.60	6.46	2.10	0.79	13.47
Small						
No	76.49	2.05	3.90	1.42	0.14	2.89
Yes	66.70	4.27	5.69	2.40	0.46	7.69
Medium						
No	59.67	3.32	6.56	2.28	1.04	7.16
Yes	57.68	4.23	7.32	2.01	1.01	16.34
Large						
No	68.20	1.38	5.06	0.00	1.51	12.60

Yes	56.59	6.08	6.14	1.84	1.08	20.73

3.4 Innovation and financial obstacle

More than 50 % of the innovative firms face access to financing as an obstacle (here obstacle includes availability, interest rates, fee and collateral requirement). Of the firms which are innovative and faces, the financial obstacle is engaged in both product and process innovation. forgiven size firms which are innovative faces more financial obstacle but the effect of size is not linear as the percentage distribution of firms facing a financial obstacle and are innovative is 45.95, 56.45 and 55.28 respectively for a small medium and large firm.

Table 7: Proportion of Innovative Firms Having Access to Finance as an Obstacle

Access to Finance	Innovation	
	No	Yes
No obstacle	8.60	19.01
Obstacle	21.24	51.15

Table 8: Proportion of Innovative Firms under different Category of Innovation Having Access to Finance as an Obstacle

Innovation	Access to Finance	
	No obstacle	Obstacle
No Innovation	8.62	21.28
Product Innovation	3.00	9.34
Process Innovation	2.69	5.79
Both Innovation	13.28	36.01

Table 9: Proportion of Innovative Firms under different Category of Innovation Having Access to Finance as Obstacle according to Size

Access to Finance	Innovation	
	No	Yes
Small(<20)		
No obstacle	11.29	15.76
Obstacle	27.00	45.95
Medium(20-99)		
No obstacle	6.66	19.53
Obstacle	17.36	56.45
Large(100 and over)		
No obstacle	4.73	27.63
Obstacle	12.37	55.27

4. Empirical Model to investigate the effect of size, competition and finance on Innovation

In order to study the effect of size, competition and sources of finance on innovation we have used ordered logit and logit estimation technique. The estimation procedure involves six different basic models with innovation as the dependent variable. Further, for robustness, we have defined innovation variable in four different ways. The first innovation variable takes 0 if firms answer to the question "*introduction of a significantly new product*" or answer to the question "*introduction of a significantly new process*" is no, 1 if the answer is yes for either of the questions and 2 if the answer is yes for both the question. The second innovation variable is categorized in 0 and 1, 0 is same as the first innovation variable and it will take value 1 if firms are product innovative or process innovative or both. The third innovation variable is product innovation with values 0 and 1; 0 if firms answer to the question "*introduction of a significantly new product*" is no and 1 if the answer is yes. Similarly, we have our fourth innovation variable as process innovation with values 0 and 1; 0 if firms answer to the question "*introduction of a significantly new process*" is no and 1 if the answer is yes. We have employed ordered logit method for first innovation variable and logit for the rest of the innovation variable. The six different models we have estimated follow the following structure.

First, we have estimated the relationship between size and innovation with age, manager's experience, a dummy for part of a large organization, a dummy for export and capacity utilization while controlling for country and sector effect. The model we have regressed is of the form:

Model 1

$$innovation = \alpha + \beta_1 SizeDummy + \beta_2 \log ofAge + \beta_3 \text{LOG of Managers Experience} +$$
$$\beta_4 dummy\text{Part of Large Organisati on} + \beta_5 Dummy\text{Exporter} + \beta_6 DummySector +$$
$$\beta_7 DummyCountry + \varepsilon$$

Model 1 is estimated for the entire four innovation variable using firm level observation and robust standard error. Model 1 is the baseline equation, subsequently, we have introduced finance and competition variable to examine our objective econometrically.

Model 2 is the addition of finance variable in the baseline model (model 1), the mathematical form of the estimated model 2 is:

Model 2

$$innovation = \alpha + \beta_1 SizeDummy + \beta_2 \log ofAge + \beta_3 \text{LOG of Managers Experience} + \beta_4 dummy\text{Part of Large Organisati on} + \beta_5 Dummy\text{Exporter} + \beta_6 DummySector + \beta_7 DummyCountry + \beta_8 X + \varepsilon$$

where, $\beta_9 X$ is a vector of finance variable, which includes Bank, NBFI, Debt & Equity, Non-Institutional sources of investment of firms. Next, we have estimated Model 3 to gauge the interaction effect of finance variable and firm size. The structure of model 3 is:

Model 3

$$innovation = \alpha + \beta_1 SizeDummy * X + \beta_2 \log ofAge + \beta_3 \text{LOG of Managers Experience} + \beta_4 dummy\text{Part of Large Organisati on} + \beta_5 Dummy\text{Exporter} + \beta_6 DummySector + \beta_7 DummyCountry + \varepsilon$$

We then get into estimation the effect of competition on innovation for this we have two models, model 4 and model 5. Model 4 and model 5 is the same as model 2 and model 3 while replacing the finance variable by competition dummy.

Model 4

$$innovation = \alpha + \beta_1 SizeDummy + \beta_2 \log ofAge + \beta_3 \text{LOG of Managers Experience} + \beta_4 dummy\text{Part of Large Organisati on} + \beta_5 Dummy\text{Exporter} + \beta_6 DummySector + \beta_7 DummyCountry + \beta_8 Z + \varepsilon$$

Model 5

$$innovation = \alpha + \beta_1 SizeDummy * Z + \beta_2 \log ofAge + \beta_3 \text{LOG of Managers Experience} + \beta_4 dummy\text{Part of Large Organisati on} + \beta_5 Dummy\text{Exporter} + \beta_6 DummySector + \beta_7 DummyCountry + \varepsilon$$

where Z is the dummy variable for the number of competition[2].

Finally, we have estimated model 6 which combines the variables of model 3 and model 5. Thus model 6 examines the effect of size, competition and finance on firms' innovation behaviour together.

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[2] number of competition is categorical variable with value 0 if number of competitor is equal to zero, 1 if number of competitor is equal to 1, 2 if number of competitor is between 2 to 5 and 3 if number of competitor is more than 5 reported by firm.

Econometric Results and Discussions:

Result table 13 reports the estimation result for logit model estimation with innovation (with only 0 and 1 category) as the dependent variable. Result of logit estimation suggests that size is an important variable and the likelihood of innovation by the medium and large firm is more comparable to that of a small firm. The probability of undertaking innovative efforts is higher in firms which are engaged in export as compared to those which are not exporting. Again, firms which are part of a large organization will have a higher likelihood for innovation activities. Result of model 2 indicates access to bank finance by a firm increases the probability of the firm to come up with either new product or a new process or both. Surprisingly, the rest of the finance variable is statistically significant which is not in coherence with the result of Ayyagari et al. (2007). This could be possible due to the number of observation available under these categories. In the next estimation, we have dropped other finance variable as they were not coming significant in the estimated model 2. Estimation results confirm that competition is vital for innovation efforts by the firm in all the size categories. The final model includes all the variables from model 3 and model 5; result based on model 6 also corroborates the result of earlier models and confirms the importance of size, bank finance and competition for the innovation activity of the firms. Result based on other innovation variables also depicts the same results and thus confirms the robustness of the model.

5.   Conclusion:

With the increased globalization, the market is also changing in terms of internal institutional arrangement and interaction with the external institution. This has brought the size of the firm as one of the important issues in industrial organization literature and it becomes even important with the increasing intent of competitive environment in all over the world. Force of competition is also growing due to host of reasons including survival strategy, customization of product etc. In this perspective what theory suggests, that two counteracting forces are working on firm innovation – competition and external finance and this is an important aspect to understand the sustainable entrepreneurial development of an economy. Intuitively, it is assumed that small firms face much competition than the larger one and receive less external finance for the same. Thus

raising an immediate question: do the small firms, who relatively face stiff competitive, compared to a large one, innovate more? If not, how do they survive? Does the external finance help their innovation effort?

The present study intends to investigate the empirical relationship between firm size and innovation behaviour and how competition and external finance in interaction with size modelling the innovation effort of the firm. The study is based on the World Bank Enterprise Survey data from 36 countries. It appears from the estimation result that large firms are more innovative compare to that of medium and small firms. Competition has come out to important determinant of innovation in all the size categories. Whereas, in the source of external finance category it is only the bank finance which has come out to be a significant contributor to the innovation effort of the firm. It is important to note here that the non-institutional finance, which is supposed to be a potential source of finance for small firms, is so meagre to play a significant role in the innovation process of those firms and thereby on the promotion of sustainable entrepreneurship.

Table 10: Effect of Size, Competition and Finance on Innovation (Innovation is ordered variable with 0 for no innovation, 1 for product or process innovation and 2 for product and process innovation)

Variable	Model1	Model2	Model3	Model4	Model5	Model6
Size(Medium)	0.5278***	0.2788***	0.2164**	0.5595***	0.0505	0.037
Size(Large)	0.9007***	0.3292**	0.3720**	1.0776***	0.4395*	0.4550**
LOG of Age	-0.0089	0.1374**	0.1386***	-0.0281	-0.0285	-0.022
LOG of Managers Experience	0.0146	0.0774	0.0791	-0.0012	-0.0034	0.001
Part of Large Organisation	0.2714***	0.4162***	0.4190***	0.3059***	0.3106***	0.3061***
Exporter	0.6477***	0.7136***	0.7146***	0.7505***	0.7510***	0.7424***
Bank		0.0039***	0.0027			0.0093***
Debt & Equity		-0.0027	-0.0026			
NBFI		0.0022	0.0022			
non-institutional		0.0023	0.0024			
Size(medium)*Bank			0.0036			0.0004
Size(large)*Bank			-0.0015			-0.0074*
Dummy Number of Competitor (2-5)				0.3996***	0.1393	0.1385
Dummy Number of Competitor (more than 5)				0.3351***	0.0289	0.0298
Size(medium)*Dummy Number of Competitor (2-5)					0.4849**	0.4406**
Size(large)* Dummy Number of Competitor (2-5)					0.7268**	0.7276**
Size(medium)* Dummy Number of Competitor (more than 5)					0.6285***	0.5855***
Size(large)* Dummy Number of Competitor (more than 5)					0.7699***	0.7658***
Constant	0.7303***	0.4865*	0.4885*	0.349	0.6056***	0.5926***
N	8018	4323	4323	7321	7321	7321
chi2	1012.4667	416.5156	418.0574	952.4781	960.7564	983.7047

Note *, ** and *** represents the level of significance at 10, 5 and 1 per cent respectively

Table 11: Effect of Size, Competition and Finance on Innovation (Innovation is defined as 0 for no innovation, 1 for product or process innovation and product and process innovation)

Variable	Model1	Model2	Model3	Model4	Model5	Model6
Size(Medium)	0.4948***	0.2906***	0.2629***	0.5358***	0.0206	0.0144
Size(Large)	0.8566***	0.4398***	0.4935***	1.0147***	0.4499**	0.4841**
LOG of Age	-0.016	0.0921**	0.0922**	-0.031	-0.0331	-0.0271
LOG of Managers Experience	0.0424	0.0942**	0.0959**	0.0256	0.0252	0.03
Part of Large Organisation	0.2426***	0.3353***	0.3359***	0.2516***	0.2515***	0.2535***
Exporter	0.4524***	0.4048***	0.4051***	0.4963***	0.4947***	0.4851***
Bank		0.0033***	0.0032**			0.0084***
Debt & Equity		0.0008	0.0009			
NBFI		-0.0008	-0.0007			
Non-institutional		0.001	0.001			
Size(medium)*Bank			0.0013			-0.0007
Size(large)*Bank			-0.0022			-0.0076***
Dummy Number of Competitor (2-5)				0.3657***	0.0766	0.0754
Dummy Number of Competitor (more than 5)				0.3418***	0.041	0.0446
Size(medium)*Dummy Number of Competitor (2-5)					0.5918***	0.5535***
Size(large)* Dummy Number of Competitor (2-5)					0.5374**	0.5487**
Size(medium)* Dummy Number of Competitor (more than 5)					0.5669***	0.5246***
Size(large)* Dummy Number of Competitor (more than 5)					0.7269***	0.7293***
Constant	-0.5792***	-0.6129***	-0.6038***	-0.1842	-0.4524**	-0.4335**
Constant	0.4445***	0.5181**	0.5278**	0.8413***	0.5750***	0.6009***
N	8028	4327	4327	7330	7330	7330
chi2	1159.5275	471.5638	473.4865	1109.2738	1128.6984	1174.268

Note *, ** and *** represents the level of significance at 10, 5 and 1 per cent respectively

Table 12: Effect of Size, Competition and Finance on Innovation (Innovation is defined as 0 for no innovation, 1 for product innovation)

Variable	Model1	Model2	Model3	Model4	Model5	Model6
Size(Medium)	0.4251***	0.2979***	0.2395**	0.4743***	-0.0199	-0.0437
Size(Large)	0.7907***	0.4271***	0.4969***	0.9850***	0.2935	0.3338
LOG of Age	0.0155	0.1239***	0.1245***	-0.005	-0.0063	-0.0003
LOG of Managers Experience	0.0218	0.0526	0.0552	0.0034	0.0018	0.0067
Part of Large Organisation	0.2919***	0.3584***	0.3597***	0.3129***	0.3161***	0.3155***
Exporter	0.4133***	0.3342***	0.3355***	0.5079***	0.5083***	0.5003***
Bank		0.0038***	0.0032*			0.0070***
Debt & Equity		0.002	0.0021			
NBFI		0.0011	0.0011			
non-institutional		0.0028**	0.0028**			
Size(medium)*Bank			0.0029			0.002
Size(large)*Bank			-0.0026			-0.0078***
Dummy Number of Competitor (2-5)				0.4496***	0.1770	0.1763
Dummy Number of Competitor (more than 5)				0.3941***	0.5028	0.0683
Size(medium)*Dummy Number of Competitor (2-5)					0.6296***	0.4583**
Size(large)* Dummy Number of Competitor (2-5)					0.0680***	0.6495**
Size(medium)* Dummy Number of Competitor (more than 5)					0.5807***	0.5354***
Size(large)* Dummy Number of Competitor (more than 5)					0.9223***	0.9377***
Constant	0.2885*	0.0706	0.0634	-0.1753	0.0982	0.0842
N	8012	4318	4318	7317	7321	7317
chi2	870.6215	335.8402	336.8531	855.8706	960.7564	898.608

Note *, ** and *** represents the level of significance at 10, 5 and 1 per cent respectively

Table 13: Effect of Size, Competition and Finance on Innovation (Innovation is defined as 0 for no innovation, 1 process innovation)

Variable	Model1	Model2	Model3	Model4	Model5	Model6
Size(Medium)	0.5298***	0.2373***	0.2213**	0.5514***	0.0086	0.0095
Size(Large)	0.8906***	0.3933***	0.4314***	1.0051***	0.5410**	0.5616***
LOG of Age	-0.0514	0.0536	0.0538	-0.0613*	-0.0628*	-0.0571
LOG of Managers Experience	0.0603	0.1235**	0.1245**	0.0461	0.0451	0.0497
Part of Large Organisation	0.2004**	0.3241***	0.3237***	0.2190**	0.2209**	0.2186**
Exporter	0.4938***	0.5251***	0.5256***	0.5066***	0.5060***	0.4971***
Bank		0.0025**	0.0026			0.0092***
Debt & Equity		-0.0024	-0.0024			
NBFI		-0.0018	-0.0018			
non-institutional		-0.0006	-0.0006			
Size(medium)*Bank			0.0007			-0.0026
Size(large)*Bank			-0.0016			-0.0074**
Dummy Number of Competitor (2-5)				0.2582***	-0.0353	-0.0389
Dummy Number of Competitor (more than 5)				0.2413***	-0.0446	-0.0488
Size(medium)*Dummy Number of Competitor (2-5)					0.6240***	0.5935***
Size(large)* Dummy Number of Competitor (2-5)					0.5131**	0.5159**
Size(medium)* Dummy Number of Competitor (more than 5)					0.5980***	0.5693***
Size(large)* Dummy Number of Competitor (more than 5)					0.5398**	0.5393**
Constant	-0.0769	0.0456	0.0378	-0.3561*	-0.0939	-0.1123
N	8020	4322	4322	7323	7323	7323
chi2	923.7976	425.2945	425.7137	846.052	858.4188	892.4327

Note *, ** and *** represents the level of significance at 10, 5 and 1 per cent respectively

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