

**Firm Size, Finance and Innovation: Country level study**

First Draft  
April 2011

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### **Abstract**

With the increase of globalization, the size of the firm becomes important issue of industrial dynamics under more competitive environment in all over the world. Theoretically, two counteracting forces are working on firm innovation – competition and external finance and this is importance 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. So, these factors together seem to be suggesting a positive relationship between size and innovation. The present study intends to investigate the empirical relationship between firm size and innovation behaviour based on World Bank Enterprise Survey data for 36 countries during 2006-2010. It is observed that large firms are found to be more innovative compared to smaller one. Moreover, the competition plays positive role on 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 meager to play significant role in the innovation process of those firms and thereby on the promotion of sustainable entrepreneurship.

**Key words:** Sources of finance, Firm size, innovation, competition and inclusive entrepreneurship

*Jel Classification:* G21, L25, L26, O31

## 1. **Introduction/background**

The rising globalization and integration of market coupled with internal institutional arrangement of firm put a growing pressure on the large organisation or on the boundary of the firm both in development and developing country. This has been one of the primary factors for increasing trend of outsourcing within or between countries (Antras, 2003) and thereby promotes the growth of small and medium size in recent period. It is argued in the literature that the globalization with recent technological developments have made certain transformations in the internal organization of the firm. 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 also true in developing countries where the growth of small firms in the informal and unorganized sector is quite visible in the recent studies and reports (Guha-Khasnobis and Kanbur, 2006; WTO-ILO, 2009). These changes have prompted the recent scholars to study growth and dynamics of these firms. In the current study, the innovation behaviour of firms will be studied in order to understand the inclusive entrepreneurship.

In a competitive environment, the 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. In the Schumpeterian paradigm of growth theory, the role of innovation has received much importance for not only the successful acceleration of entrepreneurship but also sustainable growth. However, there is no clear cut relationship between competition and firm innovation (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 word, a relative market power of a firm motivates for higher innovation to keep market share in the economy. Another group says that the relationship of competition and firm innovation is inverted-U shaped (Aghion *et al.* 2006). So, with 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 the 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 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 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.

Another important factor of firm size has been the external sources of funds or finance for the expansion of the capacity. The acquisition of 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); second, managerial agency problem which arises as outside investors suspect that managers might not peruse the interest of shareholders and thus firms require to pay premium for external financing (Jensen and Meckling, 1976); and third transaction cost attached with issuance of debt and equity (Galor and Zeira, 1993; Aghion and Bolton, 1997). Since the small firm has classic problem of getting sufficient collateral for drawing requisite finance in order to support in-house innovation from formal financial sector, the size of the firm would remain 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 less tighter 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 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 previous relationship between competition and innovation provides a basis to draw some relationship between firm size and innovation.

The relationship between firm size and innovation is an up-coming 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 larger scale. It is noteworthy to mention here that the greater 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). On 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 classic problem of getting sufficient collateral for drawing requisite finance for innovation from formal financial sector, the dependence of those firms on the innovative sources of 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 paper intends to explore such issues here. This is organized as follows: The section 2 discusses objectives of the studies based on some recent works. The next two sections describe the database and results of the database respectively in section 3 and section 4. The section 5 ends up with concluding remarks.

## **2. Objectives**

The present study is an effort to understand the relationship between firm size and innovation in connection with market competition and finances. Keeping in mind the relationships discussed above the three distinct situations can be found. The relationship between finance and innovation is assumed to be positive.

In case, the competition and innovation are negatively related, the relationship between firm size and innovation looks likely to be U-shaped (see Fig 1a). In other words, the

innovation of firm tends to decline initially with the rise of firm size, but after a critical size, it will sharply increase. If the relationship between the competition and innovation is positive, the locus of firm size and innovation would definitely be a positively sloped (see Fig 1b). Moreover, the relationship between competition and innovation could be inverted U-shaped and then the relationship between firm size and innovation would more-or-less show a rising at least after a certain critical size (see Fig 1b). Therefore, it appears that the firm innovation tends to be rising with the firm size with an ambiguity at the small and medium size. It is now an empirical question of identification of exact relationship between firm size and innovation.

Fig 1a: Relationship between firm size and innovation

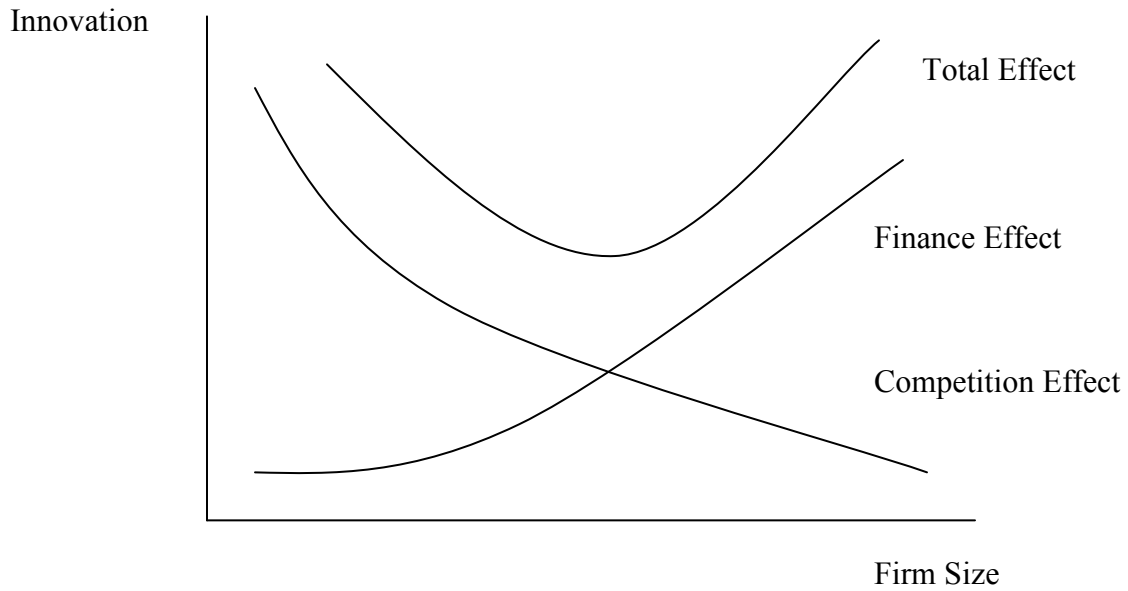


Fig 1b: Relationship between firm size and innovation

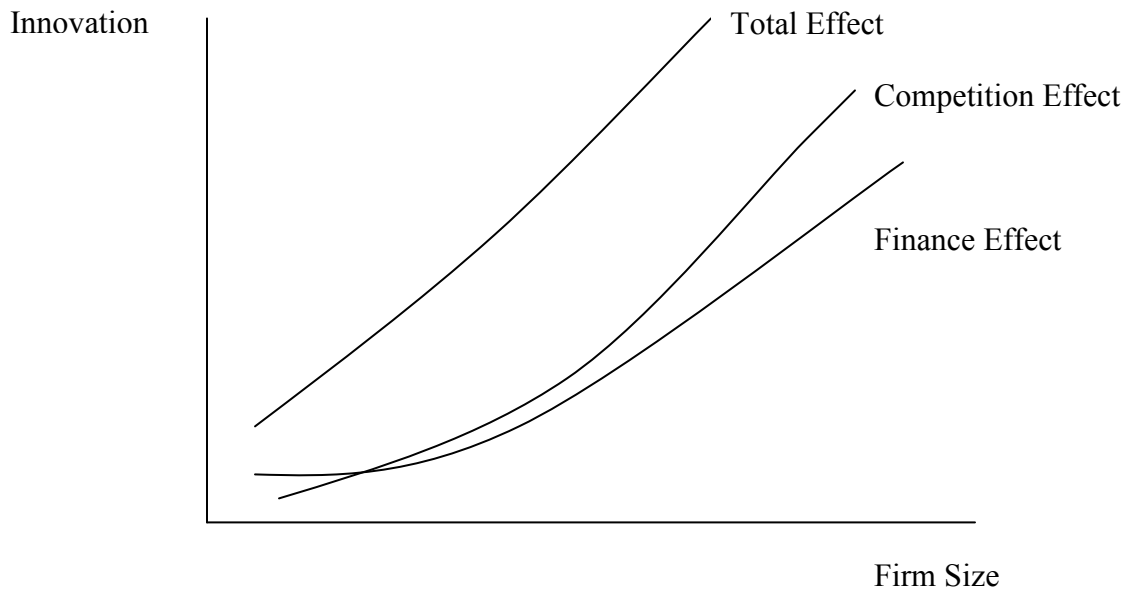
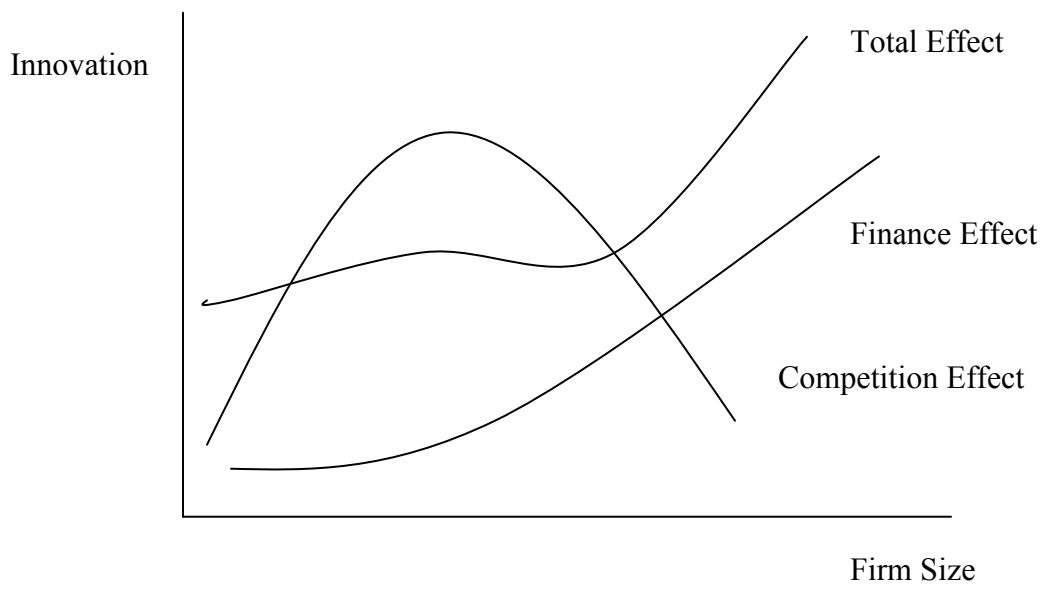


Fig 1c: Relationship between firm size and innovation



### 3.1 Data Description

Present section describes the data in terms of source, duration, and the variables included in the study. The study is based on the World Bank Enterprise Survey data conducted between year 2006 and 2010. The survey is based on stratified random sampling procedure using size of the economy and sector as strata. The World Bank Enterprise Survey data consists of firm level survey responses of around 48000 firms from 100 countries (mainly the countries constitute low and middle income countries) but considering our interest in innovation we have at first eliminated firms from the study which are not in manufacturing industry making the sample size of 27000 firms. After elimination of firms for which we do not have information of their innovative behaviour (i.e. whether the firm innovates or not) we are only left with little more than 8400 firms. The sample left after eliminating the firms for which there is no information on innovation variable have firms from 36 countries and three continents South America, North America and Africa; we have divided them according to continent to understand primarily the distribution property of the firms.

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 work force and responses to self explanatory answers on different obstacles faced in current operation, corruption etc. data set not only covers information on above mentioned parameters but also it provides information at disaggregate level on innovation i.e. whether the firm is engaged in product or process innovation. The survey data also provides information on competition in terms of number of competitors. This broad definition allows us to understand the dynamics in a better way.

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 firm is 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 behavior of firms in terms of product, process and product and process is to distinguish imitation and adaptation from creation. It is argued that low and middle income countries are inside the productivity frontier and hence mainly engaged in innovation activity consisting imitation and adaptation rather creation.

## 3.2 Descriptive Analysis of data

### 3.21 Innovation

Primary analysis is based on cross tabulation and three way tabulation. To start with we analyzed how the sample is comprised of different sized firms, summary statistics put in table 1, reveals that small sized firms are predominant in the sample (48.7 %), followed by medium (35.1 %) and finally large sized firms (16.2 %)<sup>1</sup>. 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%.

**Table 1: proportion of firms under size, continent and innovation category**

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

<sup>1</sup> 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.

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

**Table 2: Proportion of firms across continent according to innovation and 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 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 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: Proportion of firms engaged in different Innovation activity in 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 medium sized firm of South America are slightly behind them. Majority of the firms are engaged in both product and process innovation through entire size category (see table 4). If we divide the firms according to size, age and innovation category we find that very old aged firms are least innovative, results of cross tabulation are put in table 5. The mean experience of the managers (in years) for innovative firms is higher than the non innovative firms across the size.

**Table 4: Percentage wise distribution of firms engaged in different Innovation activity in different continent within different size category**

Innovation/Size	Continent		
	South America	North America	Africa
<b>Small</b>			
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
<b>Medium</b>			
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
<b>Large</b>			
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

**Table 5: Proportion of firms engaged in different Innovation activity in according to age and size**

Innovation	Age			
	Young	Middle	Old	Very Old
<b>Small</b>				
No Innovation	39.15	37.89	39.58	53.03
Product Innovation	13.76	14.47	13.58	9.09
Process Innovation	7.41	8.02	9.48	12.12
Both Innovation	39.68	39.62	37.35	25.76
Total	100.00	100.00	100.00	100.00
<b>Medium</b>				
No Innovation	26.67	26.04	21.04	46.43
Product Innovation	15.38	11.35	11.96	14.29
Process Innovation	13.33	8.82	9.17	1.79
Both Innovation	44.62	53.79	57.83	37.50
Total	100.00	100.00	100.00	100.00
<b>Large</b>				
No Innovation	14.00	20.55	14.48	38.00
Product Innovation	8.00	9.87	9.71	6.00
Process Innovation	10.00	8.25	7.40	4.00
Both Innovation	68.00	61.33	68.41	52.00
Total	100.00	100.00	100.00	100.00

**Table 6: Average Year of Managers Experience**

Size / Innovation	Managers Experience (Average Years)
<b>Small</b>	
No	17.80
Yes	18.30
<b>Medium</b>	
No	18.85
Yes	21.11
<b>Large</b>	
No	18.57
Yes	20.83

### ***3.2.2 Competition and innovation:***

In this section we will investigate the link between 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 not only

majority of the innovative firms faces high degree of competition but also the reverse holds true i.e. majority of the firms which are non innovative are facing high degree of competition. Taking the descriptive analysis of innovation and competition behavior of firms within the preview of size we find size does play a crucial role. Medium and large firms which face high degree of competition are more innovative, whereas, small firms which are facing high degree of competition are more non innovative compare to that innovative.

**Table 7: Percentage wise distribution of firms engaged in different Innovation activity in according to 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
<b>Size</b>				
<b>Small</b>				
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
<b>Medium</b>				
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
<b>Large</b>				
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 crucial role in determining the investment. It will be interesting and worthy enough to have a primary look at link between innovation and financial sources of the firm. Higher percentage of funds for investment comes from external sources for innovative

firm. Among the external source bank plays a vital role as bank contribution is more than 13 percent of the investment fund of the innovative firms.

**Table 8: Percentage wise distribution of firms engaged in different Innovation activity in according to number of competition they have and also according to age category**

Age of firm/Innovation	Number of Competitor			
	None	One	2 to 5	More than 5
<b>Young</b>				
No Innovation	2.90	1.98	13.06	17.41
Product Innovation	1.06	0.40	5.54	6.86
Process Innovation	0.66	0.66	2.37	4.75
Both Innovation	2.64	2.11	12.80	24.80
<b>Middle</b>				
No Innovation	2.61	2.03	9.40	18.51
Product Innovation	0.55	0.57	4.20	7.85
Process Innovation	0.57	0.44	2.48	4.67
Both Innovation	2.45	1.64	16.10	25.92
<b>Old</b>				
No Innovation	2.03	1.68	8.00	14.94
Product Innovation	0.49	0.53	4.51	6.76
Process Innovation	0.49	0.40	3.05	4.55
Both Innovation	2.30	1.77	18.52	30.00
<b>Very Old</b>				
No Innovation	2.47	0.00	8.64	36.42
Product Innovation	0.00	0.00	3.70	5.56
Process Innovation	0.00	0.62	2.47	3.70
Both Innovation	2.47	2.47	12.35	19.14

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 investment of firms. Though it is expected that firms will be not much dependent on the 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 reveals that private firms are more innovative and among the private it is the foreign which leads domestic firms in innovation. Again, it is the large and private firms which are more innovative compare to others.

**Table 9: Innovation behaviour and mean value of investment from different sources of finance according to size and age**

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
<b>Size</b>						
<b>Small</b>						
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
<b>Medium</b>						
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
<b>Large</b>						
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
<b>Age</b>						
<b>Young</b>						
No	75.72	4.88	1.41	1.36	0.00	4.00
Yes	64.14	5.85	5.23	1.29	0.67	11.28
<b>Middle</b>						
No	69.89	2.34	4.96	1.78	0.52	5.15
Yes	59.25	4.32	7.14	2.30	0.59	13.86
<b>Old</b>						
No	66.42	1.54	7.30	0.37	0.86	5.60
Yes	62.04	4.76	5.85	1.99	1.12	13.45
<b>Very Old</b>						
No	66.00	0.00	0.00	12.50	0.00	2.25
Yes	60.22	4.30	2.39	1.94	1.94	12.15

### ***3.2.4 Innovation and financial obstacle***

More than 50 % of the innovative firms faces access to financing as obstacle (here obstacle includes availability, interest rates, fee and collateral requirement). Of the firms which are innovative and faces financial obstacle are engaged in both product and process innovation. for given size firms which are innovative faces more financial obstacle but the but the effect of size is not linear as the percentage distribution of firms facing financial obstacle and are innovative is 45.95, 56.45 and 55.28 respectively for small medium and large firm. This characteristics does not show any much deviation if distribute them according to age pattern. In the ownership category it is the private domestic innovative firm which faces financial obstacle.

**Table: 10 Proportion of Innovative Firms Having Access to Finance as Obstacle**

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

**Table: 11: Proportion of Innovative Firms under different Category of Innovation Having Access to Finance as 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

**Table12: 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

**Table13: Proportion of Innovative Firms under different Category of Innovation Having Access to Finance as Obstacle according to Age**

Age of firm / Access to Finance	Innovation	
	No	Yes
Young		
No obstacle	9.51	15.42
Obstacle	24.29	50.77
Middle		
No obstacle	8.77	17.71
Obstacle	22.33	51.19
Old		
No obstacle	7.71	23.16



Obstacle	17.27	51.86
Very Old		
No obstacle	13.33	11.11
Obstacle	36.30	39.26

**Table14: Proportion of Innovative Firms under different Category of Innovation Having Access to Finance as Obstacle according to Ownership**

Access to Finance	Innovation	
	No	Yes
Private Domestic		
No obstacle	8.65	18.21
Obstacle	21.80	51.35
Private Foreign		
No obstacle	7.51	27.39
Obstacle	15.61	49.48
Government/State		
No obstacle	30.00	20.00
Obstacle	5.00	45.00
Others		
No obstacle	7.41	25.93
Obstacle	22.22	44.44

### ***3.2.5 Innovation and other obstacle***

Innovative firms most affected by the macro economic instability; this effect has a increasing trend with size and thus it affects larger firms the most. If we table --- we find that though the effect of political instability on innovative firms operation is slightly less compare to that of macro economic instability but the trend is similar in nature. Similarly, other obstacle to firm operation affects innovative firms the most with highest effect on larger firms.

**Table15: Proportion of Innovative Firms and facing different Major Obstacle**

Size / Innovation	Obstacles to the current operations of the Firm :			
	Macroeconomic Instability		Tax Rates	
	No obstacle	Obstacle	No obstacle	Obstacle
Small(<20)				
No	9.66	28.73	8.79	29.62
Yes	12.9	48.72	13.97	47.62
Medium(20-99)				
No	4.95	19.85	4.58	20.2
Yes	12.86	62.35	13.19	62.03
Large(100 and over)				
No	2.51	14.96	3.07	14.85
Yes	15.62	66.91	18.07	64.01
Political Instability			Labour Regulations	
Small(<20)				
No	12.64	25.61	22.61	15.91
Yes	18.45	43.3	29.85	31.64
Medium(20-99)				
No	6.82	17.19	10.84	13.89
Yes	17.62	58.37	28.16	47.1
Large(100 and over)				
No	3.21	13.44	6.82	11.22
Yes	18.55	64.81	26.03	55.94
Corruption			Courts	
Small(<20)				
No	12.11	26.6	23.72	14.86
Yes	15.01	46.28	35.96	25.46
Medium(20-99)				
No	5.72	19.18	13.32	11.26
Yes	15.27	59.83	36.55	38.86
Large(100 and over)				
No	4.05	14.14	7.98	9.73
Yes	17.53	64.29	29.56	52.74
Business Licensing and Permits			Customs and Trade Regulations	
Small(<20)				
No	18.47	20.34	27.33	11.77
Yes	26.9	34.3	35.13	25.76
Medium(20-99)				
No	10.72	14.4	13.54	11.39
Yes	28.76	46.13	28.93	46.14
Large(100 and over)				
No	6.55	11.47	6.23	12.15
Yes	29.71	52.27	23.11	58.51

Contd.

Size / Innovation	Obstacles to the current operations of the Firm :	
	Tax Administrations	
	No obstacle	Obstacle
Small(<20)		
No	12.49	26.06
Yes	19.15	42.29
Medium(20-99)		
No	6.52	18.25
Yes	19.41	55.82
Large(100 and over)		
No	3.51	14.48
Yes	21.51	60.5

#### **4. Empirical Model to investigate 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 dependent variable. Further, for robustness we have defined innovation variable in four different ways. For the first innovation variable we have 0 if firms answer to the question “*introduction of significantly new product*” or answer to the question “*introduction of significantly new process*” is no, 1 if the firms answer is yes for either of the question and 2 if firms answer is yes for both the question. The second innovation variable is categorized in 0 and 1, 0 is same as first innovation variable and it will take value 1 if firms is 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 significantly new product*” is no and 1 if 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 significantly new process*” is no and 1 if answer is yes. We have employed ordered logit method for first innovation variable and logit for rest of the innovation variable. The six different models we have estimated follow following structure.

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

### **Model 1**

$$\text{innovation} = \alpha + \beta_1 \text{SizeDummy} + \beta_2 \log \text{ofAge} + \beta_3 \text{LOG of Managers Experience} + \beta_4 \text{dummyPart of Large Organisation} + \beta_5 \text{DummyExporter} + \beta_6 \text{DummySector} + \beta_7 \text{DummyCountry} + \varepsilon$$

Model 1 is estimated for the entire four innovation variable using firm level observation and robust standard error. Model 1 is baseline equation, subsequently we have introduced finance and competition variable to examine our objective econometrically. Model 2 is addition of finance variable in the baseline model (model 1), mathematical form of the estimated model 2 is:

### **Model 2**

$$\text{innovation} = \alpha + \beta_1 \text{SizeDummy} + \beta_2 \log \text{ofAge} + \beta_3 \text{LOG of Managers Experience} + \beta_4 \text{dummyPart of Large Organisation} + \beta_5 \text{DummyExporter} + \beta_6 \text{DummySector} + \beta_7 \text{DummyCountry} + \beta_8 X + \varepsilon$$

where,  $\beta_8 X$  is vector of finance variable, which includes Bank, NBFIs, 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**

$$\text{innovation} = \alpha + \beta_1 \text{SizeDummy} * X + \beta_2 \log \text{ofAge} + \beta_3 \text{LOG of Managers Experience} + \beta_4 \text{dummyPart of Large Organisation} + \beta_5 \text{DummyExporter} + \beta_6 \text{DummySector} + \beta_7 \text{DummyCountry} + \varepsilon$$

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 same as model 2 and model 3 while replacing finance variable by competition dummy.

### **Model 4**

$$\text{innovation} = \alpha + \beta_1 \text{SizeDummy} + \beta_2 \log \text{ofAge} + \beta_3 \text{LOG of Managers Experience} + \beta_4 \text{dummyPart of Large Organisation} + \beta_5 \text{DummyExporter} + \beta_6 \text{DummySector} + \beta_7 \text{DummyCountry} + \beta_8 Z + \varepsilon$$

### **Model 5**

$$\text{innovation} = \alpha + \beta_1 \text{SizeDummy} * Z + \beta_2 \log \text{ofAge} + \beta_3 \text{LOG of Managers Experience} + \beta_4 \text{dummyPart of Large Organisation} + \beta_5 \text{DummyExporter} + \beta_6 \text{DummySector} + \beta_7 \text{DummyCountry} + \varepsilon$$

where, Z is the dummy variable for number of competition<sup>2</sup>.

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 behavior together.

### **Econometric Results and Discussions:**

Result table 1 reports the estimation result for logit model estimation with innovation (with only 0 and 1 category) as dependent variable. Result of estimation suggest that size is an important variable and the likelihood of innovation by medium and large firm is more compare to that of small firm. The probability of undertaking innovative efforts is higher in firms which are engaged in export as compare to those which are not exporting. Again, firms which are part of large organization will have higher likelihood for innovation activities. Result of model 2 indicates access to bank finance by firm increases the probability of the firm to come up with either new product or new process or both. Surprisingly, 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 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 firm in all the size categories. 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 variable also depicts the same results and thus confirms the robustness of the model.

### **5. Conclusion:**

With rise in globalization, market is also changing in terms of internal institutional arrangement and interaction with external institution. This has brought size of the firm as

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<sup>2</sup> 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.

one of the important issue 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 importance 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 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 molding the innovation effort of firm. Study is based on the World Bank Enterprise Survey data for the year 2006-2010 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 significant contributor in 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 meager to play significant role in the innovation process of those firms and thereby on the promotion of sustainable entrepreneurship.

Result Table 1: 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 level of significance at 10, 5 and 1 percent respectively

Result Table 2: 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 level of significance at 10, 5 and 1 percent respectively



Result Table 2: 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 level of significance at 10, 5 and 1 percent respectively

Result Table 2: 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 level of significance at 10, 5 and 1 percent respectively

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