# Does Competition Enhance or Hinder Innovation? Evidence from Philippine SMEs[1]

## Tristan Canare[2]

## Abstract

Competition has two possible contrasting effects on firm innovation. On one hand, competition can force SMEs to innovate to become more competitive. On the other hand, competition can shrink the SME's market share, revenues, and profit, making it difficult to implement financial-capital-intensive innovations. Using data from a survey of 480 SMEs in the Philippines, this paper found evidence that there is a generally positive association between competition and innovation. The magnitude of the relationship, however, depends on the type of innovation. The type of innovation most strongly associated with competition is improving the production process, followed by improving marketing. It is most weakly associated with introducing a product new to the market and with improving an existing product. There is also some evidence that the magnitude of competition-innovation relationship varies across sectors and firm size.

**Keywords:** competition; innovation; small and medium enterprises

## I. Background and Objectives

Small and medium enterprises (SMEs) are important components of the economies of almost all countries, particularly developing ones. In the Philippines, where the data for this study was taken, more than 99 percent of all firms, about two-thirds of employment, and a third of gross value added (GVA) are accounted for by micro, small, or medium firms (Daño-Luna et al 2018). The large divergence in the share of employment and of GVA indicates that large firms are much more productive, putting workers of SMEs at a disadvantage. Among Association of Southeast Asian Nations (ASEAN) countries, SMEs comprise between 89 and 99 percent of businesses, employing between 52 and 97 percent of workers (ERIA 2014).

Although SMEs are integral to the economy, the greater disadvantages they face compared to large firms have been well-documented in the literature. This includes lack of access to finance (Berger and Udell 1998; Beck and Demirguc-Kunt 2006), inadequate access to technology (Thong and Yap 1995; Lee and Runge 2001), difficulties in accessing markets (Rogerson 2013; Abor and Quartey 2010), and excessive regulations (Klapper et al 2006; World Bank and IFC 2012, 2013).

---

[1] Paper to be presented at the 15th Asian Law and Economics Association Conference 2019. June 27-28, Chulalongkorn University, Bangkok, Thailand.
[2] Associate Director and Senior Economist, AIM Policy Center, Asian Institute of Management.

Two other significant factors that affect SME development are competition and innovation. Innovation is important because it promotes competitiveness among firms (Porter 1992; McGrath et al 1996). On the other hand, competition can reduce a firm's market share, decrease revenues, and negatively affect profit. The potential effect of competition on firm growth, however, can be complex; and competition's potential impact on innovation can be at the center of this. Competition has two possible contrasting effects on firm innovation and growth. On one hand, competition is seen as a deterrent to innovation. Competition can induce lower profits, which in turn provides a disincentive to innovate. One of the earliest proponents of this idea was Schumpeter (1942) in his seminal book; and this has been formally modeled by Aghion and Howitt (1992). On the other hand, competition can force SMEs to become more competitive by innovating (Porter 1990: Aghion et al 1999).

The primary objective of this paper is to study the relationship between competition and innovation using a survey of SMEs in two regions in the Philippines. A secondary objective is to determine if this relationship varies across firm size (small versus medium) and across sectors (industry versus services). The focus on SMEs is motivated by studies that have shown that small and medium firms innovate differently and could face different barriers to innovation compared to large businesses (Spithoven et al 2013; McAdam et al 2004; Vossen 1998; Tabas et al. 2011). The use of Philippine data attempts to address the dearth of empirical competition-innovation literature using a developing country setting. At present, most literature on this topic are either theoretical or focused on industrialized countries.

This paper is organized as follows. The background and objectives are followed by the framework and a brief review of literature on competition and innovation. This precedes the methodology, in which the data source and estimation method are discussed; followed by the results and discussions. A short summary concludes the paper.

## II. Framework and Literature Review

There are two main contrasting themes in the literature on how competition can affect innovation. The first, espoused originally in the classic Schumpeter (1942) writings, says that competition deters innovation. The Schumpeterian argument has two primary transmission mechanisms from weak competition to innovation (Cohen and Levin 1989; Ahn 2002). First, the expectation of a firm that it will have some degree of market power is an incentive to innovate. Similarly, a firm with market power has the incentive to innovate to keep that market power and keep competitors from entering the market (Gilbert 2007). The second mechanism is that the rent generated from market power provides the financial resources needed to undertake innovation. Related to this, the model of 'creative destruction' by Aghion and Howitt (1992) argues that if there are more firms (and more competition), the prospect of more innovation in the future deters current innovation because greater future innovation threatens to reduce the rent created by present innovation.

In contrast to the Schumpeterian view, some models argue that greater competition can promote innovation; primarily because competition can force firms to innovate to be more competitive and survive tough competition (Aghion et al 1999; Porter 1990). Ahn (2002) and Aghion and Howitt (1996, 1998) also discussed other similar ways by which competition can positively influence innovation. One case is when technologies of competing firms are similar. Under this condition, intense competition provides incentive to gain or maintain leadership in level of technology. Another is when there is mobility of labor across production lines. When two competing firms employ different technologies or production lines – one uses old and the other employs new – workers will move to the newer and more productive production line. This provides the competing firms with incentive to innovate (Aghion and Howitt 1996).

There is a rich body of literature that empirically tested these models using different methods and data sources. According to Aghion and Tirole (1994), the association between competition and innovation is the second-most empirically tested relationship in industrial organization, after that of competition and profit. Gilbert (2006), Schmutzler (2009), Boldrin et al (2011), and Ahn (2002) are some of the more recent reviews of empirical literature on competition-innovation relationship. While there have been many studies on this topic, the contribution of this paper is the use of a developing country case and a perception-based measure of competition, which are rarely utilized.

Most of the empirical literature support the theory that competition and innovation are positively related (Aghion et al 2009; Okada 2005; Carlin et al 2004; Galdon-Sanchez and Schmitz 2002; Blundell et al 1999; Nickell 1996; Baily and Gersbach 1995; Acs and Audretsch 1988). Only a handful of studies support the Schumpeterian view, and most of these are not recent (Acs and Audretsch 1987; Lunn 1986; Lunn and Martin 1986; Culbertson and Mueller 1985). A few studies found no evidence of a significant relationship (Geroski 1990; Levin et al 1985; Scott 1984), while some found mixed results (Aghion et al 2005; Angelmar 1985) depending on spillovers and level of competition.

### III. Methodology and Data Source

#### III.A. Data Source

The data source of this study is a survey of 480 SMEs in the Metro Manila and Calabarzon regions in the Philippines. Metro Manila, also known as the National Capital Region, is composed of 17 cities; while neighboring Calabarzon is composed of five provinces, each of which is composed of cities and municipalities. Survey respondents were drawn using multi-stage systematic random sampling. The first stage was selecting 12 cities in Metro Manila and one city from each of the five provinces of Calabarzon. In this stage, the probability of a city being selected is proportional to the actual number of firms in each city. The number of sampled SMEs per region and per sector (agriculture, industry, and services) is also proportional to the actual number of SMEs.

The second stage is randomly selecting *barangays*[3] from each of the drawn cities. Randomly selected points from the drawn barangays served as starting points for the systematic sampling of SME respondents. In the systematic sampling, the enumerator selects every third business for interview. If the prospect business refuses or is not qualified, the enumerator proceeds to the next firm. If needed, the enumerator proceeds to the next barangay. This process is repeated until the target number of respondents per city is met.

The survey questionnaire includes items on several aspects of SME competitiveness and firm and owner characteristics. It measures the degree of competition faced by the firm in two ways. The first is through the question '*How would you rate the intensity of competition faced by your business?*', which can be answered by either '*very low*', '*low*', '*medium*', '*high*', or '*very high*'. This is a self-assessed indicator of the degree of competition faced by the SME. Tang (2006) argued that a firm's own perception of the level of competition it faces is a better measure of competition than the more commonly-used industry-based statistics such as seller concentration. A perception-based indicator measures competition specific to the firm. This is important because firms, even when they belong to the same sector, produce different products and cater to different markets. A perception-based indicator therefore more accurately measures the degree of competition faced by a specific firm. Moreover, perceived competition considers competitors from foreign firms in addition to those in the domestic market. The second competition measure is through the question '*How many firms do you consider as your competitors?*'.

The survey considers five types of innovations and asks the respondents if the firm implemented each of them. These are (variable name in parenthesis): introduced a product or service new to the company (*prodnewcomp*), introduced a product or service new to the market (*prodnewmkt*), improved current products and services (*imprvdprod*), improved process of production or service delivery (*imprvdprocs*), and improved marketing (*imprvdmrktg*).

### III.B. Estimation Method

This study used the following equation in estimating the relationship between competition and innovation.

$$innov_i = \beta_0 + \beta_0{}^* comp_i + X_i + \mu_i \qquad (1)$$

In equation (1), *innov$_i$* is a dummy variable equal to one if firm *i* implemented a specific innovation. Logit regression was run on equation (1) for each of the five types of innovation described earlier. The variable *comp$_i$* is a measure of the degree of competition faced by the firm. Here, *comp$_i$* is represented by two variables: a dummy variable for respondents who answered 'high' or 'very high' to the question on how intense the competition faced by the firm is (*comp_high*); and the number of competitor firms the business has (*competitors*).

---

[3] Barangay is the smallest political unit in the Philippines

The variable *Xi* is a vector of control variables. It includes: a services sector dummy (*services*), number of years the firm has been operating (*firmyears*), age of owner or majority owner (*ageowner*), dummy for a medium, as opposed to a small, firm[4] (*medium*), number of employees (*employ*), number of competencies, out of eight listed, wherein the respondent rated his/her skill level to be 'advanced' (*advancedskill*), percent share of employees with college degree (*collegeemp*), percentage of total cost allocated to training (*trainingcost*), a dummy variable for firms that engaged in any of the following partnerships with a large or foreign firm: sub-contracting, outsourcing, being licensed to manufacture or distribute a product, joint venture, strategic alliance, or consortium (*partnership*), a dummy variable for firms that took out a loan in the past two years (*loan*), percent increase or decrease of profit over the last two years (*profitchange*), and the total number of the following forms of expansion implemented by the firm over the last two years: increased production volume, sold additional products to local or foreign markets, and opened additional office or production site (*expansion*).

An interaction term between the competition variable and the medium firm dummy was also included. This is to test if any relationship between competition and innovation varies across firm size. The effect of competition on innovation can differ between small and medium firms because response to competition, innovation behavior, and performance can depend on firm size (Alsharkas 2015; Fernandez et al 2019; Damanpour 2010; Tang 2006). Different responses to competition requires different amounts of capital and this can depend on the size of the firm. An interaction between competition and the services dummy was also included to test if the magninure of competition-innovation relationship varies across sectors. Tingvall and Karpaty (2011) and Tether (2005) suggest that firms from different sectors can respond differently to stiff competition and may innovate differently.

**IV. Results and Discussions**

*IV.A. Respondent Profile and Summary Statistics*

Table 1 shows the summary statistics of all the dependent and independent variables used in this study. It also shows a profile snapshot of the SME respondents. Eighty-nine percent of all respondents implemented at least one of the five innovations considered in this study; with an average firm implementing three innovations. The most commonly implemented innovation is improving exiting products and services, with 82 percent of respondents doing so, followed by improving the production process or service delivery (70 percent) and improving marketing (64 percent). The least implemented innovation is introducing a product or service new to the market

---

[4] In the Philippines, a small enterprise is defined as a firm with asset size, excluding land, between three million and 10 million pesos (around USD 57,700 to USD 192,300) or employment size of ten to 99. Medium firms have asset size, excluding land, between 10 million and 100 million pesos (around USD 192,300 to USD 1.92 million) or employment of 100 to 199. In the survey, both the asset size and employment definitions were used in identifying respondents. In classifying whether they are small or medium, the asset size takes precedence if it contradicts with the employment definition.

(42 percent) and introducing a product or service new to the firm (51 percent). In terms of competition, 37 percent of respondents said that they are facing high or very high competition, 16 percent said that they face low or very low competition, and the remaining experience medium competition. The average respondent has six competitor firms.

Turning to firm and owner characteristics, the average years in operation of the business is 14 years, and the average age of owner or majority owner is 52. Fourteen percent of the respondents are medium-sized firms while the remaining 86 percent are small. The average employment size is 24, and an average 40 percent of these employees have a college degree. More than one in five respondents took out a loan in the past two years; and half engaged in at least one of the formal partnerships with large firms described earlier (sub-contracting, outsourcing, being licensed to manufacture or distribute a product, joint venture, strategic alliance, or consortium).

**Table 1. Summary statistics**

| Variable | Obs | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| prodnewcomp | 480 | 0.513 | 0.500 | 0 | 1 |
| prodnewmkt | 480 | 0.421 | 0.494 | 0 | 1 |
| imprvdprod | 480 | 0.821 | 0.384 | 0 | 1 |
| imprvdprocs | 480 | 0.702 | 0.458 | 0 | 1 |
| imprvdmrktg | 480 | 0.635 | 0.482 | 0 | 1 |
| comp_high | 480 | 0.373 | 0.484 | 0 | 1 |
| competitors | 480 | 5.608 | 8.954 | 0 | 100 |
| services | 480 | 0.804 | 0.397 | 0 | 1 |
| firmyears | 480 | 13.683 | 13.180 | 2 | 83 |
| ageowner | 476 | 51.664 | 11.285 | 21 | 90 |
| medium | 480 | 0.138 | 0.345 | 0 | 1 |
| employ | 480 | 24.352 | 29.887 | 10 | 192 |
| advancedskill | 480 | 3.490 | 2.856 | 0 | 8 |
| collegeemp | 480 | 40.429 | 29.458 | 0 | 100 |
| trainingcost | 480 | 10.408 | 7.884 | 0 | 35 |
| partnership | 480 | 0.550 | 0.498 | 0 | 1 |
| loan | 480 | 0.215 | 0.411 | 0 | 1 |
| profitchange | 480 | 20.123 | 22.969 | -50 | 100 |
| expansion | 480 | 2.135 | 1.392 | 0 | 5 |

## IV.B. Estimation Results

The logit average marginal effects are reported in Tables 2 to 6 (the logit coefficients are in the Appendix). The five tables show the results for each innovation indicator. In each table, column 1 reports the result when competition is measured by the variable *comp_high*, which is a dummy variable for observations who reported that they are facing 'high' or 'very high' competition. Column 2 reports the results when competition is measured by the number of competitor firms the

SME has. Columns 3 and 4 are the same as columns 1 and 2 but they include an interaction term between the competition indicator and dummy variable for medium-sized firms. Columns 5 and 6 are the same as columns 1 and 2 but they include an interaction term between the competition indicator and dummy variable for respondents in the services sector.

The last four rows of each table compare the marginal effects of competition on innovation between medium and small firms, and between services and non-services SMEs. This shows whether competition-innovation relationship is different across firm size and across sectors. For instance, in Table 2, the -0.3536 means that the marginal effect of *comp_high* on *prodnewcomp* is 0.3536 percent points lower for medium-sized firms than it is for small ones.

Results suggest that competition is associated with higher likelihood of innovating, but the magnitude of the relationship varies across types of innovation. Improving the marketing (*imprvdmrktg*) and improving the production process (*imprvdprocs*) are the innovation types most associated with high competition. This is shown by the statistical significance and magnitude of the marginal effects of competition on these two innovation variables. Both *comp_high* and *competitors* are significant in all regressions with *imprvdmrktg* or *imprvdprocs* as the dependent variable. Experiencing 'high' or 'very high' competition is associated with 14 percent points higher probability of improving the production process and with 11 percent points greater likelihood of improving marketing. Similarly, an additional one competitor firm is associated with 0.9 percent point higher probability of both improving the production process and improving marketing.

There is evidence that competition is positively related with the three other innovation indicators, but the relationship is much weaker. Facing 'high' or 'very high' competition (*comp_high*) is associated with six percent points higher likelihood of improving an existing product, but number of competitor firms (*competitors*) has no significant relationship with this form of innovation. On the other hand, number of competitor firms is significantly associated with higher probability of introducing a product new to the market with (with a marginal effect of 0.7 percent points), but the latter has no significant relationship with *comp_high*. Both *comp_high* and *competitors* have significant relationship with introducing a product new to the company, with marginal effects of 10 and 0.7 percent points, respectively.

Only a few interaction terms turned out significant; and thus, the competition-innovation relationship is largely the same regardless of size and sector, save for a few exceptions. Being a medium sized firm has a moderating effect on the positive relationship between facing 'high' or 'very high' competition and introducing a product new to the company. Similarly, the positive relationship between facing a 'high' or 'very high' competition and improving products is weaker among services SMEs compared to those belonging to the industry sector.

**Table 2. Logit average marginal effects: Product new to the company**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | prodnewcomp | prodnewcomp | prodnewcomp | prodnewcomp | prodnewcomp | prodnewcomp |
| comp_high | 0.1017** | | 0.0992** | | 0.1016** | |
| | (0.046) | | (0.0456) | | (0.046) | |
| competitors | | 0.0068** | | 0.008*** | | 0.0061** |
| | | (0.0028) | | (0.003) | | (0.0029) |
| services | 0.1317*** | 0.1228** | 0.1422*** | 0.1204** | 0.1318*** | 0.1323*** |
| | (0.0504) | (0.0511) | (0.0507) | (0.0511) | (0.0504) | (0.0502) |
| firmyears | -0.0012 | -0.0013 | -0.0018 | -0.0014 | -0.0012 | -0.0014 |
| | (0.0017) | (0.0018) | (0.0018) | (0.0018) | (0.0017) | (0.0018) |
| ageowner | 0.004** | 0.004** | 0.0045** | 0.0042** | 0.004** | 0.004** |
| | (0.0019) | (0.0018) | (0.0019) | (0.0018) | (0.0019) | (0.0018) |
| medium | 0.0474 | 0.0658 | 0.0561 | 0.0655 | 0.0471 | 0.0674 |
| | (0.062) | (0.0608) | (0.0578) | (0.0602) | (0.0621) | (0.0608) |
| employ | 0.0001 | -0.0002 | 0.0003 | -0.0003 | 0.0001 | -0.0002 |
| | (0.0008) | (0.0007) | (0.0007) | (0.0007) | (0.0008) | (0.0007) |
| advancedskill | 0.0109 | 0.0088 | 0.012 | 0.0084 | 0.0109 | 0.009 |
| | (0.0077) | (0.0077) | (0.0076) | (0.0077) | (0.0077) | (0.0077) |
| collegeemp | 0.0011 | 0.0009 | 0.0011 | 0.0009 | 0.0011 | 0.0009 |
| | (0.0008) | (0.0008) | (0.0008) | (0.0008) | (0.0008) | (0.0008) |
| trainingcost | 0.0009 | 0.0011 | 0.0001 | 0.0011 | 0.0009 | 0.001 |
| | (0.0026) | (0.0026) | (0.0026) | (0.0026) | (0.0026) | (0.0027) |
| partnership | 0.0932** | 0.0907* | 0.0866* | 0.0886* | 0.0925** | 0.0927** |
| | (0.047) | (0.0467) | (0.0464) | (0.0469) | (0.0471) | (0.0468) |
| loan | 0.1345*** | 0.1122** | 0.1262*** | 0.1141** | 0.1349*** | 0.113** |
| | (0.0494) | (0.0495) | (0.0491) | (0.0493) | (0.0494) | (0.0493) |
| profitchange | -0.0012 | -0.0012 | -0.0013 | -0.0012 | -0.0012 | -0.0012 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| expansion | 0.1269*** | 0.1297*** | 0.1262*** | 0.1293*** | 0.127*** | 0.1304*** |
| | (0.0143) | (0.0137) | (0.0143) | (0.0137) | (0.0144) | (0.0138) |
| comp_high: diff. between medium (1) and small (0) | | | -0.3536*** | | | |
| | | | (0.109) | | | |
| competitors: diff. between medium (1) and small (0) | | | | -0.0094 | | |
| | | | | (0.0062) | | |
| comp_high: diff. between services (1) and non-services (0) | | | | | 0.0161 | |
| | | | | | (0.1078) | |
| competitors: diff. between services (1) and non-services (0) | | | | | | 0.0081 |
| | | | | | | (0.0076) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |
| Pseudo R-squared | 0.1893 | 0.1901 | 0.2019 | 0.1930 | 0.1894 | 0.1910 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; For dummy variables, the marginal effect is the discrete change from 0 to 1

### Table 3. Logit average marginal effects: Product new to the market

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|

| | prodnewmkt | prodnewmkt | prodnewmkt | prodnewmkt | prodnewmkt | prodnewmkt |
|---|---|---|---|---|---|---|
| comp_high | 0.0364 | | 0.0339 | | 0.0366 | |
| | (0.045) | | (0.0445) | | (0.045) | |
| competitors | | 0.0073*** | | 0.0079*** | | 0.0071*** |
| | | (0.0024) | | (0.0025) | | (0.0025) |
| services | 0.1003** | 0.0888* | 0.1094** | 0.0875* | 0.0998** | 0.0906* |
| | (0.0489) | (0.0495) | (0.0494) | (0.0495) | (0.0487) | (0.0493) |
| firmyears | -0.0023 | -0.0023 | -0.0028 | -0.0024 | -0.0024 | -0.0023 |
| | (0.0019) | (0.0018) | (0.0019) | (0.0018) | (0.0019) | (0.0019) |
| ageowner | 0.0022 | 0.0019 | 0.0027 | 0.0021 | 0.0023 | 0.002 |
| | (0.0019) | (0.0019) | (0.0019) | (0.0019) | (0.0019) | (0.0019) |
| medium | 0.1006* | 0.1102* | 0.1103* | 0.11* | 0.1019* | 0.1105* |
| | (0.0599) | (0.0588) | (0.0582) | (0.0585) | (0.06) | (0.0587) |
| employ | 0.0007 | 0.0004 | 0.0009 | 0.0003 | 0.0007 | 0.0004 |
| | (0.0008) | (0.0007) | (0.0008) | (0.0007) | (0.0008) | (0.0007) |
| advancedskill | 0.0049 | 0.0036 | 0.006 | 0.0035 | 0.0049 | 0.0037 |
| | (0.0076) | (0.0076) | (0.0075) | (0.0076) | (0.0075) | (0.0076) |
| collegeemp | 0.0015** | 0.0013* | 0.0014* | 0.0013* | 0.0015** | 0.0013* |
| | (0.0007) | (0.0007) | (0.0007) | (0.0007) | (0.0007) | (0.0007) |
| trainingcost | 0.0065*** | 0.0066*** | 0.0058** | 0.0065*** | 0.0065*** | 0.0066*** |
| | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0025) |
| partnership | 0.0941** | 0.1013** | 0.087* | 0.1** | 0.096** | 0.1019** |
| | (0.0459) | (0.045) | (0.0456) | (0.0451) | (0.0459) | (0.0452) |
| loan | 0.1358*** | 0.1196** | 0.1296*** | 0.1201** | 0.134*** | 0.1198** |
| | (0.0503) | (0.0488) | (0.0502) | (0.0486) | (0.0505) | (0.0488) |
| profitchange | -0.0003 | 0.00002 | -0.0004 | 1.19E-06 | -0.0003 | 1.75E-05 |
| | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) |
| expansion | 0.1087*** | 0.1079*** | 0.1074*** | 0.1075*** | 0.1082*** | 0.108*** |
| | (0.0142) | (0.0135) | (0.0141) | (0.0135) | (0.0143) | (0.0136) |
| comp_high: diff. between medium (1) and small (0) | | | -0.3301*** | | | |
| | | | (0.1116) | | | |
| competitors: diff. between medium (1) and small (0) | | | | -0.0069 | | |
| | | | | (0.0052) | | |
| comp_high: diff. between services (1) and non-services (0) | | | | | -0.0525 | |
| | | | | | (0.1007) | |
| competitors: diff. between services (1) and non-services (0) | | | | | | 0.0023 |
| | | | | | | (0.0072) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |
| Pseudo R-squared | 0.1812 | 0.1921 | 0.1921 | 0.194 | 0.1816 | 0.1922 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; For dummy variables, the marginal effect is the discrete change from 0 to 1

## Table 4. Logit average marginal effects: Improved existing products

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | imprvdprod | imprvdprod | imprvdprod | imprvdprod | imprvdprod | imprvdprod |

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| comp_high | 0.0612* | | 0.0611* | | 0.0633* | |
| | (0.0345) | | (0.0345) | | (0.0339) | |
| competitors | | 0.0015 | | 0.0015 | | 0.0011 |
| | | (0.0016) | | (0.0016) | | (0.0017) |
| services | -0.036 | -0.0339 | -0.0369 | -0.0327 | -0.0409 | -0.0281 |
| | (0.0364) | (0.0376) | (0.0365) | (0.0376) | (0.0354) | (0.039) |
| firmyears | 0.0009 | 0.0007 | 0.0009 | 0.0008 | 0.0008 | 0.0007 |
| | (0.0015) | (0.0016) | (0.0015) | (0.0015) | (0.0015) | (0.0016) |
| ageowner | 0.0006 | 0.0008 | 0.0006 | 0.0007 | 0.0007 | 0.0008 |
| | (0.0014) | (0.0014) | (0.0015) | (0.0014) | (0.0014) | (0.0015) |
| medium | -0.0605 | -0.05 | -0.0629 | -0.051 | -0.0553 | -0.0488 |
| | (0.0566) | (0.0553) | (0.0565) | (0.0554) | (0.0567) | (0.0551) |
| employ | -0.0001 | -0.0002 | -0.0002 | -0.0001 | -0.0001 | -0.0002 |
| | (0.0006) | (0.0006) | (0.0006) | (0.0006) | (0.0006) | (0.0006) |
| advancedskill | -0.0184*** | -0.0192*** | -0.0184*** | -0.0191*** | -0.0187*** | -0.0191*** |
| | (0.0055) | (0.0055) | (0.0056) | (0.0055) | (0.0055) | (0.0055) |
| collegeemp | -0.0005 | -0.0007 | -0.0005 | -0.0007 | -0.0005 | -0.0006 |
| | (0.0006) | (0.0006) | (0.0006) | (0.0006) | (0.0006) | (0.0006) |
| trainingcost | 0.0071*** | 0.0071*** | 0.0071*** | 0.0072*** | 0.0073*** | 0.0071*** |
| | (0.0027) | (0.0027) | (0.0027) | (0.0027) | (0.0027) | (0.0027) |
| partnership | 0.0032 | -0.0008 | 0.0036 | 0.0002 | 0.0074 | 0.0003 |
| | (0.0371) | (0.0369) | (0.0372) | (0.0369) | (0.0373) | (0.0372) |
| loan | 0.0668 | 0.0597 | 0.0675 | 0.059 | 0.0639 | 0.0607 |
| | (0.0412) | (0.0429) | (0.0412) | (0.0432) | (0.0414) | (0.0428) |
| profitchange | 0.002*** | 0.0019*** | 0.002*** | 0.0019*** | 0.0019*** | 0.0019** |
| | (0.0007) | (0.0007) | (0.0007) | (0.0008) | (0.0007) | (0.0008) |
| expansion | 0.0378*** | 0.041*** | 0.0378*** | 0.0411*** | 0.036*** | 0.0413*** |
| | (0.0138) | (0.0139) | (0.0138) | (0.0139) | (0.0135) | (0.014) |
| comp_high: diff. between medium (1) and small (0) | | | 0.0215 | | | |
| | | | (0.0888) | | | |
| competitors: diff. between medium (1) and small (0) | | | | 0.0044 | | |
| | | | | (0.006) | | |
| comp_high: diff. between services (1) and non-services (0) | | | | | -0.1262* | |
| | | | | | (0.0692) | |
| competitors: diff. between services (1) and non-services (0) | | | | | | 0.0038 |
| | | | | | | (0.0055) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |
| Pseudo R-squared | 0.1261 | 0.1209 | 0.1263 | 0.122 | 0.1332 | 0.1214 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; For dummy variables, the marginal effect is the discrete change from 0 to 1

## Table 5. Logit average marginal effects: Improved production process

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | imprvdprocs | imprvdprocs | imprvdprocs | imprvdprocs | imprvdprocs | imprvdprocs |
| comp_high | 0.1422*** | | 0.1422*** | | 0.1426*** | |

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | (0.0401) |  | (0.0401) |  | (0.04) |  |
| competitors |  | 0.0093*** |  | 0.0091*** |  | 0.0095*** |
|  |  | (0.0033) |  | (0.0035) |  | (0.0033) |
| services | 0.002 | -0.0018 | 0.0027 | 0.0001 | 0.0012 | -0.0033 |
|  | (0.0451) | (0.0442) | (0.0451) | (0.0443) | (0.0454) | (0.0434) |
| firmyears | 0.002 | 0.0017 | 0.0019 | 0.0018 | 0.002 | 0.0017 |
|  | (0.0019) | (0.002) | (0.0019) | (0.0019) | (0.0019) | (0.0019) |
| ageowner | 0.0008 | 0.0011 | 0.0008 | 0.001 | 0.0008 | 0.0011 |
|  | (0.0018) | (0.0018) | (0.0018) | (0.0018) | (0.0018) | (0.0018) |
| medium | -0.1785*** | -0.1639*** | -0.1777*** | -0.1597** | -0.1778*** | -0.1641*** |
|  | (0.0659) | (0.0633) | (0.066) | (0.0626) | (0.0661) | (0.0633) |
| employ | 0.0011 | 0.001 | 0.0011 | 0.0011 | 0.0011 | 0.001 |
|  | (0.0007) | (0.0008) | (0.0008) | (0.0008) | (0.0007) | (0.0008) |
| advancedskill | -0.0203*** | -0.0229*** | -0.0202*** | -0.0228*** | -0.0204*** | -0.023*** |
|  | (0.0066) | (0.0066) | (0.0067) | (0.0066) | (0.0067) | (0.0066) |
| collegeemp | -0.0008 | -0.0012 | -0.0008 | -0.0012* | -0.0008 | -0.0012 |
|  | (0.0007) | (0.0007) | (0.0007) | (0.0007) | (0.0007) | (0.0007) |
| trainingcost | 0.0058** | 0.006** | 0.0057** | 0.0061** | 0.0058** | 0.006** |
|  | (0.0028) | (0.0028) | (0.0028) | (0.0028) | (0.0028) | (0.0028) |
| partnership | -0.0379 | -0.0421 | -0.0385 | -0.0404 | -0.0372 | -0.0426 |
|  | (0.0433) | (0.0434) | (0.0434) | (0.0433) | (0.0435) | (0.0434) |
| loan | 0.0186 | -0.0023 | 0.0176 | -0.0022 | 0.0179 | -0.0026 |
|  | (0.0491) | (0.051) | (0.0494) | (0.0512) | (0.0492) | (0.051) |
| profitchange | 0.0029*** | 0.003*** | 0.0029*** | 0.003*** | 0.0029*** | 0.003*** |
|  | (0.0009) | (0.001) | (0.0009) | (0.001) | (0.0009) | (0.001) |
| expansion | 0.0648*** | 0.0704*** | 0.0648*** | 0.0702*** | 0.0645*** | 0.0703*** |
|  | (0.0146) | (0.0147) | (0.0146) | (0.0147) | (0.0147) | (0.0147) |
| comp_high: diff. between medium (1) and small (0) |  |  | -0.0136 (0.1139) |  |  |  |
| competitors: diff. between medium (1) and small (0) |  |  |  | 0.0114 (0.0111) |  |  |
| comp_high: diff. between services (1) and non-services (0) |  |  |  |  | -0.0252 (0.0939) |  |
| competitors: diff. between services (1) and non-services (0) |  |  |  |  |  | -0.0022 (0.0095) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |
| Pseudo R-squared | 0.1443 | 0.1389 | 0.1444 | 0.1403 | 0.1444 | 0.1389 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; For dummy variables, the marginal effect is the discrete change from 0 to 1

## Table 6. Logit average marginal effects: Improved marketing

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | imprvdmrktg | imprvdmrktg | imprvdmrktg | imprvdmrktg | imprvdmrktg | imprvdmrktg |
| comp_high | 0.1106** |  | 0.1105** |  | 0.1113** |  |
|  | (0.0438) |  | (0.0438) |  | (0.0438) |  |

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| competitors |  | 0.0093*** |  | 0.009*** |  | 0.0097*** |
|  |  | (0.0032) |  | (0.0033) |  | (0.0033) |
| services | 0.052 | 0.0437 | 0.0527 | 0.0451 | 0.0505 | 0.0402 |
|  | (0.0501) | (0.0497) | (0.0502) | (0.0496) | (0.0503) | (0.0488) |
| firmyears | -0.0013 | -0.0015 | -0.0013 | -0.0014 | -0.0013 | -0.0015 |
|  | (0.0017) | (0.0017) | (0.0017) | (0.0017) | (0.0017) | (0.0017) |
| ageowner | -0.0022 | -0.0021 | -0.0021 | -0.0022 | -0.0021 | -0.0021 |
|  | (0.0019) | (0.0019) | (0.0019) | (0.0019) | (0.0019) | (0.0019) |
| medium | -0.1151* | -0.1012 | -0.1141* | -0.0988 | -0.1136* | -0.1016 |
|  | (0.0673) | (0.065) | (0.0671) | (0.0643) | (0.0674) | (0.0649) |
| employ | 0.0007 | 0.0006 | 0.0007 | 0.0006 | 0.0007 | 0.0006 |
|  | (0.0008) | (0.0008) | (0.0008) | (0.0008) | (0.0008) | (0.0008) |
| advancedskill | -0.0256*** | -0.0279*** | -0.0255*** | -0.0279*** | -0.0258*** | -0.0279*** |
|  | (0.0072) | (0.0071) | (0.0072) | (0.0071) | (0.0072) | (0.0071) |
| collegeemp | 0.0002 | -0.0001 | 0.0002 | -0.0002 | 0.0002 | -0.0001 |
|  | (0.0008) | (0.0008) | (0.0008) | (0.0008) | (0.0008) | (0.0008) |
| trainingcost | 0.0037 | 0.004 | 0.0036 | 0.0042 | 0.0038 | 0.004 |
|  | (0.0029) | (0.0029) | (0.0029) | (0.0029) | (0.0028) | (0.0029) |
| partnership | -0.0505 | -0.0527 | -0.0512 | -0.0509 | -0.048 | -0.0535 |
|  | (0.0473) | (0.0471) | (0.0473) | (0.047) | (0.0474) | (0.0471) |
| loan | 0.0646 | 0.0475 | 0.0637 | 0.0485 | 0.0626 | 0.0468 |
|  | (0.0526) | (0.0536) | (0.0527) | (0.0539) | (0.0527) | (0.0535) |
| profitchange | 0.0019** | 0.0021** | 0.0019** | 0.0021** | 0.0019** | 0.0021** |
|  | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| expansion | 0.0826*** | 0.0858*** | 0.0826*** | 0.0856*** | 0.0818*** | 0.0856*** |
|  | (0.0157) | (0.0155) | (0.0157) | (0.0155) | (0.0158) | (0.0155) |
| comp_high: diff. between medium (1) and small (0) |  |  | -0.0221 |  |  |  |
|  |  |  | (0.1231) |  |  |  |
| competitors: diff. between medium (1) and small (0) |  |  |  | 0.0107 |  |  |
|  |  |  |  | (0.0098) |  |  |
| comp_high: diff. between services (1) and non-services (0) |  |  |  |  | -0.0835 |  |
|  |  |  |  |  | (0.1065) |  |
| competitors: diff. between services (1) and non-services (0) |  |  |  |  |  | -0.0055 |
|  |  |  |  |  |  | (0.0102) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |
| Pseudo R-squared | 0.1142 | 0.1173 | 0.1143 | 0.1186 | 0.115 | 0.1175 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; For dummy variables, the marginal effect is the discrete change from 0 to 1

## IV.C. Discussions and Implications

The results suggest that when faced with tough competition, SMEs are more likely to innovate; and they are more likely to do so by improving their marketing and their production process than by introducing new products or improving existing ones. The type of innovation most strongly

associated with competition is improving the production process, followed by improving marketing. It is most weakly associated with introducing a product new to the market and with improving an existing product.

The positive relationship between competition and the different forms of innovation, albeit of varying magnitude, suggests that the possible positive effect of competition on innovation outweighs its negative effect. As discussed earlier, there are competing theories on how competition affects innovation. Strong competition can force firms to innovate to improve its competitiveness (Aghion et al 1999; Porter 1990). Developing new products, improving existing ones, enhancing the production process, and improving marketing can help firms adapt to a highly competitive environment. However, strong competition can also reduce a firm's market share, revenues, and profit, providing disincentives to innovate. Some forms of innovation require considerable amount of financial assets, making it harder to innovate in a highly competitive environment (Aghion and Howitt 1992; Cohen and Levine 1989). The results suggest that, in general, the former outweighs the latter.

However, it must be noted that the strength of the competition-innovation relationship varies across different types of innovation. It is weaker on innovations that arguably require more capital and money – developing new products and improving existing ones – compared to innovations that require less of these, such as improving marketing strategies. This result supports the contrasting theories on the effect of competition on innovation. On one hand, stiff competition forces SMEs to innovate to be more competitive, as shown by the positive association between competition and innovation. On the other hand, there is an opposite reaction – stiff competition reduces market shares, revenues, and profits making it more difficult to implement innovations that require more financial capital.

That the positive effect of competition outweighs its negative effect could be explained by factors internal and external to the SMEs covered by the survey. Some studies (Schmutzler 2013; Hashmi 2013) attempted to reconcile the contrasting theories by identifying conditions wherein competition-innovation relationship is more likely to be positive and when it is more likely to be negative. Hashmi explained that when the technologies used by firms are more similar, competition will have an inverted-U relationship with innovation; i.e. at low levels of competition, the relationship is positive, but it will turn negative at high levels of competition. Schmutzler identified two factors that influence the effect of competition on cost-reducing investments – lower marginal cost makes a positive effect more likely while innovation spillovers make the relationship more likely to be negative.

Another result of interest is the moderating effect of being a medium sized firm on the positive relationship between competition and introducing a new product. The marginal effect of competition on the likelihood of introducing a new product is smaller for medium firms than it is for small ones. It is also notable that this is not observed in other forms of innovation. A possible explanation for this is because medium firms are larger, they are naturally more innovative than

small businesses. That is, they do not require the motivation of a strong competition to innovate. Therefore, the impact of competition is not that large compared to small firms.

There is also some weak evidence that the competition-innovation relationship varies across sectors. The positive relationship between strong competition and improving existing products is weaker among services SMEs than those in the industry sector.

## V. Summary and Conclusion

Competition has two possible contrasting effects on firm innovation. On one hand, competition can force SMEs to become more competitive by innovating through the introduction of new and improvement of existing products, enhancement of production processes, and improvements in marketing On the other hand, competition can shrink the SME's market share particularly if the competitor can offer better products or lower prices, making it difficult to implement financial-capital-intensive innovation.

Using data from a survey of 480 SMEs in two regions in the Philippines, this paper found evidence that there is a generally positive association between competition and innovation. The magnitude of the relationship, however, depends on the type of innovation. The type of innovation most strongly associated with competition is improving the production process, followed by improving marketing. It is most weakly associated with introducing a product new to the market and with improving an existing product. The types of innovation with the strongest association with competition are those that require the least financial resources, as competition can shrink market share, which can potentially reduce profit and revenue.

There is also some evidence that the magnitude of competition-innovation relationship varies across sectors and firm size. For some forms of innovation, the relationship is weaker for medium firms compared to small businesses. A possible explanation for this is because medium firms are larger, they naturally have greater propensity to innovate than small businesses do. There is also weak evidence that the competition-innovation relationship is weaker for services firms compared to those from the industry sector.

## References

Abor, J. & P. Quartey. 2010. Issues in SME development in Ghana and South Africa. *International Research Journal of Finance and Economics* 39: 218-228.

Acs, Z. & D. Audretsch. 1987. Innovation, market structure, and firm size. *Review of Economics and Statistics* 69(4): 567-574.

Acs, Z. & D. Audretsch. 1987. Innovation in large and small firms: An empirical analysis. *American Economic Review* 78(4): 678-690.

Aghion, P. & P. Howitt. 1992. A model of growth through creative destruction. *Econometrica* 60(2): 323-351.

Aghion, P. & P. Howitt. 1996. Research and Development in the Growth Process. *Journal of Economic Growth* 1(1): 49-73.

Aghion, P. & P. Howitt. 1998. *Endogenous Growth Theory*. Cambridge: MIT Press.

Aghion, P., M. Dewatripont, & P. Rey. 1999. Competition, financial discipline, and growth. *Review of Economic Studies* 66(4): 825-852.

Aghion, P., N. Bloom, R. Blundell, R. Griffith, & P. Howitt. 2005. Competition and innovation: An inverted-U relationship. *Quarterly Journal of Economics* 120(2): 701-728.

Aghion, P., R. Blundell, R. Griffith, P. Howitt, & S. Prantl. 2009. The effects of entry on incumbent innovation and productivity. *Review of Economics and Statistics* 91(1): 20-32.

Ahn, S. 2002. Competition, innovation and productivity growth: A review of theory and evidence. *Organisation for Economic Co-operation and Development Economics Department Working Paper* No. 317.

Alsharkas, Z. 2015. Firm size, competition, financing and innovation. *International Journal of Management and Economics* 44(1): 51-73.

Angelmar, R. 1985. Market structure and research intensity in high-technological-opportunity industries. *Journal of Industrial Economics* 34(1): 69-79.

Baily, M. & H. Gersbach. 1995. Efficiency in manufacturing and the need for global competition. *Brookings Papers on Economic Activity: Microeconomics* 1995: 307-358.

Beck, T. & A. Demirguc-Kunt. 2006. Small and medium-size enterprises: Access to finance as growth constraint. *Journal of Banking and Finance* 30(11): 2931-2943.

Berger, A.N. & G.F. Udell. 1998. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking and Finance* 22(6-8): 613-673.

Blundell, R., R. Griffith, & J. Van Reenen. 1999. Market share, market value and innovation in a panel of British manufacturing firms. *The Review of Economic Studies* 66(3): 529-554.

Boldrin, M., J.C. Allamand, D. Levine, & C. Ornaghi. 2011. Competition and Innovation. *Cato Papers on Public Policy* 1: 109-171.

Carlin, W., M. Schaffer, & P. Seabright. 2004. A minimum of rivalry: Evidence from transition economies on the importance of competition for innovation and growth. *Contributions to Economic Analysis and Policy* 3(1): 1-43.

Cohen, W. & R. Levin. 1989. Empirical studies of innovation and market structure. In R. Schumalensee and R. Willig (eds.), *Handbook of Industrial Organization, Vol. 2*, p. 1059-1107. Amsterdam: North-Holland.

Culbertson, J. & W. Mueller. 1985. The influence of market structure on technological performance in the food manufacturing industries. *Review of Industrial Organization* 2(1): 40-54.

Damanpour, F. 2010. An integration of research findings of effects of firm size and market competition on product and process innovations. *British Journal of Management* 21(4): 996-1010.

Daño-Luna, M., T. Canare, & J. Francisco. 2018. Drivers of Philippine SME competitiveness: Results of the 2018 SME survey. *Asian Institute of Management Rizalino S. Navarro Policy Center for Competitiveness Working Paper* 2018-003.

ERIA (Economic Research Institute for ASEAN and East Asia). 2014. ASEAN SME Policy Index 2014: Towards Competitive and Innovative ASEAN SMEs. *ERIA Research Project Report 2012*, No. 8.

Fernandez, E., S. Iglesias-Antelo, V. Lopez-Lopez, M. Rodriguez-Rey, & C. Fernandez-Jardon. 2019. Firm and industry effects on small, medium-sized and large firms' performance. *BRQ Business Research Quarterly* 22(1): 25-35.

Galdon-Sanchez, J. & J. Schmitz Jr. 2002. Competitive pressure and labor productivity: World iron-ore markets in the 1980s. *American Economic Review* 92(4): 1222-1235.

Geroski, P. 1990. Innovation, technological opportunity, and market structure. *Oxford Economic Papers* 42(3): 586-602.

Gilbert, R. 2006. Looking for Mr. Schumpeter: Where are we in the competition-innovation debate? In J. Lerner & S. Stern (eds.) *Innovation Policy and the Economy*, p. 159-215. Cambridge: MIT Press.

Gilbert, R. 2007. *Competition and innovation*. Berkeley: University of California - Berkeley Competition Policy Center.

Hashmi, A. 2013. Competition and innovation: The inverted-U relationship revisited. *Review of Economics and Statistics* 95(5): 1653-1668.

Klapper, L., L. Laeven & R. Rajan. 2006. Entry regulation as a barrier to entrepreneurship. *Journal of Financial Economics* 82(3): 591-629.

Lee, J. & J. Runge. 2001. Adoption of information technology in small business: Testing drivers of adoption for entrepreneurs. *Journal of Computer Information Systems* 42(1): 44-57.

Levin, R., W. Cohen, & D. Mowery. 1985. R&D appropriability, opportunity, and market structure: New evidence on some Schumpeterian hypothesis. *American Economic Review* 75(2): 20-24.

Lunn, J. 1986. An empirical analysis of process and product patenting: A simultaneous equation framework. *Journal of Industrial Economics* 34(3): 319-330.

Lunn, J. & S. Martin. 1986. Market structure, firm structure, and research and development. *Quarterly Review of Economics and Business* 26(1): 31-44.

McAdam, R., T. McConvery, & G. Armstrong. 2004. Barriers to innovation within small firms in a peripheral location. *International Journal of Entrepreneurial Behavior & Research* 10(3): 206-221.

McGrath, R.G., M. Tsai, S. Venkataraman, & I.C. MacMillan. 1996. *Management Science* 42(3): 389-403.

Nickell, S. 1996. Competition and corporate performance. *Journal of Political Economy* 104(4): 724-746.

Okada, Y. 2005. Competition and productivity in Japanese manufacturing industries. *National Bureau of Economic Research Working Paper* 11540.

Porter, M.E. 1990. *The Competitive Advantage of Nations*. London: Macmillan.

Porter, M.E. 1992. Capital disadvantage: America's failing capital investment system. *Harvard Business Review* 70(5): 65-82.

Rogerson, C.M. 2013. Improving market access opportunities for urban small, medium and micro-enterprises in South Africa. Urbani Izziv, 24(2): 133-143.

Schmutzler, A. 2009. Is competition good for innovation? A simple approach to an unresolved question. *Foundations and Trends in Microeconomics* 5(6): 355-428.

Schmutzler, A. 2013. Competition and investment – a unified approach. *International Journal of Industrial Organization* 31(5): 477-487.

Schumpeter, J.A. 1942. *Capitalism, Socialism, and Democracy*. New York: Harper and Row.

Scott, J. 1984. Firm versus industry variability in R&D intensity. In Z. Griliches (ed.) *R&D, Patents, and Productivity*, p. 233-248. Chicago: University of Chicago Press.

Spithoven, A., W. Vanhaverbeke, & N. Roijakkers. 2013. Open innovation practices in SMEs and large enterprises. *Small Business Economics* 41(3): 537-562.

Tabas, J., M. Beranova, & J. Vavrina. 2011. Barriers to Development of the Innovation Potential in the Small and Medium-Sized Enterprises. *Acta Universitatis Agriculturae Et Silviculturae Mendeliane Brunensis* 59(7): 447-458.

Tang, J. 2006. Competition and innovation behavior. *Research Policy* 35(1): 68-82.

Tether, B. 2005. Do services innovate (differently)? Insights from the European Innobarometer survey. *Industry and Innovation* 12(2): 153-184.

Thong, J.Y.L. & C.S. Yap. 1995. CEO characteristics, organizational characteristics and information technology adoption in small businesses. *Omega* 23(4): 429-442.

Tingvall, P. & P. Karpaty. 2011. Service-sector competition, innovation, and R&D. *Economics of Innovation and New Technology* 20(1): 63-88.

Vossen, R.W. 1998. Combining small and large firm advantages in innovation: Theory and examples. *University of Groningen, Research Institute SOM Research Report* 98B21.

World Bank and International Finance Corporation (IFC). 2012. *Doing Business 2013: Smarter Regulations for Small and Medium-Size Enterprises*. The World Bank and International Finance Corporation, Washington.

World Bank and International Finance Corporation (IFC). 2013. *Doing Business 2014: Understanding Regulations for Small and Medium-Size Enterprises*. The World Bank and International Finance Corporation, Washington.

## Appendix 1. Logit coefficients

### 1.1. Logit coefficients: Product new to the company

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| comp_high | 0.534** |  | 0.779*** |  | 0.469 |  |
|  | (0.242) |  | (0.264) |  | (0.512) |  |
| competitors |  | 0.0358** |  | 0.0493*** |  | -0.00224 |
|  |  | (0.0149) |  | (0.0178) |  | (0.0375) |
| services | 0.690** | 0.643** | 0.760*** | 0.633** | 0.660** | 0.467 |
|  | (0.272) | (0.274) | (0.281) | (0.275) | (0.331) | (0.329) |
| firmyears | -0.00627 | -0.00705 | -0.00945 | -0.00763 | -0.00623 | -0.00733 |
|  | (0.00914) | (0.00927) | (0.00947) | (0.00926) | (0.00913) | (0.00932) |
| ageowner | 0.0211** | 0.0209** | 0.0244** | 0.0221** | 0.0210** | 0.0211** |
|  | (0.00996) | (0.00977) | (0.0101) | (0.00982) | (0.00997) | (0.00978) |
| medium | 0.249 | 0.346 | 0.983** | 0.597* | 0.247 | 0.355 |
|  | (0.326) | (0.321) | (0.386) | (0.351) | (0.326) | (0.322) |
| employ | 0.000372 | -0.000992 | 0.00177 | -0.00152 | 0.000352 | -0.00127 |
|  | (0.00397) | (0.00377) | (0.00395) | (0.00369) | (0.00397) | (0.00381) |
| advancedskill | 0.0573 | 0.0461 | 0.0642 | 0.0446 | 0.0574 | 0.0473 |
|  | (0.0410) | (0.0409) | (0.0414) | (0.0411) | (0.0411) | (0.0410) |
| collegeemp | 0.00601 | 0.00456 | 0.00581 | 0.00491 | 0.00601 | 0.00474 |
|  | (0.00407) | (0.00405) | (0.00412) | (0.00408) | (0.00407) | (0.00406) |
| trainingcost | 0.00458 | 0.00602 | 0.000760 | 0.00556 | 0.00447 | 0.00547 |
|  | (0.0138) | (0.0139) | (0.0140) | (0.0140) | (0.0138) | (0.0140) |

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| partnership | 0.476** | 0.465** | 0.452* | 0.456* | 0.473** | 0.475** |
| | (0.236) | (0.235) | (0.238) | (0.237) | (0.236) | (0.236) |
| loan | 0.702*** | 0.585** | 0.669** | 0.597** | 0.704*** | 0.590** |
| | (0.260) | (0.259) | (0.263) | (0.260) | (0.261) | (0.259) |
| profitchange | -0.00645 | -0.00625 | -0.00717 | -0.00644 | -0.00642 | -0.00634 |
| | (0.00518) | (0.00529) | (0.00516) | (0.00525) | (0.00518) | (0.00532) |
| expansion | 0.667*** | 0.684*** | 0.676*** | 0.684*** | 0.668*** | 0.688*** |
| | (0.0977) | (0.0966) | (0.0994) | (0.0970) | (0.0984) | (0.0978) |
| comp_high*medium | | | -1.872*** | | | |
| | | | (0.582) | | | |
| competitors*medium | | | | -0.0495 | | |
| | | | | (0.0330) | | |
| comp_high*services | | | | | 0.0799 | |
| | | | | | (0.569) | |
| competitors*services | | | | | | 0.0425 |
| | | | | | | (0.0407) |
| Constant | -3.940*** | -3.785*** | -4.208*** | -3.885*** | -3.914*** | -3.653*** |
| | (0.664) | (0.662) | (0.672) | (0.665) | (0.676) | (0.670) |
| | | | | | | |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

## 1.2. Logit coefficients: Product new to the market

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| comp_high | 0.193 | | 0.422* | | 0.439 | |
| | (0.238) | | (0.256) | | (0.502) | |
| competitors | | 0.0394*** | | 0.0485*** | | 0.0305 |
| | | (0.0132) | | (0.0153) | | (0.0398) |
| services | 0.541** | 0.486* | 0.602** | 0.480* | 0.651* | 0.443 |
| | (0.273) | (0.278) | (0.284) | (0.279) | (0.357) | (0.344) |
| firmyears | -0.0125 | -0.0126 | -0.0152 | -0.0129 | -0.0127 | -0.0126 |
| | (0.00996) | (0.00999) | (0.0105) | (0.00999) | (0.00999) | (0.0100) |
| ageowner | 0.0118 | 0.0105 | 0.0145 | 0.0115 | 0.0120 | 0.0106 |
| | (0.0103) | (0.0103) | (0.0104) | (0.0104) | (0.0103) | (0.0103) |
| medium | 0.521* | 0.578* | 1.187*** | 0.773** | 0.528* | 0.580* |
| | (0.306) | (0.305) | (0.379) | (0.334) | (0.307) | (0.304) |
| employ | 0.00355 | 0.00213 | 0.00487 | 0.00173 | 0.00364 | 0.00206 |
| | (0.00405) | (0.00366) | (0.00417) | (0.00362) | (0.00405) | (0.00368) |
| advancedskill | 0.0262 | 0.0195 | 0.0322 | 0.0189 | 0.0258 | 0.0197 |
| | (0.0403) | (0.0410) | (0.0406) | (0.0411) | (0.0401) | (0.0411) |
| collegeemp | 0.00775* | 0.00699* | 0.00756* | 0.00724* | 0.00778* | 0.00704* |
| | (0.00399) | (0.00397) | (0.00403) | (0.00399) | (0.00399) | (0.00398) |
| trainingcost | 0.0344** | 0.0358** | 0.0312** | 0.0354** | 0.0348** | 0.0357** |
| | (0.0137) | (0.0139) | (0.0139) | (0.0139) | (0.0137) | (0.0139) |
| partnership | 0.486** | 0.533** | 0.458* | 0.527** | 0.496** | 0.535** |
| | (0.236) | (0.236) | (0.239) | (0.237) | (0.236) | (0.237) |
| loan | 0.700*** | 0.626** | 0.678*** | 0.630** | 0.691*** | 0.627** |

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | (0.259) | (0.255) | (0.262) | (0.255) | (0.260) | (0.255) |
| profitchange | -0.00176 | 0.000113 | -0.00233 | 6.46e-06 | -0.00183 | 9.48e-05 |
| | (0.00477) | (0.00481) | (0.00474) | (0.00479) | (0.00477) | (0.00482) |
| expansion | 0.577*** | 0.583*** | 0.580*** | 0.582*** | 0.575*** | 0.583*** |
| | (0.0908) | (0.0889) | (0.0911) | (0.0891) | (0.0910) | (0.0895) |
| comp_high*medium | | | -1.711*** | | | |
| | | | (0.582) | | | |
| competitors*medium | | | | -0.0382 | | |
| | | | | (0.0275) | | |
| comp_high*services | | | | | -0.301 | |
| | | | | | (0.552) | |
| competitors*services | | | | | | 0.00979 |
| | | | | | | (0.0422) |
| Constant | -3.893*** | -3.920*** | -4.112*** | -3.998*** | -3.994*** | -3.888*** |
| | (0.686) | (0.681) | (0.692) | (0.686) | (0.725) | (0.688) |
| | | | | | | |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

### 1.3. Logit coefficients: Improved existing products

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| comp_high | 0.488* | | 0.460 | | 2.010* | |
| | (0.287) | | (0.313) | | (1.066) | |
| competitors | | 0.0116 | | 0.00641 | | -0.0171 |
| | | (0.0119) | | (0.0123) | | (0.0461) |
| services | -0.291 | -0.272 | -0.300 | -0.262 | 0.0377 | -0.412 |
| | (0.307) | (0.313) | (0.309) | (0.313) | (0.348) | (0.393) |
| firmyears | 0.00667 | 0.00542 | 0.00690 | 0.00582 | 0.00608 | 0.00531 |
| | (0.0118) | (0.0120) | (0.0118) | (0.0119) | (0.0119) | (0.0120) |
| ageowner | 0.00469 | 0.00612 | 0.00450 | 0.00541 | 0.00513 | 0.00636 |
| | (0.0111) | (0.0111) | (0.0112) | (0.0111) | (0.0112) | (0.0112) |
| medium | -0.434 | -0.360 | -0.514 | -0.559 | -0.401 | -0.353 |
| | (0.385) | (0.381) | (0.455) | (0.446) | (0.391) | (0.380) |
| employ | -0.00115 | -0.00127 | -0.00128 | -0.000942 | -0.000839 | -0.00147 |
| | (0.00472) | (0.00489) | (0.00482) | (0.00497) | (0.00469) | (0.00487) |
| advancedskill | -0.142*** | -0.147*** | -0.143*** | -0.147*** | -0.146*** | -0.147*** |
| | (0.0445) | (0.0441) | (0.0446) | (0.0442) | (0.0442) | (0.0442) |
| collegeemp | -0.00383 | -0.00503 | -0.00382 | -0.00533 | -0.00358 | -0.00495 |
| | (0.00490) | (0.00491) | (0.00491) | (0.00496) | (0.00487) | (0.00491) |
| trainingcost | 0.0546** | 0.0548*** | 0.0551** | 0.0554*** | 0.0568*** | 0.0545** |
| | (0.0214) | (0.0212) | (0.0216) | (0.0213) | (0.0214) | (0.0212) |
| partnership | 0.0246 | -0.00635 | 0.0279 | 0.00142 | 0.0572 | 0.00240 |
| | (0.287) | (0.284) | (0.288) | (0.284) | (0.290) | (0.286) |
| loan | 0.564 | 0.496 | 0.571 | 0.490 | 0.540 | 0.505 |
| | (0.385) | (0.390) | (0.387) | (0.392) | (0.386) | (0.390) |
| profitchange | 0.0156*** | 0.0148** | 0.0157*** | 0.0149** | 0.0149*** | 0.0148** |
| | (0.00573) | (0.00582) | (0.00572) | (0.00585) | (0.00558) | (0.00585) |
| expansion | 0.292*** | 0.315*** | 0.293*** | 0.316*** | 0.280** | 0.318*** |

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | (0.113) | (0.113) | (0.112) | (0.114) | (0.111) | (0.115) |
| comp_high*medium | | | 0.205 | | | |
| | | | (0.760) | | | |
| competitors*medium | | | | 0.0367 | | |
| | | | | (0.0486) | | |
| comp_high*services | | | | | -1.717 | |
| | | | | | (1.115) | |
| competitors*services | | | | | | 0.0308 |
| | | | | | | (0.0472) |
| Constant | 0.602 | 0.693 | 0.620 | 0.738 | 0.315 | 0.799 |
| | (0.687) | (0.683) | (0.702) | (0.684) | (0.694) | (0.695) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

## 1.4. Logit coefficients: Improved production process

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| comp_high | 0.835*** | | 0.861*** | | 0.974* | |
| | (0.247) | | (0.272) | | (0.542) | |
| competitors | | 0.0530*** | | 0.0433** | | 0.0637 |
| | | (0.0188) | | (0.0215) | | (0.0494) |
| services | 0.0115 | -0.0104 | 0.0155 | 0.000685 | 0.0571 | 0.0367 |
| | (0.259) | (0.253) | (0.259) | (0.253) | (0.305) | (0.354) |
| firmyears | 0.0114 | 0.00972 | 0.0111 | 0.0104 | 0.0113 | 0.00975 |
| | (0.0110) | (0.0112) | (0.0109) | (0.0111) | (0.0110) | (0.0112) |
| ageowner | 0.00467 | 0.00652 | 0.00485 | 0.00588 | 0.00471 | 0.00649 |
| | (0.0105) | (0.0105) | (0.0105) | (0.0105) | (0.0105) | (0.0105) |
| medium | -0.950*** | -0.868*** | -0.888** | -1.111** | -0.947*** | -0.870*** |
| | (0.343) | (0.328) | (0.425) | (0.436) | (0.344) | (0.328) |
| employ | 0.00613 | 0.00594 | 0.00624 | 0.00609 | 0.00618 | 0.00599 |
| | (0.00431) | (0.00444) | (0.00439) | (0.00448) | (0.00428) | (0.00440) |
| advancedskill | -0.117*** | -0.131*** | -0.117*** | -0.131*** | -0.117*** | -0.131*** |
| | (0.0393) | (0.0391) | (0.0394) | (0.0391) | (0.0394) | (0.0391) |
| collegeemp | -0.00441 | -0.00661 | -0.00441 | -0.00689* | -0.00437 | -0.00665 |
| | (0.00408) | (0.00414) | (0.00407) | (0.00419) | (0.00407) | (0.00414) |
| trainingcost | 0.0334** | 0.0342** | 0.0330** | 0.0351** | 0.0337** | 0.0344** |
| | (0.0162) | (0.0161) | (0.0162) | (0.0162) | (0.0162) | (0.0162) |
| partnership | -0.219 | -0.241 | -0.223 | -0.232 | -0.215 | -0.244 |
| | (0.251) | (0.249) | (0.252) | (0.250) | (0.252) | (0.250) |
| loan | 0.108 | -0.0133 | 0.102 | -0.0125 | 0.104 | -0.0149 |
| | (0.288) | (0.291) | (0.289) | (0.292) | (0.288) | (0.290) |
| profitchange | 0.0167*** | 0.0170*** | 0.0167*** | 0.0173*** | 0.0167*** | 0.0170*** |
| | (0.00546) | (0.00577) | (0.00545) | (0.00580) | (0.00547) | (0.00576) |
| expansion | 0.373*** | 0.401*** | 0.373*** | 0.401*** | 0.371*** | 0.401*** |
| | (0.0924) | (0.0935) | (0.0925) | (0.0937) | (0.0930) | (0.0936) |
| comp_high*medium | | | -0.166 | | | |
| | | | (0.630) | | | |
| competitors*medium | | | | 0.0560 | | |

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | | (0.0592) | | |
| comp_high*services | | | | | -0.169 | |
| | | | | | (0.606) | |
| competitors*services | | | | | | -0.0120 |
| | | | | | | (0.0526) |
| Constant | -0.516 | -0.455 | -0.529 | -0.404 | -0.554 | -0.493 |
| | (0.630) | (0.617) | (0.633) | (0.621) | (0.632) | (0.637) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

## 1.5. Logit coefficients: Improved marketing

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| comp_high | 0.560** | | 0.582** | | 0.869* | |
| | (0.228) | | (0.248) | | (0.482) | |
| competitors | | 0.0467*** | | 0.0381** | | 0.0676 |
| | | (0.0163) | | (0.0179) | | (0.0466) |
| services | 0.258 | 0.218 | 0.261 | 0.225 | 0.379 | 0.311 |
| | (0.246) | (0.245) | (0.246) | (0.246) | (0.305) | (0.338) |
| firmyears | -0.00642 | -0.00747 | -0.00667 | -0.00702 | -0.00666 | -0.00738 |
| | (0.00850) | (0.00877) | (0.00861) | (0.00876) | (0.00850) | (0.00875) |
| ageowner | -0.0109 | -0.0105 | -0.0107 | -0.0111 | -0.0108 | -0.0106 |
| | (0.00949) | (0.00958) | (0.00951) | (0.00962) | (0.00955) | (0.00959) |
| medium | -0.560* | -0.495 | -0.501 | -0.714* | -0.553* | -0.498 |
| | (0.324) | (0.315) | (0.388) | (0.405) | (0.325) | (0.315) |
| employ | 0.00348 | 0.00282 | 0.00360 | 0.00299 | 0.00359 | 0.00292 |
| | (0.00392) | (0.00396) | (0.00394) | (0.00403) | (0.00396) | (0.00395) |
| advancedskill | -0.129*** | -0.141*** | -0.128*** | -0.141*** | -0.130*** | -0.141*** |
| | (0.0374) | (0.0375) | (0.0374) | (0.0375) | (0.0374) | (0.0375) |
| collegeemp | 0.000959 | -0.000662 | 0.000955 | -0.000833 | 0.00103 | -0.000747 |
| | (0.00385) | (0.00391) | (0.00385) | (0.00393) | (0.00385) | (0.00391) |
| trainingcost | 0.0186 | 0.0201 | 0.0183 | 0.0210 | 0.0192 | 0.0204 |
| | (0.0145) | (0.0145) | (0.0145) | (0.0146) | (0.0144) | (0.0145) |
| partnership | -0.255 | -0.266 | -0.258 | -0.258 | -0.242 | -0.271 |
| | (0.240) | (0.240) | (0.240) | (0.239) | (0.241) | (0.240) |
| loan | 0.330 | 0.243 | 0.326 | 0.248 | 0.321 | 0.239 |
| | (0.276) | (0.278) | (0.277) | (0.281) | (0.277) | (0.278) |
| profitchange | 0.00975** | 0.0104** | 0.00972** | 0.0105** | 0.00958** | 0.0105** |
| | (0.00488) | (0.00517) | (0.00488) | (0.00518) | (0.00489) | (0.00516) |
| expansion | 0.415*** | 0.433*** | 0.415*** | 0.433*** | 0.412*** | 0.432*** |
| | (0.0878) | (0.0876) | (0.0878) | (0.0878) | (0.0882) | (0.0877) |
| comp_high*medium | | | -0.151 | | | |
| | | | (0.596) | | | |
| competitors*medium | | | | 0.0493 | | |
| | | | | (0.0484) | | |
| comp_high*services | | | | | -0.384 | |
| | | | | | (0.543) | |
| competitors*services | | | | | | -0.0237 |

|  |  |  |  |  |  | (0.0494) |
|---|---|---|---|---|---|---|
| Constant | 0.0610 | 0.124 | 0.0479 | 0.172 | -0.0421 | 0.0481 |
|  | (0.559) | (0.553) | (0.563) | (0.557) | (0.577) | (0.578) |
| Observations | 476 | 476 | 476 | 476 | 476 | 476 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1