JOURNAL OF THE ASIA PACIFIC ECONOMY
https://doi.org/10.1080/13547860.2020.1724755

Is innovation activity persistent among small firms in developing countries? Evidence from Vietnam

Trinh Quang Long

Faculty of Finance and Banking, Ton Duc Thang University, Ho Chi Minh City, Vietnam

ABSTRACT

Using firm-level panel data collected in Vietnam biannually from 2005 to 2013, this paper examines whether innovation is persistent among small firms in Vietnam. The empirical results obtained from dynamic random effect probit show some evidence of innovation persistence among these small firms. In accordance with literature, not all types of innovation show a persistent pattern. While the upgrading the existing products is state dependent, introducing new products and updating the existing production procedure did not persist. Our estimation results also show slightly different roles of human capital of firm's owner and employees in innovation activities. While the owner's human capital is associated with creating a new product, employees' human capital is positively correlated with upgrading the existing products or production procedure. However, we do not find evidence on the roles of unobserved heterogeneity in explaining this persistence. Our results are consistent with results found in the literature for firms in developed economies.

KEYWORDS

Persistence of innovation; unobserved heterogeneity; dynamic random effect probit model; small and medium enterprises; Vietnam

JEL CODE

O31; C23; L20

1. Introduction

Technological innovation is arguably an important source of growth at firm, industry and country levels. In recent year, the issue of innovation persistence has attracted a growing interest by scholars. According to Le Bas and Scellato (2014), innovation process has two broad interrelated properties: past dependence and path (or state) dependence. While the past dependence implies that the innovation process is fully determined by the initial condition, the path dependence of innovation process means innovation activities follows one after one relentlessly and unpredictably. Understanding the drivers and mechanisms of persistency in innovation performance of firms can not only allow us to understand the industry dynamics but also help policy-makers to design appropriate policy to foster the innovation activities since each property of innovation persistence may require different policies to have the most effective outcomes.

Theoretically, however, there are opposite views on whether innovation activity is persistent or not. While Aghion and Howitt (1992) point out that technological

CONTACT Trinh Quang Long trinhquanglong@tdtu.edu.vn

change can be attributed to the process of creative destruction, Romer (1990) argues that innovation is persistent at the firm level. Indeed, as Crespi and Scellato (2014) suggested, the theoretical reasoning about firm-level persistence of innovation activities can be largely attributed to the Schumpeterian view of industry dynamics, i.e. technological change is the outcome of a gradual process of technological accumulation. Recent empirical evidence using firm-level and industry-level data in developed economies have shown that the innovation process is persistent. However, little is known about the dynamics in firms' innovation activity, especially among small firms in developing countries. This paper aims to fill this gap.

In particular, we will examine whether innovation activity is persistent and which factors drive this phenomenon among small firms in a developing country. Using micro-, small- and medium- (MSM) enterprise panel data collected biannually from 2005 to 2013 in Vietnam and adopting the 'new-to-firm' approach to measure innovation, we find that some types of innovation activity is persistent among these small firms. This result is qualitatively consistent with results found in the literature using firm-level data in developed economies. Furthermore, using a dynamic random effects (RE) discrete choice model and a new estimator recently proposed by Wooldridge (2005), we find that unobserved heterogeneity plays a small role in explaining persistence of innovation, but it has a strong association with initial innovation activity conditions. We also find the extent of persistence is slightly lower for firms in low-technology industries.

The paper extends the literature by providing empirical evidence on the persistence in innovation among MSM enterprises in developing countries. While there are a rather large number of empirical studies that explore the determinants of innovation activities, only a few looks at the persistence of the innovation activities (Le Bas and Scellato 2014; Crespi and Scellato 2014; Tavassoli and Karlsson 2015). Moreover, all these studies are conducted in developed country context. As Crespi and Scellato (2014) indicated, it is necessary to have evidence on the innovation persistence in various contexts to further understand this phenomenon. In fact, current studies relating to innovation in developing countries contain on either exploring the determinants of engaging in innovation activities or assessing the effect of innovation activities on firm performance (see, e.g. Almeida and Fernandes 2008; Gorodnichenko, Svejnar, and Terrell 2010; Ayyagari, Demirguc-Kunt, and Maksimovic 2011). Yet, there are not any studies that aim to find out whether innovation is persistent in these economies or not. To our knowledge, our paper is the first paper to try to study the persistence of innovation activity in developing countries. Furthermore, the dynamic RE approach proposed by Wooldridge (2005) allows us to control for individual heterogeneity in determining the persistence of innovation.

Vietnam is an interesting case. Similar to other developing countries, Vietnamese micro-, small- and medium-sized firms (MSMEs) account contributed significantly to her growth. In 2017, MSMEs contributed around 32% of GDP (MPI 2018). Furthermore, out of nearly 13 million jobs in the economy, these firms created 60%, or 7.8 million employments (Long, Morgan, and Tran Forthcoming). Despite the enormous contribution to the economy, MSMEs have been encountering different barriers including lack of financial accessibility, and low level of technological advancement. In this context, innovation is key for their survival, growth and development. Literature finds positive effects of innovation on internationalization, firm growth and firm productivity (Long 2016; Ho and Pham 2014; Vu 2014; Vixathep, Matsunaga, and Luong 2017). Meanwhile, some studies have found that trade liberalization, human and social capital and institutions are factors determining innovation behaviors of MSMEs firms in Vietnam (Nguyen et al. 2011; Vu 2014; Tran and Santarelli 2013). Such studies have captured some determinants of innovation activities among small firms. However, none of such studies examined the persistence of innovation activities. This study helps to further understand the innovation behaviors of MSMEs. This is important, especially in the context that current innovation policies seem ineffective (JETRO 2017).

The paper is organized as follows. Section 2 gives a brief of theoretical foundation and related literature on persistence of innovation. The data and variable construction approach are discussed in Section 3. Sections 4 and 5 present our empirical strategy and some stylized facts, respectively. Econometric results are shown in Section 6, followed by some concluding remarks in Section 7.

2. Theoretical foundation and empirical evidence

Theoretically, there are various theoretical explanations for the persistence of innovation at the firm level, including path dependence, knowledge accusation and market power dynamics (Le Bas and Scellato 2014; Suárez 2014; Crespi and Scellato 2014). First, successful innovation in the past could help firms to have an advantage over other firms, thus stimulate firms to innovate in the subsequent periods. The advantages could be permanent market power (Phillips 1971) or improved technological opportunities (Mansfield 1968) or increased internal funds (Himmelberg and Petersen 1994). These advantages will further encourage firms to innovate. Second, as argued by Nelson and Winter (1982), knowledge accumulates over time. Past innovation will help firms to increase their knowledge stocks and thus technological capacities, which in turn will allow firms to efficiently accumulate knowledge in subsequent periods (Cohen and Levinthal 1990). Third, innovation incurs sunk costs, which will act as a barrier to both entry into and exit from innovation (Sutton 1991; Peters 2009). However, there are also some counter arguments for the persistence in innovation (Schmookler 1966; Reinganum 1983). Firms may stop innovation since they find that previous innovation is sufficient, and the customers do not require anything further. Or, stagnation of demand also prevents firms from carrying out innovation activities.

Although there is extensive theoretical literature that explains the persistence in innovation activities, the empirical evidence is thin. Malerba and Orsenigo (1999) find that only a small fraction of firms was able to persist in patent activities. Similarly, Cefis and Orsenigo (2001) and Cefis (2003) also find a low degree of persistence. They also find that the degree of persistence differs from industry to industry. However, patent activities are only a narrow definition of innovation, since not all inventions are patented. Therefore, Manez et al. (2009) extend the definition of innovation by examining R&D activities of Spanish manufacturing firms between

1990 and 2000. They show that past R&D experience had affected the current decision to engage in R&D. Peters (2009) examines the persistence in innovation among manufacturing and service firms and also finds that there exists a state dependence in both groups of firms, and that the state dependency effect is stronger for the firms in the manufacturing sector. Although R&D activities are important, they cannot capture innovation in small firms. Thus, some studies define innovation as new-to-firm innovation such as introducing new products or processes (for example, Geroski, van Reenen, and Walters 1997; Duguet and Monjon 2004; Rogers 2004; Raymond et al. 2010; Triguero and Córcoles 2013; Triguero, Córcoles, and Cuerva 2014; Suárez 2014; Manez et al. 2015; Tavassoli and Karlsson 2015). However, the empirical results are inconclusive and indicate significant heterogeneity. Raymond et al. (2010) find that the persistence of innovation exists among firms in the high and medium high-technology sectors but does not exist among firms in other sectors. Peters (2009) also shows that capacities, size and access to subsidies are relevant factors explaining the innovation persistence.

To our knowledge, all studies so far on the persistence of innovation activities have been carried out in the context of developed countries. Even the literature on factors that determine innovation activities in developing countries is scare. Almeida and Fernandes (2008) examine the relationship between international technology transfer and technological innovation in developing countries. They find that firms that import intermediate inputs are more likely to acquire new technology from their suppliers. Gorodnichenko, Svejnar, and Terrell (2010) look at the impact of foreign market competition on innovation and find a robust evidence of foreign competition and innovation. Ayyagari, Demirguc-Kunt, and Maksimovic (2011) analyze the impact of access to finance, competition and governance. They find that access to external financing and exposure to foreign competition are associated with greater firm innovation. However, data availability does not allow previous studies to investigate the persistence of innovation activity in developing countries.

3. Data sources and variable construction

The data were jointly collected by the University of Copenhagen and two Vietnamese research institutes (Central Institute for Economic Management and Institute for Labor Studies and Social Affairs) in 2005, 2007, 2009, 2011 and 2013. The surveys were conducted in 10 provinces in Vietnam. In each province, the sample was stratified by the form of ownership to ensure that all types of non-state enterprises, including formal and informal firms, were represented. Subsequently, stratified random samples were drawn from a consolidated list of formal enterprises and an on-site random selection of informal firms was made. After each survey round, to replace exit firms or a small number of firms which declined to continue the survey, some firms were randomly selected from a list of formal firms compiled by the Government Statistics Office in the previous year and an on-site selection of informal firms. The sample size for each survey was around 2500 firms.

Although the sample has been slightly adjusted over time, the questionnaires are nearly the same. Information collected includes the firm's and owner/managers' production, sales and markets, and some other characteristics. The questionnaires also contain questions about innovation activities that the firms have undertaken in the last two years, between surveys.

3.1. Measuring innovation

According to Schumpeter's theory of innovation, economic development is facilitated by 'new combinations'. These combinations comprise (i) a new good, (ii) a new production method, (iii) a new market, (iv) a new source of supply of raw materials or half-manufactured goods and (v) a new organization (Schumpeter 1934).

Previously, longitudinal data on innovation activities at the firm level usually covered activities of firms in the form of patent registration and R&D expenditure in developed economies (Ayyagari, Demirguc-Kunt, and Maksimovic 2011). Although original innovations (that is, new-to-world innovations) are crucial, imitation in the form of adopting new production technology, or improving quality of the products or introducing some new products are more relevant to firms in developing countries, where most firms are engaged in activities far from the technological frontier (UNCTAD 2007). The Oslo Manual, published by OECD/Eurostat, define an innovation as 'the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations' (OECD/Eurostat 2005, 46). This definition covers four types of innovation, i.e. product innovation, process innovation, marketing innovation and organizational innovation. In this study, due to data limitation, we focus on the first two types of innovation: product innovation and process innovation.

We follow Ayyagari, Demirguc-Kunt, and Maksimovic (2011) and other literature on innovation in the context of developing economies in adopting the definition of 'new-to-firm' innovation. Ayyagari, Demirguc-Kunt, and Maksimovic (2011) definition in principle followed the Oslo Manual adopted for developing countries. We use three indicators to measure the innovation carried out by firms: (i) introducing a new product, (ii) upgrading existing products, and (iii) upgrading existing production procedure. The first two indicators represent product innovation while the last one represents process innovation. We also follow Ayyagari, Demirguc-Kunt, and Maksimovic (2011) to construct an aggregate index. *Innovation index* is a dummy variable, which takes the value of one if the firm has at least an innovation activity and zero otherwise.

3.1.1. Explanatory variables

- ***Size:*** The size of the firm is measured as the number of people employed. We also use a dummy variable to indicate whether a firm is a micro firm or not, that is, firms with fewer than 10 workers. Large firms usually have more advantages in supporting innovation activities.
- ***Age:*** Age of the firm is the log of the number of the firm's operation years at the time of the survey. This variable is to capture the learning-by-doing effect on

innovation. However, a flat learning curve and being risk averse may hinder firms to innovate.

- ***Human capital:*** Percentage of employees with college degree, owners having college degree and owners having technical skills in producing their main products capture human capital of the firms. They reflect the potentials of either employees or owners in innovation activities.
- ***Sales growth:*** The sales growth is equal to log of revenue at time *t* minus log of revenue at time *t*-1. The sales growth indicates the firm's market opportunities. Higher growth may boost firms in carrying out innovation to further grasp their current advantage. Higher growth firms may also have a larger pool of internal funds to finance their innovation.
- ***Capital intensity*** is the ratio of physical capital to total full-time employees. According to Hall and Ziedonis (2001), firms with large sunk costs would respond strategically by engaging in innovation activity.
- Being an incorporated firm is a dummy variable. It takes the value of one if the firm is either a limited firm or partnership firm or joint stock firm while it is equal to zero if the firm is a household firm or private firm (sole proprietorship). This variable captures the formality of the firm. Incorporated firms tend to serve more competitive market than household firms, which mostly serve on the local customers. Thus, an incorporated firm is more likely to engage in innovation activities than household firms.
- Finally, we also control for firm's location, industry and time dummies.

4. Empirical strategy

In this paper, we use a dynamic RE probit (and dynamic RE ordered probit) model to investigate the persistence of innovation among MSM firms and factors driving this persistence (if any). We will estimate using the following equation:

$$Inn_{it} = \alpha_0 + \alpha_1 Inn_{i,t-1} + \alpha_2 X_{it} + \mu_i + \epsilon_{it} \tag{1}$$

where Inn_{it} is the innovation indicators of firm i at time t, X_{it} is a vector of firm characteristics, including the firm's age, size, human capital, sales growth, capital intensity, industry and location dummies; μ_i is the unobserved firm characteristics and ϵ_{it} is the error term. In our specification, Inn_{it} can take five values: three binary variables for three individual indicators, one binary variable for our first aggregate innovation index and an ordered variable for our second aggregate innovation index. The estimation equation implies that innovation activity depends on previous innovation $Inn_{i,t-1}$ on observable explanatory variables X_{it} and on unobservable firm characteristics which are assumed to be constant over time and captured by μ_i.

In principle, observed persistence may be attributed to persistence on observable firm characteristics, serial correlation of errors, true dependence or permanent unobserved heterogeneity (Heckman 1981). One could obtain spurious state dependence rather than true state dependence if permanent unobserved heterogeneity and serial correlation of errors are not well controlled. To deal with this problem, following

Wooldridge (2005), we assume the firm heterogeneity (μ_i) to be explained by the following equations:

$$\mu_i = \beta_0 + \beta_1 Inn_{i0} + \overline{X_i}\beta_2 + \vartheta_i \tag{2}$$

where Inn_{i0} is the value of the innovation indicator for firm i at time $t = 0$ and $\overline{X_i} = \frac{1}{T}\sum_1^t X_{it}$ are vectors of the average over time of the firm characteristics. Substituting Equation (2) into Equation (1) yields the estimation equations

$$Inn_{it} = (\alpha_0 + \beta_0) + \alpha_1 Inn_{i,t-1} + \alpha_2 X_{it} + \beta_1 Inn_{i0} + \overline{X_i}\beta_2 + \vartheta_i + \epsilon_{it} \tag{3}$$

The variables for the average value of firm characteristics are included to control for the unobserved individual effect and their estimated coefficients do not contain meaningful economic implications (Wooldridge 2005). In this paper, we use the dynamic RE probit to estimate the innovation equation with binary dependent variables (that is three individual innovation indicators and the first aggregate innovation index) while the dynamic RE ordered probit would be used to estimate the equation of ordered dependent variable (that is, the second aggregate innovation indicator.)

5. Descriptive analysis

One limitation of the estimation methods presented above is that it required a balanced sample. Thus, in this paper, we use only balanced samples, which comprised of firms that participated in all five surveys. We also drop firms whose age is below 2 by the time of the first survey (that is, in 2005) (New firms will surely introduce a new product). The data from the 2005 survey is used as the initial conditions. Ultimately, our sample includes 1198 firms (thus, sample size is 4792). Furthermore, we divided our sample into several groups based on the industry's level of technology and firm size. Firms in food processing, garment and textile, leather and wood processing and waste recycle industries are categorized as the firms in low-tech industry group while firms in chemical, metal process, electronics and means of transportation production industries are categorized as firms in medium and high-technology group, We have 778 firms (with sample size of 3112) were in the low-technology group and 420 firms (with sample size of 1680) in the medium- and high-technology group. In terms of firm size, about 74% firms in our samples are micro firms (which by definition have less than 10 employees) while 21% of firms are small firms which have more than 10 employees and less than 50 employees and 5% are medium firms which have more than 50 employees.[1]

Table 1 presents some descriptive statistics. About 40% of firms in our sample have at least one innovation. While nearly 36% of firms report that they upgraded an existing product in the studied period, only 3.1% and 12.3% of firms in our data introduced a new product and/or upgraded their production process. Nearly 5% of firms in our data have three innovation activities in a given period (data not shown). We also find that firms in low-technology group, on average, have lower innovation activities than firms in medium- and high-technology group. We also observe some differences in other variables among firms in two groups. For example, firms in

Table 1. Some descriptive statistics.

	All sample	Low-technology industries	Medium- and high-technology industries
Introducing new products	3.1%	2.6%	3.7%
	[0.17]	[0.16]	[0.19]
Upgrading existing product	35.7%	31.2%	41.7%
	[0.48]	[0.46]	[0.49]
Upgrading existing production process	12.3%	10.8%	14.8%
	[0.33]	[0.31]	[0.36]
Innovation index	40.0%	35.4%	46.1%
	[0.49]	[0.48]	[0.50]
Firm's age	22.21	23.35	20.10
	[12.99]	[13.12]	[12.48]
Firm size (full-time employees)	12.99	11.38	15.97
	[25.16]	[24.38]	[26.30]
Revenue growth	5.64%	4.10%	8.48%
	[1.34%]	[1.46%]	[1.08%]
% employees with college degree	2.79%	1.91%	4.44%
	[0.06%]	[0.06%]	[0.08%]
Owner has college degree	15.78%	12.11%	22.56%
	[0.35%]	[0.33%]	[0.42%]
Owner has technical skills	29.86%	24.74%	39.35%
	[0.46%]	[0.43%]	[0.49%]

Note: Figures in bracket are standard errors; Low-technology industries include food processing, garment, leather, wood processing and waster recycle industries; Medium- and high-technology industries include chemical, metal producing, non-metal producing, electronic and other heavy industries.
Source: Authors' calculation.

Table 2. Transition matrix.

		All sample (%)	Low-technology industry (%)	Medium- and high-technology industry (%)
Innovator at t	Innovator at $t+1$	51.7	49.8	54.4
	Non-innovator at $t+1$	48.4	50.2	45.6
Non-innovator at t	Innovator at $t+1$	27.3	26.5	33.7
	No innovator at $t+1$	72.7	73.5	66.3

Note: Innovators are firms having at least an innovation activity (that is, introducing new products, upgrading existing products and upgrading existing production procedure.
Source: Authors' calculation.

medium and high technologies have larger size, higher growth rate, and higher level of human capital but slightly are younger than firms in low-technology industries.

To further shed light on the persistence of innovation among MSM enterprises in Vietnam, Table 2 presents the transition probabilities. About 51% of innovators (that is, firms having at least an innovation activity) in this period will continue to be innovator in the next period. However, the persistence of non-innovator (that is, firms having no innovation activity) is stronger. About 72% of non-innovators will still be non-innovators in the next period. Table 2 also indicates that, the propensity to continue innovating given innovating in the previous period (and to become an innovating firms in the next period given being non-innovator this period) of firms in the medium and high-technology group is higher than that among firms in low-technology group.

Figure 1(a,b) presents the survival rates of innovators and non-innovators cohorts by years. The survival rate is the rate that an innovator (non-innovator) at time

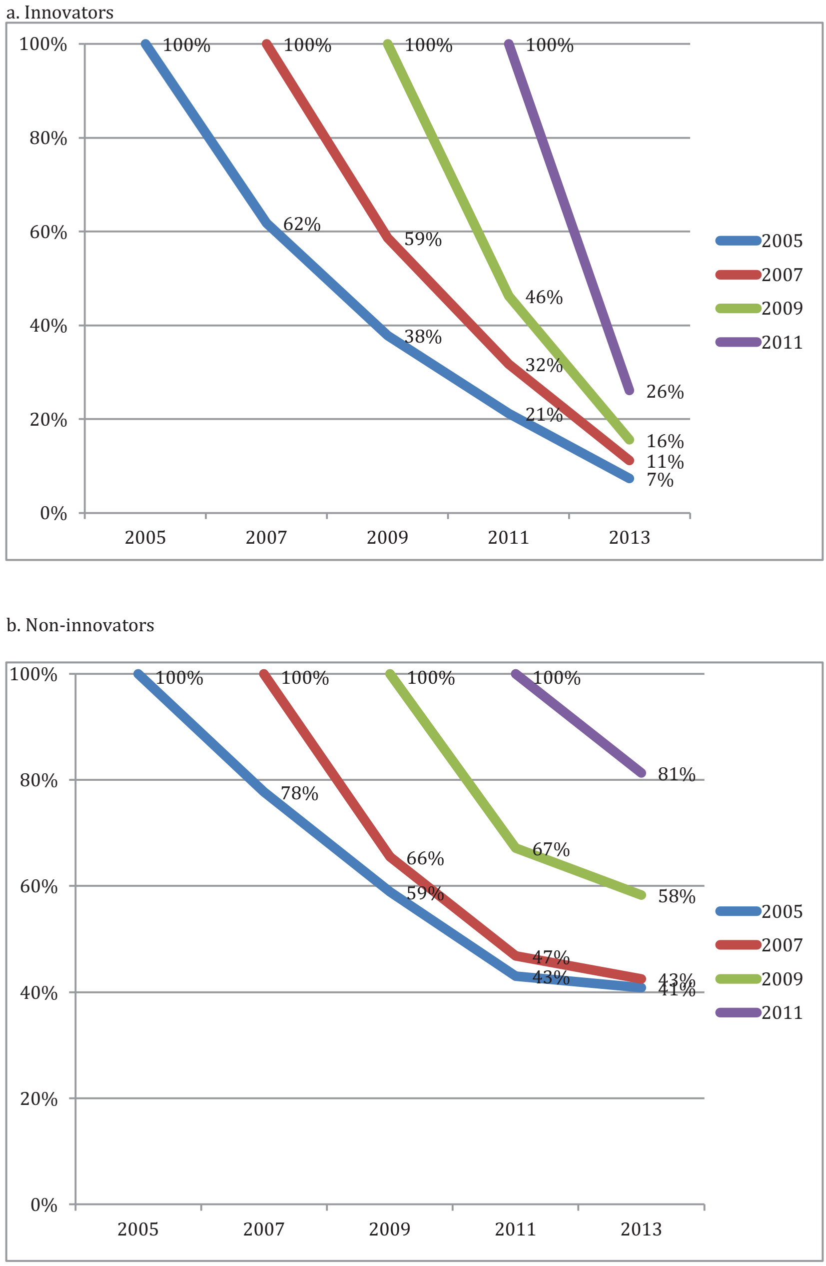

Figure 1. Survival rates of innovator and non-innovator cohorts by year: (a) Innovators and (b) non-innovators.

t continues innovating (not innovating) at time $t+s$ ($s=1\ldots 4$, in our case). We see that 52% of firms that innovated in 2005 continue to innovate in 2007 while 78% of non-innovators were still non-innovator in 2007. Only 7% who innovated in 2005 continue to have one innovation activity in 2013, however. This rate is much lower than the survival rates of non-innovators. This may suggest a small state dependence.

Table 3. Dynamic RE probit estimator (marginal effects).

Dependent variable	[1] Introduce new products	[2] Updating the existing products	[3] Updating the existing production procedure	[4] Innovation index
Lagged dependent variable	−0.002	0.066***	0.011	0.068***
	[0.009]	[0.019]	[0.015]	[0.020]
Value of dependent variable at $t = 0$	0.013**	0.087***	0.036***	0.105***
	[0.006]	[0.017]	[0.011]	[0.018]
Firm age	0	−0.057***	−0.024***	−0.066***
	[0.005]	[0.013]	[0.009]	[0.013]
Firm size (lagged)	0.012	0.036*	0.035***	0.025
	[0.008]	[0.019]	[0.012]	[0.019]
Revenue growth	−0.002	0.030***	0.010**	0.029***
	[0.002]	[0.007]	[0.004]	[0.007]
Capital intensity	0.003	−0.012	0.011**	−0.006
	[0.003]	[0.007]	[0.005]	[0.008]
% employees with college degree	−0.047	0.433***	0.278***	0.405***
	[0.052]	[0.135]	[0.083]	[0.141]
Owner has college degree	0.046**	0	0.017	0.025
	[0.020]	[0.040]	[0.027]	[0.041]
Owner has technical skills	−0.011	−0.043	−0.014	−0.043
	[0.016]	[0.031]	[0.023]	[0.031]
Being a micro firm	−0.002	0.013	0.045**	−0.004
	[0.011]	[0.028]	[0.020]	[0.028]
Being a corporate firm	0.014	−0.007	0.006	0.008
	[0.017]	[0.047]	[0.031]	[0.048]
σ	0.071	0.192	0.157	0.096
	[0.629]	[0.088]	[0.140]	[0.162]
ρ	0.005	0.036	0.024	0.009
	[0.088]	[0.031]	[0.042]	[0.030]
$N*T$	4792	4792	4792	4792

Note: Figures in bracket are standard errors, calculated using delta method. ***, ** and * denote coefficient significant at 1%, 5% and 10% statistical levels, respectively. In all specifications, we include mean of all independent variables. We also include for industry dummies, location dummies and year dummies.
Source: Authors' estimation.

6. Econometric results

Table 3 presents the marginal effects of the dynamic RE probit model for the whole sample (our benchmark estimation results). The results for each individual innovation indicators are reported in columns 1, 2 and 3, respectively. Column 4 presents the results for our innovation index (i.e. whether to carry out any innovation activity). We find that there is no persistence in two innovation indicators: introducing a new product or upgrading the existing production process while there is a state dependence in indicator relating to upgrading an existing product. The estimated coefficient is positive and statistically significant at 1% level. This result implies that, for firms that carried out upgrading their main existing product in the previous period, the probability of upgrading an existing product of is 6.6 percentage points higher than that of firms that did not. The persistence of this indicator may attribute to the persistence in our innovation index. The coefficient on the lagged innovation index is also positive and statistically significant. However, the persistence of innovation among firms in our data is much smaller than that found in studies using data from developed countries.[2] This may be attributed to the potential higher constraints that micro-, small- and medium-sized firms in developing countries face than those that their counterparts in developed countries faced.

We also find that revenue growth and capital intensity have positive and statistically significant effects on firm's innovation activities and that firms tend not to engage in innovation as they age. These results are consistent with results from Peters (2009) and Ayyagari, Demirguc-Kunt, and Maksimovic (2011). While having a college degree has a positive and statistically significant effect on introducing a new product, it does not have any statistically significant effect on other innovation indicators including the first aggregate innovation index. In contrast, the evidence shows that higher percentage of employees with college degree is positively associated with all innovative indicators, except the indicator of introducing a new product. This implies that owner's education matters in introducing new products but the employees' education plays an important role in upgrading either existing products or existing production procedure.

With regard to the role of unobserved heterogeneity, low values of $\rho \left(= \frac{\sigma_u^2}{1+\sigma_u^2}\right)$ in our estimations indicate that unobserved heterogeneity explains little about the persistence of innovation activities of firms in our data. However, the estimated coefficient on the initial condition is positive and statistically significant, implying a substantial relationship between the firm's initial innovation status and the unobserved heterogeneity.

6.1. Differences in innovation persistence across firm groups

Table 4 presents our estimations for two groups of firms by their technology level. Columns 1, 3, 5 and 7 are the results for firms with low-technology level while columns 2, 4, 6 and 8 are results for firms with medium- and high-technology levels. The estimation results for two groups of firms show a similar pattern with our benchmark estimation. That is, for both groups of firms, only the indicator indicating upgrading existing products and innovation index show a state dependence effects. There is not persistent in introducing new products or in updating the existing production procedure. However, we find that the state dependence effects are stronger among firms in the medium- and high-technology group. If a firm carried out updating existing products in this period, its likelihood of doing so in the subsequent period increase by 4.6 percentage points for firms in low-technology industries and 9.2 percentage points for firms in medium- and high-technology industries. This result is consistent with Manez et al. (2009) Raymond et al. (2010) and Hecker and Ganter (2014). Manez et al. (2009) suggest that sunk costs in innovation activity could be an explanation to these patterns.

Table 5 presents results for micro firms (columns 1, 3, 5 and 7) and small- and medium-sized firms (columns 2, 4, 6 and 8). The estimation results for two groups of firms qualitative consistent with our benchmark results. That is, for both groups of firm size, we find the persistence in upgrading the existing products, but not other types of innovation such as introducing new products and updating production procedure. However, we find a slight difference in estimated coefficients of persistence between micro firms and small- and medium-sized firms. The likelihood of updating the existing products of micro firms increases by 3.5% if they have done it in last

Table 4. Dynamic RE probit estimator (marginal effects), by the technology level.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Introduce new products		Updating the existing products		Updating the existing production procedure		Innovation index	
	Low-tech industry	Medium and high-tech industry	Low-tech industry	Medium and high-tech industry	Low-tech industry	Medium and high-tech industry	Low-tech industry	Medium and high-tech industry
Lagged dependent variable	0.000	−0.011	0.046**	0.092***	0.005	0.013	0.060***	0.072***
	[0.011]	[0.016]	[0.023]	[0.025]	[0.018]	[0.021]	[0.018]	[0.025]
Value of dependent variable at $t=0$	0.013*	0.011	0.090***	0.071***	0.029**	0.057***	0.097***	0.114***
	[0.007]	[0.011]	[0.021]	[0.027]	[0.013]	[0.019]	[0.020]	[0.030]
Firm age	−0.001	0.003	−0.043***	−0.064***	−0.017	−0.038**	−0.056***	−0.068***
	[0.006]	[0.009]	[0.016]	[0.022]	[0.011]	[0.016]	[0.016]	[0.022]
Firm size (lagged)	0.017*	0.003	0.024	0.061*	0.040**	0.035*	0.021	0.037
	[0.009]	[0.014]	[0.023]	[0.033]	[0.016]	[0.021]	[0.024]	[0.031]
Revenue growth	−0.003	0.005	0.032***	0.023*	0.012**	0.003	0.028***	0.030**
	[0.002]	[0.006]	[0.008]	[0.013]	[0.005]	[0.009]	[0.008]	[0.013]
Capital intensity	0.000	0.010*	−0.023**	0.003	0.009	0.016*	−0.019**	0.012
	[0.003]	[0.006]	[0.009]	[0.013]	[0.006]	[0.009]	[0.009]	[0.013]
% employees with university degree	0.004	−0.139	0.483***	0.359*	0.260**	0.298**	0.474**	0.304
	[0.066]	[0.093]	[0.181]	[0.207]	[0.110]	[0.133]	[0.192]	[0.210]
Owner has college degree	0.047*	0.042	−0.028	0.033	0.024	0.006	0.008	0.045
	[0.025]	[0.036]	[0.052]	[0.065]	[0.035]	[0.045]	[0.054]	[0.063]
Owner has technical skills	−0.003	−0.035	−0.023	−0.069	−0.001	−0.035	−0.023	−0.071
	[0.020]	[0.031]	[0.037]	[0.054]	[0.028]	[0.040]	[0.038]	[0.053]
Being a micro firm	−0.001	−0.004	0.014	0.011	0.041*	0.065*	−0.012	0.017
	[0.013]	[0.022]	[0.033]	[0.050]	[0.023]	[0.038]	[0.034]	[0.049]
Being a corporate firm	0.022	0.01	−0.081	0.092	−0.006	0.02	−0.033	0.074
	[0.021]	[0.029]	[0.061]	[0.073]	[0.040]	[0.050]	[0.064]	[0.073]
σ	0.14	0.001	0.223	0.003	0.127	0.003	0.005	0.01
	[0.463]	[0.088]	[0.101]	[0.029]	[0.217]	[0.029]	[0.034]	[0.098]
ρ	0.019	0.000	0.048	0.000	0.016	0.000	0.000	0.000
	[0.125]	[0.000]	[0.041]	[0.000]	[0.054]	[0.000]	[0.000]	[0.002]
$N*T$	3112	1680	3112	1680	3112	1680	3112	1680

Note: Figures in bracket are standard errors, calculated using delta method. ***, ** and * denote coefficient significant at 1%, 5% and 10% statistical levels, respectively. In all specifications, we include mean of all independent variables. We also include for industry dummies, location dummies and year dummies. We use Stata command quadchk to check the accuracy of the results.
Source: Authors' estimation.

Table 5. Dynamic RE probit estimator (marginal effects), by firm size.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Introduce new products		Updating the existing products		Updating the existing production procedure		Innovation index	
	Micro firms	Small and medium firms	Micro firms	Small and medium firms	Micro firms	Small and medium firms	Micro firms	Small and medium firms
Lagged dependent variable	0.004	−0.026	0.035*	0.123***	0.020	−0.035	0.037*	0.094***
	[0.009]	[0.018]	[0.021]	[0.030]	[0.013]	[0.035]	[0.022]	[0.031]
Value of dependent variable at $t = 0$	0.011*	0.016	0.096***	0.059	0.018	0.088***	0.108***	0.120***
	[0.006]	[0.015]	[0.019]	[0.036]	[0.011]	[0.030]	[0.020]	[0.041]
Firm age	−0.001	0.008	−0.064***	−0.023	−0.017*	−0.046*	−0.078***	−0.024
	[0.005]	[0.011]	[0.015]	[0.027]	[0.009]	[0.026]	[0.016]	[0.027]
Firm size (lagged)	0.012	0.022	0.062**	−0.004	0.007	0.079**	0.043*	0.000
	[0.010]	[0.015]	[0.025]	[0.039]	[0.014]	[0.034]	[0.024]	[0.038]
Revenue growth	0.000	−0.004	0.021***	0.052***	0.008	0.013	0.021***	0.045***
	[0.003]	[0.004]	[0.008]	[0.015]	[0.005]	[0.010]	[0.008]	[0.015]
Capital intensity	0.004	0.001	−0.008	−0.025	0.013**	−0.005	−0.003	−0.019
	[0.003]	[0.006]	[0.008]	[0.016]	[0.005]	[0.014]	[0.009]	[0.015]
% employees with university degree	−0.062	−0.052	0.394**	0.565**	0.206**	0.627***	0.412**	0.508**
	[0.061]	[0.099]	[0.171]	[0.233]	[0.094]	[0.197]	[0.184]	[0.231]
Owner has college degree	0.055**	0.048	0.044	−0.012	−0.007	0.098	0.050	0.041
	[0.026]	[0.034]	[0.057]	[0.064]	[0.033]	[0.063]	[0.059]	[0.062]
Owner has technical skills	−0.003	−0.038	−0.026	−0.123*	0.003	−0.099	−0.020	−0.136**
	[0.018]	[0.035]	[0.035]	[0.065]	[0.021]	[0.066]	[0.036]	[0.063]
Being a corporate firm	0.000	0.016	0.028	0.010	0.027	−0.028	0.008	0.015
	[0.010]	[0.030]	[0.028]	[0.073]	[0.017]	[0.067]	[0.029]	[0.072]
Σ	0.003	0.040	0.257***	0.001	0.001	0.289	0.222	0.001
	[0.023]	[0.290]	[0.086]	[0.019]	[0.012]	[0.148]	[0.092]	[0.018]
P	0.000	0.135	0.062	0.000	0.000	0.077	0.047	0.007
	[0.000]	[0.172]	[0.039]	[0.000]	[0.000]	[0.073]	[0.037]	[0.037]
N	3561	1231	3561	1231	3561	1231	3561	1231

Note: Figures in bracket are standard errors, calculated using delta method. ***, ** and * denote coefficient significant at 1%, 5% and 10% statistical levels, respectively. In all specifications, we include mean of all independent variables. We also include for industry dummies, location dummies and year dummies. We use Stata command quadchk to check the accuracy of the results.

Source: Authors' estimation.

Table 6. Robustness of estimates for the dynamic RE probit model (marginal effects).

	[1] Introduce new products	[2] Updating the existing products	[3] Updating the existing production procedure	[4] Innovation index
Panel A: All firms				
Lagged dependent variable	−0.001	0.072***	0.021	0.075***
	[0.009]	[0.020]	[0.015]	[0.021]
Value of dependent variable at $t = 0$	0.017***	0.122***	0.080***	0.151***
	[0.006]	[0.018]	[0.012]	[0.020]
Firm age	−0.005	−0.082***	−0.045***	−0.094***
	[0.005]	[0.014]	[0.010]	[0.014]
$N*T$	4792	4792	4792	4792
Panel B: low-technology industries				
Lagged dependent variable	0.001	0.050**	0.017	0.070***
	[0.010]	[0.024]	[0.019]	[0.025]
Value of dependent variable at $t = 0$	0.017**	0.135***	0.063***	0.147***
	[0.007]	[0.022]	[0.014]	[0.023]
Firm age	−0.007	−0.081***	−0.040***	−0.092***
	[0.006]	[0.017]	[0.011]	[0.017]
$N*T$	3112	3112	3112	3112
Panel C: Medium- and high-technology industries				
Lagged dependent variable	−0.01	0.108***	0.025	0.082**
	[0.016]	[0.034]	[0.027]	[0.036]
Value of dependent variable at $t = 0$	0.017	0.089***	0.107***	0.145***
	[0.012]	[0.031]	[0.021]	[0.035]
Firm age	−0.001	−0.083***	−0.057***	−0.094***
	[0.009]	[0.023]	[0.017]	[0.023]
$N*T$	1680	1680	1680	1680
Panel D: Micro firms				
Lagged dependent variable	0.004	0.036*	0.028**	0.041*
	[0.009]	[0.021]	[0.013]	[0.022]
Value of dependent variable at $t = 0$	0.013**	0.122***	0.031***	0.141***
	[0.006]	[0.020]	[0.011]	[0.021]
Firm age	−0.004	−0.076***	−0.021**	−0.092***
	[0.005]	[0.016]	[0.009]	[0.016]
$N*T$	3561	3561	3561	3561
Panel E: Small and medium firms				
Lagged dependent variable	−0.023	0.123***	−0.021	0.099***
	[0.019]	[0.030]	[0.036]	[0.031]
Value of dependent variable at $t = 0$	0.016	0.060*	0.139***	0.118***
	[0.015]	[0.036]	[0.032]	[0.041]
Firm age	0.002	−0.039	−0.080***	−0.043
	[0.011]	[0.026]	[0.026]	[0.026]
$N*T$	1231	1231	1231	1231

Note: Figures in bracket are standard errors. ***, ** and * denote coefficient significant at 1%, 5% and 10% statistical levels, respectively. In all specifications, we also control for industry dummies, location dummies and time dummies. We use Stata command quadchk to check the accuracy of the results.
Source: Authors' estimation.

period. The figure for small and medium size firm is higher, at 12.3%. This result consistent with previous results (Peters 2009; Ganter and Hecker 2013).

6.2. Robustness check

The dynamic RE probit model requires strict exogeneity of explanatory variables, that is, there are no feedback effects from the dependent variables on the future value of the explanatory variables. To assess whether inclusion of variables that potentially violate the strict exogeneity condition, we apply the stepwise procedure. If the marginal effects of lagged dependent variables change significantly as we include potential endogenous variables into the estimation, then the state dependence is spurious. Due to limited space, we only present the results obtained from a specification in which the entire explanatory variables are strictly exogenous such as the firm's age, firm's industry type, location and time (Table 6). The estimated results show that the marginal effects of lagged dependence variables are changed very slightly for the whole sample, firms in different groups by technology level and by firm size. This supports our view of true state dependence of innovation among small firms in our data.

7. Concluding remarks

This paper provides new evidence on the persistence of innovation activity among MSM enterprises in a developing country, using a unique Vietnamese panel data of micro-, small- and medium-sized firms collected every two year from 2005 to 2013. Three innovation indicators are examined: (i) introducing a new product, (ii) upgrading existing products and (iii) upgrading existing production procedure. These indicators reflect the approach of defining innovation as activities that are new to firms rather than to the markets. Using these indicators is more suitable in the context of developing countries (Ayyagari, Demirguc-Kunt, and Maksimovic 2011). The estimation results, obtained from dynamic RE probit models proposed by Wooldridge (2005), show some evidence of innovation persistence among these micro-, small- and medium-sized firms. More specifically, we find that while the upgrading the existing products is state dependent, introducing new products and updating the existing production procedure did not persist. This result is consistent with Tavassoli and Karlsson (2015)'s findings which show that not all innovation activities are persistent. Our empirical results also show the innovation persistence in low-technology industries, medium- and high-technology industries, micro firms, and small- and medium firms. However, the persistence seems to be stronger among firms in medium and high-technology industry and among larger firms. We also do not find a large contribution of unobserved heterogeneity to this persistence since the initial innovation has a strong association with unobserved heterogeneity. Our findings also show that the roles of human capital in the process of innovation are different for owners and employees, although they play a significant role in the whole process of innovation. A limitation of the study is that there is a lack of data about research and development (R&D) activities of SMEs. As a result, the study could not be able to provide insights regarding the persistence of R&D activities.

Notes

1. We follow Vietnam's official definition of firm size (Government's Decree No. 56/2009/ND-CP). Micro firms are firms with number of employees fewer than 10 people, small firms are firms with employees more than 10 and fewer than 50 and medium firms (with more than 50 employees). Since the share of medium firms is about 5%, we combined both small- and medium-sized firms into a single group.
2. For example, using German firm-level data, Peters (2009) finds that probability of engaging in an innovation activity in this period, given being an innovator in the last

period is 36 percentage points higher than that of non-innovators. Even this figure is much higher for Taiwanese electronic firms at 86 percentage points (Huang 2008).

Acknowledgments

The author gratefully acknowledges helpful comments and suggestions of editor Leong Liew, and anonymous referees, Ardeshir Sepehri (University of Manitoba), Tetsushi Sonobe (National Graduate Institute for Policy Studies, GRIPS), Naoyuki Yoshino (Asian Development Bank Institute) Tam Dong Le, and participants at various GRIPS seminars. All remaining errors are mine.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

Trinh Quang Long is an adjunct lecturer in the Faculty of Finance and Banking, Ton Duc Thang University (Vietnam) and a consultant at the Asian Development Bank Institute in Tokyo (Japan). His current researches include financial development, SME development, international trade, structural change and growth. Before joining the ADBI, he had worked as an economist at the Central Institute for Economic Management (CIEM), Vietnam's leading think-tank for more than 10 years. He received his PhD from the National Graduate Institute for Policy Studies in Tokyo (Japan).

References

Aghion, P., and P. Howitt. 1992. "A Model of Growth through Creative Destruction." *Econometrica* 60 (2): 323–351. doi:10.2307/2951599.

Almeida, R., and A. M. Fernandes. 2008. "Openness and Technological Innovations in Developing Countries: Evidence from Firm-Level Surveys." *The* Journal of Development Studies 44 (5): 701–727. doi:10.1080/00220380802009217.

Ayyagari, M., A. Demirguc-Kunt, and V. Maksimovic. 2011. "Firm Innovation in Emerging Markets: The Role of Finance, Governance and Competition." *Journal of Financial and Quantitative Analysis* 46 (6): 1545–1590. doi:10.1017/S0022109011000378.

Cefis, E. 2003. "Is There Persistence in Innovation Behavior?" *International Journal of Industrial Organization* 21 (4): 489–515. doi:10.1016/S0167-7187(02)00090-5.

Cefis, E., and L. Orsenigo. 2001. "The Persistence of Innovation Behavior. A Cross-Countries and Cross- Sectors Comparative Analysis." *Research Policy* 30 (7): 1139–1158. doi:10.1016/S0048-7333(00)00139-6.

Cohen, W. M., and D. A. Levinthal. 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation." *Administrative Science Quarterly* 35 (1): 128–152. doi:10.2307/2393553.

Crespi, F., and G. Scellato. 2014. "Knowledge Cumulability and Path Dependence in Innovation Persistence. Chapter 8." In *Routledge Handbook of the Economics of Knowledge*, edited by C. Antonelli and A. N. Link, 116-134. Abingdon: Routledge.

Duguet, E., and S. Monjon. 2004. *Is Innovation Persistent at the Firm Level? An Econometric Examination Comparing the Propensity Score and Regression Methods*. Cahiers de la Maison des Sciences Economiques Working Paper No. 2004(75). Université Panthéon-Sorbonne, Paris.

Ganter, A., and A. Hecker. 2013. “Persistence of Innovation: Discriminating between Types of Innovation and Sources of State Dependence.” *Research Policy* 42 (8): 1431–1445. doi:10.1016/j.respol.2013.04.001.
Geroski, P. A., J. van Reenen, and C. F. Walters. 1997. “How Persistently Do Firms Innovate?” *Research Policy* 26 (1): 33–48.
Gorodnichenko, Y., J. Svejnar, and K. Terrell. 2010. “Globalization and Innovation in Emerging Markets.” *American Economic Journal: Macroeconomics* 2 (2): 194–226. doi:10.1257/mac.2.2.194.
Hall, B. H., and R. H. Ziedonis. 2001. “The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995.” *The* Rand Journal of Economics 32 (1): 101–128.
Hecker, A., and A. Ganter. 2014. “Path and past Dependence of Firm Innovation.” *Economics of Innovation and New Technology* 23 (5–6): 563–583. doi:10.1080/10438599.2014.895510.
Heckman, J. J. 1981. “Statistical Models for Discrete Panel Data.” In *Structural Analysis of Discrete Data with Econometric Applications*, edited by C. Manski and D. McFadden, 114–178. Cambridge, MA: MIT Press.
Himmelberg, C. P., and B. C. Petersen. 1994. “R&D and Internal Finance: A Panel Study of Small Firms in High-Tech Industries.” *The Review of Economics and Statistics* 76 (1): 38–51. doi:10.2307/2109824.
Ho, T. M. A., and D. L. Pham. 2014. “Innovation and Productivity of Vietnamese Small and Medium Enterprises: Firm Level Panel Data Evidence.” Presented at the Seventh Vietnam Economist Annual Meeting (VEAM 2014), University of Economics, Ho Chi Minh City, Vietnam.
Huang, C. H. 2008. “A Note on the Persistence of Firms’ Innovation Behavior: A Dynamic Random Effect Probit Model Approach.” *Economics Bulletin* 15 (5): 1–9.
JETRO. 2017. “Survey on business conditions of Japanese Companies in Asia and Oceania.” https://www.jetro.go.jp/ext_images/en/reports/survey/pdf/rp_firms_asia_oceania2017.pdf
Le Bas, C., and G. Scellato. 2014. “Firm Innovation Persistence: A Fresh Look at the Frameworks of Analysis.” *Economics of Innovation and New Technology* 23 (5–6): 423–446. doi:10.1080/10438599.2014.895511.
Long, T. Q. 2016. “Dynamics of Innovation and Internationalization among Vietnamese SME, Chapter 5.” In *SMEs in Developing Asia: New Approach to Overcoming Market Failure*, edited by P. Vandenberg, P. Chantapacdepong, and N. Yoshino. Tokyo: ADBI Press.
Long, T. Q., P. J. Morgan, and B. M. Tran. Forthcoming. Heterogeneous Effects of Credit Access on Formal and Informal Firm Growth: Empirical Evidence from Vietnam. *The Singapore Economic Review*. doi:10.1142/S0217590819500723.
Malerba, F., and L. Orsenigo. 1999. “Technological Entry, Exit and Survival: An Empirical Analysis of Patent Data.” *Research Policy* 28 (6): 643–660. doi:10.1016/S0048-7333(99)00005-0.
Manez, J. A., M. E. Rochina-Barrachina, A. Sanchis-Llopis, and J. A. Sanchis-Llopis. 2009. “The Role of Sunk Costs in the Decision to Invest in R&D.” *The Journal of Industrial Economics* 57 (4): 712–735.
Manez, J. A., M. E. Rochina-Barrachina, A. Sanchis-Llopis, and J. A. Sanchis-Llopis. 2015. “The Determinants of R&D Persistence in SMEs.” *Small Business Economics* 44 (3): 505–528. doi:10.1007/s11187-014-9611-3.
Mansfield, E. 1968. *Industrial Research and Technological Innovation: An Econometric Analysis*. New York, NY: Green & Company.
Ministry of Planning and Investment (MPI). 2018. *Vietnam SMEs White Book 2017*. Ha Noi, Vietnam: Statistics Publishing House.
Nelson, R., and S. Winter. 1982. *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.
Nguyen, N. A., P. M. Nguyen, D. N. Nguyen, and D. C. Nguyen. 2011. “Trade Liberalization and Innovation Linkages Micro-Evidence from Vietnam SME Surveys.” In Hahn, C. H. and D. Narjoko(eds.), *Globalization and Innovation in East Asia*. ERIA Research Project Report 2010-04, 315–340. Jakarta: ERIA.

OECD/Eurostat. 2005. *Oslo Manual-Guidelines for Collecting and Interpreting Innovation Data*. Paris: Committee for Scientific and Technological Policy, OECD-OCDE.

Peters, B. 2009. "Persistence of Innovation: Stylized Facts and Panel Data Evidence." *The* Journal of Technology Transfer 34 (2): 226–243. doi:10.1007/s10961-007-9072-9.

Phillips, A. 1971. *Technology and Market Structure: A Study of the Aircraft Industry*. Lexington, MA: Heath Lexington.

Raymond, W., P. Mohnen, F. Palm, and S. S. van der Loeff. 2010. "Persistence of Innovation in Dutch Manufacturing: Is It Spurious?" *Review of Economics and Statistics* 92 (3): 495–504. doi:10.1162/REST_a_00004.

Reinganum, J. F. 1983. "Uncertain Innovation and the Persistence of Monopoly." *American Economic Review* 73 (4): 741–748.

Rogers, M. 2004. "Networks, Firm Size and Innovation." *Small Business Economics* 22 (2): 141–153. doi:10.1023/B:SBEJ.0000014451.99047.69.

Romer, P. M. 1990. "Endogenous Technological Change." *Journal of Political Economy* 98 (5, Part 2): S71–S102. doi:10.1086/261725.

Schmookler, J. 1966. *Invention and Economic Growth*. Cambridge, MA: Harvard University Press.

Schumpeter, J. A. 1934. *The Theory of Economic Development—An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Cambridge, MA: Harvard University Press.

Suárez, D. 2014. "Persistence of Innovation in Unstable Environments: Continuity and Change in the Firm's Innovative Behavior." *Research Policy* 43 (4): 726–736. doi:10.1016/j.respol.2013.10.002.

Sutton, J. 1991. *Sunk Costs and Market Structure*. Cambridge, MA: MIT Press.

Tavassoli, S., and C. Karlsson. 2015. "Persistence of Various Types of Innovation: Analyzed and Explained." *Research Policy* 44 (10): 1887–1901. doi:10.1016/j.respol.2015.06.001.

Tran, T. H., and E. Santarelli. 2013. *Determinants and Effects of Innovative Activities in Vietnam. A Firm-Level Analysis*. Department of Economics Working Paper No. 909. Bologna, Italy: Universita di Bologna.

Triguero, A., and D. Córcoles. 2013. "Understanding Innovation: An Analysis of Persistence for Spanish Manufacturing Firms." *Research Policy* 42 (2): 340–352. doi:10.1016/j.respol.2012.08.003.

Triguero, A., D. Córcoles, and M. C. Cuerva. 2014. "Measuring the Persistence in Innovation in Spanish Manufacturing Firms: Empirical Evidence Using Discrete-Time Duration Models." *Economics of Innovation and New Technology* 23 (5–6): 447–468.

UNCTAD. 2007. *Trade and Development Report: Regional Cooperation for Development*. New York, NY: United Nations Publications.

Vixathep, S., N. Matsunaga, and V. K. Luong. 2017. *Human Capital, Innovation, and Productivity in Vietnam's SMEs—Evidence from the Manufacturing Industry*. Discussion Paper No. 96. University of Hyogo, Institute for Policy Analysis and Social Innovation, Hyogo, Japan, February.

Vu, H. N. 2014. "The Role of Human and Social Capital in the Development of Manufacturing SMEs in Vietnam." *Journal of Economics and Development* 16 (1): 5–22.

Wooldridge, J. 2005. "Simple Solutions to the Initial Conditions Problem in Dynamic Nonlinear Panel Data Models with Unobserved Heterogeneity." *Journal of Applied Econometrics* 20 (1): 39–54. doi:10.1002/jae.770.