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Article

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Article

Firm Constraints on the Link between Proactive Innovation, Open Innovation and Firm Performance

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Abstract: This study aims to examine the impacts of firm constraints and proactive innovation on firm performance, using a sample of 3504 small and medium enterprises (SMEs) in Vietnam from 2011–2015. Our findings suggest that technological innovations in general are beneficial to firm performance, increasing firm sales and profits. Further filtering innovations into two categories of proactive and reactive ones, we find that reactive innovation negatively affects firm performance, consistent with the view that proactive entrepreneurial behavior is a highly sought-after characteristic or a valuable resource for a firm as specified in resources-based theory. Finally, our result implies that if firms have low constraint or have sufficient resources, proactive strategies should be the choice if firms seek to improve their performance.

Keywords: technological innovation; proactive innovation; reactive innovation; firm performance; manufacturing industry

1. Introduction

Global economic integration is highly conducive to SMEs' operations, as it provides them with opportunities to adopt new technology and leverage on their business network [1]. Innovation has emerged as a crucial factor that helps firms to stay competitive and sustainable in the long run [2,3]. Firms are motivated to perform innovation on account of many reasons, especially in the form of proactive and profit-driven capital expenditure to improve efficiency and competitiveness, enabling them to enter new markets while securing the current market shares [4]. In other words, these motivations are proactively initiated by the firms themselves. However, there are other sources of motivations that are of coercive force, e.g., innovation in line with the requirements from customers, or from local or central governments regarding safety and environmental concerns. When firms adopt new technology or conduct innovations out of these reasons, their behavior is reactive [5].

The question of which approach, proactive or reactive, is more beneficial towards firm performance remains topical. Different scholars may evaluate these innovative orientations differently. Proactive innovations are effective tools for firms to constitute the first mover advantage in the market [6]. First movers are less likely to cease building and leveraging on their network with clients to incorporate into their business model, which is supposed to improve their performance [7]. In the same vein, the study of Robinson and Min [8] suggests that firms proactively entering the market have higher probability to survive, compared to their late-coming counterparts. These pieces of evidence radiate the merits and positive influence of proactive orientation on firm performance.

On the other hand, first-mover edge associated with proactive innovation approach could be inexistent, as in the case of an industry with low entry barriers [9] and low operating risks [10], because late comers could easily and quickly imitate the innovative outcome of the first mover. Other studies such as Baker and Sinkula [11] and Hong et al. [12] confirm that proactive orientation does not necessarily result in more innovative products. Similarly, as much as Gilbert and Allan [13] agree that reactive strategy could appear less dynamic and slow to respond to changes in the market place compared to proactive strategy, the latter is not always superior.

In addition to the issues of the inconsistent link between proactive innovation and firm performance, there arises a literature strand examining whether firm constraints exert impact on innovative performance. Innovative investments are risky and challenging due to their uncertain outcomes, exacerbating the information asymmetry and conflicts of interest with financiers [14,15]. Besides financing constraint, SMEs could face other limitations such as the lack of privileged information from exports, technology and human resources, especially in developing economies. Due to these constraints, SMEs are bound to encounter more hurdles to innovations as opposed to their larger peers [16]. Because of their small scale, SMEs have encountered higher transaction costs, lower investment in Research & Development (R&D), insufficient knowhow and lack of networks, resulting in operational instability [17].

Itooty [18] discusses the conditions necessary for innovation to play a chief role in East Asian countries. These countries have been struggling to improve per capita income in spite of myriad of difficulties such as competitive pressure and severe lack of resources and capabilities to innovate [18]. Itooty [18] compares and contrasts the innovation patterns in two groups of countries and find that firms in developing countries innovate less than those in advanced countries, even when innovation yields high return for the former. This innovation paradox is caused by the existence of barriers in three main fronts, emphasizing the plight of firms in East Asian countries, especially Vietnam. The country has been shown to showcase top-notch innovative performance, even though the firms could perform much better if its firms had lower constraints.

As pointed out in the previous passage, SMEs face numerous potential constraints that determine SMEs' capability to innovate. Nonetheless, literature tends to focus on the lack of credit as a sole indicator of external constraints [19–22]. Studies that deal with other types of constraint tend to focus on firms in developed markets [23,24]. As a consequence, little is known about the linkage between constraints and innovative performance in developing countries. It seems unclear as to whether firms with low and high levels of constraints should choose proactive or reactive orientation. This leaves an interesting and significant research gap for firms in developing economies.

The present study aims to fill the above gap using SME data from Vietnam. This developing economy provides a suitable setting for a number of reasons. First, the growth of Vietnamese economy has been impressive since the early 1990s, and second, the rate of poverty reduction has been encouragingly unprecedented [3]. Yet, this encouragingly strong performance record is still far from the nation's full potentials [22], because the country can still increase the productivity growth through heavier investment and the uplifting of innovation capabilities. SMEs represent the major force, thus, improving the performance in this sector is meaningful [17]. The paper proceeds as follows. Section 2 discusses relevant theories and related empirical studies that provide the fabrics for the development of the hypotheses regarding the innovation performance, with and without constraint factors being considered. Section 3 describes the dataset and models to be estimated. Section 4 presents the estimations of the models, and the implications from the findings. Section 5 concludes the paper.

2. Literature Review

2.1. Relevant Theories

2.1.1. Resources-Based Theory

The theory most relevant in this paper is the resource-based view that theoretically addresses the determinants of firm's competitive advantage. This theory places an emphasis on the firm's resources heterogeneity, and seeks to answer how firms should deploy resources to attain and secure competitive advantage. Penrose [25] sets the foundation of the theory by considering a firm as a collection of resources, and that the heterogeneity of productivity derived from the resources differentiates firms from each other. Studying the characteristics of resources could provide useful insights for strategic management [26,27].

The strategic resources a firm owns are heterogeneous due to resource-market imperfections and resource immobility [28]. There are different classification schemes of resources in the firm. As Wernerfelt [27] described, each entity is a unique bundle of resources that could be both tangible and intangible. Kostopoulos et al. [26] suggested that financial or physical resources are tangible, while knowhow, human, technological and organizational resources (brand name, organizational procedures) are intangible.

Barney [28] provided another classification scheme based on the vital characteristics that resources should possess to secure or even expand firm's market shares. Initially, there are three important features: valuable, which means the resources should help the firms to suppress the threats as well as utilize opportunities from the market movements; rare, meaning that the resources are not popular and accessible to all existing and potential firms; inimitable, i.e., the resources are not easy to copy and non-substitutable. Following Barney's doctrine [28], later studies have expanded and supplemented with other desirable traits for resources, including durability, non-tradability and lastly heterogeneity [29,30].

Under the framework of resource-based theory, capabilities are also relevant and important. To some extent, a firm's advantage does not only rely on the resources, but the ability of the firm to maneuver among different resources [29]. The capabilities are basically intangible processes and unique to each firm and it requires time to develop to become efficient [29]. In fact, Kostopoulos et al. [26] argued that they are "intermediate goods", enabling the enhancement of productivity of the resources and being an indispensable part of strategic management.

Firms should have no content-free period in acquiring and upgrading their resources and capabilities to stay competitive in a market that never stops revolutionizing [31]. However, this requires firms to be able to trace back the originality of resources and capabilities. This problem has been underexplored in the literature [26], but there have been some internal sources identified, ranging from organizational exploration [32] to the role of leaders [33]. Additionally, there are external sources that can impact the way resources are obtained, selected and deployed. These include technological environment, market structure (which leads to different profiles of power between buyers and sellers) and competition [26]. In other words, industry and market factors, also known as strategic industry factors [29], should also play a key role in determining a firm's resources and capabilities.

2.1.2. Theory of Planned Behavior

According to Bird [34], intentionality is conducive to high achievements since it combines and directs an entity's attention, experience and behavior effectively. Intentionality prepares the firms to navigate through all changes, thus affecting firms' ability to survive and grow. In addition, a number of motivational factors that can influence behavior, such as the resolution and effort, can be captured by intentionality [34]. In the beginning of an innovation project, corporate intentions toward a behavior (the adoption of the innovation project) are affected by the firm's own assessment of feasibility and desirability of the project [35]. Intentions also help raise the confidence of the innovators [36]. Therefore, intentionality is important to the adoption of an innovation activity, as well as the positive outcome from the activity of a firm.

2.1.3. Pecking Order Theory

The pecking order theory posits that firms base deciding which funding sources to finance investments on a specific order of preferences. This is because firms are supposed to possess informational advantages compared to external stakeholders, when the firm risk does not emanate from observable macro-level sources such as exchange rate fluctuation or market turbulence, but is idiosyncratic to the very firm. The information asymmetry problem exacerbates the agency cost of external financing to an extent that firms are reluctant to use external funds, except when internal sources of financing have been depleted [37]. Secondly, if external financing is required, firms will favor debt over own equity.

In the realm of innovation, innovative firms are risky investments for investors [38]. They tend to heavily invest in research and development activities whose outcomes are technically uncertain (technology risk). Moreover, firms are unlikely to disclose fully the information about the innovation projects because this can encourage imitative reactions from competitors (value appropriation risk). Finally, even when the innovation is technically successful, it does not necessarily guarantee a great debut in the market place (market risk). As a consequence, firms are not willing to share information about the intended and likely outcomes of their investment opportunities to fund providers.

Under the framework of the pecking order theory, we can expect that innovative firms, which are highly risky, will be closely perused by the market. Because of the issues associated with asymmetric information, external finance for these firms can be provided only at a premium. Consequently, innovative firms may find it prohibitively expensive to rely on external finance.

2.2. Development of Hypotheses

2.2.1. Innovation and Firm Performance

Constantly upgraded technologies, changing customer tastes and shortening product life cycles coupled with increased global and regional competition have urged firms to innovate relentlessly [39]. Technologically, a firm could either improve its market products or services (product innovation) or the way these items are made (process innovation). Product innovation is mostly induced by demand factor, but supply side could also be a significant driver for this type of innovation in some cases [40]. Process innovation leads to improvements in the methods of production or delivery of products/services [41]. The process could be new or significantly improved compared to the existing version. A typical example is the changes in involved techniques, equipment or software used in producing or delivering goods/services to customers. These two types of innovation, both marginally and radically, are enabled by technological changes.

Many studies have documented the empirical positive link between technology-enabled innovation and firm performance. For example, van Beveren and Vandenbussche [42] examined the link between firm innovation and the ability to take part in abroad sales. Their findings suggest that more innovative firms, i.e., those with more product and process innovations, tend to sell their goods in overseas markets. Consistently, Gunday et al. [43] argued that both product and process innovations are likely to be associated with better corporate performance.

Other research works also compared the influence of product and process innovations on firm performance. Studies by Hall et al. [44] for Italian SMEs, Waheed [45] for firms in Bangladesh and Pakistan and Tuan et al. [46] for Vietnamese firms in supporting industry confirmed that process innovations are more prominent drivers of performance, compared to product innovations. On the other hand, Hall [47] found substantive evidence on the positive effect of product innovation on revenue, while process innovation effect is hazier. Fagerberg et al. [48] contended that new product introduction could exert a strongly positive effect on the growth of income and employment, whereas process innovation shows a more controversial effect probably due to an intrinsic feature of this innovation type is to reduce costs. Other studies such as Rosli and Sidek [49] for Malaysian firms, Tuan [50] for SMEs in manufacturing industry, Mairesse and Robin [51] for French firms and Cassiman et al. [52] posited that product innovations have more pronounced impact on firm performance, as opposed to

process counterpart. Griffith et al. [40] investigated innovative activities for a sample of firms in four European countries. These authors found that process innovation only helps increase productivity in France, while product innovation is more effective and raises productivity in France, Spain and the UK.

In summary, the conventional finding is that product and process innovations, in short technological innovations, tend to have positive effects on firm performance, though in some cases, product innovations were found to be more productive than its counterpart and vice versa. Innovations are important towards firm performance and survival, and consistent with the mainstream finding, the following hypothesis was established:

Hypothesis 1 (H1). *Technological innovation has a positive effect on firm performance.*

2.2.2. Proactive Technological Innovation and Firm Performance

Discussed previously, a firm's resources are a key factor to achieve competitive edge, and they could be either tangible or intangible [53]. Proactive entrepreneurial behavior is an intangible resource. Proactive behavior represents strong beliefs and great value placed on the importance of being a first mover to attain better performance [54]. Proactive orientation is the tendency to conduct innovations based on the anticipation of the market changes to grasp new opportunities [55]. Other studies, such as Nasution et al. [56] and Rhee et al. [57], stated that an SME's proactive behavior could even shape the trend in the market, rather than just follow it.

Based on the resources-performance linkage theory by Barney et al. [53], a direct and positive link relationship between proactive innovation and firm performance is expected [26]. Firms with a proactive orientation have a tendency to desire the status of a first mover in a competition and focus on seeking opportunities, thus, they are more likely to pool their resources for innovative activities [58]. If a firm attains first-mover status, it may face weak competition, since there should be very few or even no companies that offer similar products. The resulting outcome is that the products or services of proactive firms could meet business targets more easily.

Besides the direct resources-performance linkage, there could also be an indirect resources-performance, where proactive behavior affects performance through its impact on innovation capability. The resource-capability link suggests that proactive behavior improves a firm's capability [29]. In a firm's innovation context, proactive entrepreneurial behavior forms an organizational resource that guides the firms to concentrate on innovative programs in a bid to pursue market opportunities [55]. Through repeating these innovative programs, firms cultivate experience and obtain insights of how to conduct such programs more efficiently, ultimately upgrading capability [59]. Consequently, proactive firms are those that could obtain knowhow and experience, which develops concrete and solid innovation capability. In turn, under the resources-based theory, innovation capability helps combine and deploy firms' resources appropriately to achieve superior performance from innovative activities.

Theoretically, the above links suggest a positive relationship between proactive innovation behavior and innovative performance. Empirically, Sibanda et al. [60] studied the key factors that discriminate the performance of export companies, and found that firms that have high levels of adaptation of export marketing strategy (proactive firms) tend to have higher performance. Akhlag et al. [61] argued that proactive risk-taking strategies are the most effective innovation strategies if firms decide to heighten their performance. On the other hand, Vagnani and Volpe [62] found that a reactive innovation due to pressures stemming from the environment tends to lead to underperformance. In short, it emerges that proactive business strategies are more likely to lead to better business performance. Therefore, the following hypothesis is established:

Hypothesis 2 (H2). *Reactive innovations are inclined to be more negative towards firm performance compared to proactive innovations.*

2.2.3. Firm Constraints and the Proactive Innovation—Performance Linkage

Firms that are not constrained are those that are large and old [63]. Larger firms are bound to have greater access to the resources required for investment and the adoption of new technology. This is because larger firms have more funds available for acquiring and internalizing new technology: according to the pecking order theory, larger firms with lower levels of information asymmetry could obtain funds externally, while smaller firms have to rely more on internal funds. Coupled with the fact that innovation activities are risky due to their uncertain nature, smaller firms are likely to encounter more challenges to fund their investment in research and development activities. Besides problems related to information asymmetry, Khalifa [64] and Hall and Khan [65] pointed out that due to its operation scale, larger firms can spread the fixed costs of technological adoption over a larger quantity of units. Firms that are large are usually those that are older compared to smaller firms. With more years of operations, larger firms could be expected to become more experienced in improving their efficiency [64]. In this study, we also proxied for size by considering a dummy variable of firms with one or more than one owner. Compared to a firm with only one owner, it is very likely that firms with more owners are larger.

Besides size factor (or operation scale), firms also have constraint in their access to privileged knowledge, which can hamper their capability to innovate. In this regard, if a firm has its goods/services exported, knowledge could be exchanged between companies that are partners in the trading relationship. The flows of goods and services, as well as skilled labor, could move internationally among the partners, facilitating technological transfers. Hall and Khan [65] confirmed that as firms import highly technological products/services, they also receive knowledge and knowhow from their partners. Oum et al. [66] suggested that foreign trade has high impact for technological innovation, implying that SMEs indeed attain significant benefits from foreign counterparts, as well as from engagement in product networks, consistent with learning-by-export hypothesis.

From the above arguments, it is expected that firms with low constraints, i.e., firms that are large, have more owners and/or engage in exporting, are suitable for proactive innovation approach. This is because they could have better tangible resources (better financing options due to low information asymmetry) and intangible resources (better knowledge and experience). In turn, proactive innovation has a positive effect on a firm's capability to innovate, thus ultimately driving up corporate performance. Therefore, we suggest the following hypothesis:

Hypothesis 3 (H3). *Firms with low constraints should choose proactive innovation strategies to have better performance.*

3. Data and Methodology

Dana [67] suggested that, compared to its peer in Eastern Europe and the former Soviet Union, the reform undertaken in Vietnam has a different ultimate purpose—to allow entrepreneurship to thrive and complement state-owned enterprises, rather than completely replace them. The reform has seen huge success since its start in 1986: real income per capita adjusted for purchasing power parity in 1990 was roughly one twentieth of that in OECD, but by 2014, this ratio has surged to 13.1 per cent. To achieve even higher economic performance, Pham and Nguyen [68] opine that policies that strengthen domestic market-oriented private micro, small and medium-sized enterprises are important. These authors also argue that in the period from 2011–2015, SMEs have increased considerably in quantity but not in quality, and call for policies that support innovation activities to sustain quality growth of SMEs in Vietnam.

This study uses three rounds, collected biennially from 2011–2015, of firm-level data surveys on SME manufacturing enterprises in Vietnam. The data are a joint effort of Central Institute for Economic Management, Institute of Labour Science and Social Affairs, the Development Economics Research Group at University of Copenhagen and UNU – Wider. Each round of the survey covers firms in nine provinces of the country: Hanoi, Hai Phong, Ho Chi Minh, Phu Tho, Nghe An, Quang Nam, Khanh Hoa, Lam Dong and Long An. The sampling was based on stratified random technique to ensure that

the sample represents adequately the population of SMEs across approximately 18 sectors. The surveys provide detailed firm-level information on firm characteristics, innovation and performance. Regarding the innovation characteristics, this study focuses on technological innovation, because technological innovations are what facilitate product and process innovations. Moreover, the surveys provide reasons with respect to proactive and reactive motivations only for technological innovations. Specifically, the reasons include: “need upgrading to face competition”, “upgrading was done to potentially earn profit”, “everybody else is upgrading”, “required by buyers to improve quality”, “required by law, regulations, others”. Firms’ innovation strategies are categorized as “proactive” if they conduct technological innovations to improve their edge over competitors or earn higher profits (first and second motivations). Otherwise, the remaining rationales are quite reactive, i.e., following trend from competitors, the orders from regulatory bodies or customers.

In this study, conventional panel data models are compared and selected based on tests. Following the test results, it appears that firm effects are not present, thus, pooled Ordinary Least Squares (OLS) with robust standard errors was used to estimate research models. Our baseline model is as follows:

$$\text{performance}_{it} = \beta_0 + \beta_1 \text{newtech}_{it} + \beta_2 \text{competition}_{it} + \beta_3 \text{export}_{it} + \beta_4 \text{diversification}_{it} + \beta_5 \text{age}_{it} + \beta_6 \text{gender}_{it} + \varepsilon_{it} \quad (1)$$

We further considered whether new technological innovation that is reactive in nature has negative impact on firm performance with the below model:

$$\text{performance}_{it} = \alpha_0 + \alpha_1 \text{reactive}_{it} + \alpha_2 \text{competition}_{it} + \alpha_3 \text{export}_{it} + \alpha_4 \text{diversification}_{it} + \alpha_5 \text{age}_{it} + \alpha_6 \text{gender}_{it} + \mu_{it} \quad (2)$$

Finally, we added interactions of reactive technological innovation and different constraint indicators to test hypothesis H3:

$$\text{performance}_{it} = \gamma_0 + \gamma_1 \text{constraint}_{it} \times \text{reactive}_{it} + \gamma_2 \text{competition}_{it} + \gamma_3 \text{export}_{it} + \gamma_4 \text{diversification}_{it} + \gamma_5 \text{age}_{it} + \gamma_6 \text{gender}_{it} + \delta_{it} \quad (3)$$

Table 1 provides the description of the variables in the models and their respective formation as follows:

Table 1. Variable definition.

| Variable | Definition | Relevant Studies |
|--------------------|--|---|
| Profit_increase | Performance proxy: a dummy that is 1 if firm i’s net income experiences an increase compared to that in previous year, and 0 otherwise. | Seelanatha [69], Verbeeten [70] |
| Sale_increase | Performance proxy: a dummy that is 1 if firm i’s revenue experiences an increase compared to that in previous year, and 0 otherwise. | Capon et al. [71], Verbeeten [70] |
| Newtech | Receives 1 if firm i has employed new technology, 0 otherwise | Tuan et al. [46], Gunday et al. [43] |
| Reactive | Receives 0 if firm i deploys new technology due to its own initiatives, 1 if a firm i does this according to external stakeholders’ request | Vagnani and Volpe [62] |
| Competition | Receives 1 if a firm i report that they feel the strong intense of competition in the market, 0 if it does not | Bloom and Van Reenen [72], Du and Chen [73] |
| Export | A dummy variable, receiving 1 if firms have exporting sales, 0 otherwise. | Wagner [74] |
| Diversification | The number of main products/services of the firm, measuring the diversification level of a firm’s business. | Bhatia and Thakur [75] |
| Age | Age of Chief Executive Officer (CEO) of the firm | Eduardo and Poole [76] |
| Gender | Gender of CEO of the firm | Eduardo and Poole [76] |
| Constraint proxies | Large: A firm that is large is considered to have low constraint (dummy variable). Multipleown: A firm that has more than one owner is considered to have low constraint (dummy variable) Export: A firm that engages in exporting is considered to have low constraint (dummy variable) | Guariglia [63], Oum et al. [66] |

Source: Author’s compilation.

4. Results and Discussion

From Table 2, *sale_increase* is 65%, suggesting that 65% of the cases are positive, and 58% record positively increase in profit. *Newtech* is 0.081, meaning that only 8% of the case introducing new technology for improving process and products. *Competition* is 0.871, implying that 87% of the observations report that they face strong competition in the market. *Reactive* is 29.5%, which means 29.5% of the cases when firms introduced new technologies was due to orders or requirements from external stakeholders, rather than the own firms' willingness. 60.5% of the respondents are males, and the average age of the respondents is 46. On average, firms had barely more than 1 product. Maximum number of different goods is 8, and minimum 1. *Newtech* variable has 7701 observations of 0 and 1 values. When firms responded yes (value = 1) to *newtech*, firms also indicated the reason for their introduction of new technology. Very few firms responded to the questions of the rationales that they performed innovation, or where they sought technology.

Table 2. Descriptive statistics.

| Variable | Observation | Mean | Std. Dev. | Min | Max |
|------------------------|-------------|--------|-----------|-----|-----|
| <i>sale_increase</i> | 7612 | 0.655 | 0.476 | 0 | 1 |
| <i>profit_increase</i> | 7676 | 0.580 | 0.494 | 0 | 1 |
| <i>newtech</i> | 7701 | 0.081 | 0.273 | 0 | 1 |
| <i>reactive</i> | 623 | 0.295 | 0.457 | 0 | 1 |
| <i>competition</i> | 7699 | 0.871 | 0.336 | 0 | 1 |
| <i>export</i> | 7651 | 0.064 | 0.246 | 0 | 1 |
| <i>age</i> | 7700 | 46.109 | 10.860 | 17 | 94 |
| <i>gender</i> | 7701 | 0.606 | 0.489 | 0 | 1 |
| <i>diversification</i> | 7699 | 1.129 | 0.398 | 1 | 8 |

Source: Author's calculation.

From Table 3, the correlation matrix shows signs of correlation that are consistent with hypotheses 1 and 2. Both *sale_increase* and *profit_increase* variables are positively related to *newtech*, suggesting that firms may innovate to earn profits and increase sales. However, *reactive* is negatively related to *sale_increase* and *profit_increase*, implying that firms that innovate in response to the order or requirements of other stakeholders, i.e., regulatory requirements, demand from customers or from peer pressure, were not as successful as firms that proactively innovate.

Table 3. Correlation matrix of variables in the model.

| | <i>Sale_Increase</i> | <i>Profit_Increase</i> | <i>Newtech</i> | <i>Reactive</i> | <i>Competition</i> | <i>Export</i> | <i>Age</i> | <i>Gender</i> | <i>Diversification</i> |
|------------------------|----------------------|------------------------|----------------|-----------------|--------------------|---------------|------------|---------------|------------------------|
| <i>sale_increase</i> | 1.000 | | | | | | | | |
| <i>profit_increase</i> | 0.673 | 1.000 | | | | | | | |
| <i>newtech</i> | 0.084 | 0.081 | 1.000 | | | | | | |
| <i>reactive</i> | −0.146 | −0.128 | | 1.000 | | | | | |
| <i>competition</i> | −0.032 | −0.018 | 0.048 | 0.025 | 1.000 | | | | |
| <i>export</i> | 0.032 | 0.018 | 0.109 | 0.085 | 0.031 | 1.000 | | | |
| <i>age</i> | −0.051 | −0.060 | −0.064 | −0.011 | −0.081 | −0.075 | 1.000 | | |
| <i>gender</i> | −0.010 | 0.011 | −0.024 | 0.020 | 0.004 | −0.052 | 0.1702 | 1.000 | |
| <i>diversification</i> | 0.011 | 0.019 | 0.044 | 0.041 | 0.023 | 0.020 | −0.0347 | 0.0041 | 1.000 |

Source: Author's calculation.

Pooled regressions showed that *newtech* is positively linked to profit and sale increases (significant to 1% level), which is consistent with hypothesis 1 (Table 4). This implies the beneficial effect of *newtech*, consistent with various studies on the process and product innovations on firm performance. Previous literature may record that different types of innovation (process and product) may come up with different success levels, but in general, innovations are positively related to firm performance. *Gender* has a positive effect, suggesting that male CEOs tend to be able to increase firm performance measured in terms of profit increase. *Competition* affects negatively corporate profitability.

Table 4. Regression result (hypothesis H1).

| | Profit | Sale |
|-----------------|-----------------------|-----------------------|
| newtech | 0.141 *** (0.019) | 0.138 *** (0.018) |
| competition | −0.037 * (0.017) | −0.055 *** (0.016) |
| export | 0.02 (0.023) | 0.042 * (0.021) |
| age | −0.003 *** (0.001) | −0.002 *** (0.001) |
| gender | 0.024 * (0.012) | 0.002 (0.011) |
| diversification | 0.019 (0.015) | 0.008 (0.014) |
| _cons | 0.688 *** (0.034) | 0.772 *** (0.033) |
| No. of obs | 7622 | 7559 |
| r ² | 0.011 | 0.011 |

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively. Source: Author's calculation.

Table 5 shows that the proactive innovations surpass reactive counterparts in terms of their effect on firm performance, proxied by both profit and sale increases, consistent with hypothesis H2. This result is in line with the findings in other fields like proactive exporters [60]. In a Vietnamese context, this finding presents important implications. One explanation for this could come from the planned behavior theory [60]. In the aspect of perceived behavioral control, it may be easier to tailor innovations towards firm characteristics or strategies, rather than just passively comply with regulatory requirements. Moreover, attitudes toward innovation may be more positive when firms conduct innovations to win market share, to satisfy customer demand rather than just to satisfy regulators. Regulatory requirements may not go hand in hand with firm strategy, and firms may lack control over what external stakeholders demand. Secondly, going beyond what is required may win trust from various stakeholders. Finally, when firms are proactive in innovations, they have more plans, which means that they can reserve appropriate resources. The reactive market orientation approach will always fall behind the proactive market orientation approach due to the fact that the latter address both the expressed and latent needs from customers [77].

Table 5. Regression results of reactive technological innovation (hypothesis H2).

| | Profit | Sale |
|------------------------|----------------------|-----------------------|
| reactive | −0.129 ** (0.041) | −0.129 *** (0.039) |
| competition | −0.015 (0.069) | −0.01 (0.060) |
| export | −0.029 (0.050) | 0.002 (0.045) |
| age | 0.001 (0.002) | 0.001 (0.001) |
| gender | 0.005 (0.037) | −0.073 * (0.033) |
| diversification | 0.022 (0.036) | −0.021 (0.036) |
| _cons | 0.714 *** (0.110) | 0.838 *** (0.101) |
| Number of observations | 621 | 620 |
| r ² | 0.019 | 0.03 |

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively. Source: Author's calculation.

Besides rationales drawn on the planned behavior theory, based on the resources-performance linkage theory by Barney et al. [53], proactive innovation could also be expected to have a direct and positive link with firm performance [26]. Firms that have a tangible resource (proactive orientation) have a tendency to desire the status of a first mover in a competition and focus on seeking opportunities, thus, they are more likely to pool their resources for innovative activities [58]. If a firm attains first-mover status, it may face weak competition since there should be very few or even no companies that offer similar products. The resulting outcome is that the products or services of proactive firms could meet business targets. Besides the direct resources-performance linkage, there could also be an indirect resources-performance, where proactive behavior affects performance through its impact on innovation capability. The superior performance of proactive innovation is consistent with empirical studies of the proactive export adaptation by Sibanda et al. [60] and the innovation strategy by Akhlagh et al. [61] and Vagnani and Volpe [62].

In Table 5, the sole effect of reactive innovation is negative in both specifications. However, in Table 6, the coefficient of the reactive variable is only negatively significant in only one sale-related specification. This implies that the negative effect of reactive innovation dissipates when the constraint factor is considered. All the interactive variables formed by reactive variable and indicators of firm constraint (reactive_large, reactive_export and reactive_onemultiple) are negatively significant at 1% level. This result implies that, if firms that have low constraints, i.e., firms that are large, have export sales and/or have multiple owners rather than only one, should choose proactive innovation strategies to reap benefits of this strategy. Reactive innovations are prone to deliver negative impact on firm performance (Table 5), thus, for firms that have sufficient resources, the option should be proactive. This result is consistent with hypothesis H3.

Table 6. Regression results of interactive reactive technological innovation.

| | Profit | Profit | Profit | Sale | Sale | Sale |
|------------------------|----------------------|-----------------------|-----------------------|----------------------|----------------------|-----------------------|
| reactive | −0.187 (0.147) | −0.201 (0.139) | −0.158 (0.144) | −0.131 (0.111) | −0.189 * (0.108) | −0.121 (0.112) |
| reactivexlarge | −0.097 ** (0.049) | | | −0.115 ** (0.046) | | |
| reactive × export | | −0.289 *** (0.099) | | | −0.154 * (0.091) | |
| reactive × multipleown | | | −0.090 *** (0.030) | | | −0.086 *** (0.028) |
| competition | −0.005 (0.068) | −0.02 (0.068) | −0.01 (0.068) | 0.001 (0.061) | −0.015 (0.061) | −0.006 (0.060) |
| export | −0.024 (0.051) | 0.071 (0.057) | −0.018 (0.049) | 0.009 (0.046) | 0.05 (0.050) | 0.012 (0.045) |
| age | 0.001 (0.002) | 0.001 (0.002) | 0.000 (0.002) | 0.001 (0.001) | 0.002 (0.001) | 0.001 (0.001) |
| gender | 0.000 (0.037) | 0.000 (0.037) | 0.002 (0.037) | −0.079 ** (0.033) | −0.077 ** (0.033) | −0.076 ** (0.033) |
| diversification | 0.022 (0.037) | 0.018 (0.036) | 0.024 (0.036) | −0.02 (0.036) | −0.025 (0.036) | −0.019 (0.036) |
| _cons | 0.693 *** (0.110) | 0.674 *** (0.110) | 0.712 *** (0.110) | 0.819 *** (0.102) | 0.804 *** (0.102) | 0.836 *** (0.101) |
| N | 621 | 621 | 621 | 620 | 620 | 620 |

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively. Source: Author's calculation.

The results from the findings suggest that as larger firms have the more funds available for acquiring and internalizing new technology, according to the pecking order theory, larger firms with lower levels of information asymmetry can obtain funds externally, while smaller firms have to rely more on internal funds. Coupled with the fact that innovation activities are risky themselves due to their uncertain nature, smaller firms are likely to find it extremely challenging to fund their investment in research and development. Khalifa [64] and Hall and Khan [65] also pointed out larger firms can

spread the fixed costs of technological adoption over a larger quantity of units due to their larger scale of operations. We also proxied for size by considering a dummy variable of firms with one or more than one owner; the result remained consistent.

Firms also have constraints if they have limited access to privileged knowledge, which can hamper their capability to innovate. Our findings show that if a firm has their goods/services exported, knowledge could be exchanged between companies that are trading partners. The flows of goods and services, as well as skilled labor, could move internationally among the partners, facilitating technological transfers. Hall and Khan [65] confirmed that as firms import highly technological products/services, they also receive knowledge and knowhow from their partners. This result is in line with Oum et al. [66], suggesting that SMEs could derive significant benefits from foreign partners, as well as from engagement in product networks, consistent with learning-by-export hypothesis.

In summary, it is expected that firms with low constraints, i.e., firms that are large, have more owners and engage in exportation, are suitable for proactive innovation approach, because they can have better tangible resources (financing options due to low information asymmetry) and intangible resources (knowledge and experience). In turn, proactive innovation has a positive effect on firm capability to innovate, thus ultimately driving up firm performance.

Proactive behavior represents strong beliefs and great value placed on the importance of being a first mover to attain better performance [54]. Proactive orientation is the tendency to conduct innovations based on the anticipation of the market changes to grasp new opportunities [55]. Other studies such as Nasution et al. [56] and Rhee et al. [57] stated that an SME's proactive behavior could even shape the trend in the market, rather than just follow it. These huge advantages are costly in a sense that they would require significant resources to accommodate them. Large firms are able to cover these requirements with their internal resources, but SMEs and startups tend to rely on open innovations to alleviate resource constraints [78]. In conducting open innovations, several issues arise as follows.

Individualistic values can stimulate uniqueness and individualistic groups tend to be more creative than collectivistic counterparts, and this association is considered useful when creativity is a highly-valued outcome. However, individualism may bring about conflict and opportunism. Open innovation motivates individual creativeness and, consistently, open innovation decreases collectivism; in turn, individualism motivates open innovation through individual emergence. In sum, there is a positive association between individualism and open innovation, which may bring more innovative outcomes.

From macro-dynamic viewpoint, open innovation is conducive to economic growth [79,80], but this link is complicated. From a micro-dynamic point of view, open innovation should increase the complexity of target systems, and this complexity, if well controlled, could help the focal firm to obtain opportunities from evolutionary changes. Various studies have suggested that SMEs need open innovation, but the associated complexity should be controlled properly [81]. Collectivism reduces the complexity associated with open innovation [82].

One more noteworthy point is the link between serial entrepreneurs and open innovation. The former is by definition a continuous business establisher who runs a different new business after having finished another business. Serial entrepreneurs are motivated by open innovation strategies. It is interesting to note that open innovations can lead to the existence of creative and successful business models only when the associated complexity is controlled to some extent [83]. If this condition is not held, open innovation startups may collapse as a result.

5. Conclusions

In a globalization context, innovation plays a critical role in improving firm competitive edge in a sustainable manner. Proactive innovation could bring first-mover advantage, but this approach requires substantive resources. For SMEs, the decision to opt for innovation is more complex, since they suffer from higher constraints which thwart their resources and capabilities to innovate. This study uses a sample of 3504 firms in Vietnam, and aims to fill the gap whether proactive or reactive innovation

is better for SMEs, and whether proactive/reactive innovation is better for SMEs firms with higher or lower constraints.

Our findings suggest that technological innovations in general are beneficial to firm performance, as this increases firm sales and profits. We continue to dig further by filtering innovations into two categories: proactive and reactive, and examine which is better for firm performance. The result shows that reactive innovation brings negative effects to firm performance, consistent with the view that proactive entrepreneurial behavior is a highly sought-after characteristic or a valuable resource for a firm. Finally, our result indicates that if firms have sufficient resources, then proactive strategies should be the choice rather than reactive one to improve firm performance.

The findings of this research add significantly to the literature in two aspects. First, it examines the constraint—innovative performance linkage in a developing country setting. While there are a number of extant studies dealing with this link, the samples only comprise of firms in developed economies. Since SMEs in developing countries tend to experience a stronger impact of constraints, the study on the link between constraint—performance is critical in Vietnam. Second, this study found that constraints a firm faces play a role in the decision of innovation strategies, specifically the choice between proactive and reactive orientation.

Proactive innovation is beneficial towards firm performance, but it requires planning and resources and new ideas. Those factors could be obtained through open innovations, which could significantly help in the case of SMEs in developing countries due to their insufficient resources. It is suggested that individualism boosts open innovation thanks to its strong association with creativity, but the complexity from the collaboration with external parties should be controlled to some extent to ensure the stability of the business. Additionally, complexity from open innovation if well managed could be an enabler for successful serial entrepreneurs. Furthermore, open innovation should also be well handled due to its complicated nexus under the micro- and macro-dynamic viewpoints.

This research suffers from two major limitations. First, the data have some missing observations, are short and have not been updated since 2015, while innovations are the term that should be analyzed in the most current setting possible. Second, the mechanisms/factors to relieve the constraint impact on firm innovation adoption have not been studied in the current research. Therefore, future studies could seek to update the data and examine the solutions to tackle the negative impact of constraint on firm innovation.

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