The spillover effect of nonprofit universities: Some policy implications of private higher education in Vietnam

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Abstract: Extending Cooper & Ross' analysis of competition in markets with informational asymmetry, and Hirth's researches on nonprofit nursing homes in United States, this paper developed a competitive model for a mixed market of private for-profit and nonprofit universities. The model proved the spillover impact of nonprofit universities on the overall quality of the market. As a result, the paper sheds some insights on the quality problems faced by private universities in Vietnam, and also offers some policy implications to improve the overall quality of this market.

Key words: Private university, nonprofit, spillover effect, asymmetry of information, higher education market, education quality

1. Introduction

After promulgation of the Law of Higher Education in 2013 and the University Regulations in 12/2014, the role of nonprofit universities has raised much interest and public debate in Vietnam. However, the lack of academic research in Vietnam on nonprofit organizations have led to much of misconception by the public, academics and policy-makers about the roles of nonprofit universities in the country's higher education system.

In fact, the roles of nonprofit universities in particular and nonprofit organizations in general have been researched extensively in the world over the las several decades. Many theories have been developed to explain the existence and growth of nonprofit organizations in society. These theories are generally divided into two main groups: demand-side theories (Weisbrod 1977, 1989; Hansmann 1980, 1987, 1996, 2012; Vlassopoulos 2009; Valentinov 2011; James 2011; Titova & Shutove 2014) and supply-side theories (Rose-Ackerman 1996; Valentinov 2008).

Besides these theories, Hirth (1993, 1997, 1999) has developed a competitive models to explain the impact of nonprofit nursing homes on the quality and price of this specific market in the US, based on classical analysis of competitive market with asymmetric information by Cooper & Ross (1984). The main result of Hirth was what he called the "spillover effect" of nonprofit nursing homes: the participation of nonprofit nursing homes providing high quality services will increase the overall quality of the market not only through traditional competitive force, but also through the change of distribution of informed consumers in the market.

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Our research aims to answer the question of whether there is also a spillover effect of nonprofit universities on private higher education. Particularly, adopting the approaches of Cooper & Ross (1984) and Hirth (1993, 1997 and 1999), we proposed competitive market models for private universities that is focused on the relationship between price and quality of higher education services. We described the characteristics of the market equilibrium and demonstrated the spillover effect on education quality of nonprofit universities. The findings helped shed some crucial insights in explaining the quality problems faced by private universities in Vietnam and provide policy implications on how to address these problems. Methodologically, the research suggested that the modeling approach, relatively rare used in the study of university governance, could constitute a promising research direction in this important topic.

In the next section, we will briefly review the literature on nonprofit organizations in general, and nonprofit universities in particular. (A more comprehensive review of literature could be found in Khang (2016).) Then, the equilibrium of the pure market of for-profit universities will be characterized following Cooper & Ross's (1984) method. Afterwards, competitive models for the mixed market with both for-profit and non-profit universities are developed and the spillover effect of non-profit universities demonstrated. In the end, we will discuss the policy implications of results obtained from models. A numerical example is given in Appendix to illustrate the spillover effect.

2. Background

2.1. Some basic concepts

In this paper, *higher education* is understood as the formal training in universities or graduate schools. Based on the form of ownership, organizations providing higher education services, or universities for short, are divided into two categories: public and private (non-public). We only focus on private universities, so throughout this paper, unless explicitly explained otherwise, the terminology *university* means private university.

Universities include two forms of governance: *for-profit* and *nonprofit*. A university is called nonprofit if it "is barred from distributing its net earnings, if any, to individuals who exercise control over it", a condition commonly called "non-distribution constraint" (Hansmann 1980, p.838). All other universities are generally called for-profit. Like any enterprise, for-profit universities aim to maximize shareholder value through accumulated profits.

An important characteristic of higher education is asymmetric information, which implies that consumers (students) cannot have enough information as well as the ability and condition to assess the true quality of their education provided before, during and even after the end of their study in universities.

2.2. Related researches

In many theories that were put forward to explain the existence and development of nonprofit organizations in general and nonprofit universities in particular, "the contract failure theory" of

Hansmann (1980, 1987) was often considered as the strongest argument for researchers. According to this theory, for a for-profit firm to provide goods and services with maximum efficiency, certain market conditions should be met:

(i) customers can evaluate the product and prices before making decision;
(ii) customers can reach clear agreement with the chosen firm on quantity, quality and price;
(iii) customers can determine if the firm complies with agreement or not; and
(iv) customers can penalize the firm if it did not.

In the case of asymmetric information like the higher education market, the above conditions are not met. Then, to maximize profits, for-profit organizations will take advantage of customers by providing services with lower quality than that was promised. Hansmann's arguments are partially based on analysis by Cooper & Ross (1984) of market model in which for-profit organizations are competing in quality and price on a market where consumers have different levels of access to the information on the services provided. Such market failures necessitate operations of nonprofit organizations where those in control are constrained in their ability to benefit personally from providing low-quality services and thus have less incentive to take advantage of their customers than the owners or managers of for-profit organizations. Therefore, for consumers, especially for uninformed consumers, the nonprofit status may serve as a credible signal of quality of services they will buy besides the information about price.

Hirth (1993, 1997, 1999) extended Cooper & Ross's models to consider the mixed market of both for-profit and nonprofit private nursing homes in the US. The model demonstrated that, with adequate enforcement of non-distribution constraint, when the presence of nonprofit nursing homes increases, the poorly informed customers will be disproportionately attracted to nonprofit nursing homes, leaving the for-profit market with a higher ratio of better-informed customers. As the results, for-profit nursing homes are then forced to increasingly deliver the quality promised to their customers and the observed quality differences between the two subsectors understate the real benefits of nonprofit nursing homes. Eventually, when nonprofit nursing homes dominate the market, the quality of both sectors will converge because of the very presence of nonprofit universities. Hirth called this beneficial impact of nonprofit nursing homes in increasing the overall quality of the market the spillover effect.

A more extensive review of the academic literature on the socio-economic roles of nonprofit organizations and universities is provided in Do Ba (2016).

3. Model 1 (Pure market of for-profit universities):

In this section, we follow closely the models and analysis by Cooper & Ross (1984) of the market with informational asymmetry, and summarize the results as applied to the market of for-profit universities. Thus, the terminology "university" means "for-profit university". The following hypotheses and notations will be used in this model.

3.1. Assumptions and notations

- The market consists of a single product (educational service) with varying qualities called q-commodity. The quality of this q-product is bounded from below by a legally minimum level of quality $\underline{q}$ [2].

- Customers (or students) have the same income y, and they spend on one unit of the q-commodity with the price $p(q)$. The remaining income is denoted by $z = y - p(q)$.

- All the students have the same preference for the q-commodity with same utility function

$$U(z,q) = U(y - p, q) = W(p,q),$$

where U is increasing and concave in both variables (i.e. $W_p < 0,\ W_q > 0,\ W_{pp} < 0,\ W_{qq} < 0$). Let $\overline{U} := U(y, 0)$ be the utility when the consumer does not purchase the service. We also assume $W(\underline{p}, \underline{q}) < \overline{U}$, that is no consumer would buy the service with the minimum quality $\underline{q}$ and with price $p \ge \underline{p} = C(\underline{q})$ [3].

- All the universities in the market have same production cost function. Let $AC(x,q)$ be the average cost of producing x units of good with the same quality q. We assume that $AC(x,q)$ to be U-shaped in terms of quantity x and increasing in quality q. We define $C(q) := \underset{x}{\mathbf{Min}}\, AC(x,q)$ and assume that $C(q)$ is increasing and convex in q (i.e. $C'(q) > 0,\ C''(q) > 0$).

- The market is competitive in the sense that the number of universities is large enough so that they cannot determine the market prices, and there is no barrier to entry to and exit from the market.

3.2. Model 1A (case of informational symmetry):

We first consider the case of information symmetry, where customers have as much information about the quality of the service as their service providers. The following proposition, due to Cooper & Ross (1984), characterizes the equilibrium of this market.

Proposition 1. In market with informational symmetry, at the equilibrium, all universities provide services with same quality $q*$ and price $p*$, where $(p*, q*)$ is determined by:

(i) $p* = C(q*)$,

(ii) $-W_q(p*, q*) / W_p(p*, q*) = C'(q*)$.

From Proposition 1 we can immediately derive the corollary below.

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[2] $\underline{q}$ can be interpreted as the minimal quality to meet the government's requirements for the establishment of a private university.

[3] Allowing for $W(\underline{p}, \underline{q}) \ge \overline{U}$ would make the model more complicated, without much impact on the results.

Corollary 1.

(i) The number of universities providing the optimum tuition/quality pair $(p*, q*)$ in equilibrium is $I/\bar{x}$, where I is the number of consumers and $\bar{x}$ is the efficient scale of production for quality $q*$ which determined by $AC(\bar{x}, q*) = p*$.

(ii) The point $(p*, q*)$ is exactly tangent point for two curves $C(q)$ and W_1 as in Figure 1 below, where W_1 represents the maximized consumer utility, with $W(p*, q*) = \underset{p \geq C(q)}{\text{Max}} W(p, q)$

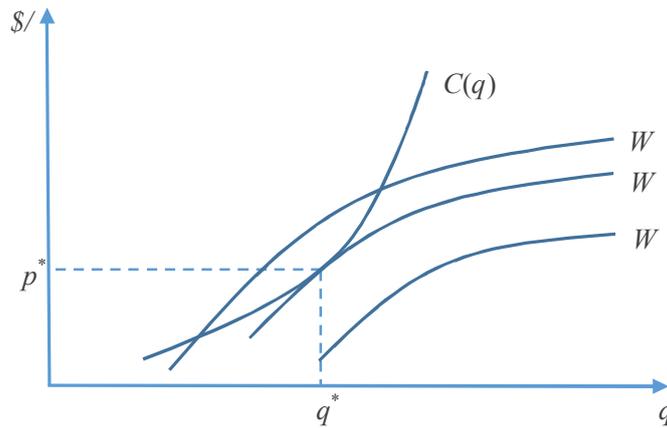(iii) The average quality at the equilibrium is $\Omega = q*$.

Figure 1

3.3. Model 1B (case of informational symmetry):

Given the high asymmetry of information observed in higher education, now we extend Model 1 and assume that consumers can access the information on quality of the q-product at different levels. More specifically, we assume that there are two types of customers: those with full information about the service quality (we call them informed customers), and those without (or uninformed customers).

Let θ be the proportion of informed consumers in the market $(0 < \theta < 1)$. These consumers choose among the universities offering tuition/quality pairs (p, q) in order to maximize their utility. The remaining uninformed consumers, when assess their choice of universities, can only determine whether or not the quality provided exceeds the minimal quality level $\underline{q}$. They will use tuition fee offered by universities as signal of the quality of services, and choose the tuition level that

maximizes the expected utility when they randomly choose among universities offering this level of tuition.

Under these conditions, in order to serve informed buyers, there should be some universities that provide services at price commensurate with quality. We call these universities *honest universities*. At the same time, the uninformed customers provide opportunities to universities to take informational advantage to increase their profit by selling services at lower quality than as promised by price. These universities are called *dishonest universities*.

Informed customers only choose honest universities. On the other hand, uninformed customers will first choose the price p yielding maximum expected utility $E_q\left[W(p,q)\right]$ subject to the constraint that $E_q\left[W(p,q)\right] \geq \overline{U}$. Then, these customers choose randomly among all universities offering service at the same price p.

The following proposition, also due to Cooper & Ross (1984) characterizes the equilibrium of this market.

Proposition 2. At the equilibrium (if it exists):

(i) There are at most two types of universities:
   (a) Honest universities offer price-quality pair $(p*,q*)$, with the same efficient scale $\overline{x}$.
   (b) Dishonest universities offer price-quality pair $(p*,\underline{q})$, with the same expected scale x^0 determined by $AC(x^0,\underline{q}) = p*$ (see Figure 1).

(ii) The number of honest universities n_h and dishonest universities n_d at the equilibrium are determined by following equations:

$$\frac{\theta I}{n_h} + \frac{(1-\theta)I}{n_h + n_d} = \overline{x} \quad ; \quad \frac{(1-\theta)I}{n_h + n_d} = x^0 . \tag{1}$$
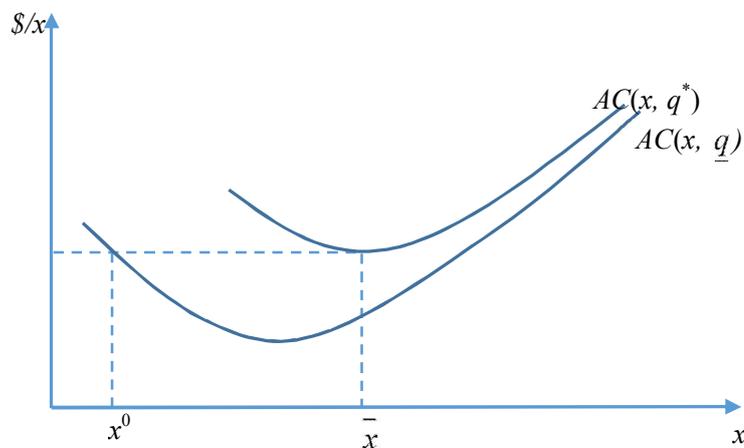

Figure 2

Proof. See Cooper & Ross (1984) for details.

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Let π denote the proportion of honest universities, and n_h^*, n_d^* the solution of system of equations (1). Then, the expected utility of uninformed consumers at the equilibrium is determined by the following equality:

$$E_q\left[W\left(p^*,q\right)\right] = \pi^* W\left(p^*,q^*\right) + \left(1-\pi^*\right) W\left(p^*,\underline{q}\right), \text{ where } \pi^* = \frac{n_h^*}{n_h^* + n_d^*}. \qquad (2)$$

Let π' be the critical value of π, at which uninformed customers are indifferent between dropping out and staying in the market (i.e. $\pi' W\left(p^*,q^*\right) + \left(1-\pi'\right) W\left(p^*,\underline{q}\right) = \overline{U}$).

Then the following proposition provides the condition for the existence of equilibrium.

Proposition 3. There exists equilibrium if $\pi^* > \pi'$.

Proof. If $\pi^* > \pi'$, uninformed customers will drop out the market. Since $W\left(p^*,q^*\right) > W\left(p^*,\underline{q}\right)$, so

$$E_q\left[W\left(p^*,q\right)\right] = \pi^* W\left(p^*,q^*\right) + \left(1-\pi^*\right) W\left(p^*,\underline{q}\right) > \pi' W\left(p^*,q^*\right) + \left(1-\pi'\right) W\left(p^*,\underline{q}\right) = \overline{U}.$$

Moreover, in this situation, universities have no motivation to drop out or join the market.

Then, the equilibrium exists with n_h^*, n_d^* are, respectively the numbers of honest and dishonest universities. □

Remark 1. If $\pi^* \le \pi'$, equilibrium will not exist: Indeed, since $E_q\left[W\left(p^*,q\right)\right] \le \overline{U}$, uninformed customers will drop out the market, and pushing dishonest universities out of market, and pushing π^* up.

Corollary 2.

(i)   If $\theta \ge \dfrac{\overline{x} - x^0}{\overline{x}}$, then at equilibrium, the market has only honest universities, with $n_h = I \big/ \overline{x}$.

(ii)   If $\theta < \dfrac{\overline{x} - x^0}{\overline{x}}$, then at the equilibrium, both honest and dishonest universities coexist, and their numbers are determined by:

$$n_h = \frac{\theta I}{\overline{x} - x^0} \qquad \text{and} \qquad n_d = \frac{\left(1-\theta\right) I}{x^0} - \frac{\theta I}{\overline{x} - x^0}. \qquad \qquad □$$

Remark 2. It follows from Corollary (ii) that, if the proportion of informed consumers is small enough, then there are dishonest universities that rip off uninformed consumers. We call this the failure of the for-profit market. In this case, θI informed consumers will choose honest universities with quality q^*; the $(1-\theta)I$ remaining consumers are uninformed, so they will choose a random university, as all universities offer price p^*, with probability π^* of finding a honest for-profit university of quality p^* and probability $1-\pi^*$ of finding a dishonest one with quality $\underline{q}$. Hence, the expected quality of the whole market is given by:

$$\Omega_1 = \theta q^* + (1 - \theta)\left[\pi q^* + (1 - \pi)\underline{q}\right] < q^*, \qquad (3)$$

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which monotone increasing in both θ and π.

4. Model 2: Mixed market with for-profit and nonprofit universities

To assess the quality impact of nonprofit universities on the higher education market, in this section we draw a parallel to research by Hirth (1993, 1997, 1999) and expand Model 1B above by allowing nonprofit universities to join the market along with for-profit universities.

For this purpose, the notations and assumptions of 3.1 will be retained. In addition, nonprofit universities are assumed to provide the same q-commodity as for-profit universities with the same cost function $AC(x,q)$[4]. Nonprofit status (defined by non-distribution constraint discussed in 2.1) of such universities are recognized by all consumers, informed and uninformed alike.

Absent of profit maximizing motive, nonprofit universities provide the quality as promised. Such behavior of nonprofit universities is just like that of honest universities considered above. The basic difference is that, uninformed consumers cannot distinguish between honest and dishonest universities, but they can recognize a nonprofit university due to its status. Thus, nonprofit status serves to signal quality to uninformed customers.

Note that from Proposition 2, although quality q is a continuous variable, at the equilibrium there are at most two values of equality $q*$ (maximum) and $\underline{q}$ (minimum). Hence, for simplicity and without loss of generality, we can assume that the market has only these two levels of quality. As assumed in 3.1, no consumer would buy the service with the minimum quality $\underline{q}$ and with price $p \geq \underline{p} = C(\underline{q})$. As consequence, nonprofit universities only provide services at the quality $q*$ and price $p_n \geq C(q*)$ to maintain sustainable operation.

For informed consumers, nonprofit universities do not bring any change in their decision, and they can stay with their choice of a honest for-profit university providing optimal price-quality pair $(p*, q*)$. Thus, nonprofit universities will be assumed to serve the uninformed consumers only. To attract such consumers, price p_n offered by nonprofit universities must not be higher than the critical price p_{n*} where uninformed consumers have equal expected utility for nonprofit and for-profit universities, that is

$$W(p_{n*}, q*) = \pi W(p*, q*) + (1 - \pi) W(p*, \underline{q}).$$

Let βI $(0 < \beta < 1)$ be the capacity of the nonprofit sector, that is the number of consumers that nonprofit universities can serve. Since nonprofit universities only serve uninformed consumers, we may assume $\beta \leq 1 - \theta$. The impact of nonprofit sector on the market is shown in the following proposition.

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[4] To be fair when assessing the impact, we assume nonprofit universities do not receive any subsidy to serve for their operations.

Proposition 4. If $\beta \geq 1 - \frac{\theta \bar{x}}{\bar{x} - x^0}$, the market will have equilibrium with the following characteristics:

(i) There are at most two types of universities at equilibrium: honest for-profit universities and nonprofit universities. They serve the same price-quality pair $(p*, q*)$.

(ii) The number of universities of each type n_h and n_n at the equilibrium are determined by:

$$n_h = \frac{(1-\beta)I}{\bar{x}} \quad \text{and} \quad n_n = \frac{\beta I}{\bar{x}}.$$

Proof.

(i) Since the θI informed consumers already choose honest for-profit universities and βI is the number of uninformed consumers choosing nonprofit universities, the remaining $(1-\theta-\beta)I$ uninformed consumers will have to choose from the for-profit submarket that include both honest and dishonest universities.

Applying Proposition 2 to the for-profit submarket, the numbers of honest and dishonest for-profit universities at the equilibrium (if exists) must satisfy the following system of equations:

$$\begin{cases} \dfrac{\theta I}{n_h} + \dfrac{(1-\theta-\beta)I}{n_h + n_d} = \bar{x} \\ \dfrac{(1-\theta-\beta)I}{n_h + n_d} = x^0 \end{cases} \Leftrightarrow \begin{cases} n_h = \dfrac{\theta I}{\bar{x} - x^0} \\ n_d = \dfrac{(1-\theta-\beta)I}{x^0} - \dfrac{\theta I}{\bar{x} - x^0} \end{cases}.$$

Hence, dishonest for-profit universities exist if and only if:

$$n_d^* = \frac{(1-\theta-\beta)I}{x^0} - \frac{\theta I}{\bar{x} - x^0} > 0 \Leftrightarrow (1-\beta)(\bar{x} - x^0) - \theta \bar{x} > 0 \Leftrightarrow 1 - \frac{\theta \bar{x}}{\bar{x} - x^0} > \beta.$$

In other words, if $\beta \geq 1 - \frac{\theta \bar{x}}{\bar{x} - x^0}$, there are only honest universities in for-profit sector. Thus, $\pi = 1$. By Proposition 3, there exists equilibrium of for-profit sector.

We now consider the market including both for-profit and nonprofit sectors. For nonprofit universities, the price p_n is bounded by $p* \leq p_n \leq p_{n*}$, where p_{n*} is determined by:

$$\mathbf{W}(p_{n*}, q*) = \pi \mathbf{W}(p*, q*) + (1-\pi)\mathbf{W}(p*, \underline{q})$$

Since $\pi = 1$, this follows that $\mathbf{W}(p_{n*}, q*) = \mathbf{W}(p*, q*)$, hence $p_{n*} = p*$.

Therefore, the price offered by nonprofit universities is also $p*$. This implies that the capacity of nonprofit sector is exactly the efficient scale $\bar{x}$.

Then, the market (including both for-profit and nonprofit sectors) will exist equilibrium since:

- Both for-profit and nonprofit universities have no motivation to join or drop out the market.

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- The price-quality pair $(p*, q*)$ will maximize the utility of consumers, so consumers will not drop out the market.

(ii) From $\dfrac{\theta I}{n_h} + \dfrac{(1-\theta-\beta)I}{n_h+n_d} = \bar{x}$ with $n_d = 0$, we get $n_h = \dfrac{(1-\beta)I}{\bar{x}}$ and subsequently $n_n = \dfrac{\beta I}{\bar{x}}$. $\square$

Remark 3. For $\beta < 1 - \dfrac{\theta \bar{x}}{\bar{x}-x^0}$, nonprofit universities do not drive out completely the dishonest universities from market, but still contribute significantly to improve the overall qualiy of the market. This impacts is two-fold:

- the quality $q*$ of nonprofit universities is higher than the market average due to the existence of dishonest universities;
- nonprofit universities increase the proportion of informed consumers in the for-profit market $\left(\dfrac{\theta}{1-\beta} > \theta\right)$ and thus reduce the number of dishonest universities in the market.

The second impact is the fundamental difference between nonprofit and honest for-profit universities offering same quality $q*$. In other words, a nonprofit university has a better impact than a for-profit one in increasing the overall market quality, even both of them have the same quality level $q*$. This fact will be demonstrated by a numerically simple example in Appendix.

Remark 4 The results obtained above demonstrate the spillover effect of the nonprofit sector, independent of its size. Note also that with β is big enough, even when nonprofit universities cannot serve all uninformed consumers (i.e. $1 - \dfrac{\theta \bar{x}}{\bar{x}-x^0} \leq \beta < 1-\theta$), dishonest for-profit universities are also driven out of market, and there will be only one optimal quality $q*$ (of both honest for-profit and nonprofit universities), and uninformed consumers will be not ripped off. However, it should be emphasized that the convergence in price and quality of both such types of universities is a consequence of the adequate presence of nonprofit universities, and we cannot use this convergence as an argument to say that nonprofit universities will no longer be needed. Indeed, if number of nonprofit universities declines, dishonest for-profit universities would have incentive to re-enter the market and reduce the overall quality.

5. Some policy implications for private higher education in Vietnam

Non-public higher education system (including private and semi-public universities) in Vietnam was formed and developed in over 20 years (started in 1993 after the first model of people-funded Thang Long university in 1988). Over the past 20 year, Vietnam has accomplished notable progress in setting up new private universities and colleges. At present, there are about 84 non-public higher education institutions (54 universities and 30 colleges) training 14 percent of all students.

However, the quality of these universities does not keep up with the expansion in quantity. This is reflected by the low employment rate of graduates from private universities and low public perception and image of these universities. Several factors have been pointed out in public media and other forums to account explain this quality problem of the private higher education sector:

the inadequacy of policies for public and non-public universities, the very fast growth and weak governance, the asynchronous investment, and investors chasing profit. Our study sheds new insights to the debate, and then offers some suggestions on how to address the problem.

Proposition 2 partly explains the inevitability of the decline of this quality in the private higher education sector in Vietnam recently. Indeed, without nonprofit sector, the asymmetric information and profit maximizing objective will drive at least some for-profit universities to be dishonest and exploit the uninformed consumers. Meanwhile in Vietnam, the concept of nonprofit universities was legally recognized only in 2013 with the Higher Education Act. The subsequent absence of nonprofit universities has been therefore a systemic reason for the failure of private higher education market in the country. On the other hand, Proposition 4 opens up a theoretical possibility to eliminate this market failure: if there are enough nonprofit universities in the market, the dishonest for-profit universities will have no incentive to stay in the market, and we end up with honest for-profit and nonprofit universities serving with optimal price and quality.

The findings in this study also have some more practical policy implications to improve the quality of private higher education market in Vietnam. Indeed, since the expected (or average) quality Ω_2 of the market is increasing in variables β, θ and $\underline{q}$ (Equation 4), three main policy groups could be considered to raise the overall quality of this market, namely:

P1. Raising the proportion θ of informed consumers.

P2. Creating conditions for the participation of nonprofit universities in the market, thereby enhancing β.

P3. Raising the minimum quality $\underline{q}$ of private universities.

Policies in P1 might include mandatory requirements on disclosure of information such as:

- Information concerning quality of education services: facilities, lecturer qualification, curriculums, student quality, employment rates of graduates, etc.
- Financial information: financial statements, operating budget, auditing reports, investments, etc.

In addition, independent information services and accreditation systems could also increase the information access of the public and reduce the asymmetry of the market.

For policies in P2, it should be noted that in Vietnam, nonprofit universities are at infantile stage and need strong support of government in many aspects, for example:

- A clear, consistent, adequate, hassle-free and stable legal framework for establishment and operation of nonprofit universities;
- Strong monitoring mechanisms to ensure that the non-distribution constraint is strictly enforced at nonprofit universities;
- Other supports in terms of tax privileges, land and financial grants, and human resource to nonprofit universities.

Currently, the regulations for nonprofit universities in Vietnam are stipulated in Decision 70 (QD70 / 2014 / QD-TTg) of the Prime Minister dated 20.12.2014, and are relatively close to international practices. The main difference is the recognition by the state of shareholders with

their legal rights to limited dividends, blurring the division between nonprofit and for-profit universities.

Finally, for policies in P3, Proposition 4 and its consequences imply that for a mixed higher education market like the one in Vietnam now and in near future, raising the minimal quality requirements for opening a private university will improve the overall education quality in general through multiple channels:

- Improving the quality of even dishonest for-profit universities

- Reducing the threshold required for the minimum proportion of informed customers to drive the dishonest universities out of the market (Corollary 2);

- With given proportion of informed customers in the market, Reducing the threshold required for the minimum scope of the nonprofit sector to eliminate the market failure (Proposition 4).

APPENDIX

Below is a numerical example to illustrate the quality impact of a nonprofit university compared to that of a for-profit one.

Suppose that the capacity of private universities is 200.000 students, where there are 40.000 informed students, i.e. $\theta = 0,2$. Suppose further that the whole market with 50 for-profit universities, including 30 honest universities of quality q^* and 20 dishonest universities of quality $\underline{q}$, and the capacity of each university is 5.000 students.

By Equation (3), the expected education quality of whole market is then:

$$\Omega_1 = \left(0,2 + 0,8 \times \frac{30}{30+20} \right) \times q^* + 0,8 \times \frac{20}{30+20} \times \underline{q} = 0,680q^* + 0,320\underline{q}.$$

We now compare the market in two following options: (1) Establishing a honest for-profit university: (2) Establishing a nonprofit university.

Choosing the first option, the expected education quality of market is:

$$\Omega_1' = \left(0,2 + 0,8 \times \frac{31}{31+20} \right) \times q^* + 0,8 \times \frac{20}{31+20} \times \underline{q} = 0,686q^* + 0,314\underline{q}.$$

For the second option, the capacity of nonprofit sector is $\beta = \frac{5000}{200000} = 0,025$, so by Equation (4), the expected education quality of market is:

$$\Omega_2 = \left(0,025 + 0,2 + \left(0,8 - 0,025 \right) \times \frac{30}{30+20} \right) \times q^* + \left(0,8 - 0,025 \right) \times \frac{20}{30+20} \times \underline{q} = 0,690q^* + 0,310\underline{q}.$$

Obviously, $\Omega_2 > \Omega_1' > \Omega_1$, hence a nonprofit university has greater social benefits than a for-profit one in improving the education quality of whole market.

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