



## Administrative capacity assessment in higher education: The case of universities in Vietnam

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### ABSTRACT

Administrative staff are a crucial human capital input in tertiary education institutions. Given the substantial investment in recruitment and selection of administrative staff, efficient and effective use of these staff affects the organisational and financial performance of universities. Whereas much concern has been placed on the performance of academic staff, the ability of a university to obtain an optimal level of administrative staff has not been addressed. This paper investigates whether the usage capacity of administrative staff is maximised in Vietnamese universities. Vietnam has implemented several education reform policies with the aim to improve the standing of its universities in the world's education market. The process is not only about obtaining and delivering good education quality, but also efficiently using human resources to reach optimal performance and sustainable development. Employing the stochastic frontier input requirement model with data on 112 Vietnamese universities, we examine the presence of excess administrative capacity in these universities, given the existing student outputs and other input resources. We find that, on average, the level of excess administrative capacity is 3.4%, implying an economic loss in universities. In addition, under the analysis of determinants of the variances of the inefficiency effects and the error terms in the input-requirement function, our findings reveal that excess administrative capacity varies according to location and ownership. Some policy implications are discussed to address excess capacity of administrative staff in the Vietnamese context and some key lessons learned for the rest of the world.

### 1. Introduction

Higher education plays a crucial role of serving the demands of society and is indispensable for society to survive and thrive (Serdyukov, 2017). It should not only be comprehensive and innovative in teaching and learning but be continuously efficient in performance to meet challenges of the fast-changing globalized world. The performance must be efficient in input use (input saving), given the confines of limited resources; therefore, educational administrators are expected to minimize input resources or maximize educational outputs to ensure the best performance for sustainable development of institutions (Tran and Villano, 2017a).

Higher education institutions are considered as labour intensive. Universities tend to have most of their budgets devoted to personnel. Therefore, their performance and success are most likely to depend on this resource (Johnsrud, 2002; Szelągowska-Rudzka, 2017). Human resources of universities are classified by academic and professional staff (Gordon and Whitchurch, 2007). Academic staff are involved in

teaching and research activities. By contrast, professional staff participate in management, administering students and facilitating the teaching and learning process (Küskü, 2003; Tran and Villano, 2017a). Given limited financial resources, there has been increasing concern on the distribution of human resources over the different activities within a university, in which administrative costs have been increasing disproportionately (Gornitzka and Larsen, 2004) caused by possible excess administrative capacity in universities. Leslie and Rhoades (1995) showed that costs in terms of administrative staff and other related administrative services in universities could be increasing because of revenue growth, government regulatory pressure and organizational complexity. Depending on the specific aims of institutions, financial resources could shift away from instructional and research activities to invest in administrative operations such as academic services (Leslie and Rhoades, 1995) and institutional support. A recent study of 198 American public and private colleges and universities showed that the costs in instructional spending per student increased by 39% between 1993 and 2017 whereas administrative spending per student rose by

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61% in the same period (American Council of Trustees and Alumni, 2017). One of the reasons for this is attributed to an increase in administrative staff to comply with government regulations. As shown in Romero (2017), 12 presidents of colleges and universities said that to meet the federal mandates, operational costs could be as high as 15% of their budgets, regardless of state regulations that they need to address as well.

Research on the growth in administration is important for understanding the nature and functions of universities (Gornitzka and Larsen, 2004). Hence, measuring the usage capacity of administrative staff provide useful information about operational inefficiency of universities. Casu and Thanassoulis (2006) evaluated cost efficiency in central administrative services in UK universities using data envelopment analysis (DEA). Their findings revealed that, on average, UK universities displayed inefficiency of 27% in cost expenditure for administrative services, indicating that there is considerable scope for savings. Tran and Villano (2018a) revealed that financial efficiency of public universities in Vietnam could potentially improve if administrative staff decreased by 23%. This change should go together with a proportional decline in other inputs. However, the authors did not estimate excess administrative capacity to produce the existing output while being separated from overuse of other inputs—thus, this motivates us to bridge this gap in the efficiency literature.

In the theory of frontier production models, excess capacity of a firm is an output-based measure defined as the difference between the firm's frontier output and its observed output, in which the frontier output of the firm is the output it could produce if they kept the same level of inputs but removed inefficiency and moved to the frontier (Kirkley et al., 2002, 2004; Felthoven and Morrison Paul, 2004; Guan, et al. 2009). Following Guan et al. (2009), the concept of excess input capacity, drawn from an input-requirement frontier, is closely associated with, but not the same as, excess output in frontier production function models. This is because excess input capacity is measured in a single input space rather than output space. That is, excess input capacity is measured by the quantities by which a single input of interest can be reduced while keeping the output and other inputs constant. Additionally, excess input capacity is also related to another common input-orientated approach that can be estimated by using a stochastic frontier model or a stochastic input distance function (Kumbhakar and Tisonas, 2006; Coelli et al., 2005). However, in these methods, technical inefficiency could be improved when all inputs are reduced by the same proportion without allowing a measure on excess capacity of a single input of interest. This is because an excess of an individual input cannot be separated from overuse of other inputs. In the higher education context, excess capacity of inputs, such as administrative staff, can be estimated under this framework where outputs and other inputs are held constant.

This paper examines whether there exists excess administrative capacity in universities under the assumption that the output (e.g., enrolments of students) and other inputs, such as instructional staff and operating expenses, are kept constant. We use a frontier input requirement function in the stochastic frontier analysis (SFA) framework that allows us to explain an excess level of a specific input without changing output and other inputs. It is noted that excess administrative capacity is different from input slacks obtained from DEA, in which all inputs change by the same proportion to reach full efficiency. Understanding excess administrative staff would help universities improve human resource investment decisions and, thus, reduce administrative costs and contribute to their overall performance.

The organisation of the paper is as follows. Section 2 presents the role of human resources in higher education. This is followed by a review of efficiency studies in higher education in Section 3. Section 4 introduces our study on Vietnamese universities. The methodology, including the stochastic frontier input requirement method, data source and the empirical model are presented in Section 5. Section 6 discusses our empirical results and policy implications are presented in Section 7.

Section 8 contains some conclusions and directions for future research.

## 2. The role of human resources in higher education

Human resource capacity plays a crucial role in higher education in the 21st century, the time of development of a knowledge-based economy that requires changes in management, financing and personnel functions (Gordon and Whitchurch, 2007; Szelągowska-Rudzka, 2017). Khasawneh (2011, p. 535) revealed that "... Through investment in people, the quality of work improves; individuals acquire returns in the form of additional income, higher wages, greater economic security, and increased employment prospects; and the organization realizes economic benefits." This implies the fact that the organisation's development strategy needs to comprise human resource management strategies and policies and support their implementation together with ensuring the care of employees (Szelągowska-Rudzka, 2017). Needless to say, such human resource management strategies can be applied to the university context because competencies of staff make decisions on the attractiveness of the institutions and their qualifications, skills, commitment, aspirations and work contribute to the success of a university (Gordon and Whitchurch, 2007; Szelągowska-Rudzka, 2018).

University staff are an important asset contributing to the success of an organisation in terms of the level of education services provided and the quality of scientific research (Grobela et al., 2016). University staff can be classified into two types: academic and professional staff. According to Gordon and Whitchurch (2007, p. 140), the role that an academic is expected to undertake includes six overarching core functions: "teaching and student support; research; community service; professional service; leadership, management and consultancy; and development project work". Meanwhile, professional staff focus on undertaking professional roles such as general management and facilitating the learning and teaching process, namely learning support, finance, and property, etc. (Gordon and Whitchurch, 2007; Tran and Villano, 2017). However, there is no clear-cut way to distinguish between professional staff from academic managers such as pro-vice chancellors or deans who conduct both academic and professional work. This has led to a greater diversity in university human resource management and to a blurring of differences between academic and professional staff (Gordon and Whitchurch, 2007; Scott, 1997).

On a human resource management perspective, a university's universal goal is to build its competitive position by obtaining high work efficiency, increase the value of its human capital and, thus, provide value to stakeholders. When this process is done well it increases the competencies of staff and enables them to work more effectively for the university's benefit (Szelągowska-Rudzka, 2017). However, on the financial performance perspective, leaders of universities bear high pressure of the distribution of human resources over various activities within a university due to limited financial resources, in which administrative costs increased disproportionately (Gornitzka and Larsen, 2004). Complying with government regulations is referred to as one of the reasons that leads to an unexpected increase in administrative costs (Romero, 2017). In other words, the number of professional staff must increase to meet demands of government mandates. This suggests the question whether universities actually use professional staff in an efficient way, given existing academic staff, for their academic activities.

The importance of administrative staff in higher education has been well-recorded since the 1990s when administrative costs as the share of education expenditures started increasing faster than academic costs (Leslie and Rhoads, 1995). This has led scholars to conduct separate studies on administrative staff to understand the sources and causes of mounting administrative costs that are important for educational managers to have broader oversight on their institutional budgets (Leslie and Rhoads, 1995) and improve management practices in the universities (Pitman, 2000). Leslie and Rhoads (1995) emphasised that "administrative expenditures are conceptualised as opportunity costs, that is, revenues forgone by production activities" (p. 190). Thus, an

increase in administrative costs via a growth of administrative staff without an intentional plan would lead to a decrease in cost efficiency, and, subsequently, the performance of the institutions. Baltaru and Soysal (2018) indicated that one of the factors fostering administrative and professional bodies such as universities is attributed to expansion and diversity in the missions of higher education. This was evidenced in examining the performance of 761 universities in 11 European countries where universities with a high level of entrepreneurship tended to have a higher proportion of administrative staff. In the same vein, Baltaru (2019) showed that UK universities tended to engage more professional staff when they became more reliant on tuition fees and education contracts and that increases in the number of administrative staff was to “cater for demographic inclusion in terms of ethnicity and disability” (p. 641).

However, by investigating the structure of the administrative workforce in Norwegian universities, Gornitzka and Larsen (2004, p. 470) revealed that “paying attention to administrative cost and efficiency issues is a legitimate concern, but seeing administration and administrative personnel solely from that perspective might inhibit an understanding of nonacademic personnel’s contribution and role in university life”. Supporting this view, Pitman (2000, p. 166) showed that “the role of administrative staff in tertiary organisational culture has been somewhat ignored” whilst the administrative tasks aim to facilitate the learning and teaching process. Using data from interviewing 13 administrative staff in different levels of management at Curtin University in Western Australia, Pitman (2000, p. 173) reported that administrative staff believe that “they play a vital role in the teaching and learning processes of the university”, but their customers (academics and students) “have a relatively low opinion of the importance of their service”. That is, the contribution of administrative staff in academia is huge but it is not appropriately recognised. In the same vein, in a study of middle-level academic management in a Vietnamese university through 24 interviews and document analysis, Nguyen (2013) indicated that middle-level academic managers play an important role in university management, but their roles are not clear and straightforward. Given a low level of autonomy in leadership, the academic managers found it challenging to perform their best practice, thus, affecting university performance.

The abovementioned findings appeared to be in line with the findings of job satisfaction found in some recent studies (Jung and Shin, 2015; Kùshù, 2003; Pick et al., 2012). For example, using a questionnaire sent to 1,822 staff in a Turkish state university regarding job satisfaction and, with the results of 291 respondents, Kùshù (2003) revealed that administrative staff had a lower level of professional satisfaction, but they tolerated their job conditions and expressed their loyalty to the institution better than academic staff. On the other hand, Jung and Shin (2014, p. 881) showed that interpersonal skills of administrative staff in a Korean research university affected their overall job satisfaction and that “each dimension of job competency (organizational understanding, problem solving, interpersonal skills, ICT skills, and global competency) has a different impact on the different dimensions of job satisfaction (job field, workplace, and job task). Pick, Teo and Yeung (2011) indicated that job stresses reduced job satisfaction of administrative staff in three Australian public universities and the level of job satisfaction could be improved via staff engagement, better communication and work-related social support.

The abovementioned studies have reflected, to some extent, the importance of administrative staff in facilitating the learning and teaching process of universities. Without support services provided by administrative and professional staff, universities will be less effective in meeting the teaching and research outcomes. Clearly, using professional staff efficiently is vital for universities in terms of creating value for stakeholders, achieving financially sustainable development and determining their standing in the global educational market. In addition, efficiency in using administrative staff can generate not only cost efficiency but also maintain management effectiveness via increasing

the satisfaction level of administrative bodies.

### 3. University performance: an estimation using stochastic frontier analysis (SFA)

The use of SFA is well established in the econometrics literature to measure the efficiency of organisations. To date, voluminous studies have used the SFA approach to estimate the performance of higher education institutions in terms of types of functions and functional forms (see Gralka (2018a) for a systematic review on SFA in higher education). Based on this review, key considerations in the use of SFA include the underlying assumptions and specifications of the empirical model and inclusion of determinants of inefficiency.

The evidence suggests that the majority of studies chose to apply translog cost-functions, assuming a half-normal distribution for the inefficiency term to measure the efficiency of universities.<sup>1</sup> For example, Steven (2005) applied the quadratic stochastic frontier cost function to estimate cost efficiency of UK universities whereas Kempkes and Pohl (2010) and Sav (2012) utilized the translog cost function adapted from the model of Battese and Coelli (1995) to measure the cost efficiency of universities in Germany and the USA, respectively. The random effects model was also used to compare the results of stochastic frontier functions in the studies of Lenton (2008) and Agasisti and Johnes (2010). The dependent variable was measured in different ways, such as current costs (Agasisti and Johnes, 2010), total expenditures or variable costs (Steven, 2005; Sav, 2012; Agasisti and Belfield, 2017) that depend on the specific context of each study. This also consists of independent variables which varied from student characteristics to macro variables (De Witte and López-Torres, 2017; Agasisti and Gralka, 2019).

Whilst variables used in the analyses appear to be quite similar and deliberately chosen for usage, the model specifications have been improved and extended to capture changes of inefficiency over time. For example, Agasisti and Belfield (2017) estimated the cost efficiency of 950 community colleges in the USA using SFA for the period 2003–2010. Their findings showed that efficiency scores varied significantly across colleges by applying latent class estimation to address these heterogeneous characteristics. However, Gralka (2018) argued that this method was not satisfactory because of the difficulty to define key factors used for distinguishing institutions. Instead, the author suggested management as a factor to make a difference between the institutions and introduced a new specification of heterogeneity and persistent inefficiency in the SFA method. Using data from 73 German universities during 2001–2013 and the method proposed by Kumbhakar, Lien and Hardaker (2014), Gralka (2018b) showed that cost inefficiency tends to be long-term and persistent rather than short-term and residual, and that the university structure is required to be thoroughly changed to increase efficiency. The Kumbhakar, Lien and Hardaker (2014) model specification was applied in Titus, Vamosiu and McClure (2017) to investigate the performance of 252 institutions in the USA that offered master degrees using data over the years, 2004–2012. Their findings revealed that regional clustering of costs exist, and cost inefficiencies tend to persist over time. This implies that consideration of location is imperative in understanding the performance of universities and higher education institutions. Most recently, Agasisti and Gralka (2019) used the same SFA specification to estimate the performance of Italian and German universities in separate frontiers. Their objective was to capture short- and long-term inefficiencies of the two groups of universities. The findings showed that both groups of universities witnessed high and similar short-term institutional

<sup>1</sup> Given the consistency of results from previous studies, we focus our brief overview of the use of SFA over the past decade to provide a contextual backdrop for our empirical analysis. For a detailed overview of the application of SFA in higher education, see Gralka (2018a).

inefficiencies. However, the Italian universities exhibited a higher average long-term structural efficiency relative to the average long-term structural efficiency of the German universities. However, it is not clear whether there is a gap between the Italian and German higher education sectors if they were investigated using a metafrontier framework, given that they come from two European nations.

We note that research on the efficiency of administrative and professional bodies in the university context is still in its nascent phase. Only a few studies on the efficiency of universities addressed the performance of administrative or professional services or staff in the academic production process. For instance, *Casu and Thanassoulis (2006)* assessed the cost efficiency of central administrative services for 108 UK universities in the year 1999/2000. Their findings indicated that 17 universities were on the best-practice frontier and that, on average, these UK universities could potentially reduce their administrative costs by 27%. *Tran and Villano (2017a)* used a two-stage DEA method to estimate the operational efficiency of universities in Vietnam and found that an average input saving of 2.5% could be achieved on administrative staff costs. *Tran and Villano (2018a)* found that public universities in Vietnam could potentially reduce the usage of administrative staff by 23% to assist universities to reach their full frontier efficiency. However, this administrative saving level was estimated simultaneously with other inputs in terms of the same proportion. It is noted that because these studies used the nonparametric DEA approach rather than the SFA method, they do not provide estimates of excess capacity of a single input while holding the current levels of other outputs and inputs fixed. Although saving inputs can be computed in the DEA framework, as in *Tran and Villano (2017a; 2018a)*, they were not measured separately from other inputs and outputs. Thus, measuring and evaluating the excess capacity of an individual input is limited.

Our paper aims to investigate excess administrative capacity in higher education in Vietnam. This study provides significant contributions to the literature by: (1) using a novel application of the stochastic input-requirement frontier to estimate excess levels of administrative staff; (2) investigating the influences of external factors on the technical inefficiency effects and the error term using the half-normal approach, thereby, helping explain the variability of excess administrative capacity as a form of economic loss in higher education institutions, where there is heterogeneity in their inefficiency of using administrative staff resources; and (3) using the stochastic input-requirement model in Vietnamese universities as a case study. This model could be widely applied in other countries where universities exhibit similar characteristics.

#### 4. Vietnamese universities

Vietnam currently has 235 universities in the higher education system, in which public universities play a crucial role, accounting for 72.3% (170 institutions) of the total number of universities in the nation. From *Table 1*, we see that the number of universities and their enrolments have had significant increases over various periods. We note that public universities account for more than 86% of total university enrolments in each of the years considered. There was more than a doubling in the number of private universities during the decade from 2005/06–2015/16. However, their enrolments in 2016/17 were 243,975, which was about one-sixth (16%) of the enrolments of public universities. This implies that the government objective to increase enrolments in the private tertiary institutions by 40% seems infeasible (*Villano and Tran, 2018*).

The academic staff in universities increased considerably in 2016/17–97,052 lecturers, which is more than three times the number of lecturers in 2000 (Ministry of Education and Training (MOET), 2018). Although higher education in Vietnam has made remarkable progress during the three decades of economic reform from 1986, the stated goal of the Vietnamese government in 2007 to get at least one Vietnamese

**Table 1**

Numbers of institutions and enrolments of Vietnamese universities over years. Source: MOET (2018).

|                                 | 1999/2000 | 2005/06   | 2015/16   | 2016/17   |
|---------------------------------|-----------|-----------|-----------|-----------|
| <b>Institutions</b>             | 69        | 125       | 223       | 235       |
| Public                          | 52        | 100       | 163       | 170       |
| Private                         | 17        | 25        | 60        | 65        |
| <b>Enrolments</b>               | 719,842   | 1,046,291 | 1,753,174 | 1,767,879 |
| Public                          | 624,423   | 933,352   | 1,520,807 | 1,523,904 |
| Private                         | 95,419    | 112,939   | 232,367   | 243,975   |
| <b>Share of total enrolment</b> |           |           |           |           |
| Public                          | 86.7%     | 89.2%     | 86.7%     | 86.2%     |
| Private                         | 13.3%     | 10.8%     | 13.3%     | 13.8%     |
| <b>Graduates</b>                | 90,791    | 143,017   | 352,789   | 305,601   |
| <b>Academic staff</b>           | 30,309    | 45,579    | 93,851    | 97,052    |
| <b>Administrative staff*</b>    | 146.87    |           |           |           |
| Year 2011/12                    |           |           |           |           |
| Year 2012/13                    | 154.30    |           |           |           |
| Year 2013/14                    | 159.00    |           |           |           |

\* Data for 112 universities.

university into the list of the top 200 universities of the world by 2020<sup>2</sup> was not realised.<sup>3</sup> Gaining a high rank among the world's universities depends on, not only the education quality, but the efficiency of academic performance, in which both academic and administrative staff play important roles.

Over recent years, Vietnamese universities have put much more emphasis on academic staff than administrative staff in academic operations, as has been the case in universities in most countries of the world. Statistical data published by MOET only refer to academic staff, except for the individual reports of some universities. The data for administrative staff in *Table 1* were collected from the 112 universities that submitted their annual reports to MOET for the period 2011/12–2013/14. This suggests that the role of administrative staff seems to have been overlooked, whereas they are indispensable in academic operations of tertiary education institutions to facilitate the teaching and learning process. As indicated by *Leslie and Rhoades (1995)*, administrative staff numbers keep increasing for the aim of meeting target revenue, dealing with government regulations or solving organisational complexity. Accordingly, financial resources shifted to administrative staff due to the action of educational managers might lead to inefficiency.

In Vietnam, universities must conform to the 2012 Labour Code and the 2010 Law on Cadres and Civil Servants<sup>4</sup> in recruiting employees for their operations. Based on these laws, academic and administrative staff are eligible to sign a full-time, fixed-term contract with universities from one to three years (12–36 months). Then, if there are no substantial changes, universities can hire these individuals as full-time permanent and continuing staff. Following the newest adjustments to these laws, approved by the National Assembly in late 2019<sup>5</sup>, the duration for full-time, fixed-term contracts could be increased up to five years (60 months), allowing more flexibility for negotiations and

<sup>2</sup> Decision 121/2007/QG-TTg issued by the Prime Minister about the development plan for higher education institutions for the period 2006–2020.

<sup>3</sup> In the Quacquarelli Symonds (QS) World University Rankings, the top Vietnamese university was the Viet Nam National University, Ho Chi Minh City (VNU-HCM), which was listed at 701–750. The Viet Nam National University, Hanoi was listed at 801–1000. See <https://www.topuniversities.com/university-rankings/world-university-rankings/2020>. The above-stated goal of the Vietnamese government was stated to be “quite ambitious” by *Marginson (2008)* and *Tran, Crawford and Villano (2017)*.

<sup>4</sup> The 2012 Labour Code 10/2012/QH13 was approved by the National Assembly on 18/06/2012 and the 2010 Law on Cadres and Civil Servants 58/2010/QH12 was approved by the National Assembly on 15/11/2010.

<sup>5</sup> The 2019 Labour Code 45/2019/QH14 was approved by the National Assembly on 20/11/2019

decisions between employers and employees after the expiration of full-time, fixed-term contracts. Based on these regulations, academic and administrative staff officially hired by universities are often on a full-time basis. Whilst universities need to meet the obligatory requirement of the ratio of students to a lecturer, as indicated in Circular 24/2015/BGDDT<sup>6</sup>, there is no limitation for hiring administrative staff. Universities can recruit as many administrative staff as they want to meet demands for the learning, teaching and research and the institutional development plans for their institutions. This implies high autonomy in managing administrative staff in universities, but this would inevitably impact on cost efficiency and, thus, overall performance if the growth of administrative staff goes beyond the optimal level.

The literature on the operational efficiency of Vietnamese universities is sparse, the first study being Nguyen, Thenet and Nguyen (2015). Tran and Villano (2017a), using cross-sectional data and applying DEA, found that Vietnamese universities work at a high level of efficiency, and input-saving of administrative staff was, on average, 2.5% of the total administrative staff. Later, Tran and Villano (2018a) found that public universities had excess staff that amounted to 23%, on average, of the administrative staff. It is noted that these results were estimated using a combination of changes in other inputs with the same proportion. Later studies using nonparametric DEA confirmed inefficiency in production, academic and financial divisions and extended the analysis by accounting for heterogeneity. For example, Tran and Villano (2017b) suggested that heterogeneity in financial capacity and in demographic features account for differences in the input mix of Vietnamese universities. They showed that *vital* universities, as recognised by the government, are more efficient than *non-vital* ones. Tran and Villano (2019) focused on adjusting efficiency of universities by accounting for influences of environmental factors. Villano and Tran (2018) utilized the DEA distance function with quasi-fixed inputs to estimate efficiency of private universities—a method that can be used for detecting outliers. Whereas the above studies focused on the overall performance of institutions, no research has been conducted on a single administrative staff input as a key agent for enhancing efficiency of using this resource in universities. By measuring excess capacity of administrative staff, given the existing output and other fixed inputs, universities would have a better strategy in utilising this input resource to obtain improvements in their academic performance. Financial resources invested in academic staff could be more efficient, thus, reducing economic losses. Accordingly, education quality can be enhanced due to financial surpluses being diverted to teaching operations.

## 5. Methodology

### 5.1. Input-requirement frontier

The stochastic frontier production function model that incorporates technical inefficiency effects was first proposed by Aigner, Lovell and Schmidt (1977). This model has been extended and SFA has been widely utilised to estimate the technical efficiency of firms in different sectors. Most studies on production efficiency use an output-orientated definition of inefficiency which is associated with the difference between the frontier output for the firm's input vector and the observed output of the firm. Generally, many firms were found to be inefficient in their operations, leading to excess capacity of firms in using their input resources. Guan, Kumbhakar, Myers and Lansink (2009, p. 765) argued that "in most production studies, *capacity* refers to capital goods (e.g., plant and equipment), not to variable inputs (e.g., materials) that are consumed in one production cycle." They focused on estimating *excess capital capacity*—the extent to which inefficient firms could produce the same level of output using less capital while keeping other inputs

unchanged. Accordingly, this input-orientated approach was used to estimate technical efficiency of individual firms.

In this paper, we extend the methodology of Guan et al. (2009) to measure *human capital usage capacity* in higher education (i.e., *excess/deficit administrative capacity* in universities). We investigate the extent to which technically inefficient universities could produce the same level of output using less administrative staff while other input factors remain unchanged. To do so, the administrative staff variable is specifically singled out to measure its overuse using the input-orientated approach. One may doubt the correlation between the usage capacities of academic and administrative staff in the university context because both these types of staff contribute simultaneously to production outputs of universities. This would make it challenging in separate analyses of administrative and academic staff that limit potential research to estimate efficiency of using administrative staff in higher education. However, as stated earlier, we aim to address this issue as an innovative approach in investigating the capacity usage of administrative staff in the university context, *ceteris paribus*. In so doing, we use a cross-sectional dataset that allows us to keep temporally dynamic changes of inputs and output constant. Therefore, change in efficiency of using administrative staff can be independently estimated to meet demands of current outputs.

The analysis of excess administrative capacity is grounded on the concept of a stochastic input-requirement frontier (Diewert, 1974; Guan et al., 2009). This approach estimates the efficiency of an input in terms of its minimum amount required to produce an existing level of output, given unchanged levels of other inputs used in the production process. An advantage of this method is that it enables us to directly estimate the utilisation efficiency of an input to the extent to which that input could be reduced in a technically inefficient university, without varying output levels and other input levels, to move the university to its production frontier. The stochastic input-requirement frontiers have been widely applied in banking, insurance and agriculture (e.g., Battese, Heshmati and Hjalmarsson, 2000; Heshmati, 2001; Kumbhakar, Heshmati and Hjalmarsson, 2002; El-Gamal and Inanoglu, 2005; and Guan et al., 2009). However, no previous study has been conducted to measure excess administrative capacity in an academic environment.

An input-requirement frontier is based on the frontier production function for an input of interest and is derived from the SFA models including a stochastic error term and a random variable characterised as inefficiency. Following Guan et al. (2009), we assume that the desired level of the administrative staff for the  $k$ th university ( $ADS_k^*$ ) and the observed level ( $ADS_k$ ), given the levels of output and other inputs, are given by:

$$ADS_k^* = ADS_k e^{-u_k} \quad (1)$$

where  $u_k$  denotes the random effect for the  $k$ th university associated with inefficiency of use of administrative staff in educational purposes. This inefficiency effect is a nonnegative random variable whose distribution is assumed to be half-normal. Hence, the model of Eq. (1) specifies that the desired level of academic staff is less than the observed level and that the excess level of administrative staff ( $ADS_k^e$ ) is given by:

$$ADS_k^e = ADS_k - ADS_k^* = ADS_k(1 - e^{-u_k}). \quad (2)$$

Further, we define the observed levels of administrative staff in the sample of  $K$  universities in terms of the levels of output and the levels of other inputs, as follows:

$$\ln(ADS_k) = f(y_k, x_k; \beta) + v_k - u_k, \quad k = 1, \dots, K \quad (3)$$

where  $f(y_k, x_k; \beta)$  is an appropriate function of the levels of the vector of inputs  $x_k$  involved in producing the output,  $y_k$ ;  $\beta$  is the associated vector of technology coefficients; and  $v_k$  is a random error, representing the stochastic nature of the production process beyond the control of any university, which is assumed for all  $k = 1, \dots, K$  to be independent normal random variables with zero means.

<sup>6</sup> Circular 24/2015/BGDDT was promulgated by the Ministry of Education and Training on 23/9/2015 about *Standards for Higher Education Institutions*.

The model of Eq. (3) can be extended to account for firm heterogeneity (Greene, 2005a, 2005b) and include determinants of inefficiency (Wang, 2002). In this paper, we specify that the one-sided technical inefficiency effect  $u_k$  and the error term  $v_k$  have variances that are affected by external factors, and we assume that:

$$u_k \sim N_+(0, \sigma_u^2(Z_k)), v_k \sim N(0, \sigma_v^2(Z_k)) \tag{4}$$

where the Z-variables affect excess capacity of administrative staff through the variances, which are parameterised as follows:

$$\sigma_u^2(Z_k) = \exp(Z_k' \gamma) \tag{5}$$

$$\sigma_v^2(Z_k) = \exp(Z_k' \omega). \tag{6}$$

If a particular coefficient of  $\gamma$  is positive, then the variance of  $u_k$  goes up when the corresponding variable in  $Z$  increases, which, in turn, makes the distribution of  $u_k$  flatter and increases inefficiency or excess in using administrative staff (Guan et al., 2009).

### 5.2. Model specification

The empirical model for the administrative staff requirement frontier function is specified as a flexible translog functional form, as follows:

$$\ln ADS_k = c_0 + \beta_0 \ln y_k + \beta_{00} (\ln y_k)^2 + \sum_{j=1}^2 \beta_{0j} \ln y_k \ln x_{jk} + \sum_{j=1}^2 \alpha_j \ln x_{jk} + \frac{1}{2} \sum_{j=1}^2 \sum_{l=1}^2 \alpha_{jl} \ln x_{jk} \ln x_{lk} + v_k - u_k \tag{7}$$

where  $ADS_k$  is the number of administrative staff for the  $k$ th university<sup>7</sup>;  $y$  is the total number of students;  $x_1$  is the number of academic staff; and  $x_2$  is the operating expenses (VND<sup>8</sup> billion).

The model of Eq. (7) defines the observed number of administrative staff involved in academic operations, given the level of output and other inputs that would influence the technical requirement of administrative staff numbers. Excess administrative capacity is the difference between the observed administrative staff number and the desired number, as modelled in Eq. (2). This excess capacity can come from either inefficient use of administrative staff or administrative staff that are left idle. It is noted that prior to taking logs, the independent variables were scaled (divided by their geometric means). As a result, the first-order coefficients in the model can be interpreted as elasticities of the number of administrative staff with respect to the output and the inputs, evaluated at the means of the data (Kumbhakar, Lien and Hardaker, 2014).

Using the maximum-likelihood method to estimate the input-requirement frontier may face an endogeneity problem, for example, the number of students (output  $y$ ) may be correlated with operating expenses ( $x_2$ ) (Guan et al., 2009). To avoid this, we conduct a two-step method of estimation. First, instead of using the generalised method of moments for panel data, as in Guan et al. (2009), we use two-stage least squares to obtain consistent estimates of the frontier parameters. However, this method does not identify the excess administrative staff component of each university and does not determine what factors affect excess administrative staff. Second, we use the maximum-likelihood method on the residuals from the first-step estimation. This step allows us to estimate the influence of external factors on the variability of both the inefficiency and random errors:

$$\hat{e}_k = e_0 + v_k - u_k \tag{8}$$

<sup>7</sup> The subscript,  $k$ , on variables to denote the  $k^{\text{th}}$  university is hereafter excluded for simplicity of presentation.

<sup>8</sup> On 1st July 2019, one USD was equivalent to 23,267 VND (Vietnamese Dong).

where  $\hat{e}_k$  are the residuals from the first step of the method.

Determinants of excess administrative staff analysed in the models of Eq.s (5) and (6) for the inefficiency effects  $u_k$  and the random errors  $v_k$ , respectively, are specified as follows:

$$\exp(Z_k' \gamma) = \exp(\gamma_0 + \gamma_1 z_{1k} + \gamma_2 z_{2k} + \gamma_3 z_{3k} + \gamma_4 z_{4k} + \gamma_5 z_{5k} + \gamma_6 z_{6k}) \tag{9}$$

$$\exp(Z_k' \omega) = \exp(\omega_0 + \omega_1 z_{1k} + \omega_2 z_{2k} + \omega_3 z_{3k} + \omega_4 z_{4k} + \omega_5 z_{5k} + \omega_6 z_{6k}) \tag{10}$$

where  $z_1$  is the *location* dummy variable (1 = metropolitan, 0 = regional);  $z_2$  is the *ownership* dummy variable (1 = public, 0 = private);  $z_3$  is the *age* of the university (in years);  $z_4$  is the *national entry exam mark*;  $z_5$  is *other revenue* (VND billion) including research services, the state budget and other related incomes; and  $z_6$  is the proportion of academic staff who had PhDs.

The variance parameters of these equations are estimated by the maximum-likelihood method, not by the regression of predicted inefficiency effects on a set of control variables (Kumbhakar and Lovell, 2000; Wang, 2002; and Guan et al., 2009).

### 5.3. Data source and variables

Data for this paper were obtained from MOET and additional data were compiled from the individual websites of the universities for the year 2013/14. These cross-sectional data were limited to account for any temporal changes of inputs and outputs so that efficiency of administrative staff can be estimated, given the reported outputs for the year 2013/14. This is because the databases from MOET and the reporting universities are not available for longer periods and are mostly incomplete. However, the single year of 2013/14 is worthy of being considered because this was the final year for the 2010 tuition-fee policy of the government to be undertaken before moving to the next phase with a new decree<sup>9</sup> on tuition fees in education. Our analysis provides a good starting point for evaluating the performance of administrative staff in Vietnamese universities and will inform future research undertakings when more complete longitudinal data become available.

The analysis in our paper involve data from 112 universities, which is only slightly less than half the total universities. Due to the swift growth in the number of universities in Vietnam in recent years, new universities are not included in our sample. Therefore, caution must be taken in making inferences regarding the current state of the whole Vietnamese university population. Nevertheless, we can confirm that: (1) our sample provides a significant dataset for our application of the input-requirement frontier model to data on administrative staff of Vietnamese universities; and (2) the universities in our sample are institutions which have followed the guidelines of MOET to submit their reports to MOET and have been made public to researchers and the community; thus, these data from these institutions are the best that are available at the present time for analysis.

From the input-requirement function model of Eq. (7), the dependent variable is the logarithm of the number of administrative staff. In this paper, administrative staff are those who take charge of administering students and facilitating the teaching and research operations and include management positions at different levels. The output is the number of students including undergraduates and postgraduates enrolled in 2013/14. Data on research output (publications, book chapters, conference papers, etc.) are not included in the model because data for research output have not been sufficiently recorded at the institutional level; hence, are not available for our analysis. In the Vietnamese university context, although being encouraged, research activities are still restricted because the tasks of academic staff focus mainly on

<sup>9</sup> Decree 86/2015/ND-CP was issued by MOET on tuition fees in education for 2015/16–2020/21

teaching rather than research activities to produce scholarly outputs. A recent study of Nguyen (2016, p. 231) revealed that “the four leading universities in Vietnam have shown their recognition of academic research; however, their human resource management policies are not powerful enough to encourage academics to do research to the best of their potential”. As a result, the main responsibilities of administrative staff are to facilitate the learning and teaching process, rather than serve research activities. This limitation should be addressed in future studies when data on research output are available for analysis.

The inputs consist of the number of academic staff and operating expenses. These inputs are necessary for operations of universities and were used in recent efficiency studies (Carrington, O'Donnell and Rao, 2018; Tran and Villano, 2018a, b, Tran and Villano 2017a,b; Tran and Villano, 2019; Abbott and Doucouliagos, 2003, 2009; Thanassoulis et al., 2011; Miranda, Gramani and Andrade, 2012).

Determinants that influence the variability of the inefficiency effects and the random errors in our model are included in both models of Eq.s (9) and (10) to test for heterogeneity of universities. In Vietnamese universities, these factors are expected to affect both their inefficiencies and the unobserved disturbances that cause heterogeneity in their performance. For these control variables, the following issues are investigated:

- (i) *Location* may influence excess administrative capacity. Those universities located in one of the four main cities (Ha Noi, Ho Chi Minh City, Da Nang and Hue City) would use more administrative staff to conduct work to facilitate marketing activities, manage large numbers of students and effectuate changes in the government policies. This variable can influence the universities leading to differences in the use of administrative staff.
- (ii) *Ownership* can be positively linked to excess administrative capacity and make universities heterogeneous in using administrative resources. This is because private universities do not receive subsidies from the government; hence, they must efficiently manage their expenditures for human resources.
- (iii) *Age of universities* is expected to be positively related to excess administrative capacity because the older universities have better reputations; thus, they would need more administrative staff to meet the requirements of sustainable development and maintain their reputations. Age may contribute to endogeneity of universities causing them to use different levels of administrative resources.
- (iv) *The average national entry exam (NEE) marks* are expected to be influential on the numbers of new annual enrolments of universities. Thus, NEE may indirectly affect excess administrative capacity and if new enrolments increase more than expected.
- (v) *Other revenue* consists of extra income resources additional to tuition fees. It is assumed that if *other revenue* is higher, excess administrative capacity of universities may be less because universities tend to use additional revenue for other academic development objectives. This variable may also contribute significantly to heterogeneous features of universities.
- (vi) *A larger proportion of staff with PhD degrees* may impact universities in using administrative staff resources rather than causing excess administrative capacity.

Summary statistics for all variables used in our analysis are presented in Table 2.

On average, the number of administrative staff was 159; however, this variable varied greatly across universities, ranging from 45 to 718. The average number of enrolments was 8,437 students, indicating that the average number of students per administrative staff was about 53. The average number of students per academic staff was about 23, being greater than the average of 20, as recommended by MOET (2015). However, there are no regulations for administrative staff, implying that universities are quite flexible in hiring administrative staff,

depending on their budgets and the needs of academic operations. About 60% of the universities in our sample were in metropolitan areas and about 73% were public institutions. The *other revenue*, including various sources of income from the state budget, research services and other related activities, account for about 30% of total expenditures, which would help universities have more financial resources for investment and development. The average percentage of academic staff with PhD degrees was 18%, being much less than the percentage of PhD staff as recommended by MOET (2015) at 40% for higher education institutions.

## 6. Empirical results

The 2SLS estimates of the empirical model of Eq. (7) for the number of administrative staff, obtained from the frontier package in STATA 14, are presented in Table 3. The whole model is statistically significant at the 1% level.

As can be seen in Table 3, a majority of the estimated second-order coefficients of the input requirement model for the number of administrative staff are statistically significant at least at the 10% level. Because the model is a quadratic function of the inputs and output, the relationships between the number of administrative staff and the student enrolments and inputs are indicated by the elasticity relationships that are summarised in Table 4. The partial derivatives of the logarithm of the number of administrative staff and the student enrolments, the number of academic staff and the operating expenses, as defined in Eq. (7), are functions of the logarithms of the student enrolments, the number of academic staff and the operating expenses. The variables,  $\ln y$ ,  $\ln x_1$  and  $\ln x_2$ , are listed as headings of the last three columns of Table 4. The values in the cells of the table are the coefficients of the logarithms of the enrolments and inputs involved in the columns. The elasticity relationships indicate some interesting interactions between the student enrolments, the number of academic staff and the operating expenditures, as discussed below.

First, the elasticity of the number of administrative staff with respect to student enrolments is found to significantly decrease as the number of enrolments increase but increase with increases in the operating expenses. Although this elasticity is estimated to be negatively related to the number of academic staff, the effect was not statistically significant at the 10% level.

Second, the elasticity of the number of administrative staff with respect to the number of academic staff is estimated to significantly increase as the number of academic staff increases but significantly decrease as the operating expenses increase.

Third, the elasticity of the number of administrative staff with respect to the operating expenses is found to significantly increase as the number of enrolments increases but decrease with increases in the number of academic staff.

The empirical results obtained for the parameters of the variance models for the inefficiency effects and the random errors are presented in Table 5. These results show that the variance of the inefficiency effects is significantly greater for universities in metropolitan than regional areas, the effect being significant at the 5% level. The other variables did not have statistically significant effects on the variance of the inefficiency effects for the number of administrative staff in the input-requirement model, specified in Eq.s (7) and (9).

The variances of the random errors in the input-requirement function for the number of administrative staff are estimated to be significantly greater for public than private universities, the effect being statistically significant at the 5% level. Other factors did not have any significant influence on the variances of the random errors in the stochastic frontier input-requirement model for the number of administrative staff, as specified in Eq.s (7) and (10).

We predict the technical inefficiency effects using STATA and then calculate the factor on the right-hand side of Eq. (2) to obtain the ratio of the excess administrative staff to the observed level of administrative

**Table 2**  
Definitions and summary statistics of variables (n = 112).

| Variable   | Definition                                       | Label          | Mean | Standard deviation | Min  | Max    |
|--|--|----------------|------|--------------------|------|--------|
| Dependent  |  |                |      |                    |      |        |
| Administrative staff   | Total number of administrative staff             | ADS            | 159  | 127                | 45   | 718    |
| Independent  |  |                |      |                    |      |        |
| Student enrolments   | Total number of students enrolled in 2013/14     | y              | 8437 | 7,519              | 201  | 40,308 |
| Academic staff   | Total number of academic staff                   | x <sub>1</sub> | 370  | 273                | 48   | 1,477  |
| Operating expenses   | Total operating expenditure (VND billion)        | x <sub>2</sub> | 91   | 86                 | 0.89 | 529    |
| Inefficiency determinants of variability of the efficiency effects and random errors |  |                |      |                    |      |        |
| Location   | Metropolitan = 1 (n = 67), Regional = 0 (n = 45) | z <sub>1</sub> | 0.60 | 0.49               | 0    | 1      |
| Ownership  | Public = 1 (n = 82), Private = 0 (n = 30)        | z <sub>2</sub> | 0.73 | 0.44               | 0    | 1      |
| Age  | Number of years established                      | z <sub>3</sub> | 16.8 | 11.0               | 5    | 60     |
| National Exam Entry  | Average National Exam Entry marks                | z <sub>4</sub> | 17.6 | 3.90               | 13   | 28.1   |
| Other revenue  | Other sources of revenue (VND billion)           | z <sub>5</sub> | 27.0 | 29.0               | 0.08 | 186    |
| PhDs   | Proportion of academics with PhDs                | z <sub>6</sub> | 0.18 | 0.14               | 0.01 | 0.75   |

**Table 3**  
Empirical results for the input requirement function.

| Variables                         | Parameters      | Coefficient | SE <sup>a</sup> | Z-value |
|-----------------------------------|-----------------|-------------|-----------------|---------|
| lny                               | β <sub>0</sub>  | 25**        | 11              | 2.33    |
| lnx <sub>1</sub>                  | α <sub>1</sub>  | -10.1**     | 4.4             | -2.27   |
| lnx <sub>2</sub>                  | α <sub>2</sub>  | -2.4        | 2.0             | -1.23   |
| (lny) <sup>2</sup>                | β <sub>00</sub> | -13.6*      | 7.7             | -1.76   |
| (lnx <sub>1</sub> ) <sup>2</sup>  | α <sub>11</sub> | 22.3**      | 8.8             | 2.55    |
| (lnx <sub>2</sub> ) <sup>2</sup>  | α <sub>22</sub> | -1.6        | 1.2             | -1.42   |
| lnx <sub>1</sub> lnx <sub>2</sub> | α <sub>12</sub> | -6.7**      | 2.6             | -2.54   |
| lnx <sub>1</sub> lny              | β <sub>01</sub> | -6.4        | 5.2             | -1.22   |
| lnx <sub>2</sub> lny              | β <sub>02</sub> | 9.4**       | 4.4             | 2.12    |
| Constant                          | c <sub>0</sub>  | -5.9**      | 2.6             | -2.24   |
| N                                 |                 | 112         |                 |         |
| R <sup>2</sup>                    |                 | 0.56        |                 |         |
| p > χ <sup>2</sup>                |                 | 0.000***    |                 |         |

\* p < 0.1.

\*\* p < 0.05.

\*\*\* p < 0.01.

<sup>a</sup> The standard errors (SEs) are presented correct to two-significant digits and the coefficients are presented to the same number of digits behind the decimal points as their corresponding SEs.

**Table 4**  
Elasticities of number of administrative staff with respect to output and inputs.

| Elasticities of ADS with respect to y, x <sub>1</sub> and x <sub>2</sub> | Constant | lny       | lnx <sub>1</sub> | lnx <sub>2</sub> |
|--|----------|-----------|------------------|------------------|
| Student enrolments (y)   | 25**     | 2(-13.6*) | -6.4             | 9.4**            |
| Academic staff (x <sub>1</sub> )   | -10.1**  | -6.4      | 2(22.3**)        | -6.7**           |
| Operating expenses (x <sub>2</sub> )                                     | -2.4     | 9.4**     | -6.7**           | 2(-1.6)          |

\* p < 0.1.

\*\* p < 0.05.

staff for the sample universities involved. Table 6 presents the percentages of excess administrative staff for different categories of universities and for different percentiles of the distribution involving the top 10% and 25% and the bottom 10% and 25% for each category of universities.

The findings reveal that, on average, universities have 3.4% excess administrative staff capacity, implying that operating expenses potentially increase by the same figure, holding other things unchanged. In Vietnamese universities, a decrease by 3.4% in revenue may not be a problem to public institutions, which are supported financially by the government, but it would be a significant problem for private universities. Furthermore, the most efficient universities (bottom 10

**Table 5**  
Empirical results for determinants of the variances of the inefficiency effects and random errors<sup>a</sup>.

| Variables                             | Parameters     | Coefficient | SE <sup>b</sup> | Z value |
|---------------------------------------|----------------|-------------|-----------------|---------|
| Location (z <sub>1</sub> )            | γ <sub>1</sub> | 0.99**      | 0.41            | 2.41    |
| Ownership (z <sub>2</sub> )           | γ <sub>2</sub> | -0.43       | 0.57            | -0.76   |
| Age (z <sub>3</sub> )                 | γ <sub>3</sub> | -0.002      | 0.023           | -0.07   |
| National Exam Entry (z <sub>4</sub> ) | γ <sub>4</sub> | 0.092       | 0.073           | 1.25    |
| Other revenue (z <sub>5</sub> )       | γ <sub>5</sub> | -0.0052     | 0.0076          | -0.68   |
| Proportion of PhDs (z <sub>6</sub> )  | γ <sub>6</sub> | -0.5        | 1.5             | -0.36   |
| Constant                              | c <sub>1</sub> | -6.24***    | 0.98            | -6.36   |
| Location (z <sub>1</sub> )            | ω <sub>1</sub> | 0.8         | 1.5             | -0.52   |
| Ownership (z <sub>2</sub> )           | ω <sub>2</sub> | 7.6**       | 3.9             | 1.96    |
| Age (z <sub>3</sub> )                 | ω <sub>3</sub> | -0.016      | 0.041           | -0.39   |
| National Exam Entry (z <sub>4</sub> ) | ω <sub>4</sub> | -0.54       | 0.48            | -1.12   |
| Other revenue (z <sub>5</sub> )       | ω <sub>5</sub> | 0.016       | 0.019           | 0.85    |
| Proportion of PhDs (z <sub>6</sub> )  | ω <sub>6</sub> | 9.0         | 5.7             | 1.60    |
| Constant                              | c <sub>2</sub> | -5.2        | 4.6             | -1.15   |
| Log likelihood                        |                | 89.87       |                 |         |
| p > χ <sup>2</sup>                    |                | 0.000***    |                 |         |

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

<sup>a</sup> Using a Chi-square test, the null hypothesis that all coefficients are equal to zero is rejected at the 5% level of significance.

<sup>b</sup> The standard errors (SEs) are presented correct to two-significant digits and the coefficients are presented to the same number of digits behind the decimal points as their corresponding SEs.

**Table 6**  
Percentages of excess capacity of administrative staff in Vietnamese universities.

| Grouping of Universities | Mean excess capacity | Top 10 percentile | Top 25 percentile | Bottom 25 percentile | Bottom 10 percentile |
|--------------------------|----------------------|-------------------|-------------------|----------------------|----------------------|
| All                      | 3.4%                 | 12.9%             | 9.2%              | 0.2%                 | 0.1%                 |
| n                        | 112                  | 12                | 28                | 29                   | 12                   |
| Private                  | 0.5%                 | 3.4%              | 1.0%              | 0.1%                 | 0.05%                |
| n                        | 30                   | 3                 | 8                 | 9                    | 4                    |
| Public                   | 4.7%                 | 14.4%             | 10.5%             | 0.9%                 | 0.4%                 |
| n                        | 82                   | 9                 | 21                | 22                   | 9                    |
| Metropolitan             | 2.9%                 | 11.1%             | 7.6%              | 0.2%                 | 0.1%                 |
| n                        | 67                   | 7                 | 17                | 17                   | 8                    |
| Regional                 | 4.8%                 | 15.1%             | 10.9%             | 2.8%                 | 2.4%                 |
| n                        | 45                   | 5                 | 12                | 12                   | 5                    |

percentiles) have, on average, 0.1% excess administrative capacity whereas the least efficient (top 10 percentiles) have an average of 12.9% excess capacity of administrative staff. About 11% of the sampled universities fall in the top 10 percentile (12 of the 112) that need to consider their administrative staffing strategy.

It should be noted that inefficiency in using administrative staff is

estimated with the assumption of keeping other inputs and outputs in the university's production process constant. Hence, this inefficiency might be lower than in the overall technical inefficiency of universities that account for changes of all inputs and outputs at the same time. However, "still waters run deep" would make universities less efficient.

Looking more closely at excess administrative capacity classified by ownership and location, private universities have much less excess administrative staff than public ones, 0.5% versus 4.7%, respectively, meaning that private universities demonstrated greater efficiency in using their financial resources in employing administrative staff, given their quality of education. This is because: (1) they do not receive financial assistance from the government; (2) their top priority is cost benefits to maintain their academic operations; and (3) pressures from stakeholders force them to be more efficient and effective in human resource management. In fact, the operational efficiency of private universities was assessed to be quite good, but the quality of education should be assured and improved to some extent (Villano and Tran, 2018). In contrast, public universities have greater excess administrative staff in their academic operations. This might result in government financial support; thus, public universities have found no pressures to hire more administrative staff to meet their demand for their education development strategies. The finding compares with the result of Tran and Villano (2018a, Table B.1, p. 19), using the dynamic DEA, in which public universities were found to have a mean of 20% in the overall inefficiency with respect to simultaneous changes with inputs and outputs, and, on average, 23% of administrative staff could be saved. In other words, there is, on average, 4.6% of inefficiency in administrative staff out of the overall inefficiency of public universities, *ceteris paribus*. In addition, Table 6 indicates that metropolitan universities have less excess administrative capacity than their regional counterparts, 2.9% and 4.8%, respectively. The top 10 percentiles of regional universities have a mean of 15.1% excess administrative capacity, approximately five times higher than the sample average excess administrative staff.

## 7. Discussion

The demand for maintaining teaching and learning operations, developing and expanding the scope of academic operations, including quickly adapting to variability in government regulations could explain the presence of excess administrative capacity in Vietnamese universities. The findings in this study are in line with those in Tran and Villano (2017a), in which the universities used excess capacity of input resources to produce the existing outputs involving administrative staff. In addition, Tran and Villano (2017a; 2019) point out that exogenous variables such as location, ownership and national entry exam marks influence excess input resources. These findings lead us to the fact that using excess inputs seems to be inevitable in higher education, where administrative services potentially increase to meet the development and growth of institutions, regulatory pressures and complexity in organisational structures (Leslie and Rhoades, 1995; Johnsrud, 2002). This is, indeed, the case in Vietnam where universities face instability in the government policy environment that they are not well prepared to respond to. The common way to solve this problem is to increase the administrative staff to deal with unexpected cases.

Moreover, domestic and international competitiveness in higher education make universities increase both teaching and administrative staff to enhance their education quality and academic reputations (Tran, Crawford and Villano, 2017). The reasons for excess administrative staff may seem reasonable in the academic environment. However, our results suggest that increasing administrative staff can potentially contribute to an increase in operational expenditures and cause the management systems of universities to become cumbersome and complicated, thus, obviously leading to significant inefficiencies.

The appropriate solutions to improve the performance of universities, including human resource management, are still at the heart

of discussions among educational managers and policy makers. Getting to best resolutions to move forward is also challenging due to the inflexible governance system, complicated management mechanisms and poor transparency and accountability (Tran, 2018). Although the government sought unsuccessfully to get at least one Vietnamese university in the world's top 200 universities by 2020, the process of support for higher education in Vietnam will continue to reach more promising results in the future. No matter what kinds of policies are introduced, individual universities first need to manage well their performance, in which human resource management is a key factor to contribute to success. Universities can seek to reduce the administrative staff, use seasonal staff for irregular work such as student recruitment, enrolment or physical facilities, and rearrange the existing administrative staff to ensure "the right person for the right job". When human resources are well managed, then operating expenses would reduce. Accordingly, financial resources would become healthy to assist improvements in education quality and academic performance (Tran and Villano, 2018a, 2018b).

## 8. Conclusions

The success of a university or any organisation primarily depends on efficiency of using human resources. Both academic and professional staff are key players in ensuring the efficiency of a university. This paper provides a new application by extension of the input-requirement method (Guan, et al., 2009) to a university context to measure efficiency of administrative staff in academic operations using cross-sectional data on Vietnamese universities. This model fits into the stochastic frontier framework, using the input-orientated approach to measure the excess administrative staff in a single input space. Accordingly, we examine whether the same outputs could be produced with less administrative staff in universities. This usage capacity is measured directly in administrative space without the assumption that inefficiencies in input usage are the same for all inputs without temporal change.

Our findings showed that, on average, universities have 3.4% of excess administrative staff and that the least efficient universities (top 10 percentiles) have 12.9% of excess administrative staff. Some university outliers used too much excess administrative capacity in their operations that resulted in substantial economic losses when their financial resources were limited.

The elasticity of the number of administrative staff with respect to student enrolments was estimated to significantly decrease with increases in student enrolments but increase with increases in operating expenses. The elasticity of the number of administrative staff with respect to the number of academic staff was estimated to increase significantly with increases in the number of academic staff but decrease with increases in operating expenses. Finally, the elasticity of the number of administrative staff with respect to operating expenses was estimated to decrease significantly with increases in the number of academic staff but increase with increases in the student enrolments. It is interesting to note that operating expenses demonstrate mixed effects on the elasticities of the number of administrative staff with respect to increases in student enrolments and the number of academic staff.

Determinants of the variances of the inefficiency effects in the use of administrative staff revealed that location was the only variable that had a significant (and positive) effect, such that metropolitan universities had greater variability of the numbers of administrative staff than regional universities. Public universities had higher variability of the random errors in the input-requirement model for the numbers of administrative staff than private universities. This reflects the real nature in human resource management in Vietnamese higher education. Private universities tend to manage their financial resources in the most efficient way because they are not subsidised by government. They often pay a higher salary for high-quality staff and recruit just enough administrative staff for their needs. By contrast, public universities seem to be more generous in recruiting employees because

they are granted an annual budget and should use it as planned.

Our paper provides useful findings by measuring excess administrative capacity in higher education in a single input space, *ceteris paribus*. However, due to the incomplete and complex data reporting system in Vietnam, our paper was limited to cross-sectional data that could not capture the dynamic changes in the performance and changing role of administrative staff over time. In addition, in the Vietnamese context, research output for individual universities has not been adequately recorded and publicly published, therefore, it could not be included in our empirical model. This may potentially lead to overestimated efficiencies in using administrative staff in universities. Moreover, an increase in the sample size would be preferable to increase the power of the analysis and generalisability of the empirical findings. In addition, although the frontier input-requirement model could be generalised in different contexts to measure directly excess capacity of any inputs of interest, we focus on the usage of administrative staff inputs. However, our empirical findings should be carefully interpreted because differences in geographical areas, cultural characteristics, human resource strategies and Vietnam's economic development policies could potentially affect the performance of its universities.

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