ORIGINAL ARTICLE

Estimating unit cost of public university education in Vietnam

Vu Thang Pham[1] · Binh Tran-Nam[2,3]

Abstract

This paper is motivated by the ongoing debate on university reform in Vietnam. In particular, there is a need to quantify the level of governmental support for public universities and examine whether or not such a support is adequate. To this end, the present paper estimates training costs per student in different disciplines within the Vietnamese public university education system in 2010. The various estimates of unit costs are based on the definitional approach which defines unit cost as the ratio of total costs over output. In measuring total costs, private costs incurred by university students (apart from formal tuition fees) are excluded. Further, the opportunity cost method employed emphasizes implicit costs such as imputed land rent. The total output is based on weighted student numbers. Unit costs are then estimated using a variety of primary (from survey) and secondary data sources. The results obtained suggest that the unit costs of public university education in Vietnam vary considerably between disciplines. The results also support the presence of economies of scale and scope in higher education and a negative relationship between unit costs and teaching quality proxies. The overall unit cost of public universities in Vietnam is very low in absolute terms when comparing with other countries. However, unit cost relative to GDP per capita in Vietnam is more comparable with those of neighboring countries. Nevertheless, the findings of the paper imply that more resources need to be allocated to the public university sector as part of an urgently needed university reform in Vietnam.

✉ Vu Thang Pham
thangpv@vnu.edu.vn

Binh Tran-Nam
b.tran-nam@unsw.edu.au

[1] Center for Economic Development Studies, VNU University of Economics and Business, Vietnam National University, Hanoi, 144 Xuan Thuy Road, Cau Giay District, Hanoi, Vietnam

[2] School of Taxation and Business Law, UNSW Sydney, Kensington, NSW 2052, Australia

[3] School of Business and Management, RMIT University Vietnam, Ho Chi Minh City, Vietnam

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1 Introduction and policy context

As a transition economy, Vietnam has achieved reasonable successes in economic growth and poverty alleviation. Thanks to its steady real GDP growth rates, averaging 7% per annum from 2001 to 2010 (General Statistics Office of Vietnam 2011), Vietnam has transformed from one of the world's poorest countries 25 years ago to a lower-middleincome country by 2020 (World Bank 2013). Correspondingly, income poverty fell from 58% in the early 1990s to about 10% (or 20% according to a new poverty line which is more appropriate for Vietnam's new status) by 2010.

However, Vietnam's development has been uneven and many sectors have been lagging behind. In particular, the relative weakness of Vietnam's higher education sector in comparison with other countries has been revealed in international rankings. According to the 2014–2015 Global Competitiveness Report, Vietnam was ranked 96 out of 144 in terms of higher education and training (Schwab 2014, p. 384). Poor quality and low relevance of skills of Vietnamese university graduates were also highlighted in a study by the World Bank (2013, p. xix). Not surprisingly, issues, options and reform strategy for Vietnam's higher education sector have been extensively discussed in the literature (see, for example, Tran-Nam 2003; Hayden and Lam 2007).

The Vietnamese government has long committed to a systematic reform of the country's education sector (Communist Party of Vietnam 1991), which has been manifested in the rapid expansion of Vietnam's higher education sector in recent years. Their plan and commitments to higher education reform represent a great challenge in view of the limited budget and severe competition for public funding for development. Within this broad plan, the Ministry of Education and Training (MOET) initiated two major projects, namely Higher Education Project 1 (HEP1) and Higher Education Project 2 (HEP2) with financial support from the World Bank. The overarching aim of HEP2 is to improve the quality of teaching and research in Vietnamese universities in order to raise graduates' rate of employment and the relevance of university research.

This paper arises from the financing component of the HEP2. Its primary purpose is to determine the magnitude of the unit costs (i.e., the average costs per student) of public universities in Vietnam in 2010, using a justifiable method and reliable data. Such estimates, hitherto unavailable, provide much needed evidence for sound educational policy debate and decision making in areas such as government budget allocation, tuition fees or financial institutional autonomy.

The estimation method employs an opportunity cost approach that emphasizes implicit costs such as land rent. However, the private costs incurred by students (apart from tuition fees) in undertaking their university studies are excluded. To make the estimates more meaningful and relevant, unit costs are disaggregated by academic disciplines that are known to display differential cost patterns.

The remainder of the paper is organized as follows: Section 2 provides an overview of the public universities in Vietnam. Section 3 briefly reviews conceptual and measurement issues arising from estimating unit costs of university education and empirical evidence. The methodology and data collection are then discussed in the next two sections, respectively. In Sect. 6, empirical findings are presented and policy implications discussed. It is apparent

that much more resources are urgently needed to be allocated to the public universities in Vietnam. Section 7 concludes.

2 Overview of Vietnam's public universities

The number of public universities in Vietnam has grown by almost three times from 52 in 2000 to 149 in 2014 (MOET 2014a). Following the Soviet model, many of them are single-discipline universities (e.g., Foreign Trade University) although, for revenue raising purposes, many science/technology universities (e.g. Hanoi University of Science and Technology) are also allowed to offer business studies programs. There are eight broad disciplines, namely engineering and technology; natural sciences; social sciences and humanities; pedagogy and education management; agriculture, forestry and fishery; medicine and pharmacy; economics, finance, banking and law; and fine arts.

In terms of governing authority, public universities can be divided into four groups: national university directly controlled by the Prime Minister and funded by the Ministry of Finance (MOF); those controlled by the ministries (mostly by MOET) and other sectors, those controlled by the city/provincial governments and those controlled by state-owned enterprises or conglomerates. In terms of geographical location, they are classified into Red River Delta, North and Central Coast, Central Highland, South East, Mekong River Delta and mountainous and remote areas. The distributions of Vietnam's public universities in terms of discipline, governing authority and location are illustrated in Figs. 1, 2 and 3, respectively.

The number of academics at public universities has increased at a similar rate from 19,772 in 2000 to 52,500 in 2014 (by 2.65 times). Their education qualifications (possessing a postgraduate degree) have also improved from about 50% in 2000 to over 83% in 2014 (MOET 2014b). The number of enrolled students has expanded at a slower pace during the same period (by 2.07 times) to 1,290,756 students in 2014. The gender gap has also been eliminated as the percentage of female over all students has steadily increased from 43.38% in 2000 to 50.56% in 2013. The number of ethnic minority students has also increased fivefold from 1454 in 1999–2000 to 7488 in 2010–2011 (MOET 2013).

Interestingly, data from MOF (2013) for 2009–2012 reveal that from 2010 to 2012, public expenditure on higher education (including both universities and colleges) declined relative

Fig. 1 Distribution of public universities by discipline, Vietnam, 2014. *Source*: MOET (2014a)
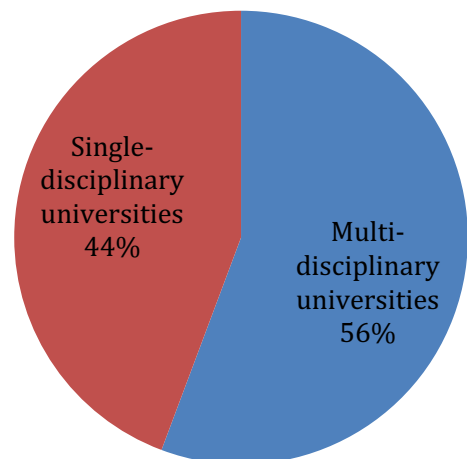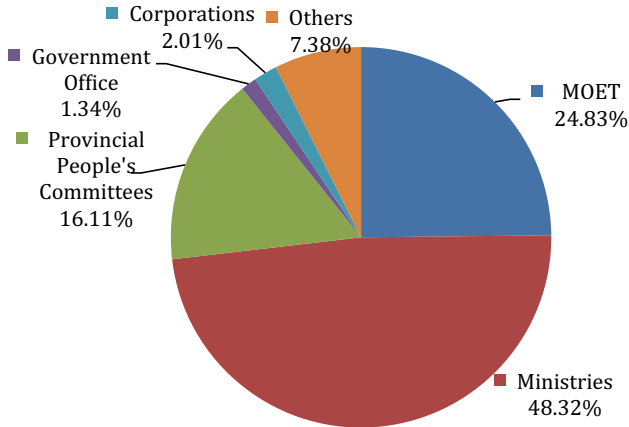
Fig. 2 Distribution of public universities by governing authority, Vietnam, 2014. *Source*: MOET (2014a)
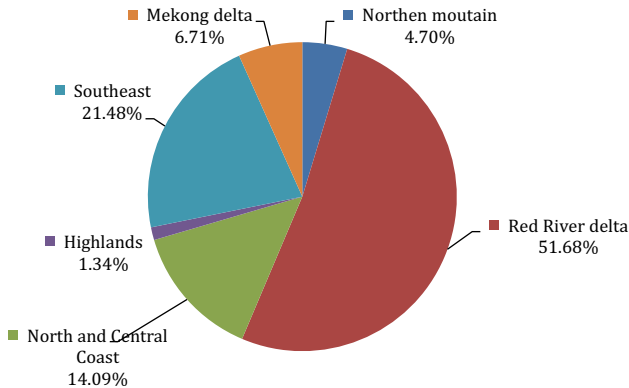
Fig. 3 Distribution of public universities by geographical location, Vietnam, 2014. *Source*: MOET (2014a)

to public expenditure on education (from 11.59% to 7.86%), total public expenditure (from 2.11% to 1.54%) and GDP (0.61% to 0.43%). During the same period, recurrent expenditure counted for a large share of public expenditure on higher education and increased steadily from 73.00% to 82.34%. Meanwhile, the share of capital expenditure in total public expenditure on higher education decreased from 27.05% in 2010 to 17.66% in 2012. The same dataset also shows that public expenditure on higher education per students declined slightly from 7.97 million VND (equivalent to 428 USD) in 2010 to 7.53 mil VND (equivalent to 362 USD) in 2012.

3 Brief literature review

3.1 Conceptual and measurement issues

The economic definition of average (unit) cost as the ratio of total cost over the output quantity is unambiguous in the case of private businesses. However, it is very problematic to apply this definition to the higher education sector. The problems that arise from measuring total costs and volume output in higher education have been well recognized and discussed in the literature (see, for example, Schreyer 2010; Massy et al. 2012). The problems pertaining to measuring costs and output in higher education will be further elaborated in discussing the definitional approach in the remainder of this subsection.

Further, actual costs of public university education in Vietnam (and elsewhere) are not incurred as a result of unconstrained decision processes by autonomous universities, but are largely determined by various policies on public universities adopted by the central government. There is thus an element of predetermination in actual unit cost, which reflects not so much the 'true' average cost but government policies on public funding, tuition fees and student quotas (Throsby 1986: 177).

In practical applications, there are basically three methods for estimating unit costs of education, namely the definitional, ingredient and econometric approaches (see, for example, Brovender 1974; Levin 1981; Throsby 1986; Levin and McEwan 2001; Creedy et al. 2003; Santiago et al. 2007; Maelah et al. 2011). Each of these three approaches will be discussed in turn below.

The definitional approach relies on the definition stated above. Under this approach, total costs and total output of education are separately measured. The measured total costs are then divided by the measured total output to provide an estimate of average (unit) cost of education. Conceptual and practical issues in measuring total costs and total output of education are many as follows.

As discussed above, measuring total costs of education is difficult from many reasons. First, a typical modern university produces many different types of output such as education, research, community service and policy advice. It is generally not possible to precisely assign the overall total costs to education alone. Secondly, some of the opportunity costs of teaching students are implicit costs which do not correspond to actually observable cash flows (e.g., the 'free' use of public land provided to public universities by the government). Thirdly, it is necessary to distinguish between public costs (incurred by all levels of government) and private costs (incurred by individual students). As mentioned in Sect. 1, private costs are excluded from this study apart from tuition fees which are collected by universities and counted by the government as their funding to public universities.

Measuring the output of education is even more difficult. Focusing on the productive value of education, teaching output should be ideally interpreted as the increase in the stock of human capital resulting from the education process. Thus, teaching output should be based on the quality-adjusted quantity of students. Even simple head counting is difficult because of the heterogeneity of students in terms of enrollment status (full time vs. part time), discipline (science vs. art), level of study (undergraduate vs. postgraduate) and nature of program (formal degree vs. continuing education). Quality adjustment, especially in terms of value adding, is practically impossible to be precisely measured and needs to be proxied by some observable indicators such as common exit examination, employment rates immediately after graduation or annual salaries.

The ingredient method distinguishes between input quantities and input prices (Levin 1981; Levin and McEwan 2001). This approach typically involves three steps:

- Identifying a vector of input quantities (such as number of teaching and general staff, floor area, amount of computing equipment, and number of library books) required to train one student per time period (the relationship between the training of one student and this vector of inputs is known as the unit education function).
- Identifying the price per time period for each of the required inputs.
- Multiplying each required input quantity by its corresponding price and aggregate over all inputs. The resulting value is an estimate of the unit cost of education.

The econometric method goes beyond the definitional approach by explicitly incorporating the impact of explanatory variables other than output on total costs (Brovender 1974; Throsby 1986; Creedy et al. 2003). It involves the following steps:

- Specifying the total costs of education as a function of output (total student load), instructional standards and other demographic factors.
- Deriving data for all of the above variables (total costs, output, instructional standards, etc.) from a cross section of universities under study.
- Regressing the total costs on all explanatory variables specified in the model.
- The unit cost is defined as the ratio of estimated total costs (obtained from the regression) over output. Note that, for each level of output, the unit cost is not a single value but function whose magnitude depends on the assumed values of other explanatory variables in the estimated regression equation.

3.2 Empirical evidence

In terms of empirical evidence, multinational institutions such as the Organisation for Economic Co-operation and Development (OECD), United Nations Educational, Scientific and Cultural Organization (UNESCO), and the World Bank regularly publish various absolute and relative proxies of unit costs of tertiary education such as annual public expenditure per student in tertiary institutions and total government expenditure per student in higher education as a percentage of GDP per capita. For example, Fig. 4 illustrates annual expenditure (in purchasing power parity (PPP) USD) per student in tertiary education institutions in the OECD member countries in 2008.

The data from UNESCO Institute for Statistics (UIS) contain some estimates of relative unit costs of tertiary institutions from many countries, including both developing and developed countries. Table 1 shows annual public expenditure per student as a percentage of GDP per capita in selected countries from 1999 to 2010.

Generally speaking, the available official data suggest that:

- There is substantial variation in annual public expenditures per tertiary student across countries;
- There exists a correlation between public expenditures per tertiary student and GDP per capita. This point is also seen in OECD (2018, Figure C1.3, pg. 251).

There exists a paucity of empirical evidence on unit costs of university education using the three methods discussed above. A study by Santiago et al. (2007) provides unit cost estimates for the Bachelor Degree in Science (Home Technology) from 29 universities in the Philippines. Their results are summarized in Table 2. The results indicate the dominance of

Table 1 Annual public expenditure per student as a percentage of GDP per capita, selected countries, 1999–2010. *Source*: UIS database

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Australia	26.6	25.6	25.7	22.6	22.8	23.3	21.5	20.6	20.2	19.8	20.7	...
Brunei Darussalam	...	...	...	...	...	...	...	...	...	...	...	32
Cambodia	...	...	42.5	...	...	...	...	...	...	...	...	...
China	90	...	...	...	...	...	...	...	...	...	...	...
China, Hong Kong SAR	...	...	...	...	65	67.7	59.7	57.2	38.5	28.6	56.2	26.8
China, Macao SAR	59.6	60.3	...	26.6	20.9	19.7	22.1	19.5	16.3	16.7	15.8	...
Fiji	...	...	...	...	...	62.8	...	...	...	...	...	...
Indonesia	...	...	...	...	...	...	...	...	19.3	16.8	...	...
Japan	15.1	17.7	17.4	17.4	19.9	20.8	19.2	19.1	20.1	20.9	...	...
Lao PDR	67.7	69.5	110.1	81.9	...	...	...	...	...	...	...	...
Malaysia	...	81.6	110.3	98.9	90.6	69.4	...	60.7	50.3	34.4	60.7	...
Marshall Islands	...	...	...	73.5	...	...	...	...	...	...	...	...
Myanmar	...	...	27	...	...	...	...	...	...	...	...	...
New Zealand	39.5	...	35.8	35.9	32.9	26.7	25.2	25.9	28.1	28.2	31	31.4
Palau	...	...	81	...	...	...	...	...	...	...	...	...
Philippines	...	14.4	13.3	14	13.7	12.1	11.1	...	9.2	...	...	...
Republic of Korea	8.4	...	...	4.8	8.8	8.4	8.7	9.5	9	10.1	...	...
Singapore	...	...	...	...	...	...	...	...	...	...	27.9	28.7
Thailand	...	36.5	33.2	...	...	23.9	25.9	29.6	...	22.3	22.7	17.6
Timor-Leste	...	...	...	...	...	...	...	...	...	...	83.9	...
Vietnam	...	...	...	...	...	...	...	...	...	60.6	...	...

*The figures in brackets represent the percentage of students enrolled in public institutions in tertiary education, based on full-time equivalents

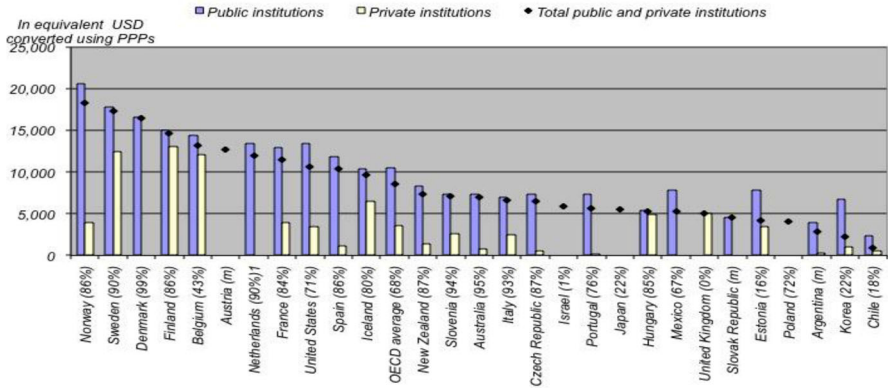** Government-dependent institutions are included with public institutions

Fig. 4 Annual public expenditure (PPP USD) per student in tertiary education by type of institution, OECD, 2008. *Source*: OECD (2011, Chart B3.4, p. 239)

Table 2 Unit costs (USD) for BSc (Home Technology) Philippines, 2000–2001. *Source*: Santiago et al. (2007, Table 2, p. 6)	Year	Direct teaching	Direct operating	Indirect costs	Total
	First year	380.79	71.02	214.59	666.50
	Second year	618.75	81.75	214.69	914.61
	Third year	886.21	71.02	214.69	1171.92
	Fourth year	578.29	46.66	214.69	838.64
	Total	2.464.04	269.87	858.76	3591.67

direct teaching costs (mainly wages and salaries) in university education structure. It is also interesting to note that unit costs increase over the duration of the bachelor program except in the final year, possibly due to less teaching classes.

In a more recent study, Maelah et al. (2011) employ the activity-based costing (ABC),[1] a variation of the definitional approach, to investigate unit costs of different faculties at University Kebaangsa, Malaysia, during the academic year 2008–2009. Their estimates are presented in Table 3. The results obtained exhibit two striking features. First, for health-related disciplines such as dentistry, medicine and allied health, ABC estimates are much higher than traditional estimates based on number of students. Secondly, unit cost of an undergraduate in any particular faculty far exceeds that of a postgraduate student in the same faculty. Again, this is not surprising in view of the dominance of direct teaching (wages and salaries) in the cost structure.

There are also available some estimates of unit cost of education at Australian universities using the econometric method. They are summarized in Table 4. It is interesting to note that different models, which have been estimated using different datasets that are 18 years apart, generate unit cost estimates (evaluated at the mean student load) that differ by no more than a few hundred AUDs in terms of constant prices. The stability of unit cost of Australian university education has also been confirmed by a later study (see Creedy et al. 2003, Table 4, p. 129).

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[1] ABC is a costing method that identifies all activities in an organization (a university in this case) and assigns the cost of each activity to all products and services (students in this case) according to the actual consumption by each activity.

Table 3 Annual unit cost (in Malaysian Ringgit) at Universiti Kebaangsan, Malaysia, 2008–2009. *Source:* Maelah et al. (2011, Table 1)

No.	Faculty	Based on number of students	ABC Undergrad. 2009	2009 U' grad unit cost ratio to min	ABC Graduate 2009	ABC Undergrad. 2008	ABC Graduate 2008
1	Economics and Business	15,174	15,663	1.20	7170	15,760	8294
2	Engineering	18,343	35,945	2.74	16,787	34,494	16,108
3	Education	11,281	13,102	1.00	8159	12,938	8052
4	Islamic Studies	14,131	17,054	1.30	9821	16,783	9660
5	Dentistry	47,091	113,843	8.69	56,764	104,277	52,000
6	Medical	34,296	68,322	5.21	31,500	66,558	30,680
7	Allied Health Science	18,876	32,993	2.52	20,603	32,588	20,343
8	Pharmacy	17,975	26,600	2.03	12,757	18,784	9061
9	Science and Technology	16,866	24,840	1.90	12,241	24,843	12,235
10	Social Science Humanity	15,668	24,192	1.85	12,670	24,338	12,738
11	Info. Science Technology	14,807	19,303	1.47	9737	18,764	9462
12	Law	14,024	18,256	1.39	8479	17,996	8352

1 MR = 0.33 USD

Table 4 Estimates of average and marginal costs, Australian universities. *Source*: Heaton and Throsby (1997, p. 13)

Authors	Year of estimation	Mean student load	Average cost (AUD)	Marginal cost (AUD)
Throsby (1986)	1978–1982	7547	12,689	9843
Lloyd et al. (1993)	1988	4352	12,137	10,192
Throsby and Heaton (1995)	1991	10,043	12,135	11,879
Heaton (1996)	1994	11,298	12,942	12,879

The brief review above has revealed some gaps in the literature. First, as shown in Table 1, Vietnam, as a country, has so far been neglected in international studies of public expenditure per student in tertiary educations institutions. Secondly, public expenditure per student is a useful but not accurate proxy of unit cost as public expenditure would exclude implicit costs (such as imputed land rent). Thirdly, very little information is available on how unit costs vary across different academic disciplines. The remainder of this paper sets out to rectify these gaps in the literature.

4 Estimation methodology

As discussed in Sect. 3, there are broadly three different approaches for estimating unit cost of education, namely the definitional, ingredient and econometric methods. The ingredient method suffers from several disadvantages. First, it is very data demanding to construct a unit education function. Secondly, it relies on the use of either competitive market prices or imputed prices based on markets, whereas it is well known that the university education system is generally not a competitive market.[2] The ingredient method is, in particular, not appropriate for a national study that involves many different types of universities, different academic disciplines and different types of students.

Unlike the ingredient method, the econometric method is, in principle, suitable for a national study of unit cost of public universities such as the present study. However, it is more data demanding than the definitional approach. In addition to total costs and output (which are sufficient to compute unit cost), the researcher is required to have reliable data on instructional quality and other relevant demographic variables. Further, an implicit assumption of the econometric method is that universities act like private firms which can vary their output at will. As suggested previously, this assumption does not always hold true for public universities

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[2] Universities are educational institutions and not businesses although in some limited ways universities run like a business. In a competitive market, profit-maximizing firms sell a private good to many buyers who are willing and able to pay for the product. University education is not a usual private good. It is a process of human capital accumulation (analogous to physical capital investment). It has some properties of a public good, and it generates positive externalities. It is a service that students (direct buyers) do not decide for themselves, especially in the case of Vietnam. It is an intermediate good that the ultimate buyers are the consumers (or the population). The relationship between teachers and students is not the same as that between sellers and buyers in a competitive market. Universities aim to achieve specific non-commercial targets, not profit maximization. Public universities cannot freely set their fees and select their student numbers. Universities, whether public or private, do not allocate students to different programs by students' willingness and ability to pay alone. The government also often intervenes in the university sector in many visible ways.

because their student numbers are typically constrained by government tertiary education policy.

The definitional approach is thus employed in this study for two reasons. First, it is the simplest and least data demanding method out of the three available options. In particular, the definitional approach can be applied to the entire university instead of individual programs so that it is more capable of capturing the full costs of training students. Secondly, it does not rely on any assumptions, whether implicit or explicit, about the market structure or competitiveness of public university education system.

The definitional approach's main disadvantage, compared to the ingredient approach, is the difficulty in measuring precisely the output of education. To overcome these difficulties, certain assumptions about conversion need to be made (to be elaborated below). Further, due to the absence of relevant data, no explicit quality adjustments can be made although some implicit quality adjustments will be considered in analyzing the data obtained. There is little or no basis for making a priori prediction whether the definitional method produces an under- or over-estimate of the 'true' unit cost. However, bearing in mind the potential omission of some opportunity cost components in measuring total costs, it seems plausible to suggest that the definitional approach would more likely generate an under-estimation of the true unit cost.

A step-by-step method for implementing the definitional method is now described.

Step 1 (Disaggregation of universities by discipline): Classify public universities into single- or multi-discipline type.

Step 2 (Calculation formula): For each university, the annual total cost is estimated using

$$AC = TC/N \tag{1}$$

where AC = Average cost, TC = Total costs = Recurrent annual expenses + Depreciation of fixed assets +Imputed land rent, and N = Total number of 'regular' students.

Recurrent expenses include all personnel costs, equipment and material costs, scholarships, repairs, etc. Note that recurrent expenses in Vietnam are funded by both government budget and tuitions fees collected from students. Fixed assets are confined to existing buildings based on current market prices, whereas imputed land rent is estimated as interest forgone on land value (= physical area × land value per area unit).

Step 3 (For single-discipline universities): Convert the number of all students into regular (bachelor, full time) equivalent students using a conversion table provided by a government decree (The Government of Vietnam 2010):

$$N = \Sigma_k w_k N_k \tag{2}$$

where w_k is the conversion factor for the kth type student, and N_k is the number of kth type students.

Step 4 (From head counting to study-load counting): We use weighted average of student enrollments in September 2009 and September 2010 to determine the regular equivalent student number adjusted for study load in 2010 as follows:

$$N = 0.6N_{2009} + 0.4N_{2010} \tag{3}$$

The weights associated with N_{2009} and N_{2010} are derived as follows. The students in the calendar year 2010 consisted of three groups: those who enrolled in both 2009 and 2010 (X), those who enrolled in 2009 only (Y) and those who enrolled in 2010 only (Z). By definition, $N_{2009} = X + Y$ and $N_{2010} = X + Z$. A student in group X studied a full load (10 months) in 2010 (January 2010 to June 2010 and September 2010 to December 2010), a student in group

Y studied six months (January to June 2010), while a student in group Z studied only four months (September to December 2010). Taking study load into account, N is the study-load weighted sum of X, Y and Z, i.e.,

$$N = (10/10)X + (6/10)Y + (4/10)Z$$
$$= 0.6(X + Y) + 0.4(X + Z)$$
$$= 0.6N_{2009} + 0.4N_{2010}.$$

Step 5 (Averaging for each discipline): For the ith discipline ($i = 1, 2,.., 8$), we calculate AC_i, which is the weighted average unit cost of all single-discipline universities in the ith discipline where the weights correspond to each university's number of study-load adjusted regular equivalent students (see (3) above).

Step 6 (For multi-discipline universities): We choose the single discipline with the greatest number of study-load adjusted regular equivalent students as its main discipline. It is assumed that the cost differentials between various disciplines in all multi-discipline universities exhibit the same relative patterns as those of single-discipline universities.[3] For example, if, for single-discipline universities, the unit cost of educating one engineering student is 1.3 times that of one economics student, then this cost ratio also is assumed to prevail for all multi-discipline universities that offer both engineering and economics undergraduate programs. Under this assumption, we can calculate the number of regular equivalent students in a multi-discipline university where its main discipline is I as follows:

$$N = \Sigma_i v_i \Sigma_k w_k N_{k,i} \tag{4}$$

where $v_i = AC_i/AC_I$ (based on single-discipline universities), and $N_{k,i}$ is the number of kth type students in the ith discipline.

Using (4), we can work out the training cost of one regular student in the main discipline of a multi-discipline university. The unit costs of other disciplines in that university can be derived by the use of the cost ratios v_i defined above.

Step 7 (For all universities): For any single discipline, we can now combine the results obtained in Steps 4 and 6 to estimate the (weighted) unit training costs of all public universities in the same discipline. Note that the results in Step 7 can be re-employed in Step 6 to calculate new estimates of average costs of multi-discipline universities until the cost ratios for all universities converge.

5 Data

This study requires both published data and primary data derived from public universities in Vietnam in 2010.

5.1 Secondary data

Sources of secondary data include:

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[3] This assumption is essential to our empirical analysis of multidisciplinary universities. The assumption of cost ratio uniformity can be justified in the context of Vietnam's public universities. The public university sector is tightly regulated by the Vietnamese government in terms of (uniform) staff/student ratio for each discipline, salaries, tuition fees, core subjects, etc. Further, public universities tend to employ highly similar combination of inputs in delivering their education programs.

- MOET: student numbers; financial statements of universities under the MOET; MOET annual statistics reports with data relating to number of teaching staff, areas of physical facilities, number of graduates, etc.
- MOF: financial statements of universities under the control of other ministries.
- State Treasury: financial statements of remaining universities.
- Three Disclosures: quality of graduates, resources available for teaching, revenues and expenditures relating to teaching.
- World Bank: international data on proxies of teaching quality such as staff/student ratio and teaching staff qualifications.
- Other sources: international information on unit costs of university education by disciplines.

5.2 Primary data

A wide range of primary data relating to the calendar year 2010 was collected by means of a postal mail survey. The data collected include:

- Basic information about university (name, age, physical area, etc.)
- Data on student enrollment by programs (undergraduate, postgraduate, advanced programs, etc.) in various disciplines in 2009–2010 and 2010–2011.
- Data about total teaching hours by programs in various disciplines and by staff type (permanent and casual).
- Data about recurrent expenditure (personnel and non-personnel expenses) and depreciation.

5.2.1 Sample selection

The sample for the mail survey is the population of all public universities in Vietnam in 2010 (149 universities). The survey was directed toward either chief finance officers or vice rectors in charge of financial affairs.

In addition to the mail survey, two universities, namely National University of Civil Engineering and Hanoi Medical University, were chosen to determine the market values of universities' buildings by types and ages for the purpose of re-valuing all buildings of all universities in the effective sample by an accredited valuing company. These two universities were chosen because they are higher education institutions with a very long history having buildings of diverse type (e.g., lecture theaters, experimental laboratories, residential halls), varying size and different ages. The information obtained from this evaluation exercise is thus comprehensive for re-valuing all buildings of universities in the effective sample.

5.3 Questionnaire design

The questionnaire (see 'Appendix') was organized in separate sections that facilitate ease of response by different administrative departments at the university such as planning and finance, training, administration, human resources and equipment management. The terminology and order of financial items in the questionnaire strictly followed the university accounting conventions to minimize any misunderstandings. The questionnaire focuses on two major topics: training costs and training quality.

5.3.1 Pilot testing

The questionnaire was first used to obtain expert opinion and pilot testing at five universities in Hanoi and Da Nang. The questionnaire received many enthusiastic comments, and many questions were updated, employing terms that ensure simplicity and accuracy and allowing readers to easily grasp ideas and answer correctly.

5.3.2 Response rates

Of 149 postal questionnaires sent to the whole population of universities in Vietnam, 50 completed questionnaires were sent back through postal mail, email and fax. This corresponded to a survey response rate of approximately 34%.

The team combined the survey responses with an additional and reliable secondary data source, namely the universities survey conducted in 2011 by MOF.[4] As a result, complete data from 60 universities were available for analysis. The effective response rate is thus more than 40% (= 60/149), which is regarded as a highly satisfactory response rate.[5]

5.3.3 Representativeness of survey data

With 60 universities, the survey sample represents well the population of public universities in Vietnam regarding discipline, governing authority, age, size and location. It includes universities in all target single-discipline and multi-discipline groups. The universities have diversified governing authorities including universities under the management of MOET, other ministries, government and provincial people's committees. The sample also represents the population well in terms of age (less than 10, between 10 and 30 and more than 30 years) for cost analysis to ensure comparability between new school and old school groups. The universities are evenly distributed among small (less than 5000 students), medium (from 5000 to 15,000 students) and big (more than 15,000 students) sizes, which are measured by the number of regular equivalent students. Finally, universities in the sample are distributed throughout various regions of Vietnam (47% in the north, 18% in the central and 35% in the south).

The data employed in the present study are somewhat dated. It is important to note, however, that quantitative data of this nature is extremely difficult to obtain in Vietnam. The authors were able to gather data as a part of a one-off MOET-sponsored project. Further, reform of public universities in Vietnam has progressed very slowly so that the 2010 data have remained largely relevant (see, for example, Pham 2011; Temmerman 2019). Most importantly, our study can be viewed as a benchmark study that can be replicated in the future (e.g., 2020) for tracking the development of public universities in Vietnam over time.

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[4] MOF has conducted universities survey in 2011 to collect financial information of 60 public universities between 2009 and 2011. Among 60 surveyed universities, 24 universities are managed by MOET, 20 universities are from other ministries, four universities are national universities, and the other 12 universities are managed by Provincial People's Committees. The data are categorized into four groups, namely staff and faculty group (number of teaching hours, number of publications and papers), student group (number of students per class, number of students per high-quality class), financial information group (revenues, expenditures, usage of state budget, tuition fee) and facilities information group (total land area, total floor space, number of computers).

[5] In a well-cited, large-scale study on survey response rates, Baruch and Holtom (2008: 1140) found that 'the average response rate for studies that utilized data collected from organizations was 35.7 percent with a standard deviation of 18.8.'

6 Results and discussion

Applying the data obtained in Sect. 5 to the estimation method described in Sect. 4, the main findings of the paper can be summarized as follows.

Table 5 presents tuition fees and estimated unit costs (in VND, USD and PPP USD) by discipline of the surveyed universities in 2010. In this table, two sets of unit costs are presented: one without imputed land rent and one with imputed land rent. It is apparent that including imputed land rent raises overall unit cost by almost 46% from 6.04 million to 8.81 million VND per annum. It can also be seen that the lowest unit cost is in the discipline of economics and law with actual annual unit cost of 4.85 million VND (without imputed land rent) or 6.29 million VND (with imputed land rent), whereas, not surprisingly, the most expensive discipline is medicine and pharmacy with annual unit cost of 18.09 million VND (without land) or 34.75 million VND (with land). When converting to 2010 USD or 2010 PPP USD, unit costs of public universities in Vietnam are extremely low, varying between USD 325 or PPP USD 1070 (without imputed rent) and USD 473 or PPP USD 1560 (with imputed rent).

The unit cost in economics and law is the lowest because training students in this discipline does not require as much equipment and laboratories as in other disciplines. In addition, within this discipline, larger class sizes can be used as well. On the other hand, the unit cost in medicine and pharmacy is the highest because studying in the discipline requires laboratories, supporting equipment and materials, which are very expensive. Consequently, the unit cost in medicine and pharmacy is more than triple that of in economics and law.

Figure 5a and b illustrates the impact of the scale of operation (number of regular equivalent students) on unit cost (excluding land rents) of single-discipline and all universities, respectively. Note that in Fig. 5b, a multi-discipline university is treated as many single-discipline universities. For example, Quang Binh University is treated as five single-discipline universities. Both figures show a broadly negative relationship between unit cost and the number of regular equivalent students, affirming the economies of scale in the provision of university education in Vietnam (i.e., an additional student requires decreasing marginal cost). This negative relationship is much clearer among single-discipline universities.

It is interesting to establish whether or not economies of scope exist in higher education in Vietnam, i.e., whether a multi-discipline university has a lower actual overall unit cost than a set of equivalent single-discipline universities. To do so, we simultaneously compare (1) the weighted unit costs and (2) the teaching quality (such as the student/teaching staff ratio) of single- and multi-discipline universities. The two, respectively, *t* tests conducted indicate that, at 5% level of significance, the weighted unit costs of multi-discipline universities are statistically lower than that of single-discipline universities, whereas there is no significant difference between the student/teaching staff ratios of single- and multi-discipline universities. Combining the two results, it may be concluded that there exists empirical evidence supporting the presence of economies of scope in Vietnamese higher education.

It is also expected that teaching quality measured in terms of instructional standard indicators (such as number of academic staff per student or teaching floor area per students) varies positively with unit costs of education. These expectations are borne out by our data as illustrated in Fig. 6a and b. In Fig. 6a, as number of regular equivalent students per tenured academic staff increases (indicating a decline in teaching quality), estimated unit cost decreases for most of the observed range of the student/staff ratios. It is worth noting that in nature some

Table 5 Tuition fees and estimated unit costs by discipline, Vietnam, 2010. *Sources:* Own data and World Bank (n.d. a)

Discipline	Tuition fee VND mil*	Unit cost (excluding imputed land rents)			Unit cost (including imputed land rents)		
		2010 VND mil	2010 USD**	2010 PPP USD***	2010 VND mil	2010 USD**	2010 PPP USD ***
Engineering and technologies	3.10	5.51	296	976	6.49	349	1149
Natural sciences	3.10	6.82	366	1208	6.54	351	1158
Social sciences and humanities	2.90	5.86	315	1038	9.64	518	1707
Pedagogy and education management		6.50	349	1151	10.04	539	1778
Agriculture, forestry and fishery	2.90	6.02	323	1066	14.89	800	2637
Medicine and pharmacy	3.40	18.09	972	3203	34.75	1867	6154
Economics, finance, banking and law	2.90	4.85	261	859	6.29	338	1114
Fine arts	3.10	10.91	586	1932	16.72	898	2961
All		6.04	325	1070	8.81	473	1560

*Calculated from Sect. 12.1 in The Government of Vietnam (2010) (= monthly tuition fee × 10 months); **2010 USD/VND = 18,612.92; ***2010 PPP/VND = 5647.10
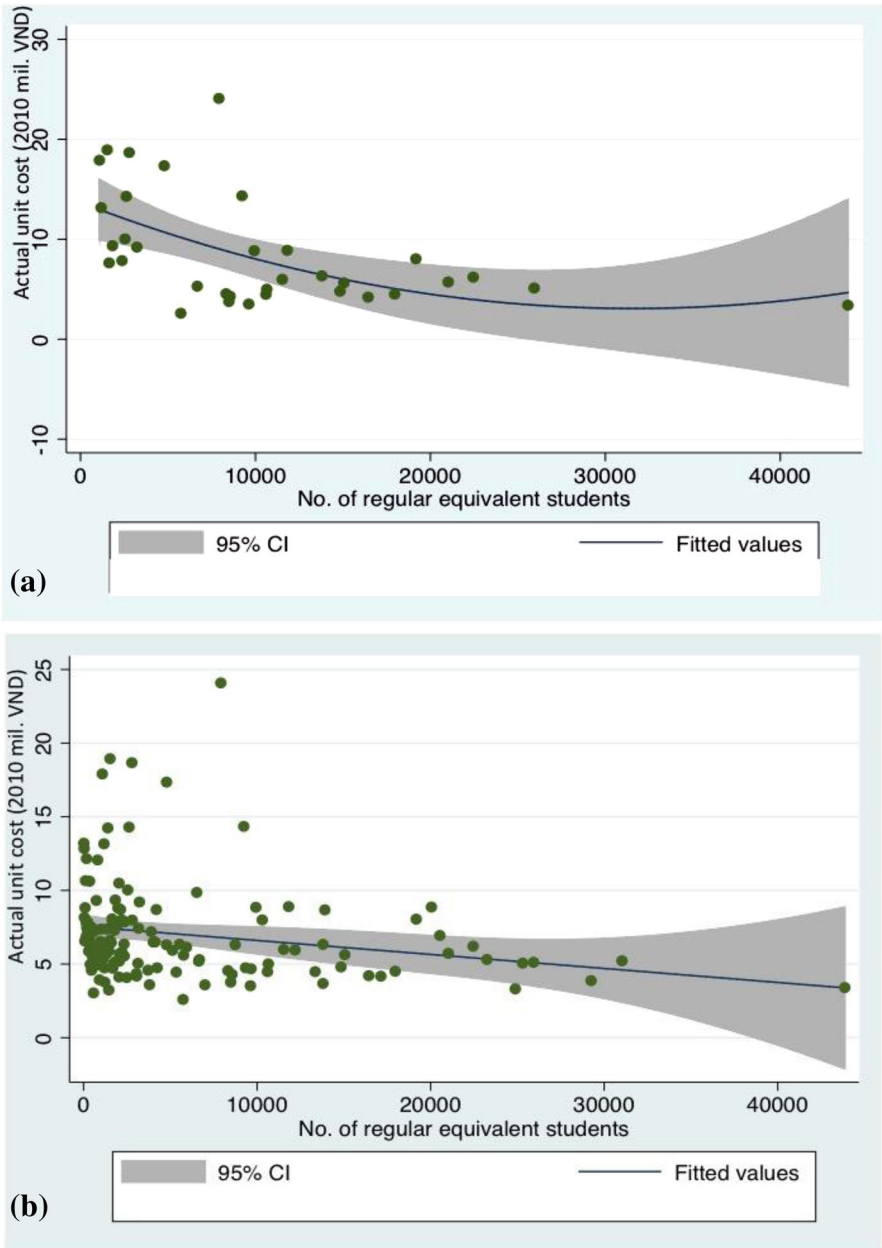
Fig. 5 a Impact of scale of operation, single-discipline universities, Vietnam, 2010 **b.** Impact of scale of operation, all universities, Vietnam, 2010

disciplines such as medicine and pharmacy and fine arts will have a lower student–teacher ratio than social sciences and humanities purely for reasons related to the disciplines.
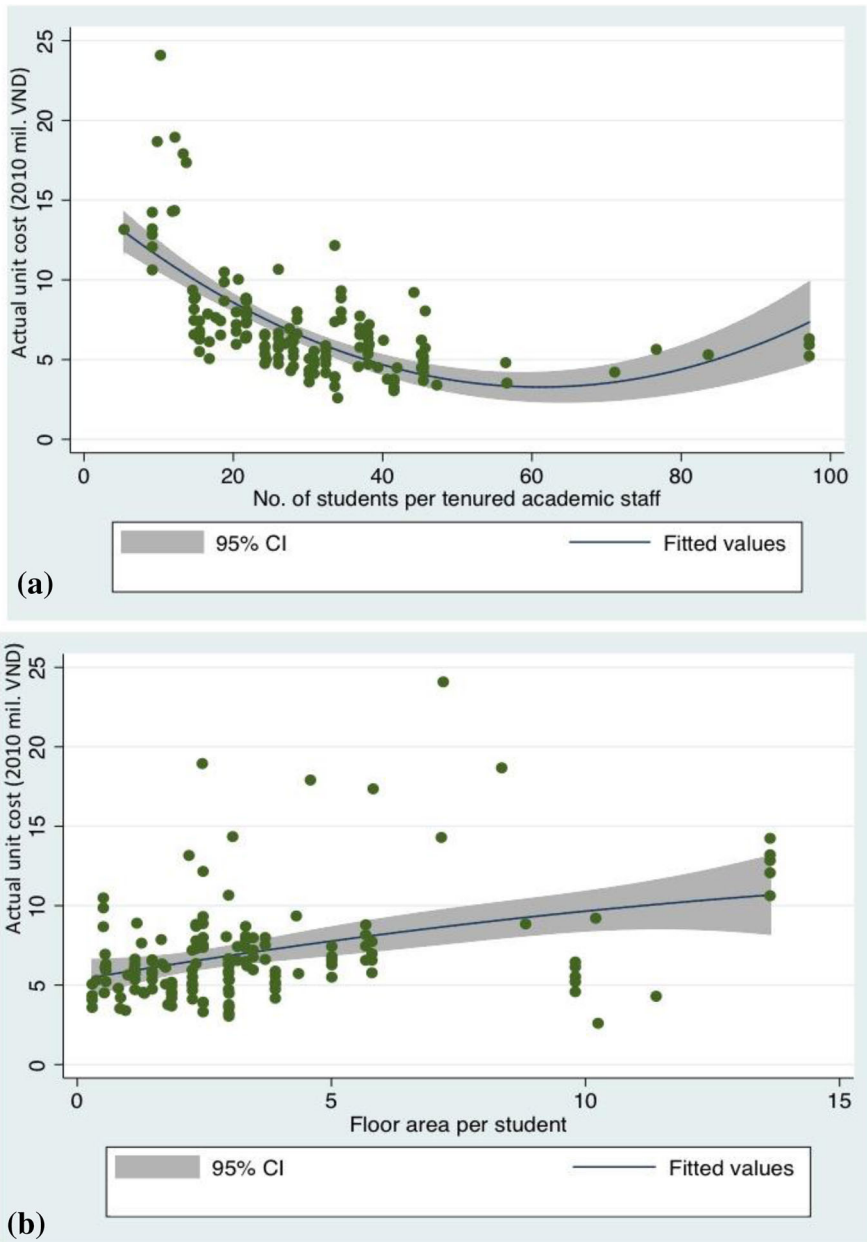
Fig. 6 a Impact of student/staff ratio, all universities, Vietnam, 2010. **b**. Impact of floor area/student ratio, all universities, Vietnam, 2010

In contrast, in Fig. 6b, as floor area per student increases (indicating a rise in teaching quality), estimated unit cost increases for most of the observed range of the floor/student ratios.

Table 6 Public expenditure per student in the tertiary education sector of selected East Asian and Pacific countries, 2010. *Sources*: UNESCO Institute for Statistics (n.d.), World Bank (n.d. a), World Bank (n.d. b)

Country	USD	PPP USD
Australia	11,101	8376
Brunei Darussalam	8769	21,809
Cambodia	218	685
China, Hong Kong SAR	7956	11,390
China, Macao SAR	12,146	22,147
Indonesia	682	1819
Japan	9969	8076
Malaysia	4111	9386
New Zealand	8540	9302
Singapore	10,557	16,801
Thailand	814	2130
Timor-Leste	551	1095
Vietnam (unit cost)	325*	1070**

* = 6.04 million VND/18 612.92 (VND/USD in 2010)
** = 6.04 million VND/5 647.10 (VND/PPP in 2010)

Strict international comparison of unit cost estimates is generally not possible due to lack of comparable data. Table 6 provides data on public expenditure per student in tertiary education sector of selected East Asian and Pacific countries in 2010. Before making any comparisons, it is important to bear in mind that (1) the tertiary education sector is wider than the public university sector, and (2) public expenditure per students is necessarily much lower than unit cost of public universities. It is apparent that Vietnam's overall unit cost (excluding land rents) of public universities in 2010 is extremely low by international standards. Even when compared with comparable neighboring countries, Vietnam's unit cost (in USD or PPP USD) is far smaller than public expenditures per student in Indonesia or Thailand. However, when comparing the ratio of public expenditure per student to GDP per capita, there are similarities between these countries (varying from about 19% for Thailand to 22% for Indonesia and 26% for Vietnam).

As a final exercise, it seems worthwhile to make an international comparison of relative unit cost using the economics and law discipline (which has the lowest unit cost in Vietnam) as the reference group. Table 7 summarizes relative unit cost data derived from various international studies using different methods of estimation. There is a general agreement in international unit cost data in the sense that, except for Malaysia, economics and law represents the lowest cost discipline, whereas medicine and pharmacy represents the highest cost discipline. There exists a strong positive correlation of 0.83 between Vietnam's relative unit costs and the unweighted average of relative unit costs of other countries. Two most apparent and interesting discrepancies are that (1) medicine and pharmacy and (2) engineering and technologies in Vietnam are, respectively, very high- and low-cost disciplines relative to other comparison countries.

Note that the data in Table 6 are collected in a relatively more uniform manner by multi-national institutions, whereas, in Table 7, cost estimates for different countries are derived by individual researchers using different methods and assumptions.

Table 7 International comparison of relative unit costs. *Sources*: Table 1 in Maelah et al. (2011, p. 42), Table 2.1 in Bennett (2011, p. 10), Table 2 in Texas Higher Education Coordinating Board (2009, p. 4), Table 36.2 in University Grants Committee (1996), Appendix B in Higher Education Financing Council for England (2010), and own data

Disciplines	Malaysia	Hong Kong	Australia	Texas	UK	Average	Vietnam
Engineering and technologies	1.7	1.5	1.5	2.0	1.6	1.56	1.14
Natural sciences	1.1	1.6	1.9	1.6	1.5	1.54	1.41
Social sciences	1.6	1.1	1.1	1.0	1.0	1.16	1.21
Pedagogy and education management	0.7	1.1	1.3	1.1	1.1	1.06	1.34
Agriculture, forestry and fishery	1.2	1.6	2.5	1.6	1.4	1.66	1.24
Medicine and pharmacy	2.1	2.3	2.6	2.1	2.5	2.32	3.73
Economics and law	1.0	1.0	1.0	1.0	1.0	1.00	1.00
Fine arts		1.6	2.1	1.4	1.3	1.6	2.25

7 Conclusion

This article reports the results of the first comprehensive and rigorous study into unit costs of public universities in Vietnam in 2010. The study adopts the definitional approach in estimating unit costs by discipline where total cost is measured in terms of opportunity costs and volume output in terms of number of regular equivalent students. The data are derived from a variety of published sources and a questionnaire survey. The results obtained appear to be highly plausible. Unit costs vary considerably between disciplines with economics and law being the lowest cost discipline, whereas medicine and pharmacy the highest cost discipline. The estimated unit costs support the presence of economies of scale and scope in the public higher education sector. Further, as expected, there is evidence that unit cost tends to increase (decrease) in response to an increase (decrease) in teaching quality where teaching quality was operationalized as number of academic staff per student or teaching floor area per student.

In terms of methodology, the article makes a positive contribution to the theory and academic literature on unit cost of university education. It expands the definitional approach to average cost by providing a clear and rigorous step-by-step procedure for calculating unit costs of university education. The proposed method has not only yielded reasonable estimates (as outlined above) but can also be replicated in similar future studies on unit costs.

Vietnam's overall unit cost of public universities in absolute terms (USD or PPP USD) appears to be very low by international standards, even when comparing with comparable neighboring countries such as Indonesia and Thailand. However, the ratio of unit cost over GDP per capita of Vietnam is very comparable to those of Indonesia and Thailand. Based on available international data, a comparison of relative unit costs by discipline (using economics and law as the reference group) reveals that there is a strong positive correlation between Vietnam's relative unit cost and the unweighted average of relative costs of comparison countries. Since these countries are mostly developed economies, these relative unit costs could serve as a norm for Vietnam's university reform in the future.

The results of the study provide much needed evidence for sound policy debate and decision making in higher education. It is apparent that to improve the quality of teaching and research, and thus international ranking, of universities, a considerable amount of additional resources need to be allocated to public universities in Vietnam. While some of these additional recourses could be derived from the state budget, it is unlikely that the Vietnamese government could contribute much further. This is mainly because Vietnam has found it very difficult to maintain a high level of government revenue-to-GDP ratio due to declining trade taxes and oil revenue in recent years (see, for example, Haughton 2011; Truong and Le 2017). Further, as discussed in Sect. 2, Vietnam's public expenditure on higher education as a percentage of public expenditure on education has also declined in recent times. This implies that households are expected to play a greater role in funding universities. Thus, an integral component of university reform in Vietnam necessarily involves university autonomy, at least financial autonomy, tuition fees and private universities. To preserve access to and equity in higher education, any substantial proposed increase in public university fees should be accompanied with an appropriate student loan scheme.

Appendix: Survey instrument

Questionnaires

Note: Data collected for this questionnaire are the statistical data for the whole university *(including in joint training activities in other locations managed by the university)*

I. General information

1. Name of university:………………………………………………………………………
…………………
2. Governing organization/ministry:…………………………………………………………
…………
3. Is the university willing to participate in a direct interview?

<div align="center">O Yes   O No</div>

4. Is the university willing to participate in the workshop for reporting survey results?

<div align="center">O Yes   O No</div>

Please give information on university's representatives who will participate in the workshop *(priority to two senior officers from the university):*

	Representative 1	Representative 2
Full name		
Position		
Mobile		
Email		

5. The starting year of bachelor's degree student enrollment:………………………….
6. The degree of financial autonomy of the university?

<div align="center">O Autonomy 100%   O Partial autonomy</div>

7. Please list information on land use rights by the university *(excluding rent land)* at 31/12/2010:

No.	Land area (m^2)	Location (district, province)
Location 1		
Location 2		
Location 3		
Location 4		
…		
Total		

8. Total area of university's buildings by time period?
o Building area before 1990:……………………………………………………………
………………. m^2

o Building area during 1991–2000:…………………………………………………
……………… m^2

o Building area after 2000:……………………………………………………
………………… m^2

9. In 2010, number of computers for students?
By Faculty of Information Technology (*if any*) and other faculties:

	Before 2008	2008–2010
Faculty of Information Technology (*if any*)		
Other faculties		
Total		

10. How many additional computers for students should the university equip to ensure educational quality? How much to purchase these additional computers?

	Additional computers	Expected expense (mil. VND)
Faculty of Information Technology (*if any*)		
Other faculties		

11. Total number of book titles in the university library in 2010 is………………….
With the number of students as in 2010, how many additional book titles should the university purchase to increase educational quality?………………….. book titles.
Estimated expense for purchasing these additional book titles is…………………. mil. VND

12. Do students have rights to use international and internal electronic database for studying?

O Yes   O No

If yes, the number of these database sources in 2010 is……………………….. Total expense for purchasing the license of these sources in 2010 is ………………….. mil. VND.

13. Number of articles published in scientific journals from full-time teachers and staff in the university in 2010:

o National scientific journal: ……………...………………………………………………
o International scientific journal:…….….……………………………………………..
o Patents: …………….…………………………………………………………
………….

According to the university, at least how many articles published in scientific journals do each full-time teacher write to increase the educational quality?

o Prof./Ass. Prof.:…………………………………………………..articles/person/ year

o Dr./Senior teacher:………………………………………………articles/person/ year

o Other teachers:…………………………………………………….articles/person/ year

14. If the university receives additional 5% (10%, 15%) of the state budget for formal under-graduate training expenditures in 2013, which areas will the university give priority to spending more on to improve the educational quality? Priorities are listed in descending order:

	+ 5%	+ 10%	+ 15%
Priority 1			
Priority 2			
Priority 3			
Priority 4			
Priority 5			

15. If the university receives less than 5% (10%, 15%) of the state budget for formal under-graduate training expenditures in 2013, which areas will the university give priority to spending less? Priorities are listed in descending order:

	+ 5%	+ 10%	+ 15%
Priority 1			
Priority 2			
Priority 3			
Priority 4			
Priority 5			

16. How many first year students and classes were there in 2010? *(Differentiate by 'regular' and 'high-quality' programs, in which the latter means advanced/high qual-ity/talented/taught in English or similar programs)Note:* Fill all the available disciplines in 2010

Discipline	Regular		High quality	
	Number of 1st year students	Number of classes	Number of 1st year students	Number of classes

17. Total equivalent teaching hours
Note: Use the conversion rates which are in use by the university

	2nd semester 2009–2010	1st semester 2010–2011
Permanent teachers		
Guest teachers		

II. FINANCIAL INFORMATION

18. Total revenue in 2010:

No. Revenue	Million dongs
1 State budget funding (including National Targeted Program)	
In which:	
1.1 Funding on recurrent expenditure	
1.2 Funding on researches	
1.3 Funding on capital expenditure	
1.4 Funding for other state-assigned tasks *(survey, environment protection tasks, marine-islands protection tasks,* etc.*)*	
2 Tuition and fees	
3 Teaching support	
4 Revenue from other education services *(general education, entrance examination preparation, professional short courses,* etc.*)*	
5 Revenue from cooperation with foreigner programs	
6 Other revenues	
TOTAL REVENUE	

19. Total expenditure in 2010:

No. Expenditure	Million dongs
1 Recurrent expenditure *(from all sources mentioned in Question 177)*	
In which	
1.1 Personnel expenditure *(including salaries, wages, allowances, remunerations to local people and expatriates, bonuses, welfares, contributions, other payment to people, extra-teaching payments, thesis introduction, administrative management,* etc.*)*	
1.2 Scholarships to students	
1.3 Professional expenditure *(public service payment, stationeries, communication, seminars, per diems, rents, repairs,* etc.*)*	
1.4 Expenditure on large purchases and repairs of fixed assets such as automobile, equipment… *(if any)* from current expenditure funding	
1.5 Research expenditure	
1.6 Expenditure on other education services *(if any) (general education, entrance examination preparation, professional short courses,* etc.*)*	
1.7 Other recurrent expenditure	
2 Capital expenditure	
3 Other expenditure	
Total expenditure	

20. Depreciation of fixed assets calculated from 1/1/2010 to 31/12/2010 is…………………
mil. VND.

21. In 2010, what percentage of current expenditure for regular undergraduate students did
revenue from tuition and fees of these students meet for?………………. percent.

22. Total procurement of fixed assets *(excluding building construction)* during 2006–2010 (mil. VND)

2006	2007	2008	2009	2010

23. Total expenditure for research activities by full-time teachers and staff in the university in 2010:
o National:…………………………………………………..mil. VND
o International:….………………………………………..mil. VND
24. Estimated cost/revenue ratio of training services *(e.g. secondary education, college exam preparation, professional training, short training…)* in 2010 is:……….. percent.
25. Does the university have building and internal roads over 50 years of age?

<div align="center">O Yes   O No</div>

If yes, how much is estimated value of this construction?……………………….. mil. VND.
26. About information on students, teaching staff, facilities and building, the university is recommended to offer period statistical reports for DPF-MOET in the schooling year of 2009–2010 and 2010–2011 *(Tables 2, 5.1 and 6)*. Please send this questionnaire via postal mail, fax or email address xxxxx

The research team would like to thank you for your cooperation!

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