International Review of Accounting, Banking and Finance
Vol 14, No. 1, Spring, 2022, Pages 27-40

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An Analysis of the Correlation between Financial Performance and the Nurse-Patient Ratio: Evidence from Different Hospital Levels in Taiwan

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Accepted March 2022

A B S T R A C T

In light of the situation in Taiwan following the COVID-19 outbreak in May 2021, hospitals face a shortage in nursing manpower, resulting in many registered nurses leaving the profession. As a result, the issue of the high nurse-patient ratio has received renewed attention. This study attempts to fill this gap by conducting an empirical analysis of public hospitals at different levels between 2019 and 2020. The empirical results show that, as medical centers have a better financial position than regional hospitals and district hospitals, a lower nurse-patient ratio can improve a hospital's operating performance. In addition, Taiwan's six municipality areas have relatively more resources and tend to have a good health care quality, which means that they provide better benefits and therefore have a better nurse-patient ratio, resulting in a lower turnover rates and lower manpower training costs which in turn improves operating performance.

Keywords: Nurse-Patient Ratio, Financial Performance, Hospital Levels
JEL classification: M10、I15、I18

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1. Introduction

In accordance with the Securities and Exchange Act, financial reports of listed companies in Taiwan should be signed by the chairman, manager and accounting supervisor, and an official declaration stating that the contents of the financial report are not deceptive or hidden should be issued to fully disclose the financial statements to the public. However, different levels of hospitals adopt different management strategies and cost control models. In accordance with Article 73 of the Health Insurance Law, if for one year a medical insurance provider receives medical expenses exceeding a certain amount, they should submit a financial report related to the National Health Insurance to the insurer before the deadline. The financial report should be certified by an accountant or audited by an auditing agency, and include at least a balance sheet, a income statement, a cash flow statement, and a statement of medical revenue and expenses. The threshold for hospitals to publish financial reports is gradually expanded. Therefore, the standard for filing from 2013 to 2015 was that the application exceeds 600 million. However, the threshold for filing from 2016 to 2017 was reduced to 400 million. After 2018, it will be reduced to 200 million, and the hospitals that disclose their financial reports will account for more than 90% of all hospital expenses (Ministry of Health and Welfare, 2020).

Under the health care system created by the Taiwanese government, the majority of public and private health care systems is subject to the same medical payment standards. Because of this, finding ways to improve the performance of hospital operations and enhance their competitive advantage has become a crucial issue for all health care systems. Due to the rapid aging of the population and new medical technology in addition to limitations on the total budget for the implementation of the National Health Insurance, it is increasingly difficult for hospitals to operate successfully. In the past, a number of studies have been conducted on hospital cost behaviors, management approaches, and health care quality, which can help the public and financial statement users to understand and keep track of the situation and help authorities to formulate and coordinate medical resources in Taiwan.

The Department of Nursing and Health Care of the Ministry of Health and Welfare announced “2020 State of the World’s Nursing: Taiwan Profile” on May 11, 2020. The density of nursing manpower in Taiwan is 73.9 (approximately 73.9 nursing manpower per 10,000 population), which is a significant increase of at least 20 compared to 2013. The global ranking belongs to the top, allowing the world to see the cultivation and achievements of nursing in Taiwan (Ministry of Health and Welfare, 2020). As a result of the COVID-19 outbreak in Taiwan in May 2021, nursing staff are considered part of the high-risk group and as a result receive unfriendly treatment. This, in combination with frequent reports of violence against medical staff, has caused many registered nurses to leave the field. The nursing shortage has not only led to high turnover rates among nursing staff but has also had a direct impact on patient outcomes as well as hospital costs. Past studies have shown that the higher the nurse-patient ratio, the higher the amount of medical errors (Chen, 2011). As a result of the declining number of nurses, patient outcomes have worsened, which includes increased medical errors, decreased patient satisfaction, and increased family complaints. Research shows that if the reasonable allocation of clinical nurses is reduced due to economic considerations, it will generally lead to a decline in the quality of medical care for patients, which in turn affects the hospital’s income (Liang et al., 2012; Schubert et al., 2012; Butler et al., 2011). if the nurse-patient ratio is too high, nursing staff are faced with an excessive workload, high pressure, and high risks, which may lead to a lowered retention of nursing staff. If the workload of nursing staff becomes too great, Taiwan’s current medical manpower might not be sufficient to handle a sudden disease outbreak.

Benefits from the National Health Insurance affect the operation of hospitals and even the entire health care industry, which of course also impacts nursing staff. If the nursing field actively strives for

a reasonable nurse-patient ratio in the future, a much greater nursing manpower will be required. In addition, in order to meet the government's requirements, specific hospitals need to disclose their financial statements to hospital physicians, nursing staff, management staff, and the general public in order to facilitate the policies and operations of medical institutions. Therefore, this study uses the net profit margin as a tool to measure hospital financial performance in order to understand whether differences between hospital levels impact the financial position of hospitals and, by extension, to examine whether hospitals located in Taiwan's six municipalities have a better quality of performance, which can help authorities to formulate and coordinate medical resources in Taiwan.

2. Literature Review

In March 2021, the National Health Insurance Administration (NHIA) published the 2019 financial reports for hospitals receiving more than NT$200 million in health insurance. Hospital revenue is divided into two main categories, healthcare revenue and non-healthcare revenue, with healthcare revenue being the main source of income. There are many factors that impact hospital operations in the market, and it is believed that the operating performance of medical institutions can be divided into three major categories: medical effectiveness, hospital productivity, and financial performance (Wang *et al*., 2005). Due to there are many factors that affect hospital operating performance, such as hospital cost habits, management approach, and quality of Hospital Care (Berger et al., 2020; Karim et al., 2018; Yana and Yang, 2013), And the performance indicators of hospital operating performance: (1) Financial performance indicators: such as return on assets; (2) Operating performance indicators: such as occupancy Rate; (3) Marketing performance indicators: such as admission market share (Chang *et al*. , 2012; Dong 2015; Bem *et al*., 2014), which can further help the public and users of financial statements in interpretation and supervision.

The nursing staff is an essential and integral component of the healthcare system, and the shortage of nursing staff is a worldwide problem: Taiwan is not the only place where the ideal nurse-patient ratio of 1:6 is exceeded, as the same goes for many European countries and Japan. However, Taiwan ranks quite poorly. Since 2019, the nurse-patient ratio has been officially legislated, specifying the maximum number of patients one registered nurse can take care of, with a 1:9 ratio in medical centers, a 1:12 ratio in regional hospitals and a 1:15 ratio in district hospitals. According to the Taiwan Union of Nurses Association (TUNA) in December 2020, the actual practice rate of people with nursing licenses in Taiwan is 59.9%, and nearly 40% of them do not want to work in nursing even after obtaining a nursing certificate. In facing the shortage of nursing staff, high sickness levels as well as pay and overtime are all important problems to overcome. If the nurse-patient ratio is too high, their health status and work pressure will have an impact on the retention rate (Asakura *et al*., 2020; Aiken *et al*., 2014). Moreover, if the work pressure is too great, it will likely increase the physical and social pressure on the nursing staff and will make them more likely to change professions (Salam & Alghamdi, 2016; Lanz & Bruk-Lee.,2017). In order to improve the work environment for registered nurses, in 2015, the Ministry of Health and Welfare included the nurse-patient ratio in the official hospital evaluation while also linking it to the hospitalization insurance reimbursement, and formally passed the Registered Nurse Staffing Act in 2019 (Ministry of Health and Welfare, 2019). In recent years, several articles on nursing manpower issues in Taiwan have been published in international nursing journals (Chang *et al*., 2019; Hung and Wu, 2019; Chang and Lin, 2020). However, it has been discovered that most of the previous studies on turnover factors have been inferential research focused on turnover intention. In addition, the nurse-patient ratio in combination with the heavy workload has been the focus of the demands by clinical nurses in recent years, and the workload for registered nurses has been increasingly recognized as being

related to employee turnover and shortages as well as quality of care (Salam & Alghamdi, 2016; Lanz & Bruk-Lee., 2017).

According to the Ministry of the Interior (2021)[1] reported that the six municipalities have accounted for 70% of the country's total population, which shows that Taiwan is facing a more serious situation of resource and population concentration in the six capitals, because the six cities have better social economy, medical services, and healthy environment. In addition, there are currently six municipalities in Taiwan, namely Taipei, New Taipei City, Taoyuan City, Taichung City, Tainan City, and Kaohsiung City. They are collectively referred to as the "six capitals" (City6), all of which have a population greater than one million people, and a company that is located in a City6 is essentially operating in a region that is economically significant, or which represents a niche for the company. Moreover, companies located in a City6 typically have relatively more resources and are able to attract large-scale investment (Huang, 2020). Moreover, public hospitals (medical centers, regional hospitals, and district hospitals) are distributed throughout Taiwan, this study aims to further understand whether there are differences in operating performance between City6 and Non-City6 regions.

Due to the impact of COVID-19 on hospital finances, the financial reports of 2020 will only be publicly available in 2022; as such, this study uses the data from public hospitals during 2019 and 2020 as its materials, conducting empirical analysis of the impact of the nurse-patient ratio on the financial performance of public hospitals at different levels.

3. Research Method

3.1 Sample Selection

This study has collected relevant variables through a literature review to establish an empirical model and adopts appropriate methods for data analysis. Taking into consideration the impact of COVID-19 on hospital finances, as well as the fact that the 2020 financial reports will only become available to the public in early 2022, this study focuses on the period from 2019 to 2020. Because public hospitals are required by the Taiwan government to publish their annual financial statements, this study uses public hospitals as its research corpus and manually collects data to calculate relevant financial information and explore whether the nurse-patient ratio has an impact on the financial status of hospitals.

Table 1: Sample Distribution

Hospital-Level Distribution by City6 and Non-City6				
Level Type [a] \ Hospital-	Medical Centers	Regional Hospitals	District Hospitals	Total
City6	12 (10.00%)	30 (25.00%)	22 (18.33%)	64 (53.33%)
Non-City6	0 (0.00%)	18 (15.00%)	38 (31.67%)	56 (46.67%)
Total	12 (10.00%)	48 (40.00%)	60 (50.00%)	120 (100%)

[a] There are currently six municipalities in Taiwan, namely Taipei, New Taipei City, Taoyuan City, Taichung City, Tainan City, and Kaohsiung City. They are collectively referred to as the "six capitals" (City6), all of which have a population greater than one million people.

The hospitals have been divided according to their levels into medical centers, regional hospitals, and district hospitals; in addition, the differences between hospitals within and outside of Taiwan's six municipalities have been analyzed, after which regression analysis has been conducted. The source of

[1] Lai, Yu-Chen. 2021/1/23. Ministry of the Interior: The six municipalities have accounted for 69.45% of the country's total population, approaching 70%. United Daily News. https://udn.com/news/story/7314/5197388

the data is the Health and Welfare Statistics Special Zone and the medical service organization of the NHIA. This study took public hospitals as the research object, collected data manually to calculate relevant financial data, and the data will be further to analyse with the statistical software STATA Statistics version 16.0. A total of 120 samples has been collected, and a breakdown of the different hospital levels and municipalities is shown in Table 1. As can be seen, within the six municipalities the number of regional hospitals is greater, accounting for 25% of the total, whereas outside of the six municipalities the number of district hospitals is greater, accounting for 31.67% of the total.

3.2 Research Design and Proxies

3.2.1 Empirical Models

In this study, an empirical analysis was conducted to find the impact of the nurse-patient ratio on the financial performance of public hospitals at different levels, using the net profit margin as a performance indicator for probing linear models and introduces macros for STATA statistical software to simplify the computations in ordinary least squares (OLS) and logistic regression. The regression model (1) is as follows:

$$NI_{i.t} = \gamma_0 + \gamma_1 NPR_{i,t} + \gamma_2 Occupancy_{i,t} + \gamma_3 RoomG_{i,t} + \gamma_4 SER_{i,t} + \gamma_5 EQR_{i,t} + \gamma_6 ASR_{i,t} + \gamma_7 TCR_{i,t} + \varepsilon_{i,t} \quad (1)$$

where:

NI	=	net profit margin, current profit and loss / medicine incomes;
NPR	=	nurse-patient ratio;
Occupancy	=	average occupancy rate;
RoomG	=	growth of hospital beds;
SER	=	ratio of personnel expense to medicine incomes;
EQR		ratio of medical supply expenses to medicine incomes;
ASR		ratio of administration expense to medicine incomes;
TCR	=	ratio of medical cost expenses to medicine incomes;
ε	=	residual term.

3.3 Related Variables and Operational Definitions

3.3.1 Dependent Variable: Net Profit Margin (NI)

The financial performance indicator measures the profitability of hospitals using the net profit margin (NI), which is the ratio of revenue or loss to the medical revenue of one public hospital in a given year (Dong, 2015).

3.3.2 Independent Variable: Nurse-Patient Ratio (NPR)

The Nurse-Patient Ratio (NPR) is the average number of patients per one registered nurse in a hospital and is calculated as follows: number of hospital beds x occupancy rate x 3 ÷ total number of registered nurses working three shifts a day. Using a VPN to access information on hospitals contracted by the National Health Insurance Administration under the Ministry of Health and Welfare, data was collected on the average nurse-patient ratio for each month.

3.3.3 Control Variables

For this study, previous related research has been referenced while adding the following control variables: average occupancy rate (*Occupancy*), growth of hospital beds (*RoomG*), ratio of personnel

expense to medicine incomes (*SER*), ratio of medical supply expenses to medicine incomes (*EQR*), ratio of administration expense to medicine incomes (*ASR*), and the ratio of medical cost expenses to medicine incomes (*TCR*) (Chien *et al*., 2014).

4. Empirical Results

4.1 Descriptive Statistics

Table 2 shows the descriptive statistics analysis. In this paper, the research corpus has been categorized by hospital level and divided into medical centers (n=12), regional hospitals (n=48), and district hospitals (n=60). As can be seen, medical centers have the highest net profit margin (*NI*), indicating that medical centers have a better net profit margin due to the advantages of their medical technology and practice. In addition, medical centers have a lower nurse-patient ratio as well as a higher average occupancy rate (*Occupancy*), lower growth of hospital beds (*RoomG*), lower ratio of personnel expense to medicine incomes (*SER*), higher ratio of medical supply expenses to medicine incomes (*EQR*), and a lower ratio of administration expense to medicine incomes (*ASR*) and ratio of medical cost expenses to medicine incomes (*TCR*), indicating that large-scale medical systems have a better financial position and cost control system.

Table 2: Descriptive Statistics

Distribution of Hospital-Level									
	Medical Centers (n=12)			Regional Hospitals (n=48)			District Hospitals (n=60)		
Variables [a]	Mean	Median	Std. Dev	Mean	Median	Std. Dev	Mean	Median	Std. Dev
NI	0.0509	0.0512	0.0194	0.0407	0.0407	0.0184	0.0258	0.0202	0.0553
NPR	7.4021	7.2583	0.3486	10.2750	10.2750	1.2305	10.1255	10.4750	2.2050
Occupancy	0.8417	0.8551	0.0579	0.7147	0.7187	0.1114	0.6657	0.7043	0.1722
RoomG	-0.0087	-0.0055	0.0114	0.0111	0.0019	0.0409	0.0116	0.0003	0.0440
SER	0.2843	0.2809	0.1151	0.3426	0.3168	0.1498	0.3385	0.3390	0.1021
EQR	0.4150	0.4342	0.0789	0.2768	0.3023	0.1007	0.2662	0.2623	0.0651
ASR	0.0489	0.0459	0.0124	0.0735	0.0653	0.0462	0.1064	0.1029	0.0453
TCR	0.8418	0.8841	0.9549	0.9720	0.9720	0.0659	1.0085	1.0396	0.1451

[a] *NI*: net profit margin; *NPR*: the nurse-patient ratio; *Occupancy*: average occupancy rate; *RoomG*: growth of hospital beds; *SER*: ratio of personnel expense to medicine incomes; *EQR*: ratio of medical supply expenses to medicine incomes; *ASR*: ratio of administration expense to medicine incomes; *TCR*: ratio of medical cost expenses to medicine incomes.

4.2 Correlation Matrix

In this paper, an analysis has been made on the correlation between the above-mentioned variables using the Pearson correlation coefficient, and the degree of influenced was measured. These findings can be found in Table 3. As the table shows, there is a negative correlation between net profit margin and nurse-patient ratio (correlation coefficient is -0.388), meaning that hospitals with a lower number of nurses tend to have a higher net profit margin. Additionally, net profit margin (*NI*) is positively correlated with growth of hospital beds (*RoomG*), whereas *NI* is negatively correlated with ratio of administration expense to medicine incomes (*ASR*) and ratio of medical cost expenses to medicine incomes (*TCR*). Although the Pearson correlation coefficient of *NI* and *TCR* was greater than 0.59, the variance inflation factors in the subsequent empirical results were all lower than 10, indicating that the co-linearity between the variables was still within the allowed range, and there should be no serious co-linearity issues.

Table 3: Correlation Matrix

Variables [a,b]	*NI*	*NPR*	*Occupancy*	*RoomG*	*SER*	*EQR*	*ASR*	*TCR*
NI	1.000							
NPR	-0.388*	1.000						
Occupancy	-0.040	0.262*	1.000					
RoomG	0.206*	0.023	-0.240*	1.000				
SER	-0.034	0.158	0.039	-0.062	1.000			
EQR	-0.013	-0.326*	0.079	-0.001	-0.467*	1.000		
ASR	-0.293*	0.319*	-0.081	-0.021	0.374*	-0.429*	1.000	
TCR	-0.586*	0.332*	-0.050	-0.060	0.030	-0.124	0.158	1.000

[a] *NI*: net profit margin; *NPR*: the nurse-patient ratio; *Occupancy*: average occupancy rate; *RoomG*: growth of hospital beds; *SER*: ratio of personnel expense to medicine incomes; *EQR*: ratio of medical supply expenses to medicine incomes; *ASR*: ratio of administration expense to medicine incomes; *TCR*: ratio of medical cost expenses to medicine incomes.

[b] Pearson correlations in the lower diagonal. * Indicates significance at the 5 percent level.

4.3 Multivariate Analysis

4.3.1 Nurse-Patient Ratio and Net Profit Margin

This study used multiple regression analysis in combination with the ordinary least square method to make estimations in order to examine the impact of the nurse-patient ratio on the financial performance of hospitals, of which the empirical results can be found in Table 4. As the results show, only the nurse-patient ratio (*NPR*) in medical centers had a significant negative correlation (t=-0.36, p <0.01) with the hospital net profit margin (*NI*). This is most likely a result of the Ministry of Health and Welfare's 2019 legislation on the nurse-patient ratio, in which it was included in the official hospital evaluation and linked to the hospitalization insurance reimbursement. The Ministry has pointed out that hospitals that do not meet the standards are required to make improvements within two months, otherwise they will fail the assessment. This demonstrates that when nurses have fewer patients to care for, medical centers have a better financial position compared to regional hospitals and district hospitals: since medical centers treat patients with more complex medical conditions, they possess modern medical equipment and have support from medical schools, allowing for them to improve the effectiveness of their operations. The negative correlation between *NI* and *TCR* indicates that because hospitals disclose their financial information in accordance with the regulations, they have their own cost control mechanism and therefore are able to achieve a better net profit margin.

Medical centers possess larger quantities of advanced medical equipment and devices; larger numbers of quality medical equipment and devices increase the probability of achieving higher scores in health-care evaluations. Such centers are capable of purchasing medical equipment with the goal of improving health-care quality. Consequently, sufficient nursing manpower in these centers effectively lowers the number of patients cared in the nurse-to-patient ratio. By contrast regional hospitals may experience challenges to the pressure applied through National Health Insurance-related policy changes, increases in health insurance copayments for drugs and medical supplies have added additional financial pressure. District hospitals reduce each year and the competition in district hospitals business, in which hospitals of the same level recruit health-care professionals and offer higher salaries.

Table 4: Nurse-Patient Ratio and Net Profit Margin

Variables [a]	Pred. Sign	Medical Centers Coef.	Medical Centers *t*-value [b]	Regional Hospitals Coef.	Regional Hospitals *t*-value	District Hospitals Coef.	District Hospitals *t*-value
CONSTANT		0.0858	0.16**	0.1592**	2.55***	0.2966	6.06***
NPR	−/+	-0.0168	-0.36***	0.0010	0.11	-0.0080	-2.40
Occupancy	−/+	0.1207	0.50	0.0273	1.19	0.0421	1.05
RoomG	−/+	0.7788	0.61	0.0641	0.99	0.2627	2.13**
SER	−/+	-0.0052	-0.06	0.0260	1.09	-0.0195	-0.35
EQR	−/+	-0.0478	-0.44	-0.0321	-0.82	-0.0670	-0.75
ASR	−/+	0.2711	0.34	-0.1025	-1.53*	-0.2701	-2.03**
TCR	−/+	-0.0882	-1.75*	-0.1402	-3.09***	-0.1663	-4.27***
Adj. R^2		58.70%		34.83%		57.53%	
Nobs.		12		48		60	

[a] *NPR*: the nurse-patient ratio; *Occupancy*: average occupancy rate; *RoomG*: growth of hospital beds; *SER*: ratio of personnel expense to medicine incomes; *EQR*: ratio of medical supply expenses to medicine incomes; *ASR*: ratio of administration expense to medicine incomes; *TCR*: ratio of medical cost expenses to medicine incomes.

[b] Asterisks *, **, *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively.

4.3.2 Considering government fiscal condition

Currently, there are six municipalities that are Taipei City, New Taipei City, Taoyuan City, Taichung City, Tainan City, Kaohsiung City in Taiwan, all of which have a population greater than one million people. In order to assess the competitive situation of the region of each hospital, this study divided the samples into City6 and Non-City6 to determine whether any differences are due to regional competition. The empirical results in Table 5 show that hospitals located in City6 areas have a significant relationship between *NPR* and *NI* compared to hospitals in Non-City6 areas (t=-2.22, p <0.05). This means that if a hospital is located within the City6 areas (Taipei City, New Taipei City, Taoyuan City, Taichung City, Tainan City, Kaohsiung City), it has economic significance or serves a niche for businesses, and as it is located in an area with special needs in terms of political, economic, cultural, and metropolitan development, meaning that hospitals located in City6 areas have relatively more resources, a better nurse-patient ratio, and a better net profit margin. This research also means that City6 has the great magnetic attraction to Non-City6, but it can obtain better economic, educational, medical and other conditions than Non-City6, and City can also attract foreign talents and concentrate a large amount of capital to create more opportunities. Most of the medical centers and regional hospitals in Taiwan are located in City6, which shows the disparity in the distribution of medical resources. In the future, the number of samples can be expanded to further observe whether each county and city also has uneven distribution of medical resources.

Table 5: Nurse-Patient Ratio and Net Profit Margin- City6 and Non-City6

Variables [a]	Pred. Sign	City6 Coef.	City6 *t*-value [b]	Non-City6 Coef.	Non-City6 *t*-value
CONSTANT		0.3504	7.42***	-0.8860	-0.51
NPR	−/+	-0.0060	-2.22**	-0.2810	-1.51
Occupancy	−/+	0.0272	0.77	-0.1502	-0.06
RoomG	−/+	0.2384	2.55***	0.0025	0.08
SER	−/+	-0.0207	-0.56	-1.7674	-0.82
EQR	−/+	-0.1952	-3.80***	-5.3709	-0.64
ASR	−/+	-0.2609	-2.57***	0.0877	0.45

TCR	−/+	-0.1995	-4.89***	-0.7483	-0.43
Adj. R^2		55.17%		45.92%	
Nobs.		64		56	

[a] *NPR*: the nurse-patient ratio; *Occupancy*: average occupancy rate; *RoomG*: growth of hospital beds; *SER*: ratio of personnel expense to medicine incomes; *EQR*: ratio of medical supply expenses to medicine incomes; *ASR*: ratio of administration expense to medicine incomes; *TCR*: ratio of medical cost expenses to medicine incomes.

[b] Asterisks *, **, *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively.

4.4 Additional Tests

4.4.1 Nurse-Patient Ratio and Net Profit Margin- 2019 and 2020

In response to the severe challenges posed by COVID-19, Taiwan's success in epidemic prevention has become the world's praise. In July 2020, the US "Bloomberg Economics" appraisal ranked first in anti-epidemic performance. In particular, health professionals of the frontline are holding the front line of epidemic prevention for Taiwan, and the medical system is supported by health insurance has also as the main key to Taiwan's strong epidemic prevention. The daily hard work of medical staff and the increase in health insurance costs in 2021 that have caused discussions among the public. Table 6 divides the study sample into empirical analysis of hospital financial performance with nurse-patient ratio to compare between 2019 and 2020 that means before and after COVID-19.

This study shows that there is a significant negative correlation between the NPR and NI in 2019, because the nurse–patient law was formally legislated in May 2019, the lower nurse-patient ratio only in 2019 which is due to the relatively the care of fewer patients and better medical quality, which further improves the financial performance of the hospital.

Table 6: Nurse-Patient Ratio and Net Profit Margin- 2019 and 2020

		2019		2020	
Variables [a]	Pred. Sign	Coef.	*t*-value [b]	Coef.	*t*-value
CONSTANT		0.3436	7.82***	0.1627	4.29***
NPR	−/+	-0.0119	-4.08***	0.0015	0.95
Occupancy	−/+	0.0234	0.66	0.0185	1.01
RoomG	−/+	0.3278	2.95***	-0.0787	-1.13
SER	−/+	-0.0151	-0.35	0.0439	1.82**
EQR	−/+	-0.1918	-3.23***	-0.0037	-0.10
ASR	−/+	-0.2864	-2.41***	-0.1639	-2.77 ***
TCR	−/+	-0.1299	-3.93***	-0.1596	-5.93***
Adj. R^2		63.60%		53.34%	
Nobs.		60		60	

[a] *NPR*: the nurse-patient ratio; *Occupancy*: average occupancy rate; *RoomG*: growth of hospital beds; *SER*: ratio of personnel expense to medicine incomes; *EQR*: ratio of medical supply expenses to medicine incomes; *ASR*: ratio of administration expense to medicine incomes; *TCR*: ratio of medical cost expenses to medicine incomes.

[b] Asterisks *, **, *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively.

5. Conclusion and Recommendations

Taiwan's success in universal health care is internationally recognized. However, recently, numerous emergency departments have reduced their number of beds or closed wards due to the shortage in

nursing manpower. Due to the high workload, stress, and relatively low salaries compared to the required labor, the nursing shortage in Taiwan has received attention from various industries.

This study conducted an empirical analysis of different levels of public hospitals in Taiwan from 2019 to 2020. The empirical results show that, as medical centers have a better financial position than regional hospitals and district hospitals, a lower nurse-patient ratio can improve a hospital's operating performance. In addition, Taiwan's six municipality areas have relatively more resources and tend to have a good health care quality, which means that they provide better benefits and therefore have a better nurse-patient ratio, resulting in a lower turnover rates and lower manpower training costs which in turn improves operating performance.

The development of Taiwan's medical institutions is greatly impacted by the health insurance system, and the increasing costs combined with decreasing profits affect hospital operations to different degrees. In the future, we can refer to the indicators of financial performance: (1) Asset activity analysis: accounts receivable, turnover ratio, accounts receivable turnover ratio; (2) Profitability analysis: Return on Investment; (3) Operating-cost: ratio of personnel expenditure to medical costs; (4) Operating income: hospital beds turnover ratio, this study uses financial performance as a measurement index to help managers understand whether the allocation of internal resources in the organization has been fully and effectively used, and can effectively use limited resources. Future research could attempt to create a comparison between the operational efficiency of different hospitals in the same level in order to further extrapolate the results and achieve more clarity. Finally, improving the situation of nursing manpower in Taiwan would include the improvement of the retention and employment rate for nurses, government should utilize the Communicable Disease Control Act and the Occupational Safety Act to severely punish those who use violence or discriminate against healthcare workers, and protect the rights of registered nurses in Taiwan.

As the demand for nurses increases, to prevent loss of manpower and increase registered nurses' pursuit of the vocation, the challenge should be viewed from a perspective of medical and nursing professionals with nursing and technology combined to simplify performance of mechanical tasks. Smart nursing transfer systems as well as reporting methods and solutions are targets for future technological optimizations. These would allow nurses to adequately administer nursing care and devote their time to the real requirements of human care and, thus, improve their sense of professional identity and reduce their likelihood of resigning.

Therefore, patient health-care quality and safety, nurse-to-patient ratios, and nursing fees are mutually related and directly influence each other. Reasonable nursing care costs can facilitate appropriate nurse-to-patient ratios, which in turn lead to high quality health care and safety for patients.

Hospital operators and managers must fully understand their operations, which serve as references for resource input and staffing, to maximize hospitals' operational performance with the few resources available in given operation scales. In addition, effective evaluation of management can assist hospitals in measuring their operating performance to fully extend their operational efficiency.

6. Discussion

The result of mean difference test (Table 8) showed the significant difference in the bank performance before and after the pandemic with respect to ROE, NIM and stock price but no effect on ROA. Thus, it is confirmed that the pandemic lowered the banks' performance. When decomposing each ratio, ROE and NIM related directly to the net interest income and earning assets, while ROA related to the banks' assets having no effect from the pandemic as the size of the banks' assets still does not change. Therefore, only ROE, NIM, and stock price were directly affected by the pandemic.

Return on equity (ROE) is measured by net income of the bank compared to its total equity where the bank's net income derived from net interest income deducted the burden and provision for loan losses plus gain on securities investment and deducted tax. The change in net interest income is an important variable effecting the banks' return on equity. Thus, a huge reduction of net interest income received after the pandemic has a negative impact on the banks' ROE. This variable is also a component of net interest margin ratio (NIM) which showed a significant lower in a mean difference after the pandemic. Another important variable affecting net income is a provision for loan losses (PLL), a non-cash expense representing the estimation of potential incremental lost revenue or income due to bad debt. An overstated amount of PLL could affect the huge reduction in the banks' net income. Lower income of the bank also results from lower demand for loans during the pandemic as borrowers are concerned about the economy recovery, solutions for COVID-19 pandemic, the effectiveness of the vaccines, and the ending of the pandemic. Current borrowers cannot make payment on their debts due to the negative effect of the pandemic on their businesses' and individuals' income. Therefore, the willingness of investors to invest in the banking sector would be less attractive than before despite of the Central Bank's policies adopted by banks, evidenced by the large fluctuation of the stock prices in the Stock Exchange of Thailand.

When exploring the result of the regression analysis, the more the number of the Central Bank's policies applied by each bank, the larger the significant effect on the banks' performance, especially on ROE, ROA, and stock price. However, the empirical result showed negative effects towards the banks' performance implying that the more policies applied, the lower the banks' performance. Policies implemented by banks related to their product types offered in the market. Banks accepting more policies covering most of their products received less repayment or inflow steams than banks adopting less policies. Banks adopting less policies imply less product types covered in the debt relief program. Thus, they can still earn income from those exempt portfolio product that were not included in the program. As a result, the study concludes that the more policies applied by each bank lead to greater negative effects on the bank performance due to the fact that more products were covered by the debt relief program.

The market capitalization was utilized as an independent variable to test the effect of the banks' size on their performance. The result concludes that ROA and stock price are affected by the size of the banks. ROA measures the bank's return on assets deriving from net income over total assets and the market capitalization is obtained from the stock price multiplied by the number of shares outstanding. Thus, changes in the stock price result in changes in the banks' market capitalization. The study concludes that market capitalization inversely affects the banks' ROA but positively affects the banks' stock price, implying that lower market capitalization resulted from lower demand of the stocks in the market led to higher ROA and lower stock price during the pandemic.

Type of the banks (structure and ownership), commercial banks, state owned banks, and foreign banks, had a negative effect on the banks' ROE, ROA and NIM. The effect of the bank's type directly revealed that the owner structure played an important role reflecting the bank performance during the pandemic. The effect towards ROE can be explained by the structure of return on equity deriving from net income over total equity. The change in equity structure, represented by the percentage of the ownership, can be part of the significant effect, which can be altered more during the pandemic for commercial banks and foreign banks comparing to state owned banks, which this issue can be further explored. The study reveals that NIM surprisingly shows a negative and significant effect with respect to the banks' structure and ownership.

Regarding the differed types of the Central Bank's policies employed by banks, it showed that the policy regarding debt restructuring or credit risk reduction policy (CCP1) to customers in various groups

had a negative and significant relationship with the bank performance with regards to ROE and ROA. It could be explained that the more debt restructuring or credit risk reduction policy given to the customers, the lower the banks' financial performance. This inverse relationship suggested that the debt restructuring policy would not strengthen the banks' performance in the future. With a limited time, the banks are still struggling from the pandemic even with the policies' adoption. Debt restructuring or credit risk policy emphasize on customers debt repayment relief objective. By receiving less amount of repayment from principal reduction, interest rate reduction and extension periods, these polices negatively affect the banks' revenue in long run. Loans, a major source of funds of banks, represent the banks' earning assets to compensate with the interests on the depository accounts the banks pay to depositors. The negative effect of the Central Bank's policy possibly related to the imbalance of loans and deposit accounts as well as other expenses incurred by banks. The imbalance of source of funds and use of fund would cause the banks' problems for example liquidity and credit risk in long run. The policy has objective to reduce customers credit risk during the pandemic. Even though the result of less revenue or cashflows will affect the banks' performance, banks allowed customers to adopt the policies in short run around three to six months for the longest periods. It indicated that banks would not risk by allowing customers to take such policies for a long period of time. Banks attempt to deal with these negative impacts by allowing customers who are truly affected by the pandemic to continue the next phrase of debt relief policy with stringent evaluation criteria. The policy reducing credit risk of customers have a negative effect on the banks' return from imbalance of funds. As such, the banks only handle this risk in short-term with an option for customers to renew the program with rigorous criteria. However, the long-term effect should be investigated.

Liquidity improvement policy (CCP2) influenced the stock price only, showing a negative relationship between the stock price and policy implementation. This implies that this policy may not help increase the customers' ability to borrow in the market if the banks still apply the same criteria in offering the loans before the COVID-19 pandemic. The less strict evaluation criteria are one of the most sensitive issue for banks. The subprime crisis and other financial crises from the past showed the failure and the aftermath of banks offering loans to customers with no capacity to repay their debts. However, liquidity improvement is still necessary during the pandemic. Banks need to apply this policy carefully with respect to customer segmentation. However, the policy was offered to business sectors or commercial loan segment especially to the sectors that affect directly from the pandemic rather than the consumer loan market. Individuals have received cash from many government programs which help enhance their liquidity during the pandemic. The size of consumer loan market is quite large for many banks; however, more stringent evaluation criteria and narrowed market segment coverage of policy resulted in the lower demand from investors to buy and hold stock in the exchange market. Thus, CCP2 policy with more stringent criteria and selective market segment covered by the policy possibly leads to a negative relationship in terms of the stock price and policy implementation.

The last group of the Central Bank's policy, debt repayment holiday policy (CCP3) to help customers maintained their cash flows or income and reduced debt burden during the lock down, had no significant effect on any of the banks' financial performance ratios. However, it showed a positive relationship with the bank performance with no significant effect even the customers stop making payments for a short period of time. This relationship can be further explored for the extended period.

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