

## **Profitability of Nepalese Commercial Banks: Test of Market Structure versus Efficient Structure**

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*This study investigates the validity of traditional structure conduct performance (SCP) and efficient structure (EFS) hypotheses in Nepalese commercial banking industry. This study incorporates directly into the test a unique measure of efficiency (cost efficiency). Efficiency scores are calculated using non-parametric data envelopment analysis (DEA). The ordinary least square (OLS) estimates indicate that bank efficiency has a significant effect on banks' profitability, thus, supporting the efficient structure hypothesis. However, empirical results do not show any support in favour of SCP hypothesis for a sample of 18 banks over a nine-year period, beginning from 2004 to 2012. Therefore, this study concludes that market power does not explain profitability of the Nepalese commercial banks rather their performances are determined through an efficient activity.*

**Keywords:** Structure conduct performance hypothesis, efficient structure hypothesis, Nepalese banking

**JEL Codes:** G21

### **1. Introduction**

There are two competing hypotheses that seek to explain the relationship between structure and performance in the banking sector (Park and Weber, 2006). The traditional structure performance (SCP) hypothesis suggests a positive relationship between concentration and profitability as reflected in the setting of prices that are less favorable to consumers in a more concentrated market because of either collusion or other forms of non-competitive behavior (Berger and Hannan, 1989). The main result of this collusion is the monopoly rents achieved by firms in the industry (Smirlock *et al.*, 1984), in which large firms charge higher loan rates, pay lower deposit rates, and reap abnormal profits (Park and Weber, 2006; Demirguc-Kunt, *et al.*, 2003). On the other hand, the efficient structure (EFS) hypothesis suggests that the most efficient firms obtain greater profitability and market share and, as a consequence, the market becomes more concentrated (Maudos, 1998). Thus, the positive relationship between profits and concentration, under efficient structure framework, is explained by lower costs achieved either through superior management or production processes (Goldberg and Rai, 1996).

The main difference between these two competing hypotheses is the 'structure' that links concentration with profitability. The SCP hypothesis takes concentration as exogenous and maintains that high concentration allows for non-competitive behavior that results in less favorable prices for consumers and higher profits for the firm. EFS hypothesis, however, takes firm-specific efficiencies as exogenous and maintains that these efficiencies result in more markets that are both concentrated and have higher profits (Berger and Hannan, 1989).

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From literature, numerous studies have tested these two competing hypotheses as regards the banking sector. For example, Berger (1995), Goldberg and Rai (1996), Maudos (1998), Park and Weber (2006) and Rettabet *et al.* (2010) are a few of them. Al-Muharrami and Matthews (2009), as well as Molyneux and Forbes (1995), found evidence in support of SCP hypothesis.

On the other hand, a significant relationship between a direct measure of efficiency and bank performance has also been reported. For example, a frequently cited work of Goldberg and Rai (1996) found no evidence for structure conduct performance (SCP) hypothesis, rather they found a support for efficient structure hypothesis. In line with this, Berger (1995), Park and Weber (2006), Seelanatha (2010), Mency and Zoury (2011), and Maudos (1998) recorded the significant impact of efficiency on the bank's performance.

Although, various studies have tried to analyze the market structure and performance relationship in other economies, very few studies have tried to investigate this relationship in Nepalese banking industry. The relationship between Nepalese commercial banks operating in a very competitive market, which is similar to EFS argument, or operating in a market where collusions still existed have not been clearly analyzed. In Nepalese context, Bist *et al.* (2015) conducted a research on structure-performance relationship using the technical efficiency as a measure of efficiency. However, their study has failed to give an accurate picture, as cost efficiency is not directly included in the test. Moreover, their study was conducted between 2007 and 2012. Therefore, it is very important to analyze the market structure of the commercial banking industry, as it alone occupies 50.6 percent of the financial system's total assets in Nepal (NRB, 2014). Encouragement and incentives from regulatory bodies to venture into merger and acquisitions and a complete prohibition on issuing a license to a new commercial bank in Nepal can be another argument for a highly competitive market, which might signal the presence of EFS hypothesis. Industries with a large number of firms in the market areas are less collusive and highly competitive, which ultimately signals the presence of efficient structure hypothesis (Berger *et al.*, 2004). On the other hand, it has also been observed that traditionally, Nepalese banks generate higher returns through wide margins and core lending spread (NRB, 2014), which might signal the presence of traditional SCP hypothesis.

This study, therefore, examines the relationship between structure and performance in Nepalese commercial banking industry. More specifically, it seeks to answer how Nepalese commercial banks generate their performances and whether they generate it through collusive behavior or through their efficiency.

Section two of this paper consists of a brief review of earlier studies on the structure-performance relationship. Section three describes the sample, data, and methodology. Section four presents the empirical results and the final section draws conclusion and discusses the implications of the study findings.

## 2. Literature Review

In the context of advanced economies, structure and performance relationship in the banking sector has been extensively studied; however, low-income countries like Nepal still have a deficit in such studies. Since these studies have various policy implications, they are even more required in countries like Nepal. Theoretically, the structure-performance relationship asserts that firms generate their performances either through efficiency or through market power. The two hypotheses; traditional structure conduct performance hypothesis and efficient structure hypothesis, seek to explain those behaviors of the firm in an industry. The traditional SCP hypothesis stated that firms in a concentrated market are likely to reap larger

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profits through oligopolistic behavior (Goldberg and Rai, 1996). Stigler (1964) argued that oligopolists wish to collude in order to maximize joint profits. On the other hand, the efficient structure hypothesis proposed by Demsetz (1973) and Peltzman (1977) suggested that market structure is determined by the efficiency of the operating firm. Efficient firms increase in size and market share because of their ability to generate higher profits, which usually leads to higher market concentration.

On the empirical side, Smirlock (1985) studied the relationship of profitability with concentration, market share, and other control variables. He found a positive relationship between market share and profitability and concluded that efficient structure hypothesis is in effect. However, Shepherd (1986) raised the question on such interpretations. The argument made by Shepherd (1986) is that market share is not the proxy of efficiency, rather it measures the market power. Similarly, Berger and Hannan (1993) and Berger (1995) have also criticized the use of market share as the proxy of efficiency and proposed two unique measures of efficiency; X-efficiency and scale efficiency.

Ruthenberg (1994), Molyneux and Teppet (1993), Lloyd-Williams *et al.* (1994), and Tregenna (2009) found evidence in support of structure conduct performance hypothesis. Ruthenberg (1994) concluded that concentration increases profitability if barriers to entry are high. Likewise, Molyneux and Tappet (1993) using a data set from Sweden, Norway, Finland, Austria, and Switzerland found evidence in support of SCP hypothesis. Tregenna (2009), used bank-level panel data on US banking to test the effects of concentration, market power, bank size and operational efficiency (measured by operating cost ratio) on profitability, found that there is a positive relationship between profitability and concentration. Similarly, Short (1979) examined the relationship between the profit rates and concentration which revealed a positive relationship between profitability and concentration. However, he concluded that the coefficients of concentration are small, which indicates that relatively large changes in concentration are necessary to reduce profit rates by one percentage point. Similarly, Berger and Hannan (1989) also found some evidence in support of traditional SCP hypothesis.

Goldberg and Rai (1996) have studied the relationship between market structure and performance in European context using the model proposed by Breger and Hannan (1993). They modified the SCP and EFS hypothesis into four different hypotheses; two related to the market power paradigm (structure conduct performance and relative market power) and two to the efficient-structure paradigm (X-efficiency and Scale efficiency). They concluded that there is evidence to support the X-efficiency hypothesis.

Using the data set from Spanish banking industry, Maudos (1998) examined structure-performance relationship. They used four modified hypotheses, that is, pure collusion, efficient structure, modified efficient structure and hybrid efficient structure hypothesis. They used three different stochastic measures of efficiency (based on three alternative distributional assumptions for inefficiency: half-normal, normal-truncated and exponential). The study concluded that results obtained support the modified efficient structure hypothesis. Likewise, Park and Weber (2006) analyzed the determinants of profitability in the Korean banking sector within the period of 1992–2002. They concluded that bank efficiency has a significant impact on bank profitability, thereby supporting the efficient structure hypothesis.

Similarly, recent studies by Seelanatha (2010), Rettabet *et al.* (2010), as well as Mensi and Zouary (2011) on structure-performance relationship found evidence in support of efficient structure hypothesis. Seelanatha (2010), using Berger and Hannan (1993) approach, examined structure-performance relationship for the banking industry in Sri Lanka. He concluded that bank performance in Sri-Lanka depended neither on market concentration nor

on the market power of individual firm, rather it depends on the level of efficiency of the banking unit. Rettabet *et al.* (2010), using data envelopment analysis (DEA) technique to calculate the efficiency scores, evaluated the validity of structure, conduct performance hypothesis and efficient structure hypothesis on Gulf Cooperation Council (GCC) banking system. They concluded that efficiency considerations drive the performances of GCC banks. Moreover, Mensi and Zouary (2011) investigated the structure-performance relationship in Tunisian banking industry for the period of 1990-2005. They concluded that Tunisian banks generate their performance through an efficient activity rather than market power exercise.

The above literature indicates that there is no consensus as such that supports the prevailing hypothesis on the banking industry. The question of whether banking industries perform in a competitive market or in a collusive market as at now has remained unanswered. The situation is even more difficult to discern in Nepalese context, as Nepalese commercial banking industry severely lacks studies on its structure-performance relationship. This study, therefore, tries to test the structure-performance relationship in Nepalese commercial banking industry. More specifically, this study examines both traditional structure conduct performance (SCP) hypothesis and efficient structure (EFS) hypothesis in Nepalese commercial banking industry.

### 3. The Methodology and Model

This study is based on a balanced panel of 18 Nepalese commercial banks covering the period from 2004/05 to 2012/13. Selection of the banks was based on the availability of data. Out of 31 commercial banks as of year 2012/13, this study selected 18 banks due to unavailability of data for our chosen variables and time period. However, concentration is calculated, including all the 31 commercial banks within the study period. The data were collected from Banking and Financial Statistics and Quarterly Economic Bulletin published by Nepal Rastra Bank and annual reports of selected commercial banks.

#### 3.1 Model Specification

To test the efficient structure hypothesis versus collusion hypothesis, this study used the model developed by Maudos (1998). The equation is:

$$\Pi_{it} = \beta_0 + \beta_1 CR_t + \beta_2 MS_{it} + \beta_3 EFF_{it} + \sum \alpha_j x_{jt} + \mu_{it} \quad (1)$$

The variables are defined as follows: EFF is the cost efficiency obtained through data envelopment analysis (DEA) technique. Where  $\Pi$  denotes bank performance (ROA and NIM). ROA is defined as the net income over total assets and the NIM is calculated as differential interest to total assets. MS is the market share of the bank measured by (1) bank deposits to industry deposits (MSDEP) and bank assets to industry assets (MSASSET), CR is the concentration measured by Herfindahl-Hirschman Index (HHI), which is defined as the sum of Squares of the individual bank's market share. The vector  $x$  accounts for firm-specific control variables. Control variables indicate two variables for risk control, total loan and advances to total asset ratio (LEVRISK) and shareholders' equity to total asset ratio (CAPRISK), and one variable for expense control which is a ratio of staff expenses to total assets (SETA). Based on the estimation of equation (1), the summarized expressions of the different explanatory hypotheses of structure-performance relationship are presented as follows:

Pure collusion hypothesis

$$\frac{\partial \Pi}{\partial \text{HHI}} > 0; \frac{\partial \Pi}{\partial \text{MS}} = 0; \frac{\partial \Pi}{\partial \text{EFF}} = 0 \quad (2)$$

Efficient structure hypothesis

$$\frac{\partial \Pi}{\partial \text{HHI}} = 0; \frac{\partial \Pi}{\partial \text{MS}} = 0; \frac{\partial \Pi}{\partial \text{EFF}} > 0 \quad (3)$$

Modified efficient structure hypothesis

$$\frac{\partial \Pi}{\partial \text{HHI}} = 0; \frac{\partial \Pi}{\partial \text{MS}} > 0; \frac{\partial \Pi}{\partial \text{EFF}} > 0 \quad (4)$$

Hybrid collusion/efficiency hypothesis

$$\frac{\partial \Pi}{\partial \text{HHI}} > 0; \frac{\partial \Pi}{\partial \text{MS}} = 0; \frac{\partial \Pi}{\partial \text{EFF}} > 0 \quad (5)$$

Equation (2) and (3) are pure collusion and efficient structure hypotheses. Equation (4) is a modified efficient structure hypothesis. Modified efficient structure hypothesis states that variance in performance is explained by efficiency as well as by the residual influence of the market share because market share captures the influence of factors unrelated to the efficiency, such as the power of the market and/or the product differentiation (Maudos, 1998). Similarly, equation (5) is hybrid collusion hypothesis, which postulates that concentration affects profitability because of market power. In addition, this hypothesis affirms that most efficient firms are more profitable, with the residual effect of market share held as negligible (Maudos, 1998).

### 3.2 Measures of Performance

The interest on loans, the interest on deposits, and the service charges on demand deposits are frequently used as the measures of performance in earlier studies (Evanoff and Fortier, 1988). However, Goldberg and Rai (1996) argued that examining either deposit rates or loan rates separately may not present the full picture because banks could operate competitively with one rate and operate non-competitively with the other. Thus, Goldberg and Rai (1996) suggested net interest margin (NIM) as a measure of performance which takes into account both deposits and loans rates. However, NIM does not entail the overall performance of the bank, as it excludes other income of the bank. Therefore, this study used return on asset (ROA), which includes revenues from interest and other services rendered by the banks into the account, and net interest margin (NIM), which shows the pricing ability of the banks, as the measures of profitability.

### 3.3 Measure of Concentration

The three-bank concentration ratio (CR3) and HHI index are the popular measures of concentration (Goldberg & Rai, 1996). Demirgüç-Kunt *et al.* (2003) measured market concentration using three-bank concentration ratio. Likewise, Katib (2004) used three one-bank concentration ratio (CR1), the two-bank concentration ratio (CR2), and the five-bank concentration ratio (CR5) as the proxies of market concentration. However, Rettabet *et al.* (2010) argued that CR3 and CR5 assumed market power and market share showed a linear relationship. Therefore, this study used HHI index (defined as the sum of the square of the

individual bank's market share) as the measure of market concentration. Prior studies including that of Berger and Hannan (1998), Goldberg and Rai (1996), and Mensi and Zaouri (2011) have also used HHI index as the measure of concentration.

### 3.4 Measure of Efficiency

Most of the earlier studies have used market share as the measure of a large bank's efficiency (Goldberg & Rai, 1996). However, following the criticism of Shepherd (1986) on the use of market share as efficiency and inclusion of a unique measure of efficiency by Berger and Hannan (1993), most of the recent studies have used different techniques to calculate input-output oriented efficiency scores. For example, Goldberg and Rai (1996), Park & Weber (2006), Rettab *et al.* (2010), Seelanatha (2010), and Mensi & Zouri (2011) are some important works that have been done in the literature of structure- performance relationship. The literature shows that there are mainly two types of approaches for evaluating the efficiency of a firm: (1) parametric functional form and (2) the non-parametric form. Among them, the Stochastic frontier approach (SFA), parametric approach, data envelopment analysis (DEA), and non-parametric approach are the most used techniques.

This study obtained the cost efficiency scores using the non-parametric method of data envelopment analysis (DEA). Three inputs (labour, fixed assets, and total deposits) and three outputs (investment, other revenues, and total credits) have been used to derive the cost efficiency scores. For the DEA method, the study assumes an input-oriented variable return to scale (VRS). To derive efficiency scores, necessary data, which is related to inputs, outputs, and costs of inputs, were converted into text format to suit the data set for processing with the software by name DEAP 2.1; and the input file, Instruction file, and output files were prepared by developing the DOS command in DEAP. Finally, the obtained scores were exported to MS Excel and then taken for future processing with STATA11.

### 3.5 Control Variables

The literature on structure performance relation in banking contains an array of independent variables used to control the estimation procedures. These explanatory variables are included to hold constant other risks, cost and demand factors that may affect profits (Evanoff and Fortier, 1988). This study, therefore, used three control variables; two risk measure variables and one expense control variable. Risk measure variables are (1) ratio of total loans and advances to total assets (LEVRISK) and (2) capital to total assets (CAPRISK). Similarly, expense control variable is the ratio of total staff expenses to total assets (SETA), which measures the ability of the banks to operate at lower costs.

## 4. The Results

### 4.1 Descriptive Statistics

Table 1 presents the descriptive statistics of selected bank-specific and industry-specific variables. The table shows that return on assets ranges from a minimum of -18.92 percent to a maximum of 18.04 percent, leading to an average of 1.54 percent. Two variables (concentration and market share) that represent market power shows that an average market share is about 4.9 percent and HHI is about 6 percent. Market share ranges from a minimum of about 0.9 percent to a maximum of 17 percent. Likewise, the measure of concentration (HHI) ranges from a minimum value of 0.04 to a maximum value of 0.09.

**Table 1: Descriptive statistics**

	Minimum	Maximum	Mean	STD
ROA	-0.1892	0.1804	0.0154	0.0326
NIM	0.0172	0.0791	0.0359	0.0113
MSDEP	0.0088	0.1699	0.0489	0.0323
MSASSET	0.0098	0.1665	0.0485	0.0303
HHIDEP	0.0441	0.0916	0.0639	0.0163
HHIASSET	0.0441	0.0881	0.0610	0.0147
LEVRISK	0.1747	0.8296	0.6142	0.1254
SETA	0.0034	0.0596	0.0110	0.0102
CAPRISK	-0.5740	0.2226	0.0506	0.1165
DEAEFF	0.5820	1.0000	0.9387	0.0891

From the table above, salary expense ratio (SETA) on the average is about 1.10 percent with a minimum of 0.3 percent to a maximum of 5.96 percent. The average LEVRISK of the selected banks during the study period is about 61 percent with a minimum of 17 percent to a maximum of 83 percent. The CAPRISK of selected banks ranges from a minimum of -57.40 percent to a maximum of 22.26 percent with an average of 5.06 percent.

#### 4.2 Empirical Results

After conducting series of tests for acceptance or rejection of some hypotheses, the empirical analysis proceeded into an Ordinary Least Square (OLS). Variance Inflation Factors (VIF) rejected the presence of serious multicollinearity. The inbuilt heteroscedasticity test in stata11 (Breusch-Pagan/Cook-Weisberg test) shows the presence of heteroscedasticity problem. White's heteroscedasticity corrected *t* values, therefore, are calculated for the robustness of the results. Gujarati (2004) argued that in the presence of heteroscedasticity, the OLS does not provide actual variances for the OLS estimators, which leads to highly misleading *t* and *F* tests values.

The empirical analysis focuses on the estimates of equation (1). Table 2 shows the results of Ordinary Least Square (OLS) techniques with White's heteroscedasticity corrected *t* values. The estimates show negative coefficients for concentration (HHI) indicating that a higher concentration would lower the bank's performance. Beta Coefficients for concentration (HHI) are significant when ROA is the dependent variable. Hence, the estimated negative coefficients of concentration rejected the pure collusion and hybrid collusion hypothesis. In the case of the market share, an important variable of market power (Shepherd, 1986) which is the results appear to be sensitive to the choice of the dependent variable. It has positive beta coefficients with ROA and negative beta coefficients with NIM. However, coefficients are not different from zero (that is, they are insignificant) in either of the equations. Besides, these results are also against the notion of modified efficient structure hypothesis. Thus, the empirical results have failed to support pure collusion, modified efficient structure, and hybrid collusion/efficiency hypotheses because of the illogicality of the coefficients with the theoretical expectations.

**Table 2: OLS estimates for structure-performance relationship**

(This table reports the estimates for equation (1) on the structure-performance relationship. The parameters are estimated using ordinary least square (OLS) method. ROA is the ratio of net income to total assets; NIM is the ratio of net interest income to total assets; HHI, a measure of market concentration, is the Hirschman-Herfindahl Index of total assets and total deposits; MSDEP is the market share of banks on total deposit basis; MSASSET is the market share of banks on total assets basis; DEAEFF is cost efficiency derived from DEA methodology; LEVRISK is the ratio of total credit to total asset; CAPRISK is the ratio on total equity to total assets; SETA is the ratio of total staff expenses to total assets. Values in the parenthesis are White's heteroscedasticity corrected *t* values.)

	ROA	ROA	NIM	NIM
CONSTANT	-0.035 (-0.917)	-0.05 (-1.358)	-0.0179 (-1.621)	-0.0174 (-1.612)
MSASSET	0.2086 (1.018)		-0.00796 (-0.152)	
HHIASSET	-0.446*** (-3.004)		-0.0325 (-0.807)	
MSDEP		0.296 (1.28)		-0.0135 (-0.2466)
HHIDEP		-0.365*** (-2.71)		-0.0425 (-1.107)
LEVRISK	-0.037* (-1.70)	-0.026 (1.202)	.0245** (2.576)	0.0242** (2.598)
CAPRISK	0.093 (1.59)	0.114* (1.689)	-0.00039 (0.0293)	-0.002 (-0.148)
SETA	0.104 (0.425)	0.116 (0.54)	0.787*** (8.886)	0.786*** (9.353)
DEAEFF	0.089* (1.878)	0.089* (1.94)	0.0346*** (3.245)	0.036*** (3.385)
Adj. R_sqr	0.224	0.238	0.436	0.438
Std. error	0.028	0.0285	0.00847	0.00846
F	8.739	9.363	21.769	21.932

\*Significant at 10 percent level of significance. \*\* Significant at 5 percent level of significance

\*\*\* Significant at 1 percent level of significance.

So far, the estimated results support efficient structure (EFS) in explaining profitability of Nepalese commercial banks. It states that cost advantage enjoyed by efficient firms leads them to have a higher profit than inefficient firms (Seelanatha, 2010). For robustness of the conclusion and for the remedy to different interpretations of the positive coefficient of efficiency with NIM, there is a need for further analysis to check whether efficient structure hypothesis is in place or not. Goldberg and Rai (1996) argued that a necessary condition for efficient structure hypothesis is that efficiency affects market structure. Hence, as expected, there is a positive relationship between efficiency and market structure because efficient banks obtain higher profitability and greater market share due to efficiency, which leads to a more concentrated market (Park & Weber, 2006). The results of the necessary conditions relative to efficient structure hypothesis are presented in table 3.



**Table 3: OLS estimates for necessary conditions of the efficient structure hypothesis (ES)**

(This table reports the estimates for necessary conditions of the efficient structure hypothesis. HHI, a measure of market concentration is the Hirschman-Herfindahl Index of total assets and total deposits; MSDEP is the market share of banks on total deposit basis; MSASSET is the market share of banks on total assets basis; DEAEFF is cost efficiency derived from DEA methodology; LEVRISK is the ratio of total credit to total asset; CAPRISK is the ratio of total equity to total assets; SETA is the ratio of total staff expenses to total assets. Values in the parenthesis are White's heteroscedasticity corrected t values.)

	HHIASSET	HHIDEP	MSASSET	MSDEP
CONSTANT	0.0195 (1.566)	0.011 (0.707)	0.044* (1.786)	0.069*** (2.705)
DEAEFF	0.036*** (3.607)	0.046*** (4.167)	0.067*** (3.359)	0.049** (2.324)
LEVRISK	0.019* (1.763)	0.024** (2.034)	-0.106*** (-5.972)	-0.109*** (-6.690)
CAPRISK	-0.056*** (-6.189)	-0.066*** (-6.768)	-0.063** (-2.503)	-0.112*** (-3.835)
SETA	-0.137* (-1.751)	-0.146* (-1.703)	0.89*** (5.179)	0.612*** (3.996)
Adj. R_sqr	0.143	0.164	0.5708	0.6278
Std. error	0.0136	0.0149	0.0198	0.0197
F	7.689	8.904	54.533	68.884

\*Significant at 10 percent level of significance. \*\* Significant at 5 percent level of significance

\*\*\* Significant at 1 percent level of significance.

Table 3 shows the results of necessary conditions for efficient structure hypothesis. Two variables, market share and HHI index are regressed against cost efficiency and other control variables. Based on the theory, the efficiency must be positive in relation to EFS hypothesis. The estimated coefficients of efficiency confirm the considered signs ensuring that the EFS hypothesis is in place. All the coefficients are significant at 1 percent level of significance.

## 5. Summary and Conclusions

This study is an empirical analysis of the structure-performance relationship in Nepalese commercial banking industry for a period of 9 years from 2004/05 to 2012/13. For this purpose, this study has directly incorporated a unique measure of efficiency (that is, cost efficiency) into the analysis. Non-parametric data envelopment analysis (DEA) approach with software named DEAP 2.1 was used to calculate the efficiency scores for this research paper.

The ordinary least square (OLS) estimates support the efficient structure hypothesis. Results indicate that bank efficiency has a positive and significant impact on the profitability of the banks. The results of this study are consistent with those of Goldberg and Rai (1996), Maudos (1986), Park and Weber (2006), Seelanatha (2010), Rettabet *et al.* (2010), and Mensi and Zouary (2011). However, this study does not find any support for pure collusion, Modified efficient structure, and Hybrid collusion/efficiency hypotheses. Therefore, it can be concluded that the market power cannot explain the profitability of Nepalese commercial banks, rather they need to generate their performances through an efficient and effective activity. From this study, it is also possible to derive a policy implication that the commercial banks in Nepal should give utmost priority to efficiency and effectiveness in their functionalities in order to achieve better performance. The regulatory bodies need to focus on making policies that can generate healthy competition in the market for Nepalese Commercial Banks. Lastly, the conclusion

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obtained from this study is based on the sample size of 18 banks for a 9-year period from 2004/05 to 2012/13. Likewise, the study is also based on the assumption that every bank operates in the same market. Hence, a further study is required for making an analysis based on the commercial bank's market segmentation or for a group of banks (whether it is government, foreign or private banks).

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### Appendix

The cost of input variables used to generate cost efficiency scores are calculated as below:

Input prices	
Cost of Deposit Fund	Total interest expenses divided by total deposit fund
Labor Cost	Total staff expenses divided by total assets
Cost of Fixed assets	Total operating expenses divided by total assets