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Financial Deregulation and Productivity of Commercial Banks in Emerging economies: a case study of Mauritius

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1.0 Introduction

There has been a lot of recent debate on the impact of financial deregulation on the efficiency and productivity of commercial banks in both developed and increasingly, in developing countries (Berger and Humphrey, 1997). One important issue of concern refers to the quality of banks services and efficiency in a new competitive environment. This paper addresses the specific issue of determinants of banks efficiencies and productivities in the context of commercial banks in Mauritius using regression techniques using the efficiency scores and productivities estimated by using nonparametric methods namely data envelopment analysis and Malmquist , respectively (see Jankee 2008, African Econometric Society) .

This research explores the impact of factors such as market share, bank size, staff costs, bank branches, banking control, financial leverage and problem loans impact on bank efficiency especially in the post-deregulation period for small island open economy like Mauritius. The rest of the paper is organized as follows. Section 2 discusses the financial reforms undertaken in Mauritius during the recent decade and in section 3 , a brief review of the theoretical and empirical literature is attempted to be used as a background for our the analysis. Moreover, Section 4, the methodology and model is discussed. The theoretical rationale and analysis of results are highlighted in section 5 and section 6 concludes the paper.

2.0 An overview of the Mauritian banking sector

Before discussing the efficiency issues, in this section I will discuss the main features of the Mauritian banking sector (Jankee 1999; Worldbank 2003). Mauritius is a small island economy in the Indian Ocean and inherited a bank-dominated financial system at the time of independence in 1968. As compared to many developing countries especially in the African region, the Mauritian financial system was quite developed with 11 banks. The first set of control has been the regulation of banks' interest rates by monetary authorities throughout the 1970s until late 1980s. Other repression policies consisted of the imposition of cash ratio and liquid asset ratio that were gradually tightened over the years as well as the exchange control on current and capital transactions. In the mid 1970s, the monetary authorities tightened their control over the financial system in an attempt to regulate credit expansion and allocate it to productive sectors.

In the early 1980s, the control over the overall credit was modified whereby sectors were categorised into priority and non-priority and ceilings were imposed respectively on both types of sectors. Furthermore, banks were individually subject to a certain quantum of credit depending upon their extent of deposit mobilisation and credit creation. The early 1980s were marked by the beginning of the process of gradual liberalisation of the financial system. Controls over interest rates were gradually lifted. Exchange control on current transactions was no longer imposed as from mid 1980s. By late 1980s, interest rates were fully liberalised. However, quantitative controls in the form of reserve requirements and credit ceilings continued to be imposed. The 1990s were marked by the relaxation of most of the remaining banking sector controls. Credit ceilings were gradually abolished and the exchange control act was suspended

by mid 1990s. The cash ratio and liquid asset ratio were gradually lowered and the liquid asset ratio was brought down to zero in 1997.

The financial liberalisation programme was also accompanied by other market-oriented reforms such as a free float exchange rate, the auctioning of Treasury bills and the setting up of a secondary market for government securities amongst others. Most recently, transactions involving the repurchase of bank reserves and foreign currency swaps have increased enormously. In addition, bank branches expansion has also contributed largely to the institutional development of the banking sector. From 32 in the 1970, the number of bank branches expanded significantly to reach 117 in 1990 and 163 in 2003.

3.0 OVERVIEW OF LITERATURE

The banking sector has attracted considerable theoretical and empirical research during the preceding decades. Studies have involved a number of issues including the role of banks in financial development, bank efficiency, pricing behaviour of banks and banking regulation. Prior studies on bank efficiencies concentrated on estimating cost functions and measuring economies of scale and scope with the implicit assumption that banks being studied operate efficiently (Gilbert, 1984). Many researchers who have claimed the importance of investigating inefficiencies in the banking units have questioned this assumption. Since then, this issue has led to considerable research. However, one issue of recent interest has been the effects of deregulation on the performance of banks (see Berger, 1993, 1997 for a review). The literature distinguishes two main types of bank efficiency. The first is operational efficiency as introduced by Farell (1957) to measure efficiency and the second is X-efficiency as introduced by

Leibenstein (1966) to explain differences in efficiency between banks. The concept of operational efficiency is purely technical and can be defined as the product of technical efficiency and allocative efficiency (see Coelli, 1996). While technical efficiency tells us how far the bank output is from the bank's isoquant, allocative efficiency captures inefficiencies due to the fact that the bank has picked up a suboptimal input combination given input prices.

A number of factors have motivated research on bank efficiency (Berger *et al.*, 1993, 1997; Hardy *et al.*, 2001). First, there is the mainstream economic thinking that improving the efficiency of financial systems is better implemented through deregulatory measures aiming at increasing bank competition on price, product, services and territorial rivalry (Smith, 1997; Fry, 1995). However, empirical evidence on the impact of financial deregulation on bank efficiency has been mixed. Berger and Humphrey (1997) stated that the consequences of deregulation might essentially depend on industry conditions prior to the deregulation process as well as on the type of deregulation measures implemented. The deregulation on the asset side of the balance sheets that focused on the liberalisation of the volume and the interest rates of bank lending resulted in the improvement of both efficiency and productivity of Norwegian banks (Berg *et al.*, 1992). Turkish banks had a similarly experience (Zaim, 1995). But the impact of liberalisation on Indian banks resulted in varied productivity efficiency depending on the type of ownership (Battarcharyay *et al.*, 1997).

Berger and Humphrey (1997) undertook a comprehensive survey of 130 studies that apply the parametric and non-parametric frontier efficiency analysis to financial institutions in 21 countries.

A number of issues had been raised and tested relating to bank efficiency and financial deregulation. These issues mainly included the alternative methodologies used to estimate different types of efficiencies, namely technical efficiency, allocative efficiency, scale efficiency, pure technical efficiency, cost efficiency and change in factor productivity (see Coelli, 1996). Moreover, researchers have also tested empirically the extent to which factors such as market share, total assets, credit risk, technology and scale of production, bank branches, ownership and location, quality of bank services and diversity of banking products, financial deregulation and managerial objectives determine bank efficiencies.

Das (2002) examined the effects of financial deregulation on risk and productivity change of public sector banks in India for the period 1995-2001. They found evidence that capital; non-performing loans and productivity were entwined, with each reinforcing and to a certain degree complementing the other. They also found that higher capital led to a rise in productivity whilst higher loan growth reduced productivity. Moreover, increased government ownership tended to increase productivity.

Leightner and Lovell (1998) using the best practice production frontiers, constructed the Malmquist growth indexes and productivity indexes for each Thai bank, for 1989-1994, incorporating two different specifications of the services that the bank provides, one derived from the objectives of the bank itself and the other derived from the objectives of the Bank of Thailand. They found higher productivity growth of banks when the bank objective of profit-maximisation was pursued as compared with the model when the Bank of Thailand's objective was achieved.

Laeven (1999) used DEA to estimate the efficiencies of the commercial banks in Indonesia, Korea, Malaysia, Philippines and Thailand for the years 1992-1996. They also included risk when analysing the performance of banks and found that foreign banks took lower risk as compared with family-owned banks.

Battacharyay *et al.* (1997) examined productive efficiency of 70 Indian commercial banks during the early stages of the on-going liberalisation process. They estimated the technical efficiency scores using DEA and then used stochastic frontier analysis to attribute variation in the calculated efficiency scores to three sources, temporal, component, ownership component and random noise component. They found public owned banks to be the most efficient followed by foreign banks and privately owned banks. Hardy *et al.* (2001) estimated the effects of banking reform on the profitability and efficiency of the Pakistani banking system. They estimated the profitability, cost and revenue frontiers to derive measures of efficiency of the banking system relative to the best available practice. They found that financial market reform has increased both revenues and costs but did not increase overall profitability and led to convergence in efficiency.
Jagtiani and Khantavit (1996) examined the impact of risk-based capital requirements on bank cost efficiencies in the US banking industry. They found that the introduction of risk-based capital requirements led to a significant structural change in the banking industry both in terms of efficient size and optimal product mixes. Their results implied that regulations encouraging large banks to expand production and product mixes resulted in a less efficient banking industry.

Research on the determinants of x-efficiencies in financial institutions especially banks has been very limited (see Berger *et al.*, 1993, 1998; Molyneux *et al.*, 1996). Earlier studies made an attempt to examine the effects of regulation and organisational form on costs and scale and scope efficiencies but there has been no direct attempt to examine the effects of these factors on x-efficiencies (see Flannery, 1984; Hunter and Timme, 1986; Mester, 1991). However, some recent works have tried to examine the x-efficiencies in financial institutions looking at three groups of factors namely agency problems between owners and managers, regulation, organisational and legal structures, and scale and scope of operations.

Pi and Timme (1993) found that agency costs lower efficiency. Berger *et al.* (1993) found that X-efficiency is strongly positively related to a bank's scale of operations. On the other hand, ed *et al*. (1993), Gardner and Grace (1993), Mester (1993) presented mixed results for the relationships between scale and financial institutions X-efficiency. Hasan *et al.* (1990) examined the effect of size of bank, degree of urbanisation and product diversity on different measures of bank efficiencies. They found that overall and technical efficiency were negatively related to product diversity and positively related to the extent of urbanisation. In addition, pure technical efficiency was positively related to size.

Sathye (2001) empirically investigated the X-efficiency, both technical and allocative, in Australia. He used the non-parametric method of DEA to estimate the efficiency scores. He found that banks in the sample had low levels of efficiency as compared with the banks in the European countries and in US. Efficiency in Australia came mainly from the waste of inputs (technical efficiency) rather than choosing the incorrect input combinations (allocative

efficiency). Moreover, domestic banks were found to be more efficient than foreign owned banks.

Sathye (2001) also examined the effects of size of the bank, market power, ownership, use of technology and cost per employee on bank efficiency. He found that market power had a significant negative relationship on technical efficiency. In the case of allocative efficiency, market power had a significant negative relationship and loans had a significant positive relationship indicating that output mix was positively influencing allocative efficiency. Berger and Young (1997) employed the Granger causality techniques to test four different hypotheses regarding the relationships among loan quality, cost efficiency and bank capital. They found that cost efficiency might be an important indicator of future problem loans and problem banks. Overall research on the determinants of x-efficiencies in banks has been mainly carried in the case of developed economies with very few attempts in the case of developing countries.

4.0 **Data, Methodology and Hypotheses**

This work has been heavily constrained by the lack of data. The main reason is that detailed balance sheets and profit and loss account of banks are available only since the mid 1990s. We thus use a sample consisting of panel data for 10 commercial banks over the period 1994 to 2000. Yearly data were extracted from the consolidated income and balance sheets of individual banks. The fact that different banks close their financial year in different months has been disregarded for the sake of simplicity. The efficiency scores and productivity changes have been obtained from the DEA exercise. We define market share (MS) as the deposit share of banks out of total deposits. The size of the bank, SIZE, is represented by the total assets of individual banks out of total assets of the banking sector. Staff cost, SC is the cost per employee. INVT is the

share of investments in government securities and treasury bills of banks out of their respective total assets. NII is the share of non-interest income out of the total income which comprises interest income and non-interest income. SOUND, which is the ratio of provision for loan losses to total loans of respective banks', measures the soundness of individual commercial banks. BRANCH is the number of branches of respective banks. Fixed capital, FC is the physical assets of the bank and DEPO is the total deposits of respective banks. Financial leverage (FL) is measured by the ratio of loans to shareholders' capital. Lastly, CONTROL is the index of financial repression namely overall banking controls, constructed in chapter five using the principal component method. Lastly, the LIMDEP package has been used for the estimation.

4.1 **Estimation Technique**

One particular problem in estimating this model is that errors are likely to be correlated across time for each individual bank. In cases where individual banks are correlated across time, OLS estimation will produce inconsistent parameter estimates and other estimation techniques are required.

Panel data models are usually estimated using pooled OLS, fixed effects or random effects techniques. These latter two techniques have been developed to handle the systematic tendency of individual specific components to be higher for some units than for others-the random effects estimator is used if the individual specific component is assumed to be random with respect to the explanatory variables; the fixed effects estimator is used if the individual specific component is not independent with respect to the explanatory variables.

Fixed Effects Model

The fixed-effect model involves the recognition that the assumption of constant intercept and slope may be unreasonable if the model is estimated using the ordinary least squares pooling procedure. Dummy variables are thus introduced to allow the intercept term to vary over time and over cross-section units. The fixed effect model takes the following form:

$$y(i,t) = \alpha 0 + \alpha(i) + \gamma(t) + \beta' x(i,t) + \varepsilon(i,t) \qquad (1)$$

where

$$\alpha(i) = \begin{cases} 1 & \text{for } i^{th} \text{ bank, } i=1,\ldots,10 \\ 0 & \text{otherwise} \end{cases}$$

$$\gamma(t) = \begin{cases} 1 & \text{for } t^{th} \text{ time period, } t=1\ldots 7 \\ 0 & \text{otherwise} \end{cases}$$

Random Effects Model

The inclusion of dummy variables represents a lack of knowledge about the model which is accounted for in the disturbance term. The random-effect model is a pooled cross-section and time-series model in which the error terms may be correlated across time and banks. The model takes the following form:

$$y(i,t) = \alpha + \beta' x(i,t) + \varepsilon(i,t) + \upsilon(i) + \omega(t) \qquad (.2)$$

$$\nu(i,t) = \varepsilon(i,t) + \upsilon(i) + \omega(t)$$

Where $\upsilon(i) \sim N(0, \sigma_\upsilon^2)$ = cross-section error component

$\omega(t) \sim N(0, \sigma_\omega^2)$ = time-series error component

$\varepsilon(i,t) \sim N(0, \sigma_\varepsilon^2)$ = combined error component

Here, it is assumed that individual error components are uncorrelated with each other and are not autocorrelated across both cross-section and time-series units. The random-effects formulation is obtained from the fixed-effects model by assuming that the mean effect of the random time-series and cross-section variables is included in the intercept term and the random deviations about the mean are equated to the error components $\upsilon(i)$ and $\omega(t)$ respectively.

The random effects model can be estimated as a generalised least-squares regression. The estimation weights observations are inversely to their variances. In the first stage, the entire pooled sample is estimated using OLS. The OLS residuals are used to calculate sample estimates

of the variance components. The estimated variances are then used in the second stage in which the generalised least-squares parameter estimates are obtained.

To distinguish between models, a series of statistics will be used. The software provides hypothesis tests for selecting among the various models. The fixed/random effects model is compared to the pooled OLS estimation. The latter imposes zero restrictions on the parameters of the dummy variables of the fixed effects model. Chi-squared statistics based on the likelihood functions and F statistics based on the sums of squares are used for testing these restrictions. The null hypothesis in both tests is that the parameter estimates are not significantly different from zero. If the null hypothesis is not rejected this would mean that the least squares dummy variables model is not different from the pooled OLS model. Bank-specific and period-specific parameter estimates would give us no significant information.

The Breusch and Pagan Lagrange Multiplier test provides a statistic to distinguish between one factor models and the pooled OLS regression with no bank-specific effects. The null hypothesis of homoskedasticity implies that group specific effects are not important so that the rejection of null hypothesis implies that group specific effects are important and thus favours the one-way fixed/random effects models against the pooled OLS regression.

The Hausman test provides a statistic to distinguish between fixed and random effects models. The random-effect model requires the assumptions that individual error components are uncorrelated with each other and with the explanatory variables in the model. However, the fixed-effect model requires none of such assumptions. The Hausman test which tests for simultaneity indicates that if simultaneity is present, one or more of the explanatory variables will be endogenous and therefore will be correlated with the disturbance term. No simultaneity favours random-effect models against fixed-effect models.

As a rule of thumb, large values of the Haussman statistic argue in favor of the fixed effects model over the random effects model. Large values of the LM statistic argue in favor of the fixed/random effects models against the classical regression with no group specific effects. In

our case, large values of the LM statistic in the presence of a small Haussman statistics argue in favor of the random effects model.

5.0 Theoretical Rationale and Analysis of Results

In this study, we borrow a lot from the literature to specify and estimate a reduced form equation with measures of bank efficiency and productivity as dependent variable and factors such as market share, bank size, agency costs, technology, capital, staff expenses, banking control and bank risks as explanatory variables (see Berger and Humphrey, 1997). According to conventional wisdom, financial deregulation is expected to improve the performance of the banking sector. However, evidence has been mixed on this issue and an increase in efficiency will depend on the industry conditions prior to deregulation (see Berger *et al.*, 1997).

On the other hand, the relationship between problem loans and bank efficiency can be explained by different hypotheses namely bad luck, bad management, skimping behaviour and moral hazard problem (see Berger and De Young, 1997). According to the bad luck, bad management, skimping hypothesis, moral hazard problem, a negative relationship between problem loans and efficiency is expected. However, the evidence is mixed from studies testing these different hypotheses. In the case of market structure and concentration, the efficient-structure paradigm links concentration to high profitability through efficiency (Demsetz, 1973) while evidence shows that neither market power nor efficiency explains profitability.

We undertake a number of regressions with overall efficiency, technical efficiency, allocative efficiency and productivity change as dependent variables and in line with prior literature, we test for the influence of market share, bank size, staff costs, capital, financial leverage, financial soundness and banking regulation. In Table 1, we summarise the empirical results obtained on the relationships between measures of efficiency and some determinants which we seek to examine in the case of Mauritius.

Table 1: Evidence from Empirical Studies

Variables	Expected Impact on Efficiency

Market share	+ / -
Banks size	+
Staff expenses	+ / -
Bank branches	+
Fixed capital	+
Financial leverage	+ / -
Financial soundness	+ / -
Banking control	+ / -

Source: computed

5.1 Overall Efficiency

We regress overall economic efficiency on staff costs, deposits, investment, market size, financial soundness and banking control. The regression results are given in Table 2 Prior studies have shown that staff expenses can have both a positive and negative relationship on bank efficiency and productivity. We find a negative and significant relationship between staff costs and economic efficiency indicating that higher staff expenses are contributing negatively to efficiency. In the literature, when staff expenses represent quality of staff, then higher expenditure on staff increases efficiency. In the case of Mauritius, it appears that increase in staff expenditure is not accompanied by higher productivity. This could represent overstaffing in banks, which suggests that these banks would probably need to reduce staff costs so as to reap higher efficiency. The level of deposits which is represented by DEPO is found to have a positive effect on overall efficiency. Thus, higher deposit mobilization which is a primary function of banks, appears to improve efficiency.

Table 2 : Random Effects Estimates for Overall Efficiency

	Random Effects Model: v(i, t) = e(i, t) + u(i) + w(t)	
	Var(e)=0.008 Var(u)=0.06 Var(w)=0.04 Lagrange Multiplier Test Statistic = 47.84 Hausman Test Statistic= 3.62 Sum of Squares=2.79 R-squared=0.17	
	Coefficient	**t-statistics**
C	0.62	0.62
SC	-1.48	-3.79
DEPO	0.8E-11	1.47
INVT	-0.41	-2.10
SIZE	0.19	0.32
SOUND	1.58	2.12
CONTROL	-0.07	-0.46

Source: computed

However, its coefficient is statistically insignificant. The coefficient of INVT which represents the share of each bank's investment in government securities and Treasury bills out of total assets is negative and statistically significant at the 5% level. This implies that such a captive market for the government has a negative impact on efficiency and probably indicates a misallocation of funds. In line with theory, bank size (SIZE) has a positive impact on efficiency. However, it is statistically insignificant. Financial soundness (SOUND) as measured by provision of loan losses has a positive influence on bank efficiency. Its coefficient is also statistically significant at the 5% level. The higher the provisioning for loan losses, the lower is the bank's risk and thus the higher is its efficiency. Lastly, the coefficient of banking control (CONTROL) which is a measure of financial repression, has a negative effect on efficiency but the coefficient is insignificant.

5.3 Technical Efficiency

From Table 7.14, we find empirical evidence that staff cost (SC) and the level of deposits (DEPO) have a positive influence on technical efficiency. However, their coefficients are statistically insignificant. On the other hand, bank size (SIZE) and fixed capital (FC) seem to have a negative impact on technical efficiency. However, only the coefficient of bank size is statistically significant at the 10% level. This probably indicates that smaller banks achieve higher levels of efficiency as compared to large banks which are reaping diseconomies of scale.

Table 3: Random Effects Estimates for Technical Efficiency

	Random Effects Model: v(i, t) = e(i, t) + u(i) + w(t)	
	Var(e)=0.003 Var(u)=0.002 Var(w)=0.09 Lagrange Multiplier Test Statistic=14.25 Hausman Test Statistic= 1.71 Sum of Squares=0.27 R-squared=0.19	
	Coefficient	**t-statistics**
C SC DEPO SIZE FC	0.95 0.10 0.88E-11 -0.37 -0.10E-09	7.77 0.56 1.56 -1.80 -1.24

Source: computed

5.4 . Allocative Efficiency

Allocative efficiency refers to the input-output mix. The results in Table 4 show that staff cost (SC), investment in government securities (INVT) and banking control (CONTROL) negatively impact on allocative efficiency. Though the coefficient of SC is statistically significant at the 5% level, the coefficient of INVT is significant only at the 10% level while the coefficient of CONTROL is statistically insignificant. Market share (MS), financial soundness (SOUND), bank branches (BRANCH) and noninterest income (NII) have a positive impact on allocative efficiency. However, none of the coefficients are statistically significant.

Table 4: Two-way Random Effects Estimates for Allocative Efficiency

	Random Effects Model: v(i, t) = e(i, t) + u(i) + w(t)	
	Var(e)=0.007 Var(u)=0.007 Var(w)=0.06 Lagrange Multiplier Test Statistic=39.77 Hausman Test Statistic= 3.60 Sum of Squares=2.68 R-squared=0.23	
	Coefficient	**t-statistics**
C	0.10	0.08
SC	-1.45	-3.88
CONTROL	-0.12	-0.70
MS	0.08	0.09
SOUND	0.82	1.10
BRANCH	0.01	0.85
INVT	-0.35	-1.76
NII	0.85	1.42

Source: computed

5.6 Productivity

Results of the regression in Table 5 indicate that staff cost (SC) and financial leverage (FL) have a negative and significant impact on total factor productivity of banks. The negative impact of staff expenses could be an indication of overstaffing and decreasing returns to factor labour in the banking sector. Financial leverage here is defined as the ratio of loans to share capital of banks and is an indication of the extent of risk taken by banks. Financial leverage may also be interpreted as agency cost to some extent and as found in the case of other studies it has a negative effect on productivity. Bank size (SIZE) and financial soundness (SOUND) also have a negative impact on productivity but they are statistically insignificant. Finally, as expected from economic theory, fixed capital (FC) of the bank has a positive influence on the bank's productivity and is statistically significant at the 10% level. It seems that higher investment in technology and capital may foster bank productivity.

Table 5 : Two-way Random Effects Estimates for Total Factor Productivity Change

	Random Effects Model: v(i, t) = e(i, t) + u(i) + w(t)	
	Var(e)=0.01 Var(u)=0.10E+05 Var(w)=0.61E+06 Lagrange Multiplier Test Statistic=247.36 Hausman Test Statistic= 0.03 Sum of Squares=0.86E+07 R-squared=0.25	
	Coefficient	**t-statistics**
C	-141.3	-0.48
SC	-1.78	-3.67
SIZE	-0.42	-0.28
SOUND	-1.01	-1.17
FC	0.20E-09	1.80
FL	-0.004	-2.17

Source: computed

6.0 Conclusion

Hence, a number of factors have an impact on efficiency and productivity of banks in Mauritius. We analysed the impact of a host of factors on different efficiency scores namely overall efficiency, technical efficiency and allocative efficiency . The impact on productivity is also examined. There is evidence that staff costs and commercial banks investment in government securities have a negative impact on economic efficiency of banks . On the other hand, higher bank deposits , bank size do contribute positively to efficiency but they are not statistically significant. However, financial soundness as a positive and statistically significant impact on efficiency. One interesting result is that banking controls that is financial repression has a negative impact on efficiency.

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