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Cost and Profit Efficiency of Banks in Haiti: Do Domestic Banks Perform Better than Foreign Banks?*

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Abstract

I use the stochastic frontier methodology to estimate a cost and a profit frontier functions. The Fourier-flexible form is used in this paper because of its flexibility. Results show that, although foreign banks are more cost efficient than domestic banks, domestic banks are more profit efficient than foreign banks, in Haiti. The paper reveals also that, although treasury bills constitute an alternative source of profit for banks in Haiti, a growth of interest rate on treasury bills increases profit efficiency in current period whereas it decreases profit efficiency one period after this growth. The main implication of this paper is that foreign banks are not always more efficient than domestic banks in developing countries, and even in a country with low income level.

JEL classifications: G21; G28; N26
Keywords: Cost Efficiency; Profit Efficiency; Foreign Banks; Domestic Banks

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1 Introduction

Efficiency measure is an essential topic for researches about firms performance. Regarding banks, many studies evaluate a wide range aspects of banks efficiency, in different economies. Such studies are, for instance, those of Berger et al. (1993), Berger et al. (1997), DeYoung et al. (1998), Kumbhakar et al. (2001), Bonin et al. (2005), Carbo et al. (2007) etc. One of the topics of interest in literature about banks efficiency is whether foreign banks are more efficient than domestic banks in developing economies.

My paper reveal that, in Haiti, domestic banks are more profit efficient than foreign banks. However, foreign banks are more cost efficient than domestic banks. In the literature, the results diverge about efficiency difference between foreign and domestic banks. Roa (2005) and Sensarma (2006) find that foreign banks are less efficient than domestic banks in United Arab Emirates and in India, respectively. On another hand, Bonin et al. (2005) and Staikouras et al. (2007) find that foreign banks are more efficient than domestic banks in transition countries and in South Eastern European region, respectively. Because the results are contradictory in the literature, it is essential, when considering a specific economy, to test empirically which ones are more efficient between domestic and foreign banks.

Since the mid-1990's, in Haiti, the banking system became larger in term of asset size. On the other hand, several banks disappeared between the end of 1980's and the beginning of 2007. Among banks that disappeared are some foreign banks that have been acquired by domestic banks or domestic investors. Thus, are foreign banks less efficient than domestic banks, in Haiti? This paper compares the cost and profit efficiencies of domestic banks and foreign banks in Haiti, using quarterly data from the first quarter of 2001 to the first quarter of 2007.

The results show that, although foreign banks are more cost efficient than domestic banks, domestic banks are more profit efficient than foreign banks, in Haiti. To my knowledge, no other paper has studied cost and profit efficiencies of banks in Haiti. This paper fills this gap. To study banks efficiency, I estimate a stochastic cost frontier function and a stochastic profit frontier function, with inefficiency effects, following the model of Battese and

Coelli (1995). I use the Fourier-flexible form because of its flexibility. The paper uses an unbalanced panel data of 12 banks and 25 time periods. The paper is organized as follows: the next section presents the methodology, the third one presents the data, and the fourth one presents and discusses the results. And, a conclusion summarizes the main findings of the study.

2 Methodology

To estimate cost and profit efficiencies of banks in Haiti, I use the stochastic frontier analysis (SFA), which is a parametric approach. Unlike non-parametric approach, parametric approach accounts for random error. In addition, SFA enables to take account for environmental variables that affect inefficiencies. When firms produce several outputs, Berger and Mester (1997) underline that one should use parametric approach to compare these firms. This is the case in Haiti, where banks produce several outputs.

The SFA assumes that the error term has two components, v and u. One of the components, v, is independent and identically distributed (i.i.d.) normal random variable. Actually, v is the random error component such as $v \sim N(0, \sigma_v^2)$. The other component, u, measures the difference between the cost or the profit of the best-practice firm and another firm. This difference is due to inefficiency, according to the stochastic frontier approach. The component u is assumed to be independent and identically distributed normal, such as $u \sim N(\mu, \sigma_u^2)$. Following the stochastic frontier model proposed by Aigner et al. (1977) and Meeusen and van den Broeck (1977), an extended cost function can be written as follows:

$$lnC = lnf(y, p) + v + u \tag{1}$$

In equation 1, C is the total of cost, f is a functional form, and y and p are outputs and input prices respectively. In literature about stochastic frontier analysis, the three functional forms usually used to estimate efficiency are the Cobb-Douglas form, the translog form and the Fourier-flexible form.

In this paper, the Fourier-flexible form is used to estimate cost and profit efficiency scores of the banks in Haiti. I choose this functional form because

it is flexible. Actually, because the function of Cobb-Douglas imposes restrictions on returns to scale, it is not a flexible functional form, whereas the translog and the Fourier forms are flexible functional forms. However, if the real function does not have a translog form, the estimation of a translog form give skewed estimates. The Fourier-flexible form, in contrast with translog form, do not impose any restriction about the form of the estimated function. That's why Mitchell and Onvural (1996) underline that it is preferable to estimate a Fourier-flexible (FF) functional form in spite of a translog form.

I estimate the cost and the profit frontier functions, using the model of Battese and Coelli (1995). The model of Battese and Coelli (1995) estimates the frontier functions and the inefficiency effects simultaneously, by maximum likelihood. For two outputs and three input-prices, the Fourier-flexible form of the cost function is specified as follows:

$$\begin{aligned}
\ln C_{kt} &= \alpha_0 + \sum_{i=1}^{2} \alpha_i \ln y_{ikt} + \frac{1}{2} \sum_{i=1}^{2} \sum_{j=1}^{2} \alpha_{ij} \ln y_{ikt} \ln y_{jkt} + \sum_{l=1}^{2} \beta_l \ln p_{lkt} \\
&+ \frac{1}{2} \sum_{l=1}^{2} \sum_{m=1}^{2} \beta_{sm} \ln p_{lkt} \ln p_{mkt} + \sum_{i=1}^{2} \sum_{l=1}^{2} \delta_{il} \ln y_{ikt} \ln p_{lkt} \\
&+ \sum_{n=1}^{2} [\phi Cos(x_{nkt}) + \varphi Sin(x_{nkt})] \\
&+ \sum_{n=1}^{2} \sum_{q=n}^{2} [\phi Cos(x_{nkt} + x_{qkt}) + \varphi Sin(x_{nkt} + x_{qkt})] \\
&+ \sum_{n=1}^{2} \sum_{q=n}^{2} \sum_{w=q}^{2} [\phi Cos(x_{nkt} + x_{qkt} + x_{wkt}) + \varphi Sin(x_{nkt} + x_{qkt} + x_{wkt})] \\
&+ v_{kt} + u_{kt} \qquad (2) \\
u_{kt} &= \gamma_0 + \sum_{s=1}^{3} \gamma_s z_{skt} + e_{kt} \qquad (3)
\end{aligned}$$

The total cost of the bank k is denoted C_{kt}, y_{ikt} is the output i, and p_{jkt} is the price of the j-ieth input of bank k in period t. For the profit frontier function, I replace the total cost, C_{kt}, by the profit before tax, P_{kt}. The

variable z_{skt} is the environmental variable s of the bank k in period t. The variables x_{kt} are normalized variables of the logarithm of outputs so that these normalized variables are bound to the interval $[0, 2\pi]$. I use the same method than Altunbas et al. (2001) to obtain the variables x_{nkt}.

The variables x_{nkt} are obtained as follows: $x_{nkt} = \mu(lny_{ikt} - \omega)$. The term ω is calculated so that the smallest value among outputs may be near zero. And, μ is calculated so that the highest value among output be near 2π. I choose 0.001 to be the value which is near zero, and 6 to be the value that is near 2π. In equation 3, e_{kt} is a random error. For the estimation of the profit frontier function, I use the same structure, two outputs and three input-prices, replacing the total cost of the bank, k, by the profit of the bank, denoted by P_{kt}.

3 Data

Except interest rate on treasury bills, all the data are from quarterly reports that banks send to the Bank of the Republic of Haiti (BRH). These reports are prepared by the banks according to a standardized format imposed by BRH. Interest rate on treasury bills is published by BRH in its web site.[1] This paper uses an unbalanced panel data of 12 banks and 25 quarterlies, from the first quarterly of 2001 to the first quarterly of 2007. The list of banks is in annex A. The sample relies on the availability of data. The data are in thousand gourdes. Table 1 presents the variables used in this paper.

To identify the outputs of banks, this paper uses the value-added approach. Actually, the three principle approaches used in literature about efficiency of financial firms are: the asset or intermediation approach, the value-added approach, and the user-cost approach. Regarding the asset approach, a financial firm is an intermediary that raises funds which are inputs, to produce credit and other assets which are outputs. The value-added approach considers that all assets and liabilities have some characteristics of output. According to the value-added approach, when an asset or a liability has large value-added, it is an output. The user-cost considers that an asset is an output if the financial returns associated to this asset is superior to the opportunity

[1] www.brh.net

cost. Inversely a liability is an output if the financial cost associated to this liability is inferior to the opportunity cost.

Table 1: Variables used in the stochastic frontier model

Symbol	**Variable Name**	**Definition**
P	Total of profit	Profit before taxes.
C	Total cost	Total of operating cost and interest expenses
y_1	Net loan portfolio	Total amount of net loan portfolio
y_2	Bills	Treasury bills
y_3	Deposits	Total of deposits,
p_1	Labor price	Total of personnel expenses divided by the number of employees
p_2	Price of physical capital	Expenses for buildings and depreciation divided by fixed assets
p_3	Price of funds	Total of interest expenses divided by total deposits
z_1	Dummy variable for foreign banks	Variable that has the value 1 for foreign banks, and 0 for the other banks
z_2	Size of the bank	Logarithm of total assets
z_3	Growth rate of interest rate on treasury bills	Variation of the logarithm of the interest rate on treasury bills

Berger and Humphrey (1992) underline that banks pay interest rates on deposits that are inferior to the market interest rate. This difference constitutes the implicit cost of deposits supported by depositors. Thus, deposits can be considered as outputs. Berger and Humphrey (1992) emphasize that the problem of implicit cost is particularly essential when one estimates cost efficiency. Because I estimate cost frontier function in addition to profit frontier function, I choose the value-added approach to define outputs. To estimate the cost frontier, I identify two banks outputs in Haiti: loan port-

folio, and deposits. The same approach is used to estimate profit efficiency; only the endogenous variable, C, is replaced by P, for the estimation of the profit frontier function.

Regarding the input prices, it is difficult to obtain data relative to market prices. To face this problem, in literature about stochastic frontier, researchers calculate prices using data from firms balance sheet. Because these prices are endogenous to the banks, they may cause a biased estimation of the function. To get exogenous prices, Bos and Kool (2006) divide banks according to their geographic region in Netherlands, and according to the degree of urbanization of each region; then, they calculate average prices for each category of bank. They include these prices in their estimation. However, because they use data from balance sheet of the banks to calculate prices, Bos and Kool (2006) are agreed that these prices are not strictly exogenous. Because all domestic banks, in Haiti, have their headquarters at the capital of the country, the difference between input prices faced by banks should be meaningless.

The input prices included in the estimation of the cost and profit functions are obtained, using the common approach used in literature about stochastic frontier analysis. The price of labor is the personnel expenses divided by the number of employees. When data about the number of employees are not available, the researchers define another proxy for the price of labor. For instance, because data about the number of employees are not available, Vennet (2002) and Carvallo and Kasman (2005) divide the personnel expenses by the total of assets. The price of physical capital equals to the total capital expenses and depreciation divided by the total of fixed assets. The price of funds is calculated as the total interest expenses divided by the total of deposits.

To take account for symmetry and homogeneity restrictions, I normalize the endogenous variables, the price of labor, and the price of physical capital, dividing them by the price of funds. In addition, the outputs are divided by the total of assets to avoid problem of heteroscedasticity.

4 Results and discussion

Results show that, in Haiti, domestic banks have higher profit efficiency scores than foreign banks, whereas foreign banks have higher cost efficiency scores than domestic banks. The dummy variable for foreign banks is included in the model to take account for inefficiency effects. The dummy variable for foreign banks have a negative and significant sign, according to the results of two regressions of cost efficiency (see table 2). Thus, the results indicate that foreign banks reduce cost inefficiencies; regarding these results, foreign banks are more cost efficient than domestic banks.

Table 2: Cost Inefficiency effects

Variables	Symbol	**Regressions**		
		1	**2**	**3**
Constant		-1.004 (-0.723)	-8.252 (-21.323)**	-3.382 (-1.536)
Foreign Bank	z_1	-4.446 (-4.106)**	-1.546 (-21.812)**	-1.753 (-0.972)
Size	z_2	-0.292 (-2.610)**	0.626 (21.844)**	-0.846 (-6.572)**
Interest rate growth	z_3	-0.082 (-0.060)		
	$z_{3(t-1)}$		0.025 (0.591)	
	$z_{3(t-2)}$			0.228 (0.510)
Mean Efficiency Scores		0.78	0.32	0.74

** Indicate significance at 1% level

* Indicates significance at 5% level

According to the results of the estimations of the profit efficiency effects, domestic banks are more profit efficient than foreign banks. Foreign banks increase profit inefficiencies. In fact, the dummy variable of foreign bank has a positive and significant coefficient for three of the four regressions of table 3. This result contradicts the result found for cost efficiency. Domestic banks are more profit efficient than foreign banks whereas foreign banks are more cost efficient than domestic banks. This may be due to the constraint the headquarters of foreign banks impose to their branch in Haiti. Foreign banks rely a lot on their headquarters for management decisions. For instance, to do non regular expenses, local managers of foreign banks should ask for an approval decision of their headquarters. In addition, foreign banks do less publicity. Consequently, their relative expenses for marketing may be less than domestic banks. Because it is easier for domestic banks to do extra expenses than it is for foreign banks, domestic banks seem to minimize cost less than foreign banks.

Domestic banks are, however, more profit efficient than foreign banks. Probably, foreign banks neglect expenses that may allow them to maximize their profit. Because of their status of international banks, foreign banks, with less marketing expenses than domestic banks, can attract many customers with high revenue and big firms. That may help foreign banks to minimize their cost better than domestic banks. However, domestic banks are more proactive than foreign banks; domestic banks invest in some profitable activities that allow them to maximize their profit more than foreign banks.

The results are ambiguous , regarding the impact of the the size of a bank on its cost and profit efficiencies. In fact, in some regressions, its coefficient is positive and significant whereas it is negative and significant in some other regressions (see tables 2 and 3). These results may be ambiguous because, in the panel data, both small and big banks have sometimes high or low level of efficiency score.

Banks seem to profit from treasury bills in Haiti. In some banks, sometimes treasury bills are more than a half of loan portfolio. Actually, Brownbridge (1998) underlines that, in some countries of Africa, treasury bills are

Table 3: Profit Inefficiency Effects

Variables	Symbol	Regressions			
		1	**2**	**3**	**4**
Constant		-18.904 (-4.537)**	-18.005 (-9.426)**	-0.012 (-0.012)	-16.792 (-9.227)**
Foreign Bank	z_1	4.545 (4.793)**	2.605 (2.046)*	0.033 (0.034)	1.699 (2.743)**
Size	z_2	0.475 (3.256)**	-0.008 (0.167)	-0.544 (-8.964)**	0.009 (0.235)
Interest rate growth	z_3	-4.142 (-3.767)**			-4.369 (-5.596)**
	$z_{3(t-1)}$		5.239 (3.788)**		5.393 (5.599)**
	$z_{3(t-2)}$			-0.008 (-0.008)	
Mean Efficiency Scores		0.77	0.76	0.25	0.76

** Indicate significance at 1% level

* Indicates significance at 5% level

largely profitable for banks.[2] The African countries considered by Brownbridge (1998) are developing countries with low income level like Haiti. That is the reason why I study also the effect of interest rate on treasury bills on cost and profit inefficiencies.

I try several estimations where the current growth of interest rate on treasury bills and its lags are used respectively. The results are coherent through the different models estimated. A tightening monetary policy has no signif-

[2]Freedman and Click (2006) reveal that banks are highly liquid in developing countries. This is probably the reason why banks get large earnings from treasury bills in developing countries.

icant impact on cost inefficiencies. However, a tightening monetary policy decreases profit inefficiencies in current period, whereas it increases profit inefficiencies one period after the implementation of the tightening monetary policy. Thus, even though treasury bills is perceived to be an alternative source of profit for banks in Haiti, a growth of interest rate on treasury bills has two opposite effects on profit efficiency of banks. A growth of interest rate on treasury bills increases the level of profit efficiency only in current period, whereas it decreases profit efficiency one period after the growth of the interest rate.

The mean efficiency score of the first regression of table 2 and the first regression of table 3, which are the most robust to explain cost and profit inefficiency effects, are respectively 0.78 and 0.77. Thus, the banks, in average, use efficiently 78% of thier ressources, and they waste 22% of these ressources, relative to the best practice. The banks, in average, maximize their profit at 77%, relative to the best practice in the banking sector.

To verify if inefficiency effects exists in the cost function, I perform the one-sided generalized likelihood ratio test. Actually, when maximum likelihood estimation is involved, Coelli (1995) underlines that the one-sided generalized likelihood ratio test is the appropriate test to verify if inefficiency effects exists in the model. The null hypothesis of this test is that $\gamma = \delta_1 = ... = \delta_s = 0$. I reject the null hypothesis for all the regressions, because the value of LR exceeds the critical value found in table 1 of Kodde and Palm (1986). As a result, the inefficiency effects exists in the estimations. According to the result of the one-sided generalized likelihood ratio test, the most robust model to explain respectively cost and profit inefficiency effects is the first model of table 2 and the first one of table 3.

Regarding efficiency of foreign banks, some other studies that use data from other banking systems find the same result as mine. For instance, Bonin et al. (2005) and Staikouras et al. (2007) find that foreign banks are more cost efficient, respectively in transition countries and in South Eastern European countries. Some other papers, however, find that foreign banks are less efficient than domestic banks. Both Roa (2005) studying an emergent market, and Sensarma (2006) studying India, find that domestic banks are more efficient than foreign banks. Those results show that foreign banks do

not have the highest efficiency in all developing and emergent economies. Those contradictions may suggest also that foreign banks are the most efficient banks in some economies because of the low performance of domestic banks.

Actually, regarding bank size, the results are different from an economy to another one. For instance, the study of Sensarma (2006) finds that large banks are less cost efficient than small banks. On the other hand, Roa (2005) finds that bank size has no impact on cost inefficiency in United Arab Emirates. About banks in South Eastern European countries, Staikouras et al. (2007) find that medium sized banks are more efficient than large and small banks.

5 Conclusion

The results of my paper reveal that domestic banks are more profit efficient than foreign banks, whereas foreign banks are more cost efficient than domestic banks. This paper is the first one that studies cost and profit efficiencies of banks in Haiti. It shows also that, although treasury bills constitute an alternative source of profit for banks in developing countries such as Haiti, a growth of interest rate on treasury bills increases profit efficiency in current period whereas it decreases profit efficiency one period after the growth of the interest rate. To conduct this study, I use the stochastic frontier analysis approach to estimate a Fourier-flexible form of the cost and profit frontier functions. The results of the estimations are robust to explain inefficiency effects. Actually, most of the translog and Fourier parameters, not shown in the paper, are significant. In addition, the one-sided generalized likelihood ratio test indicates that there are inefficiency effects in the estimations.

The main implication of this paper is that foreign banks are not always more efficient than domestic banks in developing countries, and even in a country with low income level. Further research should reveal why domestic banks are more efficient than foreign banks, in some developing countries.

A Appendix: List of banks of the sample

Domestic Banks

1. Banque Nationale de Crédit (BNC)
2. Banque Populaire Haïtienne (BPH)
3. Banque de l'Union Haïtienne (BUH)
4. Capital Bank
5. Banque de Promotion Industrielle et Commerciale S.A. (Promobank)
6. Société Caraíbéenne de Banque S.A. (SOCABANK)
7. Socabel
8. Société Générale Haïtienne de Banque S.A. (SOGEBANK)
9. Sogebel
10. Unibank

Foreign Banks

1. Citibank
2. Scotia bank

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