

# BANKING EFFICIENCY IN COLOMBIA: A REVIEW OF THE LITERATURE

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Research on banking performance and efficiency has advanced greatly in the past three decades. The large number of studies on the subject<sup>1</sup> worldwide is largely justified by the importance of a properly functioning financial system to the economy in general. Specifically, the financial system's role in channeling resources to productive sectors where liquidity is relatively scarce, its function as the engine of the payments system, and also the part it plays in promoting long-term growth are major factors motivating research into the efficiency of its productive structure.

In Colombia, too, banks have been the subject of research studies, though as yet to a lesser extent than in developed countries. Between 1983 and 2003 barely a dozen studies were carried out on the financial system's cost structure. The present review will focus on a number of studies that have contributed to public debate on banking efficiency in Colombia.

In speaking of banking efficiency, a distinction has to be made between two concepts: output efficiency and input efficiency.

Output efficiency has to do with the likelihood that the banking firm is producing either optimal output levels (scale efficiency), or an optimal combination of several outputs (scope efficiency), or both. The level of inefficiency is measured by comparing the costs of the current output level with those of an optimal output level.

Input efficiency has to do with the firm's capacity for using its inputs efficiently to produce a given quantity of output. Inefficiency in the use of inputs refers to: (1) the likelihood of using more inputs than necessary for producing a given level of output (technical inefficiency), and (2) the likelihood of using a wrong mix of inputs in such production (allocative inefficiency). These two types of efficiency in the use of inputs are called X-efficiency. X-efficiency is most commonly measured by determining a function that describes the industry's best possible practice. This is equivalent to estimating an efficiency frontier (a minimum cost function, for example) for comparing how far each firm deviates from such "ideal behavior."

The Colombian studies fit into two large groups on both a chronological and a topical basis. The first group consists of papers published between 1983 and 1996 on measuring economies of scale in Colombia's financial sector. They include, notably, studies by Bernal and Herrera (1983), Suescún (1987) and Ferrufino (1991). A study by

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<sup>1</sup> For a list of studies on bank efficiency in various countries, see Berger and Humphrey (1997).

Suescún and Misas (1996) marks the transition between the studies on scale efficiency and those on input efficiency (also called economic efficiency or X-efficiency).

Since then (from 1996 to 2003), research on Colombian banks has focused almost exclusively on seeking measures of economic efficiency. This may have been because the country's financial liberalization in the 1990s substantially reduced the entry barriers that created distortions in the sector in terms of sunk costs and lack of competition. It thus became more interesting to study the banks' output structure in terms of their ability to use inputs in the best possible way (cost-wise), rather than simply reviewing the industry's position against its average cost curve (output scale).

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#### I. SCALE EFFICIENCY (ECONOMIES OF SCALE AND SCOPE)

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The literature on economies of scale in Colombian banks began with a study by Bernal and Herrera (1983). The study sought to estimate a Cobb-

Douglas type of cost function for the banking industry, to quantify the elasticity of costs to changes in the level of output. The study shows the existence of economies of scale in 1981 (Table 1).

Because of the assumption made in constructing the cost function, the average cost curve estimated is not U-shaped but a decreasing monotonous function. According to this finding, the economies of scale would never be exhausted and there would be no optimal scale of production, since costs could always be saved by marginally increasing the level of output. So it is not possible to calculate a level of scale inefficiency, because each bank's current level of production cannot be compared with an optimal level.

Suescún (1987) and Ferrufino (1991) updated and improved on the estimations of Bernal and Herrera (1983) by using more flexible functional forms to model operating costs and by considering bank outputs other than the loan portfolio (Table 1). Their findings are similar for commercial banks, but they too failed to obtain average cost curves with minimums for these banks, so that it was impossible to determine an optimal output level.

TABLE 1  
ECONOMIES OF SCALE <sup>1/</sup>

Study	Period studied	Output	ES	AES <sup>2/</sup>
Bernal y Herrera (1983)	1981	Loan portfolio	0,93	
Suescún (1987)	1983 y 1986	No. of active & passive accts.	0,71	0,83
Ferrufino (1991)	1986-1988	No. of active accounts	0,61	0,82
		No. of active & passive accts.	0,67	
Suescún y Misas (1996)	1989-1995	Loan portfolio	0,78	1,06
Castro (2001)	1994-1999	Loan portfolio	0,76	
		Investments	0,18	

<sup>1/</sup> For commercial banks only.

<sup>2/</sup> Amplified economies of scale (AES): Economies of scale that take into account output expansion.

**TABLE 2**  
**CHARACTERIZATION OF COLOMBIAN BANKS' PRODUCTIVE ACTIVITY**

Study	Inputs	Outputs
Suescún Misas (1996)	Physical capital, labor	Loan stock
Castro (2001)	Physical capital, deposits, labor	Loan & investment stocks
Badel (2002)	Financial capital, labor	Loan & investment stocks
Janna (2003)	Physical capital, deposits, labor	Loan & investment stocks
Estrada y Osorio (2003)	Physical capital, deposits, labor	Loan & investment stocks, deposits with other intermediaries

The only study to overcome the constraint described above is by Suescún and Misas (1996), who used a translog specification of the banks' cost function and modeled the banking system as a group of firms using physical capital and labor to produce stocks of loans (Table 2). The cost function also included the number of bank branches and a temporal trend to quantify [the effect of] technological change on costs.

The study measured scale inefficiency by comparing for each firm the difference between the unit costs of producing its observed loan quantity and the corresponding minimum average cost when the firm operates with its number of branches and the sector's average factor prices. The findings revealed that scale inefficiency was low, since operating at a socially optimal output level meant only a 3.2% saving of operating costs. Suescún and Misas (1996) also corroborated the existence of simple economies of scale but not economies of scale involving the opening of new office (Table 1).

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## II. ECONOMIC EFFICIENCY (ALLOCATIVE EFFICIENCY AND TECHNICAL EFFICIENCY)

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The first measurement of X-inefficiency in Colombian banks was also made by Suescún and

Misas (1996). Applying the thick-frontier approach,<sup>2</sup> they used a six-monthly sample of 22 banks between 1989 and 1995 and found that X-inefficiency accounted for about 27% of commercial banks' total operating costs (Table 3).

It is important to point out, however, that the study did not include financial costs within the banks' cost structure. Hence, the study's measure of inefficiency ignored the greater part (about 66.2%) of total costs, tending to underestimate the degree of economic inefficiency.

Castro (2001) adopted an intermediation approach to characterize the productive activity of banks. According to this approach, banking consists of using deposits, physical capital and labor (three inputs) and producing stocks of loans and/or investments (two outputs). Thus, this approach takes into account financial costs as well as operating costs in estimating the cost function, thereby obtaining a more accurate measure of input efficiency.

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<sup>2</sup> The "thick frontier" approach divides all financial entities into different groups according to their historical performance in terms of administrative spending on assets, which makes it possible to separate "efficient" banks from "inefficient" ones. Once this is done, a cost frontier is estimated for each group. Cost differences between groups are considered inefficiencies, while each group's regression residuals are regarded as random noise.

TABLE 3  
ECONOMIC EFFICIENCY

Study	Period studied	Methodology 1/	Average X-efficiency
Suescún Misas (1996)	1989-1995	TFA	73%
Castro (2001)	1994-1999	DFA	49%
Badel (2002) 2/	1998-2000	DFA	73%
Janna (2003)	1992-2002	SFA	34%
Estrada y Osorio (2003)	1989-2003	SFA	28%

1/ TFA: thick frontier approach; DFA: distribution free approach; SFA: stochastic frontier approach.

2/ The estimated cost frontier includes Costa Rican, Colombian and Mexican banks. The figure here is the average for Colombian banks.

The estimation methodology used unbalanced panel data from 30 banks, covering the period from January 1994 to December 1999. Castro found that the Colombian banking sector's relative cost efficiency averaged 55.2%, which suggests that, in the absence of X-inefficiency, the banks could reduce their costs by about 44% in producing the same quantities of loans and investments.

Badel (2002), for his part, sought to broaden the studies on X-efficiency in Colombian banks through comparisons with other banking systems in Latin America. To this end, he estimated a cost function common to Colombian, Mexican and Costa Rican banks, using information from 54 banks for 1998-2000. Modifying the intermediation approach used by Castro (2001), Badel did not regard physical capital as a relevant input for producing stocks of loans and investments. Instead, he established financial capital as a fixed input, considering it an alternative source of financing for such outputs.

Badel's findings revealed that average efficiency was fairly homogeneous across the countries, though there was high dispersion within each country. On average, the most efficient banks over the period under study were those of Costa Rica, with 77%, followed by Colombian banks (73%)

and Mexican banks (66%). However, Colombian banks were found to be more efficient than Mexican or Costa Rican ones in the last year of the period studied (2000).

Because of the methodology used, the studies by Suescún and Misas (1996), Castro (2001) and Badel (2002) could only measure inefficiency relative to the most efficient bank or group of banks. That is to say, their constructions assumed that the firm with the lowest cost per output represented the best possible practice in the industry, ignoring that the "most efficient" firm might also be wasting resources relative to an optimal cost frontier.

More recently, Janna (2003) and Estrada and Osorio (2004) have tried to overcome that constraint, so as to obtain estimators of absolute inefficiency rather than inefficiency relative to the best-practice bank.

Using a characterization of banking similar to Castro's (2001), and on information from 28 credit institutions for 1992-2002, Janna (2003) estimated a stochastic cost frontier for Colombia's banking system. He found that the system currently presents an efficiency indicator of around 43% (an average of 34% for the period studied), which suggests a lot of room for reducing costs (Table 3)

Estrada and Osorio (2004), for their part, have used information for 1989-2003 from different financial intermediaries to construct a cost frontier for the entire financial system. Applying a cost frontier estimation similar to Janna's (2003), they have found that the inefficiency indicator for the average bank is 28%, the lowest estimated so far by any of the studies.

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### III. TIME VARIATIONS IN ECONOMIC EFFICIENCY

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Castro (2001), Badel (2002) and Janna (2003) have all tried to measure to what extent banking efficiency has changed over time. Their findings are mostly similar and favor the conclusion that great advances were made in cost saving in the 1990s.

Castro sought to quantify the impact of various mergers and acquisitions on the efficiency of the entities involved, in 1996-1999. His findings revealed that, on average, such reorganizations had a negative effect in terms of efficiency, though detailed analysis of each case provided mixed results. For example, privatization and acquisition by foreign agents subsequently improved bank efficiency, whereas nationalization had a negative effect. Between 1994 and 1999, average efficiency for the banking sector as a whole (including reorganized and other banks) improved by 10.3%.

Badel (2002), for his part, constructed time-varying indicators of efficiency to observe changes in the banking efficiency of each of the countries studied. He found that Colombian banks registered some improvement. In effect, though they were less efficient than Mexican or Costa Rican banks in the

first half of 1998, by the second half of 2002 their indicator was the best of the three countries'.

Lastly, Janna (2003) sought to quantify Colombian banks' efficiency improvements between 1992 and 2002, so as to identify the major factors that had caused them. His findings revealed that the banks' average efficiency improved by 63% (or 17 percentage points) in those ten years but not uniformly over the period, for their progress was interrupted by the financial crisis of 1998-1999.

Janna also showed that efficiency progress between 1992 and 1998 stemmed largely from changes in general market conditions that affected the whole banking system (deregulation, economic cycle, market deconcentration), whereas improvements after 2000 resulted from each bank's control variables. He concludes therefore that this shift in efficiency-driving variables bears out the view that the crisis had a "disciplining effect" on the banks' cost management. For it detached progress in efficiency from improvements in environmental conditions and gave relevance to a number of variables under greater control by each bank.

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### IV. DETERMINANTS OF ECONOMIC EFFICIENCY

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Castro (2001) and Badel (2002) aimed to explain efficiency levels on the basis of each bank's particular variables (type of ownership, type of output, and other features of the entity). In Castro's study, the simultaneous inclusion of all relevant variables in one regression provided no statistically significant coefficient. But regressions carried out with fewer

**TABLE 4**  
**DETERMINANTS OF COLOMBIAN BANKS' X-EFFICIENCY**

Variables	Studies		
	Castro (2001)	Badel (2002)	Janna (2003)
<b>Ownership</b>	Foreign Public	Not significant Negative	Positive Not significant
<b>Company features</b>	Size Offices Return on assets Return on equity Solvency	Negative Positive Positive	Positive Negative Positive
<b>Type of output</b>	Credit deterioration Output quality % of commercial loans	Negative Positive	Negative Negative Positive
<b>Environment / market conditions</b>	Regulatory burden Economic cycle Concentration		Negative Negative Negative

variables provided some significant relationships (Table 4). In Badel's study, all the variables used were significant in a single regression.

Janna (2003) not only tried to explain banks' X-efficiency in terms of each bank's particular variables, as had Castro and Badel, but he also included some variables that described general market (environmental) conditions and had the same behavior for all banks. The inclusion of these industry-wide variables provided interesting results, revealing that regulatory burden, economic cycle and market concentration all had a negative effect on efficiency (Table 4).

#### V. OTHER TYPES OF EFFICIENCY

Benefit efficiency is another way of characterizing the behavior of a firm. As in the case of cost efficiency (economic efficiency), the idea of this

measure is to gauge a bank's position against an optimal frontier of benefits (a function describing the greatest quantity of benefits that a financial entity can achieve subject to its industry characteristics).

In a market with perfect competition, cost efficiency and benefit inefficiency should be equal. But, in the presence of any type of market power, firms may exhibit optimal benefit levels without operating at minimum cost. Hence, comparing indicators of benefit efficiency and cost efficiency may cast light on the structure of the banking market.

The only measurement of benefit efficiency for Colombia's financial sector is to be found in Estrada and Osorio (2004). Specifically, the benefit efficiency of commercial banks is estimated at around 50%; that is to say, if these banks operated optimally they could, on average, double their benefits. Comparing these authors' benefit-efficiency measurement with their cost-efficiency

estimation reveals benefit efficiency to be greater than cost efficiency. Similarly, no high relation is found to exist between individual intermediaries' cost-efficiency and benefit-efficiency measures. Estrada and Osorio believe that these findings reflect the existence of some market power in the Colombian banking sector.

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## VI. CONCLUSIONS

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The studies on economies of scale and scope in Colombia's banking sector were mostly carried out in the 1980s and early 1990s, and their findings in general favored the idea there were economies of scale in banks in those years. But the lack of studies for the second half of the 1990s and the years since 2000 precludes the conclusion that economies of scale persist today.

There are few studies about input efficiency, and their findings are rather more heterogeneous than those of studies on economies of scale. In effect, measures of cost efficiency in banking are quite sensitive to the functional forms of costs, the variables chosen as inputs and outputs, the sample used, and estimation methodologies.<sup>3</sup>

Although efficiency estimators fell within a relatively broad range (between 28% and 73%), there is still potential for the costs of Colombian banks to be more efficiently managed. This potential is actually greater than in developed countries, where banks are closer to their efficient frontier.<sup>4</sup> Colombian banks have, in fact, begun in recent years to exploit this capacity for improving their cost management, as evidenced by the studies that have measured temporal variations in cost efficiency.

Lastly, there is some evidence that the efficiency of Colombian banks is influenced both by factors peculiar to each entity (type of ownership, levels of financial capital, type of business, size of branch network), and by environmental factors jointly affecting the whole sector (regulatory burden, economic cycle, market concentration, financial crises). For this reason, regulators and bank managers alike hold the main tools for continued improvement in Colombian banking efficiency.

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<sup>3</sup> Berger and Mester (1997).

<sup>4</sup> Berger and Humphrey (1997) report that studies on the United States estimate the country's economic-efficiency level to range between 61% and 95%.

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