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Journal of Banking & Finance 27 (2003) 2087–2098
Journal of BANKING & FINANCE
www.elsevier.com/locate/econbase

A note on banking efficiency in Portugal, *New* vs. *Old* banks

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Received 27 January 2000; accepted 8 March 2002

Abstract

Following entry into the European Community in 1986, Portugal transformed rapidly its repressed banking system with deregulation, the opening of borders, the granting of new banking licenses, and privatization. In a more competitive banking system, one would expect a priori an increase in operational efficiency. This paper attempts to quantify the magnitude of efficiency gains over the years 1990–1995. Moreover, the paper documents the relative efficiency performance of *new* domestic banks. Not hampered by a legacy of inefficiency from the past, they could operate nearer the efficiency frontier. The case of Portugal provides unique information on the joint effect of deregulation and the granting of new banking licenses on the change in operational efficiency of a previously repressed banking system.

JEL classification: G21; G28
Keywords: Banking; Bank efficiency; Bank deregulation

1. Introduction

Following entry into the European Community in 1986, Portugal transformed rapidly its repressed banking system with deregulation, the opening of borders, the granting of new banking licenses, and privatization. A priori, one would expect that a more competitive system should lead to operational efficiency gains as banks strive to maintain or increase profitability. The purpose of this paper is first to quantify the impact of deregulation on the efficiency of the Portuguese banking system.

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0378-4266/$ - see front matter
doi:10.1016/S0378-4266(02)00316-3

Moreover, the case of Portugal is unique in Europe as deregulation was accompanied by the creation of *new* banks that controlled 20% of bank assets in the mid-1990s. Not hampered by a low productivity legacy of the past, these *new* banks should, in principle, be able to operate nearer the efficiency frontier. A second objective of this paper is to quantify the relative efficiency of *new* domestic banks as compared to that of *older* existing banks.

The paper belongs to one segment of the bank efficiency literature. According to the international survey of Berger and Humphrey (1997), bank efficiency studies can contribute to government policy, research, and bank management. This paper contributes to government policy with an empirical evaluation of the impact of deregulation and the granting of new banking licenses on the efficiency of a banking system. In Berger and Humphrey's study, the authors observe that the conventional wisdom that holds that deregulation improves efficiency is not always validated by empirical studies. For instance, the banking efficiency in the US was relatively unchanged by deregulation in the early 1980s (Grabowski et al., 1994; Elyasiani and Mehdian, 1995), while banks of Norway and Australia experienced improved efficiency after deregulation (Berg et al., 1992; Avkiran, 1999). This paper shows that the rapid deregulation in Portugal has been accompanied by a major increase in the efficiency of banks over the period 1990–1995. Moreover, a limited series of papers in the government policy literature have analyzed the performance of *new* (de novo) commercial banks in terms of rate of bank failures, portfolio structure, or profitability (for instance, DeYoung and Hasan, 1998). This paper contributes to that literature with a focus on operating efficiency, which to the best knowledge of the authors, has not been studied specifically. It shows that *new* domestic banks are more efficient than *old* banks. Although it is only a conjecture, it could well be that it is the combined effect of substantial deregulation and the granting of new banking licenses that have contributed to the improved efficiency of the Portuguese banking system.

The present paper is structured as follows. In Section 2, the history of Portuguese banking is summarized briefly. In Section 3, the sample of banks with data on inputs and outputs is presented. The sample retained for the study covers more than ninety percent of the industry. In Section 4, the non-parametric data envelopment analysis (DEA) methodology used to evaluate technical efficiency is reviewed. Finally, the empirical results are presented in Section 5.

2. Banking in Portugal

Following the military coup of 25 April 1974, Portugal was first governed by militaries (*Conselho da Revoluçao*) heavily influenced by leftist parties. Banks were nationalized in 1975. The 1976 Constitution of the Portuguese Republic established the irreversibility of nationalization and barred entry of private firms into banking. [1]

[1] 1976 Constitution. Article 83 states explicitly that all nationalizations that took place after the 25 April 1974 revolution are irreversible conquests of the working class.

The banking system was very much repressed by very strict regulations in terms of entry, opening of branches, regulation of interest rates, credit ceilings, and very high reserve requirements needed to finance a large public deficit. This situation, which lasted ten years, was completely reversed in the mid-1980s when the liberal Prime Minister, Cavaco Silva, undertook a profound reform of financial markets to prepare the country for the 1986 entry into the European Community (Borges, 1990). The banking reforms included three dimensions: entry of private firms, privatization, and liberalization.

Private entry into banking was authorized [2] in February 1984. The banking sector then included 12 state-owned institutions, one domestic savings bank, and three foreign banks [3] that had not been nationalized in 1975. New banking licenses were granted so that by the late 80s the banking sector had changed considerably with thirty-three banks, among which were seven newly-created domestic banks and thirteen foreign institutions. Some of these banks target the retail and corporate markets, while others are merchant banks targeting the very large corporate and institutional clients. In 1989, the irreversibility of nationalization was abolished in the course of the second revision of the 1976 Constitution. State-owned banks were gradually privatized over the period 1989–1996, with only the financial group headed by the large savings bank CGD [4] remaining in the public sector. Finally, major steps in deregulation included the lifting of credit ceilings, the end of administered interest rates, and the freedom to open branches. During the 1990–1995 period, the number of bank branches increased from 2082 to 3876 (86% growth). The surprisingly large increase in the number of branches observed at a time when other European countries were sharply reducing their branch network is explained by the deregulation of branch opening and the end of a 'repressed' banking system (ECB, 1999).

The Portuguese banking industry can be divided into two main groups: The *old* established banks which could carry a legacy of inefficient production techniques and the *new* banks which seized the opportunity of liberalization to expand nationwide.

The purpose of the paper is to quantify empirically the magnitude of the efficiency gains over the years 1990–1995, and to measure the relative efficiency of *new* and *old* banks.

3. Structure of the banking sample and input/output data

Tables 1 and 2 describe the sample of banks included in the empirical study and the banking market structure.

Excluding all investment banks and some very small banks created during the period under review, the sample includes 20 banking institutions. These comprise

[2] Decree law 406/83, 19 November and decree law 51/84, 11 February.

[3] Crédit Franco Portugais, Bank of London and South America, and Banco do Brazil.

[4] In Portugal, most banks are known by their initials.

Table 1
The sample of 20 banks

Old commercial banks	BBI, BCA, BESCL, BFB, BNU, BPA, BPSM, BTA, UBP
Old savings banks	CGD, CPP, MG
New commercial banks	Banif, BCI, BCM, BCP, BIC, Barclays, Banco Bilbao Vizcaya, Crédit Lyonnais

Table 2
Structure of the banking industry in 1995 (share in %)

	Assets	Loans	Deposits	Branches	Labor
Old commercial banks	54.6	49.4	53.2	56.4	59.8
Old savings banks	27.2	33.5	32.3	22.2	24.7
New commercial banks	18.1	17.2	14.5	21.4	15.5
Total	100	100	100	100	100

12 *old* commercial or savings banks, five *new* banks, and three foreign banks. These 20 institutions controlled 92.6% of banking assets and 97.6% of branches in 1990. Homogeneity criteria guided the creation of the sample, which includes all banks that operated simultaneously in retail banking, in small business banking, in private and corporate banking, and in treasury. Commercial banks with very few offices that were created during the period 1991–1995 have been excluded from the sample on the grounds that, not having had the time to develop fully their output potential, they should not be compared to banks created in the mid-1980s. Merchant banks (many of them foreign) targeting large corporations that operate with one or two offices are also excluded for a similar reason of homogeneity. [5] In the '*old* banks' category, a distinction is made between the commercial banks and savings banks on the grounds that differences in governance structure could lead to different degrees of efficiency. In the '*new* commercial banks' category, we have included not only the banks created after the 1984 deregulation but also three foreign banks (Barclays, Banco Bilbao Vizcaya and Crédit Lyonnais). Barclays can be considered a *new* bank, as it entered Portugal with the creation of a new branch network in 1985. BBV, who purchased 12 branches of Lloyds in 1991, and Crédit Lyonnais were already established in Portugal. They are included on the grounds that they were not nationalized in 1975 and that they seized the opportunity given by deregulation to expand rapidly [6] and benefit from the choice of the most efficient means of production.

The structure of the banking industry is described in Table 2. The *old* commercial and savings banks controlled 81.8% of total assets and 85.5% of deposits in 1995. In that year, 84.5% of bank employees worked in the *old* sector. The *new* domestic and

[5] A simple check of the ratio loan per employee *does* confirm that the lending activity of these merchant banks is very different from that of retail banks.

[6] For instance, the number of branches of BBV grew from 12 to 40 over the period 1991–1995.

foreign banks had a combined share of 18% of total assets and 14.5% of deposits. 15.5% of the labor force worked in the *new* sector.

Over the period 1990–1995, the real growth of assets for the total sample was 7.7% per year, with an annual increase in the number of branches of 12.5%. Quite remarkably, the number of employees decreased slightly by 0.3% per year over the same time period. One observes that *new* banks grew at a faster rate, 16% per year for the real growth of assets. [7]

Banks' inputs and outputs are defined according to the intermediation approach. [8] The output vector includes loans, deposits, securities, interbank assets/liabilities [9] measured in Portuguese escudos, and the number of branches. The implicit assumption is that the number of branches represents an additional value for retail customers, the availability of banking services. [10] The input vector includes the number of employees and physical capital. Capital is approximated by the book value of fixed assets. A problem could have arisen if historical cost data had been used to measure the physical capital of *old* and *new* banks. Fortunately, physical assets of banks reported in the book were re-evaluated to market prices. [11] Finally, all variables, except labor and the number of branches, are deflated by the consumption price index with base year 1990.

4. Technical efficiency, a non-parametric approach

Technical efficiency is evaluated using a non-parametric programming technique, DEA. The methodology developed by Charnes et al. (1978) has been used widely in the banking literature.

The DEA approach defines a non-parametric efficient production frontier that serves as a benchmark for the Debreu–Farrell measure of efficiency. [12] This benchmark is a linear combination of banks included in the sample. Intuitively, an efficiency score of 0.6, for instance, indicates that if the bank under review were producing on the frontier instead of at its current location, it would require only 60% of current inputs to produce the same level of output.

A well-known advantage of DEA is that there is no need to specify a particular functional form for the production frontier, while the drawback of a non-parametric deterministic method is to assume that there is no random error. Deterministic models do not distinguish between inefficiency and random noise, assuming that all

[7] Detailed tables on annual growth of inputs and outputs for each category of banks are available from the authors upon request.

[8] The distinction between the production and intermediation approaches is discussed in Clark (1988).

[9] Several studies do not include securities and interbank assets on the grounds that the operational costs should not be very large. We prefer to include them for the sake of completeness of the output vector.

[10] For instance, Berg et al. (1993) use a similar definition of output.

[11] Decree laws 49/91, 264/92 and 22/92.

[12] Debreu (1951) and Farrell (1957).

deviations from the estimated frontier represent inefficiency. The small number of banks in Portugal motivates the choice of the non-parametric approach.

Formally, [13] with multi-output frontier technology and a panel of data, the Debreu–Farrell input savings efficiency measure ($E^{b,t}_{t+i}$) based on an efficient frontier technology constructed with banks observed at time $t+i$, for a specific bank b observed at time t is defined by

$$E^{b,t}_{t+i} = \min_{e^{b,t}_{t+i}} \left\{ e^{b,t}_{t+i} : F_{t+i}(y^{b,t}, e^{b,t}_{t+i} x^{b,t}) \leqslant 0 \right\} \quad \forall\, b, t+i, t \in T,$$

where $F_{t+i}(.,.)$ denotes the production function in period $t+i$, $x^{b,t}$ and $y^{b,t}$ are the observed vectors of inputs and outputs for bank b at time t, and $e^{b,t}_{t+i}$ is the proportional (radial) scaling factor expressing the usage of inputs needed by a benchmark efficient bank relative to those inputs used by bank b at time t. The reference frontier technology used to produce the same output vector is constructed with the banks observed at time $t+i$ and T is the set including the banks with their respective inputs and outputs at times t and $t+i$. The production transformation function $F_{t+i}(.,.)$ will meet some standard regularity properties defined below. When $i=0$, the set of banks whose efficiency is being evaluated is identical to the set of banks used to create the benchmark efficient bank. In this case, the efficiency measure varies from zero to one, with a low value indicative of poor efficiency performance.

To calculate the efficiency score, a linear programming model is solved for each bank. Let us assume k inputs, m outputs, and a benchmark sample of n banks at time $t+i$. The formal problem to evaluate the efficiency of bank b at time t (the benchmark bank being a linear combination of the banks observed at time $t+i$, satisfying several regularity properties) is stated as follows:

$$\min_{z^{b,t}_{t+i}} E^{b,t}_{t+i},$$

s.t.

$$\text{(a)} \quad Y_{t+i} z^{b,t}_{t+i} \geqslant y^{b,t},$$

$$\text{(b)} \quad X_{t+i} z^{b,t}_{t+i} \leqslant x^{b,t} E^{b,t}_{t+i},$$

$$\text{(c)} \quad I z^{b,t}_{t+i} = 1,$$

$$\text{(d)} \quad z^{b,t}_{t+i} \geqslant 0,$$

where Y_{t+i} is the $m \times n$ matrix of outputs in the benchmark sample, X_{t+i} is the $k \times n$ matrix of inputs in the benchmark sample, I is a $1 \times n$ identity vector, and $z^{b,t}_{t+i}$ is the $n \times 1$ vector of intensity weights used to define the benchmark bank for bank b observed at time t.

The first two constraints state that excess outputs or inputs can be disposed of freely. The third constraint will define the degree of returns to scale imposed on

[13] The notation of Berg et al. (1993) is adapted.

the benchmark technology (Grosskopf, 1986). It is referred to as the variable returns to scale (VRS) property of the banks in the benchmark technology. When it is imposed, it implies that the average cost can change with the size of output. Deleting constraint (*c*) would imply the constant returns to scale (CRS) hypothesis. In line with the literature, we will report both the VRS and CRS results. An index of scale efficiency (*S*) can be derived from the VRS and CRS measures of efficiency ($E^{\text{VRS}}, E^{\text{CRS}}$). It expresses the additional gain in efficiency that could be obtained if banks were operating at the long-run equilibrium CRS. The measure of scale efficiency is formally defined as

$$E^{\text{CRS}} = E^{\text{VRS}} \times S.$$

To compare the relative efficiency of two observations, two cases must be considered. If two banks are observed at time *t*, using as a reference technology all the banks observed at time *t*, then a direct comparison of efficiency is feasible, as the efficiency of the two banks is calculated vis-à-vis a common efficiency benchmark constructed with an identical sample of banks. However, if a bank is observed in two different time periods and if efficiency scores are calculated with different benchmark samples of banks, a comparison of efficiency scores may not be an indicator of absolute improvement of efficiency. It would only show changes in the relative efficiency of that bank vis-à-vis that of other banks between two different times. In the latter case, the Malmquist productivity index is commonly used to calculate absolute improvement over time in efficiency. [14] This index allows separating the relative efficiency gain (the *catching up* effect) and the technology shift (the *frontier shift* effect).

5. Empirical results

The discussion of the empirical results on the technical efficiency [15] of banks in Portugal will be structured in two main parts. In the first part, we evaluate the efficiency of the full sample of banks and study its evolution over time. In the second, we focus on the specific issue of the relative efficiency of *new* vs. *old* banks. Following the literature, the comparison of means of efficiency scores will be supported by nonparametric statistical tests.

5.1. Efficiency over time

Having access to a panel of data incorporating both cross-sectional and time series data, two approaches can, in principle, be adopted to analyze efficiency over time. First, the data can be pooled into one sample with an implicit assumption of a common benchmark technology. In this case, one can calculate the efficiency of

[14] See for instance Berg et al. (1993) or Färe et al. (1994).
[15] Linear programming problems are solved with LINDO (Linear Interactive and Discrete Optimizer).

Table 3
Average efficiency measures with the pooled sample (1990–1995) used to create the benchmark frontier technology

	E^{CRS}	E^{VRS}	Scale (S)
1990–1995	0.69	0.8	0.86
1990	0.59	0.73	0.82
1991	0.61	0.72	0.85
1992	0.65	0.77	0.85
1993	0.7	0.81	0.87
1994	0.76	0.85	0.89
1995	0.84	0.93	0.91

Note: E^{CRS} is efficiency score under the constant relative scale hypothesis; E^{VRS} is efficiency score under the variable relative scale hypothesis; S is measure of scale economies and $E^{CRS} = E^{VRS} \times S$.

each bank observed in different years and analyze the improvement in efficiency calculated vis-à-vis the common benchmark. The second approach consists of analyzing each annual time series separately. In the latter one, one can calculate the relative efficiency of each bank within each time series, but one cannot compare directly these efficiency scores over time, as they have been calculated vis-à-vis different efficiency benchmarks. In this case, the Malmquist indices of productivity will be reported. Calculated with the same reference technology, they allow proper comparisons of banks across time periods.

Efficiency scores under both the VRS (E^{VRS}) and the CRS (E^{CRS}) hypotheses for the benchmark constructed with the pooled sample (1990–1995) are reported in Table 3. As discussed above, the ratio (S) of the two measures of efficiency (E^{CRS}, E^{VRS}) represents the measure of scale efficiency. One observes an average CRS efficiency measure of 69% for the pooled sample, which means that if the average bank were producing on the frontier instead of at its current location, only 69% of the inputs currently being used would be necessary to produce the same output vector. From 1990 to 1995, the CRS efficiency measure rose from 59% to 84%. These results are in line with estimates found in the literature for other countries. [16] The VRS results show a similar evolution of efficiency scores over time. [17]

Using the distribution of efficiency scores calculated with the benchmark constructed with the pooled sample of banks, we have tested whether the increase observed in the annual average of the efficiency measures is statistically significant. All tests of the pooled frontier approach for efficiency scores (E^{CRS} or E^{VRS}) are statistically significant. They reject the null hypothesis of equality of distributions. [18]

The reported increase in technical efficiency could be due to the fact that banks are becoming more efficient (closer to the production frontier) and/or to the fact that

[16] See the international survey of efficiency by Berger and Humphrey (1997).

[17] Efficiency scores have been calculated using annual benchmarks calculated only with the bank data available in that year. For the sake of space, the results are not reported, as one cannot compare the evolution over time of the efficiency scores if the benchmark in each year is different.

[18] Tests available from the authors upon request.

Table 4
Malmquist productivity index of improvement of efficiency

	Malmquist productivity index	Frontier shift component	Catching up component
1991–1992	1.15	1.16	0.99
1992–1993	1.15	1.20	0.96
1993–1994	1.12	1.16	0.98
1994–1995	1.13	1.16	0.98
1991–1995	1.59	1.74	0.91

Note: Index of improvement of efficiency between years t and $t+j$, taking year t to construct the benchmark technology ($M_t^{t,t+j}$).

the benchmark technology is changing. Since a change in technology is possible, we report the Malmquist productivity index to compare efficiency over time.

5.1.1. Malmquist productivity index

Consistent with the literature and for the sake of space, we report the Malmquist productivity index for the CRS case. Changes in efficiency during two consecutive years (taking the first year to construct the benchmark technology), as well as changes between 1991 and 1995, are reported in Table 4. The Malmquist productivity index is broken into two components: A 'frontier shift' effect to study technical progress between two periods, and a 'catching up' component to study whether banks are moving closer or farther away from the own period best practice frontier.

The Malmquist indices are above one, confirming the prior result of a positive evolution in efficiency over the period that followed deregulation. For instance, the increase in efficiency was 59% between 1991 and 1995, an empirical result fully consistent with the casual observation of a stable labor force in a rapidly growing banking sector. The 'frontier shift' component is above one for each pair of consecutive years, showing a positive impact of technical change. The 'catching up' component is below one, indicating a small decrease in average efficiency indices relative to the own period benchmark technology.

The first part of the empirical analysis focused on the efficiency score of the overall sample of banks in Portugal following a period of deregulation and on the evolution of these efficiency scores over time. The second part of the empirical analysis compares the relative efficiency of *old* and *new* banks over the same period of time.

5.2. Relative efficiency of old and new banks

A similar methodology is used to compare the efficiency of the three groups of banks: *old* commercial banks, saving banks, and *new* banks. [19] Table 5 reports the difference in mean efficiencies for the three groups using the 1990–1995 pooled sample to construct the benchmark. The *new* banks show the highest mean $E^{\mathrm{CRS}}(E^{\mathrm{VRS}})$ efficiency of 77% (86%) compared to 62% (73%) for the *old* commercial banks.

[19] The comments will be centered on the *new* vs. *old* commercial banks as there are few savings banks in the sample.

Table 5
Average efficiency measures for each group of banks calculated with the benchmark calculated with the pooled sample 1990–1995

	E^{CRS}	E^{VRS}	S
Old	0.62	0.73	0.85
New	0.77	0.86	0.89
Savings	0.69	0.86	0.82
Total	0.69	0.8	0.86

Note: E^{CRS} is efficiency score under the constant relative scale hypothesis; E^{VRS} is efficiency score under the variable relative scale hypothesis; S is measure of scale economies and $E^{CRS} = E^{VRS} \times S$.

Table 6
Malmquist productivity index of improvement of efficiency

	Malmquist productivity index	Frontier shift component	Catching up component
1991–1992			
Old	1.06	1.1	0.96
New	1.26	1.24	1.02
Savings	1.14	1.13	1.01
1992–1991			
Old	1.15	1.18	0.98
New	1.19	1.25	0.95
Savings	1.05	1.15	0.92
1993–1994			
Old	1.08	1.13	0.95
New	1.17	1.16	1.01
Savings	1.15	1.20	0.97
1994–1995			
Old	1.15	1.22	0.95
New	1.13	1.12	1.0
Savings	1.09	1.10	0.99
1991–1995			
Old	1.56	1.82	0.86
New	1.67	1.72	0.97
Savings	1.43	1.62	0.89

Note: Index of improvement of efficiency between years t and $t + j$, taking year t to construct the benchmark technology ($M_t^{t,t+j}$).

Statistical tests investigating whether the distributions of efficiency measures of each group of banks proceed from a common distribution have provided overwhelming evidence that the difference of mean efficiency scores between the *old* and the *new* banks is statistically significant. [20]

[20] Tests available from the authors upon request.

Moreover, since earlier analysis indicated the need to compare banks of different years relative to a common benchmark using the Malmquist productivity index, we report in Table 6 the average results for pairs of consecutive years. A 1991–1995 comparison is also provided.

With one exception, the Malmquist productivity index for the *new* banks is larger than that for the *old* banks, an indicator of superior improvement in efficiency over time. Therefore, from both a static and a dynamic perspective, the efficiency of *new* banks is superior to that of *old* banks. Particularly remarkable is the case of the '*catching up*' effect where the index for the *new* banks is, with one exception, higher than that for the *old* banks. This result highlights the fact that the positive effect of technological progress is reinforced by relative '*catching up*' performance.

6. Conclusion

Portugal presents an interesting case to study the impact on bank efficiency of rapid deregulation in a previously repressed banking system. Moreover, it is a unique case in Europe, as a series of new banks created at the time have most likely been an accelerating factor in efficiency improvement. Not hampered by a legacy of overstaffing from the past, the new banks should be able, in principle, to operate more closely to the efficiency frontier. The case of Portugal allows quantifying the impact of deregulation on technical efficiency over time and across groups of banks from different generations, the *old* and the *new*. The non-parametric DEA shows an improvement in efficiency for the overall sample over time of the order of 59% over the years 1990–1995. The *new* banks dominate the *old* ones in terms of efficiency with an average efficiency score of 77% compared to 62%. Moreover, the Malmquist productivity index indicates that the *new* banks consolidate their relative efficiency advantage over time. The usual caveat of non-parametric studies applies: the amount of *X*-efficiency may be overstated because this measure is a residual that could incorporate an error term ignored under the current approach.

A policy recommendation drawn from the case of Portugal is as follows. The creation of *new* banks is likely to accelerate the efficiency gains expected from a period of deregulation. Not hampered by the past, they can choose the best production techniques, increase competition, and put restructuring pressures on incumbents. One must recognize that the creation of *new* banks was facilitated because in 1984 Portugal had a repressed banking system. There was room for considerable expansion of the banking system, the network of branches, and growth opportunities for new players.

Acknowledgements

The authors are grateful to Jean Cropper, Matti Suominen and two referees for their insightful comments.

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