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Original Article

Early warning mechanism to control delinquency levels

Mecanismo de alerta temprana para controlar los niveles de morosidad

Mecanismo de alerta precoce para controlar os níveis de inadimplência

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Abstract

The growth of financial institutions depends to a great extent on the granting of loans to their customers. This contract establishes the values and terms in which the capital must be repaid together with interest and commissions. Delinquency related to loans originated when there was inadequate analysis and control of the policies established in each institution. Therefore, this document proposes an early warning mechanism to control delinquency levels. It also offers the measurement of the performance of these financial institutions through the CAMEL methodology. This will allow senior management to take prompt decisions and corrective actions to avoid decreased liquidity levels. A heat map is also defined to enable timely detection of risk and thus place greater emphasis on those that are necessary. Finally, the conclusions and recommendations are presented as a basis for future research, encouraging readers to deepen or replicate the work.

Keywords: *Liquidity, CAMEL Methodology, Non-Performing Loans, Mutuals.*

Resumen

El crecimiento de las entidades financieras depende en gran manera del otorgamiento de créditos para sus clientes. En este contrato se establecen los valores y plazos en los que el capital se deberá devolver junto a los intereses y comisiones. La morosidad relacionada con los créditos se origina cuando no se realiza un adecuado análisis y control de las políticas establecidas en cada institución. Por ello en este documento se propone un mecanismo de alerta temprana para el control de los niveles de morosidad. También así como la medición del desempeño de estas instituciones financieras a través de la metodología CAMEL. Esto le permitirá a la alta dirección tomar decisiones prontas y acciones correctivas para evitar una disminución en los niveles de liquidez. También se define un mapa de calor que permita detectar oportunamente el riesgo y así poner mayor énfasis en los que son necesarios. Finalmente se exponen las conclusiones y recomendaciones como una base para futuras investigaciones, que incentiven a los lectores a profundizar o replicar el trabajo elaborado.

Palabras claves: *Liquidez, Metodología CAMEL, Morosidad, Mutualistas.*

Resumo

O crescimento das instituições financeiras depende, em grande parte, da concessão de empréstimos a seus clientes. Este contrato estabelece os valores e os termos em que o capital deve ser reembolsado juntamente com os juros e comissões. A inadimplência relacionada ao crédito surge quando não há uma análise e um controle adequados das políticas estabelecidas em cada instituição. Portanto, este documento propõe um mecanismo de alerta precoce para controlar os níveis de delinquência. Também é proposto medir o desempenho dessas instituições financeiras através da metodologia CAMEL. Isto permitirá que a alta administração tome decisões antecipadas e ações corretivas para evitar um declínio nos níveis de liquidez. Um mapa de calor também é definido para permitir a detecção oportuna de riscos e assim dar maior ênfase aos riscos que são necessários. Finalmente, as conclusões e recomendações são apresentadas como base para pesquisas futuras, o que incentivará os leitores a explorar ou replicar ainda mais o trabalho.

Palavras-chave: *Liquidez, Metodologia CAMEL, NPLs, Mutuals.*

1. Introduction

Latin American countries face a problem of delinquency because financial institutions risk non-payment by debtors. A quantitative and qualitative study should be carried out at the beginning of a credit application to minimize this risk [1]. The debt factor generated by overdue payments strongly impacts liquidity levels, which, if not controlled in time, could lead to a crisis in the financial institution [2], [3].

According to what is mentioned by the Latin American Federation of Banks (FELABAN) (2018), there are ten countries with delinquency indicators and values in the total portfolio and non-performing portfolios with a high level in 2018. Colombia stands out as having the highest hand compared to the other countries in the region by registering a portfolio quality index of 4.81%. In addition to Colombia, the top five nations with a high level of delinquency in Latin America are Uruguay (4.03%), Brazil (3.28%), Paraguay (2.84%), and Peru (2.64%). It can be seen from Figure 1 that from 2003 to 2014, the trend at the regional level was to decrease liquidity indicators. It is essential to maintain control of risk levels by analyzing all internal and external factors that impact the increase in delinquency levels and affect liquidity [4], [5].

In Ecuador, the financial system is considered one of the most critical factors within the economy. It allows savings to be channeled towards investment, which is why it has become the fundamental pillar for wealth generation. Economic entities have relied on financial institutions to obtain working capital, productive expansion, and infrastructure [6]. In 2002 there were 17 banks, which increased at a rate of 2.15% per year until 23 banks were in service in December 2016, which shows relative stability of the financial sector. Banks currently accumulate 70.7% of the total assets of the private financial sector, with an amount equivalent to US$35,599 million. For their part, financial companies have remained between 5 and 6 companies, the amounts in assets managed here represent 3.59%, and finally cooperatives with a piece of 6,641.59 million dollars which means 14.86.

At least annually, the Board of Directors should review and approve strategies, policies, and practices related to liquidity management, ensuring that senior management effectively manages credit risk [7]. For all relevant on- and off-balance sheet business activities, financial institutions should include liquidity costs, benefits, and risks in internal pricing, performance measurement, and new product approval processes [8]. To match the risk-taking incentives of the different business lines with the liquidity risk exposures that their activities cause to the institution as a whole [9], [10]

Financial institutions worldwide have portfolio recovery problems because there are no valid credit-granting policies [11]. There is no good management in the collections area, which generates delinquency levels that, if not controlled in time, can cause damage to liquidity levels. Although there are risks involved in this type of operation, all possible solutions should be analyzed to help improve the collections process [12]. Delinquency affects all countries and is a frequent problem with the easy granting of credits without efficient applicants' control. This project will analyze the public consolidated financial statements available on the web portal of the Superintendency of Banks and thus propose a tool to control delinquency. On the social level, adequate control when granting loans will help mutuals present financial statements with lower levels of non-performing loans to the control entity. This is a proxy measure that will help to obtain data on delinquency and liquidity and will also help to detect these high levels in time.

The materials and methods are described in section 2, and the results in section 3. Finally, the discussion is presented in section 4.

2. Materials y methods

2.1. Type of research

This research is bibliographic because it requires the review of primary and secondary documents to define the financial situation of these institutions. It is also field research because it is necessary to meet the needs of the actors in person. Finally, it is non-experimental research where a methodology is applied, but no experimental tests are performed.

2.2. Approach

This study has a mixed approach since it analyzes the satisfaction of the methodology developed using a questionnaire. On the other hand, this tool is used to improve the processes for detecting late payments, thus adding a quantitative approach.

2.3. Population-sample

The four mutual societies in Ecuador were chosen as participants in this study, and their employees used this tool to evaluate users. Indirectly, there is also an impact on end clients, who have increased confidence due to the sound levels of liquidity.

2.4. Data collection techniques and instruments

A questionnaire is used as a data collection instrument to determine the degree of user satisfaction with the tool presented. On the other hand, a usability test is also carried out to identify the degree of conformity with this developed application in percentage terms.

2.5. Procedure

The CAMEL Method is used worldwide to analyze the operational performance of financial institutions considering six fundamental components: (i) C: Capital Adequacy, (ii) A: Asset Quality, (iii) M: Management, (iv) E: Earnings and (v) L: Liquidity.

The indicators calculated are the capitalization factor (FK), intermediation factor (FI), net capitalization index, and the coverage of non-performing assets. Also considered are the percentage of non-performing assets, credit quality, credit coverage, net financial margin absorption, operating efficiency, and administrative management. Return on assets (ROA), return on equity (ROE), liquidity ratio, adjusted liquidity ratio, and immediate liquidity ratio. The rating scale performs quantitative analyses of profitability, asset quality, liquidity and funding, asset/liability management, and capital. The qualitative analysis evaluates the industry, business, financial, and management risks. Finally, a traffic light is made depending on the level of liquidity, and the entity is rated according to the levels obtained.

3. Results

3.1. Developed System

3.1.1. System description

It consists of 13 Excel spreadsheets, through which we seek to analyze and detect promptly the risk caused by the delinquency levels in the savings and credit mutuals for housing in Ecuador. Fig. 1 shows the front page of the system.

Fig. 1. Front page of the system.

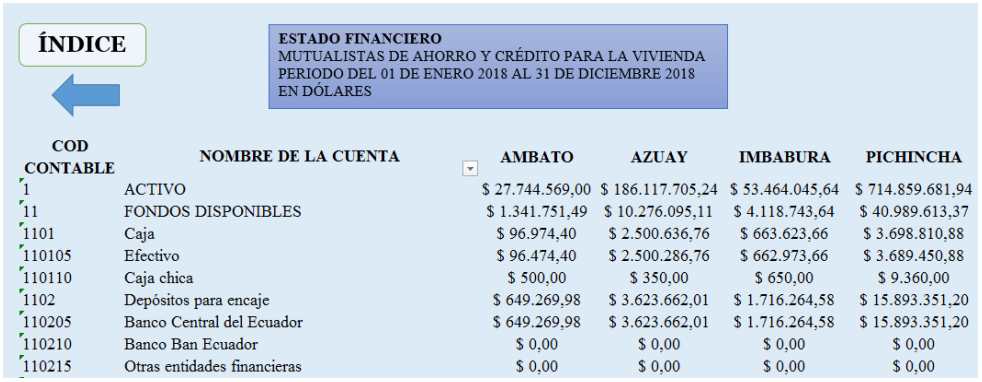
3.1.2. Table of contents

Fig. 2 shows the details of each tab contained in the arrears control system. In this way, the user has the facility to visualize the content using hyperlinks that facilitate access to each tab.

Fig. 2. Table of contents window.

3.1.3. Statement of financial position

Fig. 3 contains the statement of financial position (in thousands of dollars) obtained from the Superintendencia de Economía Popular y Solidaria (SEPS) web portal with data on the financial situation of savings and credit mutuals for 2018.



COD CONTABLE	NOMBRE DE LA CUENTA	AMBATO	AZUAY	IMBABURA	PICHINCHA
1	ACTIVO	$ 27.744.569,00	$ 186.117.705,24	$ 53.464.045,64	$ 714.859.681,94
11	FONDOS DISPONIBLES	$ 1.341.751,49	$ 10.276.095,11	$ 4.118.743,64	$ 40.989.613,37
1101	Caja	$ 96.974,40	$ 2.500.636,76	$ 663.623,66	$ 3.698.810,88
110105	Efectivo	$ 96.474,40	$ 2.500.286,76	$ 662.973,66	$ 3.689.450,88
110110	Caja chica	$ 500,00	$ 350,00	$ 650,00	$ 9.360,00
1102	Depósitos para encaje	$ 649.269,98	$ 3.623.662,01	$ 1.716.264,58	$ 15.893.351,20
110205	Banco Central del Ecuador	$ 649.269,98	$ 3.623.662,01	$ 1.716.264,58	$ 15.893.351,20
110210	Banco Ban Ecuador	$ 0,00	$ 0,00	$ 0,00	$ 0,00
110215	Otras entidades financieras	$ 0,00	$ 0,00	$ 0,00	$ 0,00

Fig. 3. Statement of financial position window.

3.1.4. Income Statement

Fig. 4 contains the statement of results (in thousands of dollars), which is also obtained from the SEPS web platform.

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ESTADO DE RESULTADOS
MUTUALISTAS DE AHORRO Y CRÉDITO PARA LA VIVIENDA
PERIODO DEL 01 DE ENERO 2018 AL 31 DE DICIEMBRE 2018
EN DÓLARES

COD CONTABLE	NOMBRE DE LA CUENTA	AMBATO	AZUAY	IMBABURA	PICHINCHA
5	**Ingresos**	$ 3.153.501,44	$ 18.135.323,07	$ 5.931.937,43	$ 81.638.860,52
51	Intereses y descuentos ganados	$ 2.905.244,55	$ 16.594.939,86	$ 5.117.832,28	$ 60.618.307,60
(-) 41	Intereses causados	$ 1.520.714,08	$ 6.945.727,30	$ 2.765.375,14	$ 28.844.520,28
	MARGEN NETO DE INTERESES	$ 1.384.530,47	$ 9.649.212,56	$ 2.352.457,14	$ 31.773.787,32
(+) 52	Comisiones ganadas	-	-	$ 517,32	$ 1.463.005,66
(+) 54	Ingresos por servicios	$ 66.006,29	$ 331.140,10	$ 377.187,40	$ 3.932.082,84
(-) 42	Comisiones causadas	$ 8.079,00	$ 126.779,40	$ 6.925,35	$ 320.455,84
(+) 53	Utilidades financieras	$ 21.203,38	$ 75.252,37	-	$ 2.967.839,59
(-) 43	Pérdidas financieras	$ 0,00	$ 53.855,78	-	$ 6.174.265,41
	MARGEN BRUTO FINANCIERO	$ 1.463.661,14	$ 9.874.969,85	$ 2.723.236,51	$ 33.641.994,16
(-) 44	Provisiones	$ 373.065,60	$ 828.959,06	$ 436.709,85	$ 6.127.181,37
	MARGEN NETO FINANCIERO	$ 1.090.595,54	$ 9.046.010,79	$ 2.286.526,66	$ 27.514.812,79

Fig. 4. Results status window.

3.1.5. Portfolio Composition

The entire loan portfolio composition is presented (Fig. 5) to obtain the total non-performing portfolio and the gross portfolio for the year 2018 of the mutual societies. These calculations will be used in the development of the indicators.

COMPOSICIÓN DE LA CARTERA

COD CONTABLE	NOMBRE DE LA CUENTA	AMBATO	AZUAY	IMBABURA	PICHINCHA
14	CARTERA DE CRÉDITOS	$ 18.507.776,57	$ 143.156.306,58	$ 40.099.758,37	$ 382.305.742,79
1401	Cartera de créditos comercial prioritario por vencer	$ 0,00	$ 4.529.480,69	$ 407.729,78	$ 65.131.826,67
140105	De 1 a 30 días	$ 0,00	$ 26.719,99	$ 11.871,33	$ 8.340.488,67
140110	De 31 a 90 días	$ 0,00	$ 53.571,88	$ 25.187,53	$ 16.496.216,07
140115	De 91 a 180 días	$ 0,00	$ 81.212,72	$ 29.670,40	$ 9.159.789,30
140120	De 181 a 360 días	$ 0,00	$ 169.149,95	$ 52.951,98	$ 6.745.019,54
140125	De más de 360 días	$ 0,00	$ 4.198.826,15	$ 288.048,54	$ 24.390.313,09
1402	Cartera de créditos de consumo prioritario por vencer	$ 5.132.293,45	$ 16.162.512,15	$ 18.493.203,40	$ 74.112.275,29
140205	De 1 a 30 días	$ 131.308,14	$ 2.143.807,87	$ 900.240,76	$ 15.889.097,78
140210	De 31 a 90 días	$ 227.240,14	$ 1.032.543,26	$ 1.104.902,54	$ 9.385.705,40
140215	De 91 a 180 días	$ 296.184,55	$ 1.247.704,14	$ 1.491.408,17	$ 7.888.146,97
140220	De 181 a 360 días	$ 547.119,85	$ 1.895.351,90	$ 2.686.617,51	$ 11.440.421,07

Fig. 5. Portfolio composition window.

3.1.6. Breakdown of assets and liabilities

As shown in Fig. 6, from the statement of financial position tab, the values of the accounts comprising liquid assets, demandable liabilities, gross unproductive assets, provisions, liabilities with cost, productive assets, and short-term deposits are obtained. These values are used to calculate the various indicators.

COMPOSICIÓN DE LA CARTERA

COD CONTABLE	NOMBRE DE LA CUENTA	AMBATO	AZUAY	IMBABURA	PICHINCHA
14	CARTERA DE CRÉDITOS	$ 18.507.776,57	$ 143.156.306,58	$ 40.099.758,37	$ 382.305.742,79
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Fig. 6. Assets and liabilities breakdown.

3.1.7. Indicator calculations

It indicates the criterion, the indicator, the type of indicator with its respective formula, the weighting per criterion, and the optimum. This can be established according to the degree of importance of each indicator, as shown in Figure 7.

Calidad de crédito	Porcentaje de activos improductivos	Cuantitativo	Activos improductivos netos / Total de los activos	16%	4%
	Calidad de crédito		Cartera vencida / Cartera bruta		7%
	Cobertura crediticia		Provisiones / Cartera vencida		5%
Gestión Operativa	Grado de absorción del margen financiero neto		Gastos Operativos / Margen financiero neto	18%	6%
	Eficiencia Operativa		Gastos Operativos / Total Activo		7%
	Manejo Administrativo		Activos productivos / Pasivos con costo		5%

Fig. 7. Methodology for calculating indicators.

3.1.8. Indicator Results

This window shows the indicators considered most important for measuring each criterion based on the CAMEL methodology, as shown in Fig. 8. This process was developed using the formulas established by the SEPS and has a traffic light. The red color indicates weakness; yellow indicates a regular state concerning the average; green indicates an optimal degree of the indicator.

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CRITERIO	INDICADOR	AMBATO	AZUAY	IMBABURA	PICHINCHA
Suficiencia de Capital	Indice de capitalización neta	5,80%	9,72%	6,68%	5,05%
	Cobertura patrimonial de activos improductivos	28,28%	57,37%	38,23%	20,08%
Calidad de crédito	Porcentaje de activos improductivos	26,94%	21,57%	22,65%	37,87%
	Calidad de crédito	0,78%	0,28%	0,92%	1,93%
	Cobertura crediticia	579,36%	766,14%	360,00%	186,07%
Gestión Operativa	Grado de absorción del margen financiero neto	109,16%	76,09%	92,61%	124,66%
	Eficiencia Operativa	4,29%	3,70%	3,96%	4,80%
	Manejo Administrativo	91,05%	99,12%	97,30%	77,77%
Rentabilidad	ROA	-0,16%	1,09%	0,51%	0,30%
	ROE	-1,94%	9,69%	5,70%	3,86%
Liquidez	Indice de liquidez	15,86%	16,35%	15,78%	7,01%
	Liquidez ajustada	15,42%	16,35%	16,56%	7,46%
	Liquidez inmediata	11,47%	9,51%	19,02%	10,20%

Fig. 8. Indicator results window.

3.1.9. Qualification

It is scored by indicator and criterion, using the weighting table above. This results in a numerical value that makes it possible to determine the range in which the mutual societies are found, as shown in Fig. 9.

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CRITERIO	INDICADOR	MUTUALISTA	PONDERACION	CALIFICACION POR CRITERIO	CALIFICACION METODOLOGÍA CAMEL
Suficiencia de Capital	Indice de capitalización neta	AMBATO	8,00%	17,33%	71,33%
	Cobertura patrimonial de activos improductivos		9,33%		
Calidad de crédito	Porcentaje de activos improductivos		2,67%	12,33%	
	Calidad de crédito		4,67%		
	Cobertura de crédito		5,00%		
Gestión Operativa	Grado de absorción del margen financiero		2,00%	12,33%	
	Eficiencia Operativa		7,00%		
	Manejo Administrativo		3,33%		
Rentabilidad	ROA		2,00%	3,33%	
	ROE		1,33%		
Liquidez	Indice de liquidez		10,00%	26,00%	
	Liquidez ajustada		8,00%		
	Liquidez inmediata		8,00%		

Fig. 9. Ambato mutual society rating.

3.1.10. Weighting

A weighting is established according to the traffic light system, where red has a value of 1 point, yellow equals 2 points, and the green represents 3 points. Fig. 10 shows the values obtained by each mutual society.

CRITERIO	INDICADOR	AMBATO	AZUAY	IMBABURA	PICHINCHA
Suficiencia de Capital	Indice de capitalización neta	2	3	2	2
	Cobertura patrimonial de activos improductivos	2	3	3	2
Calidad de crédito	Porcentaje de activos improductivos	2	2	2	1
	Calidad de crédito	2	3	2	1
	Cobertura crediticia	3	3	2	1
Gestión Operativa	Grado de absorción del margen financiero neto	1	2	2	1
	Eficiencia Operativa	3	2	2	3
	Manejo Administrativo	2	3	3	2
Rentabilidad	ROA	1	3	3	2
	ROE	1	3	3	2
Liquidez	Indice de liquidez	3	3	3	2
	Liquidez ajustada	3	3	3	2
	Liquidez inmediata	2	2	3	2

Fig. 10. Weighting of mutual society ratings.

3.1.11. Ranking and Heat Map.

Fig. 11 shows the rating of each mutual society depending on the established limits. Considering the five indicators (credit quality, credit coverage, and liquidity and their proxies), the levels of delinquency and liquidity are analyzed. An early warning system is used to avoid risks, as shown in Fig. 12.

CALIFICACION	LIMITE INFERIOR	LIMITE SUPERIOR
AAA	>=85%	100%
AA	>=70%	<85%
A	>=60%	<70%
BBB	>=50%	<60%
BB	>=45%	<50%
B	>=40%	<45%
C		<40%

	CALIFICACION
AMBATO	71,33%
AZUAY	90,33%
IMBABURA	86,33%
PICHINCHA	61,67%

Fig. 11. Ranking of mutual societies.

INDICADOR	MUTUALISTA AMBATO	AZUAY	IMBABURA	PICHINCHA	PROMEDIO
Calidad de crédito	0,78%	0,28%	0,92%	1,93%	0,98%
Cobertura crediticia	579,36%	766,14%	360,00%	186,07%	472,89%
Liquidez	15,86%	16,35%	15,78%	7,01%	13,75%
Liquidez ajustada	15,42%	16,35%	16,56%	7,46%	13,95%
Liquidez inmediata	11,47%	9,51%	19,02%	10,20%	12,55%

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Fig. 12. Heat map of the mutual societies.

4. Discussion

Financial institutions must manage their resources sufficiently to make them available immediately in case of possible liquidity risk. Each organization must have alert mechanisms that help detect and analyze its liquidity and how much it is affected by the lack of payment of loans granted. This affects delinquency levels and therefore causes a decrease in liquidity levels.

Not only is there a risk in granting loans, but also in the financial crises that may occur. For example, in 1999, Ecuador was hit by a banking crisis due to previous events that were not detected in time. This event demonstrates the need and importance of creating mechanisms or tools that allow early warning of these events so that senior management and different executives can analyze, make the best decisions, and be prepared to face this type of event. The United States Federal Reserve (FED) developed the CAMEL rating system used in this research.

The proposal developed will be used as a support tool since it is based on a financial evaluation system that has been validated for over five decades. It will be easier to know the performance behavior of savings and credit mutual societies, given the need to provide them with financial instruments to make timely and early decisions and obtain early warnings of delinquency levels through a heat map. Public information supplied by SEPS was used, including financial statements such as balance sheets and profit and loss statements. The various indicators of the CAMEL method were also included, which will be linked to the information provided in the financial statements through hyperlinks. This offers incredible speed in the calculation since it is generated automatically. The indicators to be applied are divided into five areas: capital adequacy, asset quality, administrative management, profitability, and liquidity risk.

A tool was generated to help senior management of savings and credit mutual societies to analyze their performance. Given the object of the study, special attention was given to accounts related to the loan portfolio. In addition, it will help detect high delinquency levels in time and apply corrective measures to avoid a decrease in liquidity levels, analyzing the components and indicators of the CAMEL methodology. A heat map helps to detect risk timely through credit quality, credit coverage, and liquidity indicators to make decisions that benefit financial institutions, improving their strategies and generating greater confidence and security for their members.

The main limitation of this study is that the tool is still in the testing phase since the methodology may not be adapted to all institutions. Therefore, it is proposed as future work to carry out more tests in other financial institutions and to be able to carry out a current and future analysis to determine if there was an improvement in the processes.

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Informed Consent Statement

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Conflicts of Interest

The author declares that they have no conflict of interest.

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