

Modeling and Analysis of Business Failures: Application to Moroccan SMEs

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Abstract Business failure is undoubtedly one of the most raised issues in the field of business management. Small and medium-sized enterprises (SMEs) play an important economic role in many countries, especially in developing countries. In Morocco, for example, they make up more than 90% of Moroccan companies and contribute around 50% to job creation and considerably to value-added. But despite this, most of them are at risk of default and there is very little research and empirical research on this topic in Morocco, as in many developing countries. This work aims to contribute to the understanding of the determinants of business failure using the chi-square independence test. The goal is to explain but also to explain a methodology that can be applied to explain business failures by determining their internal factors. Our empirical results seem to support the claim that the main cause of such failures lies in the absence of a strategic vision and managerial knowledge and culture among SME managers.

Keywords: SME failure, chi-square test, Gharb Chrarda Beni Hssen, Kenitra province

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1. Introduction

Business failure is undoubtedly one of the most raised issues in the field of business management. Small and medium-sized enterprises (SMEs) play an important economic role in many countries, especially in developing countries. Their contributions to the job creation and added value are considerable. But despite this, most of them are at risk of default and there is very little research and empirical research on this topic in Morocco, as in many developing countries.

In the case of Morocco, recent years have witnessed a worrying increase in the number of defaults given the difficult economic situation faced by Moroccan SMEs and in view of the slowdown in growth, the tightening of margins due to competition, the lack of funding, etc., in addition to internal dysfunctions related to management as a whole. In 2014, the country broke its default record and is listed in the international ratings among the countries with the largest failures.

For this reason, the present paper proposes to analyze and to determine the factors which are at the origin of these failures and this, through a modeling applied in the Moroccan context, in particular with the SMEs of the region of Gharb Chrarda Beni Hssen (Kenitra province). In this sense, it is an extension of the similar work applied

to other contexts, European and Anglo-Saxon, including Belgian SMEs [1], French [2,3], British [4], Canadian [5], etc.

Given its empirical vocation, our work aims to be, on the one hand, an empirical verification of failure factors sufficiently understood in the existing literature, and, on the other hand, an empirical validation of the failure factors found in the literature other contexts. Because some determinants may be found in some regions and not in others, for some categories of business, but not necessarily for others, depending on the characteristics of each context. The choice of the Moroccan context is necessary because of the very high number of failures in the country, which makes such a study urgent.

The goal is both to enrich scientific research given the originality of our work and to attract the attention of SME leaders on a set of determinants and factors that can alert them to the symptoms of failure. In both cases, our contribution is of definite interest both academically and professionally.

Therefore, the problematic that we will try throughout this research to bring elements of answers: "How could one explain the failure of SMEs in the Moroccan context?". Thus, some secondary and constitutive questions of the problematic are necessary: What are the theoretical explanatory approaches of the failure? And what are the most explanatory factors of the failure of SMEs in Morocco?

To do this, we propose to follow the following plan. As a first step, we will return to the existing literature on business failures. In a second step, we will explain our methodological approach. Finally, we will present the results and discuss their findings and interpretations.

2. Literature Review and Research Hypotheses

The analysis of business failures has been the subject of a great deal of work since authors and researchers became interested in this phenomenon, which became a field of investigation in its own right after the crisis of the 1930s [6]. There are numerous factors which, from a theoretical point of view, seem to be the most explanatory of failure. In what follows, we will focus our attention particularly on the factors related to the "business management" dimension.

Indeed, a review of the literature on business failure has allowed us to identify some of its determinants. These will be presented successively with their respective hypothesis.

Hypothesis 1: "The stable job coverage rate of permanent funds (X1) may explain the failure of the company (Y)"

Indeed, one of the most frequently cited causes of failure in the literature is the existence of an unbalanced financial structure that reveals the need for stable resources to finance stable jobs in the firm [3,7]. In our case, we consider that the Fixed Asset Coverage Rate reflects the company's ability or inability to finance stable employment.

Hypothesis 2: "The liquidity of the company (X2) is an explanatory factor of the default (Y)"

Such a situation is often the result of a persistent imbalance between resources and costs from the operating cycle. This explanation is advanced by several authors including Newton [8], Martinet [9], Laitinen [10], Gerard [11], Back et al. [12], and Jabeur [3]. Thus, we can assess the general level of liquidity through the ratio of general liquidity that reflects a need (greater than 1) or surplus working capital (less than 1) of the company.

Hypothesis 3: "The debt capacity (X3) is likely to explain the failure of the company (Y)"

The impossibility for the company to obtain external funds because of the mistrust of its lenders leads it to default. This is found in the works of Argenti [13], Ooghe and Van Wymeersch [14], Marco [15], and Crutzen [16]. This capacity is largely dependent on the financial autonomy of the company, that is to say, the weight of the debt in its financial structure. Reason why, we consider the leverage ratio can be of significant relevance in the translation of such capacity.

Hypothesis 4: "The financial profitability (X4) is a factor explaining the failure of the company (Y)"

The lack of financial profitability is synonymous with the lack of profit for the capital providers. The latter can no longer ensure by the success of the company their own enrichment can decide the dissolution of it. This factor seems more discriminating according to the work of Matoussi et al. [17]. To assess the level of profitability, we will stick to the financial profitability ratio.

Hypothesis 5: "Economic profitability (X5) explains the failure of the company (Y)"

The lack of profitability of the economic asset is often mentioned as a factor of failure. Thus, this factor seems more significant in discriminant analyzes since healthy companies report good profitability [3,17], in contrast to companies in a state of default. We then consider that the economic profitability ratio is best placed to reflect the level of this profitability.

Hypothesis 6: "Commercial profitability (X6) can explain business failure (Y)"

Indeed, there is a set of commercial factors that can explain the failure of the company as the poor understanding of the needs and expectations of customers, the inadequacy of supply, the inadequate positioning on the market, the strength sales, etc. These factors, therefore, are at the root of misbehavior in the field of commercial policy and may explain the lack of commercial profitability and therefore the failure of the enterprise [14,18,19,20].

Hypothesis 7: "Customer Delays (X7) May Explain Business Failure (Y)"

It happens that some companies grant too many debts in order to satisfy its customers. This is obviously done to the detriment of its cash flow and its financial balance, which reveals the need for financing on the one hand, and the risk of default related to the failure of a customer (domino effect) on the other hand [3]. Thus, granting too many receivables can result from a weak bargaining power of the company which puts it in a weak position vis-à-vis its partners (customers). In our model, this assumption will be tested through the receivables ratio.

3. Methodological Approach

In this part, we will explain the methodology followed which we will decline in three points, namely: sampling, variables of the model and statistical test adopted.

3.1. Sample

Our methodological approach is to study a sample of SMEs in the Gharb Chrarda Beni Hssen region (Kenitra province). Specifically, we observed a sample of 62 SMEs located mainly in the Kenitra province.

Half of the sample is composed of companies in a state of legal default and companies in activity. We have also ensured that the sample does not include start-ups with less than five years of exercise and a natural risk of failure, to avoid the "age effect". We have also tried to ensure that the sample is as representative as possible of the economic fabric of the region to eliminate the "sector" effect. For each of the companies observed, we took data on the ratios considered as variables of our statistical test. This data was collected from accounting firms, auditors and legal advisers.

3.2. Variables

It is, first, the variable that we seek to explain, namely the failure. It is a qualitative variable that takes a binary form depending on the presence or absence of the "default" state for each of the companies in the sample.

Table 1. List of ratios taken as explanatory variables

Ratio	Definition	Type	Formula
R1	Fixed Asset Coverage Rate by Permanent Funds (TCF)	Financing Ratio	Permanent capital / Fixed assets
R2	Ratio of General Liquidity (RLG)	Liquidity Ratio	Current assets / Circulating liabilities
R3	Financial Leverage Ratio (RLF)	Financing Ratio	Term Debt / Equity
R4	Return on Investment Ratio (ROE)	Ratio of Profitability	Net income / equity
R5	Economic Ratio of Ratio (RoA)	Ratio of Profitability	Net income / total assets
R6	Ratio of Commercial Profitability (RoS)	Ratio of Profitability	Net Result / Turnover
R7	Customer Credit Ratio in days (CC2)	Management Ratio	(Accounts receivable / sales tax incl. VAT) × 360

Then, we have used as independent variables seven balance sheet ratios which we try to test their explanatory power of failure. These ratios are also the most representative of the economic and financial health of the company. They are summarized in the Table 1.

3.3. Statistical Tests Adopted

We tested the research hypotheses by following, initially, a bivariate model in which we test the significance of each of the variables X (the ratios R1, ..., R7) compared to the variable Y (failure). To do this, we applied the chi-square independence test.

In a second step, we tried to confirm our results by a multivariate model notably by applying the binomial logistic regression model. At the end of this one, we arrive at the following equation under which will be expressed the results of this test of modeling applied to the failures of companies:

$$Y' = \text{Log} \left[\frac{P(Y)}{1-P(Y)} \right] \quad (1)$$

$$= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_z X_z.$$

4. Analysis of the Results

After explaining our methodology, we will present in this part the results of our modeling.

4.1. Results of the Chi-square Independence Test

The link Rate of Coverage by Permanent Funds and Failure: Hypothesis H1 postulates that: "The stable coverage rate of jobs by the permanent funds (X1) can explain the failure of the company (Y)". The Chi-square independence test is used to study the link between the "default" variable and the "Permanent Fund Coverage of Assets" variable. Dependence is significant at the 5% level. Thus, the theoretical χ^2 is 0.0039, which is less than the calculated χ^2 28.18. This result suggests that the variable TCF explains the variable "failure". The values of Phi and V of cramer indicate that this bond is quite strong (67%). As a result, the null hypothesis (H0.1) is rejected and the hypothesis H1 is verified.

The link General Liquidity and Default:

This test hypothesis H2 for which: "The liquidity of the company (X2) is an explanatory factor of the failure (Y)". Here, the Chi-square test intends to test the link between the "default" variable and the "General Liquidity" variable. It appears that the dependence is not significant at the 5%

threshold and that the theoretical χ^2 is 0.0039, which is less than the calculated χ^2 53.6. In addition, this association is quite strong with association strength of 66%. We can conclude that the variable RLG, too, explains the "failure" of the company. Therefore, the null hypothesis (H0.2) is rejected and the hypothesis H2 is verified.

RLF and Failure:

This hypothesis (H3) assumes that: "The debt capacity (X3) is likely to explain the failure of the firm (Y)". It appears that the result confirms the existence of an addiction. Indeed the value of p (= 0.000) is quite below the risk threshold of 5%. On another plane, the theoretical χ^2 is 0.0039 and is less than the calculated χ^2 32, which favors the confirmation of the hypothesis in question. In addition, the strength of association is high and is significant. So, we can conclude that the variable RLF is in turn explains the variable "failure".

Therefore, the null hypothesis (H0.3) is rejected, the hypothesis H3, for its part, is validated.

ROE and Failure:

We now test hypothesis 4 which states that "Financial profitability (X4) is a factor explaining the failure of the company (Y)". The present test intends to verify this hypothesis by studying the independence between the variable "default" and the variable "Financial Profitability ROE". The result shows that this link is significant since the value of p (= 0.00) is lower than the risk threshold. Thus, the theoretical χ^2 is 0.0039, which is less than the calculated χ^2 13.37. This result shows that the variable ROE explains the variable "failure". Therefore, the null hypothesis (H0.4) is refuted and hypothesis H4 is admitted.

ROA and Failure:

This is test hypothesis H5 postulating that "The economic profitability (X5) explains the failure of the company (Y)". It appears that the result confirms the existence of an addiction. Indeed the value of p (= 0.00) is significant at the risk threshold of 0.05. In addition, the theoretical χ^2 is 0.0039 and is less than the calculated χ^2 14.88. This result leads us to conclude that the variable ROA explains the variable "failure".

Therefore, the null hypothesis (H0.5) is refuted, the hypothesis H5, for its part, is accepted.

ROS and Failure:

We test the last hypothesis H6 for which "The commercial profitability (X6) can explain the failure of the company (Y)". The Chi-square test shows a dependency between failure and commercial profitability since the asymptotic significance is below the threshold of 0.05. The theoretical χ^2 (= 0.0039) is much lower than the calculated χ^2 (= 18.083). So, hypothesis H6 is validated.

Table 2. Khi-2 test

	Value	ddl	Asymptotic significance (bilateral)
Khi-2 of Pearson	28,182 ^a	1	,000
Correction for the continuity ^b	25,434	1	,000
Report of likelihood	32,828	1	,000
Nominal per nominal Phi	0,6742		,000
V of Cramer	0,6742		
Number of valid observations	62		

a. 0 cells (0.0%) have a theoretical size of less than 5.
b. Calculated only for a 2x2 board

Table 3. Khi-2 test

	Value	ddl	Asymptotic significance (bilateral)
Khi-2 of Pearson	27,395 ^a	1	,000
Correction for the continuity ^b	24,588	1	,000
Report of likelihood	35,032	1	,000
Nominal per nominal Phi	0,665		,000
V of Cramer	0,665		
Number of valid observations	62		

a. 0 cells (0.0%) have a theoretical size of less than 5.
b. Calculated only for a 2x2 board

Table 4. Khi-2 test

	Value	ddl	Asymptotic significance (bilateral)
Khi-2 of Pearson	32,904 ^a	1	,000
Correction for the continuity ^b	29,980	1	,000
Report of likelihood	38,523	1	,000
Nominal per nominal Phi	0,728		,000
V of Cramer	0,728		
Number of valid observations	62		

a. 0 cells (0.0%) have a theoretical size of less than 5.
b. Calculated only for a 2x2 board

Table 5. Khi-2 test

	Value	ddl	Asymptotic significance (bilateral)
Khi-2 of Pearson	13,373 ^a	1	,000
Correction for the continuity ^b	11,052	1	,001
Report of likelihood	17,641	1	,000
Nominal per nominal Phi	0,464		,000
V of Cramer	0,464		
Number of valid observations	62		

a. 0 cells (0.0%) have a theoretical size of less than 5.
b. Calculated only for a 2x2 board

Table 6. Khi-2 test

	Value	ddl	Asymptotic significance (bilateral)
Khi-2 of Pearson	14,880 ^a	1	,000
Correction for the continuity ^b	12,503	1	,000
Report of likelihood	19,544	1	,000
Nominal per nominal Phi	0,49		,000
V of Cramer	0,49		
Number of valid observations	62		

a. 0 cells (0.0%) have a theoretical size of less than 5.
b. Calculated only for a 2x2 board

Table 7. Khi-2 test

	Value	ddl	Asymptotic significance (bilateral)
Khi-2 of Pearson	18,083 ^a	1	,000
Correction for the continuity ^b	15,592	1	,000
Report of likelihood	23,551	1	,000
Nominal per nominal Phi V of Cramer	0,49 0,49		,000
Number of valid observations	62		
a. 0 cells (0.0%) have a theoretical size of less than 5.			
b. Calculated only for a 2x2 board			

Table 8. Khi-2 test

	Value	ddl	Asymptotic significance (bilateral)
Khi-2 of Pearson	23,290 ^a	1	,000
Correction for the continuity ^b	20,903	1	,000
Report of likelihood	25,026	1	,000
Nominal per nominal Phi V of Cramer	0,613 0,613		,000
Number of valid observations	62		
a. 0 cells (0.0%) have a theoretical size of less than 5.			
b. Calculated only for a 2x2 board			

ROS and Failure:

We test the last hypothesis H6 for which "The commercial profitability (X6) can explain the failure of the company (Y)". The Chi-square test shows a dependency between failure and commercial profitability since the asymptotic significance is below the threshold of 0.05. The theoretical χ^2 (= 0.0039) is much lower than the calculated χ^2 (= 18.083). So, hypothesis H6 is validated.

Accounts receivable and Default:

Hypothesis 7 postulates that: "Customer delays (X7) can explain business failure (Y)". Thus, the present test intends to verify this hypothesis by studying the independence between the "default" variable and the "CC2 Receivables" variable. The result shows that this link is not significant since the value of p (= 0.00) is less than the significance level of 5%. Thus, the theoretical χ^2 is 0.0039, which is much lower than the calculated χ^2 23.9, which confirms the existence of a link between these two variables. Thus, the strength of association (= 61.3%) is significant. So, variable CC2 explains the variable "failure". As a result, the null hypothesis (H0.7) is rejected. In contrast, hypothesis H is confirmed.

4.2. Results of Logistic Regression

In this case and as we seek to regress the variable Y on several independent variables, there is the risk that they

present colinearities between them and, therefore, reflect the same information (redundancy of information), which could limit the logistic regression model. However, to overcome this limitation, the correlation matrix makes it possible to evaluate the degree of bilateral dependence between the variables. This matrix, symmetrical, is in the form of a table containing the different possible correlation coefficients between said variables. The closer the coefficients are to the extreme values 1 and -1, the higher the risk of multicollinearity (redundancy of information). On the other hand, the closer these coefficients are to 0, the less correlated they are. In our case, the test results are as follows in Table 9.

These results show that some variables are strongly linked and others are moderately dependent. In particular, this is a correlation (in the opposite direction, anti-correlation) and mean between CC2 and ROA (-49.1%) and ROE and CC2 (-52.7%). It also appears that the variable CC2 presents a risk of colinearity at the 5% threshold at which we will test our hypotheses. For this reason, we will exclude from the model the variable CC2 to which we also add RFL since it is perfectly de-correlated with all the variables of the model, which could, of course, affect the quality of the model. Therefore, the hypotheses H3 and H7 will not be tested. As for the other variables, they have weak correlations and, therefore, will be kept in the implementation of the model.

Table 9. Correlation Matrix

	TCF	RLG	RLF	ROE	ROA	ROS	CC2
CC2	1,000						
CC2	-,430	1,000					
CC2	,000	-,001	1,000				
CC2	-,066	-,051	,000	1,000			
CC2	-,194	,322	,000	,366	1,000		
CC2	,000	-,001	,000	,002	,000	1,000	
CC2	,334	-,253	,000	-,527	-,491	-,001	1,000

In addition to the multicollinearity test and after eliminating two variables, it seems equally important to test the validity of the model with the variables selected. In fact, in logistic regression and in order to be able to explain the studied phenomenon effectively, it is necessary to have a large sample. In the opposite case, the results will be limited in scope, which could be a limit to the model used. In practice, the rule is that for each explanatory variable, at least 5 to 10 observations will be needed. In our case, we selected five variables, a minimum of total observations between [25];50]. And since we performed 62 observations, the minimum number required for logistic regression modeling was satisfied.

By now analyzing the variables according to the logistic regression model, in particular the backward method which removes non-significant variables according to their likelihood ratio, the results are as follow in Table 10.

Based on the elimination of the variables on the likelihood ratio, it follows from these results that it is always the two variables namely TCF and ROS that significantly explain the failure at the 0.05 threshold. The equation of the model is as follows:

$$Y' = 0.163 + 0.364TCF + 0.097ROE + 0.024ROS.$$

Like conditional statistics, these variables have a negative effect on the Y variable. Exp (B) of the parameters suggests that, on the one hand, the increase in the coverage rate by the permanent funds (R1) of a unit

leads to decreasing the probability of failure by 0.364 times, and increasing the commercial profitability of a unit reduces the probability of failure by 0.024. This result corresponds in part to the ones we presented above, which confirms the hypotheses H1 and H6, and invalidates the hypotheses H2, H4 and H5.

4.3. Comparison and Summary of the Results

Throughout this section on business failure modeling, we used two tests and therefore obtained two results that should be compared to draw the final conclusions. The table below shows all the results obtained according to the methods followed.

Our results show that the lack of commercial profitability has an important explanatory factor in the analysis of the failures of SMEs in our region. This could be due to the decline in turnover of these companies which itself could be explained by:

- The intensity of competition [21];
- Loss of market share;
- The bad positioning on the market;
- The lack of accuracy of forecasts [13,22];
- Demotivation of the sales team [23];
- Price policy [18];
- Customer infidelity due to competitive intensity;
- Customer dissatisfaction;
- Poor understanding of expectations needs [23];
- The absence of a commercial policies.

Table 10. Variables in the equal

	A	E.S.	Wald	Ddl	Sig.	Exp(B)
Step 1 ^a	TCF	-,812	,501	2,623	1	,105
	ROE	-3,138	2,437	1,658	1	,198
	ROA	-2,148	2,934	,536	1	,464
	ROS	-2,644	1,940	1,856	1	,173
	RLG	-,228	1,149	,039	1	,843
	Constant	-1,620	1,176	1,897	1	,168
Step 2 ^a	TCF	-,791	,538	2,166	1	,141
	ROE	-2,545	2,151	1,401	1	,237
	ROS	-3,354	1,847	3,298	1	,069
	RLG	-,667	1,825	,134	1	,715
	Constant	-1,132	1,222	,857	1	,355
Step 3 ^a	TCF	-1,010	,450	5,040	1	,025
	ROE	-2,328	2,036	1,308	1	,253
	ROS	-3,749	1,694	4,896	1	,027
	Constant	-1,816	,783	5,374	1	,020

a. Variable (s) entered in Step 1: TCF, ROE, ROA, ROS, RLG.

Table 11. Summary of results

Hypotheses	variables	Bivariate model (T- χ^2)	Multivariate Logistic Model (R.Likelihood)
H1	TCF	Validated	Validated
H2	RLG	Validated	Rejected
H3	RLF	Validated	Not tested
H4	ROE	Validated	Rejected
H5	ROA	Validated	Rejected
H6	ROS	Validated	Validated
H7	CC2	Validated	Not tested

As well as other factors that can be summarized in the absence of good conduct in terms of policy, or management, commercial.

In addition to commercial profitability, the lack of permanent funds (reflected in the TCF) to cover the investment cycle of the company, and possibly its operating cycle in the event of excess working capital, explains significantly the failure of the company as this obviously causes a persistent financial imbalance in these companies. Such a situation could also be explained by:

- The difficulties related to external financing [3];
- The tightening of credit conditions (guarantee requirement for example) and the reluctance of Moroccan banks to finance SMEs;
- The absence of a compartment dedicated to SMEs in the financial market (note that a project to launch this compartment is underway);
- The manager's reluctance to use external / banking financing for religious and cultural factors (risk aversion);
- Balance sheet imbalance [7];
- The absence of a financial and accounting policy [7].

Although these explanations are not exhaustive, it seems that an explanation holds our attention. This is essentially the absence of a business management culture. Indeed, most SME managers still manage in the traditional way and do not have a managerial culture or a strategic vision of their business. Hence the lack of financial and accounting information, monitoring of the financial and economic state of the company, sectoral and market studies to adapt to changes in the environment, etc.

5. Conclusion

After this empirical examination of the problem of failure, we can conclude that all the variables tested explain the failure. This is due to the fact that the failing companies report misbehavior in the area of commercial policy (poor market positioning, poor understanding of the needs and expectations of customers, the problem of accurately forecasting the evolution of demand, prices, etc.) [18,19,20], but also in financial and investment do not generate enough profitability, which joins and confirms the work of the authors cited.

In response to the problem, we can say that the failure is mainly attributed to the lack of a business management culture among SME managers. They still manage in the traditional way without tools, indicators, or even financial and accounting systems that can feed into their decision-making system or, at least, inform them in their choices.

Thus, the main contributions of our work are at two levels: academic and professional. With regard to the first, our work proposes to contribute to the understanding of a phenomenon little apprehended in the academic world and whose existing contributions, few in fact, are limited to the theoretical aspect of the question without as much to go to an empirical verification applied to the Moroccan context. Regarding the latter, this work would be very useful for business leaders, consulting firms and consultants wishing to arm themselves with forecasting tools and / or prevention of business failures. In this sense, the factors we identified would be used to develop dashboard indicators to alert managers to symptoms of

failure. In any case, the present work is of a certain contribution as well on the academic level, as professional.

However, such contributions should not overshadow the inherent limits, or even specific to any contribution that is meant to be scientific. First and foremost, we mention the unavailability of certain information (lack of free access databases on this subject) and the confidential nature of the data we needed (access to corporate balance sheets), which explains why the refusal of certain institutions to give us access to their documentation. Added to this are the limited size of our sample, especially by sector, which would have obviously played on the statistical tests conducted, and the non-exhaustive nature of the ratios taken as variables in this work.

Reasons why, we consider that these limits are remediable by proposing in particular some ways of future research on this subject. For improvement purposes, it would be interesting to increase the size of this sample to include several sectors and regions of the realm. For deeper purposes, we propose, on the one hand, to widen the choice of independent variables by integrating, in addition to those used, other quantitative variables such as productivity, margin and value-added ratios, rotation, etc. but also qualitative such as the death of the principal partner, conflicts between partners, etc. On the other hand, it is important to deepen the issue of defaults by focusing on a particular sector, the sector where the failures are the most, for example.

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