

Bank Marketing Campaign

Analysis Report

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1. Introduction

This report analyses the publicly available dataset of the bank's marketing campaign.

The Python programming language with various libraries was used for the analysis, and creation of Machine Learning models to predict the outcomes of the marketing campaign.

The goal of this analysis is to find the parameters that are the most important for obtaining successful results and creating a ML model that can predict with high accuracy which clients will decide to subscribe to a term deposit.

Separately, in addition to this report, Tableau graphs and charts are created.

2. Data Information

The data is related to the direct marketing campaign of a Portuguese banking institution. The marketing campaign was based on phone calls. Often, more than one contact to the same client was required, to access if the product (bank term deposit) would be Yes or No.

A term deposit is a fixed-term investment that includes the deposit of money into an account at a financial institution.

This dataset is publicly available for research. The details are described in [Moro et al., 2014] S. Moro, P. Cortez and P. Rita. *A Data-Driven Approach to Predict the Success of Bank Telemarketing. Decision Support Systems, Elsevier, 62:22-31, June 2014.*

Dataset description

	Description	Possible	Notes	
age		Numeric		
job	Type of job	Categorical	admin, blue collar, entrepreneur, housemaid, management, retired, self-employed, services, student, technician, unemployed, unknown	
marital	Marital Status	Categorical	divorced, married, single, unknown	Divorced means divorced or widowed
education		Categorical	primary, secondary, tertiary, unknown	
default	Has credit in default	Categorical	yes, no, unknown	
balance	Average yearly balance, in EUR	Numeric		
housing	Has housing loan	Categorical	yes, no, unknown	
loan	Has personal loan	Categorical	yes, no, unknown	
contact	Contact communication type	Categorical	cellular, telephone, unknown	
day	Last contact day of the month	Numeric		
month	Last contact month of year	Categorical	jan, feb, mar, apr, may, jun, jul, aug, sep, oct, nov, dec	
duration	Last contact duration, in seconds	Numeric		
campaign	Number of contacts performed during this campaign and for this client	Numeric		
pdays	Number of days that passed by after the client was last contacted from a previous campaign	Numeric		
previous	Number of contacts performed before this campaign and for this client	Numeric		
poutcome	Outcome of the previous marketing campaign	Categorical	failure, success, unknown, other	
y	Has the client subscribed a term deposit	Categorical	yes, no	Output variable

3. Data Analysis

General Information

The dataset contains 45.211 rows of data, ie data on 45.211 bank clients of which 5.169 subscribed term deposits. The average age is 41 years with a minimum of 18 years and a maximum of 95 years.

The average balance is 1.362,72 EUR where the minimum value is -8.019,00 € and the maximum value 102.127,00 EUR. The median balance is 448,00 EUR.

The average duration of phone calls is 258 seconds and the client is on average basic contacted 3 times.

There are no missing and duplicated values.

Balance and Deposit

Clients with a higher account balance are likely to deposit.

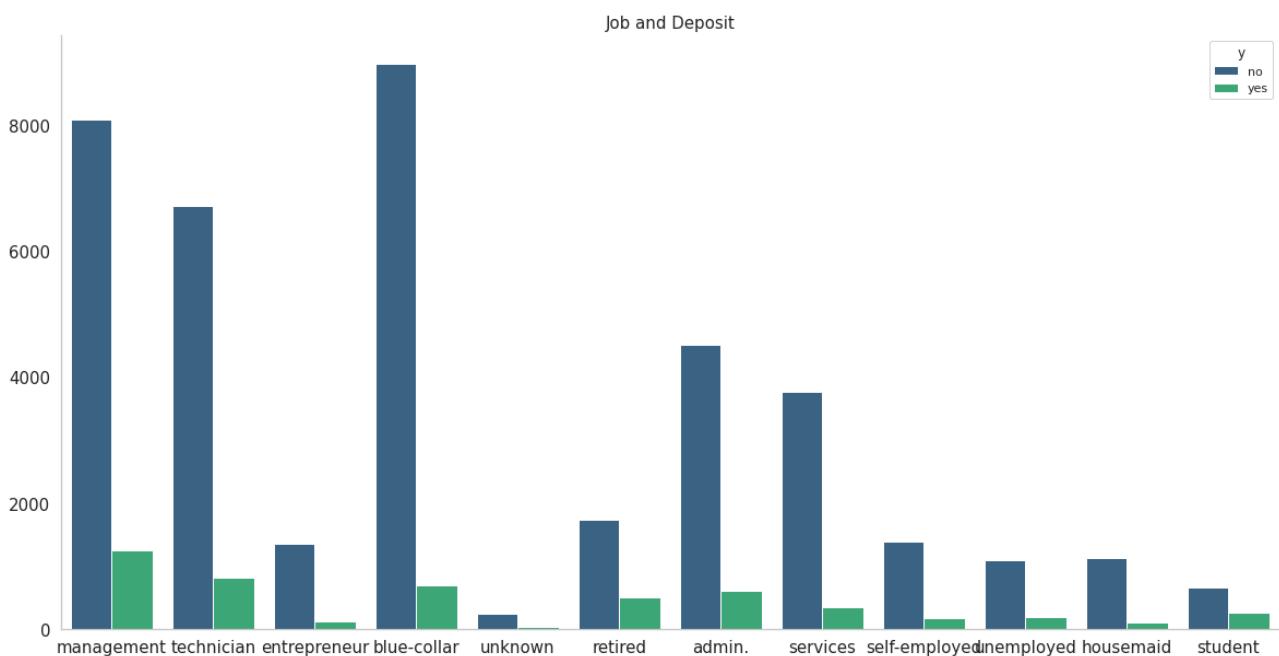
Range	Yes	No	%
< 1000	2971	27399	9,78%
1.000 - 2.000	812	5259	13,38%
2.000 - 5.000	950	4667	16,91%
> 5.000	431	2386	15,30%
Total	5164	39711	11,51%

Job and Deposit

The top three most contacted are *blue-collar*, *management*, and *technician*. From the graph above we can see that the *blue-collar* job are unlikely to subscribe to a term deposit. In general, not only from the top three contacted. A similar case is with a *technician* job.

On the other hand, *students* are the least contacted but we can see that they are more likely to subscribe to a deposit. As well as *retired* where the chance of subscribing the deposit is higher than other jobs such as *services* or *entrepreneur* etc.

We have seen earlier that the likelihood that the client will make a deposit is higher when the balance is higher, and more briefly we can see in the table, below with the average account balance by client's job. Blue-collar is the most contacted, but from the table we can see that they are one of those who have the least account balance on average basic. Students have a higher average balance and they are more likely to subscribe to a term deposit, therefore more time could be devoted to them, or retired who have a high average balance and a decent percentage of those who made a term deposit.



Job	Average Balance
Retired	1.987,22
Unknown	1.769,34
Management	1.753,68
Self-employed	1.652,75
Entrepreneur	1.523,51
Unemployed	1.522,10
Housemaid	1.394,45
Student	1.381,15
Technician	1.251,65
Admin.	1.129,14
Blue Collar	1.078,69
Services	996,34

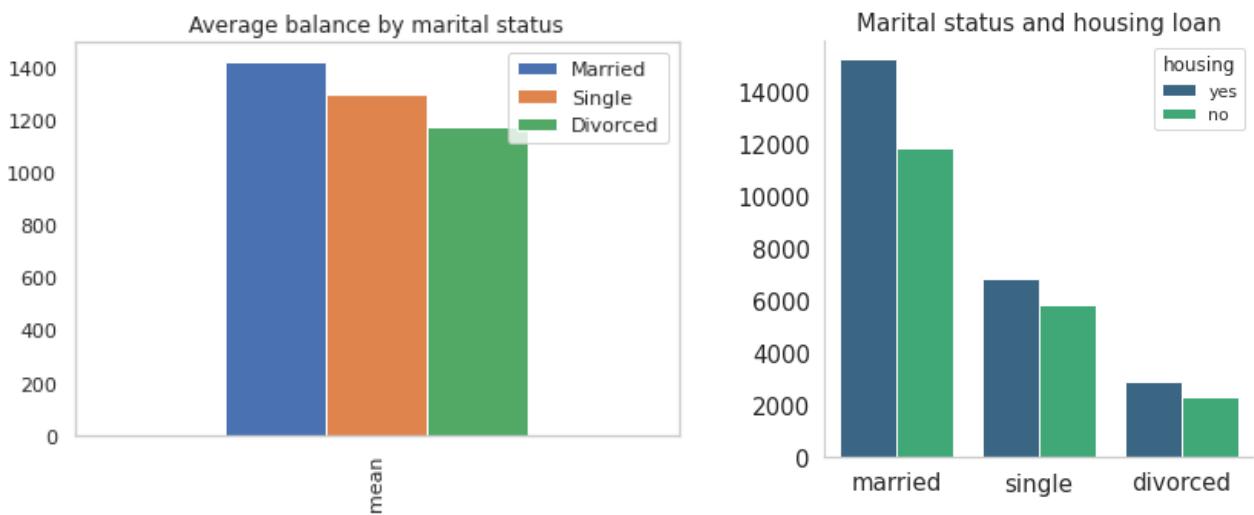
Marital and Deposit

Married clients are contacted more than twice as singles, but 11% of them decided to make a deposit compared to singles of which 17% made a deposit.

Divorced are also less likely to subscribe, 13%.

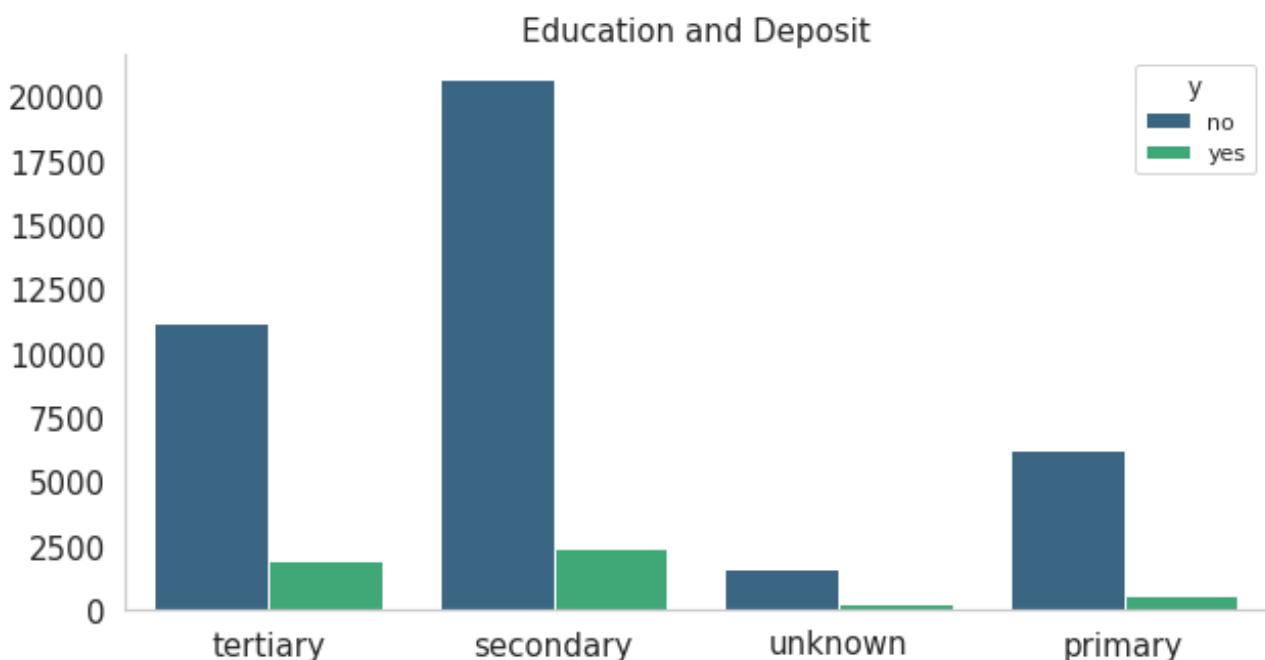


Singles are more likely to subscribe to term deposits but are not related to balance or housing loans because it is equally distributed among all marital statuses as seen in the graphs below.

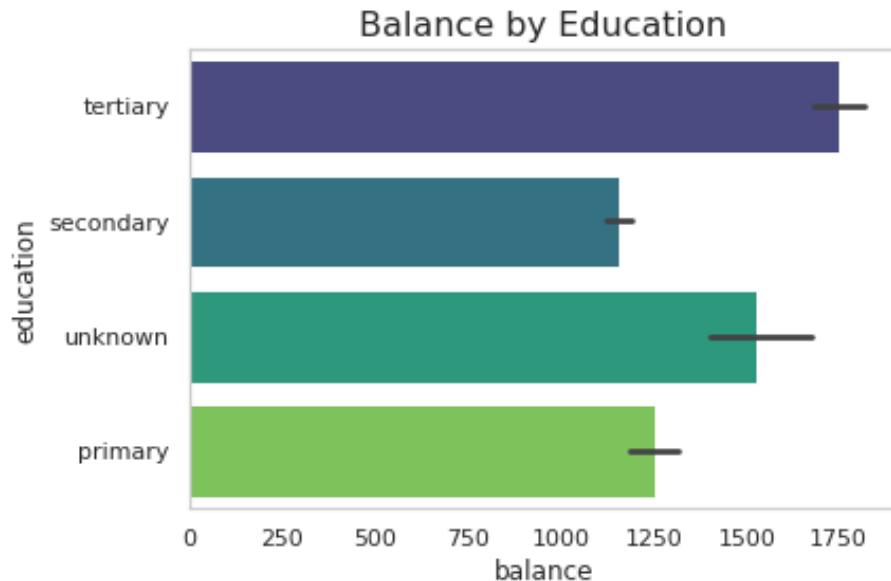


Education and Deposit

The most contacted are clients with secondary education which was to be expected due to the information we got from *Jobs and deposit* graphs.

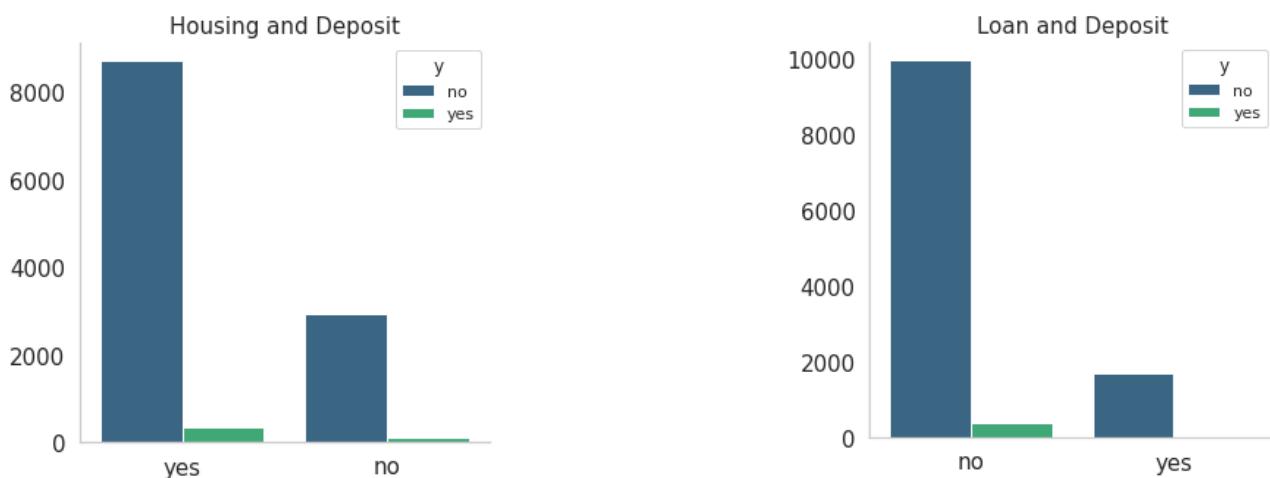


Clients with tertiary education are more likely to deposit, and when we compare the balance with education, we can see a significant impact on the balance of those with tertiary education which is tied to the conclusion from the *Balance and Deposit* section: clients with higher balance are more likely to subscribe a term deposit.



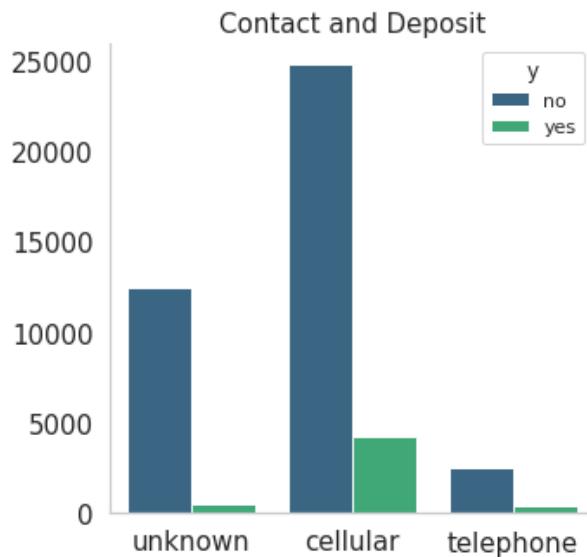
Loans and deposit

Clients with any type of loan, are less likely to deposit which we can see from the two graphs below for housing and personal loan. Personal loans have less impact on subscribing than housing loans.



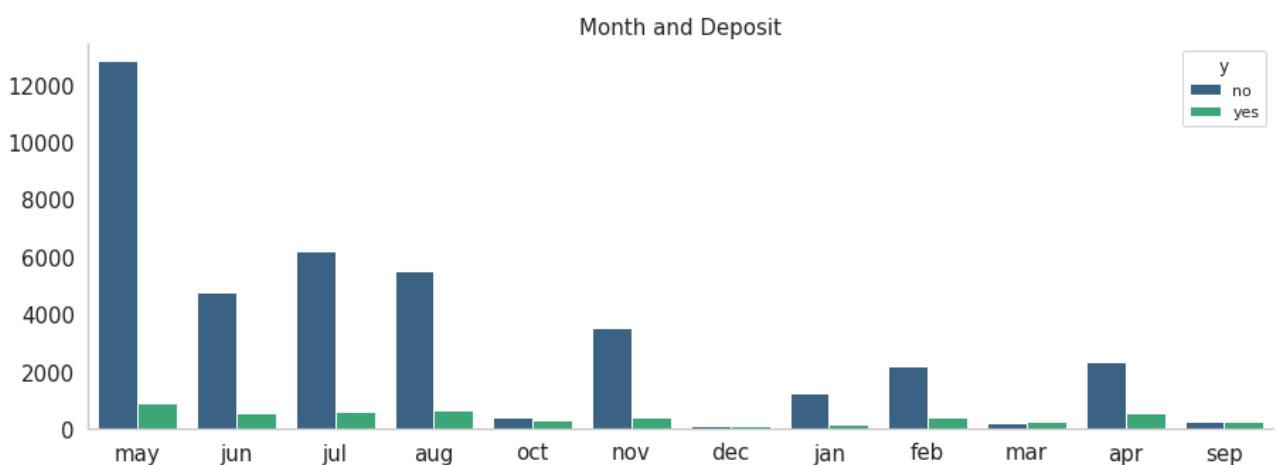
Contact and deposit

Most clients were contacted via a cellular device, as most were deposited after the cellular contact which in today's world of technology doesn't give us any valuable information.



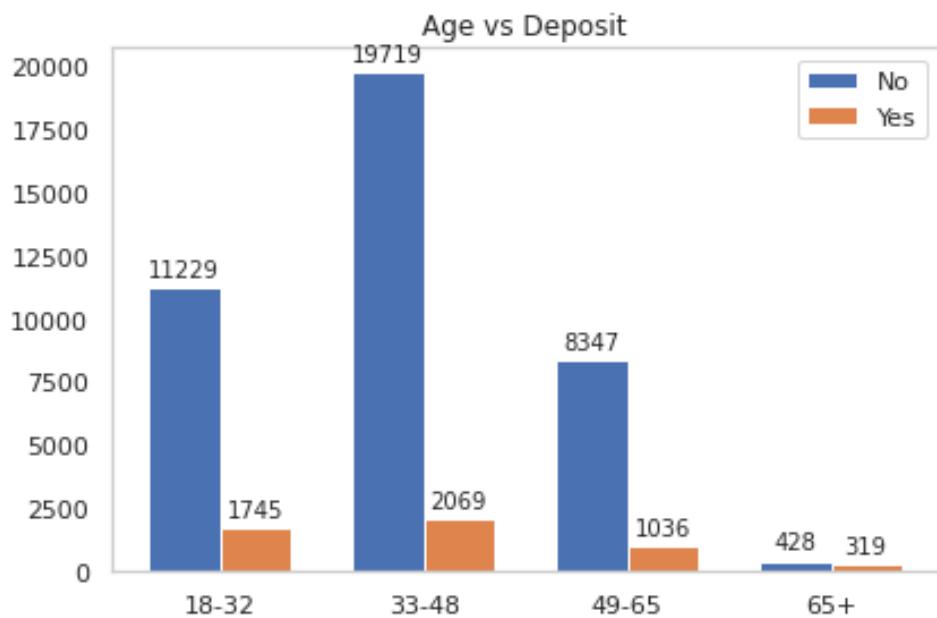
Month and deposit

By far the largest marketing activity was in May, but the results did not follow the activity especially when we compare it with April, June, July, and August. Or with March, September, October, and December we see that there are approximately 50-50. And somewhere, even more, those who decided to subscribe a deposit than those who did not.



Age and deposit

In an earlier section, we saw that students and retirees are among those who are more likely to make a deposit, and this can be again seen by another comparison in the following graph (note: age range are created according to quartiles) where the highest ratio of those who deposited in relation to the number of contacted are young from 18 to 32 (13,45%) and over 65 (42,7%):

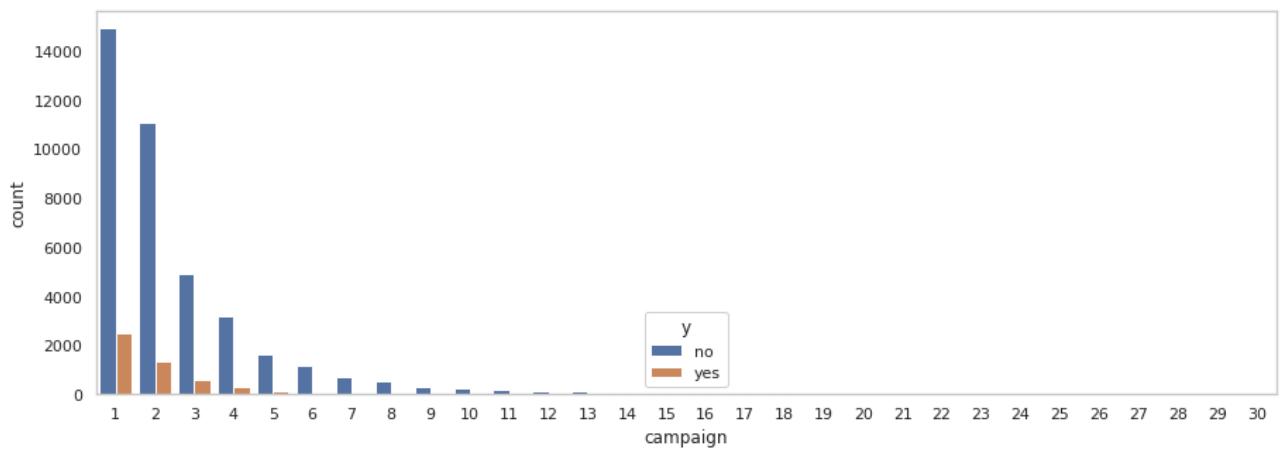


If we set that the majority of the students are aged 18 to 25, then 39,5% of them decided to subscribe to a term deposit.

Campaign and deposit

The campaign represents the number of contacts performed during this marketing campaign per client, and in the graph below we can see that the number of contacts is important. The more calls, the less likely the client will decide to make a deposit.

There are few numbers of clients who decided to subscribe to a deposit after the third call, so the recommendation is to limit the number of contacts to a maximum of three.



Duration and deposit

Duration matters. If the client is not interested in the offer in the first 5 minutes of the conversation, it is unlikely that the client will decide to make a deposit.

	Yes	No	%
< 300	1775	30929	5,43%
301 - 600	1572	6840	18,69%
601 - 1.200	1479	1737	45,99%
1.201 - 1.800	289	165	63,66%
> 1.800	54	52	50,94%

4. Conclusions

Clients under the age of 30 and clients over the age of 65 are clients who would most likely to subscribe a deposit. For clients over the age of 65, the fact that their balance is high is also beneficial, and we have seen that this is one of the positive parameters based on which clients will decide to subscribe for a term deposit.

Ages are correlated to the job attribute because people from the upper age rank are mostly students and retirees.

When we talk about the connection between the balance and the job, is unlikely that a client who is working as blue-collar or service will decide to deposit. On the other hand, it could deposit someone who works and has a tertiary education where we also had the opportunity to see that clients with a tertiary education also have a higher balance.

Clients with any type of loan, married and divorced will most likely not decide to subscribe to a deposit.

The bank should increase marketing activity in March, September, October, and December. It is recommended to implement a strategy that would keep the client in the conversation for at least 5 minutes and what is very important to note is to have a maximum of 2-3 calls to the client to save time and effort on new potential clients.