

Marketing campaign of a Portuguese banking institution



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Introduction about the data set





45,211

The data is related to the direct marketing campaigns of a Portuguese banking institution to sell bank term deposit product to **45,211** clients in the data set by Marketing phone calls.

Using same data set, the Bank wants to **cross-sell banking lending products to potential clients**. The target banking products for this marketing campaign are Unsecured Personal Loan, Unsecured Credit Card and Secured Credit Card.

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Objective



Outbound Marketing calls optimization



Telephonic marketing campaigns is one of the most effective sales tool. However, they require huge investment as large call centers are hired to actually execute these campaigns.

Reduce marketing cost

by targeting clients who are most likely to be eligible for the targeted banking lending products as well as optimize call strategy with provided data set.

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Data descriptions



▶ 45,211 rows, 3 categories & 16 data points

Client info

8 Data points

- Demographic: 4
- Banking related: 4

Latest contact info

4 Data points

Contact communication type
and latest call info

Other attributes

4 Data points

Reference Data for previous
Term-Deposit Marketing
Campaign

	Column name	Description	Data Value	Data type
Client info	age	Age	18 - 95	numeric
	job	Type of job	"admin.", "unknown", "unemployed", "management", "housemaid", "entrepreneur", "student", "blue-collar", "self-employed", "retired", "technician", "services"	text
	marital	Marital status	"married", "divorced", "single"; note: "divorced" means divorced or widowed	text
	education	Education level	"unknown", "secondary", "primary", "tertiary"	text
	default	has credit in default?	"yes", "no"	text
	balance	Average yearly balance, in euros	(8,019) - 102,127	numeric
	housing loan	Has housing loan? Has personal loan?	"yes", "no" "yes", "no"	text text
Latest contact info	contact	Contact communication type	"unknown", "telephone", "cellular"	text
	day	Last contact day of the month	1 - 31	numeric
	month	Last contact month of year	"jan", "feb", "mar", ..., "nov", "dec"	text
	duration	Last contact duration, in seconds	0 - 4,918	numeric
Other attributes	campaign	number of contacts performed during this campaign and for this client (includes last contact)	1 - 63	numeric
	pdays	number of days that passed by after the client was last contacted from a previous campaign (-1 means client was not previously contacted)	(1) - 871	numeric
	previous	number of contacts performed before this campaign and for this client	0 - 275	numeric
	poutcome	outcome of the previous marketing campaign	"unknown", "other", "failure", "success"	text

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Data analysis Step-by-Step



Step-by-Step



Brainstorm for Solution



Data Cleaning



Data Processing



Review Result



Brainstorm for Solution



Data Cleaning

Data Processing

Review Result

✓ Product eligibility criteria

- Unsecured Personal Loan
- Unsecured Credit Card
- Secured Credit Card

✓ Marketing call optimization

- Sells multiple products and optimize call by higher product profitability
- Target clients who are most likely connected
- Target clients who most likely listen to bank marketing campaign

Brainstorm for Solution

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Review Result

PRODUCT ELIGIBILITY CRITERIA	Unsecured Personal Loan	Unsecured Credit Card	Secured Credit Card
Loan type	Unsecured	Unsecured	Secured
Product Risk Classification	High risk	Low risk	Very low risk or no risk
Profitability	High return	Medium return	Low return
Age	Min 24 Max 60	Min 21 Max 60	Min 18
Employment status	Employed	Employed; or Self-employed/ entrepreneur/ retired having Average Yearly Balance > 1080 ^①	All, Having Average Yearly Balance > 1000
Unfavourable Occupation	Blue-collar / housemaid	Blue-collar / housemaid	All
Monthly Income estimation based on Average Yearly balance (30% of income)	N/A	300 ^①	0
Marital status	All	All	All
Education	All	All	All
Housing (has housing loan)	All	All	All
Loan (has personal loan)	No	All	All
Default: has credit in default?	No Default	No Default	All

^① Yearly Income estimation based on Average Yearly balance(30% of income). With min required income = 300euro, the minimum yearly balance is required = $300 \times 12 \times 30\% = 1,080$ euro.

Brainstorm for Solution

Data Cleaning

Data Processing

Review Result

MARKETING CALL OPTIMISATION	Call optimisation priority criteria		
Product type	Unsecured Personal Loan	Unsecured Credit Card	Secured Credit Card
Last contact communication type	Cellular	Telephone	Unknown
Last contact month of year	Latest	Furthest	
Last contact duration	Longest	Shortest	

➤ Sells multiple products and optimize call by higher product profitability

- ▶ To sell both Unsecured Personal & Unsecured Credit Card to clients who are eligible for Unsecured Personal Loan
- ▶ Next, target clients who are eligible for Unsecured Credit Card
- ▶ Last, target clients who are eligible for Secured Credit Card

➤ Target clients who are most likely connected

- ▶ Clients with Cellular
- ▶ Clients that have been contacted in most recent month

➤ Target clients who most likely listen to bank marketing campaign

- ▶ Clients with longer contact duration in last call

Brainstorm for Solution

Data Cleaning

Data Processing

Review Result



Data before cleaning

age	job	marital	education	defa...	balance	housing	loan	contact	day	month	duration	camp...	pdays	previ...	poutcome	y
58	management	married	tertiary	no	2143	yes	no	unknown	5	may	261	1	-1	0	unknown	no
44	technician	single	secondary	no	29	yes	no	unknown	5	may	151	1	-1	0	unknown	no
33	entrepreneur	married	secondary	no	2	yes	yes	unknown	5	may	76	1	-1	0	unknown	no
47	blue-collar	married	unknown	no	1506	yes	no	unknown	5	may	92	1	-1	0	unknown	no

- Remove Null value
- Drop Unused column

Data after cleaning

age	job	marital	education	default	balance	housing	loan	contact	day	month	duration	y
58	management	married	tertiary	no	2143	yes	no	unknown	5	may	261	no
44	technician	single	secondary	no	29	yes	no	unknown	5	may	151	no
33	entrepreneur	married	secondary	no	2	yes	yes	unknown	5	may	76	no
47	blue-collar	married	unknown	no	1506	yes	no	unknown	5	may	92	no



➤ Create new id column to identify each customer and Employment column

	age	job	marital	education	default	balance	housing	loan	contact	day	month	duration	y	id	Employment
0	58	management	married	tertiary	no	2143	yes	no	unknown	5	may	261	no	1	Employed
1	44	technician	single	secondary	no	29	yes	no	unknown	5	may	151	no	2	Employed
2	33	entrepreneur	married	secondary	no	2	yes	yes	unknown	5	may	76	no	3	Other
3	47	blue-collar	married	unknown	no	1506	yes	no	unknown	5	may	92	no	4	Employed
4	33	unknown	single	unknown	no	1	no	no	unknown	5	may	198	no	5	Other
...
45206	51	technician	married	tertiary	no	825	no	no	cellular	17	nov	977	yes	45207	Employed
45207	71	retired	divorced	primary	no	1729	no	no	cellular	17	nov	456	yes	45208	Other
45208	72	retired	married	secondary	no	5715	no	no	cellular	17	nov	1127	yes	45209	Other
45209	57	blue-collar	married	secondary	no	668	no	no	telephone	17	nov	508	no	45210	Employed
45210	37	entrepreneur	married	secondary	no	2971	no	no	cellular	17	nov	361	no	45211	Other



➤ Create new table for Unsecured Personal Loan

	age	job	marital	education	default	balance	housing	loan	contact	day	month	duration	y	id	Employment
41574	46	management	married	tertiary	no	273	yes	no	cellular	15	sep	1962	yes	41575	Employed
41588	40	technician	married	tertiary	no	1293	no	no	cellular	16	sep	1702	yes	41589	Employed
41609	59	technician	married	tertiary	no	883	no	no	cellular	18	sep	1551	no	41610	Employed
44824	28	admin.	single	secondary	no	127	no	no	cellular	16	sep	1334	yes	44825	Employed
44898	24	management	single	tertiary	no	393	no	no	cellular	27	sep	1298	yes	44899	Employed
...
44598	29	admin.	married	secondary	no	1937	no	no	unknown	25	aug	6	no	44599	Employed
44599	35	admin.	married	secondary	no	2374	yes	no	unknown	25	aug	5	no	44600	Employed
43434	36	management	single	tertiary	no	579	no	no	unknown	12	apr	481	yes	43435	Employed
43564	30	admin.	single	secondary	no	915	yes	no	unknown	27	apr	370	yes	43565	Employed
43472	38	technician	married	secondary	no	497	no	no	unknown	14	apr	173	yes	43473	Employed

21414 rows × 15 columns



➤ Create new table for Unsecured Credit Card

	age	job	marital	education	default	balance	housing	loan	contact	day	month	duration	y	id	Employment
0	58	management	married	tertiary	no	2143	yes	no	unknown	5	may	261	no	1	Employed
1	44	technician	single	secondary	no	29	yes	no	unknown	5	may	151	no	2	Employed
5	35	management	married	tertiary	no	231	yes	no	unknown	5	may	139	no	6	Employed
6	28	management	single	tertiary	no	447	yes	yes	unknown	5	may	217	no	7	Employed
9	43	technician	single	secondary	no	593	yes	no	unknown	5	may	55	no	10	Employed
...
45201	53	management	married	tertiary	no	583	no	no	cellular	17	nov	226	yes	45202	Employed
45202	34	admin.	single	secondary	no	557	no	no	cellular	17	nov	224	yes	45203	Employed
45205	25	technician	single	secondary	no	505	no	yes	cellular	17	nov	386	yes	45206	Employed
45206	51	technician	married	tertiary	no	825	no	no	cellular	17	nov	977	yes	45207	Employed
45210	37	entrepreneur	married	secondary	no	2971	no	no	cellular	17	nov	361	no	45211	Other

27214 rows × 15 columns



➤ Create new table for Secured Credit Card

	age	job	marital	education	default	balance	housing	loan	contact	day	month	duration	y	id	Employment
0	58	management	married	tertiary	no	2143	yes	no	unknown	5	may	261	no	1	Employed
3	47	blue-collar	married	unknown	no	1506	yes	no	unknown	5	may	92	no	4	Employed
34	51	management	married	tertiary	no	10635	yes	no	unknown	5	may	336	no	35	Employed
40	44	services	divorced	secondary	no	2586	yes	no	unknown	5	may	160	no	41	Employed
50	54	blue-collar	married	secondary	no	1291	yes	no	unknown	5	may	266	no	51	Employed
...
45199	34	blue-collar	single	secondary	no	1475	yes	no	cellular	16	nov	1166	no	45200	Employed
45204	73	retired	married	secondary	no	2850	no	no	cellular	17	nov	300	yes	45205	Other
45207	71	retired	divorced	primary	no	1729	no	no	cellular	17	nov	456	yes	45208	Other
45208	72	retired	married	secondary	no	5715	no	no	cellular	17	nov	1127	yes	45209	Other
45210	37	entrepreneur	married	secondary	no	2971	no	no	cellular	17	nov	361	no	45211	Other

14642 rows × 15 columns



➤ Combine 3 tables to Main table and create 3 new columns to assign Edibility Product

	id	age	job	Employment	marital	education	default	balance	housing	loan	contact	day	month	duration	y	Eligibility	Eligibility2	Eligibility3
0	1	58	management	Employed	married	tertiary	no	2143	yes	no	unknown	5	may	261	no	Secured	Unsecured	Loan
1	2	44	technician	Employed	single	secondary	no	29	yes	no	unknown	5	may	151	no		Unsecured	Loan
2	3	33	entrepreneur	Other	married	secondary	no	2	yes	yes	unknown	5	may	76	no			
3	4	47	blue-collar	Employed	married	unknown	no	1506	yes	no	unknown	5	may	92	no	Secured		
4	5	33	unknown	Other	single	unknown	no	1	no	no	unknown	5	may	198	no			
...
45206	45207	51	technician	Employed	married	tertiary	no	825	no	no	cellular	17	nov	977	yes		Unsecured	Loan
45207	45208	71	retired	Other	divorced	primary	no	1729	no	no	cellular	17	nov	456	yes	Secured		
45208	45209	72	retired	Other	married	secondary	no	5715	no	no	cellular	17	nov	1127	yes	Secured		
45209	45210	57	blue-collar	Employed	married	secondary	no	668	no	no	telephone	17	nov	508	no			
45210	45211	37	entrepreneur	Other	married	secondary	no	2971	no	no	cellular	17	nov	361	no	Secured	Unsecured	

45211 rows × 18 columns

Brainstorm for Solution

Data Cleaning

Data Processing

Review Result



➤ Call optimization

	id	age	job	Employment	marital	education	default	balance	housing	loan	contact	day	month	duration	y	Eligibility	Eligibility2	Eligibility3
41588	41589	40	technician	Employed	married	tertiary	no	1293	no	no	cellular	16	sep	1702	yes	Secured	Unsecured	Loan
41605	41606	26	management	Employed	single	tertiary	no	1646	no	no	cellular	18	sep	890	yes	Secured	Unsecured	Loan
41436	41437	59	admin.	Employed	single	secondary	no	4744	no	no	cellular	4	sep	879	yes	Secured	Unsecured	Loan
44857	44858	25	management	Employed	single	tertiary	no	3902	no	no	cellular	23	sep	856	yes	Secured	Unsecured	Loan
41475	41476	45	management	Employed	single	tertiary	no	1411	no	no	cellular	7	sep	800	yes	Secured	Unsecured	Loan
...
44589	44590	21	student	Other	single	secondary	no	681	no	no	unknown	20	aug	6	no			
44604	44605	30	blue-collar	Employed	married	primary	no	124	yes	no	unknown	28	aug	5	no			
44601	44602	23	student	Other	single	secondary	no	43	no	no	unknown	27	aug	4	no			
43468	43469	45	blue-collar	Employed	single	primary	no	116	no	no	unknown	13	apr	122	yes			
43492	43493	21	student	Other	single	secondary	no	546	no	no	unknown	17	apr	94	no			

45211 rows × 18 columns

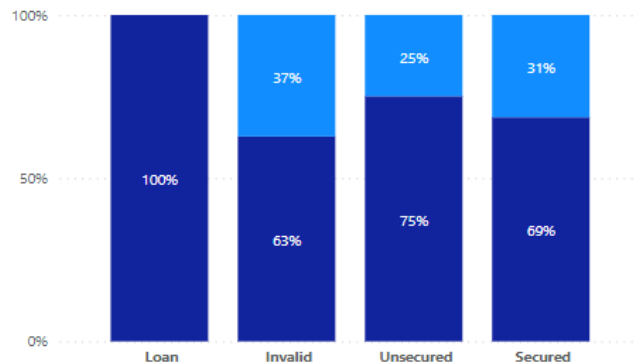
Brainstorm for Solution

Data Cleaning

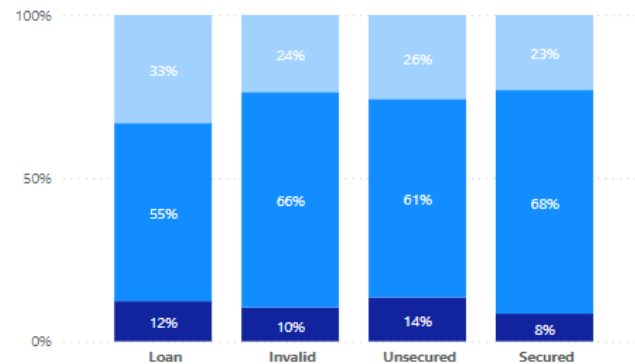
Data Processing

Review Result

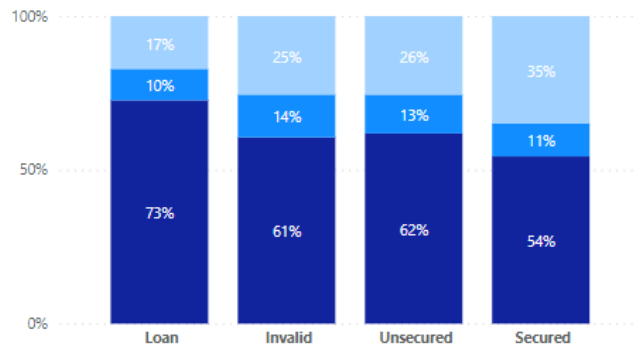
Employment ● Employed ● Other



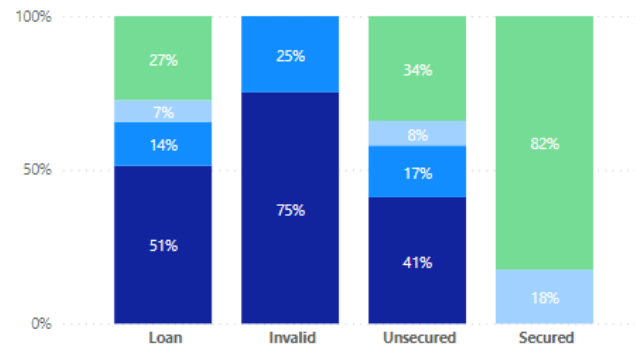
marital ● divorced ● married ● single



range_age ● 30 to 50 ● Below 30 ● From 50



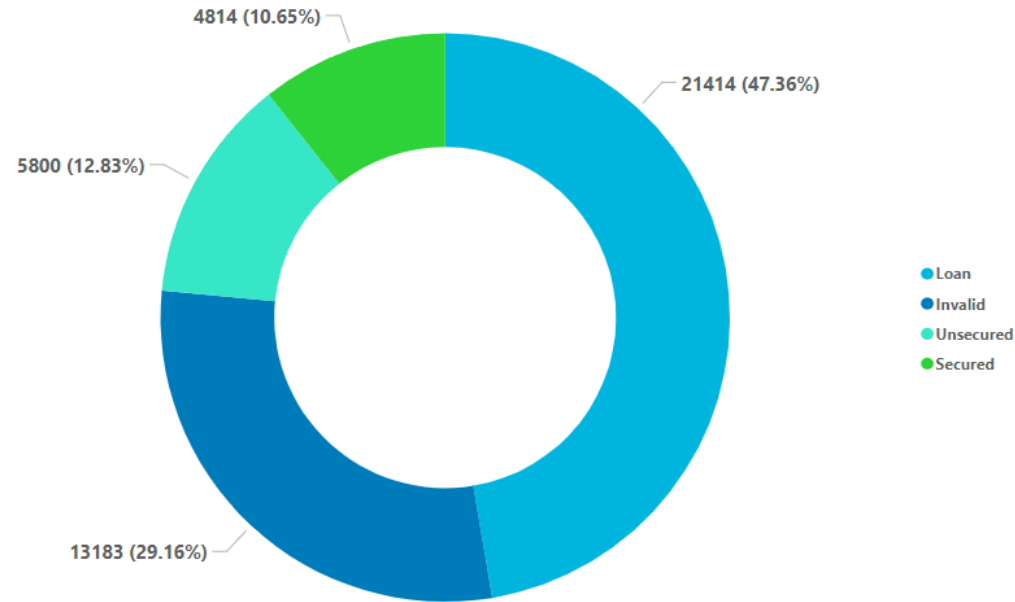
Range_balance ● < 1000 Euro ● <= 0 Euro ● >= 5000 Euro ● 1000 - < 5000 E...





The chart illustrate the number and % of qualified clients by each product

- 47.36 % (~21.4k clients) qualify for both Unsecured Personal loan and Unsecured Credit Card
- ~12.83% (~5,8k clients) qualify for Unsecured Credit Card
- 10.65% (~4,8k clients) qualify for Secured Credit Card
- 29.16% (~13,2k clients) do not qualify for any product and no marketing call is proposed for this segment



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Proposal





32,028

The data has been processed and the final proposed data points to contact **reduce to 32,028** from **45,211 (30% reduction)**.

The final list is proposed to **Reduce marketing cost** by targeting clients who are most likely to be eligible for the targeted banking lending products as well as optimize call strategy with provided data set.

Citation

Special thanks to all the people who made and released these awesome resources for free.

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

THANKS!

Any questions?

