



American University: Kogod School of Business

Insight Hackers Project

Optimizing Bank Marketing: Who
Subscribes to Term Deposits and Why?

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Agenda

- Project Objectives
- Data Overview
- Data Analysis
- Key Findings & Recommendations

Project Objectives

- How effective were previous marketing campaigns in driving term deposit subscriptions?
- Which customer segments are most likely to subscribe based on demographic characteristics?
- How do financial attributes like account balance, loans and defaults influence subscription likelihood?
- What economic and social factors affect customer decisions to adopt term deposit products?

Data Overview:



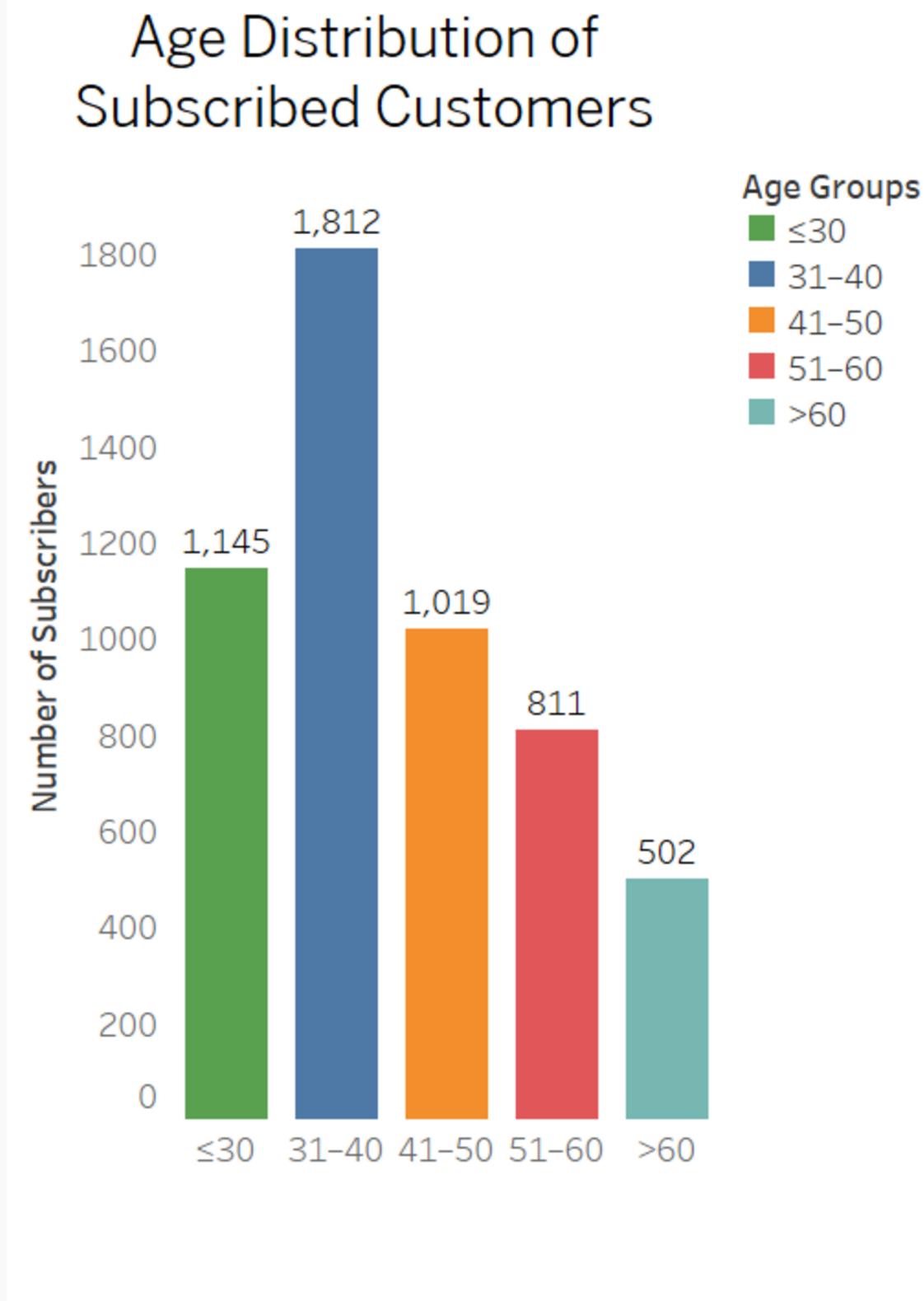
#	age	job	marital	education	default	housing	loan	contact	month	day_of_week	duration	campaign	pdays	previous	poutcome	emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed	y
1	56	housemaid	married	basic.4y	no	no	no	telephone	may	mon	261	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191	no
2	57	services	married	high.school	unknown	no	no	telephone	may	mon	149	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191	no
3	37	services	married	high.school	no	yes	no	telephone	may	mon	226	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191	no
4	40	admin.	married	basic.6y	no	no	no	telephone	may	mon	151	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191	no
5	56	services	married	high.school	no	no	yes	telephone	may	mon	307	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191	no

- Source: UC Irvine Machine Learning Repository – Bank Marketing Dataset
- Observations: 41,188 client records collected from May 2008 to November 2010
- Target Variable: y – Binary outcome indicating if a client subscribed to a term deposit (yes / no)
- Inputs: 20 features including
 - Demographics: age, job, marital status, education
 - Financial: balance, housing loan, personal loan, default history
 - Campaign-related: contact method, duration, previous outcome, number of contacts
 - Economic indicators: employment variation rate, consumer confidence index, EURIBOR rate



DATA ANALYSES

Customer segments that are most likely to subscribe based on demographic characteristics



Peak Subscription Age: (31–40)

- This group has the highest number of subscribers (1,812). People in this age range are likely in stable careers or starting families

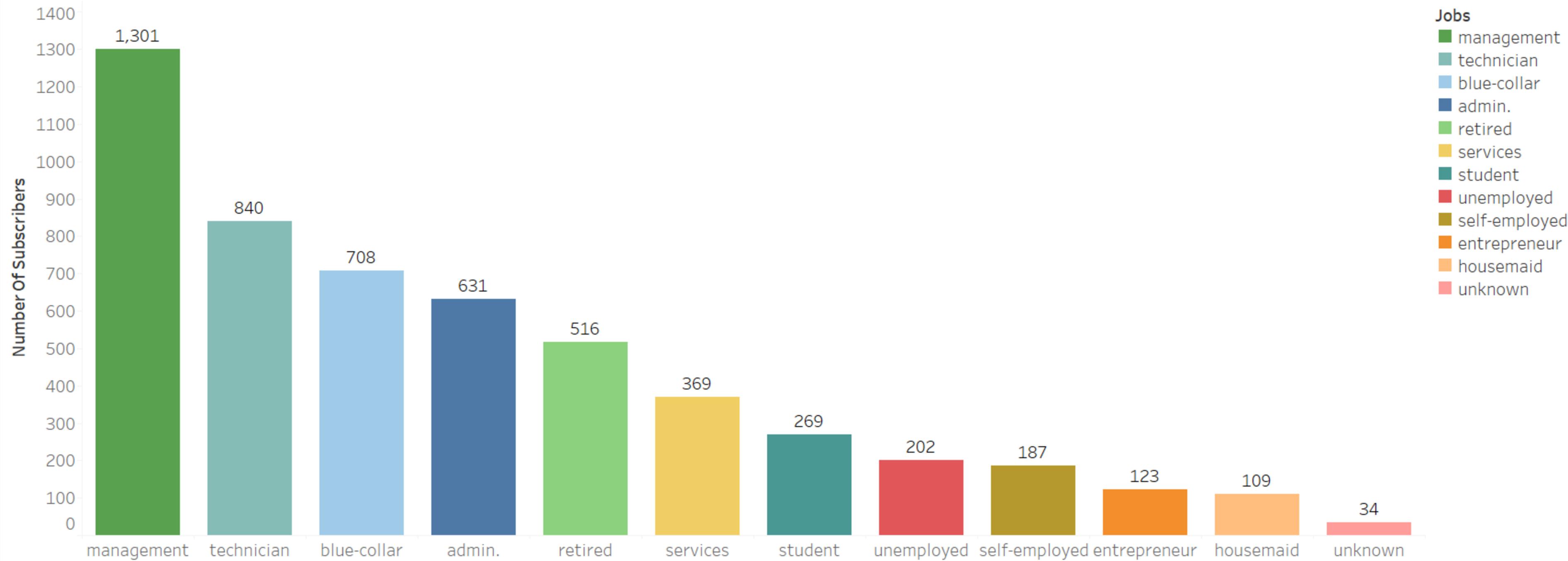
Younger than 30 (≤ 30)

- Second highest group with 1,145 subscribers. Younger individuals might be drawn to new offerings but slightly less than the 31–40 range, possibly due to income levels.

Gradual Decline with Age

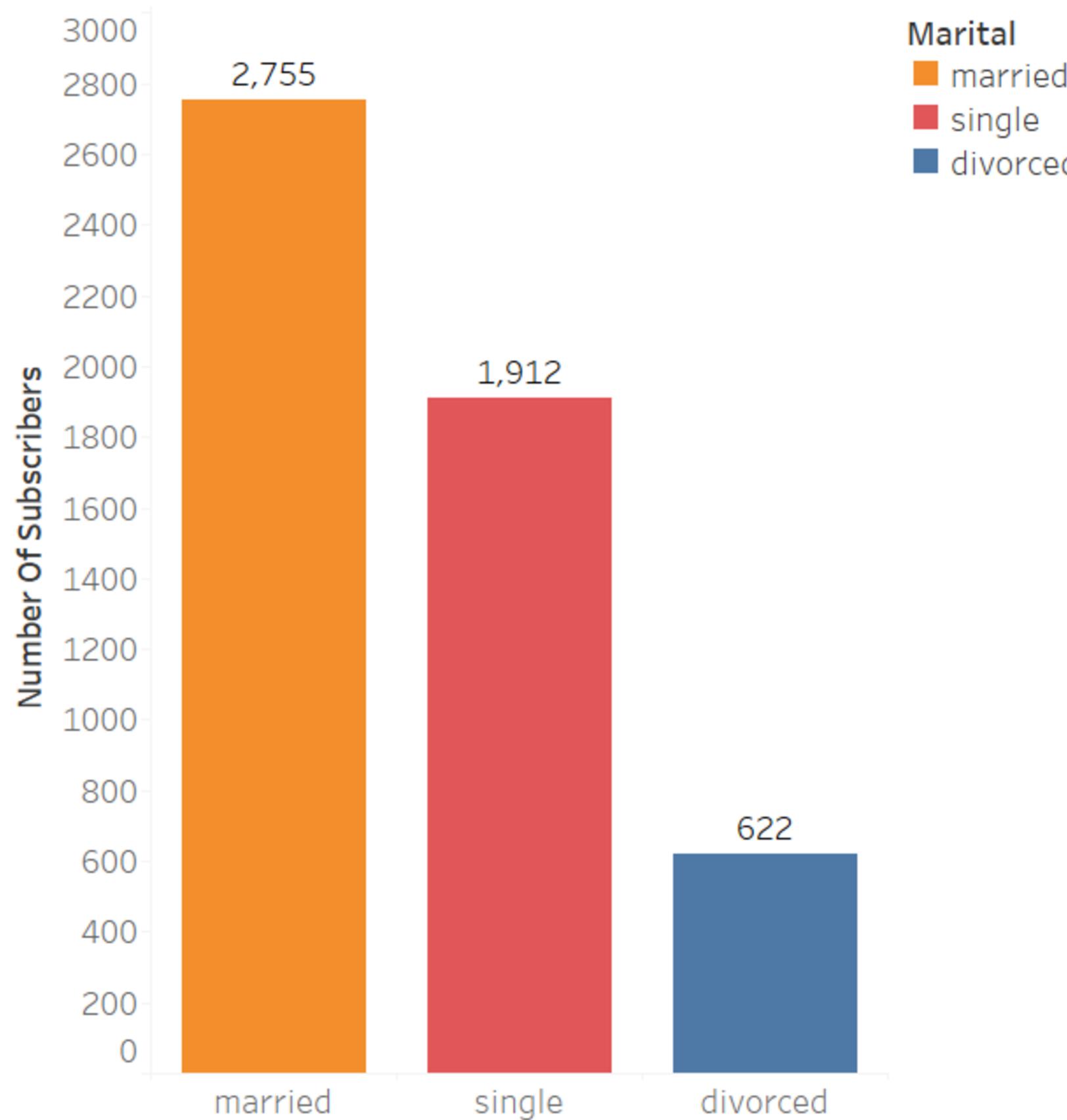
- Subscriptions decrease progressively after age 40. This may reflect lower digital engagement, less need or interest in the product.

Job Distribution of Subscribed Customers



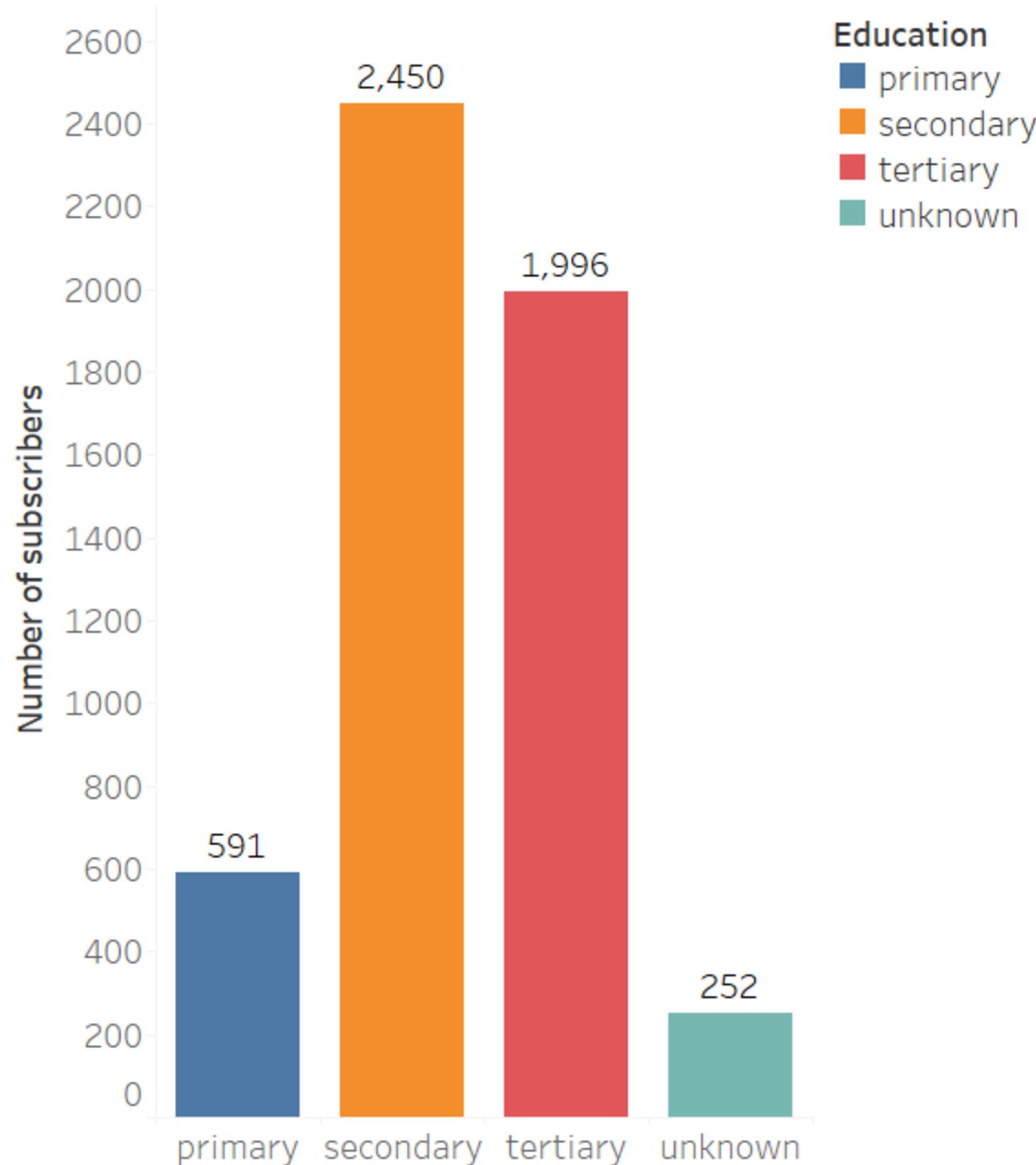
Management professionals lead in subscriptions with 1301, likely due to higher income and influence. Technicians and blue-collar workers also engage well, showing broad appeal. Lower rates among students, unemployed, and housemaids suggest financial constraints. Overall, job stability and income appear to drive subscription rates.

Marital Status distribution of Subscribed Customers



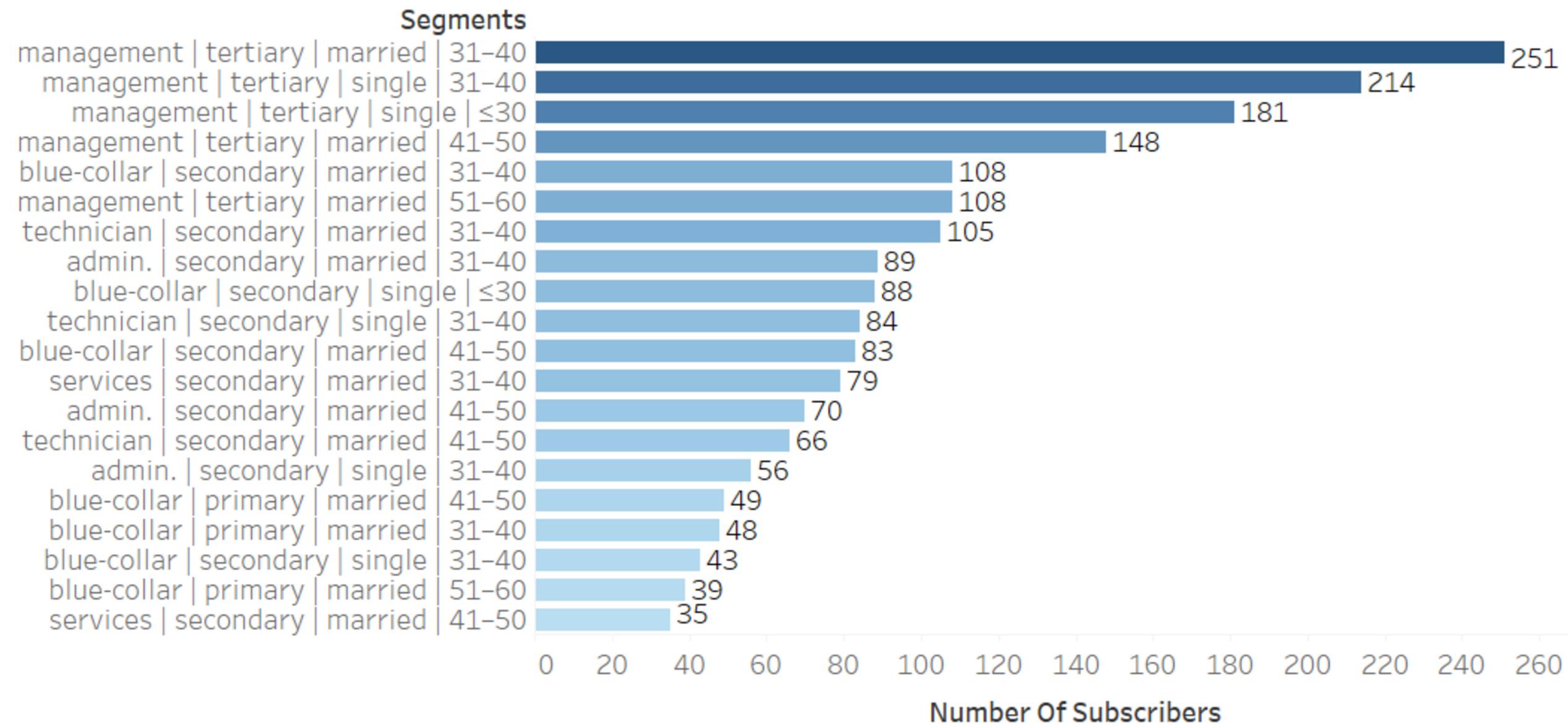
- Married individuals have the highest subscription count (2,755) possibly reflecting financial stability or family planning needs.
- Single customers follow with 1,912 subscriptions, indicating strong individual interest.
- Divorced customers have the lowest engagement (622) they may be less responsive or represent a smaller segment

Education Level of Subscribed Customers



- Secondary-educated individuals have the highest number of subscriptions (2,450), followed by tertiary (1,996).
- Primary education level shows much lower engagement (591), and unknown education levels have the least (252).
- This suggests that people with basic to higher education are more likely to subscribe, possibly due to better awareness and financial literacy.

Horizontal bar chart showing the top 20 subscriber segments based on job, education, marital status and age group

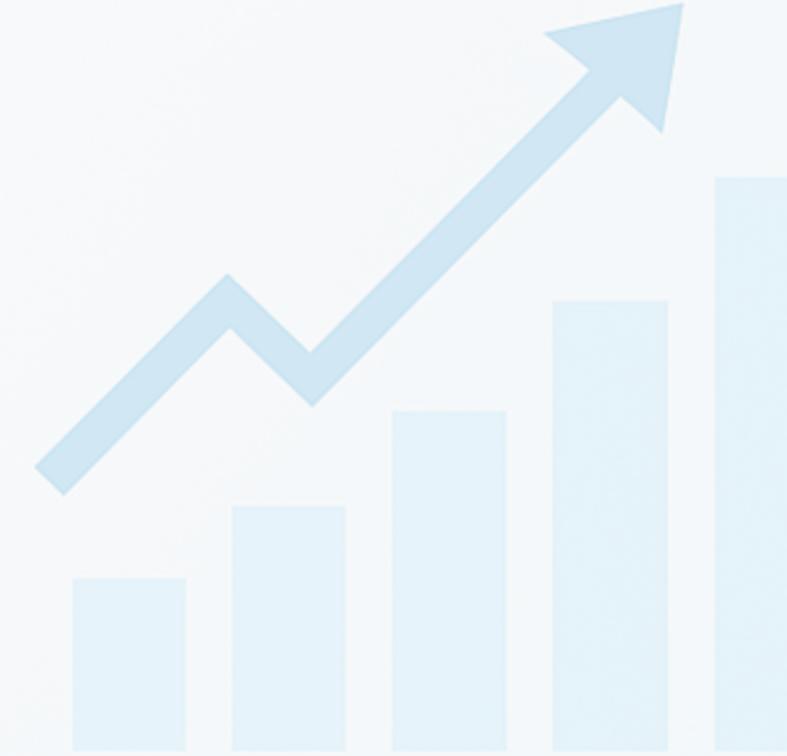


- The top subscriber segment is management | tertiary | married | 31–40, with 251 subscribers highlighting the power of education, income, and life stage.
- This chart confirms that combining job stability, higher education, and marital status sharply increases subscription likelihood.

Financial Information and Profitability



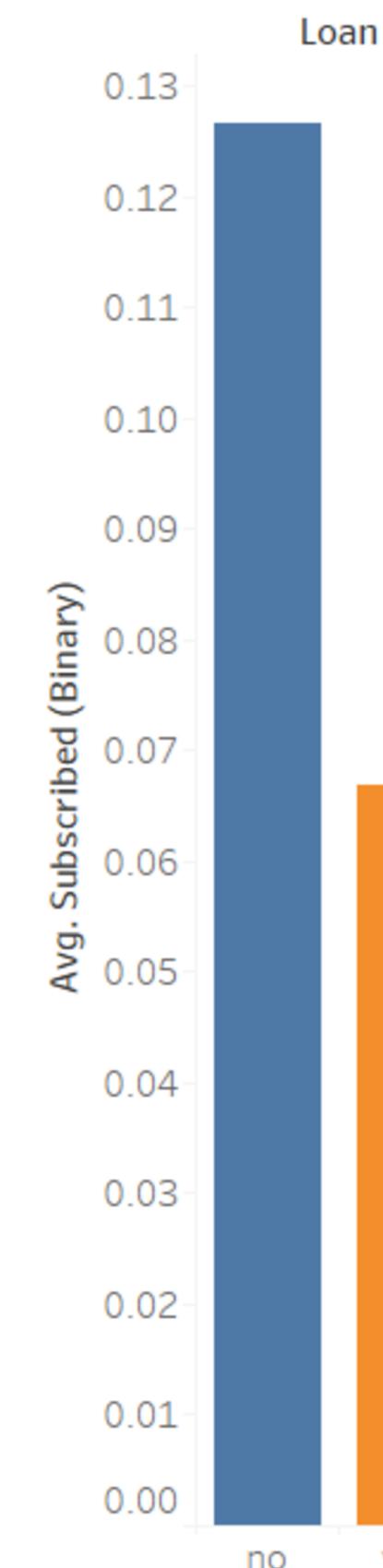
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Subscription Rate with Personal Loan

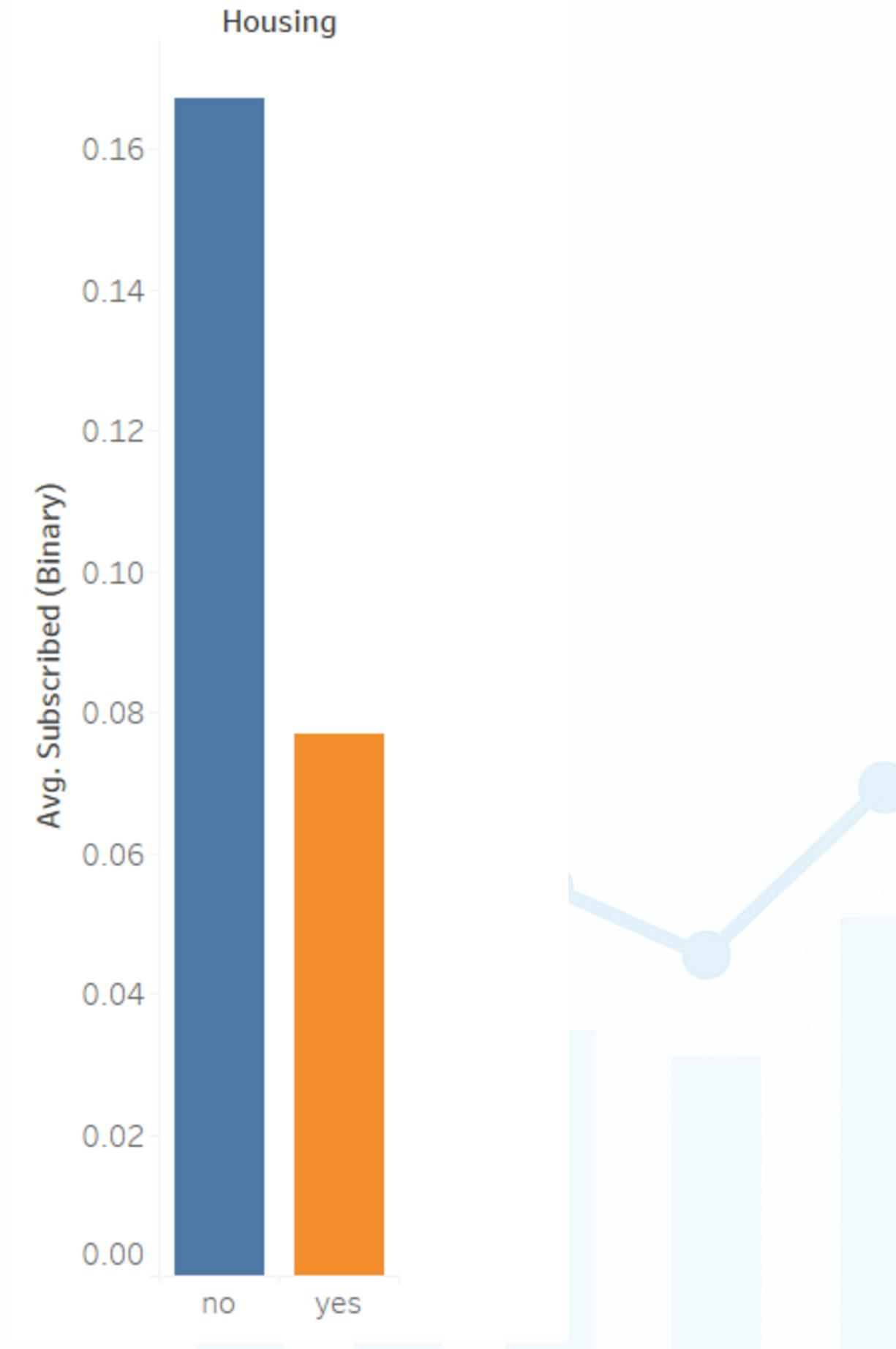


Financial Analysis

- Clients without personal loans subscribed at a much higher rate (~13%).
- Clients with personal loans had a significantly lower subscription rate (~6.5%).
- Personal loan presence is a strong negative predictor of term deposit subscription.
- Insight: Focus marketing on individuals without active personal loans for better outcomes.

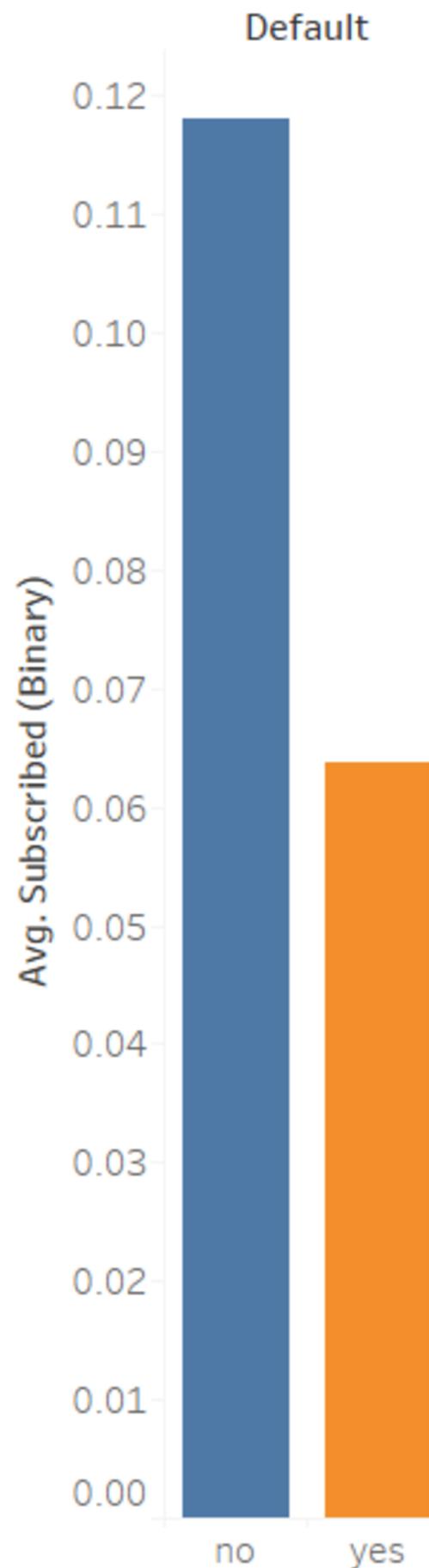
Financial Analysis

Sub Rate with Housing



- Clients without housing loans subscribed at a much higher rate (~16.5%).
- Clients with housing loans subscribed at less than half that rate (~7.7%).
- Housing debt may reduce perceived financial flexibility or willingness to invest.
- Insight: Targeting renters or mortgage-free clients may improve campaign efficiency.

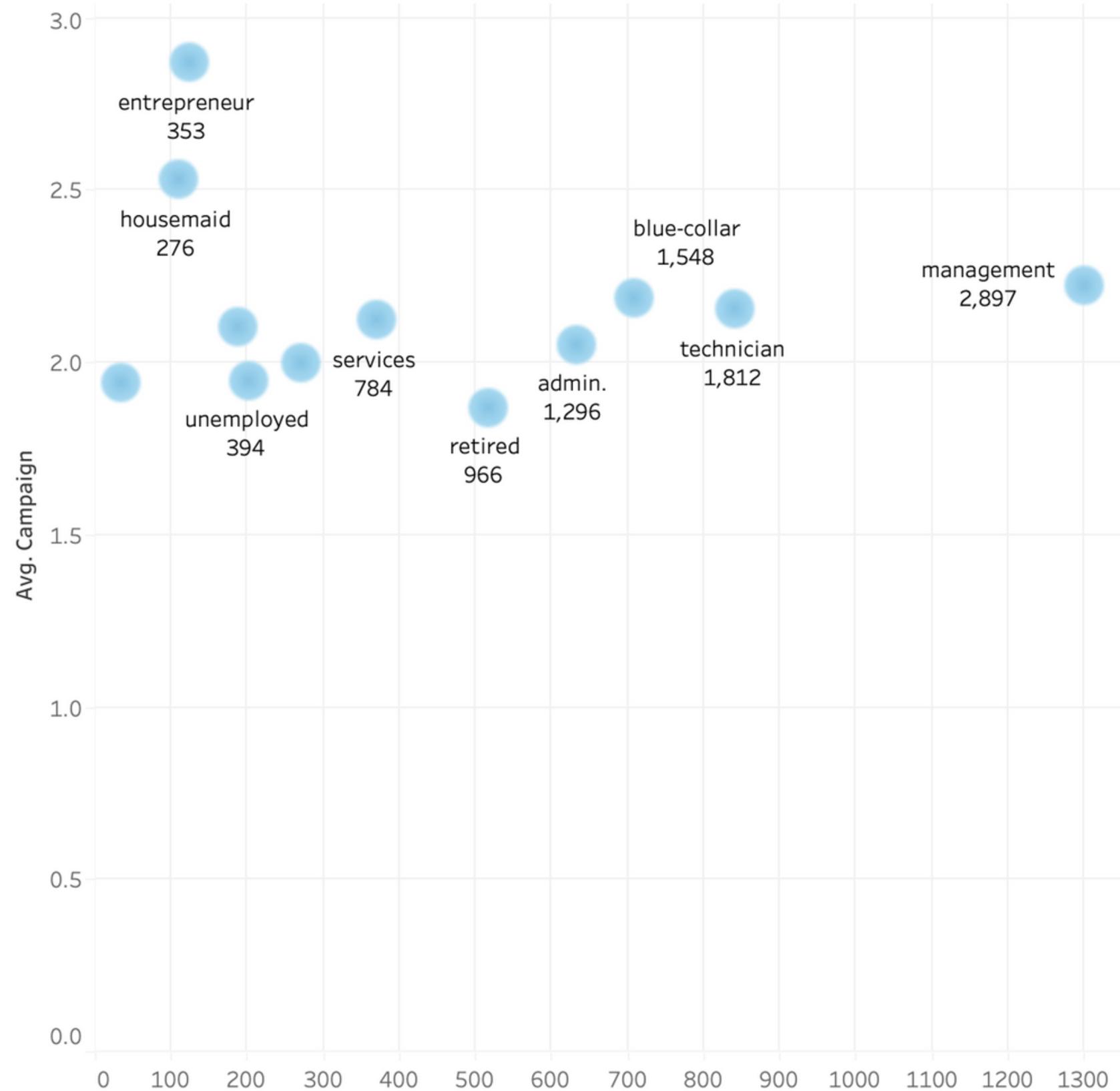
Sub Rate with Default



Financial Analysis

- Clients with no history of default subscribed at a strong rate (~12%).
- Clients with a default history subscribed at just ~6.5%.
- Credit reliability is a key predictor of term deposit interest.
- Insight: Direct campaigns toward financially reliable clients for higher conversion.

Campaign Effect on Subscription By Job



Efficient Converters

Retired:

- 966 subscriptions
- Avg. contacts: ~1.8
- High conversion efficiency
- Opportunity for increased outreach

Student:

- 538 subscriptions
- Avg. contacts: ~1.9
- Lower volume but efficient
- Scalable if targeted well

Unknown:

- 66 subscriptions
- Avg. contacts: ~1.7
- Low-cost, niche conversions

Inefficient Converters

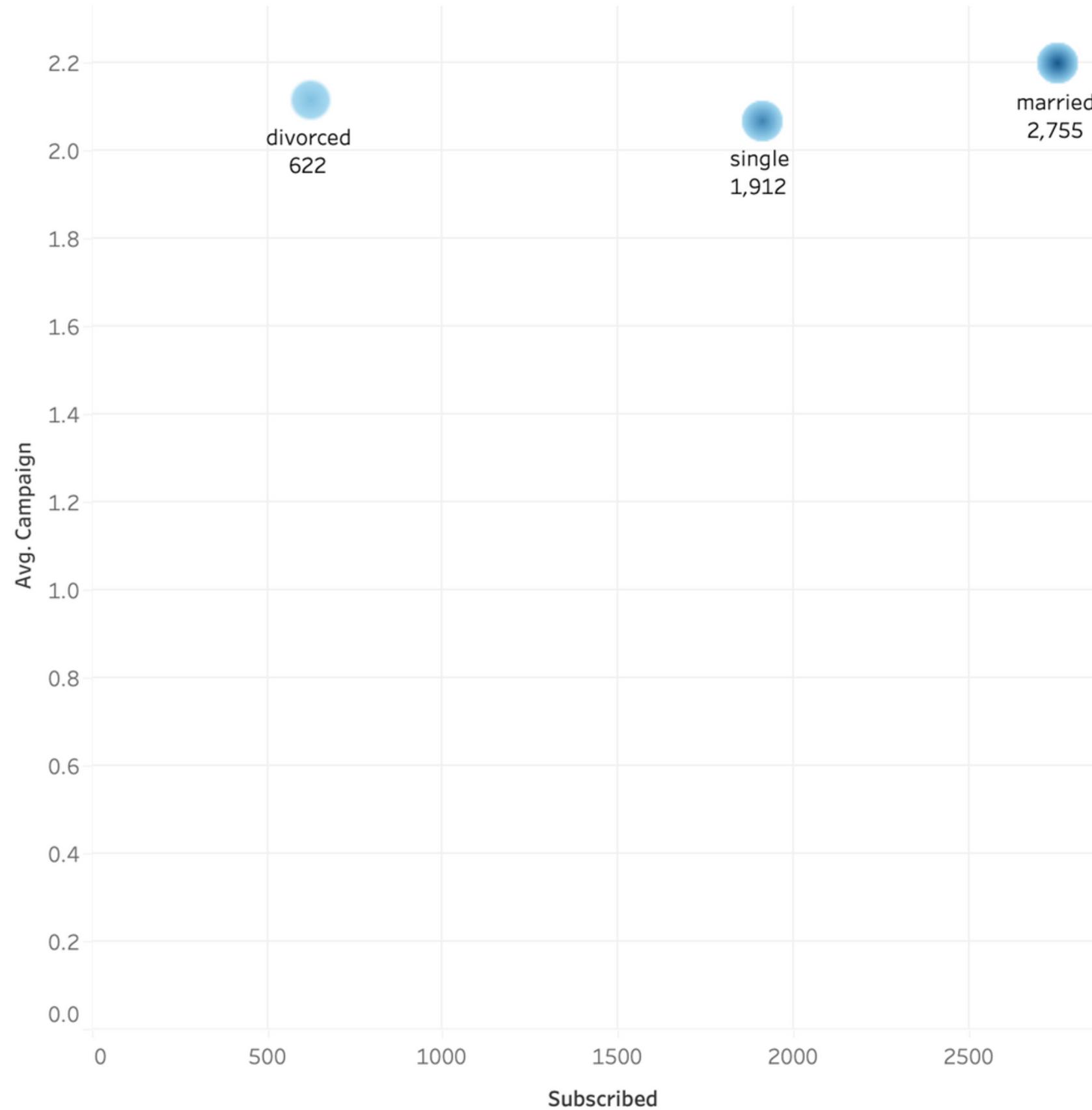
Entrepreneur:

- 353 subscriptions
- Avg. contacts: ~2.9 (highest)
- High effort, low return
- Deprioritize this group

Housemaid:

- 276 subscriptions
- Avg. contacts: ~2.6
- Requires high contact effort
- Low ROI segment

Campaign Effect on Subscription By Marital



Efficient Converters

Married Individuals

- Most responsive group by volume (2,755 subscribers)

Avg. ~2.1 contact attempts

High return, worth continued investment

Inefficient Converters

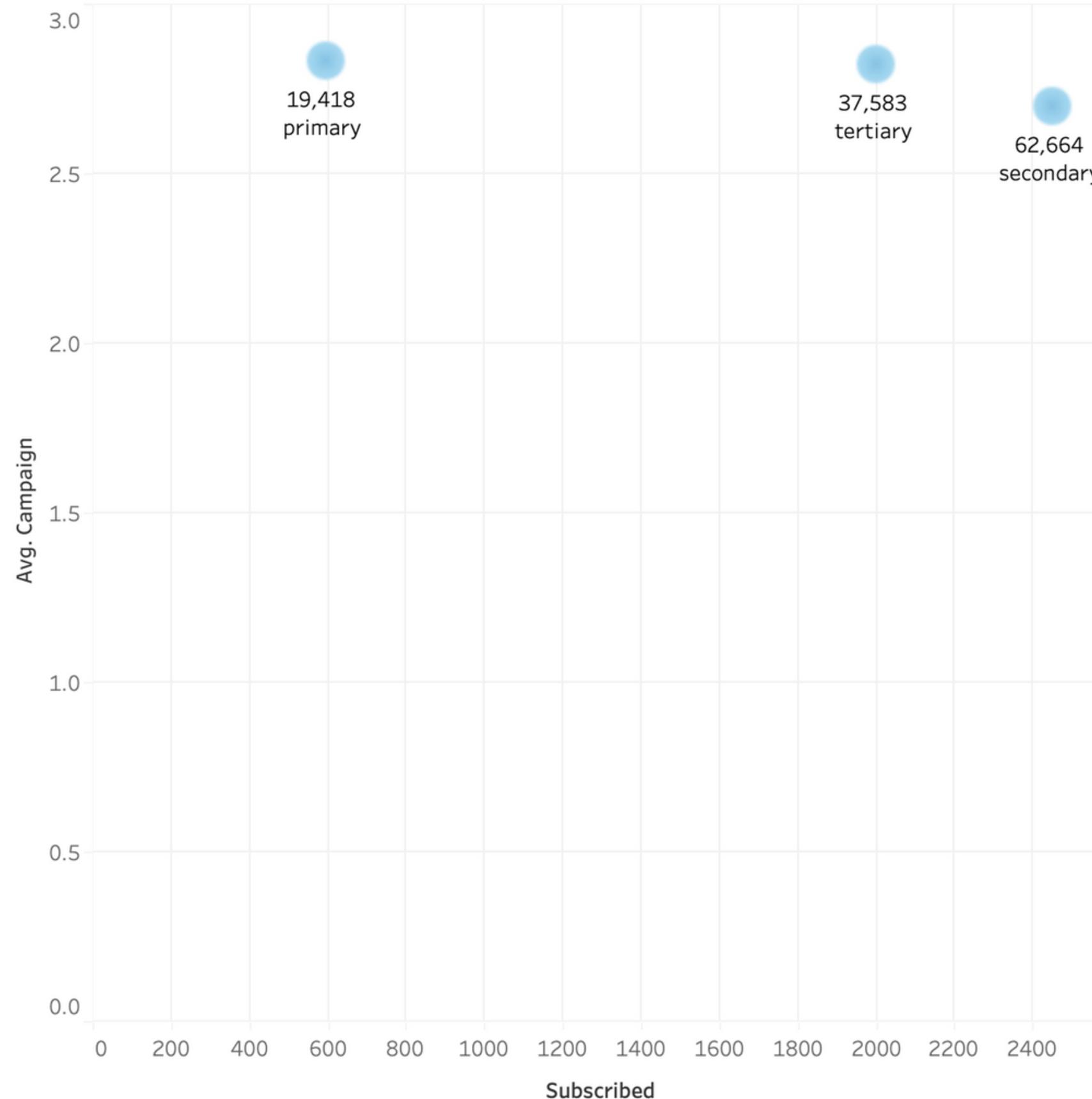
Divorced Individuals

- Lowest number of subscriptions (622)

Highest contact effort (~2.15 times)

Low ROI: difficult to convert, resource-intensive

Campaign Effect on Subscription By Education



Secondary Education

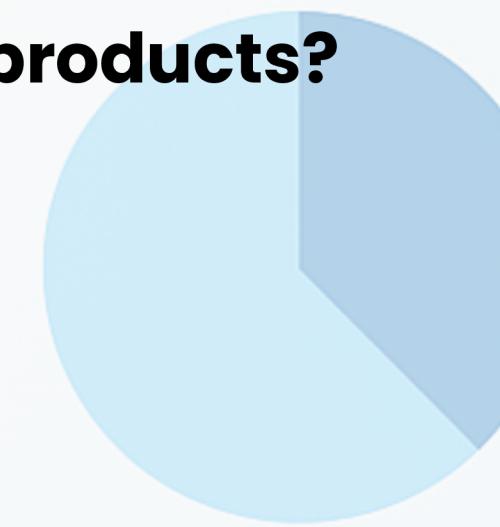
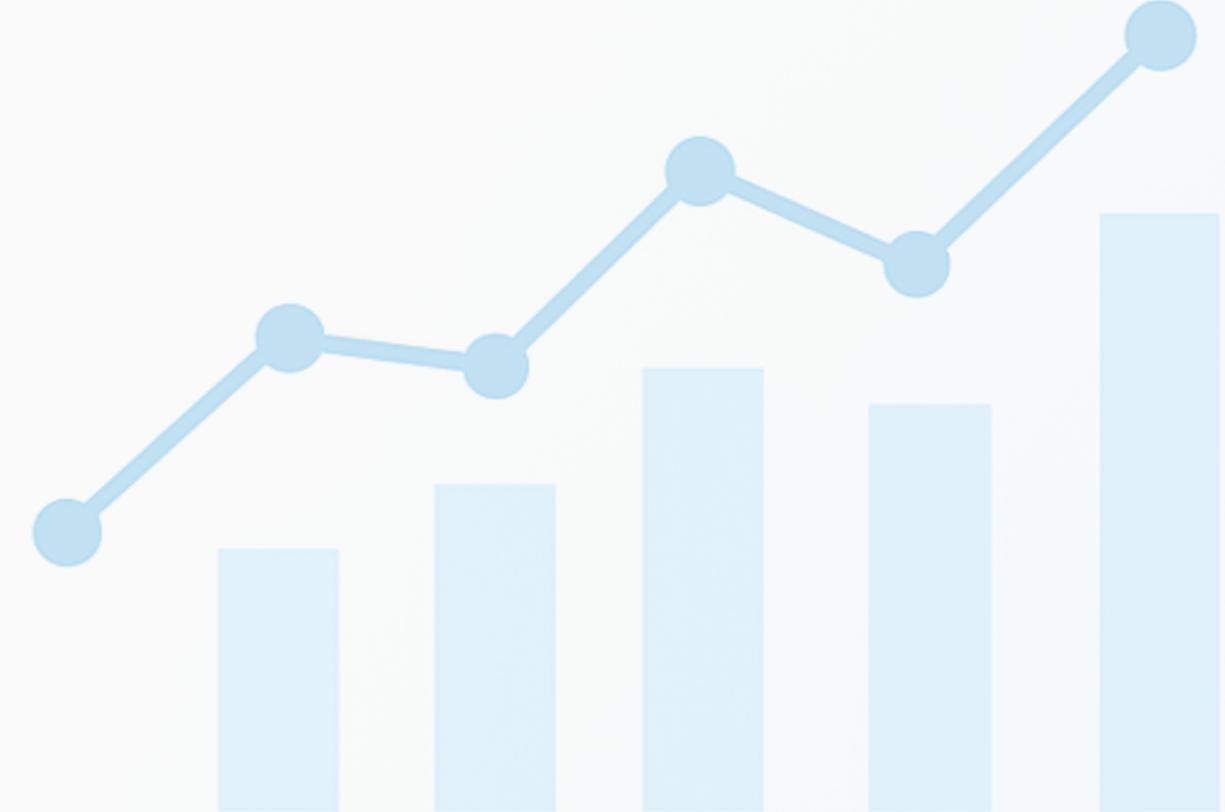
- Most subscriptions (~2,500)
- Avg. campaign contacts: ~2.75
- Best-performing group by volume
- Recommended for broad targeting

Primary Education

- Fewest subscriptions (~1,000)
- Avg. campaign effort: ~2.9 calls
- High effort, low return
- Not cost-effective to prioritize

Data Analysis

What economic and social factors affect customer decisions to adopt term deposit products?



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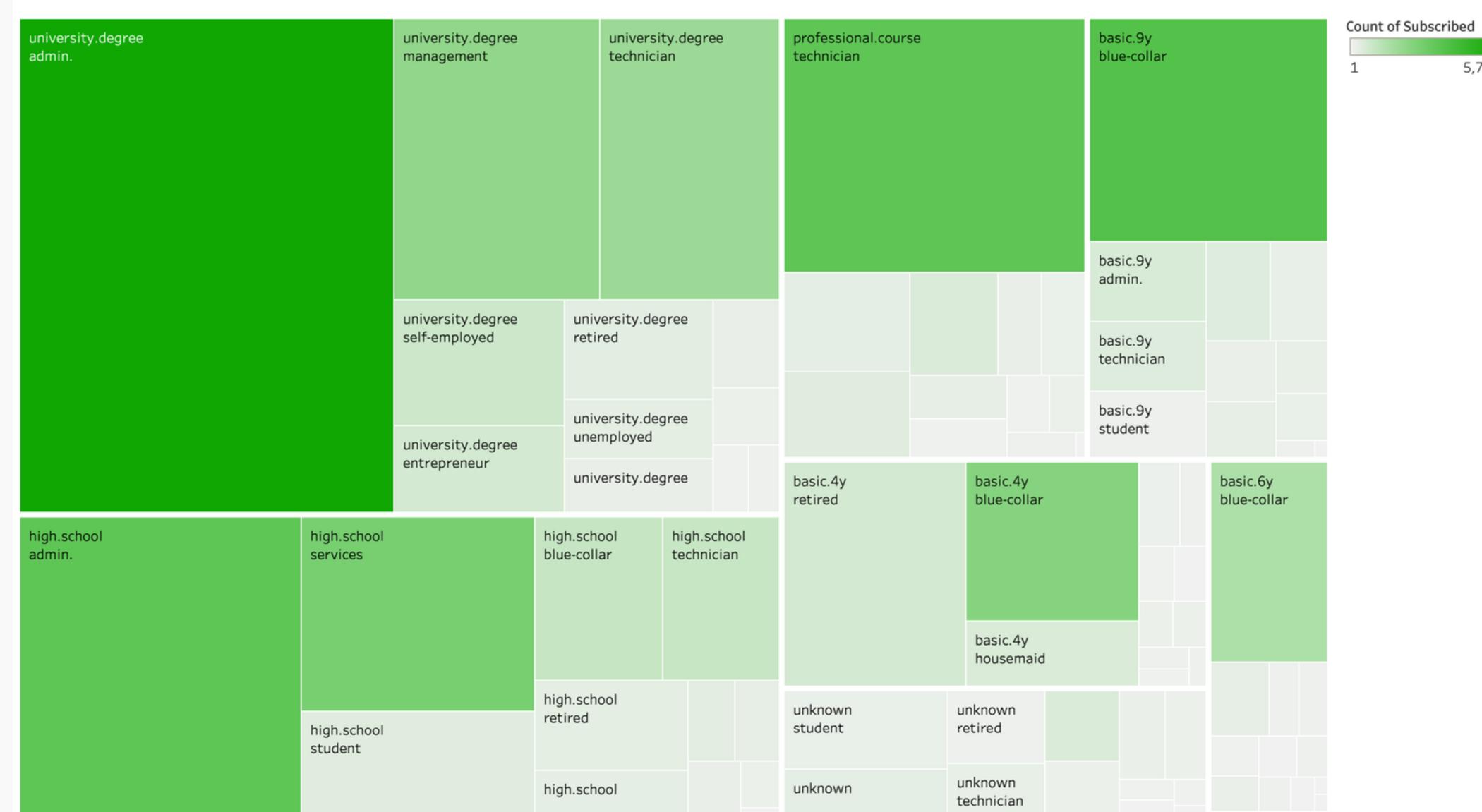
What economic and social factors affect customer decisions to adopt term deposit products?



- Customers were more likely to subscribe during periods of lower employment variation and lower interest rates, suggesting sensitivity to economic stability.
- Consumer confidence was slightly higher among those who subscribed, indicating that sentiment plays a role in decision-making.
- Price index variation had minimal impact, suggesting inflation alone doesn't drive behavior.
- **Timing campaigns during favorable economic periods could significantly improve subscription rates.**

What economic and social factors affect customer decisions to adopt term deposit products?

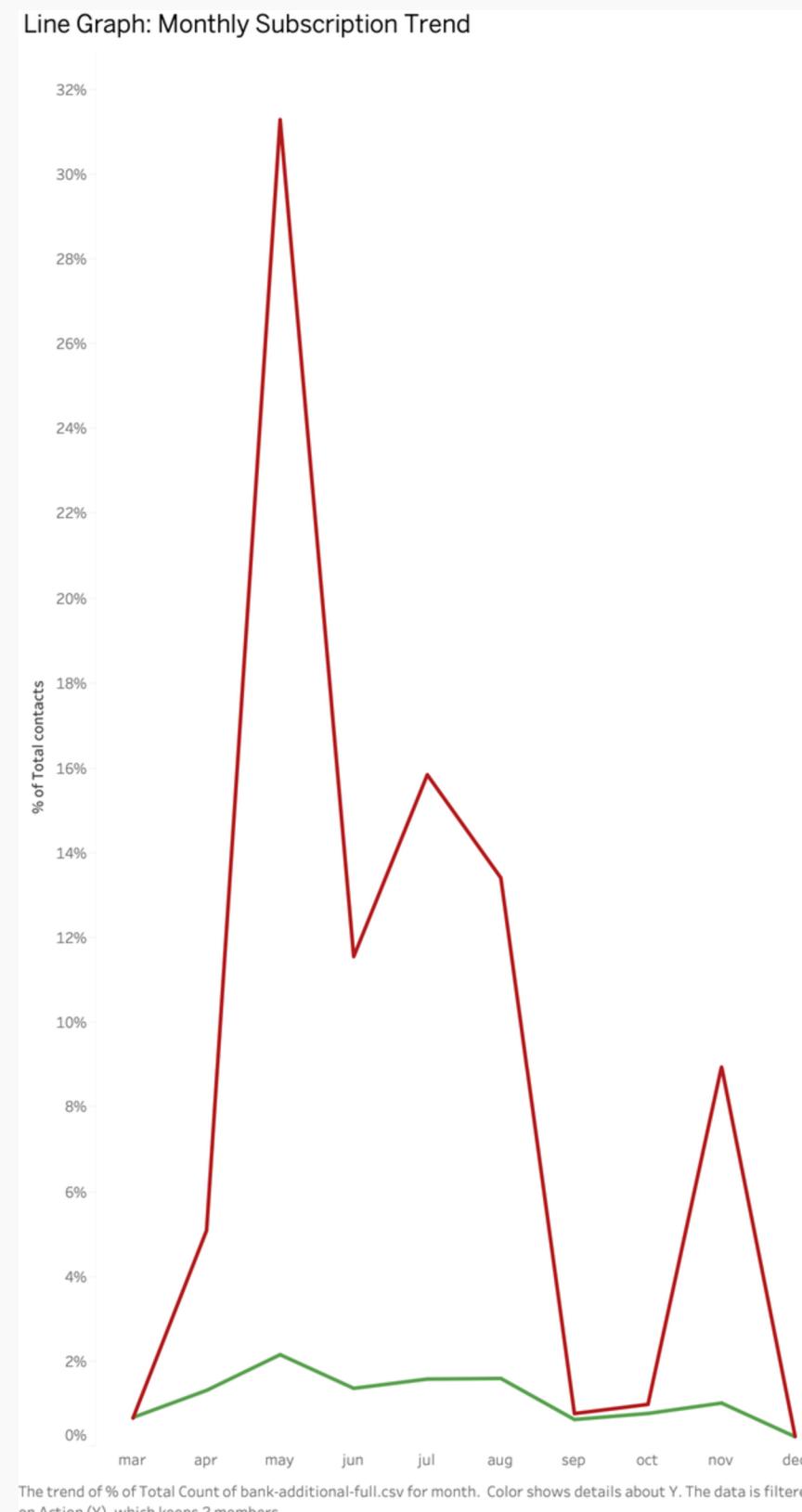
Heatmap: Job vs. Education (Subscription Rate)



Education and Job. Color shows count of Subscribed. Size shows sum of Subscribed. The marks are labeled by Education and Job. The data is filtered on Action (Y), which keeps 2 members.

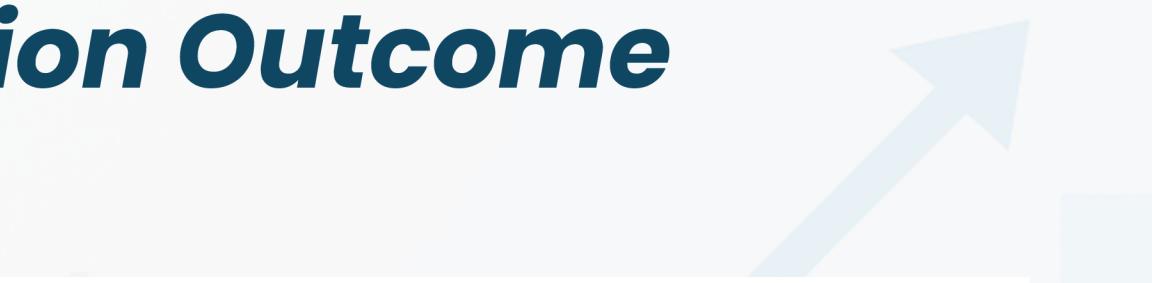
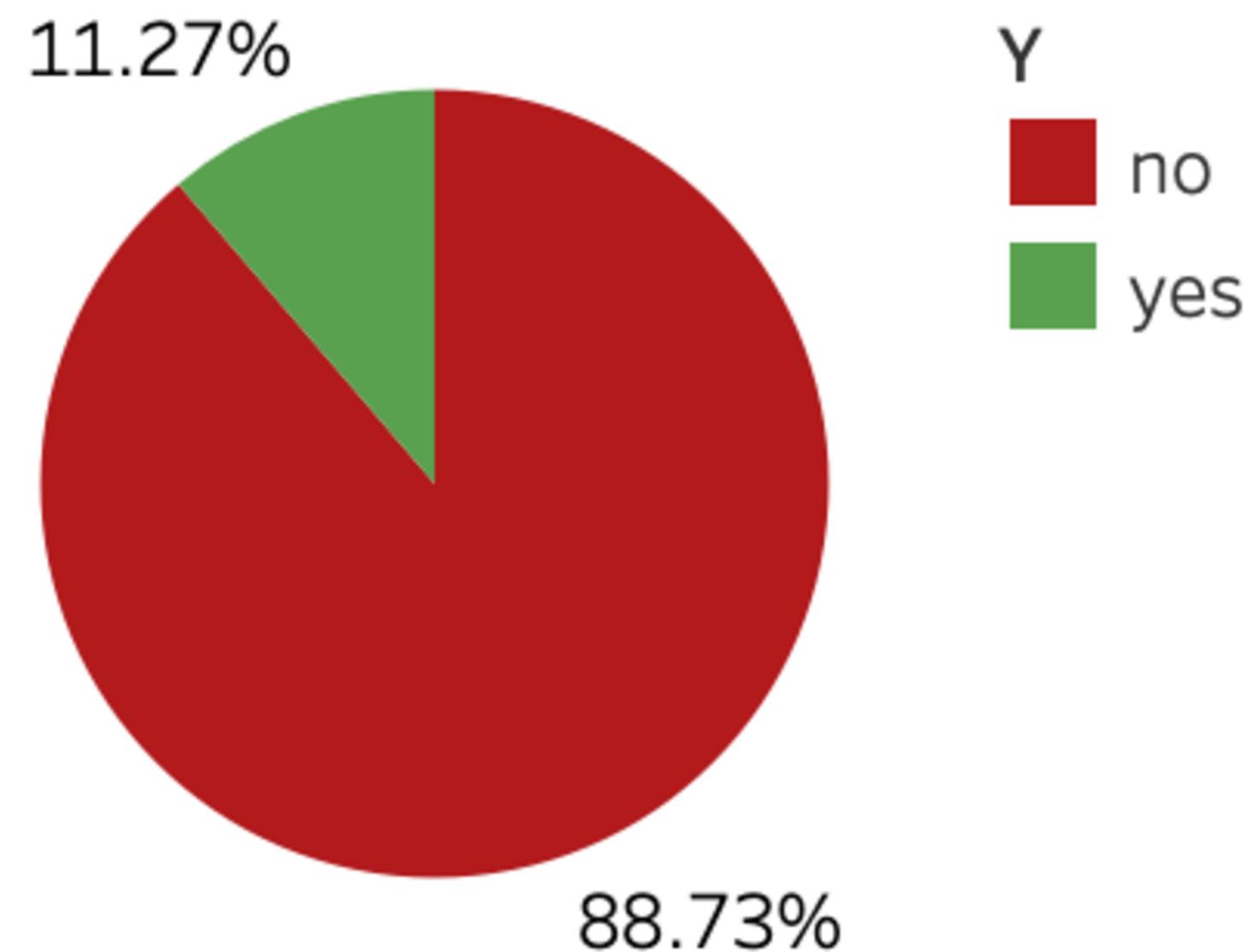
- Education level was a strong predictor of subscription: tertiary-educated clients subscribed at higher rates than those with only basic education.
- Job category and education combinations (e.g., admin + university degree) showed high performance in the heatmap, highlighting optimal targeting profiles.
- Clients with housing or personal loans were generally less likely to subscribe, suggesting perceived financial burden may reduce deposit interest.
- These patterns can inform micro-targeted outreach strategies for better conversion.

What economic and social factors affect customer decisions to adopt term deposit products?



- Subscription rates peaked in May, July, August and November, indicating potential seasonal influences or effective timing of past campaigns.
- Trends suggest that aligning campaign efforts with favorable economic windows could boost effectiveness.
- Future campaigns can benefit from historical timing analysis to optimize deployment schedules.

Overall Subscription Outcome



Key Findings

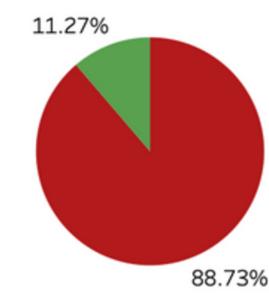
- Only 11.27% of clients subscribed to a term deposit, while 88.73% did not.
- This strong class imbalance highlights the challenge of customer conversion.
- Focus future marketing efforts on clients without personal or housing loans and with no history of credit default, as these segments consistently show the highest subscription rates for term deposits.
- The largest subscriber segment is tertiary-educated, management professionals, aged 31-40 and both married with 251 subscribers

Recommendations

- Prioritize marketing to highly educated management professionals aged 31-40, the most engaged segment
- Campaign strategies must be highly targeted and data-driven to improve this low subscription rate.
- Imbalanced outcomes also suggest the need for specialized techniques in modeling our campaigns

Optimizing Bank Marketing: Who Subscribes to Term Deposits and Why?

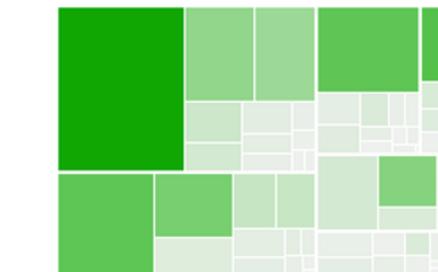
Overall Sub Status



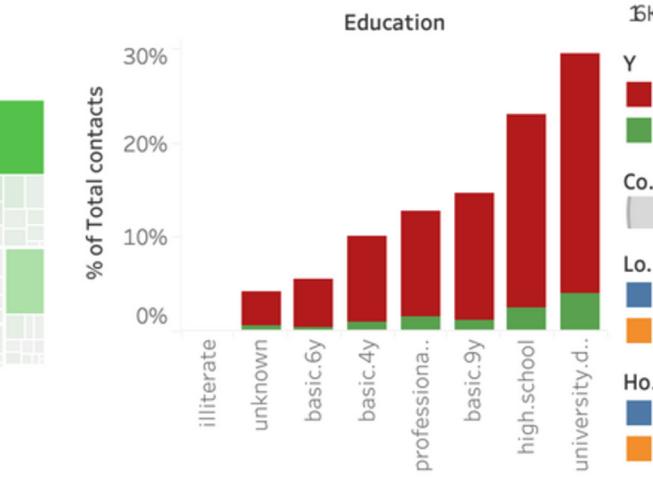
Line Graph: Monthly Subscription Trend



Heatmap: Job vs. Education (Subscription Rate)

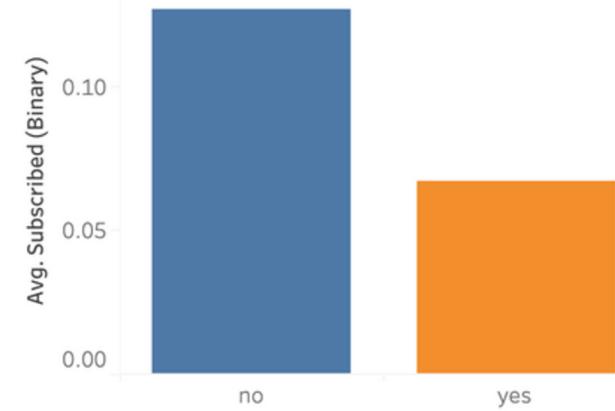


graph 2-stacked

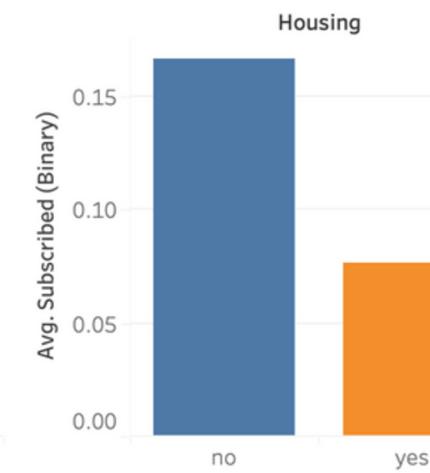


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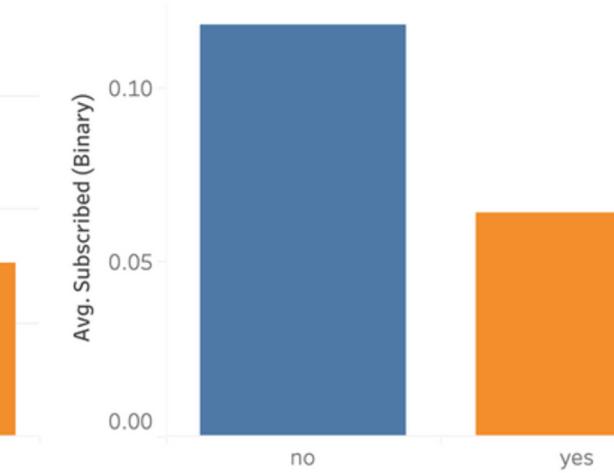
Subscription Rate with Personal Loan



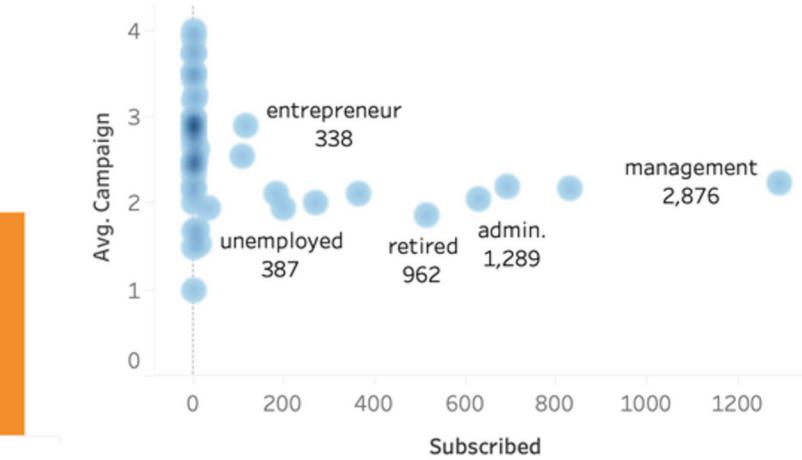
Sub Rate with Housing



Sub Rate with Default

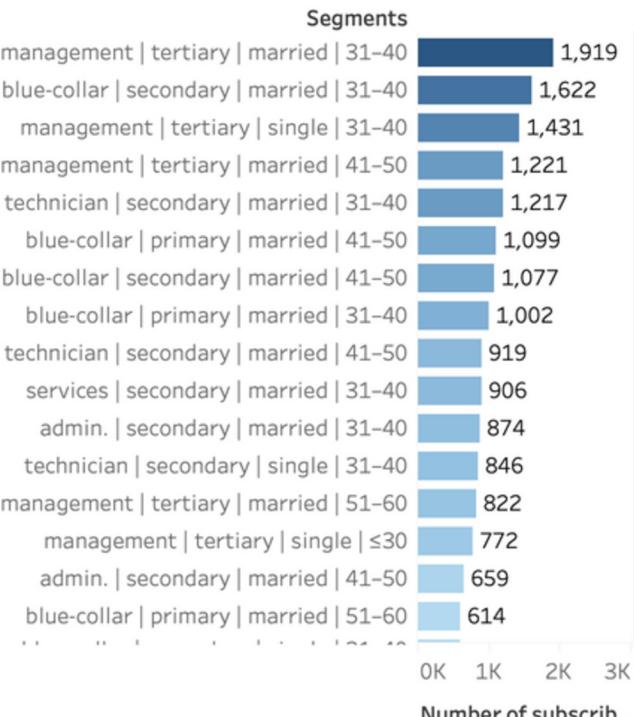


Campaign Effect on Subscription By Job



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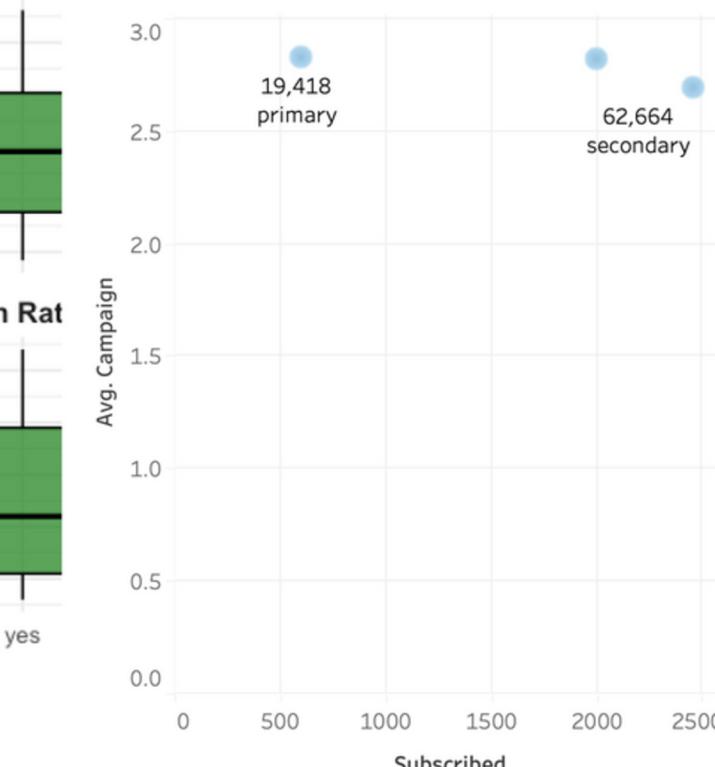
Horizontal bar chart showing the top 20 subscriber segments based on job, education, marital status and age group



Economic Indicators by Subscription Status



Campaign Effect on Subscription By Education





Thank you

