2Market: Exploratory Data Analysis and Predictive Modelling of Customer Spending

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1. Overview

This report presents insights from an exploratory data analysis conducted for **2Market**, a global supermarket with both online and in-store channels. The goal is to inform 2Market's 2025 marketing strategy by analysing customer demographics, purchasing behaviour, and advertising effectiveness.

Two datasets were analysed—customer profiles and advertising conversions using Excel, SQL, Tableau, and R. The analysis addressed three core questions:

- Who are our customers? (age, income, education, marital status)
- Which advertising channels drive the most conversions?
- Which products are most popular across customer segments?

Findings are supported by dashboards and a regression model designed to inform data-driven campaign planning.

2. Tools and Methodology

Data Sources

- marketing_data.csv: Contains customer demographics, spending behaviours, income, education, and marital status.
- ad_data.csv: Records customer responses to various marketing channels (e.g., Instagram, Facebook, brochures).

Tools

- Excel: For initial data cleaning, handling missing values, calculating age, and generating basic visualisations.
- SQL (PostgreSQL): Used to join datasets, calculate spending by segment, and summarize category spend by education level.
- Tableau: Built two interactive dashboards to present key insights to stakeholders.
- RStudio: regression analysis

Data Preparation

- Cleaning: Handled missing values, removed duplicates, and standardized data types (e.g., formatted income fields).
- Category Grouping: Combined "YOLO", "Alone", and "Single" into a single "Single" category to reflect similar behavioural patterns in spending and campaign response (see Appendix A1 Average Age by Marital Status).
- Invalid Values: Replaced "Absurd" entries with #N/A to prevent skewed analysis.
- Feature Engineering: Calculated age from Year_Birth using 2025 as the reference year, and created total spend variables by category.
- Data Join: Merged marketing_data and ad_data using the ID field.

While the dataset is historical (last recorded in 2014), this analysis projects demographic attributes (e.g., age) to 2025 to align insights with current business strategy needs. Education

is assumed stable over time, while marital status and channel effectiveness may have changed. These assumptions are acknowledged, and results should be interpreted as indicative rather than definitive. Future models would benefit from updated datasets to improve predictive accuracy and reflect changing consumer behaviour, especially in digital engagement.

SQL queries¹ were used extensively to support data cleaning, aggregation, and exploration. For instance, queries were designed to calculate total product spend by marital status, identify top-spending customer segments, and group data by family type.

3. Key Findings

Three interactive Tableau dashboards were developed to present key customer insights clearly and engagingly.

The Demographics & Spending Patterns dashboard highlights the following:

- The average customer age is approximately 55 years. (44 Years if we had considered 2014 as the base)
- Married individuals represent the most significant customer segment, with around 857 customers 38.7% followed by together 573 with 26% of the total customers
- There is a positive correlation between age, income, and education level.
- Customers with master's or PhD degrees demonstrate the highest average spending across all segments.
- Liquor and non-vegetables are the most purchased product categories, particularly among higher-educated and married customers.

This scatterplot illustrates the relationship between income and age, segmented by education level. Each point represents an individual customer, with a circle size indicating their average total spend.

¹ The full SQL queries can be found in <u>Appendix **B** – SQL Queries</u>



Figure 1: Demographics & Spending

Our analysis shows that high-income customers (earning \$90K–\$100K) are typically around 53 years old, with single and divorced individuals spending the most. Spending is also strongly linked to education, with master's degree holders leading in expenditure. Surprisingly, 60% of purchases still occur in-store, even among this digitally engaged group—highlighting the value of in-store experiences.

Instagram stands out as the top-performing ad channel, appealing to this segment's preference for visually rich, aspirational content. SQL analysis further reveals that households without young children or teens spend more on premium products like liquor, chocolates, and meat. This suggests a strong opportunity for Instagram-driven premium campaigns targeting older, high-income, educated customers without young kids.



Figure 2: High-Income Segment Analysis (\$90K–\$100K)

Dashboard 3 below shows country-level customer spending, response to social media ads, and Unique % of Social Revenue, which is the share of spending from customers who converted via at least one social platform.

- Spain had the highest total spend (\$659,557) and Social Revenue Unique % (36%).
- Canada and South Africa followed, each with 31%.
- Montenegro had no revenue from social media conversions. This insight helps identify where social ads are most effective and where to focus future campaigns.

Figure 3: Country Spend & Ad Summary

Dashboard 3: Country Spend & Ad Summary

Country	Non egetables	Vegetables	Commoditi	Fish	Chocolates	Instagram ad	Twitter ad	Bulkmail ad	Brochure ad	Canada Australia
Spain	178,409	28,288	46,181	40,153	30,134	89	87	83	16	India
South Africa									4	Germany
Canada	45,925	7,681	12,144	9,980	7,607	21	24	18	6	United Sta
Australia					4,129					Monteneg
India	23,729	3,788	6,014	4,818	3,221	6	10	13	2	Total Spend
Germany				4,601					2	
United Stat	20,185	3,034	4,839	4,411	2,863	5	6	8	0	3,122
Montenegro	817	8	220	226	122			1		

Average Spend Per Capita Per country

Country	Spend_per_capita	То
Spain	603	
South Africa		
Canada	629	
Australia		
India	529	
Germany		
United Stat	631	
Montenegro	1,041	

Top Countries by Social ad Revenue (Unique %)

Country	Social Revenue Uni	Total Spend
Spain	36	659,557
South Africa		
Canada	31	167,403
Australia		
India	26	77,806
Germany		
United Stat.	. 20	67,546
Montenegro		

Social Media-Driven Revenue by Country (Unique %)



Country
Spain
South Africa
Canada
Australia
India
Germany
United States
Montenegro
Total Spend
3,122
659,557

Social Revenue Unique % This metric estimates the

Inis metric estimates the percentage of total customer spending attributed to customers who converted via at least one social media platform (Instagram, Twitter, or Facebook). To avoid double-counting, each customer's total spend is only included once, regardless of how many platforms they converted from. Formula: Social Revenue Unique % = SuM(Social Revenue Unique % = SuM(Social Revenue Unique % = SuM(Social Revenue Unique % = spending on all major product categories: alcohol, vegetables, meat, fish, chocolates, and commodities.

Regression Analysis Summary

We used a multiple linear regression model to understand and forecast customer spending behaviour for the 2025 campaign. This approach allows us to quantify how different factors — such as income, purchase behaviour, and ad exposure — influence total spending.

We applied a **log transformation to income** to correct for skewness and better capture its relationship with spending. The model was trained on a cleaned dataset, excluding extreme outliers and statistically insignificant variables like Twitter ads. We validated the model using **robust standard errors** to account for potential heteroskedasticity and confirmed all included predictors were statistically significant.

The final model explains **approximately 73% of the variance in customer spending**, making it a reliable and interpretable tool for guiding campaign strategy and resource allocation. (see **Appendix C**

Appendix C.1-)

4. Recommendations

Descriptive and regression analysis reveal that 2Market's highest spenders are older (45–65), high-income, highly educated customers without children. They prefer in-store and online purchases and are concentrated in Spain, South Africa, and Canada.

Key spending drivers include income, purchase behaviour, and Instagram ad exposure, while households with children spend less. We recommend focusing campaigns on this core segment, prioritizing Instagram, enhancing in-store experiences, and exploring TikTok to stay ahead of digital trends.

Appendices





Appendix A1 – Average Age by Marital Status



Appendix A.3 – Average of Age by Marital Status after joining "YOLO, Single and Alone" into a single category





Appendix A.4 – Average Spend by Marital Status after joining "YOLO, Single, and Alone" into a single category

Appendix B – SQL Queries

Appendix B.1– Country-Level Total Spend and Product Category Breakdown with Ranking

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Appendix B.2 - Marital Status-Level Spend and Product Category Analysis with Rank

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127	SELECT *,													
.28		() OVER	(ORDER BY	Total_S	pend DE	SC) AS Spen	d_Rank							
129	FROM marita	l_spend;	;											
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Query Query History 2 147 - WITH family_product_spend AS (148 SELECT 149 CASE WHEN Kidhome + Teenhome = 0 THEN 'No Children/Teens' ELSE 'Has Children/Teens' END AS Family_1 150 'Liquor' AS Product, 151 SUM(AmtLiq) AS Total_Spend FROM marketing_data 152 153 GROUP BY Family_Type 154 UNION ALL 156 SELECT CASE WHEN Kidhome + Teenhome = 0 THEN 'No Children/Teens' ELSE 'Has Children/Teens' END AS Family_1 158 'Vegetables', SUM(AmtVege) 159 FROM marketing_data 160 161 **GROUP BY** Family_Type 162 163 UNION ALL SELECT 2 Data Output Messages Graph Visualiser × Notifications =+ 🖺 🗸 🗂 🗸 🛢 😂 💉 SQL Showing rows: 1 to 2 🎤 Page No: 1 of 1 4 44 >>> ▶| family_type most_popular_product total_spend text text bigint 1 Has Children/Teens Liquor 367133 2 No Children/Teens Liquor 308950

Appendix B.3 - Family Type and Most Popular Product Category Analysis

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Appendix B.4 - Country-Level Advertising Channel Conversion Analysis

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2 0	CA		24		21	18	18	6	
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4	IND		10		6	7	13	2	
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Appendix B.5 - Ad Channel Conversion Analysis by Marital Status

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223 🗸	SELECT						
224	m.Marit	al_Status,					
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226	SUM (CAS	T(a.Instagra	m_ad AS INT))	AS Instagram_L	_eads,		
227	SUM (CAS	T(a.Facebook	_ad AS INT)) A	S Facebook_Lea	ads,		
228			_ad AS INT)) A				
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230	FROM market						
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233	ORDER BY m.	Marital_Stat	us;				
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1	Divorced	18	13	12	20	5	
2	Married	62	66	62	63	7	
3	Single	32	32	31	39	5	
4	Together	42	44	32	37	12	
5	Widow	10	7	5	4	1	

Total rows: 5 Query complete 00:00:00.090

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Appendix B.6 -	Country-Level	Analysis of	Product Spend	and Ad	Channel	Conversions

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Appendix B.8 – ad conversions by education level across all ad channels

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93	SUM (a.Instagram	_ad) AS	Instagram_Conversi	ons,				
94	SUM (a.Facebook_a	ad) <mark>AS</mark> F	acebook_Conversion	is,				
95	SUM (a.Twitter_a	d) AS Tw	vitter_Conversions,					
96	SUM (a.Bulkmail_a	ad) <mark>AS</mark> E	ulkmail_Conversior	is,				
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00		a.Facebook_a							
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	text	instagram_conv		bigint	bigint	bigint	bigint	bigint	
	Graduation	instagram_conv	86	80	79	78	16	339	
	Graduation PhD	instagram_conv	86 39	80 30	79 45	78 40	16 10	339 164	
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Total rows: 5 Query complete 00:00:00.372

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	CASE											
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5	WHEN Country	= 'CA' TH	N 'Canada'									
6	WHEN Country	= 'GER' T	IEN 'Germany									
7	WHEN Country	= 'IND' T	IEN 'India'									
8	WHEN Country											
9	WHEN Country			rica'								
30	WHEN Country											
31	WHEN Country	= 'US' TH	N 'United S	tates'								
32	ELSE Country											
33	END AS Country_Na											
34	Channel AS Top_Ch	annel,										
35 36	Leads FROM ranked_channels											
86 87	WHERE channel_rank =	1										
88	ORDER BY Country_Name											
	ondan br councry_walle	,										
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Appendix B.10 - Top Advertising Channel by Country (Based on Leads)

Appendix B.11 - average amount spent on each product category by households,segmentedby:NumberofkidsorTeens

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744	SELECT										
745	Kidhome	e,									
746	Teenhor	me,									
747	CASE										
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749					0 THEN 'Kids						
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759	ROUND(AVG(AmtNonVeg), 1) AS avg_meat FROM marketing data										
760	GROUP BY K										
61	ORDER BY K	idhome	Teenhome:								
	ORDER BY K	idhome	, Teenhome;								
762			, Teenhome; aph Visualiser ×	Notification	s						
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762 Data =+ 1 2 3 4	Output Message	ges Gra home jer 0 1 2	aph Visualiser × aph Visualiser × family_type text No Kids or Teens Teens Only Teens Only Kids Only	QL avg_liquor numeric 488.1 417.7 409.6	avg_vegetables numeric 52.3 27.2 20.7	53.2 28.8 19.1	numeric 64.2 55.9 57.0	numeric 76.6 36.6 33.7	numeric 370.9 139.3 133.5		
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Appendix C

Appendix C.1- Final Linear Regression Model with Robust Standard Errors



Appendix C.2 – Effect predictors on Total Spending

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