Exploratory Data Analysis on Personality and Assets Dataset

Introduction

The goal of this exploratory data analysis is to understand how individual personality traits relate to financial behaviours, specifically through the lens of risk tolerance, asset allocation, and overall wealth. Using a combined dataset of personality metrics and detailed asset information across multiple currencies, the aim is to uncover patterns that help explain how psychological factors might shape financial decisions.

Correlation Between Personality Traits and Risk Tolerance:

The aim here is to explore how different personality traits relate to one another, particularly in the context of financial behaviour. Traits like confidence, impulsivity, and risk tolerance often act as psychological drivers behind how individuals approach investing or manage money, so it's useful to check for any strong correlations. For example, does higher composure tend to align with greater risk tolerance? Identifying these relationships helps set the foundation for more nuanced behavioural insights. To investigate this, the relevant personality trait columns were selected and pairwise Pearson correlations were calculated, which are visualised in the heatmap below.

The insights from this analysis revealed that the strongest relationship here is between confidence and risk tolerance ($r = 0.93$), which makes intuitive sense. People who feel more confident are more likely to take financial risks. These two traits are nearly interchangeable in this dataset, which might suggest that what someone interprets as tolerance for risk could reflect how confident they feel in their own judgment.

Composure also shows a moderate correlation with both confidence ($r = 0.55$) and risk tolerance ($r = 0.51$), which could hint that people who are calmer or more emotionally regulated tend to approach risk more comfortably.

Impulsivity and Impact Desire have low correlations with the rest of the variables, including risk tolerance (correlations around 0.05 or less. This suggests that financial risk tolerance in this sample might be more about deliberate confidence rather than emotional reactivity.

Overall, the pattern supports the idea that confidence and composure are closely tied to risk-related financial behaviour, whereas impulsivity and desire for influence seem to be more independent of how people handle financial uncertainty.

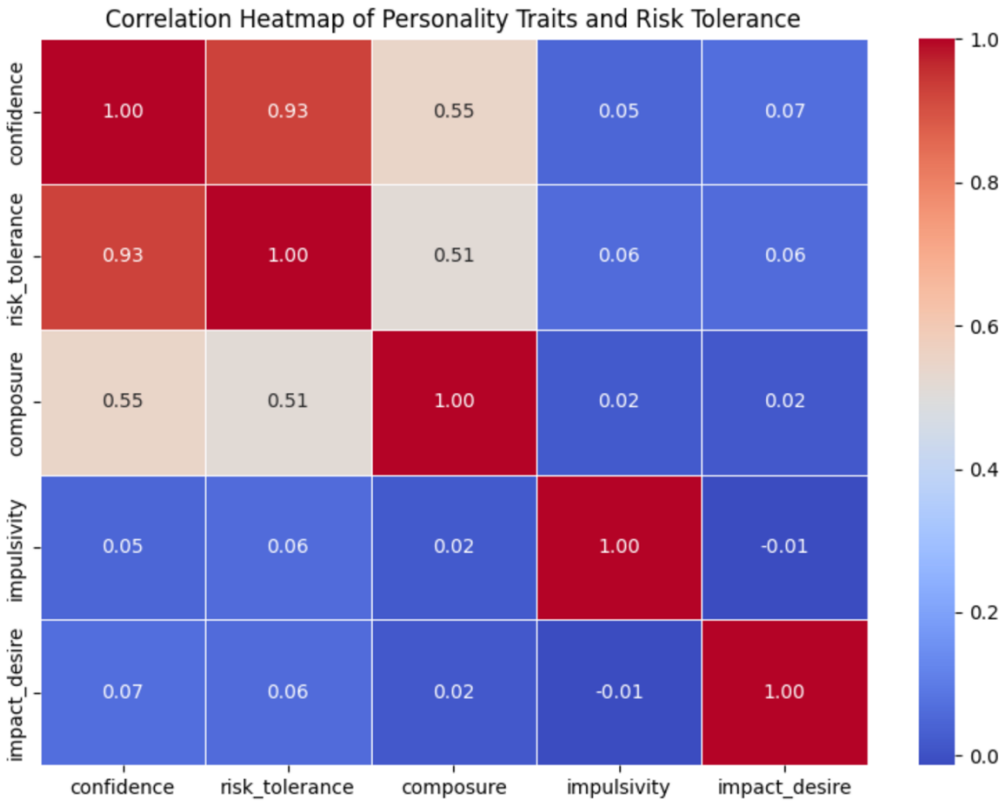

Fig. 1. Correlation heatmap of personality variables and risk tolerance

Asset Type vs Risk Tolerance:

This step looks at whether people with higher or lower risk tolerance prefer certain types of assets. It's important because it can tell us if someone's self-reported risk preference actually aligns with how they allocate their money. If we find, for example, that highly risk-tolerant individuals lean toward volatile assets, it adds a behavioural consistency layer to our understanding. On the flip side, any mismatch could also indicate that people say one thing but act differently.

For this analysis, each respondent's risk tolerance score was merged with their asset allocation type (e.g., equities, bonds, crypto, etc.). Then boxplots were used to compare the distribution of risk tolerance scores across different asset types, allowing to visually assess if specific asset categories attract people with different risk profiles.

Crypto has the highest average risk tolerance among all asset types, which aligns with its reputation as a highly volatile and speculative investment. This suggests that individuals who hold crypto assets are generally more comfortable with financial risk. Cash also ranks relatively high, though this may be due to its universal utility, making it a common holding regardless of an individual's risk profile. On the lower end, bonds and real estate show slightly lower average risk tolerance scores. These asset classes are traditionally viewed as more stable and conservative, and the data reflects that individuals holding them tend to be somewhat more risk-averse.

While the differences in average risk tolerance across asset types are relatively small, the trend is still informative. It indicates that asset preferences may reflect an individual's risk tolerance to a degree, although other factors such as age, income level, or financial literacy likely play a role as well. Overall, the analysis offers a useful behavioural perspective on how comfort with risk may influence investment decisions.

Table 1. Asset Type and Risk Tolerance

Asset Allocation	Mean Risk Tolerance	Median Risk Tolerance	Count
Bonds	0.496641	0.4990	128
Cash	0.501740	0.5020	77

Asset Allocation	Mean Risk Tolerance	Median Risk Tolerance	Count
Commodities	0.501138	0.4945	80
Crypto	0.504356	0.5020	267
Equities	0.500788	0.4970	137
Real Estate	0.497124	0.4920	97

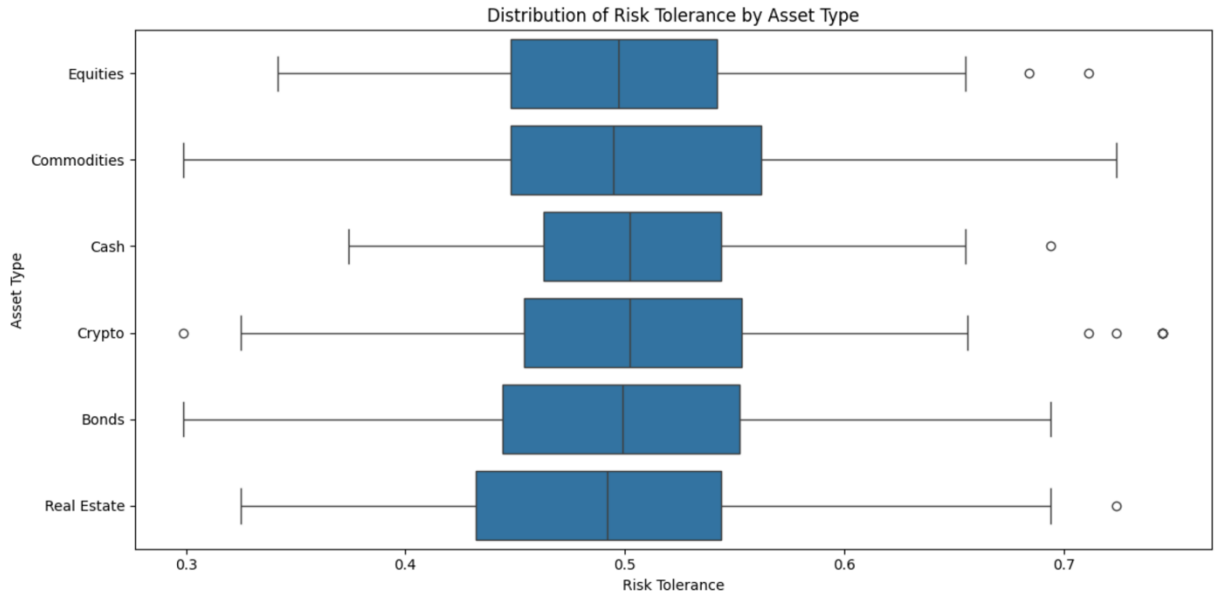

Fig. 2. Boxplot of asset type and corresponding risk tolerance

Behavioural Outliers in Asset Value vs Risk Tolerance:

This step focuses on identifying behavioural outliers—individuals whose financial behaviour deviates noticeably from what their psychological profile would typically suggest. For example, someone with a low risk tolerance but an unusually high asset value may represent an edge case worth examining more closely. Such discrepancies could reflect unique financial strategies, external factors like inherited wealth, or potential inconsistencies in self-reported personality data. Highlighting these cases adds depth to the analysis and may reveal patterns not captured by aggregate trends. To do this, all asset values were converted to GBP and then summed per

individual to get their total asset value. This was merged with risk tolerance scores to generate a scatter plot to visually spot outliers, i.e., individuals whose financial standing doesn't match their risk profile.

The scatter plot shows no strong linear relationship between risk tolerance and total asset value. Individuals with both high and low levels of risk tolerance are spread widely across the asset value range, which suggests that other factors are likely influencing asset accumulation.

There are a few notable outliers with very high asset values (above 1000 GBP), most of whom fall in the mid-to-high range of risk tolerance. This may point to a possible link between moderate or higher risk preferences and greater asset accumulation, at least for a small subset of participants.

Most participants are clustered between 200 and 600 GBP in total assets and between 0.4 and 0.6 on the risk tolerance scale. This concentration hints at a fairly risk-neutral and financially average profile for the majority of the sample.

What stands out most is how people with very similar risk tolerance scores can have vastly different levels of total assets. This variation highlights the complexity of financial decision-making and suggests that traits like impulsivity or contextual factors like income or access to investment opportunities might also play a role.

These findings reinforce the need to look beyond averages and consider individual patterns when analysing the relationship between personality and financial behaviour. Identifying outliers here could be a useful first step in narrowing down subgroups for deeper analysis.

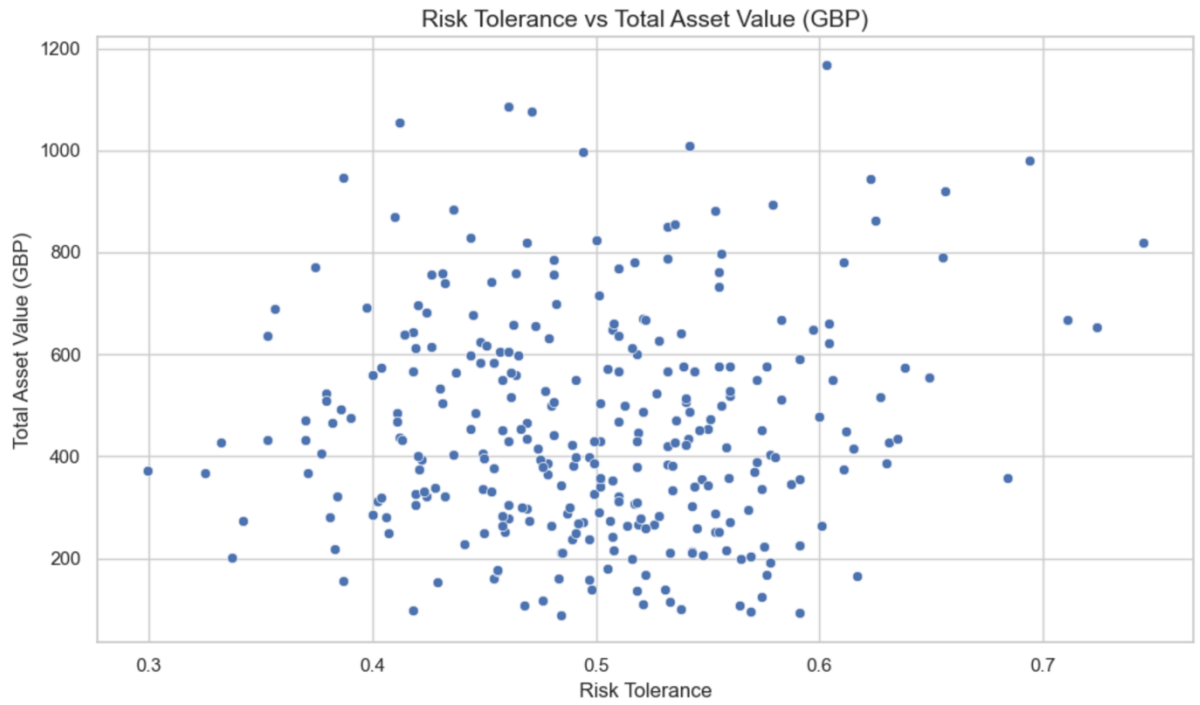

Fig. 3. Scatterplot of total asset value in GBP vs Risk Tolerance

Clustering Based on Personality Traits:

This step focuses on identifying distinct behavioural profiles based on participants' personality traits. KMeans clustering is applied to group individuals who demonstrate similar patterns across traits such as confidence, risk tolerance, composure, impulsivity, and impact desire. The objective is to determine whether meaningful groupings emerge naturally within the data. Once the clusters are formed, they are examined for potential associations with financial behaviour, including differences in total asset value and preferences for specific asset types. This approach provides a structured way to investigate how psychological characteristics may relate to financial decision-making. For this analysis, the five personality trait columns were standardized and KMeans clustering (with 3 clusters) was used to group individuals. The number of clusters was selected for simplicity and interpretability. After assigning each record to a cluster, the average trait scores per cluster were calculated to profile them. These clusters were then analysed in relation to their average risk tolerance and asset preferences.

The personality trait clustering revealed three distinct profiles among participants. Cluster 0 was characterized by the highest levels of impulsivity alongside relatively lower scores in confidence and impact desire. This suggests a group that may act quickly in financial decisions but with less strategic assertiveness or long-term ambition. Cluster 1 showed the lowest impulsivity and moderately low scores across other traits, particularly confidence and risk tolerance. This profile may reflect more cautious, conservative individuals who prefer stability and avoid high-stakes decision-making. Cluster 2 stood out with the highest averages across most traits, including confidence, risk tolerance, composure, and impact desire. This group may represent participants who are more self-assured, comfortable with financial risk, and driven by outcome-oriented goals.

These profiles offer a meaningful psychological segmentation of financial behaviour in the current dataset, setting the groundwork for deeper analysis of how trait-based clusters align with asset preferences and financial capacity.

cluster	confidence	risk_tolerance	composure	impulsivity	impact_desire
0	0.446979	0.462536	0.474052	0.747773	0.433093
1	0.430663	0.448887	0.464088	0.204237	0.529725
2	0.587558	0.561483	0.557450	0.499617	0.516967

Fig. 4. Results of KMeans clustering (k=3)

Cluster-Based Analysis of Asset Preferences & Average Asset Value:

After the clusters were formed, this step introduces an additional layer of interpretation by examining the average asset value and asset preferences associated with each group. This helps to ground the personality-based clusters in tangible financial behaviour. It enables clearer characterisation of the clusters, such as noting that Cluster 2 is generally more composed and confident, tends to hold greater average wealth, and shows a preference for diversified asset holdings. This type of behavioural segmentation can offer meaningful insights for tailoring financial advice or developing targeted services and helps to understand whether psychological groups show consistent differences in financial decision-making. To achieve this cluster assignments were merged with each respondent’s total GBP asset value and their preferred asset

types. Then the average total asset value per cluster and the distribution of asset allocation types per cluster were identified.

Average Asset Value:

Looking at the average total GBP asset value per cluster, Cluster 0 stands out slightly with the highest average wealth, followed by Cluster 1 and then Cluster 2. While the differences aren't dramatically wide, they do reinforce some of the patterns observed earlier. For instance, Cluster 0 showed notably high impulsivity, which might typically be associated with riskier or more aggressive financial behaviour—yet this group also holds the most wealth on average. This suggests that impulsivity, in this context, may not necessarily signal poor financial outcomes. Meanwhile, Cluster 2, which was the most composed and confident based on personality traits, has the lowest average wealth of the three. This disconnect between personality traits typically linked with stable decision-making and actual asset accumulation adds nuance to how personality might interact with financial behaviour. It also highlights the value of exploring both psychological and behavioural layers when analysing investor profiles.

```
cluster
0    471.926735
1    450.583423
2    446.108046
Name: total_asset_gbp, dtype: float64
```

Fig. 5. Average asset value per cluster

Fig. 6. Bar graph showing average asset value per cluster

Asset Preferences:

Crypto is the dominant asset across all groups but is especially prevalent in Clusters 0 and 2. Cluster 0, which showed the highest impulsivity, also has the lowest allocations to more stable assets like bonds and real estate. This suggests a stronger appetite for risk. Cluster 1 shows a more balanced profile, with crypto, equities, and real estate making up most of the allocation. Despite lower impulsivity, their preferences indicate more measured, possibly diversified investment behaviour. Cluster 2, with the highest confidence and risk tolerance, also leans heavily toward crypto but maintains slightly higher allocations to traditional assets like bonds and equities. This suggests that even confident, composed individuals may favour high-risk assets when they feel equipped to manage the volatility.

asset_allocation	Bonds	Cash	Commodities	Crypto	Equities	Real Estate
cluster						
0	42	27	29	104	36	30
1	35	25	18	51	49	31
2	51	25	33	112	52	36

Fig. 7. Asset distribution per cluster

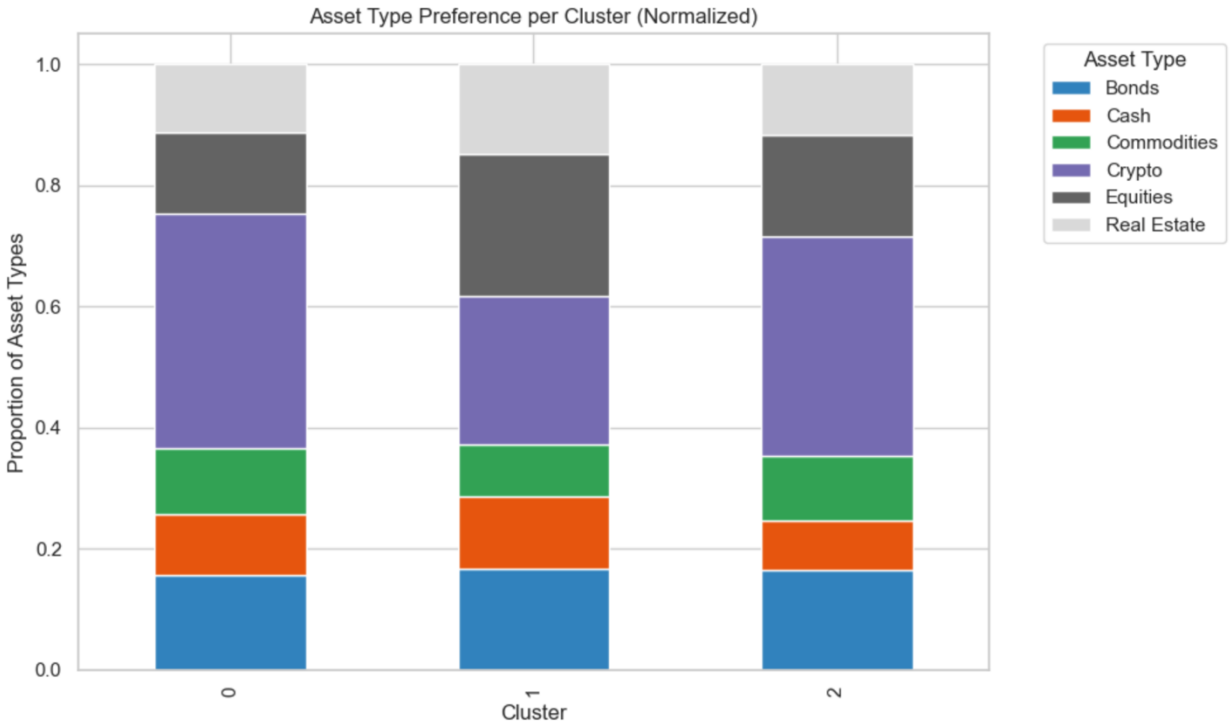

Fig. 8. Stacked bar chart showing asset distribution per cluster

The total asset value analysis shows that Cluster 0 holds the highest average wealth, followed by Cluster 1 and then Cluster 2. Cluster 0 also has the highest allocation to crypto, suggesting a potential payoff from higher-risk strategies that align with their elevated impulsivity. Cluster 1, despite having lower overall wealth, displays a more balanced asset distribution across crypto, equities, and real estate, which could indicate a more cautious or diversified approach. Cluster 2, while showing the highest confidence and risk tolerance, has the lowest average wealth and a moderately spread portfolio, pointing to a risk-seeking mindset that may not yet have translated into financial outcomes. Together, the patterns suggest that personality-driven behaviours may influence not just asset preferences but also financial outcomes.