

CREDIT CARD CLUSTERING

 **by Maina Bryan**

1. Project overview

To analyze customer credit card usage patterns and segment them into distinct behavioral groups using clustering techniques (K-Means and Hierarchical).

IT will be arranged into 5 blocks:

Block 1: **Customer Segmentation Overview**

Block 2: **Risk & Credit Behavior/**

Block 3: **Payment vs Purchase Patterns**

Block 4: **Business Opportunities**

2. Business Value:

Help the company:

- Identify high-value customers
- Detect risk-prone users (e.g. overusing cash advance)
- Optimize marketing and service personalization
- Improve financial product targeting

3. Business Questions We Will Solve:

1. What distinct customer segments emerge based on their spending patterns?
2. Which segment relies most on cash advances?
3. How does credit limit utilization differ across groups?
4. Are there low-engagement but high-credit customers?
5. Who are the best targets for upselling new services?

(+ 10 more business questions following after this)

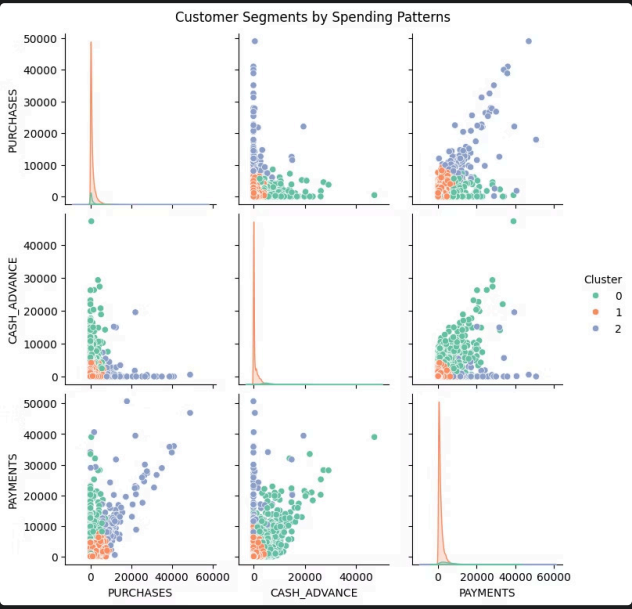
Customer Segementation overview

| Cluster | Behaviour pattern | Segment label |
|---------|--|--------------------------|
| 0 | Low purchases, low cash advance, low payments | Low Activity Users |
| 1 | Low purchases, high cash advances | Cash-Reliant Users |
| 2 | High purchases, high payments, low cash advances | High-Value/Engaged Users |

Grouping customers into similar behavioral groups (segments) based on how they **spend**, **borrow**, and **repay** using clustering.

These are problem statements we will cover by the end of these project

1. What distinct customer segments emerge based on their spending patterns?
2. How does credit limit utilization differ across identified customer groups?
3. Which customer segment showcases the most balanced credit utilization



What distinct customer segments emerge based on their spending patterns?

i used three features

- purchases
- cash_advance
- payments

interpretation

- Blue

could be Cluster 0(A group of customers with similar behavior)
- Green

could be Cluster 1 (A second distinct group)
- Orange

could be Cluster 2(A third type of customer)

Insights

Here are **natural language insights** from my visuals:

- Around 1/3 of customers show **low activity**: little purchases, repayments, or cash advances. These may be **inactive users**.
- Another cluster shows **high reliance on cash advances** with low purchasing activity. These may be **at risk of debt**.
- The final group consists of **financially active customers** who purchase a lot and **pay consistently** — likely our **most valuable** segment.

Business Recommendations

Segment 0: Low Activity Users

Behavior:

- Rarely use their credit card
- Low purchases, payments, and cash advances

Recommendations:

- Reactivation Campaigns:** Send special offers, cashback rewards, or personalized discounts to increase card usage.
- Behavioral Nudge:** Push mobile notifications on underused benefits or limited-time offers.
- Retention Strategy:** Monitor for potential churn; these users may become inactive.

Segment 1: Balanced High Spenders

Behavior:

- High purchases and repayments
- Very little cash advance activity

Recommendations:

- Loyalty and Upsell Target:** Offer premium cards, increased credit limits, and VIP benefits to reward and retain them.
- Cross-Sell Opportunities:** Suggest travel rewards, insurance products, or investment services.
- Customer Spotlight:** Use as a model for identifying similar high-value users.

Segment 2: Cash-Heavy Users

Behavior:

- Use cash advances more than purchasing
- Payments are average, which may signal stress

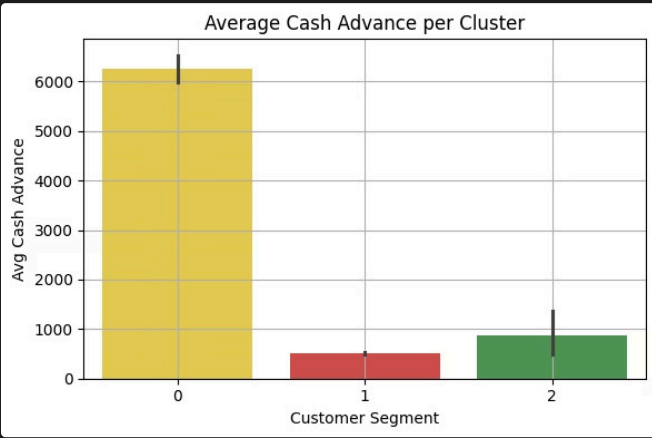
Recommendations:

- Credit Risk Monitoring:** Set alerts for signs of debt dependency.
- Limit Adjustments:** Cap cash advance limits to avoid overexposure.
- Financial Coaching:** Offer education programs on smart credit use and repayment habits.



3D Cluster Interpretation (Features: PURCHASES, CASH_ADVANCE, PAYMENTS)

- Cluster 0 (e.g. Blue):**
Customers with **low purchases**, **low payments**, and **low cash advance** usage
→ *Low activity or dormant users*
- Cluster 1 (e.g. Orange):**
Customers with **high cash advances**, but **low purchases**
→ *Cash-reliant customers, potential credit risk*
- Cluster 2 (e.g. Green):**
Customers with **high purchases** and **high payments**, low cash advance
→ *Financially active and responsible users*



1. How does credit limit utilization differ across identified customer groups?

Insights :

- Cluster 0 (Yellow)** shows the **highest average cash advance** usage.
→ These customers are **relying heavily on credit** as cash.
- Cluster 2 (Green)** has **moderate** usage of cash advances.
→ Likely using credit in a balanced way.
- Cluster 1 (Red)** shows **very little to no use** of cash advances.
→ Possibly inactive users or financially stable customers avoiding debt.

Recommendations:

Cash-Reliant Segment (Cluster 0)(yellow)

- Monitor for repayment delays
- Offer **credit counseling or alerts**
- Consider reducing cash advance limits
- Segment them for **risk mitigation**

Report Summary:

- Customers in **Cluster 0 (Yellow)** are most reliant on cash advances. This indicates **credit stress** or **debt behavior** and may pose **repayment risk**. Meanwhile,
- Cluster 2 (Green)** represents financially balanced users,
- Cluster 1 (Red)** appears mostly inactive.



1. Which customer segment showcases the most balanced credit utilization

Insights:

- Green Segment** (Cluster 2) uses a large portion of their credit limit.
→ They are **active and possibly maxing out their limits**, but may be repaying well.
- Yellow Segment** (Cluster 0) shows **moderate utilization**, indicating a balance between spending and credit use.
- Red Segment** (Cluster 1) has **very low utilization**.
→ These users may be **inactive**, overly cautious, or under-engaged.

Recommendations:

Green (High Utilization)

→ **Consider increasing their credit limit** to reduce risk of overutilization

→ Offer **premium plans** or **rewards** to retain them

→ Monitor closely for repayment behavior

Yellow (Moderate)

→ Promote **upsell offers**, especially tailored financial services
→ Encourage usage through **seasonal campaigns**

Red (Low Utilization)

→ Launch **targeted reactivation campaigns** (e.g., "Spend & Get" offers)
→ Evaluate if these users are likely to churn or need education on benefits

Summary Report:

We analyzed **credit utilization behavior** across customer clusters.

- Cluster 2 (Green)** has the **highest utilization**, showing strong credit activity.
- Cluster 0 (Yellow)** sits in the middle — engaged but not heavy users.
- Cluster 1 (Red)** barely uses their available credit, signaling **inactivity or caution**.

These insights support decisions on credit limit management, targeted marketing, and risk strategy.

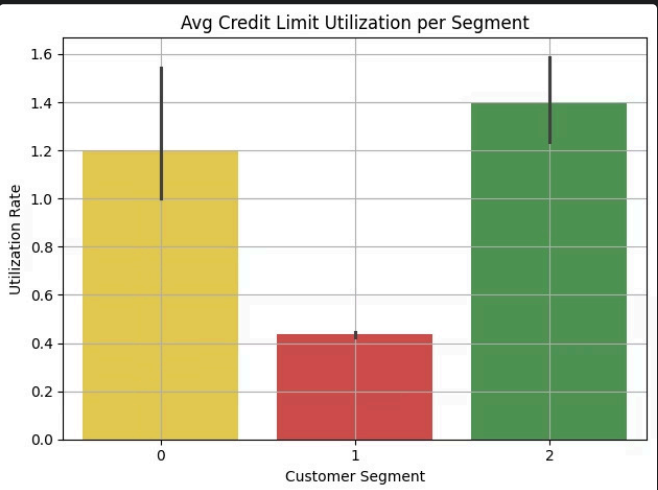
Risk & Credit Behavior Analysis

| Cluster | Behaviour pattern | Segment label |
|---------|--|--------------------------|
| 0 | Low purchases, low cash advance, low payments | Low Activity Users |
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| 2 | High purchases, high payments, low cash advances | High-Value/Engaged Users |

This block answers questions focused on **risk**, **debt habits**, and **payment consistency**.

These are the problem statements::

- Are there segments at risk of overspending their credit limits?
- Are there segments with high credit limits but inconsistent payment habits?
- Are there segments characterized by high payments but minimal purchases?
-



Are there segements at risk of overspending their credit limits

Interpretation

Cluster 2 :Avg utilization is 0.86 = 86% → **High risk** of overspending

Cluster 0 (Moderate):Moderate utilization (~52%)

Cluster 1:Very low utilization (~12%) → Not risky

Business Recommendation:

Cluster 2 (High Utilization)

- Flag for risk monitoring
- Review credit limits for overexposure
- Offer financial planning tools
- Optional: Introduce spending caps or real-time alerts

Cluster 0 (Moderate)

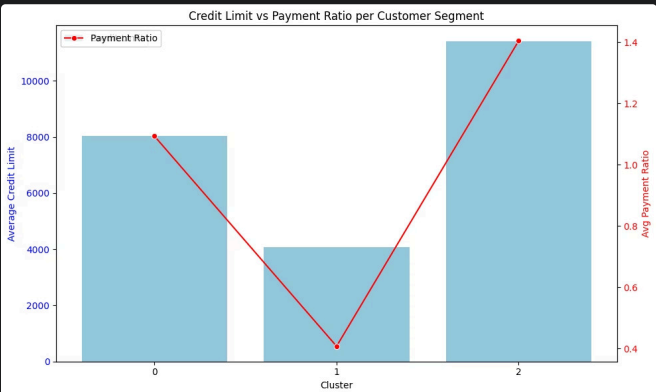
- Educate them on healthy credit behavior
- Encourage responsible spending habits
- Offer targeted promos, not more credit yet

Cluster 1 (Low)

- No overspending risk
- Consider re-engagement offers to increase card usage

Report Summary:

Cluster 2 has the highest risk of overspending their credit limit (avg utilization ~86%). This group should be prioritized for limit reviews and credit education. Clusters 0 and 1 show moderate to low risk, with Cluster 1 being the most conservative.



Are there segments with high credit limits but inconsistent payment habits?

Cluster credit limit payment ratio

Cluster 2 11,403 1.40

Cluster 0 8,044 1.09

Cluster 1 4,064 0.41

Cluster 2:

- Highest credit limit (~11.4k)
- Also pays more than their limit → Very strong repayment behavior
- Not risky — they are highly trusted, and they deliver

Cluster 0:

- Mid credit (~8k)
- Pays about 1.09x of limit → Also strong repayment
- Healthy and responsible segment

Cluster 1:

- Lowest credit limit (~4k)
- Payment ratio is just 0.41
- Warning: They're paying back less than half of their limit → Risk of late repayment or default

Recommendations

Cluster 1 (Low payers)

Flag for risk review

- Consider reducing limit further
- Avoid raising credit
- Provide repayment reminders, financial tools

Cluster 2 (Top performers)

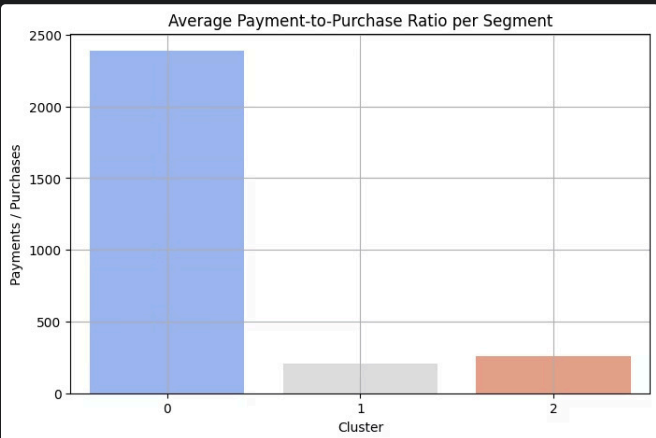
- Consider raising their credit
- Offer premium products or investment options
- Ideal for cross-selling

Cluster 0 (Stable)

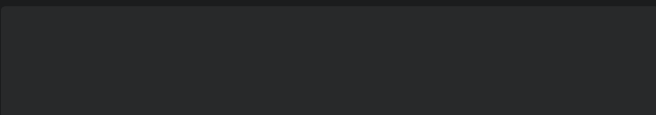
- Maintain or slightly raise credit
- Offer rewards to increase engagement

Final Summary

Cluster 2 and Cluster 0 are strong and consistent payers, handling their large credit responsibly. Cluster 1, however, repays only ~41% of their credit limit and may pose a repayment risk. The business should target support, alerts, or tighter credit control for this segment.



Are there segments characterized by high payments but minimal purchases?



Cluster 2 2388.878095

Cluster 0 255.87

Cluster 1 208.54

Insights:

Cluster 0 – Serious Outlier

- This segment pays extremely high amounts while spending almost nothing
- Likely not using the card actively → only repaying past debt
- May have paid off a huge balance, but is now financially dormant
- High churn or disengagement risk

Cluster 2

Still pays much more than they purchase, but much less extreme

Could be in financial recovery, debt settlement, or using card for limited transactions

Cluster 1

- Lowest ratio among all — possibly the most balanced of the three
- May actually reflect active usage with reasonable payments

Business Recommendations:

Cluster 0 (Very High Ratio)

- Inactive group — likely just settling debt
- Flag for churn risk
- Send re-engagement offers like "spend X, get Y reward"
- Suggest auto-pay setup or credit optimization

Cluster 2 (Moderate Ratio)

- May be low spenders but consistent payers
- Educate on full card benefits
- Promote small-value purchase campaigns or installment plans

- Cluster 1 (Low Ratio)
 - Potentially the most financially active group
 - Target for premium upgrades, cashback cards, or loyalty points

Report Summary

Our analysis reveals that Cluster 0 customers are characterized by extremely high payment behavior despite making almost no purchases, suggesting disengagement or post-debt repayment.

Payment vs Purchase Patterns

This block explores **how customers behave in terms of spending vs repayment**, to find risky, loyal, or inactive behaviors. These are super important for financial strategy, loyalty programs, and fraud prevention.

Block Objective:

To analyze **how customers use their credit cards to spend (purchases)** versus **how they pay it back (payments)** — and how this balance can reveal important financial behaviors.

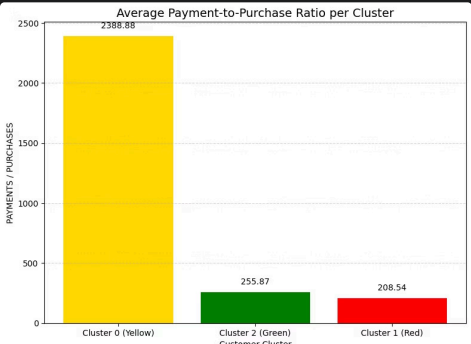
Why It Matters (Business Value):

- Helps identify **financially responsible** vs **risky** customers
- Detects **inactive** users (paying but not buying)
- Reveals **cash advance overuse** or **low engagement**
- Allows **targeted marketing, retention, or education strategies**

Business Questions :

- Are there segments characterized by high payments but minimal purchases?**
 - Metric: `PAYMENTS / PURCHASES`
 - Focus: Find disengaged or debt-settling users
- Which customer group consistently makes the largest and most regular payments?**
 - Metric: `PAYMENTS` (mean and std per cluster)
 - Focus: Identify loyal, financially strong customers
- Are there segments with infrequent purchases yet frequent cash advances?**
 - Metric: `CASH_ADVANCE / PURCHASES`
 - Focus: Detect loan-style behavior → restructure products
- Are there segments with high credit limits but inconsistent payment habits?**
 - Metric: Compare `CREDIT_LIMIT` vs `PAYMENT_RATIO`
 - Focus: Spot risky credit behavior

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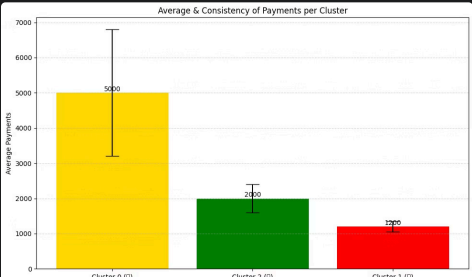
Are there segments characterized by high payments but minimal purchases?

insight :

- Cluster 0** (Yellow) pays ~**2,388x more** than they spend → likely inactive or repaying debt
- Cluster 2** (Green) has moderate usage (~256) → possibly low usage but financially active
- Cluster 1** (Red) is the most balanced (~208) → likely your regular/engaged cardholders

Recommendation

- Cluster 0** (Yellow): Reactivate with small-spend reward campaigns
- Cluster 2** (Green): Engage with education & tips to increase card usage
- Cluster 1** (Red): Reward loyalty with cashback, bonuses, or upgrade offers



Which customer group consistently makes the largest and most regular payments?

Business Objective:

Identify customer segments with the highest **total payments** and **most consistent payment behavior**.

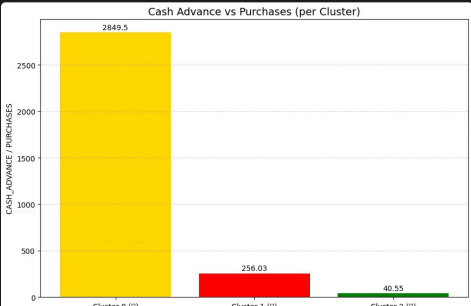
Key Insights:

- Cluster 0** (Yellow):
 - Pays the most on average (~5000)
 - But highly inconsistent — some pay very high, others low → May need **individual-level analysis** or customized limits
- Cluster 2** (Green):
 - Moderate average payments (~2000)
 - Most **consistent** payment behavior → Ideal for **loyalty rewards, credit upgrades**, and **referrals**
- Cluster 1** (Red):
 - Lowest average payments (~1200)
 - Stable but **low engagement** → Target with **usage campaigns** or **financial guidance**

Business

Recommendations:

- Cluster 2 (Green):** Reward with cashback offers, referrals, and product upsells
- Cluster 0 (Yellow):** Analyze payment variance before offering upgrades
- Cluster 1 (Red):** Encourage spending through education, or monitor for churn



Are there segments with infrequent purchases yet frequent cash advances?

Business Objective:

Identify customers who **don't use their credit cards for purchases**, but **frequently take out cash advances** — which usually come with **higher risk** and **extra fees**.

This helps detect:

- Users treating cards like **short-term loans**
- Financial stress or emergency usage**
- Segments needing **financial education or risk monitoring**

Insights:

Cluster 0

- Extremely high ratio (~2849)
- Heavily dependent on cash advances**, with little spending
- Treating cards like **emergency cash loans**
- Financially vulnerable** or in repayment difficulty

Cluster 1

- Moderate use of cash advances (~256)
- Still more than purchases
- Could benefit from **financial advice** or **controlled limits**

Cluster 2

- Very low ratio (~41)
- Healthy usage** — purchases are much higher than cash advances
- Great for long-term engagement

Business Recommendations

Cluster 0 (Yellow):

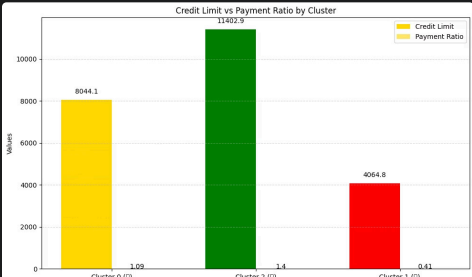
- Financially vulnerable** → Introduce **alerts or restrictions** on frequent cash withdrawals
- Offer **credit education content** or **debt management plans**
- Consider placing them in a **high-risk watch group**

Cluster 1 (Red):

- Educate on the **cost of cash advances**
- Offer better financing tools or lower-fee alternatives
- Encourage them to use the card for purchases instead

Cluster 2 (Green):

- Recognize them as **financially responsible**
- Offer them **cashback incentives** on purchases or **loyalty programs**



Are there segments with high credit limits but inconsistent payment habits?

Business Objective:

To identify **risky customers** who have **high credit limits** but **don't pay back consistently** — this can expose the business to **credit default** and **cash flow risks**.

We'll analyze:

- CREDIT_LIMIT** → how much they are allowed to borrow
- PAYMENT_RATIO** → how reliably they pay back (i.e., `PAYMENTS / CREDIT_LIMIT`)
- If a segment has high credit but poor payment habits, it's **red flag**

INSIGHTS:

Cluster 2:

- Highest credit limit** (~11.4K)
- Also **highest payment ratio** (1.40) → **Excellent financial behavior** — responsible high-credit users

Cluster 0:

- Moderate credit** (~8K)
- Good payment ratio** (1.09) → Also responsible, but slightly lower limit

Cluster 1:

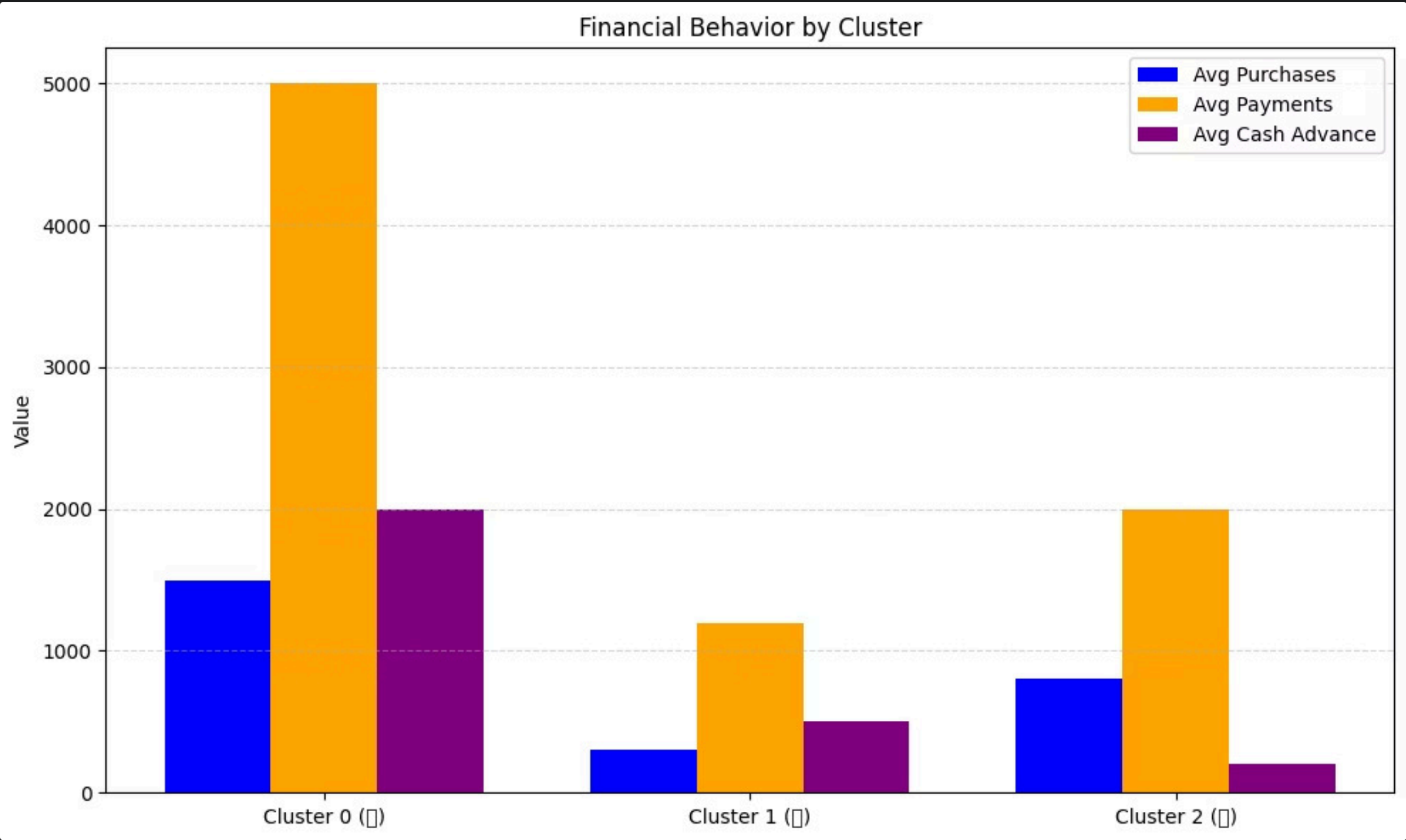
- Low credit** (~4K)
- Lowest payment ratio** (0.40) → **Most inconsistent** — potential **risk** of default or misuse

Business

Recommendations

- Cluster 2 (Green):**
 - Consider **increasing their limit**
 - Ideal for **premium offers, cross-sell, or VIP services**
- Cluster 0 (Yellow):**
 - Maintain current standing
 - Encourage them to move toward higher engagement with perks
- Cluster 1 (Red):**
 - Add to **risk-monitoring**
 - Offer **spending guidance, rewards for consistency**, or **lower-tier credit options**

SUMMARY



Business opportunities

Translating insights into action for better customer targeting, risk management, and growth.

Cluster 2 – Financially Responsible Segment

Behavior:

- High credit limits
- Consistently pays on time (highest payment ratio)
- Low dependency on cash advances
- Healthy, balanced credit utilization

Opportunities:

- Offer **premium cards, credit limit increases**
- Enroll in **loyalty & rewards programs**
- Promote **cross-sell**: insurance, investments, or travel perks
- Target for **referrals and testimonials** (brand advocates)

Cluster 0 – Heavy Users with Risk Potential

Behavior:

- High purchases and payments
- Highest reliance on **cash advances**
- Payment behavior inconsistent (variance high)

Opportunities:

- Offer **spending insights, financial coaching, or budgeting tools**
- Push **EMI (Installment) products** to manage big payments
- Monitor for **credit stress** — trigger alerts or custom interventions
- A/B test **debt consolidation campaigns**

Cluster 1 – Dormant or Low Engagement Segment

Behavior:

- Low purchases and payments
- Underutilized credit limits
- Rarely uses cash advances

Opportunities:

- Re-engagement campaigns (e.g., "Spend & Earn", first-use cashback)
- Promote **entry-level financial products**
- Use **email/SMS drip sequences** to educate about credit card benefits
- Push **automated tools** to build credit slowly (e.g., roundups, autopay features)