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What to analyze?

AML/CFT variable	Time-series indicator	Possible monitoring signal
Cash deposits	Monthly cash amount/count	Sudden increase
Cash withdrawals	Monthly withdrawal trend	Unusual escalation
Inward remittance	Monthly inflow	Abrupt change in source pattern
Outward remittance	Monthly outflow	New or rapidly increasing beneficiaries
Account turnover	Monthly debit + credit	Rapid growth inconsistent with profile
Transaction frequency	Daily/weekly/monthly count	Sudden velocity increase
High-value transactions	Monthly threshold count	Repeated threshold-related activity
STR/SAR alerts	Monthly alert volume	Emerging risk concentration
Counterparty count	Unique counterparties/month	Expansion of transaction network
Geographic activity	Country/region by month	New/high-risk geography exposure

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AML/CFT Monitoring Tools

$$= f(Velocity + Trend\ Analysis + Inter\ Quartile\ Range\ (IQR) + Coefficient\ of\ Veriation + Z_{score})$$

Velocity Analysis for AML/CFT — With Data

Velocity measures how quickly money moves through an account or how rapidly transactions occur within a defined period. It is useful in transaction monitoring because an account with a sudden increase in **transaction frequency, turnover, or rapid inflow-to-outflow movement** may warrant review. Regulators and FATF materials support ongoing, risk-based monitoring of transaction patterns and anomalous activity.

Basic velocity formula

A simple transaction-frequency velocity is:

$$Velocity = \frac{\text{Number of transactions}}{\text{Time period}}$$

For example:

- 10 transactions in 30 days:

$$Velocity = \frac{10}{30} = 0.33\ \text{transactions/day}$$

- 60 transactions in 30 days:

$$Velocity = \frac{60}{30} = 2\ \text{transactions/day}$$

The second period has a much higher transaction velocity.

2. AML/CFT money-flow velocity

For transaction monitoring, a more useful measure can be:

$$Velocity = \frac{\text{Total transaction value}}{\text{Time period}}$$

Suppose a customer has:

Month	Transactions	Total inflow	Total outflow
Jan	12	400,000	350,000
Feb	14	450,000	420,000
Mar	15	480,000	450,000
Apr	18	550,000	520,000
May	25	800,000	770,000
Jun	42	1,500,000	1,450,000
Jul	68	2,800,000	2,730,000

The account shows a substantial increase in both **transaction frequency and monetary velocity**.

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3. Inflow-to-outflow velocity

Another useful indicator is how quickly incoming funds are subsequently transferred out.

For example:

Day 1

BDT 1,000,000 received

↓ 2 hours

Day 1

BDT 950,000 transferred to another account

A simple turnover ratio is:

A simple turnover ratio is:

$$Inflow\text{-}Outflow\ Ratio = \frac{Outflow}{Inflow}$$

Therefore:

$$\frac{950,000}{1,000,000} = 95\%$$

Therefore, **95% of the incoming amount was subsequently transferred out**.

A repeated pattern of high inflow followed rapidly by high outflow can be an important investigative indicator, especially when inconsistent with the customer's expected activity.

4. Time-to-outflow analysis

For AML/CFT, I recommend adding **time between inflow and subsequent outflow**.

Example:

Inflow	Outflow	Time elapsed	Outflow / Inflow
500,000	480,000	5 days	96%
800,000	760,000	2 days	95%
1,000,000	970,000	8 hours	97%
1,500,000	1,420,000	3 hours	94.7%
2,000,000	1,950,000	45 min	97.5%

The combination of:

large inflow + high percentage transferred out + short time interval

creates a potentially meaningful **velocity-based monitoring signal**.

This is more informative than simply looking at the total monthly turnover.

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5. Example velocity calculation

Suppose during one day:

Time	Transaction	Amount
09:10	Inflow	500,000
09:45	Outflow	480,000
11:20	Inflow	700,000
12:05	Outflow	680,000
14:10	Inflow	900,000
15:00	Outflow	870,000

Total inflow:

$$500,000 + 700,000 + 900,000 = \boxed{2,100,000}$$

Total outflow:

$$480,000 + 680,000 + 870,000 = \boxed{2,030,000}$$

Outflow ratio:

$$\frac{2,030,000}{2,100,000} \times 100 = \boxed{96.67\%}$$

So approximately **96.67% of the day's incoming funds were subsequently transferred out**.

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6. Velocity escalation

You can also compare current velocity with the customer's historical baseline.

Suppose:

Month	Transactions	Transaction velocity/day
Jan	12	0.39
Feb	14	0.50
Mar	15	0.48
Apr	18	0.60
May	25	0.81
Jun	42	1.40
Jul	68	2.19

The movement from approximately **0.4–0.6 transactions/day to more than 2 transactions/day** represents a significant **behavioral change.**

Monthly transaction frequency showing a sharp increase in account activity.

A velocity increase is an alert indicator and requires contextual investigation.

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7. Velocity-based AML alert model

A practical model could monitor four dimensions:

$$Velocity\ Risk = f(Frequency,\ Amount,\ Time,\ Flow)$$

For example:

Indicator	Example observation	Signal
Transaction frequency	68/month vs historical 15/month	↑
Turnover	BDT 2.8m vs BDT 0.5m	↑
Inflow/outflow ratio	96.7%	High
Time-to-outflow	< 1 hour	Rapid
Counterparties	5 → 32	↑
Geographic exposure	New jurisdictions	New

The combination can create a **velocity alert** for investigation.

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Moving Average Formula for AML/CFT

*A **moving average (MA)** smooths short-term fluctuations in transaction activity and helps identify whether a customer's activity is developing an unusual **trend**.*

Simple Moving Average (SMA)

$$MA_t = \frac{X_t + X_{t-1} + X_{t-2}}{3}$$

For a 3-month moving average:

Where:

X_t = current month's transaction value

X_{t-1} = previous month's value

X_{t-2} = value two months earlier

AML/CFT example

Suppose a customer's monthly **total transaction turnover** is:

Month	Transaction turnover (BDT)
January	400,000
February	450,000

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Month	Transaction turnover (BDT)
March	500,000
April	600,000
May	750,000
June	1,200,000
July	1,800,000

Calculate a **3-month moving average**.

March

$$MA_{Mar} = \frac{400,000 + 450,000 + 500,000}{3}$$

$$= \boxed{450,000}$$

April

$$MA_{Apr} = \frac{450,000 + 500,000 + 600,000}{3}$$

$$= \boxed{516,667}$$

Result

Month	Actual turnover	3-Month MA
January	400,000	—
February	450,000	—
March	500,000	450,000
April	600,000	516,667
May	750,000	616,667
June	1,200,000	850,000
July	1,800,000	1,250,000

AML/CFT transaction turnover and 3-month moving average. Illustrative customer data showing how a moving average smooths monthly transaction activity.

Illustrative data only; a moving-average deviation is a monitoring signal, not by itself evidence of money laundering.

The analytical question is whether the change represents a statistically or economically unusual change relative to the customer's previous behavior and expected profile.

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B. Percentage change

$$Growth_t = \frac{X_t - X_{t-1}}{X_{t-1}} \times 100$$

*For AML monitoring, a large month-on-month increase can become a **risk indicator**, particularly when combined with other indicators.*

IQR for AML/CFT Transaction Monitoring — with Data

IQR (Interquartile Range) is useful in AML/CFT because it identifies unusually high or low transaction values without being as strongly affected by extreme observations as the mean and standard deviation.

1. IQR formula

$$IQR = Q_3 - Q_1$$

Where:

Q_1 = 25th percentile

Q_3 = 75th percentile

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The usual upper outlier boundary is:

$$Upper\ Fence = Q_3 + 1.5(IQR)$$

and lower boundary:

$$Lower\ Fence = Q_1 - 1.5(IQR)$$

AML/CFT example

Suppose we examine **20 monthly/daily transaction amounts** for a customer, in BDT:

Transaction	Amount
1	80,000
2	85,000
3	90,000
4	95,000
5	100,000
6	105,000
7	110,000

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Transaction	Amount
8	115,000
9	120,000
10	125,000
11	130,000
12	135,000
13	140,000
14	145,000
15	150,000
16	155,000
17	160,000
18	165,000
19	500,000
20	750,000

Notice the last two transactions are substantially larger than the customer's normal pattern.

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Using the **median-of-halves method** for this illustrative dataset:

Mean	172,750
Median	127,500
Q1	101,250
Q2	127,500
Q3	151,250
IQR	50,000
Range	670,000
Q3+1.5(IQR)	226,250
Q1-1.5(IQR)	26,250

Calculate the upper fence

Upper Fence = 151,250 + (1.5 X 50,000) = 151,250 + 75,000 = 226,250

Lower Fence = 101,250 – (1.5 X 55,000) = 101,250 – 75,000 = 26,250

Therefore, transactions above **BDT 240,000** are statistical outliers under this illustrative rule.

Amount	IQR assessment
2,26, 250–26,250 = 2,00,000	***Within expected statistical range***
500,000	**Outlier**
750,000	**Outlier**

Interpretation

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IQR-based AML/CFT transaction outliers: transaction amounts showing two observations above the calculated upper ***IQR fence of BDT 200,000.***

So, The **500k and 750k transactions** stand out from the customer's historical transaction distribution.

What is the Coefficient of Variation?

The **Coefficient of Variation (CV)** is a statistical measure of *relative variability*. It shows how much transaction values fluctuate compared with their average.

In AML/CFT, CV can help identify whether a customer's transaction behavior is relatively stable or highly variable over time.

Formula

$$CV = \frac{\sigma}{\mu} \times 100$$

Where:

CV = Coefficient of Variation

σ = Standard deviation

μ = Mean transaction value

A higher CV indicates greater relative variation in the data.

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AML/CFT Example: Comparing Two Customers (A Vs B)

Suppose a bank analyzes the monthly transaction values of two customers over six months.

Month	Monthly turnover (BDT) Customer A	Monthly turnover (BDT) Customer B
January	480,000	100,000
February	500,000	900,000
March	520,000	150,000
April	490,000	1,200,000
May	510,000	80,000
June	500,000	1,500,000

Customer B's turnover fluctuates considerably, whereas Customer A's activity is relatively consistent.

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Calculate CV for Customer A

Step 1: Calculate the mean

$$\mu_A = \frac{480,000 + 500,000 + 520,000 + 490,000 + 510,000 + 500,000}{6}$$

$$\boxed{\mu_A = 500,000}$$

Step 2: Calculate standard deviation

Using the sample standard deviation:

$$\sigma_A \approx 14,142$$

Step 3: Calculate CV

$$CV_A = \frac{14,142}{500,000} \times 100$$

$$\boxed{CV_A \approx 2.83\%}$$

Interpretation: Customer A's monthly turnover varies by approximately **2.83% relative to its mean**.

This indicates relatively stable transaction activity.

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Calculate CV for Customer B

Step 1: Calculate the mean

$$\mu_B = \frac{100,000 + 900,000 + 150,000 + 1,200,000 + 80,000 + 1,500,000}{6}$$

$$\boxed{\mu_B = 655,000}$$

Step 2: Calculate standard deviation

Using the sample standard deviation:

$$\sigma_B \approx 613,687$$

Step 3: Calculate CV

$$CV_B = \frac{613,687}{655,000} \times 100$$

$$\boxed{CV_B \approx 93.69\%}$$

Interpretation

Customer B has a much higher relative variation in monthly turnover.

This may indicate:

- Irregular transaction activity
- Sudden increases in turnover
- Unpredictable cash-flow patterns
- Possible changes in business activity
- Activity requiring comparison with the customer's expected profile

However, ***high variability does not establish money laundering or terrorist financing***.

Comparison

Indicator	Customer A	Customer B
Mean monthly turnover	BDT 500,000	BDT 655,000
Sample standard deviation	BDT 14,142	BDT 613,687
CV	**2.83%**	**93.69%**
Relative variability	Low	High
Possible monitoring relevance	Stable pattern	Significant behavioral variation

How CV Can Help Combat ML/TF

A. Identify unusual customer behaviour:

A customer whose monthly turnover is normally stable may suddenly exhibit substantial variability.

For example:

$$CV_{\text{historical}} = 5\%$$

$$CV_{\text{recent period}} = 75\%$$

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This change could indicate a shift in transaction behaviour.

Possible explanations include:

- Expansion of a legitimate business
- Seasonal business activity
- A major commercial transaction
- Change in employment or income
- Unusual third-party transactions
- Potential misuse of an account

The explanation must be established through appropriate review.

Z-score an AML/CFT Early-Alert Indicator:

A large positive Z-score indicates that the observation is far above the customer's historical mean.

*However, **a high Z-score alone should not automatically generate an STR/SAR**. It should trigger further investigation and contextual analysis.*

A **Z-score** measures how far a transaction or customer's activity is from its historical average, expressed in standard deviations.

In AML/CFT transaction monitoring, it can be used as a **statistical early-warning indicator** for unusual activity.

Formula

$$Z_t = \frac{X_t - \mu}{\sigma}$$

Where:

X_t = current transaction/activity value

μ = historical mean

σ = historical standard deviation

Z_t = standardized deviation

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AML/CFT example

*Assume a customer's **monthly transaction turnover** for the previous 12 months is:*

Month	Turnover (BDT)
Jan	400,000
Feb	450,000
Mar	420,000
Apr	480,000
May	500,000
Jun	460,000
Jul	510,000
Aug	490,000
Sep	530,000
Oct	470,000
Nov	520,000
Dec	550,000

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Suppose the historical statistics are approximately:

$$\mu = 481,667$$

$$\sigma \approx 45,700$$

Now suppose the customer's **January next-year turnover = BDT 850,000**.

Therefore:

$$Z = \frac{850,000 - 481,667}{45,700}$$

$$Z \approx \boxed{8.06}$$

This means the new monthly turnover is approximately ***8 standard deviations above the customer's historical mean.***

That is a strong statistical deviation and can be used as an **early-alert signal**.

Empirical rule for identifying outliers:

Z-score range	Statistical interpretation
Between -1 and +1	Approximately 68% of observations
Between -2 and +2	Approximately 95% of observations
Between -3 and +3	Approximately 99.7% of observations
Below -3 or above +3	Potential statistical outlier

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Common alert threshold

Z-score ≥ +3 or ≤ -3

A Z-score beyond ±3 indicates an observation that is unusually far from the mean under the normal-distribution assumption.

Another example with several months

Suppose:

Month	Actual turnover	Z-score	Alert
Jan	400,000	-1.79	No
Feb	450,000	-0.69	No
Mar	500,000	0.40	No
Apr	550,000	1.50	Monitor
May	620,000	3.03	Alert
Jun	750,000	5.88	Alert
Jul	900,000	9.15	Alert

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Peer-Group Deviation for AML/CFT:

Peer-group deviation compares a customer's transaction behavior with **similar customers**, rather than comparing the customer only with their own historical behavior.

This is useful because a transaction may look normal for the customer historically but be unusual compared with customers having a similar:

- business/occupation;
- customer risk category;
- account/product type;
- geographic exposure;
- business size;
- expected turnover;
- transaction channel.

Basic concept

Suppose 100 customers in the same peer group have monthly turnover around:

BDT400,000-700,000

but one customer has:

BDT3,000,000

The question becomes:

How far does this customer's activity deviate from comparable customers?

Example: Business Customer Peer Group

Suppose a bank has 10 customers classified as **small retail businesses** with comparable profiles.

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Their monthly turnover is:

Customer	Monthly turnover (BDT)
C001	480,000
C002	520,000
C003	550,000
C004	610,000
C005	580,000
C006	630,000
C007	490,000
C008	570,000
C009	600,000
C010	**1,800,000**

The first nine customers have broadly similar turnover, while C010 is substantially higher.

Let's calculate the peer-group mean:

For the **peer group excluding C010**:

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$$\mu_{peer} = \frac{480 + 520 + 550 + 610 + 580 + 630 + 490 + 570 + 600}{9}$$

$$\boxed{\mu_{peer} \approx 559,000}$$

So the typical peer-group monthly turnover is approximately:

BDT559,000

C010 has:

BDT1,800,000

Percentage peer deviation

A simple measure is:

A simple measure is:

$$\boxed{Peer\ Deviation = \frac{X_i - \mu_{peer}}{\mu_{peer}} \times 100}$$

For C010:

$$\frac{1,800,000 - 559,000}{559,000} \times 100$$

$$\boxed{\approx 222\%}$$

For C010:

Therefore, C010's turnover is approximately **222% above the peer-group mean**.

Another way of expressing this:

$$\frac{1,800,000}{559,000} \approx 3.22$$

C010's turnover is approximately **3.2 times the peer-group average**.

That is an extremely large statistical deviation in this **illustrative** dataset.

However, this also demonstrates why analysts must examine the peer-group construction and distribution carefully. A small or tightly clustered peer group can produce very large Z-scores.

Better peer-group design

A bank should not simply compare **all customers with all customers**.

Poor peer group

This mixes:

- students;
- salaried employees;
- SMEs;
- large corporations;
- NGOs;
- importers;
- exporters.

The comparison would have little analytical meaning.

Better peer group

For example:

Domestic small retail businesses + same account/product type + similar geographic market + similar business size

This creates a more meaningful benchmark.

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Example: Multiple AML/CFT peer indicators

Instead of comparing only turnover:

Indicator	Customer C010	Peer average	Deviation
Monthly turnover	1.80m	0.559m	+222%
Transactions/month	85	24	+254%
Cash deposits	1.20m	0.31m	+287%
Unique counterparties	42	12	+250%
International transactions	18	3	+500%

"The customer has high turnover."

Peer deviation vs historical deviation

This distinction is important.

Customer historical analysis

Compare:

$$Customer_{current}\ vs Customer_{historical}$$

$$Historical\ Deviation + Peer\ Deviation$$

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For example:

Test	Result
Historical baseline	500k
Current turnover	1.8m
Historical increase	+260%
Peer average	559k
Peer deviation	+222%

The two independent perspectives reinforce the observation that the customer's behavior has changed materially.

Keep in mind:

$$Peer\ deviation \neq only\ high\ value$$

You should also consider:

- *frequency;*
- *velocity;*
- *counterparties;*
- *geographic patterns;*
- *channels;*
- *payment relationships;*
- *changes from expected activity.*

Counterparty: AML/CFT Definition

In the AML/CFT (Anti-Money Laundering and Countering the Financing of Terrorism) domain, a counterparty is:

Any individual, business, organization, financial institution, or other entity that participates in or is directly involved in a financial transaction with a customer or an institution being monitored.

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In transaction monitoring, the counterparty is important because who the customer sends money to or receives money from can be as significant as the transaction amount itself.

Examples

Customer Activity	Counterparty
Customer deposits cash at a bank	Bank / account relationship
Customer sends BDT 500,000 to another person	Recipient
Customer receives BDT 1 million from a company	Sending company
Import payment to an overseas supplier	Foreign supplier
Export proceeds received from abroad	Foreign buyer
Transfer through MFS	Sender/recipient account or wallet
Loan repayment received from another account	Remitting account holder
Multiple transfers among related companies	Each participating company

Counterparty analysis in AML/CFT

A transaction-monitoring system may examine:

1. Counterparty identity

- *Name*
- *Customer/account ID*
- *Business type*
- *Country/jurisdiction*
- *Beneficial ownership*

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2. Counterparty relationship

- *Customer ↔ supplier*
- *Customer ↔ employee*
- *Customer ↔ related company*
- *Customer ↔ family member*
- *Customer ↔ unrelated third party*

3. Counterparty behavior

- Number of counterparties
- New vs. established counterparties
- Transaction frequency
- Transaction value
- Geographic distribution
- Rapid movement of funds between counterparties

Simple AML example:

Suppose a customer normally transacts with 5–8 local business counterparties each month.

Suddenly:

- *Counterparties increase from 8 → 42*
- *25 counterparties are newly introduced*
- *Several counterparties have no apparent business relationship*
- *Funds are received and transferred onward within hours*

This does not by *itself establish money laundering*, but the change in the customer's counterparty network can be an important transaction-monitoring indicator requiring further review.

Useful AML/CFT parameters:

You can calculate Counterparty Growth Rate:

$$\text{Counterparty Growth Rate} = \frac{\text{Current Counterparties} - \text{Baseline Counterparties}}{\text{Baseline Counterparties}} \times 100$$

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Example:

$$\frac{42-8}{8} \times 100 = 425\%$$

So the customer's number of counterparties increased by 425% compared with the baseline.

In short: *Counterparty = the other party involved in a financial transaction with the customer.*

For AML/CFT, counterparty identity, relationship, geography, network, frequency, and transaction behavior can all contribute to customer-risk and transaction-monitoring analysis.

