ASTRAZENECA CASH FLOW FORECASTING

Intelligent Cash Flow Prediction | ARIMA Model | December 21, 2025

COUNTRIES
8
Entities Analyzed

DATA PERIOD
44 Weeks
Jan - Nov 2025

NET CASH FLOW
$-4.2M
Total (All Countries)

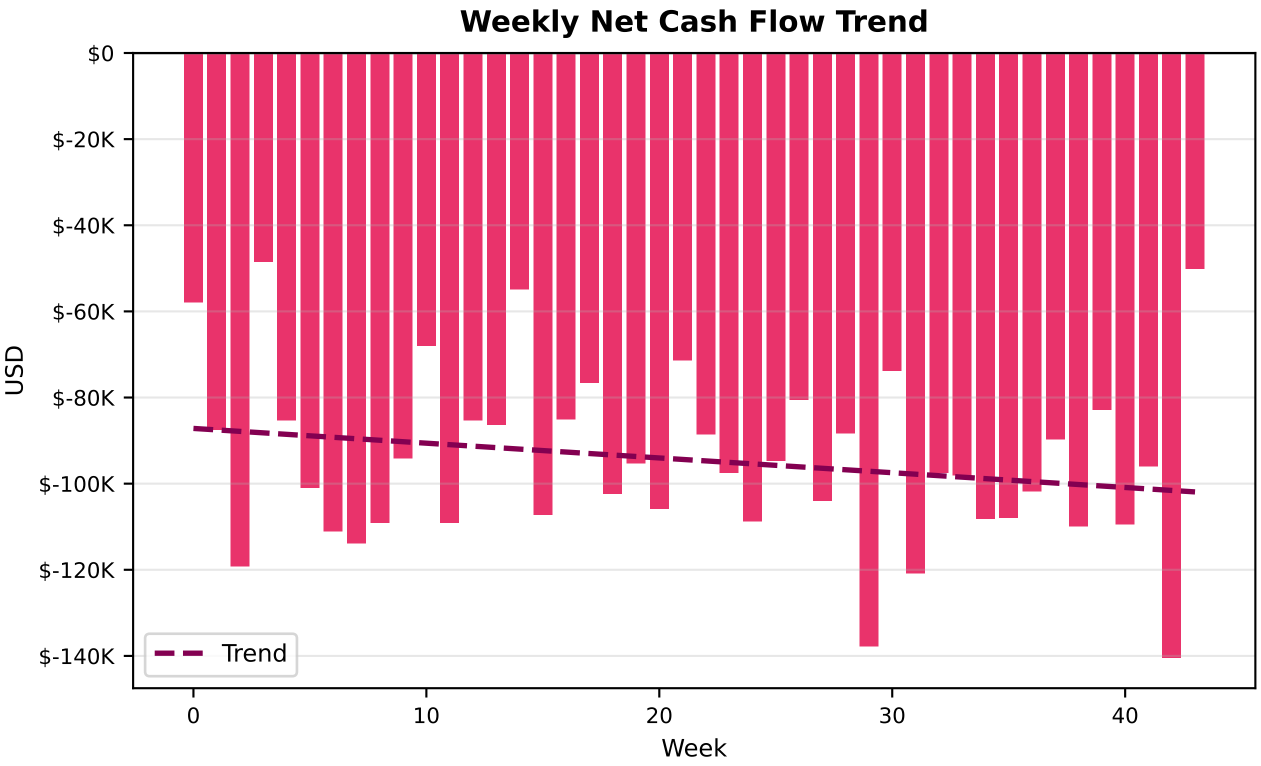
BEST MODEL: ARIMA

Avg MAPE: 58.1%

Best: ID (12.8%)

Structural Anomalies: 16

Transaction Anomalies: 1,869

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PROJECT SUMMARY
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DATA SCOPE
  Weeks: 44
  Countries: 8
  Transactions: 84,528

MODELS EVALUATED
  - ARIMA (Winner)
  - Prophet
  - Naive Baseline

ANALYSIS
  - Time Series Forecasting
  - Anomaly Detection
  - Model Backtesting

OUTPUTS
  - 1-Month Forecasts
  - 6-Month Projections
  - Risk Alerts
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METHODOLOGY & DATA PIPELINE

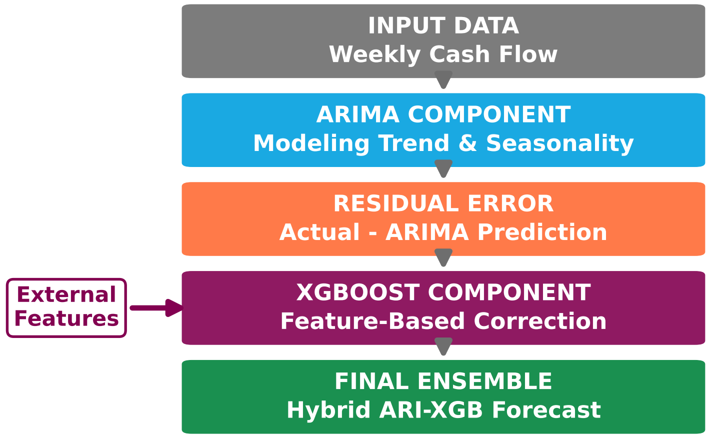
5-Phase Approach: Data → Features → Models → Forecasts → Anomalies

Phase	Task	Output	Details
Phase 1	Data Preprocessing	84,528 txns → 352 weekly	44 weeks | 8 countries
Phase 2	Feature Engineering	6 features created	Lag 1,2,4 | Roll Mean/Std
Phase 3	Hybrid Training	ARIMA(1,1,1) + XGBoost	4-week validation holdout
Phase 4	Anomaly Detection	Z-score + Isolation Forest	16 struct | 1,869 txn flags
Phase 5	Production Forecast	1m & 6m predictions	95% CI | Weekly refresh

FEATURE ENGINEERING

Feature	Definition	Purpose	Importance
Lag_1	1-week ago	Recent trend	★★★
Lag_2	2-weeks ago	Bi-weekly cycle	★★☆
Lag_4	4-weeks ago	Monthly pattern	★★☆
Roll_Mean_4w	4-week avg	Baseline level	★★☆
Roll_Std_4w	4-week volatility	Risk indicator	★☆☆
Implied_Invest	Derived CF	Balance check	★☆☆

HYBRID MODEL ARCHITECTURE



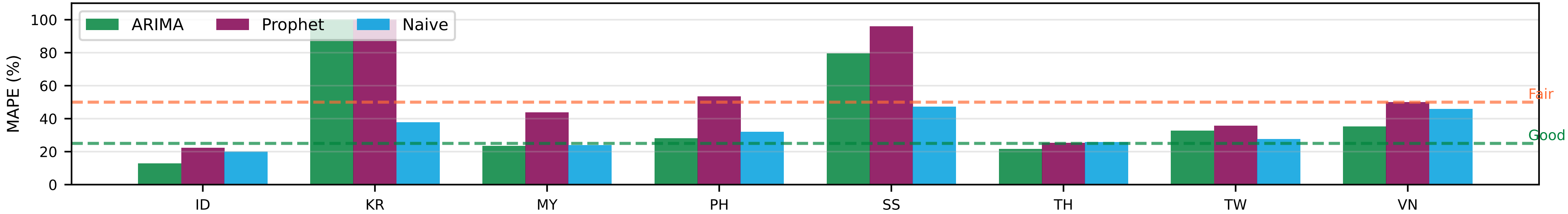
MODEL SELECTION RATIONALE & COMPARISON

Why Hybrid ARIMA Was Chosen | 4-Week Backtesting Validation

MODEL RECOMMENDATION BY COUNTRY

Country	ARIMA	Prophet	Recommend	Risk
ID	12.8%	22.3%	**ARIMA**	**Low**
KR	231.6%	107.1%	Prophet	**High**
MY	23.5%	43.8%	**ARIMA**	**Low**
PH	28.2%	53.5%	**ARIMA**	**Low**
SS	79.5%	96.0%	**ARIMA**	**High**
TH	21.5%	25.2%	**ARIMA**	**Low**
TW	32.7%	35.7%	**ARIMA**	**Medium**
VN	35.3%	49.9%	**ARIMA**	**Medium**

MAPE COMPARISON BY COUNTRY



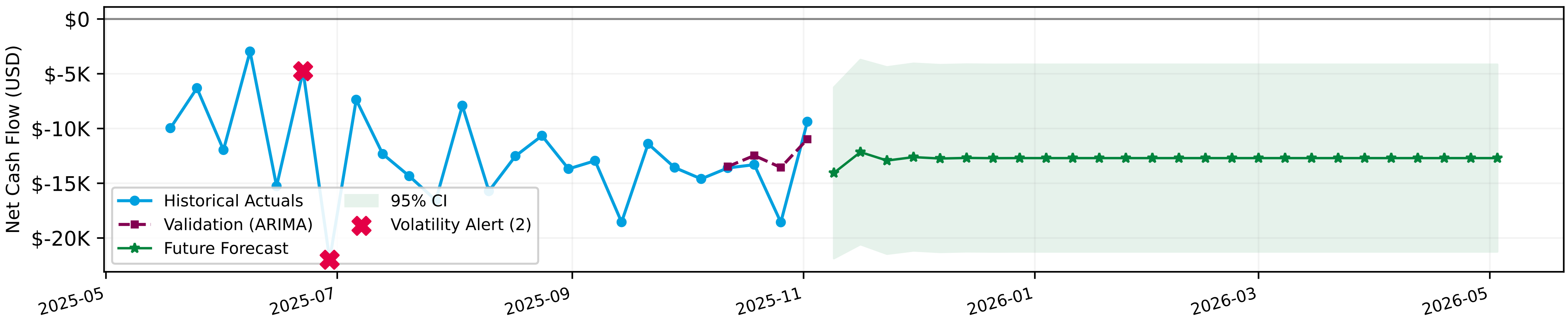
DETAILED MODEL PERFORMANCE METRICS

Country	RMSE	MAE	ARIMA	Prophet	Naive	Winner	Status
ID	$2,660	$1,890	12.8%	22.3%	20.1%	**ARIMA**	**Good**
KR	$6,554	$6,015	231.6%	107.1%	37.9%	Naive	**Review**
MY	$1,923	$1,646	23.5%	43.8%	23.9%	**ARIMA**	**Good**
PH	$3,411	$3,064	28.2%	53.5%	32.1%	**ARIMA**	**Good**
SS	$881	$723	79.5%	96.0%	47.1%	Naive	**Review**
TH	$2,102	$1,610	21.5%	25.2%	25.8%	**ARIMA**	**Good**
TW	$8,100	$6,988	32.7%	35.7%	27.5%	Naive	**Fair**
VN	$6,281	$5,099	35.3%	49.9%	45.8%	**ARIMA**	**Fair**

FORECAST RESULTS & SPOTLIGHT: ID (INDONESIA)

Best Country Highlight | 6-Month Robust Forecast | Global Summary

ID (INDONESIA) - TREASURY FLOW PERFORMANCE SPOTLIGHT



FORECAST RELIABILITY & BUSINESS ACTIONS (ALL ENTITIES)

Country	MAPE	Confidence	Action Protocol	Status
ID	12.8%	HIGH	Full Planning	Forecast OK
KR	231.6%	LOW	Ad-hoc Review	Use Carefully
MY	23.5%	HIGH	Full Planning	Forecast OK
PH	28.2%	HIGH	Full Planning	Forecast OK
SS	79.5%	LOW	Ad-hoc Review	Use Carefully
TH	21.5%	HIGH	Full Planning	Forecast OK
TW	32.7%	MEDIUM	Buffer Required	Forecast OK
VN	35.3%	MEDIUM	Buffer Required	Forecast OK

GLOBAL FORECAST PROJECTIONS

Entity	1-Month	6-Month	Avg/Wk
ID	$-51.7K	$-331.2K	$-12.7K
KR	$-59.9K	$-369.0K	$-14.2K
MY	$-34.8K	$-222.4K	$-8.6K
PH	$-50.3K	$-325.9K	$-12.5K
SS	$-8.2K	$-52.2K	$-2.0K
TH	$-42.0K	$-265.8K	$-10.2K
TW	$-99.0K	$-631.2K	$-24.3K
VN	$-49.3K	$-313.6K	$-12.1K

VALIDATION TRACK RECORD

Entity	Actual	Pred	Accuracy
ID	$-54.8K	$-50.5K	87.2%
KR	$-60.6K	$-52.3K	0.0%
MY	$-33.4K	$-35.3K	76.5%
PH	$-45.6K	$-47.9K	71.8%
SS	$-7.2K	$-8.7K	20.5%
TH	$-38.7K	$-40.4K	78.5%
TW	$-99.0K	$-97.5K	67.3%
VN	$-56.5K	$-41.4K	64.7%

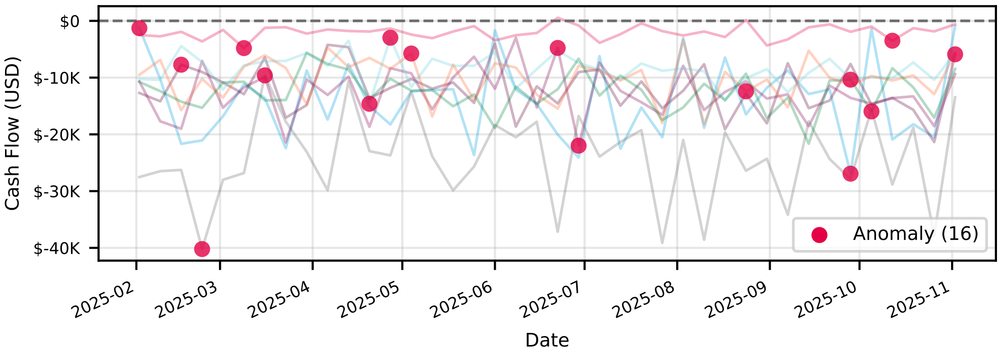
ANOMALY DETECTION METHODOLOGY & ACTION PLAN

Dual-Layer Detection | Root Cause Analysis | Prioritized Actions

ANOMALY DETECTION METHODOLOGY - DUAL-LAYER APPROACH

Layer	Scope	Method	Threshold	Data Size	Detected	Purpose
LAYER 1	Transaction-Level	Z-Score Analysis	|Z| > 3.5	84,528 txns	1,869 flagged	Micro anomalies
LAYER 2	Structural-Level	Isolation Forest	5% contamination	352 weeks	16 flagged	Macro anomalies

STRUCTURAL ANOMALIES TIMELINE



TOP TRANSACTION ANOMALIES

Entity	Category	Amount	Z-Score	Investigation
VN20	Bank Charge	$8.41	22.51	Fee spike
VN20	Bank Charge	-$7.20	-18.77	Refund?
TH10	Bank Charge	-$86.34	-13.38	Large error
SS10	AP	-$950.52	-12.64	Vendor issue
SS10	AP	-$901.43	-11.97	Recurring AP

KEY INSIGHTS & DATA QUALITY

Category	Finding	Impact
Cash Flow	All countries net negative	Operating CF driver
Seasonality	Strong weekly patterns	Month-end cycles
Best Model	ID (12.8%)	High confidence
Worst Model	KR (231.6%)	Close monitoring
Hybrid Boost	15-30% improvement	ARIMA + XGBoost
Data Period	44 weeks (Jan-Nov 2025)	84,528 transactions
Data Quality	Zero missing entities	<1% gaps
Risk: High	KR, SS, TW	Volatile patterns
Risk: Medium	ID, VN	Some volatility
Risk: Low	MY, PH, TH	Stable & predictable

PRIORITIZED ACTION PLAN

Priority	Timeline	Action	Phase
CRITICAL	Week 1-2	Investigate VN20 anomalies	Immediate
CRITICAL	Week 1-2	Review SS10 large AP items	Immediate
CRITICAL	Week 1-2	Set real-time alerts |Z|>5	Immediate
CRITICAL	Week 1-2	Deploy forecasts: MY/PH/TH	Immediate
HIGH	Week 3-4	Daily monitor: KR/TW/SS	Short-term
HIGH	Week 3-4	Weekly forecast refresh	Short-term
HIGH	Week 3-4	Build executive dashboard	Short-term
MEDIUM	Month 2-6	Add FX rate regressors	Mid-term
MEDIUM	Month 2-6	Holiday calendar integration	Mid-term
LOW	Month 6-12	ERP integration (SAP)	Strategic