

Dividend Instability Risk Detection for Income Investors

A Forward-Looking, Interpretable Machine Learning Approach

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12/16/25

Video presentation: <https://youtu.be/KxbXr0T0Rvw>

Motivation

Why this problem matters

- Dividend ETFs are widely used for stable income
- Dividend cuts or stagnation often occur after market stress becomes visible
- Investors frequently react too late, leading to panic selling
- There is limited tooling for forward-looking dividend income risk

Goal:

Enable investors to assess income risk early, before dividend instability becomes obvious

Background

Dividend Stability & Risk

- Dividend growth depends on:
 - Market conditions
 - Earnings stability
 - Volatility and drawdowns
- Dividend cuts are rare but impactful
- Traditional analysis is mostly reactive, not predictive

Machine Learning Opportunity

- ML can detect risk regimes
- Focus on patterns that historically precede instability
- Goal is *risk awareness*, not exact prediction

Related Work

Existing Approaches

- Financial risk models (volatility, drawdowns)
- Dividend growth screening (yield, payout ratios)
- Regime detection in finance (recession indicators, credit risk)

Gaps

- Limited work on dividend-specific instability risk
- Few interpretable, forward-looking ML approaches
- Many models lack transparency for investor use

Our contribution:

A simple, interpretable early-warning risk indicator for dividend ETFs.

Claim / Target Task

Claim

Market and dividend signals today can indicate whether dividend payouts are likely to stagnate or fail to grow over the next year.

Target Task

Binary classification:

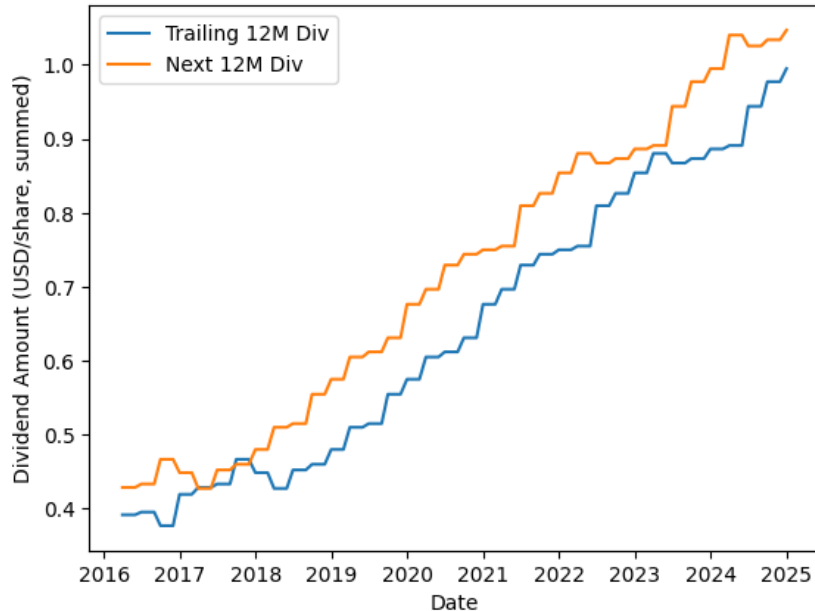
- **0 (Low Risk):** Next 12-month dividends increase
- **1 (High Risk):** Next 12-month dividends do *not* increase

Important:

- This is a forward-looking label
- No future information is used at prediction time

An Intuitive Figure Showing WHY Claim

SCHD: Trailing vs Next 12-Month Dividends



What this shows

- Blue: dividends paid in the past 12 months
- Orange: dividends paid in the following 12 months
- When orange fails to exceed blue → income instability

Key intuition

Dividend instability is observable after the fact, but warning signs often appear earlier.

Proposed Solution

High-Level Approach

1. Collect historical price & dividend data
2. Construct monthly samples
3. Define forward-looking instability labels
4. Train an interpretable classifier
5. Produce risk trend indicators

Design priorities

- Interpretability
- No data leakage
- Practical investor relevance

Implementation

Model

- Logistic Regression
- Balanced class weights
- Probability outputs for flexible thresholds

Features

- 60-day volatility
- 1-year maximum drawdown
- 1-year momentum
- Trailing dividend growth
- Dividend yield proxy

Why Logistic Regression?

- Transparent
- Stable on small datasets
- Easy to explain to non-technical users

Data Summary

Data Source

- Yahoo Finance (yfinance)
- Dividend-focused ETFs:
 - SCHD, VYM, VIG, HDV, DVY, SPHD, JEPI

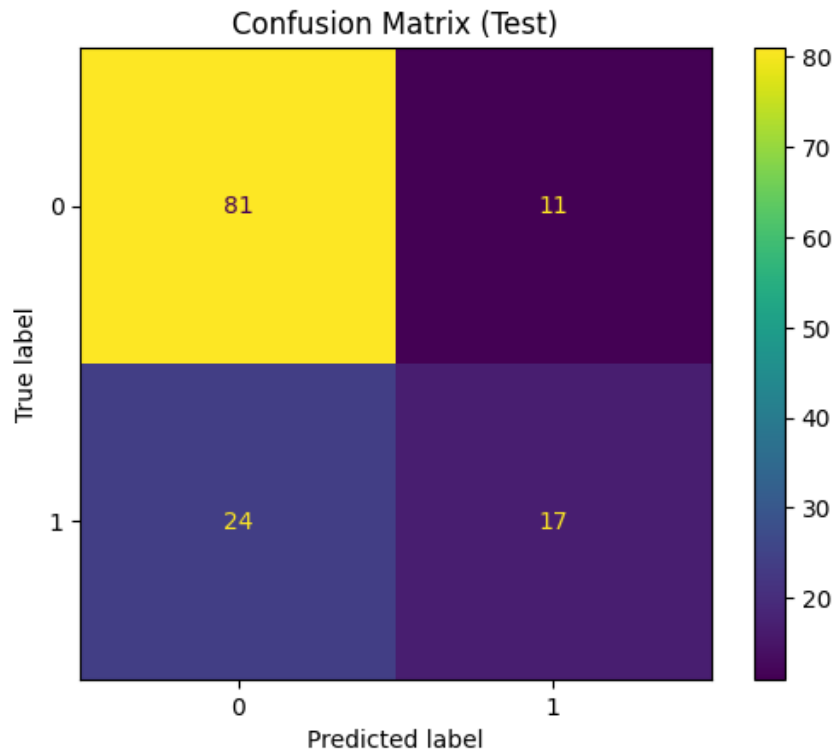
Dataset

- Monthly samples from ~2015–2025
- ~680 observations
- Self-collected and reproducible

Train/Test Split

- Time-based (80% train, 20% test)
- Prevents look-ahead bias

Experimental Results



Key Metrics (Test Set)

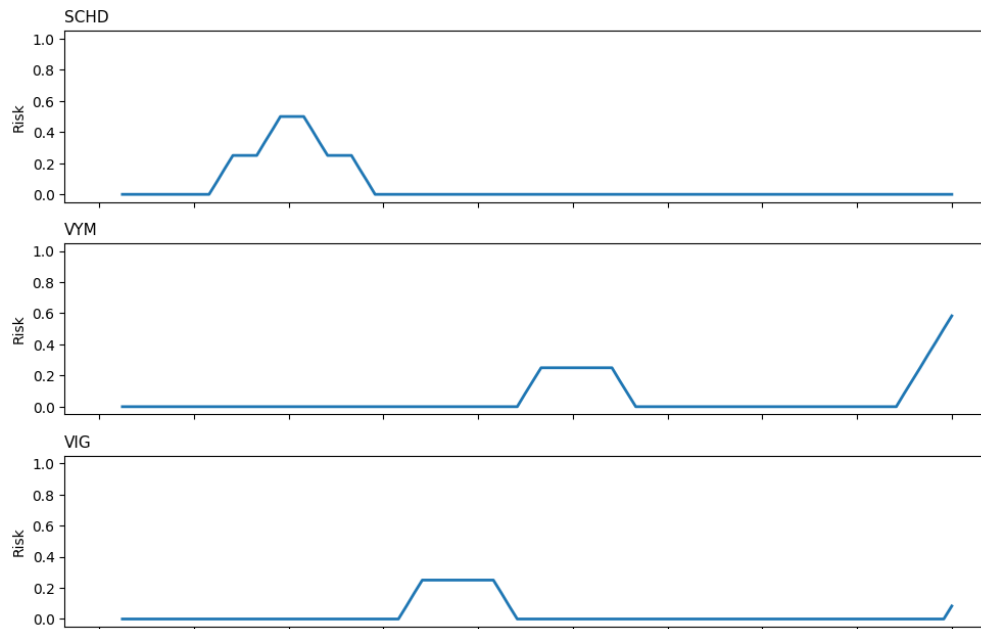
- Accuracy: ~74%
- ROC-AUC: ~0.75
- High-risk precision: ~61%
- High-risk recall: ~42%

Interpretation

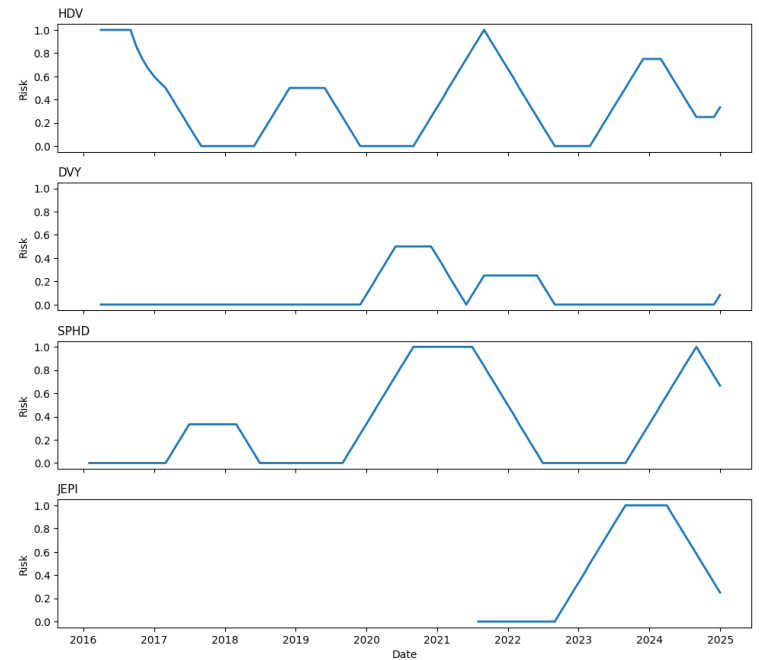
- Model is conservative
- Fewer false alarms
- Misses some risk events, but avoids over-warning

Experimental Analysis

Dividend Instability Risk Trend (Rolling 12-Month Average)



(Top half)



(Bottom half cont.)

Experimental Analysis

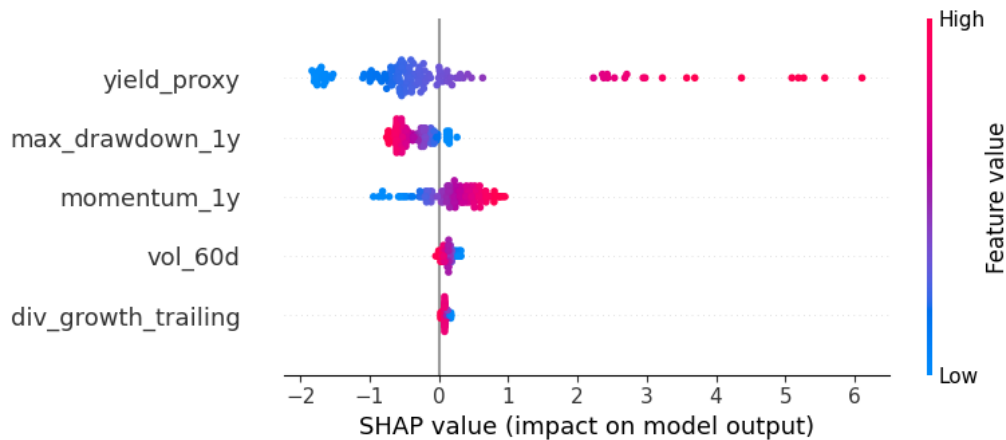
Rolling 12-Month Risk Trends

- Each line shows fraction of recent months flagged as high risk
- Rising trend → worsening regime
- Falling trend → stabilizing regime
- Flat low trend → consistent income stability

Investor Interpretation

Risk is assessed as a regime, not a single event.

Interpretability



What drives risk predictions?

- Dividend growth slowdown
- Volatility spikes
- Drawdowns
- Weak momentum

Why this matters

- Model behavior matches financial intuition
- Increases trust and usability

Conclusion and Future Work

Conclusion

- ML can provide early warning signals for dividend instability
- Simple, interpretable models are effective
- Trend-based risk indicators are more informative than static scores

Limitations

- Small ETF universe
- Proxy label for instability
- No macroeconomic features

Future Work

- Expand ETF coverage
- Add macro variables (rates, inflation)
- Multi-level risk scoring
- Real-time deployment

References

Yahoo Finance API

Macabacus. *Financial Risk Modeling and Management Strategies*. Macabacus, n.d., <https://macabacus.com/blog/financial-risk-modeling-management-strategies>.

ETFdb. *Dividend Growth ETFs*. ETFdb.com, n.d., www.etfdb.com/themes/dividend-growth-etfs/.

Molnar, Christoph. *Interpretable Machine Learning: A Guide for Making Black Box Models Explainable*.

“SHAP (SHapley Additive exPlanations).” n.d., christophm.github.io/interpretable-ml-book/shap.html.

Responsibilities

Intended 50/50 work split:

Jonathan Simon —

- Data preprocessing (yfinance, loading, cleaning, building monthly ETF samples)
- Features and target cell (selected risk-metrics)
- Model training (logistic regression)
- Class balance + simple plots (Experimental analysis + results)
- Presentation slides 10-15

Steven Liu —

- Creating project idea and problem formulation
- Evaluation plots + visualization (Confusion matrix, ROC, PR)
- Project Interpretability (SHAP)
- Presentation slides 1-9
- Code demo