

Incorporating Cross-Sectional Signals in FinRev

Time-series vs Cross-Sectional Features

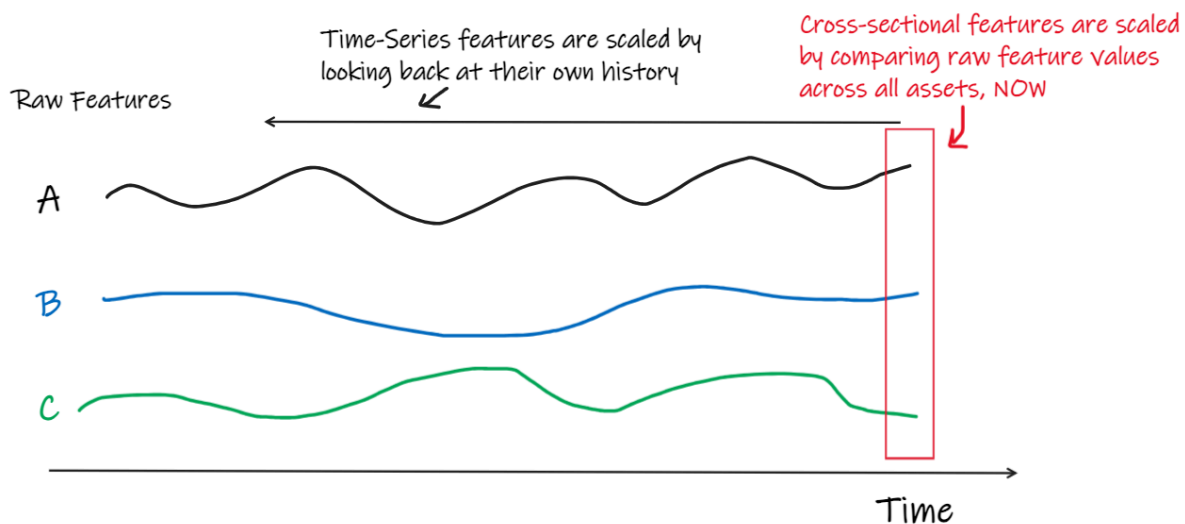
All current FinRev features are what I would call “time-series features”.

Time Series Features:

- We have universe of assets to trade
- Raw features are calculated for that asset in isolation
- Features are scaled using that asset’s history in isolation
- **Features of one asset do not affect features of another asset**

Cross-sectional Features:

- We have a universe of assets to trade
- Raw features are calculated using data for that asset in isolation
- Features are scaled by comparing features for **all assets** in the universe
- **Features of all asset impact features of other assets.**



Implications: Trend vs Cross-sectional momentum

Consider a 5-asset universe with trend-features as follows:

Asset	Trend Feature
A	0.8
B	0.4
C	0.2
D	0.3
E	-0.2

In a “time-series” trend-following context we would be long assets A to D and short asset E.

Whereas in a “cross-sectional” momentum context, the absolute values of the features don’t matter - only the relative values of the features. And we might be long the top two (A and B) and short the bottom two (D and E)

Asset	Trend Feature	Time-Series Strategy Sign	Cross-Sectional Strategy Sign
A	0.8	LONG	LONG
B	0.4	LONG	LONG
C	0.2	LONG	FLAT
D	0.3	LONG	SHORT
E	-0.2	SHORT	SHORT

The cross-sectional strategy is usually implemented as equally long/short regardless of current general market conditions.

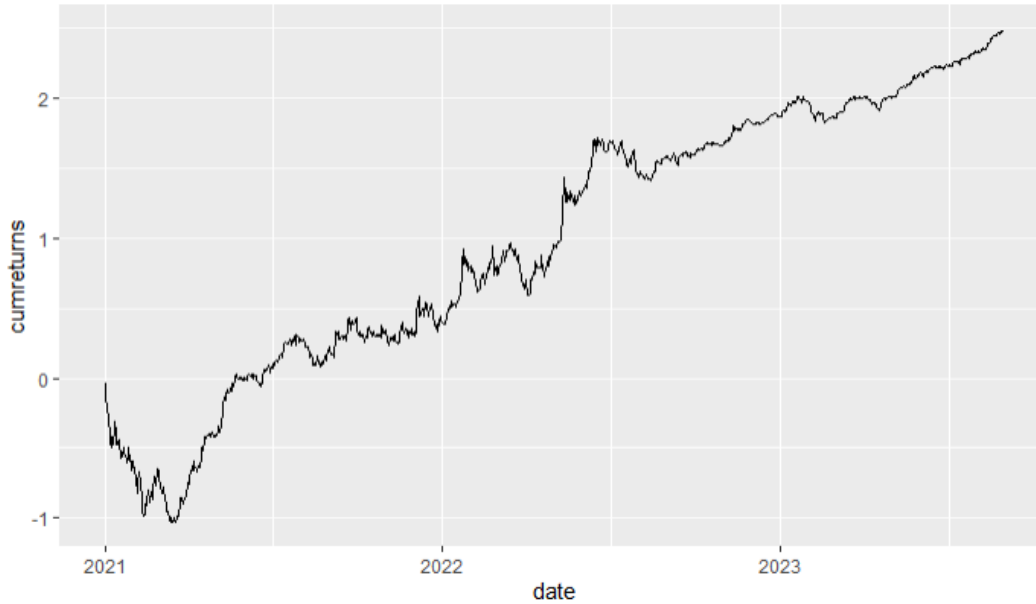
They are often useful diversifiers to directional strategies.

Carry

We want to combine cross-sectional carry features (like below) with existing trend features in FinRev.

This strategy works really well with a basket of crappy stuff.

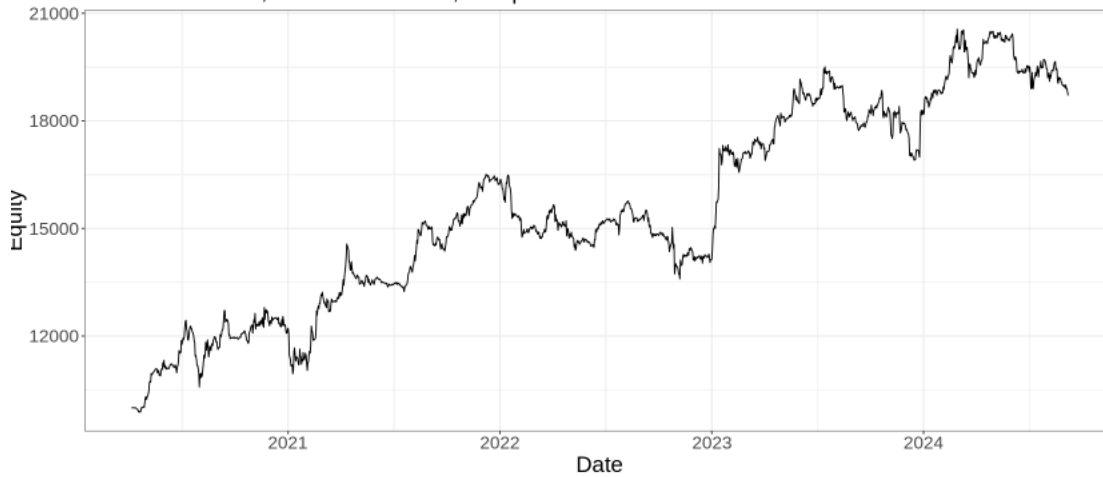
5 day carry factor - all perps weighted in proportion to xs-sectional carry centile



And slightly less well on the larger cap stuff we trade trend on. For example, here's what it looks like if we restrict to the 10 largest perps.

10 Asset Carry - Selected Barrier

Simulation, costs 0.2% of trade value, trade buffer = 0.19, trade on close
87.1% total return, 19.8% annualised, Sharpe 0.94

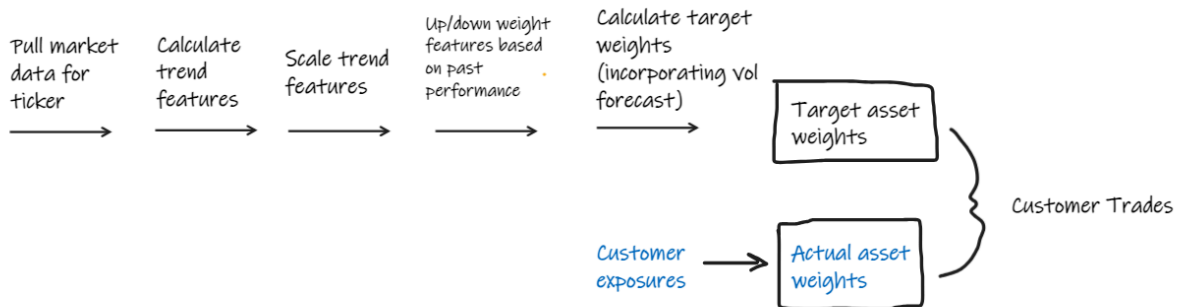


Though not a sensational strategy by itself, it's a useful diversify to our trend (and x-sectional momentum) strategies.

Combining Trend and Cross-Sectional Carry in FinRev.

The current trend features calculation acts in series on each tradeable instrument separately.

For each asset in isolation....

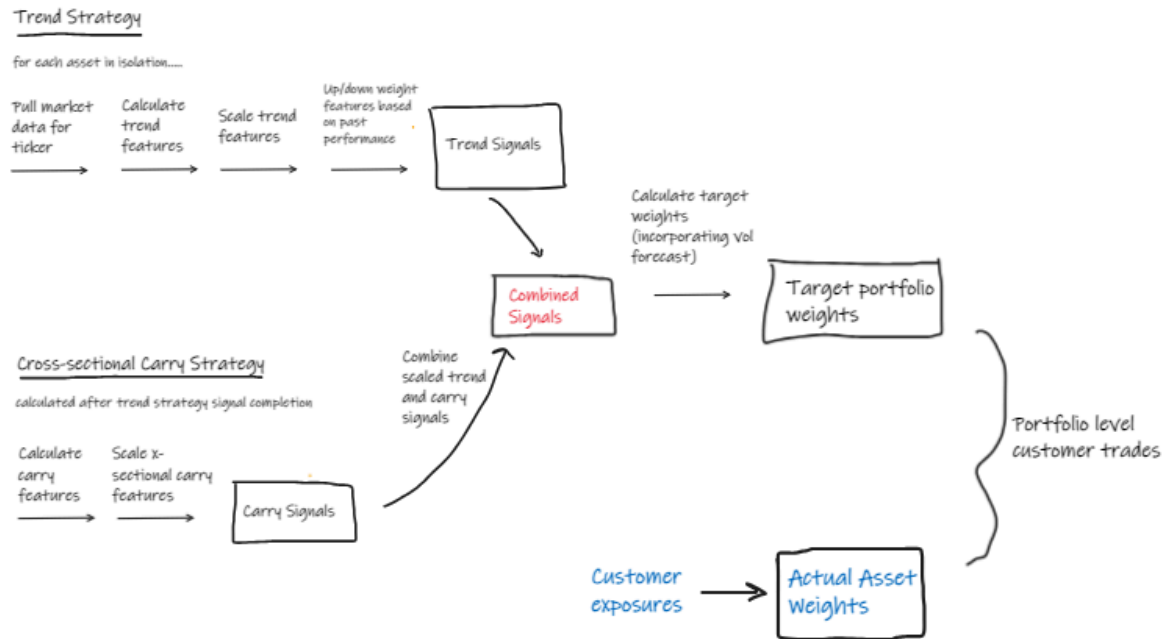


The way it is currently implemented, it can place customer trades before it has pulled price data for all tickers.

If we are incorporating cross-sectional features, we won't be able to do this anymore, because cross-sectional features require all asset features to be available for the scaling process.

We'll calculate trend and carry signals separately, then combine them into target exposures.

This is as above, except that instead of combining asset weights, we're combining signals.



Universe

We'll calculate carry features on the same universe we trade trend on.

Calculating carry features

We can calculate the carry feature in two ways:

1. Taking the average funding rate over a lookback
2. Calculating the average premium a perp trades over and above the index

The second is perhaps preferable, especially at exchanges like Binance which clamp the funding rate.

However, it requires higher frequency perp and index data to calculate.

Option 1

Calculate the raw "carry" feature as the average of the funding rate over the last 3 days. (Flip the sign cos we want to be long when it's negative.)

Option 2

Calculate the raw "carry" feature as the average premium that the perp trades above its index. Pull hourly perp and index data and take the average of the difference in prices over the previous 3 days.

Scaling carry features

Now we need to scale our features cross-sectionally. There are many ways to do this. We want our features to be as stable as possible because trading is expensive, so we'll do a zscore with the standard deviation denominator calculated over a rolling 7 day window, and then scale it to look like our trend features.

Example

Imagine we have raw carry signals for 5 assets A to E .

	Raw Carry Feature (avg of funding rate or perp/index premium over last 3 days)							
Date	A	B	C	D	E	Mean	Rolling 7 day StdDev	
1	0.10%	-0.20%	0.01%	0.10%	-0.05%	-0.01%		
2	0.09%	0%	0.01%	0.05%	-0.04%	0.02%		
3	0.05%	-0.10%	0%	0.04%	-0.01%	0.00%		
4	0.04%	-0.20%	0.05%	-0.01%	-0.01%	-0.03%		
5	0.02%	-0.15%	0.02%	0%	-0.02%	-0.03%		
6	0.00%	-0.10%	-0.01%	0.01%	-0.03%	-0.03%		
7	-0.02%	-0.05%	-0.04%	0%	-0.04%	-0.03%	0.07%	

For each day, calculate the mean of the raw signals for each day.

fx =AVERAGE(B9:F9)

	A	B	C	D	E	F	G	H
	Raw Carry Feature (avg of funding rate or perp/index premium over last 3 days)							
Date	A	B	C	D	E	Mean	Rolling 7 day StdDev	
1	0.10%	-0.20%	0.01%	0.10%	-0.05%	-0.01%		
2	0.09%	0%	0.01%	0.05%	-0.04%	0.02%		
3	0.05%	-0.10%	0%	0.04%	-0.01%	0.00%		
4	0.04%	-0.20%	0.05%	-0.01%	-0.01%	-0.03%		
5	0.02%	-0.15%	0.02%	0%	-0.02%	-0.03%		
6	0.00%	-0.10%	-0.01%	0.01%	-0.03%	-0.03%		
7	-0.02%	-0.05%	-0.04%	0%	-0.04%	=AVERAGE(B9:F9)	0.07%	

And calculate the standard deviation of the raw signals over the previous 7 days.

Now calculate zscores for each of the assets as (raw signal - mean) / rolling stdev

The only difference between the way we treat the trend and carry signals, beside the cross-sectional scaling, is that we don't apply an asset-level adjustment based on past performance.

I would suggest that we weigh the carry signal lower than the trend signal - maybe give it half or two thirds of the weight.

Cross-sectional momentum

We'll use existing trend signals, scaled cross-sectionally for cross-sectional momentum signals.

We can do this on the existing trend signals, or we can calculate them on volatility-normalised price signals.

The latter is preferable but the former will work too and we can do it easily without much extra dev, so let's do that.

The process is the same for the carry signals, except that the "raw" signals we're using will be the combined trend score for each asset.

Date	Asset Level Combined Trend Scores							Zscores					Clamped to +/- 2.5 and multiplied by 10 to look like the trend features					
	A	B	C	D	E	Mean	Rolling 7 day StdDev	A	B	C	D	E	A	B	C	D	E	
1	5	4	-10	10	5	2.8												
2	4	0	-10	8	7	1.8												
3	2	0	-15	6	10	0.6												
4	10	5	-18	4	15	3.2												
5	16	6	-20	10	14	5.2												
6	15	-2	-15	2	12	2.4												
7	12	-3	-10	5	11	3	9.682300283	0.93	-0.62	-1.34	0.21	0.83	9.30	-6.20	-13.43	2.07	8.26	

We then combine these in the same way as with carry.

I would give cross-sectional momentum the same weight as trend ultimately but we probably want to downweight it to start with because it will change the portfolio dynamics quite a bit.