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Cross-Asset Strategy CAST Cookbook – Which Factors Work, and When

CAST is our Cross-Asset Systematic Trading strategy. With CAST just one 'recipe' from 1,500+ possible factors, we dig into what works in different market regimes (high inflation, low vol, etc.). We add new factors/assets and answer FAQs.



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Cross-Asset Strategy

CAST Cookbook – Which Factors Work, and When

CAST is our Cross-Asset Systematic Trading strategy. With CAST just one 'recipe' from 1,500+ possible factors, we dig into what works in different market regimes (high inflation, low vol, etc.). We add new factors/assets and answer FAQs.

A CAST cookbook: CAST (Cross-Asset Systematic Trading strategy) is one all-weather multi-asset combination we have created from 1,500+ systematic cross-sectional and time-series factors across 15 asset groups. We discuss factor performance across different market environments and 'recipes' tailored to specific market regimes.

A custom recipe – inflation CAST: While CAST is intended to be an all-weather strategy, inflation CAST is an example of tailoring that recipe to a specific regime (rising inflation). Inflation CAST seems to be making a small pivot from rewarding 'the leading edge of inflation' to 'a rising tide lifts all boats' in some asset classes. Inflation CAST likes China, Canada and Hong Kong equities, long RUB, BRL, CAD, SEK, soybean oil, iron ore and IG credit. In rates, inflation CAST likes to pay INR 10yr, GBP and EUR 30yr. In US sectors, inflation CAST is long US healthcare versus consumer discretionary.

What's the best recipe for 2H21? Value (2020) -> momentum (1H21) -> carry (2H21): Carry seems to be favoured for a comeback, looking at the factors which work best in the three key environments that characterise 2021: i) A higher inflation regime; ii) A lower vol regime; and iii) The aftermath of a large, post-recession rally like 2004 and 2010.

What does factor seasonality tell us? The summer is dominated by carry and mean-reversion. To oversimplify, don't keep negative-carry assets on the books in the summer, especially when they also happen to be rich. Chase fundamental trends and price momentum as the summer ends.

How does CAST align with our strategists' views? CAST has large areas of agreement with our strategists: a preference for energy over metals in commodities, compression trades in credit, dislike EUR in G10 FX, prefer BRL in EM FX, pay INR rates and Japan equities over US equities. Where CAST deviates from our strategists' views: CAST is more bearish on Europe equities (awaiting a cyclical upturn in data); CAST is more bullish on EM FX (strong inflation dynamics, cheap valuations) and EM credit (on relative valuations and vol-adjusted carry).

Please drop us a mail <u>here</u> to receive weekly updates of the CAST universe.

Executive summary

CAST (Cross-Asset Systematic Trading strategy) is an all-weather multi-asset modular combination of factors chosen from building blocks of 1,500+ systematic cross-sectional and time-series factors across 15 asset groups (see <u>CAST: Our Cross-Asset Factor Model</u>, October 6, 2020). Many of you asked for a deeper look at the ingredients that went into making CAST. We attempt to provide exactly that in this cookbook, analysing the factors from a variety of perspectives:

 We address some of the frequently asked questions around CAST in investor conversations since last October and provide an expanded version of CAST and its performance in CAST performance and FAQ.

Exhibit 1: CAST performance since it went live in October 2020 (includes nine asset groups)



Source: Morgan Stanley Research; Note: All return indices are re-scaled to be 8% vol target as of end-2012. 'Market' shows the average performance across all the assets included in CAST. These stats don't account for transaction costs. Returns and Sharpe ratios will likely be lower after incorporating costs.

- Which factors perform best through time in various asset classes?
 See Global equities: Carry, yield curves and policy momentum onwards for a discussion of factor returns, risks and correlations to key market drivers in the last two decades. We show cluster maps to see how the different factors interact with each other and synthesise key asset class factor drivers.
- How do factors behave in different macro environments? We run a Factor almanac: Which factors work, when? showing factor performance ranking in a variety of macro environments: cycle phases, real yield versus inflation backdrops, equity corrections versus bear markets, dollar environments. We also look at Seasonality of factors in our universe.
- Can you create a CAST for a specific scenario, e.g., inflation? CAST is just one combination of the many that can be constructed from this universe of factors. We show how the recipe can be tailored to better suit specific market environments, e.g., 'inflation CAST', by choosing the best-performing factors for a rising inflation backdrop.
- Which factors could work in today's environment? In Tailoring factors for 2021, we use three potential backdrops that could shape 2021: i) A higher inflation regime; ii) A lower vol regime; and iii) The aftermath of a large, post-recession rally like 2004.
- How does CAST align with our strategists' views? We discuss where CAST has common ground with our strategists' views and forecasts and where it disagrees.

Exhibit 2: Which factor family has dominated the various asset classes in the last two decades?

Carry

- Commodities sees strong carry performances.
- Global equities and DM equities have carry in top 5 factors.
- G10 swaps 10yr is dominated by yield curve and carry.

Which factors have worked best in different asset classes?

Value

- Global credit is dominated by value metrics.
- G10 swaps 30yr is dominated by price mean-reversion (1m-12m horizon) as well as value and cross-value.
- Japan sectors is dominated by value and price mean-reversion.

Momentum

- EMFX is dominated by crossmomentum (rates) and short-term (1-3m) momentum.
- EM local 10yr sees strong performances by short-term momentum and cross-momentum.
- G10 swaps 2yr and EM local 2yr are led by momentum across the board.
- EU sectors is dominated by moving average crossovers.

Fundamentals

- G10 FX is cycle-driven, above-trend (Z5y) growth and price levels rewarded the most.
- Global equities and DM equities see fundamental trends (ROE, sales, growth, earnings Z5y) in top 20 factors.
- US sectors has been driven by fundamentals family (ROE, internal growth, sales trend and sales productivity).

Source: Morgan Stanley Research

Exhibit 3:	Which factors	worked in the	e last two	decades
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Asset Class	Top Cross-Sectional Factors
Global Equities	Carry and Vol Adjusted Carry (VAC) top the ranks Strong Current account level and trend supportive for global equities FX Cross-momentum as a headwind/contrarian indicator Equity vol premium as supportive cross-value factor A steep Yield Curve as indicator of supportive policy
DM Equities	Carry and Vol Adjusted Carry (VAC) top the ranks Strong Fundamental Trend (25y) in Book, GDP, Govt. Debt Relative valuation (Earnings Yield - Bond Yield Z5y) Valuation trend (25y of Price/Book and Price/Sales) (High) Profit Margin and (Low) Leverage rewarded
Global Credit	Value across different horizons (3y, 5y, 10y) Short-term (1-3m) momentum negatively correlated to equities Seasonality performs well Hi-Vol and High Carry Moving average cross-over 10x100D
Commodities	Carry and Vol Adjusted Carry (VAC) top the ranks Longer-term (6-12m) momentum ranks highly Crowding (Dealer Z1y and Non-commerical Z1y-) Seasonality performs well Moving average cross-over 10x100D and 20x100D
G10 Swaps 30yr	Price mean-reversion across the 1-12m horizon Yield Curve (2s10s level and momentum). 10s30s Curve Carry and Vol. Adjusted Carry Value (Sharpe 5y-, Sharpe 3y- and 30yr Real Yields) Fundamental momentum (Pay strong Retail Sales YoY, PMI)
G10 Swaps 10yr	Yield curve, Carry and Carry proxies top the ranks Policy momentum (2yr rates momentum, receive when CB is cutting) Value (Sharpe 1y-, Nominal yields Z5y) FX Cross-Value (REER Z5y: receive when currency is expensive) Fundmental trend (Pay when CPI, M2, retail sales above trend)
G10 Swaps 2yr	Moving average cross-over 10x100D and 3m momentum Rates 10yr Cross-momentum (Policy easier if 10yr rates falling) Unemployment Rate Change (Receive if unemployment is rising) Receive steepening Yield (2s10s) Curve. Pay steep 10s30s Curve Cross-Valuation (Pay when equity, FX valuations are troughing)

Exhibit 4: Which factors worked in the last two decades

Asset Class	Top Cross-Sectional Factors
G10 FX	Consumer Price Trend (CPI, Core CPI, PPI Z5y) and Inflation Equity Cross-momentum (3m) as a momentum indicator 2yr Nominal Yield Diff. and Carry Fundamental momentum (PMIs, YoY growth in M2, retail sales) Crowding (Leveraged Fund Z1y- and Asset Manager Z1y-)
EM FX	Rates 10yr Cross-momentum 12m- (Sell EMFX after EM rates fall) Price inflation and trend (25y) aligns with high policy rates/carry Carry and 2yr Nominal Yield Diff. Yield curve (Sell steep curves as it aligns with easy policy/low carry) Fundamental momentum (YoY Nom. GDP, M2, retail sales)
EM Local 10yr	Pay Fundamental momentum (Real/Nominal GDP, Retail Sales, IP) Short-term (1-3m) momentum, Cross-momentum (FX, rates 2yr) Yield curve level and change and Carry Value (10yr real yield level and trend, Sharpe 3y-) Current Account Level and Trend
EM Local 2yr	Short-term (1-3m) momentum,Cross-momentum (FX, rates 10yr) Pay Fundamental momentum (Real/Nominal GDP, M2, IP, PMI) Current Account (Trend and Momentum) Value and cross-value (2yr real yield, 10yr real yield Z5y) Fundamental trend (Pay when IP, M2, growth are at the trough)
US Sectors	FCF Yield (level and trend) Fundamental trend (ROE level and trend, sales and earnings trend) Value (Price/Sales and Price/Earnings) Leverage is penalized. Asset Turnover is rewarded. 1m Price Mean Reversion and 6mx1 momentum
Europe Sectors	Moving average cross-overs 20x100D, 20x200D Valuation momentum (rich getting richer, 1yr chg in P/E, Fwd. P/E) FCF Yield (level and trend) Fundamental level (Internal growth, ROE) Value (CAPE, Price/Sales)
Japan Sectors	Fundamental mean reversion (sell above trend ROE, earnings) Price Mean Reversion (1m and 12m), Sharpe 1y- FCF Yield (level and trend) Leverage is penalized. Carry (Dividend yield, payout ratios)

Exhibit 5: How does CAST align with our strategists' views?

Morgan Stanley Strategists' View	CAST	Views in Common
We maintain an OW in equities, and our regional preferences put Europe and Japan first. Europe > Japan > EM > US.	CAST is running more defensive exposure in equities driven by expensive valuations, FX headwinds. CAST prefers Japan and EM equities above US and Europe.	Global Equities: Long Japan Equities
Macro tailwinds collide with weaker fundamentals. Prices are starting to overshoot fundamentals, particularly in metals, bulks and grain.	CAST is running record exposure skewed by energy and livestock vs. industrial and precious metals. Strong momentum aligns with high carry (many curves are backwardated) to overcome valuation headwinds.	Commodities: Prefer energy over metals
We downgraded credit as a hotter cycle doesn't help against a backdrop of expensive valuations. In the US and Europe, we still favour HY over IG, and BBB over A within IG.	CAST is running more high-beta credit longs driven by strong momentum and vol-adjusted carry overcoming expensive valuations. CAST is running a compression bias, long HY vs. IG.	Credit: Prefer HY over IG credit
We remain bullish on USD. The Fed's hawkish turn and a continued tightening in the labour market and firming inflation are supportive of USD.	CAST has low net exposure to G10 FX as strong inflation dynamics and fundamentals clash with valuations or momentum headwinds. EUR features in the lower half of CAST.	G10 FX: Dislike EUR/USD
We are neutral on EM FX as EM growth is likely to lag the US, and central bank policy rates to be lifted by less than markets expect amid challenging fiscal and pandemic fundamentals. BRL better supported.	CAST is running above-average exposure to EM FX, driven by strong inflation and growth dynamics, strong 3m price momentum and cheap valuations. CAST has BRL among the top longs.	EM FX: BRL favoured
The Fed's hawkish turn is an argument for closing carry/long trades and adding bearish trades. Inflation momentum and a hawkish US backdrop could push India rates higher.	CAST is running below-average exposure to EM local, driven by strong inflation and growth dynamics, weak price momentum. India 10yr and 2yr rank at the bottom of CAST.	EM Local: Dislike INR rates
Source: Morgan Stanley Research		

Factor almanac and 2021 preview: What could work in a rising inflation and low-vol environment?

CAST is intended to be an all-weather strategy but many other 'recipes' are possible. We run an extensive analysis of which factors perform best in varied macro environments in Factor almanac: Which factors work, when? Based on our macro and strategy outlook for 2021, we choose three key environments that could characterise 2021 and see a favourable environment for carry and fundamental momentum to perform. Inflation CAST seems to be making a small pivot from rewarding 'the leading edge of inflation' to 'a rising tide lifts all boats' in some asset classes. Inflation CAST likes China, Canada and Hong Kong equities, long RUB, BRL, CAD, SEK, soybean oil, iron ore and IG credit. In rates, inflation CAST likes to pay INR 10yr, GBP and EUR 30yr. In US sectors, inflation CAST is long US healthcare versus consumer discretionary.

Exhibit 6: Evolution of factor performance in recent times

Which Factors Worked in 2020

- Value dominated across equities/credit/rates and equity sectors.
- Medium-term (3-6m) price momentum and moving average cross-overs effective in credit/commodities.
- Fundamental momentum performed in FX and rates.

Which Factors Worked in 1H21

- Price momentum takes the baton across asset classes. Especially dominant in commodities, equity sectors, driving value overshoot.
- Cross-momentum also important – rates momentum for equities/FX, equity momentum for EMFX/rates.

Which Factors Could Work in 2H21?

- Carry, carry proxies do well in a lower volatility backdrop across equities/credit/commodities/FX/rates.
- Fundamental trend (5y z-score) rewarded in rising inflation regime for FX/ equities.
- Carry, seasonality, unemployment rate, FX cross-momentum work after post-recession rally.

Exhibit 7: Which factor environments could characterise the rest of 2021



Source: Morgan Stanley Research

Exhibit 8: What does rising inflation CAST like...

	Inflatio	on CAST	Rank Changes (Δ1m)			
Asset Class	Top Ranked	Bottom Ranked	Asset	Δ1m		
	ChinaH	Singapore	S. Africa	+8		
Global Equities	Hong Kong	Germany	Switzerland	-10		
	Canada	Mexico				
DM Equition	Canada	Spain	Nikkei	+3		
Divi Equities	S&P 500	Germany	Italy	-3		
Clobal Cradit	US Corp 1-5Y	US MBS	US Corp 10Y+	+4		
Global Credit	US Corp 10Y+	US Corp A	EM \$ Corp	-5		
	Soybean Oil	Feeder Cattle	Lean Hogs	+5		
Commodities	Iron Ore	Live Cattle	Wheat	-8		
	Lumber	Cocoa				
C10 EV	CADUSD	CHFUSD	SEKUSD	+3		
GIUTA	SEKUSD	JPYUSD	AUDUSD	-3		
EM FX	RUBUSD	PENUSD	MYRUSD	+9		
	BRLUSD	THBUSD	PHPUSD	-9		
G10 Swaps 30yr	SEK 30yr	GBP 30yr	SEK 30yr	+3		
	NOK 30yr	EUR 30yr	CAD 30yr	-3		
C10 Swopo 10vr	AUD 10yr	GBP 10yr	CHF 10yr	+3		
GTU Swaps Tuyi	NZD 10yr	JPY 10yr	JPY 10yr	-6		
G10 Swape 2vr	AUD 2yr	GBP 2yr	NZD 2yr	+7		
GTU Swaps Zyr	USD 2yr	SEK 2yr	NOK 2yr	-4		
EM Local 10vr	TWD 10yr	TRY 10yr	MXN 10yr	+5		
LIVI LOCAI TOYI	THB 10yr	INR 10yr	CNY 10yr	-5		
EM Local 2vr	THB 2yr	TRY 2yr	TWD 2yr	+13		
EIVI LOCAI ZYI	PHP 2yr	BRL 2yr	HUF 2yr	-9		
LIS Sectors	US Staples	US Real Estate	US Financials	+2		
03 3601015	US Healthcare	US Discretionary	US Tech	-2		
Ell Soctore	EU Comm Services	EU Real Estate	EU Financials	+5		
LU SECIOIS	EU Financials	EU Energy	EU Staples	-4		
ID Sectors	JP Staples	JP Tech	JP Comm Services	+3		
UF SECIOIS	JP Financials	JP Utilities	JP Utilities	-3		
EM Sectors	EM Energy	EM Healthcare	EM Real Estate	+3		
EW Sectors	EM Utilities	EM Discretionary	EM Materials	-1		

Exhibit 9: ...versus what 'all weather' CAST likes?

		CAST	Rank Changes (Δ1m)			
Asset Class	Top Ranked	Bottom Ranked	Asset	Δ1m		
	Nikkei	UK	Italy	+9		
Global Equities	Hong Kong	Spain	Canada	-8		
	Korea	Netherlands				
DM Equition	S&P 500	Spain	S&P 500	+2		
Divi Equities	Sweden	Netherlands	Switzerland	-4		
Global Credit	EM \$ Corp	US MBS	US Corp 10Y+	+5		
Global Credit	EM \$ Sov XS	US Corp A	Euro HY BB	-4		
	WTI	Gold	Cotton	+17		
Commodities	Gasoil	Silver	Wheat	-10		
	Natural Gas	Corn				
C10 EV	SEKUSD	GBPUSD	CADUSD	+2		
GIUFX	NOKUSD	EURUSD	NZDUSD	-3		
	TRYUSD	PHPUSD	KRWUSD	+8		
	BRLUSD	THBUSD	PHPUSD	-5		
G10 Swaps 30yr	CAD 30yr	JPY 30yr	CHF 30yr	+4		
	NOK 30yr	GBP 30yr	GBP 30yr	-4		
G10 Swaps 10yr	NOK 10yr	USD 10yr	NOK 10yr	+6		
	NZD 10yr	JPY 10yr	CAD 10yr	-3		
C10 Curana Our	AUD 2yr	JPY 2yr	NZD 2yr	+8		
GTU Swaps Zyr	NZD 2yr	GBP 2yr	CHF 2yr	-2		
EM Local 10vr	TWD 10yr	TRY 10yr	KRW 10yr	+8		
LIVI LOCAL TOYI	PHP 10yr	INR 10yr	RUB 10yr	-7		
EM Local 2vr	TWD 2yr	CLP 2yr	TRY 2yr	+5		
LIW LOCAI ZYI	MYR 2yr	INR 2yr	INR 2yr	-4		
US Sectors	US Staples	US Real Estate	US Healthcare	+2		
03 3601015	US Healthcare	US Utilities	US Discretionary	-3		
Ell Sectors	EU Staples	EU Real Estate	EU Financials	+4		
LU Sectors	EU Materials	EU Utilities	EU Comm Services	-3		
IP Sectors	JP Energy	JP Healthcare	JP Real Estate	+5		
01 0001013	JP Financials	JP Comm Services	JP Utilities	-4		
EM Sectors	EM Tech	EM Industrials	EM Energy	+3		
Lin Sectors	EM Materials	EM Utilities	EM Financials	-4		

Seasonality from a factor lens

Arguably seasonality themes might manifest more strongly in the factor space than in the underlying assets as idiosyncratic moves get ironed out. We look at what works from a cross-sectional perspective in different periods of the year. The summer is dominated by carry and mean-reversion. To oversimplify, don't keep negative carry assets on the books in the summer, especially when they also happen to be rich. Chase fundamental trends and price momentum as the summer ends.

At a more granular level, carry and carry proxies dominate a number of asset classes: outright carry in equities and commodities; yield curve variants in rates; and FCF yield in equity sectors. The other key summer theme is value/mean-reversion: value and proxies in DM equities and credit; price-reversion in G10 FX and G10 swaps 30yr. Later in summer, short-term momentum and moving average crossovers take leadership in credit, commodities and front-end rates. Of all the asset classes, G10 FX and EM FX are most influenced by fundamental momentum and trend metrics in summer.



Rank >>	1	2	3	4	5	6	7	8	9	10
Global.Equities	Carry	Vol. Adj. Carry	Mom.12mx1	ROA	ROE	Eq. Vol Premium	Mom.12m	MA 50x200D	Seasonality	Profit Margin
DM.Equities	Сагту	Profit Margin	CAPE Z5y-	Vol. Adj. Carry	ROA	Seasonality	Price Book Z5y-	Price/Sales Z5y-	Terms of Trade Z5y	ROE
Global.Credit	Mom.3m	MA 20x100D	Spread Z10y	MA 20x200D	Mom.6m	MA 10×100D	Mom.6mx1	Spread Z5y	Mom.12m	Mom.12mx1
Commodities	Carry2s12s	Carry	Mom.12m	MA 10×100D	MA 20x100D	MA 20×200D	Mom.12mx1	MA 50x200D	CFTC Producers Z1y	Vol. Adj. Carry
G10.FX	Mom. 1m-	Nominal 10y Diff. Z5y-	Mfg. PMI 1y Chg	Earnings Z5y	Rts 10y Mom. 12mx 1	Price/Sales Z5y	RY Diff. 2y (Head.) 1y Chg	Yield Curve-	RY Diff. 2y (Head.)	CFTC Asset Mgr. Z1y-
EM.FX	ROE Z5y	Rts2y Mom.3m-	Book Z5y	Equity Mom.3m	Mom.3m	MA 20×100D	MA 20x200D	RY Diff. 2y (Head.) Z5y-	MA 10×100D	Real GDP Z5y-
G10.Swaps.30yr	Sharpe1y-	Nominal30y	Yield Curve	Mom. 1m-	Curve Carry	Core Inflation	RY 2yr (Head.) Z5y-	Price/Sales	Mom.6m-	Price/Book
G10.Swaps.10yr	Yield Curve	Curve Carry	Carry	Rts2y Mom.12mx1	RY 2yr (Head.) Z5y-	Yld, Curve Chg1y	Rts2y Mom.3m	Nominal2y Z5y-	Nominal2y 1y Chg-	Unemp. Rate 1y Chg
G10.Swaps.2yr	Curve 10s30s-	RY 10yr (Core) Z5y-	Mom.6mx1	Unemp. Rate 1y Chg	MA 10×100D	MA 20×100D	Mom.3m	Mom.6m	Nominal2y 1y Chg-	Sales Z5y-
EM.Local.10yr	Fwd. P/E Z5y	Mom.12mx1	Mom.6mx1	Rts2y Mom.12mx1	MA 20×200D	Rts2y Mom.3m	Nominal GDP YoY-	Mom.12m	MA 50x200D	FX Mom.12mx1
EM.Local.2yr	Fwd. P/E Z5y	Mom.3m	Nominal2y Z5y-	Mom.1m	FX Mom.3m	FX Mom. 12mx 1	Eq. Vol Premium-	Nominal GDP YoY.	Rts10y Mom.12mx1	M2 Growth-
US.Sectors	ROA	Mom.1m-	Profit Margin	Mom.6mx1	FCF Yld.	Price/Earn. Z5y-	ROE	Fwd. P/E 1y Chg	Dividend Yld, Z5y	Internal Growth
EU.Sectors	FCF Yld.	FCF Yld. Z5y	Payout Ratio	Profit Margin	Mom.6mx1	Sales Z5y	Price Earn. 1y Chg	Book Z5y	Mom.12mx1	Mom.3m
Japan.Sectors	FCF Yld. Z5y	Price/Earn. 1y Chg	Leverage-	FCF YId.	Fwd. P/E Z5y-	Payout Ratio	Carry	CAPE-	Dividend Yld.	ROE Z5y-
EM.Sectors	FCF YId.	Sharpe3y	MA 20x200D	Mom.1m	Asset Turnover	Profit Margin Chg 1y	CAPE 1y Chg	MA 20x100D	MA 10x100D	MA 50x200D

Data as of Mon 21 June 2021

Source: Morgan Stanley Research; Note: Green shading indicates carry family, yellow shading indicates value family. red shading indicates momentum family, blue shading indicates fundamentals family. The letters are in blue when the return is positive.

Rank >>	1	2	3	4	5	6	7	8	9	10
January	CAPE-	Price/Earnings-	CPI Z5y-	Vol. Adj. Carry	Fwd. P/E-	Price/Book-	Carry	Core Price Z5y-	FX Mom.3m-	Unemp. Rate 1y Chg
February	Carry	ROE Z5y	Vol. Adj. Carry	ROE ty Chg	Earn. Yld Bond Yld.	Earnings YoY	Dividend Yld.	ROE	Book Z5y	FX Mom.3m-
March	Eq. Vol Premium	Asset Turnover	Carry	FX Mom.12mx1-	Real GDP YoY-	Vol. Adj. Carry	Rts2y Mom.12mx1-	Rts10y Mom.12mx1-	Retail Sales Yoy-	Nominal GDP YoY-
April	FEY - RY Z5y	Vol. Adj. Carry	ERP Z5y	Carry	Rts10y Mom.12mx1-	RY 2yr (Head.) Z5y-	Yld. Curve Chg1y	Fwd. P/E Z5y-	Sharpe5y-	Yield Curve
May	Earn. Yld Bond Yld. Z5y	Earn. Yld RY Z5y	ROE	Earnings Z5y	Sales YoY	Sharpe3y	EYRYC Z5y	Rts 10y Mom.3m-	IP Z5y	Carry
June	FX Mom.12mx1-	Eq. Vol Premium	FX Mom.3m-	FX Vol Premium	FEY - RY Z5y	Leverage-	Unemp. Rate 1y Chg	ERP Z5y	Retail Sales YoY-	Mom.1m-
July	Vol. Adj. Carry	Carry	ERP Z5y	ROE	Mom.12mx1	ROE Z5y	EYRYC Z5y	Profit Margin	MA 50x200D	Current A/c
August	FX Vol Premium	Nom. GDP Z5y	Current A/c Z5y	Carry	Seasonality	Vol. Adj. Carry	Mom.1m-	Leverage-	ROA	Eq. Vol Premium
September	Carry	Vol. Adj. Carry	Mom.12mx1	MA 50x200D	Mom.12m	MA 20x200D	Asset Turnover	FX Mom.3m-	MA 10x100D	RY 10yr (Head.) Z5y
October	FEY - RY Z5y	RY 2yr (Head.) Z5y-	Vol 1m	Fwd. P/E Z5y-	Mom.1m-	Yld. Curve Chg1y	Seasonality	ERP Z5y	Rts10y Mom.3m-	Yield Curve
November	Book Z5y	Vol. Adj. Carry	Sharpe3y	FX Mom.3m-	Carry	Price/Earn. 1y Chg	Leverage.	Eq. Vol Premium	CAPE 1y Chg	Mom.12mx1
December	FX Vol Premium	Price/Sales-	Price/Book-	SpotPPP Z5y-	Asset Turnover	Сагту	Price/Earnings-	CAPE-	Leverage-	Vol. Adj. Carry
Note:										

Data as of Mon 21 June 2021

Source: Morgan Stanley Research; Note: Green shading indicates carry family, yellow shading indicates value family. red shading indicates momentum family, blue shading indicates fundamentals family. The letters are in blue when the return is positive.

Another way to look at seasonality is by asset class. For example, in equities, December-January sees value dominate performance, but February-April sees carry featuring at the top. Cross-momentum (FX and rates) is important into the March financial year-end. In April/May, ERP, earnings yield - bond yield transformations (Z5y) and fundamentals (Z5y on earnings, sales, industrial production) prove important. June sees FX cross-momentum, equity vol premium, FX vol premium and 1m mean-reversion on the top. Carry again performs in July-September, with September heavily dominated by momentum, especially moving average crossovers. October sees value and cross-value perform along with yield curves and 1m mean-reversion.

Why work with factors? CAST (group of factor clusters) > single factor cluster > factor > single asset

We see factors as having more reliable return characteristics than single assets, e.g., the G10 FX carry factor is more reliable and less prone to idiosyncratic risks than AUD as a carry trade. A cluster of factors that constitute 'value' (price/earnings, price/sales, price/ book, forward P/E, earnings yield - bond yield) will be more reliable than a single value factor (price/earnings). Finally, combining diverse factor clusters ('value cluster', 'carry cluster', 'momentum cluster', 'fundamental trends', etc.) as we did in creating CAST results in more consistent returns across different market regimes.

Composite factor combinations such as CAST are more resilient/reliable as the interaction of the factors adds considerable value and the different factors work to cover each other's shortcomings. We run clustering analysis to categorise factors for each asset class and find that clusters broadly align along the intuitive fundamental categories of carry, value, momentum and fundamentals. Within fundamentals, we often see a differentiation between a 'growth/ momentum' fundamental cluster and a 'cyclical/reversion' fundamental cluster. For example, looking at global equities clusters, we see:

1) Cluster C4 – 'momentum super-cluster': We have a large momentum cluster where price momentum aligns with cross-momentum and some fundamental momentum metrics (such as ROE, mfg. PMIs, earnings YoY, book YoY, sales YoY). A sub-cluster of some value metrics (mainly P/E and ERP), vol premium and cross-value (FX) also falls within this cluster.

2) Cluster C6 – 'carry cluster': Carry aligns with fundamental trend (z5y), e.g., inflation and money supply trend (Z5y), rising real yields and current account levels. Strong inflation dynamics arguably drive monetary policy and increase carry dispersion.

3) Cluster C8 – 'value cluster': Several of the value metrics form their own cluster. Notably, dividend yield aligns with the value cluster rather than the carry cluster. 1m mean-reversion also falls into this group, although high up on the cluster tree.

4) Cluster C8 – 'policy sub-cluster': Monetary policy momentum and yield curve align to form a policy sub-cluster within the value cluster.

The rest of the clusters are relatively small. We have seasonality standing on its own, and terms of trade trend and government debt trend standing in one cluster.

CAST is in effect a combination of factor families (carry, momentum, value and fundamentals) which not only reflect major investing frameworks used by fundamental investors but also happen to be distinct performance clusters as discussed above that make combinations such as CAST resilient across environments.



Exhibit 12: Global equity futures: Cross-sectional factors intuitively form 'carry', 'value', 'momentum' and 'monetary policy' clusters (2000-20)

Source: Morgan Stanley Research; Note: S = Sharpe ratio, I = Information ratio, p = p-value.

Factor construction basics

Factor construction is about taking different metrics and turning them into investable weights. The 1,500+ factors we discuss in this note are 'asset class factors' and are constructed at an asset class level, e.g., 'commodity - carry' or 'global credit - 12m momentum' or 'global equity futures - current account momentum'. We use two types of factors – cross-sectional (alpha bias) and time-series factors (beta bias).

Factor construction is about taking data and turning it into an investable signal. The 1,500+ factors we discuss in this note are 'asset class factors' and are constructed at an asset class level, e.g., 'commodity - carry' or 'global credit - 12m momentum' or 'global equity futures current account momentum' (see Appendix: A taxonomy of the CAST universe).

We cover 15 asset groups (global and DM equities, global credit, commodities, G10 FX, EM FX, G10 swaps 30yr, G10 swaps 10yr, G10 swaps 2yr, EM local 10yr, EM local 2yr as well as US, EU, Japan and EM sectors) where we go long and short the assets in the group based on the metric each week.

In effect, a factor is defined by:

- 1. The assets in the grouping (e.g., EM FX or commodities);
- 2. The metric (e.g., current account);
- 3. The transformation used, typically level, momentum (YoY change) or trend (5-year Z-score);
- The weighting; we use two groups cross-sectional (how it compares to peers) and time-series factors (how it compares to its own history).

A negative sign next to the factor name means the metric is flipped – a high value is sold and a low value is bought. e.g., 'Global equities momentum 1m-' is a price mean-reversion factor rather than a momentum factor due to the '-' at the end.

For each metric, we use two types of weighting – cross-sectional (more reflective of 'alpha') and time-series factors (more reflective of 'beta'):

Cross-sectional weighting (alpha bias, market-neutral): The weight of an asset in a cross-sectional factor (e.g., 1m momentum or money supply (M2) Z-score 5y) is based on the rank of the asset relative to its peers on that metric. The relative ranking is what matters here and hence cross-sectional weighting is a market-neutral weighting framework, biased to capture alpha. Due to the long-short construction, cross-sectional factors tend to have principal component exposure of PC2 or PC3 rather than PC1.

Time-series weighting (beta bias, varying directional exposure):

The time-series factors weight sign is a function of the direction of the metric (whether it is favourable or unfavourable) and the magnitude is inversely proportional to volatility. Time-series weighting cares about whether the metric is favourable or not versus the asset's own history, without regard for how other assets fare. It is possible to be long all assets in the group if carry, for example, is positive for all assets (Exhibit 14). Time-series factors can change their character, having high principal component exposure to PC1 when the metrics for all assets in the asset class are moving in the same direction but reducing the PC1 exposure in favour of PC2/PC3 exposure when the metrics are moving in different directions. Exhibit 13: Cross-sectional weighting: Linearly descending weight based on relative ranking of carry



Source: Morgan Stanley Research; Note: Gross notional of a single cross-sectional factor is 100%. Net notional of a single cross-sectional factor is 0%

As an example, in the G10 FX time-series carry, CHF and CAD both had negative carry versus USD and roughly similar volatility, which puts both their weights in the bottom three. In contrast, in the G10 FX cross-sectional carry, CAD ranks second-highest because it has the second-least negative carry in G10 FX.

Exhibit 15: The same metric can have very different weights in the time-series versus cross-sectional carry



Source: Morgan Stanley Research

Rebalancing frequency: We use a weekly rebalancing frequency – 'measure on Tuesday close, trade on Wednesday close' model, i.e., we use data available as of Tuesday close to calculate the weights of the factors and then assume we are able to realise Wednesday closing prices for transacting any change in weights versus the previous week. The returns shown don't account for transaction costs and as such will suffer from performance drag in live implementation.





Source: Morgan Stanley Research; Note: Gross notional of a single time-series factor is 100%. Net notional of a single time-series factor can vary from -100% to +100%

Data lags and revisions: Given the range of metrics across countries we are using, the challenge of achieving data as printed is considerable. There is also the issue of misaligned data across countries, i.e., PMI is measured at different points of the month, etc. As such, we have chosen to incorporate some lag in a number of cases to account for data misalignment across countries and revisions, etc. For example. as this note goes to print, the factors are still not using the latest US PMI print which was out on June 1 and are only using the previous May 1 print, i.e., a one-month lag is embedded. The expectation is that any major data revisions get reflected by lagging by one data release.

Why factors?

We see factors as having more reliable return characteristics than single assets, e.g., AUD as a carry trade is less reliable and more prone to idiosyncratic risks than the G10 FX carry factor. Furthermore, a cluster of factors that constitute 'value' (price/earnings, price/sales, price/book, forward P/E, earnings yield - bond yield) will be more reliable than a single value factor (price/earnings), etc. Finally, combining diverse factor clusters ('value cluster', 'carry cluster', 'momentum cluster', 'fundamental trends', etc.) as we did in creating CAST results in consistent returns across different market regimes.

Exhibit 16: Which factor family has dominated the various asset classes in the last two decades?

Carry

- Commodities sees strong carry performances.
- · Global equities and DM equities have carry in top 5 factors.
- G10 swaps 10yr is dominated by yield curve and carry.

Which factors have worked asset classes?

Value

- Global credit is dominated by value metrics.
- G10 swaps 30yr is dominated by price mean-reversion (1m-12m horizon) as well as value and cross-value.
- · Japan sectors is dominated by value and price mean-reversion.

best in different

Momentum

- EMFX is dominated by crossmomentum (rates) and short-term (1-3m) momentum.
- EM local 10yr sees strong performances by short-term momentum and cross-momentum.
- G10 swaps 2yr and EM local 2yr are led by momentum across the board.
- EU sectors is dominated by moving average crossovers.

Fundamentals

- G10 FX is cycle-driven, above-trend (Z5y) growth and price levels rewarded the most.
- Global equities and DM equities see fundamental trends (ROE, sales, growth, earnings Z5y) in top 20 factors.
- US sectors has been driven by fundamentals family (ROE, internal growth, sales trend and sales productivity).

Source: Morgan Stanley Research

In our view, single factor frameworks (e.g., momentum, value, etc.) have proven inadequate on their own against the challenging macro backdrop of the last decade. Our underlying factor universe went from ~20% of the factors showing a t-stat > 2.0 until 2012 (insample) to just ~8% crossing that threshold post-2012. This reflects the weaker trend in the underlying asset class returns, where only 33% of the asset classes have a t-stat above 2.0 as opposed to 53% before 2012.





Source: Morgan Stanley Research; Note: Universe of ~1,500 cross-sectional and time-series factors. 'Prior' defined around market convention/intuition (e.g., 'strong current account is favourable for FX per-formance', 'strong money supply growth is indicative of supportive policy/favourable growth dynamics for equities') and overturned only on evidence to the contrary during the in-sample period (up to 2012). In some cases, we don't overturn the prior, e.g., some of the value metrics are not overturned despite poor in-sample performance.

Is there a list of metrics that form the underlying universe?

Our metrics fall into four categories (see Appendix: Factor Universe for a detailed list):

Carry family: One of the consistent high-performing families of factors across asset classes. Apart from the traditional carry measure, carry proxies (such as dividend yield, FCF yield, nominal 2yr differentials) and their transformations, we now also include shadow short rates to adjust for the negative bound in a lot of countries.

Momentum family: Apart from the traditional momentum metrics such as 1m, 3m, 6m, 12m and 12mx1 momentum of the same asset, we have been using 'cross-momentum' - taking positions in one asset (say equity) based on the momentum of another asset (say FX), which has been quite effective. We also added moving average crossovers (10x50d, 20x100d, 20x200d, 50x200d) to our universe and found them to be very effective in some asset classes.

Value family: In a similar vein, we used cross-valuation measures to expand the value family of factors. We construct factors that are long one asset based on the valuation of another asset. While not as effective as the cross-momentum factors, they have served to improve the resilience of the value family of factors. We now add equity vol risk premium and FX vol risk premium as another measure of cross-value. High vol risk premium in equities is complementary of high risk premiums in related asset classes of the country. We find that vol risk premium is effective both within the asset class and in a cross-value sense.

It is no secret that value has struggled post-credit crisis, especially in equities, and the cross-value factors have held onto performance better than traditional value metrics, e.g., buying equities when FX

valuations are cheap or buying equities when front-end real yields are below trend. We see similar patterns in FX, G10 rates and EM local rates, where cross-valuations produce respectable risk/reward.

'Fundamentals' family: Fundamentals is a catch-all for metrics that don't fall into the other three groups above. We use three potential transformations: fundamental levels (e.g., current account level), momentum (change versus previous year - current account momentum) and trends (5yr Z-score, e.g., current account 5y Z-score). We also lump seasonality, low-vol, etc. in this group). Fundamentals seems to be an effective, under-researched family of factors.

Exhibit 18: Which factors worked in the last two decades

Asset Class	Top Cross-Sectional Factors
Global Equities	Carry and Vol Adjusted Carry (VAC) top the ranks Strong Current account level and trend supportive for global equities FX Cross-momentum as a headwind/contrarian indicator Equity vol premium as supportive cross-value factor A steep Yield Curve as indicator of supportive policy
DM Equities	Carry and Vol Adjusted Carry (VAC) top the ranks Strong Fundamental Trend (25y) in Book, GDP, Govt. Debt Relative valuation (Earnings Yield - Bond Yield Z5y) Valuation trend (25y of Price/Book and Price/Sales) (High) Profit Margin and (Low) Leverage rewarded
Global Credit	Value across different horizons (3y, 5y, 10y) Short-term (1-3m) momentum negatively correlated to equities Seasonality performs well Hi-Vol and High Carry Moving average cross-over 10x100D
Commodities	Carry and Vol Adjusted Carry (VAC) top the ranks Longer-term (6-12m) momentum ranks highly Crowding (Dealer Z1y and Non-commercial Z1y-) Seasonality performs well Moving average cross-over 10x100D and 20x100D
G10 Swaps 30yr	Price mean-reversion across the 1-12m horizon Yield Curve (2s10s level and momentum). 10s30s Curve Carry and Vol. Adjusted Carry Value (Sharpe 5y-, Sharpe 3y- and 30yr Real Yields) Fundamental momentum (Pay strong Retail Sales YoY, PMI)
G10 Swaps 10yr	Yield curve, Carry and Carry proxies top the ranks Policy momentum (2yr rates momentum, receive when CB is cutting) Value (Sharpe 1y-, Nominal yields Z5y) FX Cross-Value (REER Z5y: receive when currency is expensive) Fundamental trend (Pay when CPI, M2, retail sales above trend)
G10 Swaps 2yr	Moving average cross-over 10x100D and 3m momentum Rates 10yr Cross-momentum (Policy easier if 10yr rates falling) Unemployment Rate Change (Receive if unemployment is rising) Receive steepening Yield (2s10s) Curve. Pay steep 10s30s Curve Cross-Valuation (Pay when equity, FX valuations are troughing)

Exhibit 19: Which factors worked in the last two decades

Asset Class	Ton Cross-Sectional Factors
G10 FX	Consumer Price Trend (CPI, Core CPI, PPI Z5y) and Inflation Equity Cross-momentum (3m) as a momentum indicator 2yr Nominal Yield Diff. and Carry Fundamental momentum (PNIs, YOY growth in M2, retail sales) Crowding (Leveraged Fund Z1y- and Asset Manager Z1y-)
EM FX	Rates 10yr Cross-momentum 12m- (Sell EMFX after EM rates fall) Price inflation and trend (25y) aligns with high policy rates/carry Carry and 2yr Nominal Yield Diff. Yield curve (Sell steep curves as it aligns with easy policy/low carry) Fundamental momentum (YoY Nom. GDP, M2, retail sales)
EM Local 10yr	Pay Fundamental momentum (Real/Nominal GDP, Retail Sales, IP) Short-term (1-3m) momentum, Cross-momentum (FX, rates 2yr) Yield curve level and change and Carry Value (10yr real yield level and trend, Sharpe 3y-) Current Account Level and Trend
EM Local 2yr	Short-term (1-3m) momentum, Cross-momentum (FX, rates 10yr) Pay Fundamental momentum (Real/Nominal GDP, M2, IP, PMI) Current Account (Trend and Momentum) Value and cross-value (2yr real yield, 10yr real yield Z5y) Fundamental trend (Pay when IP, M2, growth are at the trough)
US Sectors	FCF Yield (level and trend) Fundamental trend (ROE level and trend, sales and earnings trend) Value (Price/Sales and Price/Earnings) Leverage is penalized. Asset Turnover is rewarded. 1m Price Mean Reversion and 6mx1 momentum
Europe Sectors	Moving average cross-overs 20x100D, 20x200D Valuation momentum (rich getting richer, 1yr chg in P/E, Fwd. P/E) FCF Yield (level and trend) Fundamental level (Internal growth, ROE) Value (CAPE, Price/Sales)
Japan Sectors	Fundamental mean reversion (sell above trend ROE, earnings) Price Mean Reversion (1m and 12m), Sharpe 1y- FCF Yield (level and trend) Leverage is penalized. Carry (Dividend yield, payout ratios)

Source: Morgan Stanley Research

CAST performance and FAQ

We answer some of the frequently asked questions in investor conversations since CAST was launched in October 2020. We look at how performance is broken down in cross-sectional CAST versus time-series CAST, a monthly rebalancing, a long-only CAST, etc.

We built CAST, our Cross-Asset Systematic Trading strategy, choosing from building blocks of originally 1,000+ systematic crosssectional and time-series factors across nine asset groups (see <u>CAST</u>: <u>Our Cross-Asset Factor Model</u>, October 6, 2020). We have had good conversations with systematic and fundamental investors alike over the last quarter and discuss some of the frequently asked questions and debates that came up.

What's new? i) We expand the CAST asset groups to equity sectors (US, Europe, Japan and EM) and G10 swaps 30yr. Note that when we talk about sectors, 'US sectors momentum 12mx1' will be long five sectors and short five sectors as opposed to long/short stocks within each intra-sector to capture a pure sector-neutral momentum factor; ii) We include new factors in the universe – moving average cross-overs, seasonality, volatility risk premium, CFTC positioning, shadow short rates; and iii) We expand the commodity universe from 20 to 28 and now include platinum, palladium and gasoil among others. We make changes to include some of these factors in CAST.

TRI 250 200 CAST out-ofsample period CAST CAST

2017

Source: Morgan Stanley Research; Note: All return indices are re-scaled to be 8% vol target as of end-2012. These stats don't account for transaction costs. Returns and Sharpe ratios will likely be lower after

2018

2019

2020

2021

2022

As of: 2021-06-01

Exhibit 21: Expanded CAST out-of-sample performance (after current expansion to include equity sectors and G10 swaps 30yr)



Source: Morgan Stanley Research; Note: All return indices are re-scaled to be 8% vol target as of end-2012. These stats don't account for transaction costs. Returns and Sharpe ratios will likely be lower after incorporating costs.

How did CAST perform since the launch?

We published on CAST last October and since then it has largely managed to navigate the year, keeping a defensive exposure in equities but staying on par or slightly ahead of the overall market, thanks to commodities and credit.

Commodities: CAST has got commodities largely right so far, running record longs in agri then energy, initially driven by cheap valuations and then riding the momentum, supported by high carry and backwardated curves.

Credit: CAST ran a record credit compression trade, funding HY longs with IG shorts as value and short-term momentum aligned well.

EM FX: EM FX has been successful overall as CAST ran a large long coming into the year on cheap valuations, strong inflation dynamics and high carry but suffered in 1Q volatility. However, the 2Q rebound and some good cross-sectional picks helped CAST to claw back losses and overtake the market.

Exhibit 20: CAST performance since it went live in October 2020 (includes nine asset groups)

150

2013

incorporating costs

2014

2015

2016

G10 swaps 10yr: CAST's primary challenge has been navigating the sharp rise in yields in 1Q. Usually fundamental trend and momentum take longer to normalise, which keeps CAST in rates duration as a carry trade, but the record fiscal stimulus pulled forward a rise in yields. Expensive equity valuations and strong FX headwinds motivated CAST to stay long duration. We are hopeful that it can claw back some of that as carry over the course of the year.

Front-end rates: After strong return contributions in 2020 from receiving front-end rates in G10 swaps 2yr and EM local 2yr, CAST cut exposure rapidly and turned a net payer in G10 for the first time in years and ran a good mix in EM local 2yr to come out flat when the respective markets lost money.



Source: Morgan Stanley Research; Note: All return indices are re-scaled to be 8% vol target as of end-2012. These stats don't account for transaction costs.



Source: Morgan Stanley Research; Note: All return indices are re-scaled to be 8% vol target as of end-2012. These stats don't account for transaction costs.

Exhibit 24: CAST in-sample performance (until December 2012)

Returns and Sharpe					Drawdowns and Skew					Correlations to					
PortName	Ann. Return	Ann. Vol.	Sharpe Ratio	Sortino Ratio	Inf. Ratio	Hit Ratio	Avg Win/Loss	Skew- ness	Largest Down Mth.	Max Drawdown	S&P 500	Global Agg.	DXY	S&P GSCI	HFRX Macro
CAST	23.1%	8.4%	2.75	3.5	1.88	81%	1.8	-0.3	-9.7%	-15%	43%	23%	-16%	29%	46%
Global Equities	10.1%	8.4%	1.20	1.8	1.19	67%	1.4	2.2	-5.5%	-21%	69%	2%	-8%	31%	21%
DM Equities	8.7%	8.4%	1.03	1.4	0.69	67%	1.2	1.8	-8.1%	-17%	58%	4%	-6%	27%	27%
Global Credit	13.2%	11.4%	1.16	3.0	1.46	61%	2.2	2.1	-10.2%	-13%	14%	-12%	-3%	8%	1%
Commodities	12.0%	9.5%	1.26	1.8	0.61	65%	1.5	1.1	-5.7%	-13%	-9%	-11%	8%	-8%	7%
G10 Swaps 30yr	7.8%	8.3%	0.94	1.5	0.99	59%	1.5	1.6	-6.4%	-14%	-19%	45%	0%	-17%	13%
G10 Swaps 10yr	9.7%	8.3%	1.17	1.8	0.93	64%	1.4	0.6	-4.6%	-20%	-19%	53%	-6%	-12%	14%
EM Local 10yr	13.7%	7.8%	1.75	2.0	0.48	69%	1.9	0.2	-7.9%	-12%	8%	31%	-14%	1%	22%
G10 FX	9.1%	8.4%	1.09	1.3	0.46	68%	1.1	-0.5	-11.6%	-28%	40%	31%	-45%	34%	18%
EM FX	15.9%	9.2%	1.73	2.3	1.20	74%	1.4	0.1	-6.8%	-16%	27%	16%	-20%	20%	29%
G10 Swaps 2yr	11.6%	9.7%	1.19	2.2	0.90	57%	2.4	2.0	-4.2%	-16%	-23%	32%	-4%	-14%	9%
EM Local 2yr	15.8%	8.5%	1.86	2.6	0.81	69%	2.6	1.7	-2.6%	-10%	7%	18%	-11%	-1%	13%
US Sectors	5.7%	7.1%	0.80	0.6	0.16	62%	1.2	-0.3	-6.4%	-20%	38%	6%	-14%	24%	27%
EU Sectors	6.6%	7.4%	0.89	1.1	0.39	62%	1.2	-0.2	-6.3%	-14%	16%	0%	0%	20%	36%
JP Sectors	6.0%	7.7%	0.78	0.9	0.37	60%	1.3	0.2	-8.1%	-18%	21%	-9%	2%	18%	19%
EM Sectors	11.8%	8.2%	1.44	2.1	0.92	64%	1.6	0.1	-5.5%	-11%	30%	11%	-20%	29%	41%

Source: Bloomberg, Morgan Stanley Research; Note: Both benchmark and CAST re-scaled to be 8% vol target as of end-2012. These stats don't account for transaction costs. Returns and Sharpe ratios will likely be lower after incorporating costs.

Exhibit 25: CAST out-of-sample performance (from January 2013)

	_	Return	arpe		Drawdowns and Skew						Correlations to				
PortName	Ann. Return	Ann. Vol.	Sharpe Ratio	Sortino Ratio	Inf. Ratio	Hit Ratio	Avg Win/Loss	Skew- ness	Largest Down Mth.	Max Drawdown	S&P 500	Global Agg.	DXY	S&P GSCI	HFRX Macro
CAST	15.0%	8.2%	1.81	2.1	1.50	78%	1.1	-1.1	-9.9%	-23%	68%	24%	-4%	44%	51%
Global Equities	5.4%	6.3%	0.85	0.8	0.09	72%	0.8	-1.8	-9.2%	-21%	77%	5%	-3%	56%	28%
DM Equities	4.9%	6.6%	0.74	0.7	-0.30	69%	0.8	-1.4	-8.0%	-21%	80%	-1%	3%	51%	31%
Commodities	6.2%	6.2%	0.99	1.3	0.58	60%	1.5	1.0	-4.3%	-16%	-9%	-5%	1%	-3%	12%
Global Credit	8.2%	5.9%	1.38	2.5	0.97	63%	1.9	1.6	-2.6%	-6%	18%	-24%	6%	15%	13%
G10 Swaps 30yr	7.5%	8.6%	0.87	1.3	0.99	56%	1.6	1.0	-4.1%	-13%	-17%	57%	-8%	-18%	24%
G10 Swaps 10yr	5.2%	7.8%	0.66	1.0	0.70	58%	1.2	0.3	-6.0%	-13%	-13%	62%	-10%	-12%	24%
EM Local 10yr	6.9%	6.1%	1.14	1.6	0.92	65%	1.2	-0.2	-4.2%	-10%	11%	44%	-7%	10%	30%
G10 FX	3.3%	4.8%	0.70	1.0	0.79	54%	1.4	-0.3	-5.3%	-12%	43%	28%	-12%	29%	30%
EM FX	6.2%	9.1%	0.67	0.9	0.81	59%	1.1	-0.5	-10.0%	-17%	28%	22%	-20%	20%	21%
G10 Swaps 2yr	3.4%	2.8%	1.25	2.1	0.93	64%	1.8	1.6	-1.3%	-3%	-23%	30%	-3%	-20%	15%
EM Local 2yr	6.4%	3.3%	1.95	1.7	0.78	70%	1.9	0.3	-2.4%	-5%	-4%	10%	6%	-2%	15%
US Sectors	6.2%	6.0%	1.03	0.8	-0.12	66%	1.1	-1.4	-8.2%	-19%	81%	9%	-9%	35%	30%
EU Sectors	3.4%	5.4%	0.62	0.7	-0.14	61%	1.0	-0.6	-5.6%	-15%	55%	-3%	16%	31%	43%
JP Sectors	6.8%	7.8%	0.86	1.0	0.17	63%	1.1	-1.1	-8.2%	-22%	41%	-15%	7%	35%	13%
EM Sectors	4.4%	5.3%	0.83	1.2	0.51	64%	1.1	-0.3	-4.3%	-12%	31%	15%	-9%	24%	37%

Source: Bloomberg, Morgan Stanley Research; Note: Both benchmark and CAST re-scaled to be 8% vol target as of end-2012. These stats don't account for transaction costs. Returns and Sharpe ratios will be lower after incorporating costs.

Frequently asked questions

How does CAST fit in/differ from risk premia?

CAST has two philosophical deviations (or not, depending on where one stands on the purist spectrum) from traditional risk premia.

1) Extensive use of time-series factors which may carry net market exposure (principal component 1 - PC1) alongside the more orthodox long-short, market-neutral cross-sectional factors (PC2, PC3 exposure). By forcing allocation to the time series in combination with cross-sectional factors, we ensure that CAST carries some combination of PC1/PC2/PC3 exposure at different points in time and thereby ensure some baseline diversification benefit. The usage of time-series factors this way also serves to address an important question for investors: about the relative balance of outright beta versus RV exposure one should carry at different times.

Exhibit 26: Time-series CAST and cross-sectional CAST operate in different spaces



Exhibit 27: CAST typically runs below-average PC1 exposure and above-average PC2 exposure compared to the market **CAST/Market PC2 Exposure**



Source: Morgan Stanley Research

2) The emphasis given to a family of factors over individual fac-

tors: The traditional approach tends to accept or reject individual factors based on their stand-alone performance, whereas we focus on the cheapest/best way to access a family of factors ('carry', 'value', 'momentum' and 'fundamentals'), putting the 'factor family' at the centre of our approach. By forcing allocation to each family even if some families are not the best-performing factors in terms of absolute Sharpe, we yet again ensure some diversification benefit. Our factor selection process is asking the question 'what are the best-performing factors to access this factor family?' rather than 'what are the top 10 performing factors (regardless of which family they belong to)?' Ultimately, the factor families are nothing new – they represent market drivers investors and analysts talk about when discussing the asset classes. In effect CAST is trying to practice, in a systematic way, what investors/traders/analysts preach.

How many factors do you use? Do the factors chosen change over time?

On average, we end up with a starting universe of about 50-200 factors (cross-sectional+time-series) per asset class. CAST itself is built using a subset of roughly 20-50 factors per asset class from this universe. There is diminishing marginal utility to adding factors. Choosing too many factors is counterproductive as the average of infinite factors will simply end up being the market. At the same time we need to ensure representation across the different factor families to provide a balance of factors to perform in a range of environments.

We choose the factors based on in-sample performance (until 2012) and lock them. There is **no** dynamic factor selection based on rolling performance.

How do you weight the different factors? Is there any optimisation of the factor weights.

Our weighting scheme is simple – every factor has equal weight. We don't explicitly optimise using the correlation information other than being mindful of the representation of the different factor families and the factor clusters.

Factor almanac: Which factors work, when?

A comprehensive look at how our universe performs across different environments: cycle phases, inflation backdrops, volatility regimes, equity melt-ups versus drawdowns, rate regimes, USD environments and oil regimes. We focus on cross-sectional factors here.

We further explore the properties of our universe and which factors do best in different environments. This creates an opportunity to go further and create a strategy for each of these environments, which we demonstrate with 'inflation CAST', which is based on equally weighting factors that work best in rising inflation environments (i.e., to be exact, when inflation is above average and rising).

Inflation CAST

Inflation CAST is an example of tailoring that recipe to a specific regime (rising inflation), by using best-performing factors for that environment. Inflation CAST answers the question 'what works in an rising inflation environment?' by using best-performing factors for

Exhibit 37: What does inflation CAST like today?

	Inflatio	on CAST	Rank Changes (Δ1m)				
Asset Class	Top Ranked	Bottom Ranked	Asset	Δ1m			
	ChinaH	Singapore	S. Africa	+8			
Global Equities	Hong Kong	Germany	Switzerland	-10			
	Canada	Mexico					
DM Equition	Canada	Spain	Nikkei	+3			
Divi Equilies	S&P 500	Germany	Italy	-3			
Clahal Oradit	US Corp 1-5Y	US MBS	US Corp 10Y+	+4			
Global Credit	US Corp 10Y+	US Corp A	Rank Changes (2 Asset S. Africa Switzerland Nikkei Italy US Corp 10Y+ EM \$ Corp Lean Hogs Wheat SEKUSD AUDUSD MYRUSD PHPUSD SEK 30yr CAD 30yr CHF 10yr JPY 10yr NZD 2yr MXN 10yr CNY 10yr TWD 2yr HUF 2yr US Financials EU Staples JP Comm Services JP Utilities EM Real Estate EM Real Estate	-5			
	Soybean Oil	Feeder Cattle	Lean Hogs	+5			
Commodities	Iron Ore	Live Cattle	Wheat	-8			
	Lumber	Cocoa	Rank Changes (∆ Asset S. Africa Switzerland Nikkei Italy US Corp 10Y+ EM \$ Corp Lean Hogs Wheat SEKUSD AUDUSD MYRUSD PHPUSD SEK 30yr CAD 30yr CAD 30yr CAD 30yr CAD 30yr CHF 10yr JPY 10yr NZD 2yr NOK 2yr MXN 10yr CHY 10yr TWD 2yr HUF 2yr US Financials EU Staples JP Comm Services JP Utilities				
C10 EV	CADUSD	CHFUSD	SEKUSD	+3			
GIUFA	SEKUSD	JPYUSD	AUDUSD	-3			
	RUBUSD	PENUSD	MYRUSD	+9			
	BRLUSD	THBUSD	PHPUSD	-9			
C10 Swope 20ur	SEK 30yr	GBP 30yr	SEK 30yr	+3			
GTU Swaps Suyr	NOK 30yr	EUR 30yr	CAD 30yr	-3			
C10 Swope 10vr	AUD 10yr	GBP 10yr	CHF 10yr	+3			
GTU Swaps Tuyi	NZD 10yr	JPY 10yr	JPY 10yr	-6			
C10 Currence Our	AUD 2yr	GBP 2yr	NZD 2yr	+7			
GTU Swaps Zyr	USD 2yr	SEK 2yr	NOK 2yr	-4			
EM Local 10m	TWD 10yr	TRY 10yr	MXN 10yr	+5			
EW Local Toyr	THB 10yr	INR 10yr	CNY 10yr	-5			
EM Local Our	THB 2yr	TRY 2yr	TWD 2yr	+13			
EIVI LOCAI ZYI	PHP 2yr	BRL 2yr	HUF 2yr	-9			
US Sectors	US Staples	US Real Estate	US Financials	+2			
US Sectors	US Healthcare	US Discretionary	US Tech	-2			
Ell Contorn	EU Comm Services	EU Real Estate	EU Financials	+5			
EU Sectors	EU Financials	EU Energy	EU Staples	-4			
ID Contoro	JP Staples	JP Tech	JP Comm Services	+3			
JF Sectors	JP Financials	JP Utilities	JP Utilities	-3			
EM Sactoro	EM Energy	EM Healthcare	EM Real Estate	+3			
EW Sectors	EM Utilities	EM Discretionary	EM Materials	-1			

Source: Morgan Stanley Research

that environment, e.g., the market rewards above-trend ROE (ROE Z5y) in a rising inflation environment, but the specific asset (S&P 500 or Nikkei) which has best above-trend ROE changes over time. This makes the answer to the inflation question somewhat dynamic – which assets to buy may change based on where inflation is manifesting the most and where it is in the price.

Inflation CAST likes China, Canada and Hong Kong equities, long RUB, BRL, CAD, SEK, soybean oil, iron ore and IG credit. In rates, inflation CAST likes to pay INR 10yr, GBP and EUR 30yr. In US sectors, inflation CAST is long US healthcare versus consumer discretionary. Inflation CAST seems to be pivoting from a strategy of 'the leading edge of inflation' to 'a rising tide lifts all boats' in some assets.

CAST Rank Changes (A1m) Asset Class **Bottom Ranked Top Ranked** Asset Δ1m Nikke UK Italy +9 **Global Equities** Hong Kong Snain Canada -8 Netherlands Korea S&P 500 S&P 500 +2 **DM Equities** Netherlands Sweden witzerla US Corp 10Y+ EM \$ Corp US MBS +5 **Global Credit** EM \$ Sov XS US Corp A uro HY BB +17 Commodities Gasoil Silver Wheat -10 Natural Gas Corn GBPUSD SEKUSD CADUSD G10 FX NOKUSD EURUSD NZDUSD TRYUSD KRWUSD +8 EM FX THBUSD BRLUSD -5 CAD 30yr JPY 30yr GBP 30yr USD 10yr CHF 30y +4 G10 Swaps 30yr NOK 30yr NOK 10yr NOK 10v +6 G10 Swaps 10yr JPY 10yr JPY 2yr GBP 2yr TRY 10yr NZD 10yr 10yı NZD 2yr AUD 2vr +8 G10 Swaps 2yr NZD 2yr TWD 10yr CHF 2yr KRW 10yr +8 EM Local 10vr PHP 10yr TWD 2yr INR 10yr CLP 2yr RUB 10yr +5 TRY 2vr EM Local 2yr INR 2yr US Real Estate INR 2yr MYR 2yr US Healthcare **US Staple US Sectors** US Healthcare EU Staples US Utilities EU Real Estate US Discretion EU Financials EU Sectors EU Utilities JP Healthcare **EU Materials** EU Comm Service JP Energy JP Real Estate JP Sectors JP Comm Service EM Industrials JP Financials JP Utilities EM Energy EM Tech +3 EM Sectors **EM Materials** EM Utilities **EM Financials**

Exhibit 38: What does CAST like today?

In EM FX, inflation CAST has a strong allocation to fundamental momentum, rates cross-momentum and short-term momentum at the expense of value. This explains why inflation CAST puts RUB at the top versus CAST putting BRL at the top.

Exhibit 39: RUB weight boosted by inflation CPI trend





Source: Morgan Stanley Research





Source: Morgan Stanley Research. Note: Scaled to 8% vol as of end-2012.

Exhibit 42: Factor almanac: A brief overview of what works in different environments

Market Environment	Environment A	Environment B
Inflation regimes: Below Avg.+Rising vs. Above Avg.+Rising	Inflation low and rising: Cross-value, Value rank high up in equity, credit, rates and sectors. Consumer price trend and inflation, M2 growth rewarded in FX.	Inflation high and rising: Fundamentals trend (Z5y) strong in equities, G10 swaps 10yr and FX. Long-term (12m) price momentum works in credit and commodities. Value is absent.
Inflation regimes: Below Avg.+Falling vs. Above Avg.+Falling	Inflation low and falling: <i>Fundamental momentum</i> across across equities, FX, front-end rates. Policy momentum in G10 and EM rates.	Inflation high and falling: Value across asset classes. Positioning unwinds in commodities and G10 FX. Value in equities and equity sectors.
Cycle Phase: Repair vs. Recovery	Repair: Value favoured in equities/credit/rates/sectors. Fundamental trends in G10 FX, EM FX and EM Local. Short-term (1-3m) momentum strong in credit/commodities/FX. Leverage penalized in Global and DM equities.	Recovery: Long-term momentum up in credit, commodities and sectors. Carry up across assets, yield curves in rates. Rates pivot from value to price mean reversion (<12m). Leverage penalized in sectors, especially Europe and Japan.
Cycle Phase: Expansion vs. Downturn	Expansion: Carry dominates across nearly all asset classes. EM Local dominated by price momentum. Earnings/sales trend (Z5y) important across asset classes.	Downturn: Short-term (1-3m) momentum and moving average cross-overs dominate credit/commodities/sectors. ROE and current account important across asset classes.
Volatility Regime Low vs. High (S&P 500 1m Vol terciles)	Lo-Vol regime: Carry dominates in nearly every asset class. Asset turnover ROE trend in global equities. FCF yields work in Sectors.	Hi-Vol regime: Value and short-term (1-3m) momentum Fundamental trend across asset classes. Yield curve dominant in rates.
S&P 500 Falling vs. Rising (weekly return buckets)	S&P 500 falling: Short-term (1-3m) price momentum fundamental momentum	S&P 500 rising: Carry and value/mean reversion Seasonality in credit and commodities.
S&P 500 Drawdowns: Small Tail vs. Bear Market	S&P 500 small tail correction: Long-term (12m) momentum Positioning corrections (in commodities)	S&P 500 bear market: Short-term momentum (1-3m) across asset classes. Monetary policy (rates 2yr) momentum
Real Yields: Falling vs. Rising	Real yields falling: Policy rate momentum and carry in macro markets	Real yields rising: <i>Fundamentals</i> family in macro markets. Value in equities.
Breakevens: Falling vs. Rising	Inflation breakevens falling: Positioning and momentum reversals in commodities. Carry in equities/rates, Lo-Vol in sectors	Inflation breakevens rising: Carry in FX/commodities Value in equities/credit and sectors
US Dollar (DXY): Falling vs. Rising	DXY falling: Value and cross-value in sectors, EM local, EM FX, credit. Leverage penalized. Equity vol premium rewarded.	DXY rising: Fundamentals and short-term (1-3m) momentum in equities, EM FX and EM Local. Current account rewarded in equities and FX.

Source: Morgan Stanley Research

Exhibit 40: BRL weight in CAST boosted by value **BRL Weight (%)**



Source: Morgan Stanley Research

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DM equities: Fundamental trends and crossvalue

Carry and fundamental trend (5y z-score in book, ROE, real and nominal GDP, earnings) dominated DM equities. FX crossmomentum and cross-value proved important over the last two decades, as did the yield curve. Profit margin was rewarded and leverage was penalised.

We introduce developed market (DM) equities factors separately from global equities as many asked for a DM-only version due to concerns about liquidity in EM equity futures. However, we only use the global equities CAST (and exclude the DM equities CAST) in the overall multi-asset CAST to avoid doubling up on DM equity futures.

Top-performing factors (cross-sectional)

Similar to global equities, carry again tops the list of DM equity crosssectional factors over the last two decades, although its performance is less of an outlier compared to global equities. It is notable that dividend yield (trailing 12m) doesn't have the same performance and is at the bottom of the rankings.

Otherwise, fundamental trend dominates the top 20 (5y Z-score in book, ROE, real and nominal GDP, earnings). The market has rewarded assets which can sustain strong trends in fundamental metrics. Yield curves which are steep or getting steeper are rewarded as well.

Profit margin is rewarded but leverage is penalised.

FX cross-momentum as a mean-reversion indicator (i.e., selling equities with the fastest currency appreciation) ranks among the top 20. Even rates cross-momentum has done better than traditional momentum and moving average crossovers, which are notable by their absence in the top ranks.

In the value family, price/book and price/sales trend along with earnings yield - bond yield trend do best versus spot valuations.

Equity vol premium (buying equities where 3m equity volatility has the highest premium to 3m realised vol) features in the top 25.

Top-performing factors (time-series)

As with global equities, relative valuation (earnings yield - bond yield, earnings yield - real yields) and their transformations dominate the time-series factors alongside fundamental trend (book, CPI, sales, nominal and real growth).

Moving average crossovers rank highest among momentum factors, followed by rates cross-momentum and fundamental momentum (PMI, terms of trade improvement).

Clustering summary (cross-sectional)

1) Cluster C8 – 'momentum super-cluster': We have a momentum super-cluster where the price momentum cluster aligns with cross-momentum and some fundamental momentum metrics (such as ROE, mfg. PMIs, earnings YoY, book YoY, sales YoY). A sub-cluster of some value metrics (mainly P/E and ERP) and cross-value (FX) also falls within the cluster. The 'price momentum' sub-cluster includes price momentum and moving average crossovers. 200D moving averages align with 12m momentum and 100D moving averages align with 6m momentum.

2) Cluster **C2** – 'value cluster': Several of the value metrics form a large value cluster. Notably, dividend yield aligns with the value cluster rather than the carry cluster.

3) Cluster C1 – 'monetary policy cluster': Monetary policy momentum and yield curve align with some valuation trend metrics.

4) Cluster C5 – 'inflation cluster': Consumer and producer price momentum and trend along with money supply trend form an important cluster.

Exhibit 91: DM equities: Cross-sectional factor clusters

DM Equities Cross-Sectional Factor Clusters



Source: Morgan Stanley Research; Note: S = Sharpe ratio, I = Information ratio, p = p-value.

Exhibit 92: DM equities: Cross-sectional factor performance (continued on next page)

		Returns and Sharpe				Drawdowns and Skew					Correlations to				
	Ann		Sharne	Sortino	Inf		Ανα	Skew-	Largest	Max	S&P	Global		S&P	HERX
Factor	Return	Ann. Vol.	Ratio	Ratio	Ratio	Hit Ratio	Win/Loss	ness	Down Mth.	Drawdown	500	Aaa.	DXY	GSCI	Macro
Carry	3.6%	6.6%	0.55	0.8	-0.04	59%	1.2	3.7	-6.3%	-13%	-25%	5%	-6%	-4%	-1%
Book Z5v	2.9%	6.1%	0.47	0.4	-0.01	51%	1.4	0.4	-4.9%	-15%	1%	17%	-15%	5%	11%
Vol. Adj. Carry	2.9%	6.5%	0.44	0.6	-0.11	57%	1.1	4.3	-6.6%	-12%	-20%	2%	-3%	-3%	-2%
Real GDP Z5y	3.0%	7.0%	0.42	0.7	-0.09	56%	1.3	8.4	-6.4%	-15%	-11%	8%	0%	-3%	3%
Govt. Debt Z5y-	2.4%	6.0%	0.40	0.4	-0.07	56%	1.1	0.5	-4.7%	-23%	-17%	2%	3%	-7%	-2%
Price/Book Z5y-	2.3%	6.1%	0.38	0.4	-0.05	52%	1.3	0.5	-4.7%	-18%	7%	9%	-11%	5%	-13%
Earn. Yld Bond Yld. Z5y	2.1%	5.9%	0.35	0.4	-0.04	53%	1.2	0.1	-4.8%	-20%	-13%	10%	-8%	1%	0%
Nom. GDP Z5y	2.4%	7.2%	0.33	0.4	-0.16	52%	1.2	0.0	-9.2%	-21%	0%	5%	0%	0%	2%
Profit Margin	2.3%	7.2%	0.32	0.4	-0.16	55%	1.1	0.0	-7.8%	-19%	-27%	14%	-5%	-10%	0%
ERP Z5y	2.0%	6.6%	0.30	0.3	-0.21	52%	1.2	-0.3	-7.8%	-23%	-1%	-1%	-2%	-1%	1%
Leverage-	1.7%	5.8%	0.30	0.3	-0.09	53%	1.1	0.0	-6.9%	-22%	8%	11%	-12%	3%	3%
Price/Sales Z5y-	1.7%	6.0%	0.29	0.3	-0.10	56%	1.0	0.1	-7.5%	-16%	-2%	5%	-11%	-3%	-16%
ROE Z5y	2.1%	7.2%	0.29	0.3	-0.21	51%	1.2	0.1	-6.5%	-22%	-9%	-11%	10%	-4%	5%
FX Mom.12mx1-	1.8%	6.4%	0.28	0.3	-0.20	55%	1.0	-0.3	-10.9%	-26%	-2%	6%	-7%	5%	10%
Yield Curve	1.7%	6.6%	0.26	0.4	-0.25	53%	1.2	6.4	-7.4%	-13%	3%	5%	-7%	6%	-1%
Earnings Z5y	1.7%	6.3%	0.26	0.3	-0.09	53%	1.1	0.4	-5.0%	-23%	-8%	14%	-11%	-1%	2%
Yld. Curve Chg1y	1.7%	6.5%	0.26	0.3	-0.23	54%	1.1	4.5	-5.3%	-14%	5%	-8%	6%	-2%	3%
Price/Earnings-	1.7%	6.7%	0.25	0.3	-0.24	52%	1.2	-0.5	-12.3%	-17%	-20%	5%	1%	-2%	-5%
SpotPPP Z5y-	1.6%	6.2%	0.25	0.3	-0.13	51%	1.2	-0.2	-8.5%	-14%	-3%	11%	-8%	7%	7%
Mfg. PMI 1y Chg-	1.7%	6.7%	0.25	0.5	-0.22	54%	1.3	12.9	-3.5%	-14%	-2%	10%	-3%	0%	-1%
Eq. Vol Premium	1.7%	7.1%	0.24	0.3	-0.23	54%	1.0	0.5	-6.0%	-26%	-4%	11%	-6%	-7%	4%
ROA	1.6%	6.8%	0.24	0.3	-0.10	53%	1.1	0.5	-6.0%	-20%	-27%	6%	-3%	-10%	4%
Rts10y Mom.12mx1-	1.6%	6.9%	0.24	0.3	-0.22	47%	1.3	0.0	-6.4%	-22%	8%	-3%	4%	1%	-7%
M2 Growth	1.5%	6.6%	0.23	0.2	-0.22	56%	1.0	-1.6	-15.9%	-22%	4%	5%	1%	2%	2%
Fwd. P/E 1y Chg	1.5%	6.7%	0.22	0.5	-0.23	49%	1.4	11.0	-4.7%	-11%	-6%	3%	1%	-1%	12%
Rts2y Mom.3m	1.4%	6.5%	0.22	0.4	-0.26	51%	1.3	11.4	-2.6%	-13%	2%	-7%	5%	-2%	4%
Mom.1m-	1.3%	6.2%	0.21	0.3	-0.27	53%	1.1	6.0	-4.7%	-18%	14%	-3%	-2%	3%	-7%
Terms of Trade Z5y	1.4%	6.6%	0.21	0.2	-0.24	57%	0.9	0.4	-6.4%	-22%	-6%	2%	6%	3%	1%
FCF Yld. Z5y	1.5%	7.3%	0.20	0.2	-0.27	52%	1.1	0.2	-5.3%	-29%	-17%	-10%	10%	-13%	-5%
RY 2yr (Head.) Z5y-	1.2%	6.4%	0.19	0.2	-0.25	52%	1.1	-0.6	-8.8%	-23%	14%	-8%	4%	2%	9%
Unemp. Rate 1y Chg	1.2%	6.4%	0.19	0.3	-0.27	51%	1.1	4.6	-4.5%	-17%	4%	4%	0%	-4%	0%
Earn. Yld Bond Yld.	1.2%	6.7%	0.18	0.2	-0.28	51%	1.1	-0.4	-11.6%	-17%	-21%	-2%	5%	-1%	1%
Earn. Yld RY Z5y	1.0%	5.6%	0.18	0.2	-0.22	47%	1.3	0.2	-4.8%	-16%	-20%	9%	-4%	-4%	-5%
Current A/c Z5y	1.3%	7.1%	0.18	0.2	-0.26	53%	1.0	-0.2	-11.1%	-25%	-2%	-5%	1%	-1%	-3%
ROE	1.2%	6.7%	0.18	0.2	-0.14	53%	1.0	0.4	-5.7%	-20%	-33%	5%	2%	-11%	3%
Terms of Trade YoY	1.2%	6.6%	0.18	0.2	-0.25	54%	1.0	-0.1	-6.8%	-23%	-7%	-2%	0%	3%	0%
Price/Sales-	1.2%	7.0%	0.17	0.2	-0.30	51%	1.1	0.6	-6.4%	-23%	12%	-13%	6%	8%	0%
EYRYC Z5y	1.0%	6.0%	0.17	0.2	-0.22	50%	1.2	0.3	-5.4%	-21%	-19%	9%	-5%	-6%	-5%
Price/Book-	1.2%	7.0%	0.16	0.2	-0.31	50%	1.1	0.1	-6.5%	-28%	-6%	-7%	4%	10%	-1%
CAPE Z5y-	0.9%	5.9%	0.16	0.2	-0.17	50%	1.1	0.5	-5.1%	-22%	-2%	-1%	-3%	-8%	-13%
Fwd. P/E Z5y-	1.1%	6.9%	0.16	0.2	-0.28	51%	1.1	0.0	-6.5%	-26%	10%	-1%	-5%	1%	-7%
Price/Sales 1y Chg	1.0%	6.9%	0.15	0.2	-0.27	50%	1.1	0.0	-9.8%	-19%	-5%	2%	1%	1%	8%
Dividend Yld. Z5y	0.9%	5.8%	0.15	0.2	-0.17	53%	1.0	0.3	-7.3%	-16%	-7%	3%	-3%	-2%	-9%
Mom.6mx1	1.0%	7.1%	0.15	0.2	-0.25	51%	1.1	-0.1	-11.0%	-19%	-13%	-1%	3%	0%	22%
ROE 1y Chg	0.9%	6.4%	0.14	0.2	-0.19	49%	1.2	0.8	-5.4%	-21%	-15%	-3%	4%	-1%	2%
Mfg. PMI	0.8%	6.4%	0.13	0.3	-0.30	46%	1.4	12.0	-4.8%	-12%	-9%	3%	0%	-1%	-1%
Mom.12mx1	0.9%	6.8%	0.13	0.1	-0.26	56%	0.9	-2.8	-18.0%	-21%	-8%	3%	2%	0%	18%
Sales YoY	0.9%	7.0%	0.13	0.2	-0.28	49%	1.1	0.3	-6.5%	-29%	12%	6%	-9%	-4%	3%
EYRYC	0.8%	6.5%	0.13	0.2	-0.26	52%	1.0	-0.6	-12.0%	-18%	-12%	2%	1%	1%	-3%
Earn. Yld Real Yld	0.8%	6.7%	0.13	0.2	-0.25	51%	1.0	-0.6	-12.0%	-19%	-17%	4%	1%	0%	-3%
Seasonality	0.7%	5.9%	0.12	0.1	-0.24	48%	1.2	0.7	-6.2%	-18%	8%	-2%	0%	-1%	-5%
RY 10yr (Head.) Z5y	0.7%	6.2%	0.11	0.1	-0.26	51%	1.1	0.7	-5.7%	-17%	-13%	9%	-7%	-2%	-5%
Forward Earnings YoY	0.7%	6.7%	0.11	0.2	-0.29	52%	1.0	5.7	-6.5%	-16%	-7%	2%	-1%	-2%	11%
MA 50x200D	0.7%	6.8%	0.11	0.1	-0.27	53%	1.0	-2.7	-18.1%	-21%	-5%	6%	0%	1%	19%
FX Mom.3m-	0.7%	7.3%	0.10	0.1	-0.27	52%	1.0	-4.6	-24.4%	-28%	-2%	2%	-2%	4%	9%
Asset Turnover	0.6%	6.0%	0.10	0.1	-0.17	54%	0.9	0.3	-4.8%	-27%	0%	-5%	2%	-8%	3%
Nominal GDP YoY	0.7%	6.8%	0.10	0.1	-0.27	51%	1.0	-1.9	-16.9%	-22%	2%	11%	-2%	2%	-1%
Mom.12m	0.6%	6.6%	0.09	0.1	-0.27	55%	0.9	-2.7	-17.4%	-20%	-12%	2%	3%	-1%	18%
Book YoY	0.5%	6.9%	0.08	0.1	-0.28	50%	1.1	0.1	-8.3%	-24%	-1%	12%	-9%	1%	11%
MA 20x200D	0.5%	6.9%	0.08	0.1	-0.28	54%	0.9	-2.7	-18.3%	-21%	-9%	4%	2%	-1%	21%
Real GDP YoY	0.5%	6.7%	0.08	0.1	-0.29	53%	1.0	0.1	-6.8%	-25%	0%	12%	-4%	1%	0%
Rts10y Mom.3m-	0.4%	6.2%	0.07	0.1	-0.32	48%	1.2	5.2	-6.0%	-19%	-3%	9%	-4%	-1%	-3%
Current A/c	0.4%	6.8%	0.06	0.1	-0.34	51%	1.0	-0.4	-8.7%	-19%	-17%	-21%	17%	-6%	6%
CAPE-	0.4%	7.2%	0.06	0.1	-0.34	53%	0.9	-0.6	-12.1%	-24%	-9%	-6%	7%	0%	-5%
Price/Earn. Z5y-	0.3%	6.5%	0.05	0.1	-0.19	46%	1.2	0.6	-6.9%	-22%	-13%	10%	-7%	-1%	-8%

Source: Morgan Stanley Research; Note: Scaled to 8% vol as of end-2012.

Global credit: Value and short-term momentum

We prefer credit when it is cheap and has strong short-term momentum (1-3m). Don't fight seasonality either on a crosssectional or time-series basis.

Top-performing factors (cross-sectional)

Value tops the cross-sectional factors, defined here as buying credit assets whose spreads are the most standard deviations above 10yr/5yr/3yr averages. 3yr is a value horizon for credit on a cross-sectional basis. Sharpe 5y-, which is a total return measure of value, is less effective than the spread measure of value.

Short-term (1-3m) momentum and 10x100D moving average crossovers follow value close behind. In comparison, longer-term (6-12m) momentum measures or x200D moving average crossovers are comparatively less effective although still momentum measures.

Seasonality is also a strong performer, featuring in the top five, and it ranks higher than carry or vol-adjusted carry.

Top-performing factors (time-series)

Short-term momentum and seasonality top the list of time-series factors. Interestingly, short-term momentum seems to be defensive in nature and generating returns by de-risking and avoiding losses, as evidenced by more negative correlations to the S&P 500. Value in comparison is generating returns from the long side and perhaps buying the asset class too soon in drawdowns.

Clustering summary (cross-sectional)

1) C3 – **'momentum cluster':** This is the largest, with 3-6m momentum and 12m momentum forming sub-clusters with 100D moving averages and 200D moving averages, respectively. 1m momentum forms its own unique cluster.

2) C8 – **'value cluster':** Based on spread Z-score, this is distinct from others. Sharpe 5y- is not as closely aligned to value. In comparison, carry and vol 1m align better with value.

3) C7 and C5 – 'carry cluster': Compared to other asset classes, carry and vol-adjusted carry are somewhat distinct in terms of the clustering.

4) C4 – **'seasonality cluster':** This is very effective both in terms of performance as well as being the most unique of all the factors.

Commodities: Carry and positioning factors

Commodities factors is about buying when carry is strong, i.e., commodity curves are in backwardation and have strong momentum. In addition, seasonality, CFTC positioning and moving average crossovers also add value as well in capturing the momentum turns.

Top-performing factors (cross-sectional)

In commodities, we use the second future due to its lower volatility and less vulnerability to short-term swings and more time for factor performances to play out, unhindered by the roll dynamics.

Overall carry is the best performer within commodities over the last 20 years.

CFTC producer positioning Z1y (as a momentum indicator) and noncommercial positioning Z1y- (as a contrarian indicator) feature among the top 10. We discuss the value in CFTC positioning extensively in <u>Cross-Asset Dispatches: Wisdom of the Crowds</u>, March 11, 2021. Seasonality is also among the top 10 factors.

Within momentum, longer-term momentum (6-12m) has been most effective over short-term (1-3m) momentum.

Top-performing factors (time-series)

Trend (time-series momentum) factors top the ranks of time-series factors, notably 6-12m momentum and 20x100D moving average crossover.

Carry also does quite well although posting slightly lower performance than the cross-sectional counterparts.

The time-series positioning factors are much less effective than their cross-sectional counterparts. As we flagged in *Wisdom of the Crowds*, positioning is more effective in driving relative performance rather than absolute performance.

A similar dynamic seems evident in the seasonality factor, i.e., timeseries seasonality is less effective than cross-sectional seasonality.

Factor clusters (cross-sectional)

1) Cluster C1 – 'Carry and long-term momentum cluster': Carry, long-term (6-12m) momentum and moving average crossovers align to form the biggest cluster in our universe.

2) Cluster C4 – 'value cluster': Value is a distinct cluster by itself, with 5yr and 3yr horizons forming sub-clusters.

3) Clusters C2-C3 – 'short-term (1-3m) momentum cluster': 1-3m momentum forms a distinct, separate group.

4) Cluster C5-C7: CFTC positioning brings entirely new information to the universe of factors, joining very high on the tree. Likewise seasonality is quite distinct from the other factors.

G10 FX: Fundamental trends and cycle matter

Cycles (inflation, growth), which in turn drive nominal yield differentials and carry, seem to be most effective in G10 FX.

Top-performing factors (cross-sectional)

The best-performing cross-sectional strategies in G10 FX are those that buy currencies with better fundamental trend in price (CPI, PPI), growth (real and nominal GDP) and terms of trade. These strategies also align with higher carry and 2yr yield differentials, which fall into the top ten.

Cross-momentum (buy FX in markets where equities and bonds are doing well) is overall more effective than momentum. There is a strong near-term mean-reversion element in G10 FX cross-sectional returns, i.e., strong 1m returns is an indicator of poor returns in the subsequent months.

Fundamental momentum is also influential. M2 growth, manufacturing PMI, nominal and real growth and unemployment rate change all feature in the top 20.

Leveraged funds and asset manager positioning acts as a contrarian indicator and is modestly effective, falling in the middle of the pack.

Current account levels are historically a disadvantage for G10 FX investors. Arguably high current account surpluses translate into low monetary policy rates, lower carry and hence poor G10 FX performance. Current account trend and momentum are marginally more effective than just the outright level today.

Top-performing factors (time-series)

There is a good overlap between the cross-sectional and time-series factors in G10 FX. Fundamental trend (Z5y) in terms of trade, inflation, growth and retail sales all feature in the top 20. Fundamental momentum (YoY growth in M2, CPI, retail sales, terms of trade) also show strong performance.

Carry proxies such as nominal rate differentials and shadow short rate differentials are more effective than spot carry.

6m momentum and 20x100D moving average crossover featured in the top ten.

CFTC positioning works in the opposite way to cross-sectional factors, i.e., dealer positioning acts as a contrarian indicator whereas leveraged funds and asset managers act as a momentum indicator.

Factor clustering summary (cross-sectional)

1) Cluster C1 – 'fundamental momentum and carry super-cluster': We have a large super-cluster comprising carry, carry proxies (such as nominal yield differentials and shadow rate differentials), with fundamental trend and fundamental momentum factors.

CFTC positioning forms a sub-cluster although it is meeting the fundamentals momentum sub-clusters high on the tree.

2) Cluster C7 – 'price momentum cluster': Momentum and moving average crossovers and momentum in yield differentials form a sizeable momentum cluster.

3) Cluster C3 – 'value cluster': FX value and rates cross-value (nominal and real yield trends) alongside current account transformations form a value cluster.

4) Cluster C2 – 'equity fundamentals cluster': ROE, sales, book and earnings trends along with current account form an equity fundamentals cluster.

EM FX: Carry, cross-momentum and fundamental momentum

EM rates cross-momentum, fundamental momentum and carry dominate EM FX factors. EM FX cycles seem shorter than G10 FX, more driven by fundamental momentum than the fundamental trend and short-term (1-3m) price momentum than long-term (12m) momentum.

Top-performing factors (cross-sectional)

Like G10 FX, EM FX also favours fundamental momentum and carry proxies. High carry, headline inflation, nominal 2yr yield differentials, nominal GDP growth, M2 growth and retail sales are among the best-performing strategies.

However, what differentiates G10 and EM FX is the momentum cycles. EM FX has strong short-term momentum (1m) whereas G10 FX favours mean-reversion (sell best performers of the last month). The performance of 12m momentum in EM FX is modest in comparison to G10 FX. Bottom line, EM FX markets tend to revert over the 1yr horizon, whereas G10 FX only starts chasing trends that lasted more than 6m.

This mean-reversion is also evident in the performance of cross-momentum, i.e., 12m momentum of 10yr EM local rates and 2yr EM local rates for the country is a strong contrarian indicator for EM FX. So, fade currencies which have seen the strongest EM local returns over the year or had policy easing from the central banks (2yr rate momentum as proxy). Similarly, strong 12m equity momentum is a contrarian indicator.

Steep EM local yield curves is a contrarian indicator, i.e., sell currencies with steep yield curves. Steep yield curves are potentially aligned to easier policy and low carry currencies.

Top-performing factors (time-series)

Fundamental momentum and trend dominates the top ranks – manufacturing PMIs in expansion, core inflation, M2 and retail sales growth. Trend (Z-score) in consumer price, book and earnings also do well.

Short-term (1-3m) momentum portfolios (i.e., 'trend') and 10x100D moving average crossovers are among the best-performing time-series portfolios, but 12m momentum is not very effective, reinforcing the point that the EM FX momentum cycles are short and intense compared to G10 FX, where 6m and 12m momentum do better.

Cross-value: Rate valuations (10yr real yields) and vol premium (FX vol premium and equity vol premium) feature in the top twenty.

Carry and nominal yield differentials also make it to the top twenty.

Factor clustering summary (cross-sectional)

1) Cluster C8 – 'carry and cross-value super-cluster': Carry, equity valuations and rate valuations (nominal and real yield differentials) along with yield curves form a super-cluster.

2) Cluster C4 – 'policy and rate momentum cluster': Momentum in policy rate, real yield, nominal yield and yield curve forms a distinct, important high-performing cluster.

3) Cluster C1 – 'momentum cluster': Short and long-term momentum, moving average crossovers and cross-momentum form the momentum cluster, along with FX vol premium.

3) Cluster C6/C7 – 'FX cross-value and PMI clusters': FX cross-valuation, terms of trade and PPI trend form an adjacent cluster to PMI levels and momentum.

G10 swaps 10yr: Carry and yield curves

G10 swaps 10yr is driven by carry proxies and policy rate momentum and less dominated by mean-reversion compared to the G10 swaps 30yr.

Top-performing factors (cross-sectional)

Carry and carry proxies such as yield curve (2s10s) level and yield curve momentum top the ranks of G10 swaps 10yr.

Monetary policy momentum (3m, 12m momentum of 2yr rates) features strongly in the top ten factors, i.e., pay rates when policy rates are rising.

Price mean-reversion features in the top twenty factors but is not as prominent as mean-reversion was in the G10 swaps 30yr earlier and reversion is more in the short term (1-3m).

Fundamental trend (CPI, M2 and retail sales trend), i.e., pay rates in markets which are further ahead in the inflation cycle, is usually stronger than fundamental momentum (manufacturing PMI, unemployment rate change).

Surprisingly seasonality was not as strong, certainly compared to G10 swaps 30yr.

Top-performing factors (time-series)

Similar to G10 swaps 30yr, time-series factors – 3m momentum and cross-momentum (rates 2yr momentum, equity momentum) – feature at the top.

Fundamental momentum (headline inflation, GDP growth) and trend (GDP, price, money supply, real GDP, government debt) are also represented strongly in the top twenty. Counterintuitively, the fundamentals family seems to get priced out and is a strong contrarian indicator, i.e., the more assets in the group that have strong momentum and the further ahead in the cycle they are, the greater the duration exposure one should take.

However, carry and carry proxies (10s30s curve is particularly effective) perform similarly strong in line with the cross-sectional factors.

Factor clusters (cross-sectional)

1) Cluster C4 – 'policy momentum + carry cluster': Rate 2yr momentum and front-end real yield transformations, yield curve momentum and current account momentum along with moving average transformations form the policy momentum cluster. Carry and yield curves form a sub-cluster within the policy momentum cluster.

2) Cluster C1 – 'value cluster': Nominal and real yields, equity valuations, as well as 10s30s curve and core inflation form a value cluster.

3) Cluster C2 – 'mean-reversion cluster': Short-term price mean-reversion and real yield and nominal yield trend and FX valuations and momentum form a major cluster close to the value cluster.

4) Cluster C6 – 'fundamentals cluster': Industrial production, money supply, retail sales, inflation, growth, unemployment rate change as well as equity fundamental momentum and trend metrics (sales, earnings, book trend) all align to form the fundamentals cluster.

G10 swaps 2yr: Momentum and moving average crossovers

Momentum of all kinds is overwhelmingly dominant in G10 swaps 2yr. 2yr rates are policy-sensitive and central banks are likely to be cautious in switching momentum frequently.

Top-performing factors (cross-sectional)

Momentum of some kind accounts for the majority of the top factors in G10 swaps 2yr. 1-3m momentum and x100D moving averages rank at the top. Cross-momentum (rates 10yr), yield curve momentum and unemployment rate change feature in the top twenty as well as 10s30s curve (pay steep curves).

Cross-value (receive rates when FX valuation and equity valuation become expensive) is very effective, and cross-momentum is also close behind in terms of effectiveness.

Overall fundamental momentum (PMI, YoY growth in retail sales) seems to do slightly better than fundamental trend (Z5y)

Top-performing factors (time series)

The time-series themes are similar to the cross-sectional themes, with a dominance of momentum as short-term (1-3m) momentum (i.e., 'trend') and 10x100D moving average crossovers feature among the best-performing G10 swaps 2yr time-series portfolios.

Cross-momentum also features heavily, i.e., receive rates in markets with weakest equities, strongest rate 10yr momentum.

Macro fundamental momentum and trend (growth, inflation, money supply M2, PPI, retail sales) are more important than equity fundamentals.

Factor clustering summary (cross-sectional)

1) Cluster C8 – 'momentum super-cluster': Short and long-term momentum, moving average crossovers and rates cross-momentum along with real yield and current account momentum form the momentum super-cluster.

2) Cluster C1 – 'cross-momentum and cross-value cluster': Momentum in equities and FX, value in rates and FX such as 2yr and 10yr real yields, nominal yield and yield curves form an important cluster after the momentum cluster.

3) Cluster C5 – 'fundamental trend cluster': Trend in PPI, CPI, M2, retail sales, IP, nominal and real GDP fall in this fundamental cluster.

4) Cluster C7 – 'PMI cluster': Manufacturing PMI forms a distinct cluster of its own.

EM local 10yr: Growth and policy cycle

EM local seems to be dominated by the fundamental and policy momentum, with a stronger emphasis on short-term momentum (1-3m) over long-term value, i.e., value overshoots are common.

Top-performing factors (cross-sectional)

Fundamental momentum, i.e., pay rates where YoY growth is strong: YoY growth in real and nominal GDP top the ranks and YoY growth in retail sales and industrial production YoY also feature in the top twenty.

Short-term momentum (1-3m) ranks in the top ten, which is symptomatic of an asset class where idiosyncratic valuation overshoots are common. Policy rate momentum (pay 10yr in hiking cycles) is the second-best-performing factor and short-term FX momentum (supportive for receiving rates) is effective too.

Current account trend is almost as important as carry and other transformations, featuring in the top half of the ranking, i.e., a strong current account is an important support for receiving rates.

In contrast, retail sales, earnings and real growth trend all act as cyclical measures, i.e., pay rates on a relative bases when these metrics are above trend.

Value and cross-value metrics (receive when currency or equity is expensive) fall just outside the top twenty metrics.

Top-performing factors (time-series)

Short-term (1-3m) momentum tops the ranks of time-series factors in EM local 10yr. Value (real yield 2yr and 10yr) is close behind in terms of effectiveness.

Fundamental trend metrics (CPI, PPI, money supply, real and nominal GDP) all feature in the top twenty, i.e., receive rates when fundamentals are above trend/closer to cycle peak and pay rates when they are below trend/at the cycle trough. Time-series seasonality is strong in EM local 10yr compared to crosssectional seasonality, which is suggestive of seasonality being an asset class phenomenon rather than an asset-specific factor.

Cross-momentum (3m momentum in equity, rates 2yr and FX) momentum and FX cross-value (FX vol premium and FX valuation) are also effective.

Factor clustering summary (cross-sectional)

1) Cluster C6 – 'price, policy and fundamental momentum supercluster': We have a super-cluster comprising price momentum and moving average crossovers, cross-momentum (FX, equity and rate 2yr momentum) and front-end real yield transformations and yield curve momentum. Carry and yield curves form a sub-cluster within the policy momentum cluster

2) Cluster C3 – 'cycle trend cluster': Trend (5yr Z-score) of valuations (nominal yields and Sharpe) and cross-valuations, as well as fundamental metrics such as CPI and PPI, form a cyclical trend cluster.

3) Cluster C1 – 'value cluster': Nominal and real yield levels alongside FX vol premium form a value cluster.

4) Cluster C7 – 'equity fundamentals cluster': Sales, book and earnings trends along with some fundamental metrics (M2 and retail sales) form a equity fundamentals cluster.