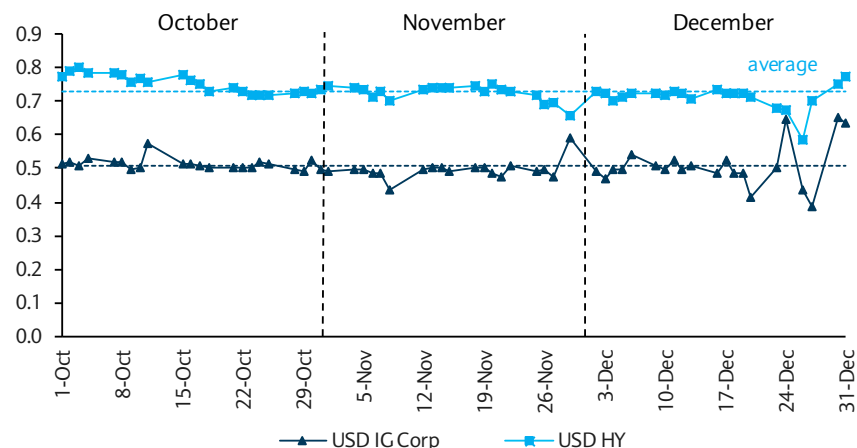


# LCS® Report – December 2019

**NEW:** We have added a new asset class to the LCS market coverage universe – USD convertible bonds (Bloomberg Barclays Index ‘U.S. Convertibles: Bonds Only’). The new data includes Monthly LCS and TES, as well as aggregated Daily LCS. Figures 2 through 5 in this report now contain additional rows.

FIGURE 1  
Daily LCS, USD IG and HY Corporates, %

Restricted - Internal



Daily LCS are computed using a universe of the most frequently quoted bonds that do not undergo any model adjustments, unlike many bonds in broad indices, which see much less activity. Hence, Daily LCS tend to be lower than the monthly values reported in Figure 2.

Source: Unless stated otherwise, the source for all figures is Barclays Research.

LCS of USD credit, both IG and HY, remained practically unchanged in December, while those of EUR credit were modestly higher (Figure 2). Trading volume was significantly lower across the board, especially in Europe, reflecting the usual holiday slowdown (Figure 5).

FIGURE 2  
LCS for Various Markets, by Sector, %

	Current Month	-1m	-3m	-6m	-12m	-24m
USD IG Credit Index*	0.643	0.643	0.622	0.612	0.587	0.563
Industrials	0.687	0.679	0.669	0.641	0.640	0.646
Utilities	1.169	1.176	1.104	1.075	1.045	1.014
Financial Institutions	0.588	0.592	0.572	0.589	0.531	0.422
Non-corporate	0.374	0.391	0.354	0.371	0.346	0.372
Corporate	0.691	0.689	0.670	0.656	0.633	0.601
USD HY Index	0.965	0.975	0.989	0.968	1.103	0.940
Industrials	0.982	0.992	0.998	0.969	1.110	0.949
Utilities	0.872	0.894	0.977	0.866	1.035	0.884
Financial Institutions	0.835	0.843	0.911	0.987	1.047	0.876
USD EM Index	0.612	0.588	0.608	0.604	0.722	0.508
Non-corporate	0.584	0.558	0.575	0.574	0.676	0.485
Industrials	0.689	0.665	0.710	0.678	0.881	0.565
Financial Institutions	0.696	0.693	0.685	0.730	0.829	0.619
EUR IG Credit Index	0.423	0.391	0.387	0.365	0.394	0.320
Industrials	0.343	0.345	0.424	0.399	0.394	0.365
Utilities	0.477	0.428	0.412	0.402	0.401	0.376
Financial Institutions	0.523	0.427	0.339	0.320	0.329	0.324
Non-corporate	0.411	0.408	0.385	0.361	0.456	0.248
EUR HY Index	0.806	0.774	0.820	0.869	1.015	0.808
Industrials	0.836	0.804	0.848	0.926	1.071	0.875
Utilities	0.558	0.480	0.690	0.567	0.742	0.799
Financial Institutions	0.718	0.697	0.725	0.693	0.801	0.563
Global Covered Bonds	0.211	0.205	0.205	0.242	0.227	0.239
USD Convertibles	0.738	n/a	n/a	n/a	n/a	n/a

\* Throughout this report, “index” refers to Bloomberg Barclays bond indices

LCS and TES data are available with an annual subscription. Please contact us for details.

There was a significant deterioration in the European government debt markets, particularly inflation-linked, with LCS of Germany's linkers increasing 41% in relative terms (Figure 6). The two most liquid nominal government debt markets in Europe were Germany and the Netherlands (Figure 7).

Spain had the lowest LCS among the Pan-European corporate markets, with Germany coming in second.<sup>1</sup> Figure 8 shows the LCS spread between corporates and Treasuries for the US and the European countries in Figure 7. Spain had the narrowest spread.

The heat maps in Figure 9 illustrate how the LCS of USD IG and HY credit depend on the age and issue size. “Warmer” colors signify higher LCS (this may be less clear if printed in black and white). Figure 10 presents the same diagram for EUR IG credit. We use different breakpoints in all three diagrams to better match the structure of each market.

Figure 11 shows a breakdown, by country and currency, of the global covered bond market; Belgium and Finland had the lowest LCS. Among the larger markets, Germany was the most liquid. Figure 12 shows LCS, the number of bonds, and MV% for the top 10 countries (by the number of bonds) in the Pan Euro Credit Index. Figure 13 contains basic statistics for various sector/quality buckets of the USD EM market.

Figures 14 and 15 plot the LCS time series of USD and EUR credit. Figures 16 and 17 plot the most recent 24 months of these time series. Figure 18 shows the LCS frequency distribution for USD IG and HY, as well as for EUR and GBP IG credit. Figure 19 demonstrates how this distribution for USD IG credit has changed over time.

Figure 20 plots the historical spread decomposition for a basket of liquid USD IG credit bonds. Figure 21 shows statistics of the 10 Trade Efficiency Score (TES) buckets for the USD Corporate Index. Figure 22 contains one- and six-month transition matrices of USD IG and HY credit LCS. Figure 23 is a scorecard for Tradable Cash Credit Baskets (TCX), highly liquid portfolios designed to track a particular benchmark.

Figure 24 displays the historical time series of Price Impact Measure (PIM) for USD IG and HY credit.

FIGURE 3

## Basic Index Statistics, by Sector

	Number of bonds	Avg Issue size, mn	OAD	OAS, bp	12m Avg LCS	12m StDev LCS
USD IG Credit Index	6,822	913	7.65	90	0.616	0.019
Industrials	3,601	890	8.50	99	0.655	0.019
Utilities	798	479	10.67	97	1.090	0.051
Financial Institutions	1,674	1,002	6.05	80	0.578	0.017
Non-corporate	749	1,288	6.32	72	0.365	0.015
Corporate	6,073	867	7.89	93	0.662	0.019
USD HY Index	1,878	662	3.05	336	0.981	0.036
Industrials	1,657	661	3.00	350	0.987	0.037
Utilities	52	608	3.25	235	0.927	0.051
Financial Institutions	169	687	3.44	242	0.937	0.064
USD EM Index	2,018	1,025	6.16	303	0.617	0.031
Non-corporate	1,277	1,202	6.78	306	0.583	0.026
Industrials	487	753	4.88	321	0.716	0.056
Financial Institutions	211	664	2.91	207	0.734	0.047
EUR IG Credit Index	3,330	1,000	5.84	82	0.384	0.018
Industrials	1,526	829	5.62	90	0.395	0.026
Utilities	216	743	5.46	89	0.418	0.022
Financial Institutions	1,125	910	4.59	98	0.354	0.065
Non-corporate	463	1,906	7.60	51	0.393	0.031
EUR HY Index	536	580	3.21	292	0.856	0.065
Industrials	414	590	3.12	289	0.899	0.074
Utilities	14	616	2.93	172	0.587	0.092
Financial Institutions	108	536	3.62	323	0.720	0.032
Global Covered Bonds	1,316	1,010	4.78	43	0.231	0.024
USD Convertibles	418	379	-	-	n/a	n/a

<sup>1</sup> These comparisons do not adjust for the potentially different characteristics of various markets.

FIGURE 4

**Current LCS Market Coverage**

Asset Class (Bloomberg Barclays Index)	Inception Date	December 2019 LCS, %
USD Credit IG	Jan-07	0.643
USD Credit HY	Jan-07	0.965
USD IG Credit 144A (no registration rights)	Jan-07	0.601
USD Treasuries	Nov-09	0.025
USD TIPS	Jul-10	0.135
USD Fixed Rate Agency MBS	Mar-10	0.092
USD Emerging Markets	Feb-12	0.612
USD Convertible Bonds	Dec-19	0.738
Pan Euro Credit IG	May-10	0.479
Pan Euro Credit HY	May-10	0.859
Pan Euro Credit FRN	May-10	0.182
GBP Corporate 100–200mm Amt Outstand	May-10	1.360
Pan Euro Agencies	May-10	0.398
Pan Euro Local Authorities	May-10	0.268
Pan Euro Treasuries	Feb-11	0.116
Pan Euro Inflation Linked	Mar-11	0.266
Global Covered Bonds	Sep-12	0.211
JPY Treasuries	Sep-13	0.244

FIGURE 5

**Average Monthly Trading Volume per Bond (mn), Adjusted to 21 Trading Days per Month**

Index	Current Month	-1m	-3m	-6m	-12m	-24m
USD IG Credit (\$)	43.2	53.0	60.2	65.8	44.1	39.0
USD HY (\$)	77.3	91.0	97.4	101.8	72.8	32.5
USD EM (\$)	39.1	63.0	78.6	87.4	39.6	45.8
EUR IG Credit (€)	29.2	56.8	58.6	66.2	22.1	16.2
EUR HY (€)	41.2	61.7	76.4	59.9	26.8	21.3
GBP IG Credit (£)	15.2	22.4	29.0	25.4	12.2	13.4
GBP HY Credit (£)	14.0	27.4	25.6	27.9	9.4	10.6
Global Covered (€)	7.1	13.9	14.5	18.0	5.1	3.6
USD Convertibles (\$)	65.6	n/a	n/a	n/a	n/a	n/a

Source: TRACE, TRAX, Barclays Research

FIGURE 6

**Non-credit LCS, %**

Index	Current Month	-1m	-3m	-6m	-12m	-24m
USD Treasuries	0.025	0.026	0.026	0.029	0.035	0.025
USD TIPS	0.135	0.136	0.135	0.136	0.150	0.143
USD MBS	0.092	0.095	0.088	0.088	0.112	0.119
EUR Treasuries	0.103	0.088	0.094	0.071	0.097	0.110
Sterling Gilts	0.086	0.073	0.076	0.053	0.151	0.067
UK inflation-linked	0.305	0.219	0.194	0.201	0.211	0.306
Germany inflation-linked	0.141	0.100	0.114	0.088	0.313	0.145
France inflation-linked	0.143	0.105	0.141	0.101	0.303	0.155
Italy inflation-linked	0.324	0.234	0.284	0.265	0.628	0.197
JPY Treasuries	0.244	0.226	0.179	0.160	0.222	0.175

FIGURE 7

## Treasury and Corporate LCS by Country of Issuer, %

Country	Treasury (domestic currency)		IG Corporate (Pan Euro currencies)		IG Corporate (Sterling)	
	Bonds	LCS	Bonds	LCS	Bonds	LCS
France	45	0.075	628	0.476	45	0.693
Germany	49	0.065	482	0.430	58	0.620
Italy	74	0.076	135	0.444	6	0.882
Netherlands	19	0.072	165	0.462	18	0.722
Spain	39	0.126	171	0.389	8	0.476
United Kingdom	42	0.086	770	0.686	501	0.900
United States	257	0.025	674	0.464	116	0.701
Japan	270	0.244	39	0.576	6	0.736

FIGURE 8

## Treasury and Corporate LCS, Current versus One Year Ago, %

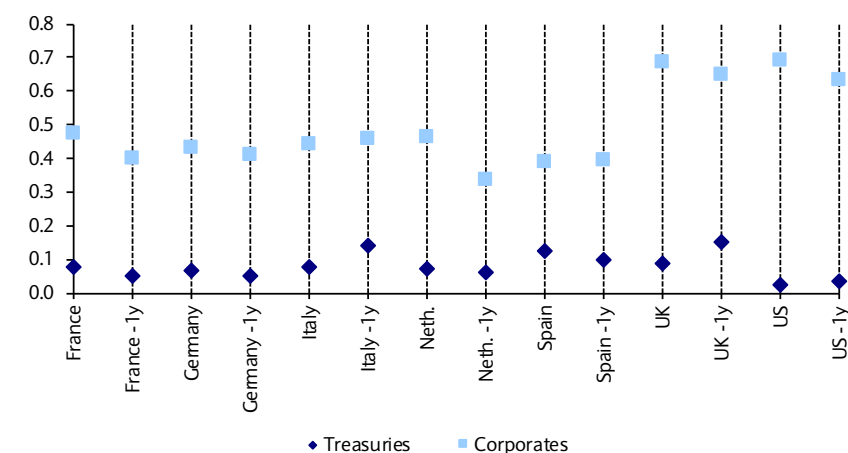


FIGURE 9

## LCS by Issue Size and Age, USD Credit, %

Inv. Grade	Maturity: 1-5 (38.1% MV)				Maturity: 5-10 (28.0% MV)			
	Age, yr				Age, yr			
Size, \$mn	<1	1-5	5-7.5	7.5+	<1	1-5	5-7.5	7.5+
<500	0.38	0.37	0.46	0.32	0.73	0.73	0.65	0.84
500-750	0.28	0.31	0.39	0.26	0.64	0.69	0.77	0.98
750-1,500	0.26	0.23	0.32	0.20	0.50	0.57	0.51	0.55
1,500-2,000	0.21	0.20	0.31	0.21	0.38	0.47		
2,000-3,000	0.21	0.19	0.27	0.18	0.33	0.41	0.60	
>3,000	0.18	0.18	0.21	0.14	0.35	0.36		

Inv. Grade	Maturity: 10+ (33.8% MV)				Maturity: All			
	Age, yr				Age, yr			
Size, \$mn	<1	1-5	5-7.5	7.5+	<1	1-5	5-7.5	7.5+
<500	1.32	1.72	1.70	1.40	0.95	0.96	0.91	1.07
500-750	1.12	1.59	1.46	1.35	0.65	0.79	0.76	0.97
750-1,500	0.99	1.26	1.40	1.26	0.53	0.58	0.67	0.84
1,500-2,000	0.82	0.99	1.14	1.16	0.41	0.50	0.62	0.83
2,000-3,000	0.79	1.06	1.15	0.92	0.39	0.50	0.51	0.67
>3,000	0.57	0.79		0.81	0.30	0.38	0.29	0.43

## High Yield

Size, \$mn	Maturity: 1-4 (61.0% MV)				Maturity: 4-7 (28.1% MV)			
	Age, yr				Age, yr			
	<1	1-3	3-7	7+	<1	1-3	3-7	7+
<300	1.32	1.76	1.36	1.14		4.17	1.71	1.83
300-500	1.16	1.23	1.22	1.02	1.24	1.52	1.85	
500-750	0.91	1.04	1.09	1.22	1.05	1.59	1.18	
750-1,000	0.78	0.82	0.87	1.05	0.79	1.26	1.44	
>1,000	0.68	0.76	0.78	0.60	0.71	1.13	0.81	

Size, \$mn	Maturity: 7+ (10.9% MV)				Maturity: All			
	Age, yr				Age, yr			
	<1	1-3	3-7	7+	<1	1-3	3-7	7+
<300				2.31	1.39	2.50	1.40	1.82
300-500	1.18	1.17	2.20	2.93	1.21	1.31	1.38	2.19
500-750	1.06	1.19	1.21	2.00	1.01	1.21	1.11	1.45
750-1,000	0.81	0.93	1.56		0.79	0.97	1.04	1.36
>1,000	0.75	0.71		1.17	0.71	0.84	0.81	0.75

Note: Buckets with fewer than five bonds are not shown.

FIGURE 10

## LCS by Issue Size and Age, EUR IG Credit, %

Size, €mn	Maturity: 1-3 (23.5% MV)				Maturity: 3-7 (46.7% MV)			
	Age, yr				Age, yr			
	<1	1-3	3-7	7+	<1	1-3	3-7	7+
<500	0.24	0.31	0.21	0.22	0.41	0.41	0.43	0.55
500-750	0.14	0.22	0.19	0.19	0.44	0.41	0.46	0.45
750-1,500	0.14	0.19	0.21	0.25	0.36	0.42	0.44	
1,500-2,000		0.25	0.22	0.32	0.40	0.35	0.50	
>2,000			0.18	0.23	0.30	0.22	0.27	0.47

Size, €mn	Maturity: 7+ (29.8% MV)				Maturity: All			
	Age, yr				Age, yr			
	<1	1-3	3-7	7+	<1	1-3	3-7	7+
<500	0.55	0.65	0.64	1.12	0.46	0.46	0.38	0.45
500-750	0.58	0.65	0.61	0.78	0.48	0.47	0.40	0.34
750-1,500	0.62	0.68	0.67	0.83	0.46	0.47	0.40	0.36
1,500-2,000	0.71	0.78	0.61		0.48	0.44	0.44	0.46
>2,000	0.37	0.49	0.58	0.67	0.33	0.37	0.37	0.41

Note: Buckets with fewer than five bonds are not shown.

FIGURE 11

## Global Covered Bonds Index, by Country and Currency

Country	LCS, %	-3m	# bonds	Currency	LCS, %	-3m	# bonds
Germany	0.097	0.094	224	EUR	0.100	0.097	964
Switzerland	0.624	0.631	195	CHF	0.649	0.657	203
France	0.102	0.100	183	USD	0.065	0.058	47
Sweden	0.429	0.411	81	SEK	0.547	0.539	39
Spain	0.115	0.108	73	GBP	0.323	0.387	28
Canada	0.086	0.084	66	DKK	0.548	0.540	14
Norway	0.116	0.114	62	AUD	0.638	0.641	10
Italy	0.207	0.202	61	NOK	0.634	0.617	8
United Kingdom	0.151	0.160	58	CAD	0.568	0.575	2
Austria	0.099	0.094	55				
Australia	0.146	0.149	54				
Netherlands	0.129	0.127	52				
Finland	0.084	0.081	34				
Denmark	0.391	0.380	28				
Belgium	0.081	0.082	22				

FIGURE 12

## Pan Euro Credit Index, Country-level Statistics (top 10 by the number of bonds)

Country	# Bonds	MV%	LCS, %	-1m	-3m	-6m
United Kingdom	776	12.38	0.684	0.670	0.658	0.651
United States	677	14.36	0.466	0.440	0.460	0.442
France	655	13.75	0.504	0.463	0.440	0.422
Germany	536	11.06	0.427	0.392	0.388	0.387
Netherlands	179	3.86	0.474	0.437	0.370	0.361
Spain	172	3.55	0.391	0.375	0.370	0.382
Italy	137	2.97	0.466	0.425	0.418	0.476
Switzerland	127	2.35	0.420	0.385	0.379	0.342
Sweden	110	1.77	0.411	0.367	0.356	0.431
Australia	98	1.63	0.474	0.405	0.395	0.375

FIGURE 13

## USD Emerging Markets Index, LCS and Market Structure

LCS, %	IG	-3m	Non-IG	-3m	Total	-3m
Non-Corporate	0.469	0.469	0.820	0.801	0.584	0.575
Industrial	0.556	0.574	0.839	0.872	0.689	0.710
Utility	0.478	0.633	1.158	0.762	0.766	0.681
Financial	0.555	0.536	0.920	0.934	0.696	0.685
Total	0.488	0.491	0.837	0.827	0.612	0.608

Bonds / %MV	IG	Non-IG	Total
Non-Corporate	847 / 50.0%	430 / 24.3%	1,277 / 74.3%
Industrial	247 / 9.4%	240 / 8.3%	487 / 17.7%
Utility	22 / 0.7%	21 / 0.5%	43 / 1.3%
Financial	134 / 4.1%	77 / 2.6%	211 / 6.7%
Total	1,250 / 64.3%	768 / 35.7%	2,018 / 100.0%

FIGURE 14  
Time Series of USD IG and HY Credit LCS, %, January 2007-December 2019

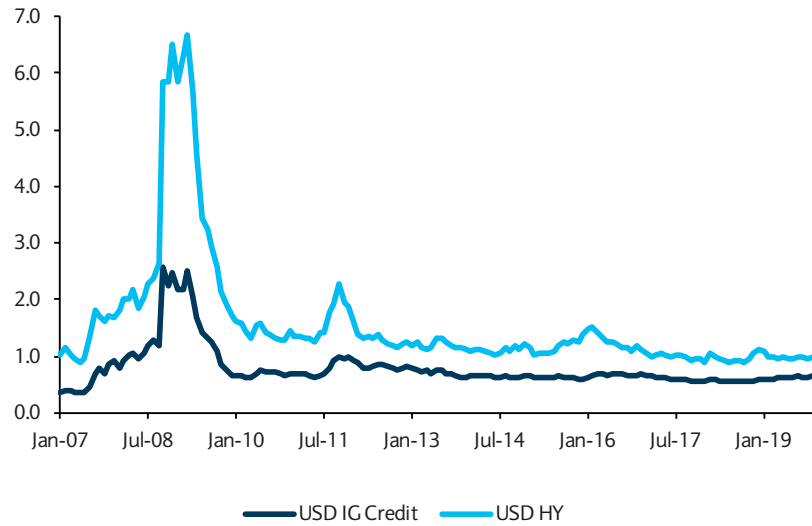


FIGURE 16  
Time Series of USD IG and HY Credit LCS, %, the Past 24 Months

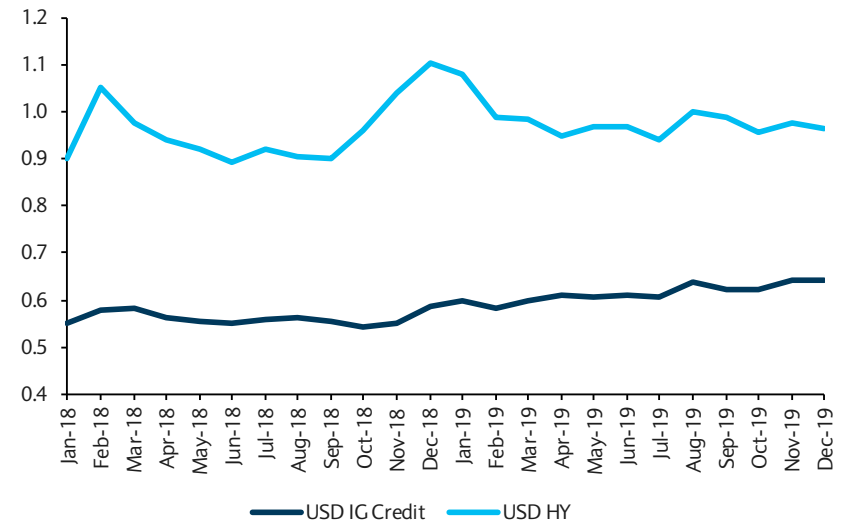


FIGURE 15  
Time Series of EUR IG and HY Credit LCS, %, May 2010-December 2019

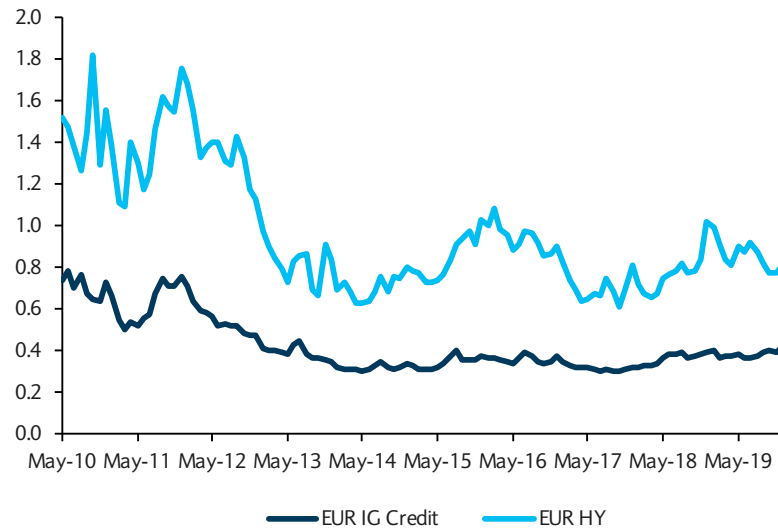


FIGURE 17  
Time Series of EUR IG and HY Credit LCS, %, the Past 24 Months

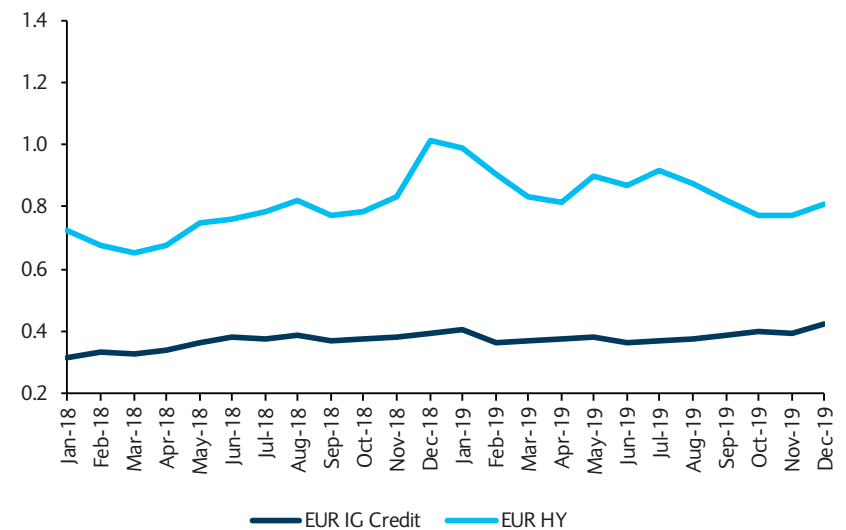


FIGURE 18  
Cross-Sectional LCS Frequency Distribution for Various Credit Markets

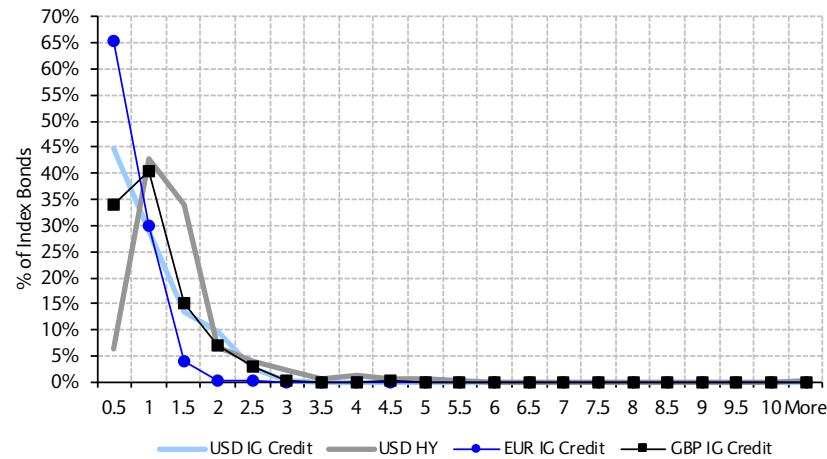


FIGURE 19  
Historical Cross-Sectional LCS Frequency Distribution for USD IG Credit

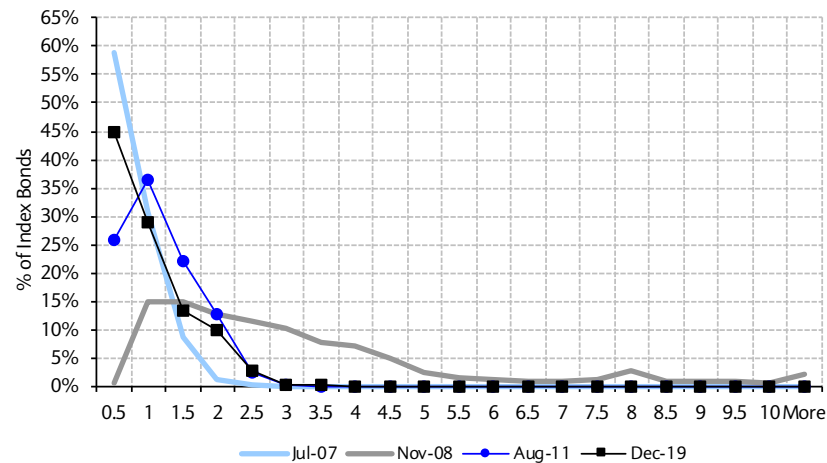
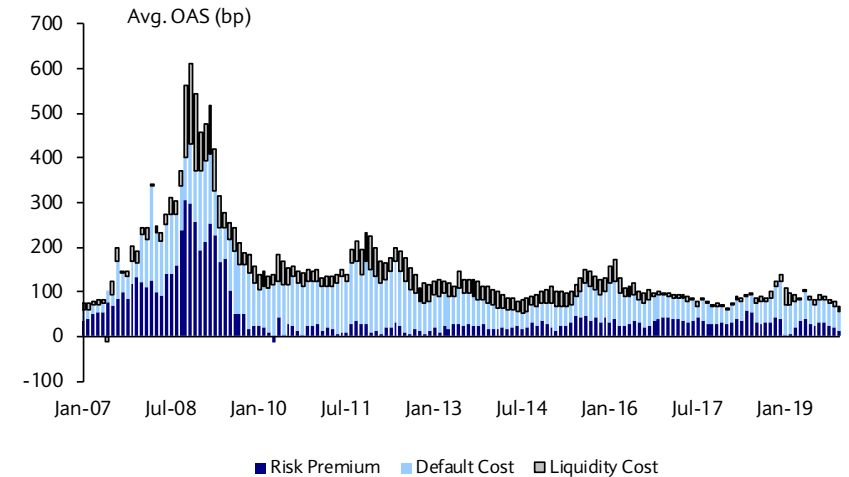


FIGURE 20  
Risk Premium, Default, and Liquidity Components of USD IG Credit Bonds OAS, January 2007-December 2019



Note: The sample is limited to 5y bonds from issuers belonging to the CDX basket.

FIGURE 21  
Trade Efficiency Score (TES) Buckets Statistics, USD IG Corporates

TES	# bonds	# bonds %	MV %	Age	Avg issue size, mn	OAS, bp	OASD	LCS, %	Avg Vol, mn
1	831	13.7	26.7	2.45	1,709	95	8.93	0.493	172.7
2	829	13.7	19.1	3.71	1,233	82	6.86	0.540	64.7
3	507	8.3	9.1	4.08	961	86	6.35	0.604	44.9
4	446	7.3	6.9	4.51	821	91	7.22	0.720	33.7
5	550	9.1	8.0	4.77	763	89	7.14	0.758	24.9
6	541	8.9	7.1	5.12	687	93	7.49	0.810	17.3
7	520	8.6	5.9	5.08	598	95	8.08	0.910	11.4
8	494	8.1	5.1	5.94	536	103	7.85	0.934	7.8
9	487	8.0	4.7	6.54	493	106	8.64	1.064	4.3
10	868	14.3	7.3	8.14	418	113	8.31	1.119	1.5

FIGURE 22

LCS Quintiles: One- and Six-month Transition Rates and Average LCS, %

## USD IG Credit

Current	Q1 (0.158)	Q2 (0.335)	Q3 (0.576)	Q4 (0.925)	Q5 (1.678)
Previous month					
Q1 (0.171)	90.5	9.1	0.4	0.0	0.0
Q2 (0.343)	6.1	85.3	8.1	0.5	0.0
Q3 (0.585)	0.1	6.7	82.8	9.9	0.5
Q4 (0.943)	0.1	0.4	6.0	83.8	9.7
Q5 (1.709)	0.0	0.0	0.9	5.3	93.9
6 months ago					
Q1 (0.180)	86.6	10.1	1.6	0.9	0.8
Q2 (0.345)	21.5	60.2	14.5	3.7	0.2
Q3 (0.550)	1.9	23.6	59.9	13.5	1.2
Q4 (0.884)	0.2	1.9	18.0	62.8	17.2
Q5 (1.593)	0.0	0.1	0.7	13.4	85.8

## USD HY

Current	Q1 (0.547)	Q2 (0.800)	Q3 (1.009)	Q4 (1.186)	Q5 (2.574)
Previous month					
Q1 (0.535)	75.5	20.4	3.6	0.3	0.3
Q2 (0.797)	18.1	56.9	21.6	3.5	0.0
Q3 (1.025)	3.2	18.3	58.3	18.8	1.3
Q4 (1.211)	1.3	4.0	15.3	67.7	11.6
Q5 (2.815)	0.0	0.3	2.2	10.3	87.3
6 months ago					
Q1 (0.598)	58.4	27.9	8.2	4.9	0.7
Q2 (0.891)	24.9	32.2	25.5	13.7	3.6
Q3 (1.080)	9.3	20.3	29.6	31.0	9.9
Q4 (1.213)	6.4	12.1	24.8	40.0	16.7
Q5 (2.077)	0.3	1.5	9.2	16.6	72.4

Note: At the beginning of the observation period (ie, last month or six months ago), we sort index bonds into LCS quintiles and follow the quintile-migration of bonds still in the index at the end of the period. For example, a bond that was in Q3 six months ago but is in Q2 now is counted in the third row, second column of the six-month transition matrix. This approach means that while rows sum to 100%, columns usually do not.

FIGURE 23

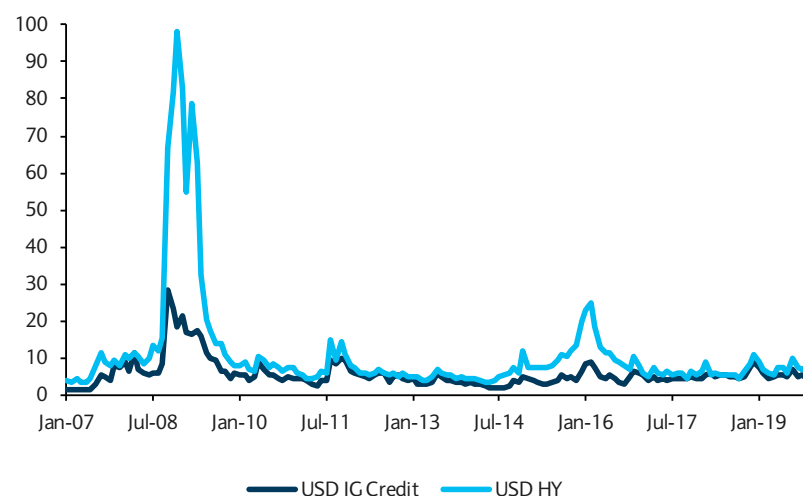
Tradable Cash Credit Baskets (TCX) Scorecard; TE and TEV in bp, LCS in %

	USD Credit	USD Long Credit	USD Corporate	EUR Credit	EUR Corporate	USD EM Corp
Inception	Feb-07	Feb-07	Feb-07	Jun-10	Aug-10	Mar-12
# of bonds	50	36	50	48	40	28
Rebalancing	Monthly	Monthly	Quarterly	Monthly	Quarterly	Monthly
December TE	11.9	17.6	7.7	4.2	-17.2	2.4
Avg. monthly TE	24.4	26.6	21.3	-17.7	-4.1	69.2
TEV	-1.2	2.3	-1.1	1.2	-1.4	-6.3
Index ExRet Vol	48.3	37.0	48.2	12.3	23.3	46.4
LCS	139.1	237.3	156.7	73.6	83.8	138.6
Index LCS	0.415	0.790	0.486	0.183	0.343	0.473

Note: TCX baskets are small portfolios of highly liquid bonds, designed to track an underlying benchmark. For details, see *Edelstein, A., S. Dastidar and B. Phelps, April 2010, Tradable Credit Portfolio (TCX) to Track the USD IG Credit Index, Barclays Cross Asset Research*.

FIGURE 24

Time Series of Price Impact Measure (PIM), bp, USD IG and HY Credit, January 2007-December 2019



Note: This figure shows the index-level PIM, which is an arithmetic average of bond-level PIM values (net of market).



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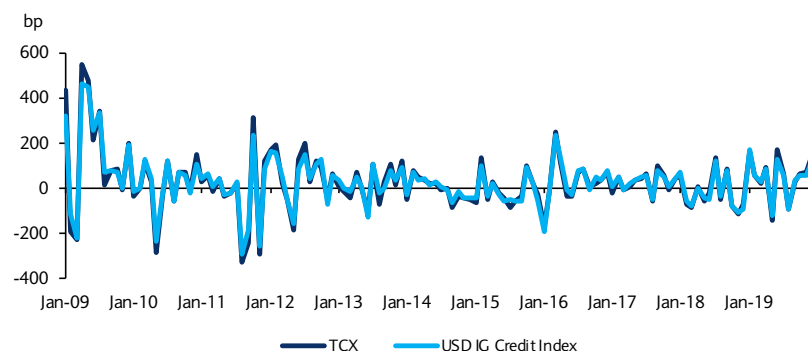
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## TCX Report – December 2019

FIGURE T1

USD Credit TCX and Credit Index Excess Returns (to Treasuries), January 2009–December 2019



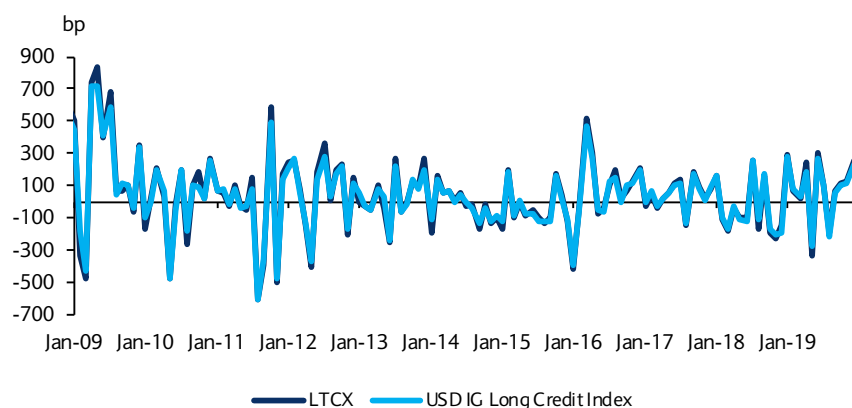
The USD Credit TCX (TCX) is a 50-bond portfolio of highly liquid bonds designed to track the USD Credit Index. It is constructed to match the index's DTS and market value weights in 25 sector/duration buckets, while selecting from among the most liquid (lowest-LCS) bonds. The USD Credit TCX is rebalanced monthly.

In terms of excess return (to Treasuries), the TCX tracking error versus the USD Credit Index was 24.4bp in December. Figure T1 shows the excess return tracking performance of the TCX since 2009. Over that period, its monthly tracking error versus the index has averaged 0.1bp, with a volatility of 25bp (for comparison, over the same period, the monthly excess return volatility of the index has been 113bp).

The LCS of the December Credit TCX basket is 0.415, versus the Index LCS of 0.643.

FIGURE T2

USD Long Credit TCX and Long Credit Index Excess Returns (to Treasuries), January 2009–December 2019



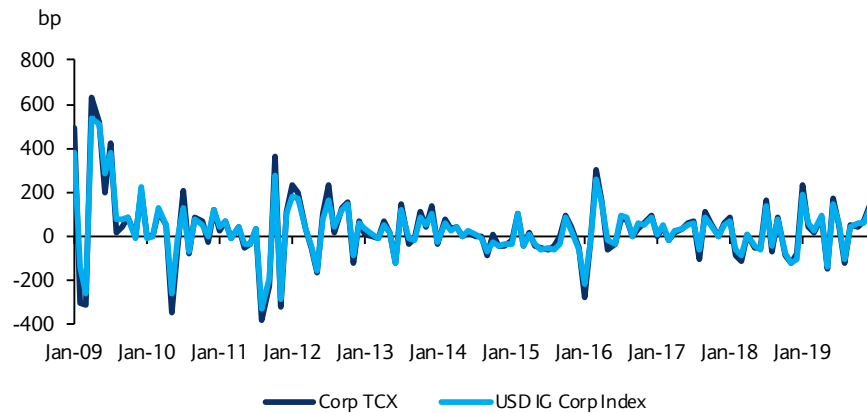
The USD Long Credit TCX (LTCX) is a 36-bond portfolio of highly liquid bonds designed to track the USD Long Credit Index. It is constructed to match the index's DTS and market value weights in 18 sector/duration buckets, while selecting from among only the most liquid (lowest-LCS) bonds. The USD Long Credit TCX is rebalanced monthly.

In December, the LTCX tracking error versus the USD Long Credit Index was 26.6bp. Figure T2 shows the excess return tracking performance of the LTCX since 2009. Over that period, its monthly tracking error versus the index has had an average of 2.6bp and a volatility of 37bp (for comparison, the monthly excess return volatility of the index has been 208bp).

The LCS of the December LTCX basket is 0.790, versus the Index LCS of 1.174.

FIGURE T3

USD Corporate TCX and Corporate Index Excess Returns (to Treasuries), January 2009-December 2019



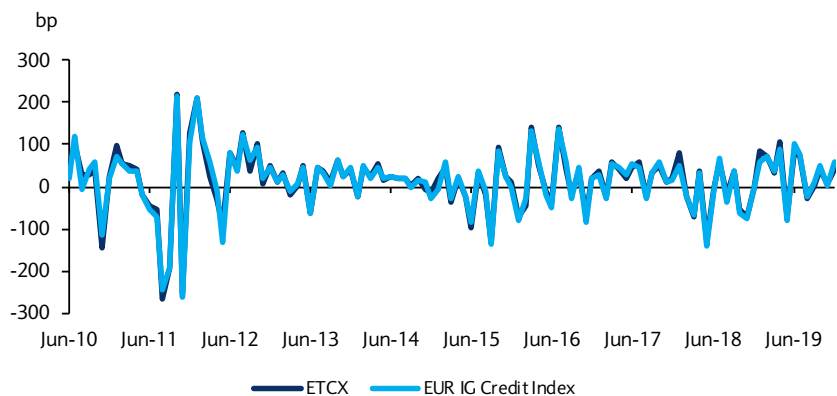
The USD Corporate TCX is a basket of 50 highly liquid bonds designed to track the excess returns of the USD Corporate Index. It is rebalanced quarterly. To ensure that the basket stays liquid over three months, we tighten the liquidity constraint by requiring candidates to have a high TRACE trading volume and amount outstanding, in addition to the regular low-LCS threshold.

In December, the USD Corporate TCX tracking error versus the Corporate index was 21.3bp. Figure T3 shows the excess return tracking performance of the USD Corporate TCX since 2009. Over that period, its monthly tracking error versus the index has averaged -0.7bp, with a volatility of 32bp (for comparison, the monthly excess return volatility of the index has been 126bp).

The LCS of the December Corporate TCX basket is 0.486, versus the Index LCS of 0.691.

FIGURE T4

EUR Credit TCX and Euro Credit Index Excess Returns (to Treasuries), June 2010-December 2019



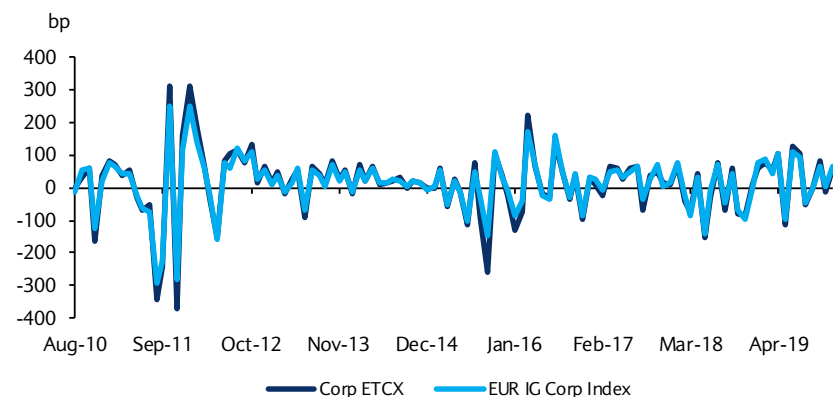
The EUR Credit TCX (ETCX) is a 48-bond portfolio of highly liquid bonds. It is designed to track the excess returns of the Euro IG Credit Index, while selecting from among only the most liquid (lowest-LCS) bonds. The ETCX is constructed to match the index's DTS and market value in 24 sector/duration buckets and is rebalanced monthly.

In December, the ETCX tracking error versus the Euro Credit Index was -17.7bp. Figure T4 shows the excess return tracking performance of the ETCX. Since June 2010, its monthly tracking error versus the index has had an average of 1.2bp and a volatility of 12bp (for comparison, the monthly excess return volatility of the index has been 74bp).

The LCS of the December ETCX basket is 0.183, versus the Index LCS of 0.423.

FIGURE T5

EUR Corporate TCX and Euro Corporate Index Excess Returns (to Treasuries), August 2010-December 2019



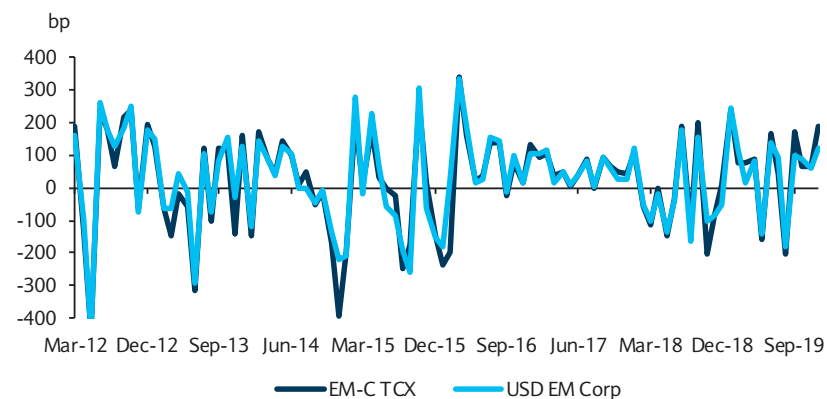
The EUR Corporate TCX is a basket of 40 highly liquid bonds. It is designed to track the excess returns of the Euro Corporate Index and is rebalanced quarterly. As we do with the USD Corporate TCX, to ensure that the basket stays liquid over three months, we tighten the liquidity constraint by requiring candidates to have a high trading volume and amount outstanding, in addition to the low-LCS threshold.

In December, the EUR Corporate TCX tracking error versus the Euro Corporate Index was -4.1bp. Figure T5 shows the excess return tracking performance of the EUR Corporate TCX since August 2010. Over that period, its monthly tracking error versus the index has had an average of -1.4bp and a volatility of 23bp (for comparison, the monthly excess return volatility of the index has been 84bp).

The LCS of the December EUR Corporate TCX basket is 0.343 versus the Index LCS of 0.427.

FIGURE T6

USD EM Corporate TCX and USD EM Corporate Index Excess Returns (to Treasuries), March 2012-December 2019



The USD EM Corporate TCX (EM-C TCX) is a 28-bond portfolio of highly liquid bonds. It is designed to track the excess returns of the Corporate component of the USD EM Aggregate Index and constructed to match the index's DTS and market value in 14 region/duration buckets. The USD EM Corporate TCX is rebalanced monthly.

In December, the EM-C TCX tracking error was 69.2bp. Figure T6 shows the excess return tracking performance of the EM-C TCX. Since its launch in April 2012, its monthly tracking error versus the index has averaged -6.3bp, with a volatility of 46bp (for comparison, the monthly excess return volatility of the index has been 139bp).

The LCS of the December EM-C TCX basket is 0.473, versus the Index LCS of 0.694.

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