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Fixed Income Research – Switzerland

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Basic study

Ultra-long and perpetual CHF bonds

Ultra-long and perpetual bonds constitute a little-noted segment of the CHF bond market. Most of these issues date back to the 1980s, and their liquidity is extremely limited. This report attempts to evaluate these exotic instruments and points out ways in which they can be used as investment vehicles.

Outstanding nominal amount of CHF 2.3 billion

This study evaluates 11 perpetual and ultra-long CHF bonds with a nominal outstanding value totaling approximately CHF 2.3 billion. The bonds issued by Bestfoods/CPC and Seagram, which come due in 2045 and 2085, respectively, have the “shortest” maturities. The other nine issues have no fixed maturity. All of the bonds give the issuer the right to redeem the security at predetermined dates prior to the scheduled maturity. Call dates usually occur at 5- or 10-year intervals with redemption prices typically above par.

Seven of the issues evaluated (CHF 1.7 billion) pay a fixed coupon; the others pay a coupon that is adjusted at regular intervals. The following description begins with a relatively simple model for valuing fixed-coupon bonds. A further section deals with variable-coupon issues. The appendix provides key data and a valuation for each of the 11 securities.

Valuing fixed-coupon bonds

Perpetual annuity

In purchasing a perpetual fixed-coupon bond, an investor is basically buying the right to a perpetual fixed cash flow. In this respect, these securities have many of the same characteristics as equity instruments. Investors use analytical tools such as the dividend discount model to derive the fair share value of a given stock. It follows, then, that the simplest model for determining the fair value of a perpetual bond is the present value (PV) of the perpetual annuity:

$$PV = \frac{COUPON}{YIELD(\%)}$$

A numerical example based on this highly simplified model would yield a value of 84.6% (excluding accrued coupon interest) for the 5 ¾% perpetual bond issued by Air Canada, a single-B borrower. The yield figure used in this example is 6.7%, which is obtained by adding an assumed credit spread of 2.5% (250 basis points) to a long-term base rate of 4.3%.

Discounting against the spot rate curve

Refined models do not assign a fixed yield for the entire duration to maturity, but rather discount future coupons against the spot rate curve. For the present valuation example, we have derived the spot rate curve from the liquid swap market curve, from which we can determine implicit spot rates (zero-coupon rates) by means of generally accepted modeling techniques known as "bootstrapping." Credit spreads adjusted to match the credit quality of the issuer are then added to these rates. This leads to a parallel shift across the curve.

Appraising the aforementioned 5 ¾% Air Canada bond (whose coupon becomes due each 7 February) on the basis of the spot rate curve below, we obtain a model valuation of 87.7%, which is not far from the result yielded by the simplified model.

Year	1	2	3	5	7	10	12	15	20	30
Spot rate (%)	1.79	2.03	2.30	2.78	3.18	3.60	3.80	4.02	4.29	4.33
Spot rate + spread (250 b.p.)	4.29	4.53	4.80	5.28	5.68	6.10	6.30	6.52	6.79	6.83

Source: CSFB calculations based on swap rates provided by Intercapital Brokers, London 8.9.98

Market price of 5 ¾% Air Canada bond implies a high credit spread

Since the Air Canada issue was trading at an average price of 74.4% at the time the above swap rates were transmitted (8 September 1998 at 5:45 p.m.), our model assumptions indicate that the bond was significantly undervalued. What credit spread, then, does the current market price for the Air Canada perpetual bond imply? Our model price would correspond to the current market price only if the credit spread were 375 basis points, which would be 125 basis points more than the 250 basis-point spread assumed for the valuation. This 375 basis-point difference has to be compared to spreads observed for comparable bonds of either Air Canada or issuers of the same rating class.

Early redemption risk

The model yields similar results when applied to the other fixed-coupon issues in our study. These perpetual and ultra-long bonds generally appear very attractive from a credit-risk perspective. However, some bonds present an added complication in that issuers might exercise their call privilege at the earliest opportunity, in particular if the coupons are well above the market yield. Our valuation assumes a worst-case situation for the bondholder ("yield to worst" in trader's jargon). If a redemption at the earliest possible opportunity results in a lower model value, we adopt this as the fair market value. This is generally the case for bonds that trade above par.

Analyzing variable-coupon bonds

Coupons adjusted at regular intervals

The coupons attached to the perpetual and ultra-long bonds issued by CPC/Bestfoods, KLM, SAS, and NZ Railways are adjusted to the actual yield environment every 10 years based on the arithmetic mean of the yields in the Swiss Bank Corporation (now UBS) index of foreign CHF bond issues and those in the Pictet index of new foreign CHF bond issues (excluding sovereigns and provinces). The result is rounded up to the nearest eighth on the interest determination day; the NZ Rail and KLM bonds tack on an additional 0.125% margin.

Advantageous for issuer if the yield curve is upward-sloping

The average maturity of the foreign CHF bonds listed in the two indices is well under 10 years. Thus, in the event of an upward-sloping yield curve, the issuing party would effectively pay less interest for the next 10-year period than if it were to set a new 10-year bond. In our sample, we discovered that the current arithmetic mean of the two indices would lie at approximately the level of the 5-year swap rate. In addition, investors would in many cases demand a higher risk premium for these issues. Also note that a few of them are subordinated debt securities.

Fixing future coupons via interest-rate swaps

Since the adjustable coupon's future interest rate is unknown at any given point in time, it is difficult to determine the fair value of such bonds. In resolving this uncertainty, one assumes that – given the current interest-rate structure – there is a counterparty in the market willing to guarantee a fixed-coupon payment for the life of the bond. Hence, the fixed-coupon model described in the previous section would then also become applicable for valuing adjustable-coupon issues.

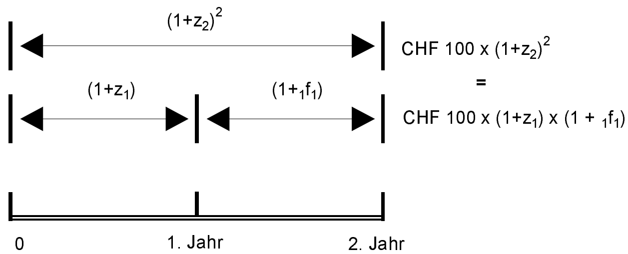
Fair value of a future interest-rate swap

Date	T	T+1	T+2	T+3	. . . .	T+9	T+10
Long swap position T through T+10		$-S(T)_{10y}$ +LIBOR	$-S(T)_{10y}$ +LIBOR	$-S(T)_{10y}$ +LIBOR	. . . .	$-S(T)_{10y}$ +LIBOR	$-S(T)_{10y}$ +LIBOR
Counterparty hedges floating rate obligation (LIBOR) by means of forward futures contracts		-LIBOR $+ {}_{T}f_1$	-LIBOR $+ {}_{T+1}f_1$	-LIBOR $+ {}_{T+2}f_1$	. . . .	-LIBOR $+ {}_{T+8}f_1$	-LIBOR $+ {}_{T+9}f_1$
Net annual cash flow		$-S(T)_{10y} + {}_{T}f_1$	$-S(T)_{10y} + {}_{T+1}f_1$	$-S(T)_{10y} + {}_{T+2}f_1$	. . . .	$-S(T)_{10y} + {}_{T+8}f_1$	$-S(T)_{10y} + {}_{T+9}f_1$

T: Next coupon reset date
$S(T)_{10y}$: 10-year swap rate on date T
${}_{t}f_1$: 1-year forward rate on date t
LIBOR: Effective short-term rates each year

In an initial step, one can ponder how much a counterparty would be willing to offer today to enter into a 10-year plain vanilla interest-rate swap agreement beginning at the next coupon reset date (T). This means that the fixed-rate payer would agree to pay the counterparty the 10-year swap rate fixed on date T for a period of ten years. In turn, the counterparty agrees to pay the floating LIBOR rate (1–4 times per annum depending on the convention) for the duration of the agreement. However, the counterparty can lock in these short rates on the trade date by hedging each of its LIBOR payments via a combination of forward futures contracts. The following simple example illustrates how this is done.

Forward rates as “hedgeable rates”



z_1, z_2:	Yield on 1- or 2-year investment (1- or 2-year spot rate)
${}_tf_1$:	1-year forward rate on date t (in this example, t = Year 1)

Both of the investment strategies depicted above should yield identical returns in an efficient market. Therefore, right from the outset, the investor can lock in the as yet unknown one-year spot rate for Year 2 by transacting a two-year investment (yield z_2) while simultaneously borrowing cash for one year (interest cost z_1). This hedgeable rate is equal to the forward rate ${}_1f_1$, which is calculated as follows using the known quantities z_1 and z_2:

$$ {}_1f_1 = \frac{(1+z_2)^2}{(1+z_1)} - 1 $$

In a perfect market, one could set this type of hedge for any future date and any time period. For example, standardized interest-rate futures contracts are commonly used in practice, as they – like discount paper and zero-coupon bonds – enable the investor to lock in a fixed return for a given time period.

Determining the implicit coupon

Returning now to the valuation of the above 10-year interest-rate swap, the known forward rates enable us to determine the fair value of the future swap rate. In an arbitrage-free market, the present value of the net cash flows for both parties to the agreement must be zero.

$$ \sum_{i=1}^{10}\Big(d(T+i)\times\big(S(T)_{10y} - {}_{T+i-1}f_1\big)\Big) = 0 \quad \Rightarrow \quad S(T)_{10y} = \frac{\sum_{i=1}^{10} d(T+i)\times {}_{T+i-1}f_1}{\sum_{i=1}^{10} d(T+i)} $$

whereby:

T:	Next coupon reset date
$S(T)_{10y}$:	10-year swap rate on date T
${}_{T+i-1}f_1$:	1-year forward rate on date $T+i-1$
$d(T+i)$:	Discount factor on date $T + i$

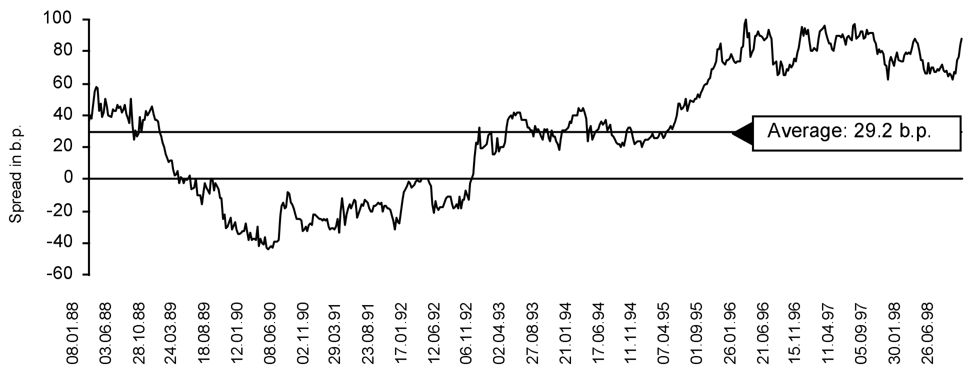
If we assume for a moment that on the next reset date, the 10-year swap rate at that time determines the new coupon, the 10-year swap rate from date T is nothing other than the implicit coupon for the following 10-year period. The same calculation can be repeated for each subsequent 10-year interval for the life of the instrument, or until its contribution to the present value of the bond becomes minimal.

Correction factor

As already described, the arithmetic mean between two indices determines the coupon rate. If we assume that this mean corresponds to the 5-year swap rate, we would have to correct the 10-year swap rate derived in the previous equation. There are two ways to do this:

1. The interest-rate structure also implies a 5-year swap rate on date T. The spread between the 5-year and the 10-year swap rate could thus be employed as the correction factor.
2. Or, the correction factor is defined as the historical average spread between the two swap rates. This spread is approximately 30 basis points in our time series beginning in 1988 (see graph below). In the valuation model, we employ this second method for periods far into the future (>20 years), i.e. beyond the horizon of the current interest term structure.

Spread between 10-year and 5-year CHF swap rates



Source: Datastream

Numerical example of the swap valuation in the case of the SAS bond

The valuation model described above is best illustrated by the numerical example that we formulated on 28 September 1998 (see the table on the next page). The bond issued by the Scandinavian airline SAS pays a fixed annual 3 5/8% coupon until 29 January 2006. The coupon will then be reset based on the aforementioned indices. The actual interest-rate structure currently implies a 10-year swap rate of 5.056% for 29 January 2006. Thus, the implied spread between the 5-year and 10-year swap is +10.7 basis points for 29 January 2006 and –10.7 basis points for 29 January 2016. A correction factor of 29 basis points (based on the historical spread) is applied for the subsequent interest periods. The resulting coupon is then discounted to the spot rate curve, which is shifted upward to reflect a suitable credit spread. In order to compare this present value with the prices quoted in the market, it must finally be corrected to account for interest accrued since the last coupon date.

Determining the fair value of the SAS bond
- Calculation carried out 28 September 1998
- Coupon 3 5/8% until 29 January 2006, reset thereafter
- Next call on 29 January 2001 at 100%
- Moody's rating: Baa1

	Determination of coupon					Fixed and *implied* cash flows		
Date (t)	Spot rate	Discount factor d(t)	$_tf_1$ (%)	$S(T)_{10y}$ at coupon fixing	Correction	Nominal	Spot rate + 80 bp	Discounted
28.09.1998								
29.01.1999	1.741	0.994				**3.625**	2.541	3.595
29.01.2000	1.741	0.977	1.741			**3.625**	2.541	3.505
29.01.2001	1.988	0.955	2.318			**3.625**	2.788	3.399
29.01.2002	2.237	0.929	2.823			**3.625**	3.037	3.281
29.01.2003	2.476	0.899	3.278			**3.625**	3.276	3.152
29.01.2004	2.707	0.867	3.714			**3.625**	3.507	3.016
29.01.2005	2.922	0.833	4.074			**3.625**	3.722	2.876
29.01.2006	3.123	0.798	4.409	5.056	0.102	**3.625**	3.923	2.733
29.01.2007	3.299	0.763	4.599			*4.954*	4.099	3.544
29.01.2008	3.475	0.727	4.953			*4.954*	4.275	3.352
29.01.2009	3.633	0.692	5.118			*4.954*	4.433	3.164
29.01.2010	3.755	0.658	5.027			*4.954*	4.555	2.990
29.01.2011	3.866	0.626	5.131			*4.954*	4.666	2.823
29.01.2012	3.954	0.596	5.052			*4.954*	4.754	2.667
29.01.2013	4.043	0.567	5.230			*4.954*	4.843	2.515
29.01.2014	4.122	0.538	5.270			*4.954*	4.922	2.371
29.01.2015	4.184	0.512	5.141			*4.954*	4.984	2.238
29.01.2016	4.246	0.486	5.265	5.090	- 0.107	*4.954*	5.046	2.110
29.01.2017	4.309	0.461	5.390			*5.198*	5.109	2.085
29.01.2018	4.371	0.437	5.515			*5.198*	5.171	1.961
29.01.2019	4.418	0.415	5.338			*5.198*	5.218	1.847
29.01.2020	4.436	0.396	4.810			*5.198*	5.236	1.749
29.01.2021	4.455	0.378	4.847			*5.198*	5.255	1.656
29.01.2022	4.473	0.360	4.884			*5.198*	5.273	1.567
29.01.2023	4.491	0.343	4.921			*5.198*	5.291	1.482
29.01.2024	4.510	0.327	4.957			*5.198*	5.310	1.401
29.01.2025	4.528	0.312	4.994			*5.198*	5.328	1.325
29.01.2026	4.546	0.297	5.031	4.752	0.290	*5.198*	5.346	1.252
29.01.2027	4.565	0.282	5.068			*4.462*	5.365	1.015
29.01.2028	4.583	0.269	5.105			*4.462*	5.383	0.958
29.01.2029	4.595	0.256	4.948			*4.462*	5.395	0.906
29.01.2030	4.595	0.245	4.594			*4.462*	5.395	0.860
29.01.2031	4.595	0.234	4.595			*4.462*	5.395	0.816
29.01.2032	4.595	0.224	4.595			*4.462*	5.395	0.774
29.01.2033	4.595	0.214	4.595			*4.462*	5.395	0.734
29.01.2034	4.595	0.204	4.595			*4.462*	5.395	0.697
29.01.2035	4.595	0.195	4.595			*4.462*	5.395	0.661
29.01.2036	4.595	0.187	4.595	4.595	0.290	*4.462*	5.395	0.627
later	4.595	0.179	4.595			*82.701*	5.395	11.031
					Present value (28.09.98 16:45)			88.735
					Accrued coupon			2.407
					Theoretical fair value			**86.329**

$S(T)_{10y}$: Implicit 10-year swap rate on coupon reset date (every 10 years after 29 January 2006)
$_tf_1$: 1-year forward rate on date t

Model indicates that SAS bond is undervalued

The theoretical fair price thus lies well above the average price (73.0 at 4:45 p.m. on 28 September 1998) for this perpetual SAS bond. As with the fixed-coupon Air Canada bond, the credit spread implied by the current market price can also be determined for the SAS issue. This spread is 173 basis points (as of 28 September 1998), which is much higher than one would normally expect for a solid triple-B borrower.

Investment strategies, relative value

Extending the duration

Perpetual bonds give investors the maximum interest sensitivity that fixed-income instruments can offer. This sensitivity essentially depends on the current yield level (see table below). At yields in the 3%–4% range, perpetual fixed-coupon bonds display a duration between 20 and 25 years. These securities thus enable the investor to extend the duration of a portfolio using a relatively modest amount of capital.

Interest-rate sensitivity of perpetual bonds

Yield	2%	3%	4%	5%	6%	7%
% drop in price per each 1% rise in yield: (duration)	33.3	25.0	20.0	16.7	14.3	12.5

Assuming a fixed yield to maturity, as expressed in the simplified model: $PV = \frac{COUPON}{YIELD(\%)}$

The disadvantages of poor liquidity…

Generally speaking, these long-dated bonds have very limited marketability. Bid/ask spreads ranging from 150 to 300 basis points are not uncommon for larger issues. Therefore, we believe these instruments are best suited for institutional investors with a long-term investment horizon (e.g., insurance firms, mutual funds, etc.).

…are offset by attractive prices

As compensation for their poor liquidity, these securities can be purchased at extremely attractive prices (see the last page of this report for the current valuations of the bonds in the study). For example, the qualitatively impeccable bonds issued by the International Bank for Reconstruction and Development (Aaa/AAA) and the Council of Europe (Aa2/AA+) trade at around 10% below their fair prices.[1] This implies a credit spread of almost 70 basis points above swap for these top-rated issuers.

Among the variable-coupon bonds, securities of SAS and KLM, both of which operate in cyclical markets, show very high implied credit spreads (SAS 199 basis points and KLM 156 basis points as of 15 October 1998). On the other hand, the Bestfoods (formerly CPC) issue maturing in 2045 is fully priced. Apparently, not all investors realize that the high 5% coupon will be readjusted in 2005.

[1] Note that this fair price assumes that the bond will be called on the next possible date. If the bond is not redeemed before the scheduled maturity date, its undervaluation would be even greater.

Valuation model for perpetual and ultra-long CHF bonds

(price data from 15 October 1998 at 4:00 p.m.)

#	Swiss Sec. No.	Issuer	Call info next call	Call info call price	Prices Bid Price	Prices Bid Size(m)	Prices Ask Price	Prices Ask Size(m)	Prices Hist. Price	Yield (Mid price) Current	Yield (Mid price) IRR	Yield (Mid price) to:	Model Spread bp vs.Swap	Theoretical Fair Price (F.P.) BID	Theoretical Fair Price (F.P.) ASK	over / (under) F.P.	Implied Spread	Action *** Data missing	Issued/ Outst. Amt. (CHF m)	Rating MDY	Rating S&P
		Fixed coupon																			
1	671371	6% SEAGRAM 1986-30.9.2085	29.9.01	102.00	105.75	0.18	105.95	0.09	106.00	5.65%	4.48%	next call	**100**	110.08	110.58	(4.33)	**132**	Buy 0.09m @ 105.95	250 / 250	A2 (*-)	A (*-)
2	662129	6 1/4% AIR CANADA 1986-Perp. Sub.	22.1.01	102.00	82.25	0.04	86.00	0.08	82.50	7.04%	7.41%	perp.	**350**	81.35	81.85	0.90	**325**	-	300 / 300	B2	
3	662130	5 3/4% AIR CANADA 1986-Perp. Sub.	2.7.99	101.50	76.10	0.07	79.75	0.03	75.00	7.02%	7.36%	perp.	**350**	74.82	75.32	1.28	**319**	-	200 / 200	B2	
4	423288	5 3/4 % AUSTRIAN AIR. 1986-Perp.	28.5.01	101.00	100.50	0.06	-	-	100.00	5.57%	5.68%	next call	**70**	108.62	109.12	(8.12)	**136**	***	150 / 126.8		
5	536209	5 3/4 % KLM 1986-Perp. Sub.	15.5.01	101.75	98.10	0.10	98.75	0.05	98.00	5.70%	7.06%	next call	**70**	109.24	109.74	(11.14)	**153**	Buy 0.05m @ 98.75	300 / 300		
6	880506	5 1/2% INTL. BANK RECON.&DEV. perp.	25.4.06	102.00	108.00	0.50	-	-	108.25	4.95%	4.37%	next call	**-10**	118.88	119.38	(10.88)	**69**	***	250 / 250	Aaa	AAA
7	478602	5 1/2% COUNCIL OF EUROPE Perp. Sub.	15.4.06	102.00	108.50	0.09	-	-	108.75	4.93%	4.32%	next call	**0**	118.27	118.77	(9.77)	**68**	***	250 / 250	Aa2	AA+
		Variable coupon																			
8	536205	5 1/4 % KLM 1985-Perp. Sub.	12.2.05	100.00	87.00	0.10	88.00	0.02	86.50	5.70%	5.90%	perp.	**70**	109.34	109.84	(22.34)	**156**	Buy 0.02m @ 88.00	200 / 200		
9	798356	3 5/8 % NZ RAILWAYS 1986-Perp.	10.1.06	100.00	92.55	0.04	95.00	0.03	92.40	3.75%	2.66%	perp.	**25**	77.50	78.00	15.05	**N/A**	Sell 0.04m @ 92.55	150 / 57.3		
10	612525	3 5/8 % SAS 1986-Perp. Sub.	14.1.01	102.50	70.50	0.25	73.00	0.25	70.50	4.87%	6.29%	perp.	**80**	87.26	87.76	(16.76)	**199**	Buy 0.25m @ 73.00	200 / 200	Baa1	
11	871602	5% BESTFOODS 1985-27.3.45	27.3.05	100.00	102.50	0.04	103.00	0.01	102.50	3.43%	4.39%	maturity	**90**	97.33	97.83	5.17	**-3**	Sell 0.04m @ 102.50	200 / 200	A2	A+

(*-) on watch list for possible downgrade
Sub.: subordinated
Source: Price data courtesy of Swiss Exchange, CSFB valuation models