

Data Deposition

Into Every Upturn a Little Correction Must Fall But The Trend Is Still Your Friend

Semiconductor Devices | Comment

Bottom Line: The SOX has declined ~5% in the last week prompting fears that the best of this upturn is in arrears. We disagree. We have analyzed 9 upturns over 30+ years defining cycles that begin when IC units Ex-Memory are most below trend growth and end when IC units are most above trend growth (~8.5% CAGR) – and would highlight the following: (1) Average upturn is ~19 months – the shortest being 14 months (1996) the longest 28 months (2002) – current upturn is in month 6, i.e. we are less than 1/3 thru the current cycle, (2) During average upturns stocks tend to have 4-6 corrections of >5% – average is 8%, the most significant correction being ~20% – i.e. what we have seen in the last few days is a typical pause that refreshes, (3) Units troughed in Jun at ~23% below trend well BELOW the average cycle of 14% – current units are 7% below trend and usually peak 12% above trend – with the most above being ~30%, and (4) Peak-to-peak units grow ~30% on average, peak-to-current we are only 7% above last peak – implying we need to get another 20% growth from here to get back to average peak on peak growth, or 35% reach best peak on peak growth.

Every Cycle is the Same, Except Different. Each of the above only looks at Semis thru a cyclical lens – we continue to argue there are structural forces at play since the last broad-based upturn in 2010 supporting our STRONGER FOR LONGER Thesis and would highlight: (1) Significant consolidation and rationalization of supply – 250 fewer chip companies, (2) Structural demand drivers in Auto (>60% content growth since 2010) and (3) Cloud (AWS up 90x since 2010). The supply rationalization is also important – to the extent that upturns end when supply catches demand – there are three drivers of incremental supply growth – (1) increasing utilization (3-4 months), (2) debottlenecking test and assembly (3-6 months) and (3) adding greenfield capacity (12-18 months). Much more of trailing-edge demand is outsourced today – as evidenced by the fact that TSMC has grown trailing edge capacity at 20% CAGR since 2010 vrs. overall semis of 3-5%. Given that foundries have structurally higher utilization – the process of supply catching demand in this upturn is much more about new green field capacity – very supportive of our Stronger for Longer cyclical thesis ([Why Good News Is Likely to Remain Good News for a VERY LONG Time...](#)).

Semis, Valuation and Rising Interest Rates. Semis do not look cheap against 3/5/10 year trend. However, we continue to argue that we are mid-stream in a re-valuation higher and while the prospect of rising interest rates is a potential headwind to continued multiple expansion, we would also highlight that Semis are positively correlated to rising rates (they are cyclicals remember). Through the last 7 periods of rising interest rates – the SOX has appreciated by an avg/median of 77%/23% - pre-'09 by 93%/22%. The SOX is currently trading at 25.3x NTM PE a 47-53% premium to 3/5-yr average 17.2/16.5 and near 10-year high. Additionally, the SOX now trades at a 15% PREMIUM to the SPX vs 3/5-yr avg discount of 6-8%. We see both as warranted as Semis move from GDP minus to GDP plus growth and would note that since 2000 SOX EPS has outperformed SOX Index by >60% vrs most other market segments which are at parity. In addition, for most of CY20 the entire Global Semi Ecosystem was being valued BELOW AAPL and while AAPL is a great company, the impact and importance of silicon on the \$85 trillion Global Economy perhaps deserves a better relative valuation.

Research Analysts

John W. Pitzer

212 538 4610
john.pitzer@credit-suisse.com

Dalya Hahn

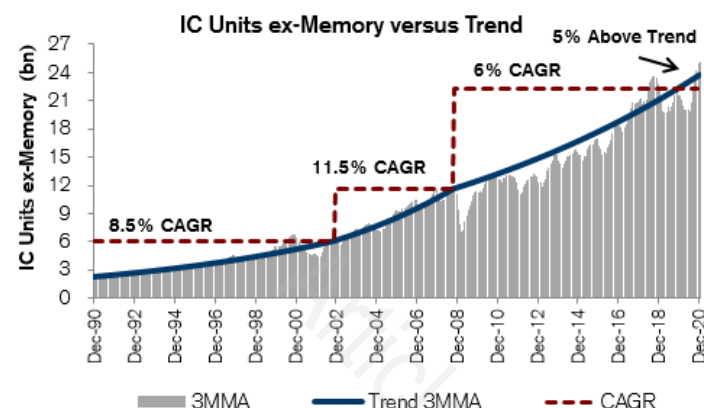
212 325 7843
dalya.hahn@credit-suisse.com

Jerome Darling

212 325 3211
jerome.darling@credit-suisse.com

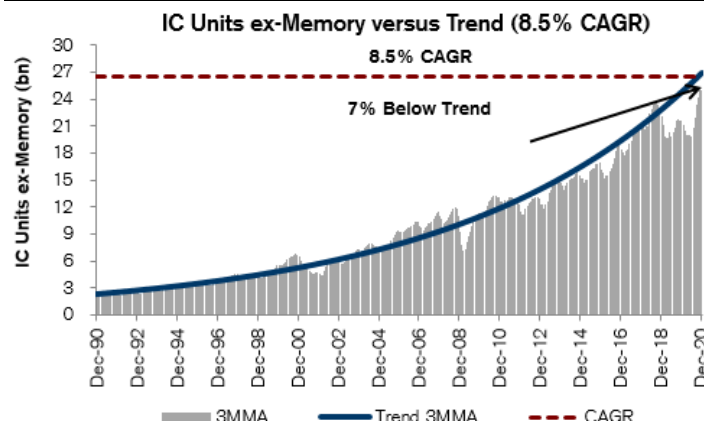
Key Charts

Figure 1: IC-Units vs Variable Trend



Source: Company data, Credit Suisse estimates, SIA

Figure 2: IC-Units vs Constant Trend



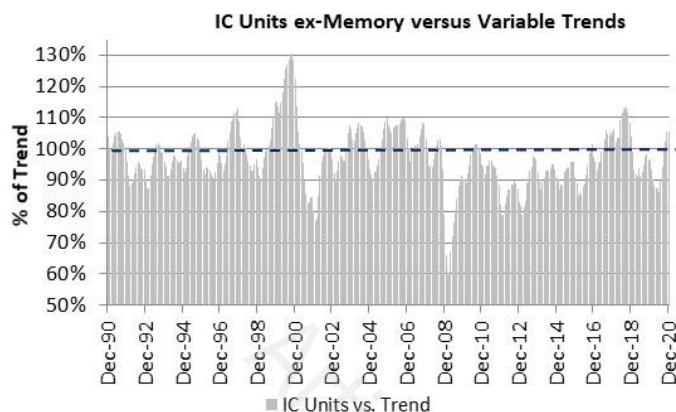
Source: Company data, Credit Suisse estimates, SIA

Defining Cycle Using BELOW/ABOVE Constant Trend: This defines cycles as IC units ex-Memory peak/trough levels ABOVE or BELOW Trend of 8.5% CAGR. We have 9 cycles in the data with avg. upturn of 19-months – with variance of ~14-30 months. In this dataset, BELOW trend (~8.5% CAGR) troughed in Jun-20 vs in the Y/Y cycle analysis where it troughs in Jun-19. We believe June-20 is more applicable to view as a trough, as if not for COVID CY20 would have been a cyclical upturn year. In this context, we would only be 6 month into upturn vs median/avg ~19 months and ~16% recovered vs median/avg of 24%/28%.

Defining Cycle Using BELOW/ABOVE Variable Trend: This defines cycles as IC units ex-Memory peak/trough % levels ABOVE or BELOW variable trend of 8.5% for 1990-2002, 11.5% for 2002-2008, and 6.0% CAGRs for 2008-Present. We have 9 cycles in the data with avg. upturn of 23-months – with a variance of ~7-57 months (under grew trend from Nov-10 to Sep 16). In this dataset, BELOW trend also troughed in Jun-20 at 14% BELOW vs in the Y/Y cycle analysis where it troughs in Jun-19. In this context similar to constant 8.5% growth CAGR cycle, we would also only be 6 month into upturn vs median/avg ~19/23 months and ~19% recovered vs median/avg of 22%/25%.

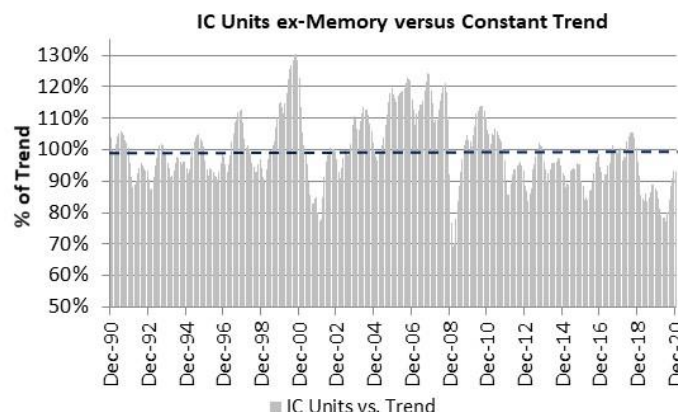
Defining Cycle Using Y/Y Cycle Trends: This defines cycles by peak-trough y/y growth rates in IC units Ex-Memory – and we view as more imprecise way of defining cyclical dynamics. We have 8 cycles in the data with avg. upturn of 16-months – with variance of ~12-23 months. In this data, June-19 troughed in y/y growth at ~13% y/y – though against June-18 growth of +18.2% only ~130bps off peak. We see as more relevant to view June-20 as a trough, despite having ~flat y/y growth – since this is against already depressed June-19 levels of down 13% y/y. In this context, we are 7 months into upturn vs median/avg ~16 months and ~16% recovered vs median/average 43%/35%.

Figure 3: Unit % of Variable Trend



Source: Company data, Credit Suisse estimates, SIA

Figure 4: Unit % of Constant Trend



Source: Company data, Credit Suisse estimates, SIA

Figure 5: Cycle Analysis of IC Units ex-Memory Peak-Trough – based on ABOVE/BELOW Constant 8.5% CAGR

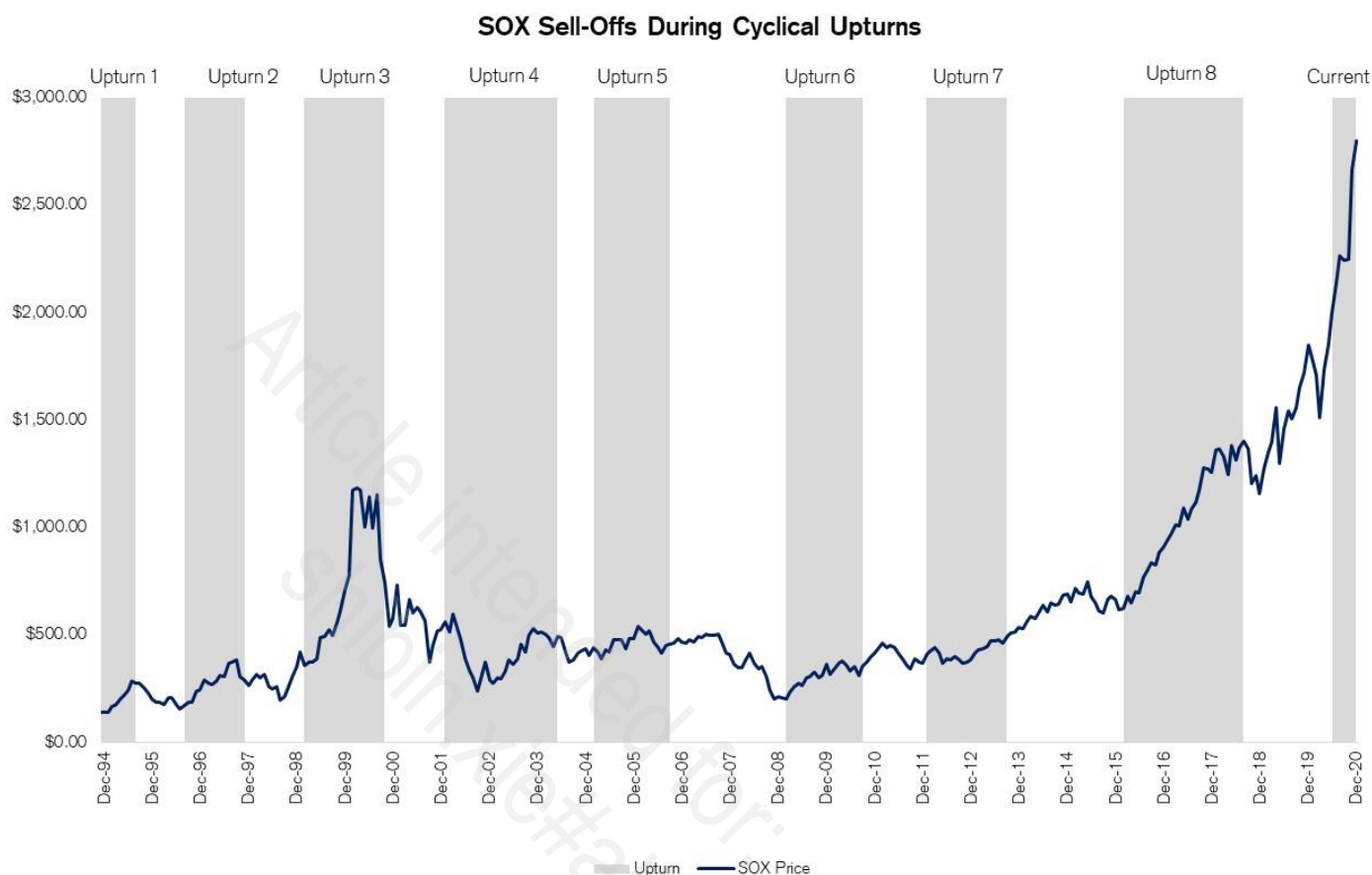
IC Units ex-Memory Peak to Trough (ABOVE/BELOW Trend)												
Cycle	1	2	3	4	5	6	7	8	9	Current	Avg	Median
Trough	01/31/93	02/28/94	08/31/96	02/28/99	01/31/02	02/28/05	02/28/09	01/31/12	02/29/16	06/30/20	-14.2%	-12.5%
% BELOW Trend	(12.5%)	(8.6%)	(9.4%)	(9.5%)	(22.9%)	(3.5%)	(30.8%)	(14.2%)	(16.1%)	(23.0%)		
Peak	08/31/93	08/31/95	11/30/97	10/31/00	05/31/04	09/30/06	09/30/10	09/30/13	08/31/18	12/31/20	12.0%	12.7%
% ABOVE Trend	1.7%	5.0%	12.7%	30.4%	13.3%	22.9%	14.0%	2.1%	5.6%	(6.9%)		
Duration (months)		18.0	14.0	20.0	28.0	19.0	19.0	19.0	30.0	6.0	20.9	19.0
Recovery (P-T)		14%	22.0%	39.9%	36.3%	26.5%	44.7%	16.4%	21.7%	16.1%	27.6%	24.3%
Peak Units	2,947,321	3,580,531	4,616,896	6,780,343	7,891,705	10,355,694	13,305,288	15,227,070	23,525,631		30.3%	28.7%
Peak-Peak Growth		21.5%	28.9%	46.9%	16.4%	31.2%	28.5%	14.4%	54.5%			

Source: Company data, Credit Suisse estimates, SIA

Figure 6: Cycle Analysis of IC Units ex-Memory Peak-Trough – based on ABOVE/BELOW Variable CAGRs

IC Units ex-Memory Peak to Trough (ABOVE/BELOW Trend - Variable)												
Cycle	1	2	3	4	5	6	7	8	9	Current	Avg	Median
Trough	01/31/93	02/28/94	08/31/96	02/28/99	01/31/02	02/28/05	02/28/09	01/31/12	02/28/17	06/30/20	-15.7%	-9.5%
% BELOW Trend	(12.5%)	(8.6%)	(9.4%)	(9.5%)	(22.9%)	(9.5%)	(40.5%)	(21.2%)	(6.8%)	(13.9%)		
Peak	08/31/93	08/31/95	11/30/97	10/31/00	05/31/04	09/30/06	09/30/10	11/30/16	09/30/18	12/31/20	9.5%	8.5%
% ABOVE Trend	1.7%	5.0%	12.7%	30.4%	8.5%	10.5%	1.6%	1.4%	13.3%	5.4%		
Duration (months)	7.0	18	14	20	28	19	19	57	19	6	22.3	19.0
Recovery (P-T)	14.3%	14%	22.0%	39.9%	31.5%	20.0%	42.1%	22.6%	20.1%	19.2%	25.1%	22.0%

Source: Company data, Credit Suisse estimates, SIA

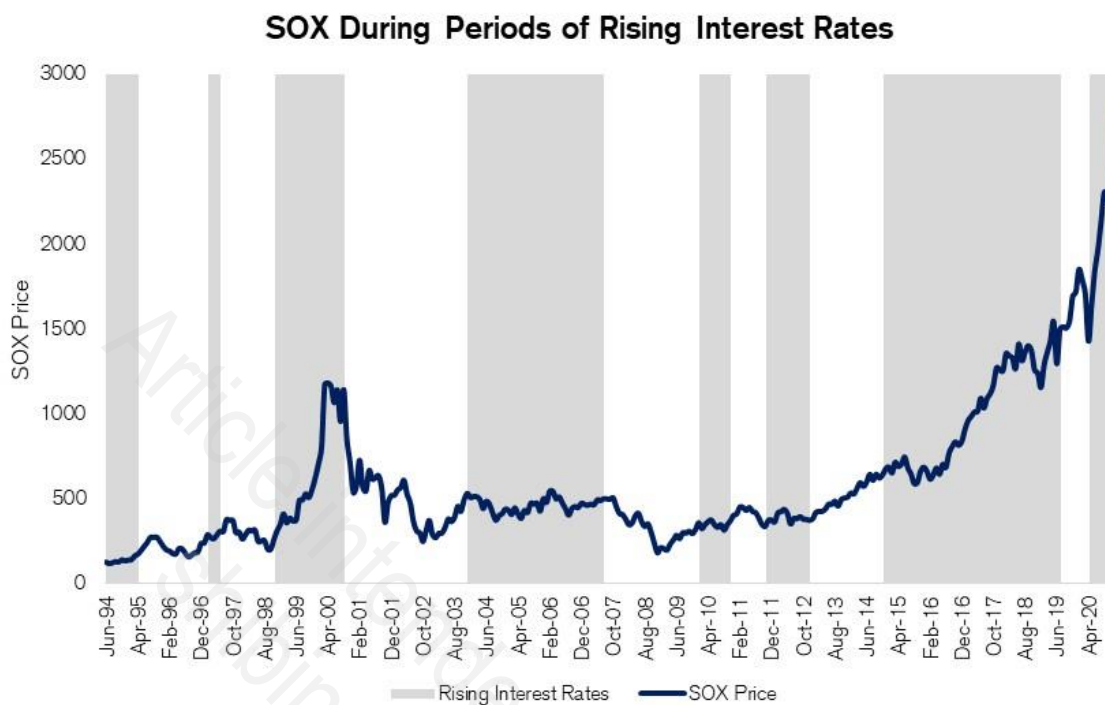
Figure 7: “Mini Sell-Offs” During Cyclical Upturns

Source: Company data, Credit Suisse estimates, FactSet

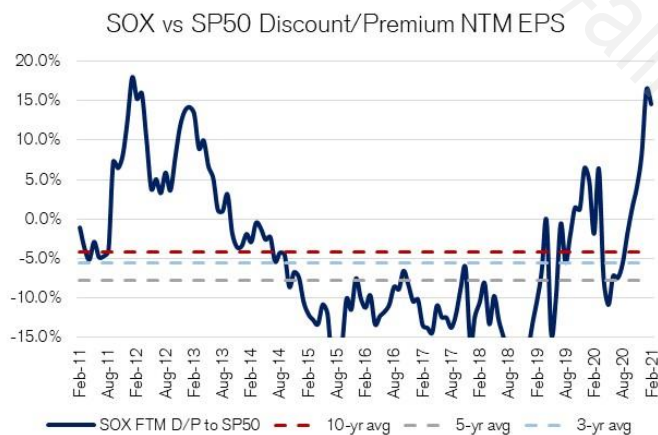
Figure 8: Avg/Median 4-6 SOX Price Corrections During Upturn

IC Units ex-Memory Peak to Trough												
Cycle	1	2	3	4	5	6	7	8	9	Current	Avg	Median
Trough	01/31/93	02/28/94	08/31/96	02/28/99	01/31/02	02/28/05	02/28/09	01/31/12	02/29/16	06/30/20		
BELOW Trend	(12.5%)	(8.6%)	(9.4%)	(9.5%)	(22.9%)	(3.5%)	(30.8%)	(14.2%)	(16.1%)	(23.0%)	-14.2%	-12.5%
Peak	08/31/93	08/31/95	11/30/97	10/31/00	05/31/04	09/30/06	09/30/10	09/30/13	08/31/18	12/31/20		
ABOVE Trend	1.7%	5.0%	12.7%	30.4%	13.3%	22.9%	14.0%	2.1%	5.6%	(6.9%)	12.0%	12.7%
Duration (months)	-	18	14	20	28	19	19	19	30	6	18.6	19.0
Recovery (P-T)	0%	14%	22.0%	39.9%	36.3%	26.5%	44.7%	16.4%	21.7%	16.1%	24.6%	22.0%
SOX Mini Sell-Offs During Upturn (decrease >5%)												
# Sell-Offs During Upturn		1.0	2.0	9.0	20.0	4.0	4.0	5.0	5.0	1.0	6.3	4.5
Average Sell-Off		-7.2%	-12.6%	-10.3%	-8.8%	-7.5%	-10.0%	-6.9%	-6.9%		-8.8%	-8.2%
Max Sell-Off		-7.2%	-19.1%	-16.3%	-15.4%	-10.7%	-13.4%	-10.0%	-7.7%		-12.5%	-12.1%
Current										-4.80%		

Source: Company data, Credit Suisse estimates

Figure 9: SOX vs Periods of Inflation

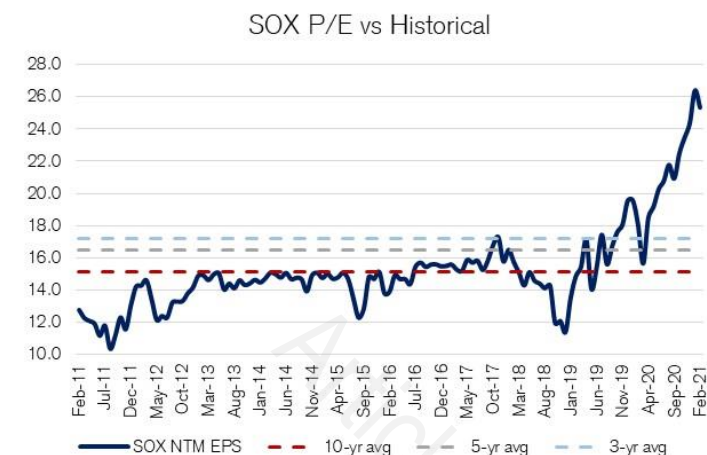
Source: Company data, Credit Suisse estimates, FRED Data

Figure 10: SOX vs SP50 Discount/Premium NTM EPS

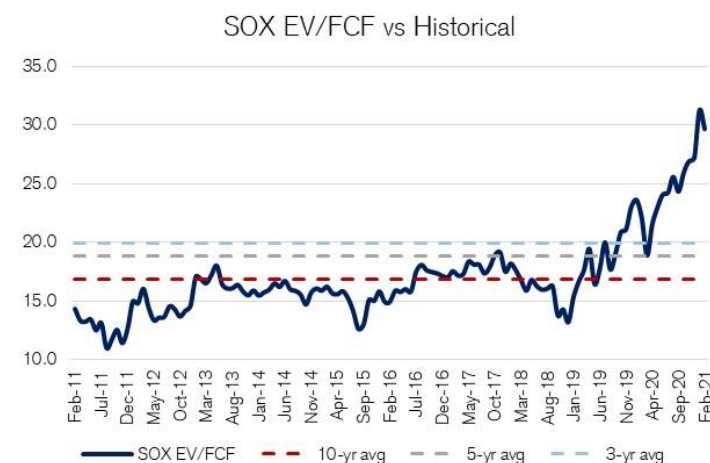
Source: Company data, Credit Suisse estimates, FactSet

Figure 11: SOX vs SP50 Discount/Premium EV/FCF

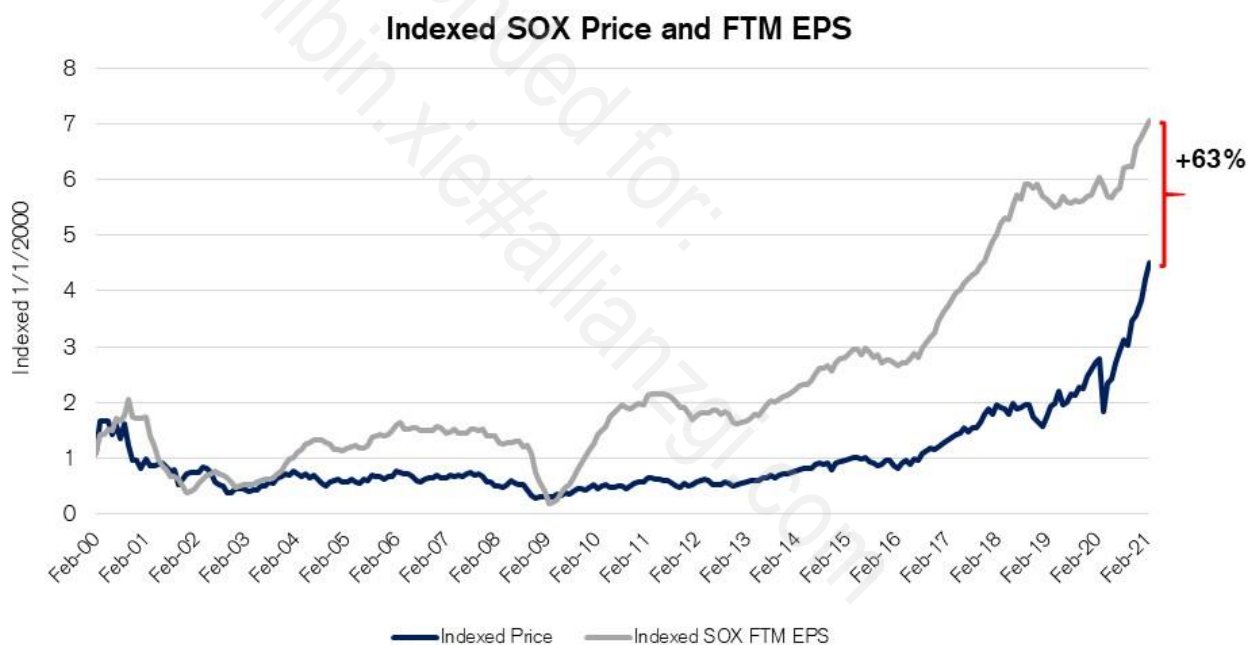
Source: Company data, Credit Suisse estimates, FactSet

Figure 12: SOX PE at Historical Highs

Source: Company data, Credit Suisse estimates, FactSet

Figure 13: SOX EV/FCF at Highs, Though Structurally Rising

Source: Company data, Credit Suisse estimates, FactSet

Figure 14: SOX vs FTM EPS Indexed to 2000

Source: Company data, Credit Suisse estimates, FactSet

Companies Mentioned (Price as of 24-Feb-2021)

Amazon com Inc. (AMZN.OQ, \$3159.53)

Apple Inc (AAPL.OQ, \$125.35)

Taiwan Semiconductor Manufacturing (2330.TW, NT\$625.0)

Disclosure Appendix

Analyst Certification

I, John W. Pitzer, certify that (1) the views expressed in this report accurately reflect my personal views about all of the subject companies and securities and (2) no part of my compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

As of December 10, 2012 Analysts' stock rating are defined as follows:

Outperform (O) : The stock's total return is expected to outperform the relevant benchmark* over the next 12 months.

Neutral (N) : The stock's total return is expected to be in line with the relevant benchmark* over the next 12 months.

Underperform (U) : The stock's total return is expected to underperform the relevant benchmark* over the next 12 months.

*Relevant benchmark by region: As of 10th December 2012, Japanese ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. As of 2nd October 2012, U.S. and Canadian as well as European (excluding Turkey) ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. For Latin America, Turkey and Asia (excluding Japan and Australia), stock ratings are based on a stock's total return relative to the average total return of the relevant country or regional benchmark (India - S&P BSE Sensex Index); prior to 2nd October 2012 U.S. and Canadian ratings were based on (1) a stock's absolute total return potential to its current share price and (2) the relative attractiveness of a stock's total return potential within an analyst's coverage universe. For Australian and New Zealand stocks, the expected total return (ETR) calculation includes 12-month rolling dividend yield. An Outperform rating is assigned where an ETR is greater than or equal to 7.5%; Underperform where an ETR less than or equal to 5%. A Neutral may be assigned where the ETR is between -5% and 15%. The overlapping rating range allows analysts to assign a rating that puts ETR in the context of associated risks. Prior to 18 May 2015, ETR ranges for Outperform and Underperform ratings did not overlap with Neutral thresholds between 15% and 7.5%, which was in operation from 7 July 2011.

Restricted (R) : In certain circumstances, Credit Suisse policy and/or applicable law and regulations preclude certain types of communications, including an investment recommendation, during the course of Credit Suisse's engagement in an investment banking transaction and in certain other circumstances.

Not Rated (NR) : Credit Suisse Equity Research does not have an investment rating or view on the stock or any other securities related to the company at this time.

Not Covered (NC) : Credit Suisse Equity Research does not provide ongoing coverage of the company or offer an investment rating or investment view on the equity security of the company or related products.

Volatility Indicator [V] : A stock is defined as volatile if the stock price has moved up or down by 20% or more in a month in at least 8 of the past 24 months or the analyst expects significant volatility going forward.

Analysts' sector weightings are distinct from analysts' stock ratings and are based on the analyst's expectations for the fundamentals and/or valuation of the sector* relative to the group's historic fundamentals and/or valuation:

Overweight : The analyst's expectation for the sector's fundamentals and/or valuation is favorable over the next 12 months.

Market Weight : The analyst's expectation for the sector's fundamentals and/or valuation is neutral over the next 12 months.

Underweight : The analyst's expectation for the sector's fundamentals and/or valuation is cautious over the next 12 months.

*An analyst's coverage sector consists of all companies covered by the analyst within the relevant sector. An analyst may cover multiple sectors.

Credit Suisse's distribution of stock ratings (and banking clients) is:

Global Ratings Distribution

Rating	Versus universe (%)	Of which banking clients (%)
Outperform/Buy*	52%	(32% banking clients)
Neutral/Hold*	35%	(27% banking clients)
Underperform/Sell*	11%	(22% banking clients)
Restricted	2%	

Please click [here](#) to view the MAR quarterly recommendations and investment services report for fundamental research recommendations.

*For purposes of the NYSE and FINRA ratings distribution disclosure requirements, our stock ratings of Outperform, Neutral, and Underperform most closely correspond to Buy, Hold, and Sell, respectively; however, the meanings are not the same, as our stock ratings are determined on a relative basis. (Please refer to definitions above.) An investor's decision to buy or sell a security should be based on investment objectives, current holdings, and other individual factors.

Important Global Disclosures

Credit Suisse's research reports are made available to clients through our proprietary research portal on CS PLUS. Credit Suisse research products may also be made available through third-party vendors or alternate electronic means as a convenience. Certain research products are only made available through CS PLUS. The services provided by Credit Suisse's analysts to clients may depend on a specific client's preferences regarding the frequency and manner of receiving communications, the client's risk profile and investment, the size and scope of the overall client relationship with the Firm, as well as legal and regulatory constraints. To access all of Credit Suisse's research that you are entitled to receive in the most timely manner, please contact your sales representative or go to <https://plus.credit-suisse.com>.

Credit Suisse's policy is to update research reports as it deems appropriate, based on developments with the subject company, the sector or the market that may have a material impact on the research views or opinions stated herein.

Credit Suisse's policy is only to publish investment research that is impartial, independent, clear, fair and not misleading. For more detail please refer to Credit Suisse's Policies for Managing Conflicts of Interest in connection with Investment Research: <https://www.credit-suisse.com/sites/disclaimers-ib/en/managing-conflicts.html>.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

Credit Suisse has decided not to enter into business relationships with companies that Credit Suisse has determined to be involved in the development, manufacture, or acquisition of anti-personnel mines and cluster munitions. For Credit Suisse's position on the issue, please see <https://www.credit-suisse.com/media/assets/corporate/docs/about-us/responsibility/banking/policy-summaries-en.pdf>.

The analyst(s) responsible for preparing this research report received compensation that is based upon various factors including Credit Suisse's total revenues, a portion of which are generated by Credit Suisse's investment banking activities

For date and time of production, dissemination and history of recommendation for the subject company(ies) featured in this report, disseminated within the past 12 months, please refer to the link: <https://rave.credit-suisse.com/disclosures/view/report?i=593895&v=7aqiu72pwzhfs6wch24b5f0u>.

Important Regional Disclosures

Singapore recipients should contact Credit Suisse AG, Singapore Branch for any matters arising from, or in connection with, this research report. The analyst(s) involved in the preparation of this report may participate in events hosted by the subject company, including site visits. Credit Suisse does not accept or permit analysts to accept payment or reimbursement for travel expenses associated with these events.

For Credit Suisse Securities (Canada), Inc.'s policies and procedures regarding the dissemination of equity research, please visit <https://www.credit-suisse.com/sites/disclaimers-ib/en/canada-research-policy.html>.

Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment.

To the extent any Credit Suisse equity research analyst employed by Credit Suisse International (a "UK Analyst") has interactions with a Spanish domiciled client of Credit Suisse AG or its affiliates, such UK Analyst will be acting for and on behalf of CSSSV, with respect only to the provision of equity research services to Spanish domiciled clients of Credit Suisse AG or its affiliates.

Pursuant to CVM Instruction No. 598/2018, of May 3, 2018, the author(s) of the report hereby certify(ies) that the views expressed in this report solely and exclusively reflect the personal opinions of the author(s) and have been prepared independently, including with respect to Credit Suisse. Part of the author(s)'s compensation is based on various factors, including the total revenues of Credit Suisse, but no part of the compensation has been, is, or will be related to the specific recommendations or views expressed in this report. In addition, Credit Suisse declares that: Credit Suisse has provided, and/or may in the future provide investment banking, brokerage, asset management, commercial banking and other financial services to the subject company/companies or its affiliates, for which they have received or may receive customary fees and commissions, and which constituted or may constitute relevant financial or commercial interests in relation to the subject company/companies or the subject securities.

This research report is authored by:

Credit Suisse Securities (USA) LLC John W. Pitzer ; Dalya Hahn ; Jerome Darling

S&P Disclosures

Copyright © 2021, Standard & Poor's Global Markets Intelligence and its affiliates (collectively, "S&P"). S&P sourced information is the exclusive property of S&P. Without prior written permission of S&P, such information, including data and ratings, may not be reproduced in any form. S&P and any third parties involved in or related to, computing or compiling this information, disclaim any guarantees of accuracy, adequacy, completeness, timeliness or availability with respect to this information. S&P and its licensors are not responsible for the results derived from their provided data, including any errors, omissions, observations, investment views or recommendations. In no event shall S&P or its licensors be liable for any damages, costs, expenses, legal fees, or losses (including lost income or lost profit and opportunity costs) in connection with any use of its content.

Important disclosures regarding companies that are the subject of this report are available by calling +1 (877) 291-2683. The same important disclosures, with the exception of valuation methodology and risk discussions, are also available on Credit Suisse's disclosure website at <https://rave.credit-suisse.com/disclosures>. For valuation methodology and risks associated with any recommendation, price target, or rating referenced in this report, please refer to the disclosures section of the most recent report regarding the subject company.

This report is produced by subsidiaries and affiliates of Credit Suisse operating under its Global Markets Division. For more information on our structure, please use the following link: <https://www.credit-suisse.com/who-we-are>. This report may contain material that is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or which would subject Credit Suisse or its affiliates ("CS") to any registration or licensing requirement within such jurisdiction. All material presented in this report, unless specifically indicated otherwise, is under copyright to CS. None of the material, nor its content, nor any copy of it, may be altered in any way, transmitted to, copied or distributed to any other party, without the prior express written permission of CS. All trademarks, service marks and logos used in this report are trademarks or service marks or registered trademarks or service marks of CS or its affiliates. The information, tools and material presented in this report are provided to you for information purposes only and are not to be used or considered as an offer or the solicitation of an offer to sell or to buy or subscribe for securities or other financial instruments. CS may not have taken any steps to ensure that the securities referred to in this report are suitable for any particular investor. CS will not treat recipients of this report as its customers by virtue of their receiving this report. The investments and services contained or referred to in this report may not be suitable for you and it is recommended that you consult an independent investment advisor if you are in doubt about such investments or investment services. Nothing in this report constitutes investment, legal, accounting or tax advice, or a representation that any investment or strategy is suitable or appropriate to your individual circumstances, or otherwise constitutes a personal recommendation to you. Please note in particular that the bases and levels of taxation may change. Information and opinions presented in this report have been obtained or derived from sources believed by CS to be reliable, but CS makes no representation as to their accuracy or completeness. CS accepts no liability for loss arising from the use of the material presented in this report, except that this exclusion of liability does not apply to the extent that such liability arises under specific statutes or regulations applicable to CS. This report is not to be relied upon in substitution for the exercise of independent judgment. CS may have issued, and may in the future issue, other communications that are inconsistent with, and reach different conclusions from, the information presented in this report. Those communications reflect the different assumptions, views and analytical methods of the analysts who prepared them and CS is under no obligation to ensure that such other communications are brought to the attention of any recipient of this report. Some investments referred to in this report will be offered solely by a single entity and in the case of some investments solely by CS, or an associate of CS or CS may be the only market maker in such investments. Past performance should not be taken as an indication or guarantee of future performance, and no representation or warranty, express or implied, is made regarding future performance. Information, opinions and estimates contained in this report reflect a judgment at its original date of publication by CS and are subject to change without notice. The price, value of and income from any of the securities or financial instruments mentioned in this report can fall as well as rise. The value of securities and financial instruments is subject to exchange rate fluctuation that may have a positive or adverse effect on the price or income of such securities or financial instruments. Investors in securities such as ADRs, the values of which are influenced by currency volatility, effectively assume this risk. Structured securities are complex instruments, typically involve a high degree of risk and are intended for sale only to sophisticated investors who are capable of understanding and assuming the risks involved. The market value of any structured security may be affected by changes in economic, financial and political factors (including, but not limited to, spot and forward interest and exchange rates), time to maturity, market conditions and volatility, and the credit quality of any issuer or reference issuer. Any investor interested in purchasing a structured product should conduct their own investigation and analysis of the product and consult with their own professional advisers as to the risks involved in making such a purchase. Some investments discussed in this report may have a high level of volatility. High volatility investments may experience sudden and large falls in their value causing losses when that investment is realised. Those losses may equal your original investment. Indeed, in the case of some investments the potential losses may exceed the amount of initial investment and, in such circumstances, you may be required to pay more money to support those losses. Income yields from investments may fluctuate and, in consequence, initial capital paid to make the investment may be used as part of that income yield. Some investments may not be readily realisable and it may be difficult to sell or realise those investments, similarly it may prove difficult for you to obtain reliable information about the value, or risks, to which such an investment is exposed. This report may provide the addresses of, or contain hyperlinks to, websites. Except to the extent to which the report refers to website material of CS, CS has not reviewed any such site and takes no responsibility for the content contained therein. Such address or hyperlink (including addresses or hyperlinks to CS's own website material) is provided solely for your convenience and information and the content of any such website does not in any way form part of this document. Accessing such website or following such link through this report or CS's website shall be at your own risk.

This report is issued and distributed in **European Union (except Germany and Spain)**: by Credit Suisse Securities (Europe) Limited, One Cabot Square, London E14 4QJ, England, which is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority; **Spain**: Credit Suisse Securities, Sociedad de Valores, S.A. ("CSSSV") regulated by the Comisión Nacional del Mercado de Valores; **Germany**: Credit Suisse (Deutschland) Aktiengesellschaft regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht ("BaFin"); **United States**: Credit Suisse Securities (USA) LLC; **Canada**: Credit Suisse Securities (Canada), Inc.; **Switzerland**: Credit Suisse AG; **Brazil**: Banco de Investimentos Credit Suisse (Brasil) S.A. or its affiliates; **Mexico**: Banco Credit Suisse (México), S.A., Institución de Banca Múltiple, Grupo Financiero Credit Suisse (México) and Casa de Bolsa Credit Suisse (México), S.A. de C.V., Grupo Financiero Credit Suisse (México) ("Credit Suisse Mexico"); This document has been prepared for information purposes only and is exclusively distributed in Mexico to Institutional Investors. Credit Suisse Mexico is not responsible for any onward distribution of this report to non-institutional investors by any third party. The authors of this report have not received payment or compensation from any entity or company other than from the relevant Credit Suisse Group company employing them; **Japan**: by Credit Suisse Securities (Japan) Limited, Financial Instruments Firm, Director-General of Kanto Local Finance Bureau (Kinsisho) No. 66, a member of Japan Securities Dealers Association, The Financial Futures Association of Japan, Japan Investment Advisers Association, Type II Financial Instruments Firms Association; **Hong Kong**: Credit Suisse (Hong Kong) Limited; **Australia**: Credit Suisse Equities (Australia) Limited; **Thailand**: Credit Suisse Securities (Thailand) Limited, regulated by the Office of the Securities and Exchange Commission, Thailand, having registered address at 990 Abdulrahman Place, 27th Floor, Unit 2701, Rama IV Road, Siom, Bangkok, Bangkok 10500, Thailand, Tel. +66 2614 6000; **Malaysia**: Credit Suisse Securities (Malaysia) Sdn Bhd; **Singapore**: Credit Suisse AG, Singapore Branch; **India**: Credit Suisse Securities (India) Private Limited (CIN no.U67120MH1996PTC104392) regulated by the Securities and Exchange Board of India as Research Analyst (registration no. INH 000001030) and as Stock Broker (registration no. INZ000248233), having registered address at 9th Floor, Ceejay House, Dr.A.B. Road, Worli, Mumbai - 18, India, T- +91-22 6777 3777; **South Korea**: Credit Suisse Securities (Europe) Limited, Seoul Branch; **Taiwan**: Credit Suisse AG Taipei Securities Branch; **Indonesia**: PT Credit Suisse Sekuritas Indonesia; **Philippines**: Credit Suisse Securities (Philippines) Inc., and elsewhere in the world by the relevant authorised affiliate of the above.

Additional Regional Disclaimers

Australia: Credit Suisse Securities (Europe) Limited ("CSSEL") and Credit Suisse International ("CSI") are authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority ("FCA") and the Prudential Regulation Authority under UK laws, which differ from Australian Laws. CSSEL and CSI do not hold an Australian Financial Services Licence ("AFSL") and are exempt from the requirement to hold an AFSL under the Corporations Act (Cth) 2001 ("Corporations Act") in respect of the financial services provided to Australian wholesale clients (within the meaning of section 761G of the Corporations Act) (hereinafter referred to as "Financial Services"). This material is not for distribution to retail clients and is directed exclusively at Credit Suisse's professional clients and eligible counterparties as defined by the FCA, and wholesale clients as defined under section 761G of the Corporations Act. Credit Suisse (Hong Kong) Limited ("CSHK") is licensed and regulated by the Securities and Futures Commission of Hong Kong under the laws of Hong Kong, which differ from Australian laws. CSHK does not hold an AFSL and is exempt from the requirement to hold an AFSL under the Corporations Act in respect of providing Financial Services. Investment banking services in the United States are provided by Credit Suisse Securities (USA) LLC, an affiliate of Credit Suisse Group. CSSU is regulated by the United States Securities and Exchange Commission under United States laws, which differ from Australian laws. CSSU does not hold an AFSL and is exempt from the requirement to hold an AFSL under the Corporations Act in respect of providing Financial Services. Credit Suisse Asset Management LLC (CSAM) is authorised by the Securities and Exchange Commission under US laws, which differ from Australian laws. CSAM does not hold an AFSL and is exempt from the requirement to hold an AFSL under the Corporations Act in respect of providing Financial Services. This material is provided solely to Institutional Accounts (as defined in the FINRA rules) who are Eligible Contract Participants (as defined in the US Commodity Exchange Act). Credit Suisse Equities (Australia) Limited (ABN 35 068 232 708) ("CSEAL") is an AFSL holder in Australia (AFSL 237237).

Malaysia: Research provided to residents of Malaysia is authorised by the Head of Research for Credit Suisse Securities (Malaysia) Sdn Bhd, to whom they should direct any queries on +603 2723 2020.

Singapore: This report has been prepared and issued for distribution in Singapore to institutional investors, accredited investors and expert investors (each as defined under the Financial Advisers Regulations) only, and is also distributed by Credit Suisse AG, Singapore Branch to overseas investors (as defined under the Financial Advisers Regulations). Credit Suisse AG, Singapore Branch may distribute reports produced by its foreign entities or affiliates pursuant to an arrangement under Regulation 32C of the Financial Advisers Regulations. Singapore recipients should contact Credit Suisse AG, Singapore Branch at +65-6212-2000 for matters arising from, or in connection with, this report. By virtue of your status as an institutional investor, accredited investor, expert investor or overseas investor, Credit Suisse AG, Singapore Branch is exempted from complying with certain compliance requirements under the Financial Advisers Act, Chapter 110 of Singapore (the "FAA"), the Financial Advisers Regulations and the relevant Notices and Guidelines issued thereunder, in respect of any financial advisory service which Credit Suisse AG, Singapore Branch may provide to you.

EU: This report has been produced by subsidiaries and affiliates of Credit Suisse operating under its Global Markets Division.

In jurisdictions where CS is not already registered or licensed to trade in securities, transactions will only be effected in accordance with applicable securities legislation, which will vary from jurisdiction to jurisdiction and may require that the trade be made in accordance with applicable exemptions from registration or licensing requirements.

This material is issued and distributed in the U.S. by CSSU, a member of NYSE, FINRA, SIPC and the NFA, and CSSU accepts responsibility for its contents. Clients should contact analysts and execute transactions through a Credit Suisse subsidiary or affiliate in their home jurisdiction unless governing law permits otherwise.

CS may provide various services to US municipal entities or obligated persons ("municipalities"), including suggesting individual transactions or trades and entering into such transactions. Any services CS provides to municipalities are not viewed as "advice" within the meaning of Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act. CS is providing any such services and related information solely on an arm's length basis and not as an advisor or fiduciary to the municipality. In connection with the provision of the any such services, there is no agreement, direct or indirect, between any municipality (including the officials, management, employees or agents thereof) and CS for CS to provide advice to the municipality. Municipalities should consult with their financial, accounting and legal advisors regarding any such services provided by CS. In addition, CS is not acting for direct or indirect compensation to solicit the municipality on behalf of an unaffiliated broker, dealer, municipal securities dealer, municipal advisor, or investment adviser for the purpose of obtaining or retaining an engagement by the municipality for or in connection with Municipal Financial Products, the issuance of municipal securities, or of an investment adviser to provide investment advisory services to or on behalf of the municipality. If this report is being distributed by a financial institution other than Credit Suisse AG, or its affiliates, that financial institution is solely responsible for distribution. Clients of that institution should contact that institution to effect a transaction in the securities mentioned in this report or require further information. This report does not constitute investment advice by Credit Suisse to the clients of the distributing financial institution, and neither Credit Suisse AG, its affiliates, and their respective officers, directors and employees accept any liability whatsoever for any direct or consequential loss arising from their use of this report or its content. No information or communication provided herein or otherwise is intended to be, or should be construed as, a recommendation within the meaning of the US Department of Labor's final regulation defining "investment advice" for purposes of the Employee Retirement Income Security Act of 1974, as amended and Section 4975 of the Internal Revenue Code of 1986, as amended, and the information provided herein is intended to be general information, and should not be construed as, providing investment advice (impartial or otherwise).

Copyright © 2021 CREDIT SUISSE AG and/or its affiliates. All rights reserved.

When you purchase non-listed Japanese fixed income securities (Japanese government bonds, Japanese municipal bonds, Japanese government guaranteed bonds, Japanese corporate bonds) from CS as a seller, you will be requested to pay the purchase price only.