What Does the CDS Market Imply for a U.S. Default?

Luca Benzoni, Christian Cabanilla, Alessandro Cocco, and Cullen Kavoussi

April 21, 2023 WP 2023-17 https://doi.org/10.21033/wp-2023-17

FEDERAL RESERVE BANK of CHICAGO

*Working papers are not edited, and all opinions are the responsibility of the author(s). The views expressed do not necessarily reflect the views of the Federal Reserve Bank of Chicago or the Federal Reserve System.

What Does the CDS Market Imply for a U.S. Default?¹

Luca Benzoni, Christian Cabanilla, Alessandro Cocco, and Cullen Kavoussi April 21, 2023

Abstract

As the debt ceiling episode unfolds, we highlight a sharp increase in activity across the U.S. credit default swaps (CDS) market and infer the likelihood of a U.S. default from these market prices. Beginning in January 2023, we document a significant increase in U.S. CDS trading activity and positions, accompanied by a spike in CDS premiums. We estimate an increase in the market-implied default probability from about 0.2–0.3% in 2022, to approximately 1% in 2023. Yet, this default probability currently remains lower than what we find for the periods leading up to the 2011 and 2013 debt ceiling episodes, due in part to the cheapening of deliverable Treasury collateral to CDS contracts.

JEL Codes: G10; G12; G18; G28; E32; E43; E44

Keywords: U.S. default; U.S. CDS; default probabilities; sovereign CDS; debt ceiling

The U.S. "debt limit" is the total amount of money the U.S. government can borrow to meet its existing obligations. On January 19, 2023, the U.S. reached this debt limit and has since taken "extraordinary measures" in order to prevent the U.S. from defaulting on its obligations as Congress deliberates increasing this limit. However, market participants estimate these measures could be exhausted into this summer (e.g., Zandi 2023). While past debt limit episodes have always resulted in Congressional actions to raise the limit, these events have implications for market pricing of a potential default of the U.S. on its debt.² Credit default swap (CDS) spreads

¹ Luca Benzoni and Alessandro Cocco are with the Federal Reserve Bank of Chicago; Christian Cabanilla and Cullen Kavoussi are with the Federal Reserve Bank of New York. We are grateful to Gene Amromin, Gabriel Herman, Tom King, Spencer Krane, Olga Roman, Robert Steigerwald, Fabrice Tourre, Dan Sullivan, Kyle Watson, and Josh Younger for many insightful comments. Max Gillet provided outstanding research assistance. All errors and omissions are our own. The views expressed in this note are solely those of the authors and should not be interpreted as reflecting the views of the Federal Open Market Committee, the Board of Governors of the Federal Reserve System, the Federal Reserve Bank of Chicago, Federal Reserve Bank of New York, or of anyone else associated with the Federal Reserve System.

² See <u>Debt Limit | U.S. Department of the Treasury</u>

referencing U.S. government debt have significantly increased during 2023. In this working paper we use these CDS markets to examine the likelihood of a U.S. default event. Moreover, we compare the current estimates of the U.S. default probabilities to those computed for the two previous major debt ceiling episodes of 2011 and 2013.

The market of U.S. credit default swaps: A brief history and recent developments

A credit default swap is a financial contract that allows two parties to trade credit risk, meaning the risk that a borrower, called the reference entity, will default on its bonds or loans. One of the parties, known as the "protection buyer," pays a premium to the other, called the "protection seller." In exchange for the premium payments, if the borrower reference entity defaults on its bonds or loans, then the protection seller is required to make a payment to the protection buyer for the decrease in market value of the borrower's bonds and loans (e.g., Cocco 2002).

Since its inception in the 1990s, the size of the CDS market has grown over time. Growth increased significantly in the years prior to the Great Financial Crisis, with the total notional amount outstanding peaking around \$67.2 trillion at the end of 2007 (Aldasoro and Ehlers 2018). The market shrank dramatically in the aftermath of the Great Financial Crisis in 2008, dropping to \$7.8 trillion by mid-2019.⁴ More recently, growth has been picking up again, and notional outstanding has increased to \$9.3 trillion by June 2022.⁵ Prior to the Great Financial Crisis the CDS market traded over-the-counter, i.e., trading between two parties away from an exchange, with terms conforming to the standards set by the International Swaps and Derivatives Association (ISDA). As a result of the global reforms introduced after the Great Financial Crisis, the majority of CDS are traded on Swap Execution Facilities (SEFs) and cleared at central counterparties (CCPs) regulated by the Commodity Futures Trading Commission (CFTC) for swaps⁶ or the U.S. Securities and Exchange Commission (SEC) for security based swaps.⁷ As of

⁴ See Graph 1 in Aldasoro and Ehlers (2018) and Table D10.1 by the Bank of International Settlements (BIS) with OTC, credit default swaps, by type of position as of June 2019. See also ISDA's <u>SwapsInfo Full Year 2022 and the Fourth Quarter of 2022 Review</u>.

⁵ See Tables D10.1 of the BIS report on OTC Derivatives Outstanding, June 2022.

⁶ For the definition of swap, see the <u>Wex Legal Dictionary at the LII Legal Information Institute (2023)</u>. Index swaps referencing more than 9 reference entities are regulated by the CFTC; see, e.g., <u>CFTC (2012)</u>.

⁷ Security based swaps are single name swaps referencing one reference entity, or narrow-index swaps, meaning swaps referencing 9 or less reference entities: For single name swaps, see the Wex Legal Dictionary at the LII Legal Information Institute (2023) available <u>here</u>, and for narrow-based security index swaps, see <u>here</u>.

2022, CDS traded on SEFs represented 82.6% of total CDS notional and 87.1% of total trade count; and CDS cleared on CCPs represented 83.7% of total credit derivatives traded notional and 88% of total trade count.⁸

Contracts on sovereign reference entities comprise a fairly small portion of the CDS universe, with a notional outstanding amount of \$1.2 trillion in June 2022, i.e., around 13% of the total market size.⁹ Within the sovereign CDS asset class, trading typically concentrates on contracts that reference debt obligations of emerging market economies, e.g., Argentina, Brazil, Mexico, Russia, and Turkey (e.g., Bomfim 2022). There have been exceptions, however. For instance, the Euro zone crisis triggered interest in trading risk on advanced European economies, in particular CDS referencing the sovereign debt of Italy or Greece.

In contrast to the broader corporate and sovereign CDS markets, the U.S. CDS market is relatively new and, in comparison, much smaller. Boyarchenko and Shachar (2020) document that the gross notional value of total outstanding CDS positions on U.S. sovereign debt peaked at \$32.3 billion in August 2011, around the time when Congress passed the Budget Control Act that resolved the debt ceiling episode of 2011. After that, trading activity has declined significantly, with pockets of growth around the debt ceiling episode of 2013. Total gross notional reached its lowest level of \$1.3 billion outstanding by 4Q 2021 – decreasing from around \$26 billion in 4Q 2013. Nonetheless, while U.S. CDS markets may see very low activity for long periods of time, they also exhibit sharp swings toward periods of elevated activity – such as in the current environment.

The on-going 2023 debt ceiling episode brought renewed attention to the CDS market on U.S. sovereign debt. Figure 1 shows that the gross notional outstanding started to increase in January 2023, reaching a \$10.7 billion peak the week of March 10, 2023. While the gross amount outstanding remains below the levels registered in 2011 and 2013, the *net* notional amount increased to \$4.7 billion the same week of March 10, higher than the \$4.1 billion level reached in the week of October 25, 2013. While gross notional activity may at times overstate the economic exposure of the seller of protection to a default by the reference entity, the net positions give a

⁸ See Graph A.6 of the BIS report on OTC derivatives statistics at end-June 2022 and ISDA (2023).

⁹ See D.10.4 of the BIS report on OTC Derivatives Outstanding, June 2022.

better estimate of the ultimate exposure, as they represent the aggregate payments to be made by the protection seller in the event of a default by the reference entity (e.g., IOSCO 2012).

In addition to increases across notional positioning, broader trading activity and CDS spreads both increased significantly as well, as seen in Figure 2. Gross weekly trading amounts peaked at \$3 billion the week of February 3, 2023, corresponding to 103 traded contracts, and declined in subsequent weeks. Concurrently, CDS premiums increased rapidly too (Figure 3), reaching 93 basis points by March 17, 2023, a level higher than that recorded during the two previous major debt ceiling episodes of 2011 and 2013.¹¹ In addition, the recent increases in CDS premiums pushed 1-year CDS spreads above the 5-year tenor; normally, the quoted spread on the 5-year CDS will be higher than the 1-year CDS due to generally more uncertainty further into the future in terms of the probability of a credit event. The relative increase in 1-year CDS reflects investor interest to seek protection for a possible credit event in the short term, such as one related to the debt ceiling episode.

These developments prompt the question, what does the recent run up in U.S. CDS premiums tell us about the underlying probability of a U.S. default from these market prices? Moreover, is such a probability any different from that implied by U.S. CDS premiums observed before the debt ceiling episodes of 2011 and 2013?

To answer these questions it is useful to clarify the cash flows generated by a CDS contract, and how such expected payments map into a CDS premium, given market participants' assessment of the likelihood of a default. To this end, in the next section we briefly discuss how CDS contracts are settled.

Settlement and cash flows

In a CDS, following a default by the reference entity the protection buyer extracts value from the contract through physical or cash settlement. In the case of cash settlement, the protection buyer receives from the protection seller the cash value of the difference between the face and the

¹¹ The press and financial analysts have increased interest in the evolution of U.S. CDS premiums and the increased activity in U.S. CDS market, see, e.g., Robin Wigglesworth in the March 8 Financial Times and research by Barclays, Credit and Rates Strategy (2023). Both of these pieces discuss the effect of these market developments on the implied probability of a U.S. default.

market values of an obligation of the reference entity. In the case of physical settlement, the protection buyer delivers to the protection seller an obligation of the reference entity that satisfies certain pre- agreed criteria (by way of example, the reference obligation must be freely transferable, must have a maximum maturity of no more than 30 years),¹² and the protection seller pays to the protection buyer 100% of the face value of the obligation. The protection buyer extracts value from this transaction because at the time of the default the obligation will be worth less than its face value. If at the time of the default the reference entity has multiple bonds outstanding, then the protection buyer delivers to the protection seller the cheapest of the assets eligible for delivery, so as to maximize their cash flow upon default.

As the market evolved, participants started to use CDS contracts to trade based on their views on the riskiness of a specific company. The derivative nature of the CDS market made it possible to express a view on the likelihood of default of a reference entity without having to physically buy or sell its bonds, which may be illiquid and sometimes in limited supply. Consequently, the outstanding amount of CDS notional on a given entity at times exceeded that of the bonds outstanding by that entity, rendering physical settlement impractical. Eventually, settlement took the form of an auction mechanism that gives investors the option to cash or physically settle.¹³ The auction is designed to arrive at a market-wide settlement valuation of the auction results. In the auction, all market participants can deliver and purchase bonds of the defaulted entity. That means that if the size of the auction exceeds the amount of cheapest-to-deliver bonds that are deliverable, then those delivering into the auction will have to find the next cheapest to deliver, and so on. Hence, the price at which the auction settles is more of a blend of the deliverable obligations issued by the reference entity.

¹² See, e.g., <u>ISDA (2011)</u>.

¹³ Markit and Creditex provide a primer on the CDS settlement mechanism, available <u>here</u>. Chernov, Gorbenko, and Makarov (2013) study the implications of the two-step auction mechanism that allows for cash and physical settlement. See also Williams et al. (2011).

If Congress fails to lift the debt ceiling going forward, the U.S. would likely be unable to make timely payments on its debt obligations.¹⁴ The Credit Derivatives Determination Committee (DC)¹⁵ would then be tasked to rule whether a credit event occurred, i.e., if payments should be made on CDS contracts. Moreover, the DC determines whether to hold an auction and what securities are deliverable into that auction. The outcome of such an auction would be affected by the *valuation* and *availability* of the cheapest deliverable bond.

The cheapest to deliver bond typically changes on a day-to-day basis. During the on-going debt ceiling episode, however, the cheapest deliverable into a hypothetical U.S. CDS auction has consistently been the thirty-year Treasury bond that matures on May 15, 2050.¹⁶ Such a bond was issued at a price close to par on May 15, 2020, at the peak of the Covid crisis, with a coupon rate of only 1.25%. Since then, the Federal Open Market Committee (FOMC) has repeatedly increased the federal funds rate, resulting in a marked increase in long-term Treasury yields and a corresponding decline in the prices of notes and bonds, especially those with long maturity that make low coupon payments. This is evident in the price history shown in Figure 4: The price of the bond maturing in 2050 reached its lowest level of \$49.4 on October 21, 2023, and subsequently partially recovered to \$58.7 on March 17.

The net notional outstanding in U.S. CDS contracts is small relative to that of Treasury bonds. For instance, there is more than \$73 billion Treasury bonds maturing on May 15, 2050. Although a fraction of these bonds are tied up in buy-and-hold portfolios of long-term investors, the sheer size of the issue dwarfs the \$4.7 billion of net notional in U.S. CDSs outstanding as of the week of March 10.¹⁷ Hence, it is reasonable to assume that, in case of a default, the CDS auction will clear at a price close to that of the cheapest-to-deliver bond.

¹⁴ Other countries have experienced sovereign debt crises that have ended in other forms of default. Examples include debt repudiation or a moratorium on debt payments (e.g., Russia 1998), and debt restructuring (e.g., Greece 2012).

¹⁵ In 2018, ISDA appointed DC Administration Services, Inc. (DCAS) as the Determination Committees Secretary. The most recent website for the Determination Committees is <u>here</u>.

¹⁶ Based solely on pricing and not taking into consideration the availability or scarcity of this security.

¹⁷ In fact, there is an additional \$89 billion outstanding in the 30-year Treasury bond maturing on August 15, 2050. That bond has a coupon rate of 1.375% and trades at a price only slightly higher than that of the cheapest deliverable.

In sum, the cash flows for a U.S. CDS contract are as follows. A protection buyer will be paying the CDS premium from the inception of the contract through either maturity or the sovereign "default," whichever comes first. In case of a credit event, the cash flow perceived by the protection buyer would approximately be the difference between \$1 and the price of the cheapest deliverable per unit of face value, times the notional amount of the CDS contract. The exact amount of that cash flow is unknown today, e.g., U.S. Treasury yields could increase in the summer if market participants anticipate that a breakdown of the negotiations on the debt ceiling is imminent. However, the price of the cheapest deliverable Treasury bond today is, in present value, a reasonable estimate of the expected cash flow based on current information.

In the next section we tie CDS premiums and their expected cash flow together with market participants' assessment of the probability of a credit event.

What do U.S. CDS premiums tell us about the likelihood of a default?

At the inception of the CDS contract, the buyer and the seller of insurance protection agree to a CDS premium such that the contract has zero market value. That is, the present value of CDS premium payments made by the protection buyer equals the present value of the payments made by the insurance provider.

In a single period model, and abstracting from transaction costs, this implies:

PV CDS premiums = p * PV Cashflow(credit event) + (1 - p) * PV Cashflow(no credit event),

where *p* denotes the probability of a credit event and PV denotes the present value of a cash flow. In case of no credit event, the seller of CDS insurance makes no payment, hence the Cashflow(no credit event) term is zero. Thus, the CDS pricing equation simplifies into an expression for the market-implied default probability,

$$p = \frac{\text{PV CDS premium}}{\text{PV Cashflow(credit event)}}.$$

Figure 5 shows our estimate of p during the on-going debt ceiling episode. In 2022, the default probability was fluctuating in a 20-30 bps range. However, beginning from January 2023, p has

spiked up to about 1%, and has been fluctuating between 80 and 110 basis points since then. ¹⁸ While the level of the p estimate remains small, its increase from the previous year is quite noticeable. It coincides with the heightened trading activity in U.S. CDS contracts (Figures 1-2) and, of course, the spike in premium (Figure 3).

For comparison, we repeat a similar exercise for the periods leading up to the 2011 and 2013 debt ceiling episodes. To that end, we collect data on all Treasury securities issues that were outstanding at the time, and for each day we identify a hypothetical security that would have been cheapest to deliver in case of a default. We then infer default probabilities from U.S. CDS prices. Figure 6 shows that default risk was somewhat higher during these two previous episodes compared to current levels, even though CDS premiums were similar to, and in some case lower than those observed in 2023 (Figure 3). This is because the CDS expected cash flow in case of a default is higher now than it was back then, due to the significant discount at which long-term Treasuries are currently trading in the context of the sharp monetary policy tightening of the past few years. Hence, while investors are paying more for CDS protection now than in 2011 and 2013, the implied default risk is at the moment is lower than it was back then.

Conclusion

As the current debt ceiling episode unfolds, we infer the likelihood of a U.S. default through the lens of the sovereign credit default swaps (CDS) market. Beginning from January 2023, we document a significant increase in U.S. CDS trading, accompanied by a spike in premiums. Accordingly, we estimate an increase in default probability from about 0.2–0.3% in 2022, to approximately 1% in 2023, a value that is generally lower than what we find for the periods leading up to the 2011 and 2013 debt ceiling episodes.

One important implication from this analysis is that a simple comparison of historical CDS spreads to gauge market expectations around the likelihood of a credit event could be complicated by the value of the cheapest deliverable bond. Currently, the cheapest to deliver

¹⁸ The biggest jumps took place on January 11-17; over those days it had become know that the U.S. was going to reach its debt limit by January 19. For instance, on January 13 U.S. Secretary of the Treasury Janet Yellen sent a letter to all members of Congressional leadership regarding the debt limit (available <u>here</u>). The financial press quickly reacted to such news, see, e.g., Thomson Reuters on January 17 (available <u>here</u>).

bond is deeply discounted when compared to prior debt ceiling episodes, which has contributed to wider U.S. CDS spreads.

Of course, our results are subject to caveats and clarifications. For instance, the market-implied probability *p* accounts for the adjustment that market participants make due to the uncertainty of a default and the actual loss-given-default, and their aversion to the risk surrounding these events. Such an adjustment could be sizeable. First, the returns on a fixed income investment are typically negatively skewed with upside limited by the face value of the bond. Second, in the event of a credit event, other assets would also likely fare poorly. Hence, there is risk in a short CDS position that is difficult to diversify away, and protection sellers will adjust the default probability upwards, thereby increasing the CDS premium. That is, the *actual* default probability is likely smaller than the risk-adjusted measure *p* that appears in the CDS pricing equation.

Another important aspect of our analysis is its reliance on U.S. CDS premiums as a gauge of default risk. While trading activity has recently increased, the U.S. CDS market remains small and historically illiquid. Hence, the implied default probabilities likely reflect the activity of a fairly small group of specialized investors, rather than a wider consensus across broader public. In this respect, concerns about the on-going debt ceiling negotiations might affect the prices of other more widely-traded securities, e.g., Treasury bills expiring around the summer of 2023, when the Treasury's extraordinary measures could be exhausted.

Figure 7 shows that, as of April 14, 2023, the term structure of U.S. Treasury bills yields is hump shaped, with a peak in August 2023. This could be explained by the expectation of additional policy tightening by the Federal Open Market Committee (FOMC) in the upcoming months, and a subsequent easing. However, it could also signal market participants' concerns for a possible default. To explore this latter interpretation, Figure 7 also shows the term structure of Overnight Indexed Swap (OIS) rates, which are less sensitive to the risk of a U.S. default. OIS rates are generally higher than Treasury bills yields; the spread is about 1% in the spring, it shrinks to nearly zero for securities maturing in August, and then widens again in the fall. This evidence suggests that market participants price Treasury bills maturing in the summer, when treasury is likely to exhaust its extraordinary measures, at a discount compared to similar securities with nearby maturities. The signal in the bills' term structure could become even more informative as

9

investors narrow their estimates for the date at which extraordinary measures are exhausted by the Treasury, and it is therefore worth continuous monitoring together with other useful indicators of market stress, e.g., measures of liquidity in the Treasury bill market.

Finally, our default probability estimates pertain to a scenario in which, upon a default event, the financial system is still functioning and the sellers of credit protection are able to fulfill their contractual obligation. They are not as useful to think about an extreme scenario in which the failure to raise the debt ceiling might unravel with potentially dire consequences for the U.S. financial system.

References

- Aldasoro, I, and T. Ehlers (2018). "The credit default swap market: what a difference a decade makes," BIS Quarterly Review, June 2018
- Austin, D., and R. Miller (2011). "Treasury Securities and the U.S. Sovereign Credit Default Swap Market," Congressional Research Service Report or Congress, August 15, 2011
- Bank of International Settlements (2019). "OTC, credit default swaps, by type of position, table D10.1," available <u>here</u>
- Bank of International Settlements (2022). "OTC Derivatives Outstanding," available here
- Bank of International Settlements (2022). "OTC derivatives statistics at end-June 2022," available <u>here</u>
- Barclays Credit and Rates Strategy (2023). "FAQs on USA sovereign CDS 2023 Edition," Macro & Credit Research, 8 March 2023
- Bomfim, Antulio N. (2022). "Credit Default Swaps," Finance and Economics Discussion Series, May 2022
- Boyarchenko, Nina, and Or Shachar (2020). "The Evolving Market for U.S. Sovereign Credit Risk," Liberty Street Economics, January 6, 2020
- CFTC (2012). "Federal Register: Rules and Regulations," Vol. 77, No. 156, Monday, August 13, 2012
- Chernov, Mikhail, Alexander S. Gorbenko, and Igor Makarov (2013). "CDS Auctions," The Review of Financial Studies, Volume 26, Issue 3, March 2013, pp. 768-805
- Cocco, Alessandro (2002). "Credit derivatives 2002: Fundamentals and latest developments in credit derivatives documentation techniques," Journal of Derivatives & Hedge Funds, Palgrave Macmillan
- IOSCO (2012). "The Credit Default Swap Market: Report," June 2012, available here
- ISDA (2011). "Credit Derivatives Physical Settlement Matrix," 20 January 2011, available here
- ISDA (2023). "SwapsInfo Full Year 2022 and the Fourth Quarter of 2022 Review," 13 February 2023, available <u>here</u>
- Mahadevan, S., P. Naraparaju, and A. Musfeldt (2011). "Sovereign CDS Markets, A Corporate Perspective," Credit Derivatives Insights, Morgan Stanley
- Markit and Creditex, "Credit Event Auction Primer," available here
- Wex Legal Ditionay at the LII Legal Information Institute (2023). "U.S. Code, Title 7, Chapter 1, § 1a(47)(A)," available <u>here</u>.
- Wex Legal Ditionay at the LII Legal Information Institute (2023). "U.S. Code, Title 7, Chapter 1, § 1a(35)," available <u>here</u>.
- Wex Legal Ditionay at the LII Legal Information Institute (2023). "U.S. Code, Title 7, Chapter 15, § 78c(a)(68)," available <u>here</u>.

- Williams, John, Doug Warren, Bryce Markus, David Moss, Robert Lee, Carlo-Edoardo Carlon, Athanassios Diplas, Glade Jacobsen, Justin Gmelich, William Roberts, Bryan Mix, Kimberly Summe, Tom Benison, Alessandro Cocco, Lisa Watkinson, Thomas Vogel, and Vincent Basulto: Investors (2011). "Systems and Methods for Credit Default Swap Auction," US Patent 8,078,521 B1, Dec. 13, 2011
- Zandi, Mark (2023). "The Federal Debt Limit and its Economic and Financial Consequences," written testimony to the U.S. Senate Committee on Banking, Housing, and Urban Affairs' Subcommittee on Economic Policy, March 7, 2023, available <u>here</u>

Wigglesworth, Robin (2023). "Does Treasury bedlam beckon?," Financial Times, March 8, 2023



Figure 1: Gross and Net Notional Outstanding in U.S. CDSs. The chart shows the gross and net notional outstanding amounts in U.S. CDS contracts. Source: DTCC Kinetics.







Figure 3: U.S. CDS Premiums. The chart shows the one- and five-year U.S. CDS premiums. Source: Bloomberg.



Figure 4: 30-year Treasury Bond Price. The chart shows the dollar price of the 30-year Treasury bond maturing on May 15, 2050. Source: Bloomberg.



Figure 5: U.S. Default Probability. The chart shows the likelihood of a U.S. default implied by the time series of the 1-year U.S. CDS premiums.



Figure 6: U.S. Default Probability: 2011 and 2013 Debt Ceiling Episodes. The chart shows the likelihood of a U.S. default in the months leading up to the 2011 and 2013 debt ceiling episodes.



Figure 7: The Term Structures of Treasury Bills Yields and OIS Rates. The chart shows the term structures of Treasury bills yields and OIS rates maturing around the summer of 2023, computed as of April 14, 2023. Source: Bloomberg.