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Wrong-way risk in OTC derivatives and its implication for Japan's financial institutions

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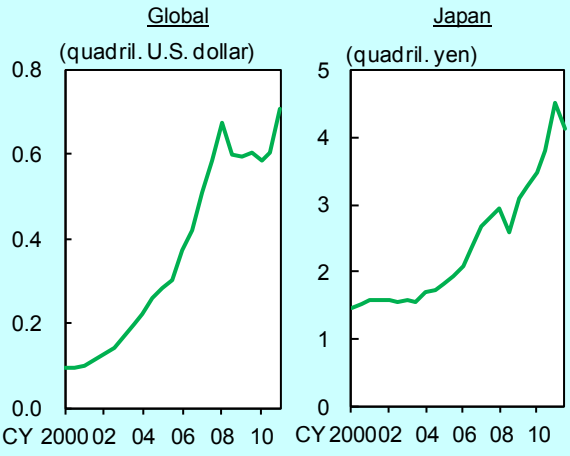
Over-the-counter (OTC) derivative transactions, like loans, present the risk of losses in the event that the counterparty goes bankrupt. This is referred to as counterparty risk. OTC derivatives differ from loans, however, in that exposure varies with market factors. The risk that both exposure and the counterparty's default probability will increase at the same time is termed “wrong-way risk”, and awareness of which increased during the recent global financial crises. International institutions and market participants have been making progresses in endeavoring to reduce counterparty risk in facing wrong-way risk. The size of the market for OTC derivatives has been growing rapidly, including in Japan, and upgrading the counterparty risk management through strengthened collateral managements has become a pressing matter for the financial institutions that frequently use these transactions.

Introduction

The level of OTC derivative transactions by the major financial institutions worldwide had been growing rapidly until 2007, and resumed a growth trend a few years ago. The size of the market in notional capital terms stood at $700 trillion as of June 2011. Japan's market, no exception to this trend, has grown to about ¥4,500 trillion. Financial institutions consider OTC derivative transactions a useful tool in managing risk and an essential component in financial activity[1] (Chart 1).

It is important to note, however, that the participants in OTC derivative transactions bear counterparty risk, which is the risk of losses resulting from the default of the counterparty in a financial transaction. Another characteristic of OTC derivative transactions is that their exposure varies based on market factors. When exposure and the counterparty's default probability increase at the same time, it is referred to as “wrong-way risk”. There have been numerous episodes of wrong-way risk causing sharp increases in risk during global financial crises, including the crisis following the failure of Lehman Brothers. Even those financial institutions that experienced a valuation gain on an OTC derivative transaction, i.e., being on the winning side of the trade, were at risk of losing much of those profits as a result of an increased probability of default by their counterparty.

[Chart 1] Size of OTC derivatives market



Sources: BIS, "Regular OTC derivatives statistics."; BOJ, "Regular derivatives market statistics in Japan."
Note: On a notional amount basis (there are differences in the data coverage between global and Japan). There are discrepancies in figures at end-December. 2007 and end-June 2009 due to changes of reporting dealers.

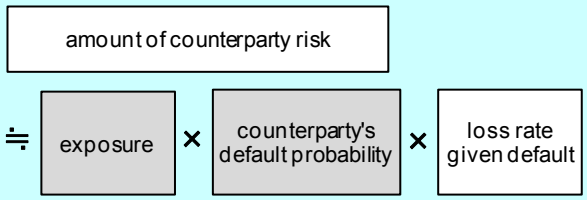
We begin this paper by explaining the mechanism by which wrong-way risk triggers a sharp increase in the amount of risk in an OTC derivative transaction in example events. Next, we give several examples of policies, aimed at reducing wrong-way risk, that are actually being tried. Lastly, we show how the sharp increase in amount of risk caused by wrong-way risk has also become an issue for Japan's financial

institutions experiencing rapid growth in OTC derivative transactions.

Wrong-way risk in an OTC derivative transaction

Counterparty risk is a type of credit risk, the amount of which can be roughly estimated by multiplying the amount of credit extended to the counterparty (exposure [2, 3]) by the default probability of the counterparty and the loss rate given default (Chart 2). This is basically the same risk calculation used with loans. In other words, calculating the amount of counterparty risk in OTC derivatives is similar to calculating loan loss reserves for the loan.[4]

[Chart 2] Approximate estimate of the amount of counterparty risk



What makes counterparty risk in an OTC derivative transaction different is that exposure rises and falls in according with the development of financial markets. This is because an OTC derivative exposure is calculated at a market value, and the larger a position with gain in an OTC derivative becomes as a result of changes in market prices, the greater the exposure to the counterparty becomes. This is considerably different from exposure to a loan, which is normally assumed to be a fixed amount that lasts for a certain period. On the other hand, the probability of default for the counterparty to a derivative transaction changes in the same way as that for the counterparty to a loan transaction. Consequently, the wrong-way risk from both exposure and default probability rising at the same time results in soar in the amount of risk.

Wrong-way risk can best be understood using the example of purchasing put options in the stock market. If a put option for corporate stock correlates highly with counterparty default probability, when the underlying share price declines, the value of the put option (in this case the exposure) increases at the same time that the probability of counterparty default increases. As a result, this wrong-way risk causes a sharp increase in overall risk.

Wrong-way risk in the latest global financial crisis

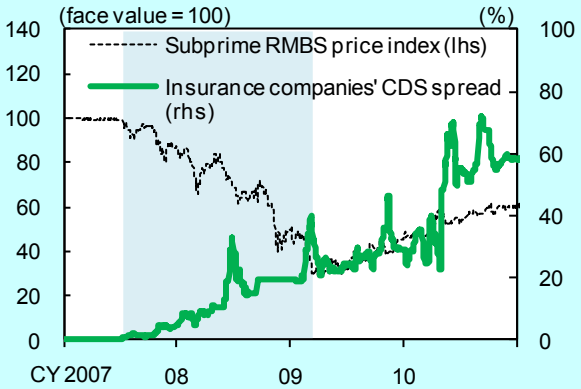
There was a period during the recent global financial crises when the market increases recognition of wrong-way risk. Below, we use three typical examples to explain the mechanism whereby wrong-way risk causes a sharp increase in the amount of risk.[5]

Example of credit derivative transactions

Wrong-way risk can cause risk to soar in a credit derivative transaction. In a credit default swap (CDS), the decline in price from the time when the financial product or debt was initially contracted is the protection value, i.e., the exposure. Accordingly, as the probability of the price decline of referenced financial product increases, the value of CDS protection increases, as does the exposure of the financial institution receiving the protection to the financial institution selling the protection. If the probability of default of the financial institution selling the protection rises at the same time, the resulting wrong-way risk causes a sharp increase in the amount of risk.

During the global financial crisis, a decline in the price of securitized products collateralized by subprime mortgages caused an increase in the protection value of CDSs referencing those products. At the same time, the default probability of the financial or insurance companies that sold the CDS protection increased substantially, as evidenced by those companies' own CDS spreads (Chart 3). Consequently, the financial institutions that purchased CDSs from these financial or insurance companies experienced a sharp increase in counterparty risk due to wrong-way risk.[6,7]

[Chart 3] Subprime RMBS price index and insurance companies' CDS



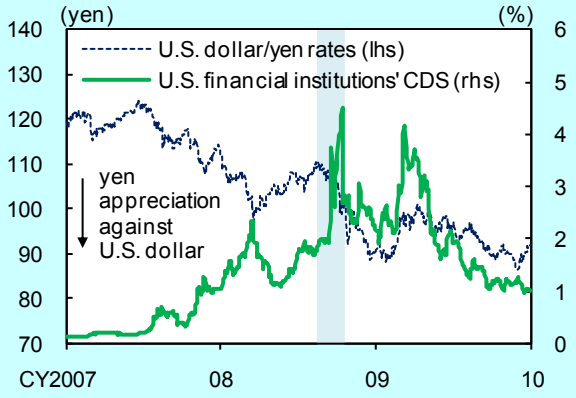
Source: Bloomberg
Note: ABX-HE (AAA-rated, 1 year maturity) for Subprime RMBS price index.

Example of currency swaps

Wrong-way risk can cause risk to increase sharply in a currency swap transaction, as well. One example is when a Japan's financial institution uses yen to get U.S. dollar funding. If the likelihood of the yen appreciating against the dollar increases during the transaction period, so does the likelihood that the value of the yen pledged by the Japan's financial institution to the counterparty will exceed the value of the dollars that the Japan's financial institution will receive in the future. The valuation gain, the difference between these two market values, is the counterparty exposure when calculating the counterparty risk of a currency swap transaction.[8] Accordingly, if exposure increases from the yen appreciating against the dollar while the default probability of the financial institution increases on the other side of the transaction, the resulting wrong-way risk causes a sharp increase in amount of risk of the Japan's financial institutions.

In the currency swap market following the failure of Lehman Brothers, the yen appreciated substantially against the dollar on concerns over an economic slowdown in the US and Europe, resulting in an increase in Japan's banks' exposure to currency swaps (Chart 4). At the same time, the default probabilities of the counterparty U.S. financial institutions increased sharply, once again as evidenced by the increase in their own CDS spreads. This suggests that wrong-way risk has caused a sharp increase in the amount of the counterparty risk held by Japan's financial institutions.

[Chart 4] U.S. dollar/yen rates and U.S. financial institutions' CDS



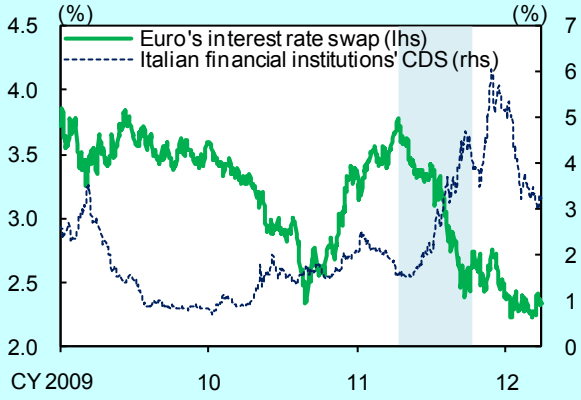
Source: Bloomberg

Example of interest rate derivatives

Wrong-way risk can also cause risk to increase sharply in an interest rate derivative transaction. For example, when the expected rate of inflation declines and/or the policy rate lowers during an economic downturn, interest rates become more likely to decline. In this case, the financial institution with a fixed-rate receiver position in an interest rate swap transaction experiences a valuation gain (replacement cost) to the extent that the swap rate declines, against the counterparty with the floating-rate receiver position (the fixed-rate payer position). This valuation gain represents the exposure when calculating the counterparty risk of the interest rate swap. Therefore if the default risk of the counterparty financial institution rises while the exposure increases as a result of a decline in the interest rate, wrong-way risk causes a sharp increase in the amount of risk.

In Italy under the European sovereign debt crisis, the euro interest rate swap rate declined, increasing exposure to euro interest rate swaps. Under these conditions, the default probability of Italian financial institutions increased sharply, also as evidenced by the increase in their own CDS spreads (Chart 5). Consequently, the financial institutions that had positive exposures in interest rate swaps with Italian financial institutions experienced a sharp increase in the amount of counterparty risk from wrong-way risk.[9]

[Chart 5] Euro's interest rate swap and Italian financial institutions' CDS



Source: Bloomberg
Note: Italian financial institutions' CDS is the simple average for CDS spreads of all banks whose senior bonds are referred to as underlying assets.

Efforts to reduce risk

The recent global financial crisis has reminded market participants, regulators, and supervisory authorities of the importance of managing counterparty risk, including wrong-way risk. Thus, there has been progress toward taking measures to strengthen risk evaluation and to reduce the amount of risk.[10]

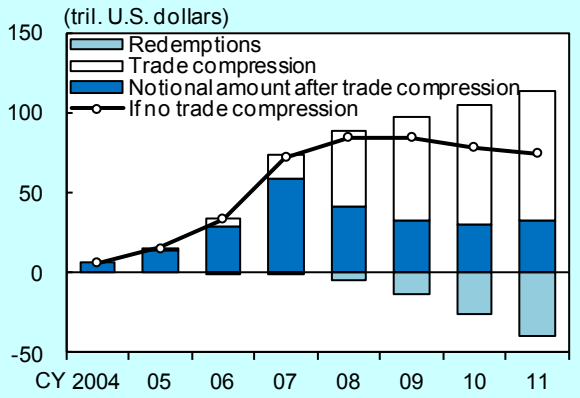
Improving collateral management

One measure aimed at reducing counterparty risk is to introduce the Credit Support Annex (CSA) between counterparties. The CSA is an agreement between two counterparties to mutually post collateral in order to provide protections for exposures. The CSA allows for a fine tuning of the collateral posted in reaction to changes in market prices and the counterparty's credit condition, making it possible to reduce exposure or the loss rate given default, two of the factors that determine the level of counterparty risk (Chart 2). This makes it possible to prevent a surge in counterparty risk. The use of CSAs has become a mainstream measure in collateralized derivative transaction.

Trade compression

The use of trade compression,[11] which reduces the amount of outstanding trades among multiple market participants, is also beneficial. This means to terminate a large number of OTC derivative transactions and compress them into (replace them with) a smaller number of contracts, even before the contracts mature. Thus, the trade compression makes it possible to reduce exposure, one of the factors that determine counterparty risk (Chart 2). By utilizing this trade compression, market participants can avoid a surge in the amount of risk even when a counterparty's default probability has increased. There has been a notable trend in the U.S. CDS market, which experienced a sharp increase in counterparty risk when Lehman Brothers failed, toward the use of trade compression to constrain exposure and thus reduce counterparty risk (Chart 6).

[Chart 6] Reduction in the notional amount of CDS by trade compression



Sources: Creditex; BIS, "Regular OTC derivatives statistics"; DTCC; TriOptima.

Notes: Data are as of end-December. The latest data of BIS statistics are as of June 2011.
"Notional amount after trade compression" is the actual notional amount market participants hold. "If no trade compression" is calculated by adding "Notional amount after trade compression" and the amount of reduction by trade compression ("Trade compression") after subtracting hypothetical amount of redemptions at maturity without trade compression ("Redemptions").

Using central counterparties

There has been a global trend toward the use of central counterparties (CCPs) for clearing standardized OTC derivatives. This centralized clearing makes it possible for individual financial institutions to transfer the counterparty risk they have directly with the counterparty to the CCPs. At the same time, the CCPs makes benefit from multilateral netting and a consequent reduction of risk.[12]

For the financial system overall, centralized clearing means the centralization of counterparty risk at the CCPs. Accordingly, the entire financial system would be gravely affected if the CCPs suffered large losses from the failure of a participating financial institution and was unable to continue providing clearing services. To avoid such a situation, the CCPs will be required to intensively manage their risks, and rules are now being put in place in the context of an ongoing worldwide dialogue over how the system should be designed.[13,14]

Credit valuation adjustment (CVA)

In addition to the above-noted measures for reducing counterparty risk itself, there are also ways to minimize the losses suffered from the realization of counterparty risk by adjusting the derivative prices by an amount commensurate with the level of the counterparty risk and setting aside reserves for counterparty risk costs. This amount is referred to as a credit valuation adjustment (CVA). It has become common in recent years for global financial institutions to base their transactions on the CVA.[15]

Conclusion: The impact of wrong-way risk on Japan's financial institutions

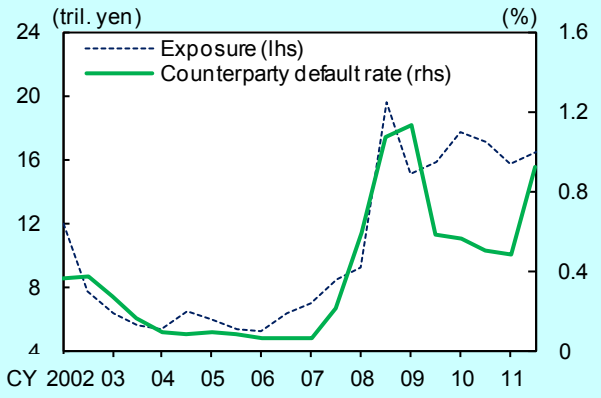
We look here at the counterparty risk related to OTC derivatives held by Japan's financial institutions. Our assessment of both exposure and default probability suggests that wrong-way risk is also an issue for Japan's financial institutions.

We note that although OTC derivatives are conducted as individual transactions, we refer here to the size of exposure using aggregates for each the five product categories (interest rate, currency, credit, equity, and commodity). We estimate default probabilities using the CDS spreads of the counterparties of Japan's financial institutions. We then use this to estimate the amount of counterparty risk for all transactions.[16] It should be noted that our

estimates here are based on various assumptions.

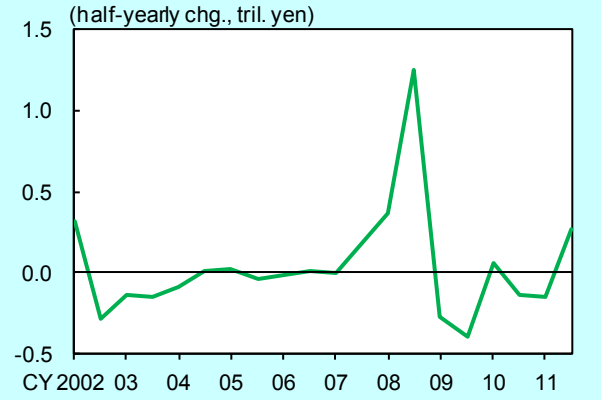
Both exposure and counterparty default probability have moved substantially in the same direction since the failure of Lehman Brothers (Chart 7). This indicates that Japan's financial institutions had been exposed to wrong-way risk. In fact, our rough estimates of counterparty risk show a sharp rise in the amount of risk brought by wrong-way risk directly after the failure of Lehman Brothers (Chart 8).

[Chart 7] Exposures and counterparty default rates



Sources: Bloomberg; BOJ, "Regular OTC derivatives statistics."
Note: Exposures are after netting basis. Major banks and securities companies are counted.

[Chart 8] Changes in the approximated amount of counterparty risk



Sources: Bloomberg; BOJ, "Regular OTC derivatives statistics."
Notes: Major banks and securities companies are counted.
Credit concentration risk for the exposure to the financial institutions is considered (default correlations are multiplied by 1.25).

Our estimates do not take into account any impact from the measures aimed at reducing counterparty risk described in the previous section, including lowering the loss rate through preservation of collateral and the use of measures to limit exposure. In this sense, our results may overestimate the amount of counterparty risk. Nevertheless, given the heightened tensions in global financial capital markets, there is no denying that Japan's financial institutions' counterparty risk from OTC derivatives could easily rise sharply through the amplifying mechanism of wrong-way risk.

For participants in OTC derivative transactions, including Japan's financial institutions, to effectively manage the counterparty risk of OTC derivatives, including wrong-way risk, with benefit from transactions in those derivatives, they must proactively introduce advanced risk management measures, including by improving their collateral management, moving to centralized clearing, and adapting the CVA.

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[1] They can also be used as a tool to obtain return given particular risk (e.g., high risk and high return).

[2] Exposures are after taking account of netting. Netting is an agreement between two parties that offsets receivables (positive market value) and payables (negative market value) to calculate a single receivable (or payable). Parties to a transaction can reduce their exposure through netting. See footnote 3 for a definition of exposure.

[3] Exposure in a derivative transaction is calculated by netting out the future expected cash flows with a specific counterparty, and if that value is positive (if money will be received after netting), is expressed as a present value. Participants with exposure may not receive the amount equivalent to that positive market value if their counterparty defaults. Consequently, exposure is also referred to as positive mark-to-market value or credit equivalent value.

[4] The value in Chart 2 is not always equivalent to accurate counterparty risk amounts. Although at the loss of some rigor, our emphasis here is making the explanation easier to understand, and we take the calculations obtained in Chart 2 as approximations (rough estimates) of counterparty risk. For more on methods to accurately calculate counterparty risk, see John Gregory, *Counterparty credit risk: the new challenge for global financial markets*, Wiley, 2010.

[5] As noted above in footnote 3, exposure is the present value of positive expected cash flow, and thus could be regarded as a call option on the derivatives. Consequently, the size of the exposure is heavily influenced not only by the future price level, but also by price volatility (width of the price distribution). To make it easy to understand the examples in this paper, however, we base our explanation on price levels.

[6] Financial institutions have substantial exposure to other financial institutions, and hedge that exposure by purchasing CDS protection from another financial institution. If demand for such hedging rises during a financial crisis, hedging costs, namely CDS spreads, increase, as does CDS exposure. For more on this, see Bank of England, "Counterparty valuation adjustment desks," *Quarterly Bulletin*, p.81, second quarter, 2010, and John Gregory, "Counterparty casino: the need to address a systemic risk," European Policy Forum, September 2010.

[7] Recently, extending credit to financial institutions in a country through reverse repo transactions collateralized by its government bonds whose creditworthiness has deteriorated significantly has also been recognized as wrong-way risk.

[8] Exposure tends to be greater for a currency swap, where principal is exchanged at maturity, than for an interest rate swap. In a currency swap, counterparty risk primarily comes

from the currency risk of the principal. For more on this, see Duffie, D., and M. Huang, "Swap rates and credit quality," *Journal of Finance*, 51 (3), July 1996.

[9] Because, in many interest rate swaps and other interbank transactions, variation margins are demanded in accordance with price changes, increases in exposure and default probability do not necessarily lead to an increase in the amount of risk. For more on how variation margining reduces risk, see the section on "Efforts to reduce risk" later in this report.

[10] This discussion is rooted in the point of view that, although wrong-way risk cannot be reduced, it can be minimized by reducing counterparty risk. For more on the importance of managing counterparty risk, see Basel Committee on Banking Supervision, "Strengthening the resilience of the banking sector - consultative document," Bank for International Settlements, December 2009; and also Singh, M., "Collateral, netting and systemic risk in the OTC derivatives market," IMF Working Paper, No.10/99, April 2010.

[11] Trade compression is conducted when the service-providing company aggregates trading data for financial institutions that want compression and uses that information to find trades that can be netted, thereby reducing the number of trades. For more on the recent trend toward trade compression in the CDS market, see Vause, N., "Counterparty risk and contract volumes in the credit default swap market," *BIS Quarterly Review*, pp. 59-69, December 2010.

[12] The Pittsburgh G20 summit in September 2009 proposed to centralize the clearing of standardized OTC derivative contracts. In response, Japan partially revised its Financial Instruments and Exchange Act in May 2010, and plans (by November 2012) to make the use of CCPs compulsory for OTC derivatives that meet certain requirements (specifically yen interest rate swaps and CDS index trades).

[13] For more on the function of CCPs and their risks, see Bank of Japan, "Payment and Settlement Systems Report 2010-2011," March 2012.

[14] In response to the global financial crisis, the BIS Committee on Payment and Settlement Systems (CPSS) and the Technical Committee of the International Organization of Securities Commissions (IOSCO) embarked on a comprehensive overhaul of global standards that apply to settlement systems, including CCPs, and in April 2012 published a new set of global standards, "Principles for financial market infrastructures." For more on this, see BIS Committee on Payment and Settlement Systems and Technical Committee of the International Organization of Securities Commissions, "Principles for financial market infrastructures," April 2012.

[15] The Basel Committee on Banking Supervision has pointed out the importance of managing the risk from large changes in CVA during the term of the contract. In its consultative document on strengthening the resilience of the banking sector published in December 2009, the Committee argued that two-thirds of losses related to counterparties during the global financial crisis were owing to CVA losses (the rest was owing to default), and that it is necessary to address this CVA risk. Under Basel III, an increase in capital commensurate with the change in CVA will be required from end-2012. For details, see Basel committee on Banking Supervision, "Strengthening the resilience of the banking sector - consultative document," December 2009.

[16] Because the actual average recovery rate on unsecured debt (according to Moody's Corporate Default and Recovery Rates, 1920-2010) is 35-50%, we assume a loss rate here of 0.6. Our exposure figures are after taking netting into account. In addition, we take our analysis of exposure by type of transaction further by looking also at type of counterparty, assuming two types: financial institutions and nonfinancial institutions. We further assume that there are two main categories of financial institution counterparties, foreign financial institutions with either a branch or subsidiary in Japan and major domestic financial institutions, and that nonfinancial institution counterparties are domestic nonfinancial companies that are referenced in a CDS index. The counterparty's average default probability is estimated from its CDS spread, etc. In this case, the risk premium is adjusted by comparing the default probability on a risk-neutral measure implied in the CDS spreads with the default probability on a physical measure obtained by reverse-engineering the amount of the bank's assets and exposure. The exposures and default probabilities thus obtained are used to calculate expected loss (EL) and unexpected loss (UL) based on methods prescribed in regulations on capital.

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