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Pre-Settlement Risk Limits for Non-Financial Counterparty in the Polish Over-the-Counter Derivatives Market

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Abstract

Theoretical background: The 2008/2009 financial crisis, the COVID-19 pandemic outbreak in 2020 or the Russian invasion of Ukraine in February 2022, all these affected market volatility causing greater interest in counterparty credit risk (CCR) management especially in the OTC derivatives market. This study investigates selected method to mitigate the CCR, namely the application of various risk limits. The research is focused particularly on the pre-settlement risk that financial institutions face after transaction conclusion until the contract's final settlement. Instead of one single limit there may be a wide range of different treasury limits (a multiple treasury limit setup) applied not only to cover the credit exposure but also to support and enhance the entire market risk management process and day-to-day operations in the financial institutions.

Purpose of the article: The paper examines treasury limits employed to manage pre-settlement risk in the Polish OTC derivatives market in the relation between financial institution and non-financial institution. The current literature on this subject includes works on various risk limits, especially in the Polish inter-bank market, however, there is still no broader view on this topic from the analysed perspective. The study indicates different pre-settlement risk limits to be applied in practice both for daily and credit-related

transactions considering multiple determinants, such as counterparty and financial instrument type, asset class or collateral form.
Research methods: Research methods comprise the analysis of guidelines and recommendations of the Polish Financial Supervision Authority as well as reports, documents and market risk management principles of selected financial institutions. Particular attention is paid to the analysis of legal backgrounds on treasury limits in Poland and bank's sources, such as master agreements, general conditions of cooperation in the field of treasury products, regulations, information brochures, etc. Selected data from the 2022 Triennial Central Bank Survey of Foreign Exchange and OTC Derivatives Market Activity in Poland is used in the context analysis.
Main findings: Different determinants of pre-settlement risk limit setup are identified and on this basis a directory of pre-settlement treasury limits is developed. The paper indicates also some challenges related to their practical application, concerning, for instance, the breaches of contractual terms (events of default), timely renewal of treasury limit or issues regarding the market risk estimation.

Introduction

Global financial market operates through interconnected institutions concluding various contracts with each other. Meeting the obligations arising from these transactions by all participants determine the market efficiency (Belmont, 2012, p. 3). Default of one party contributes to the emergence of a transmission mechanism of counterparty risk that can become systemic in the short term, as happened during the 2008/2009 financial crisis (Segoviano & Singh, 2008).[1] The 2020 coronavirus outbreak affected also market volatility complicating the risk estimation even more, not to mention deteriorating the value of already concluded derivatives. In such cases margin call clauses are triggered usually entailing the need to post additional collateral or close-out the position. The same market situation repeats when Russia invaded Ukraine on 24 February 2022. While the issue is quite well recognized in the literature on the financial risk, it remains a practical challenge, especially in times of market turbulence.

Counterparty credit risk (CCR) can be defined as a failure to fulfil obligations resulting from concluded (derivative) instruments (Regulation EU No. 648/2012; KNF, 2010). There are pre-settlement and settlement risks based on occurrence period (timing) (KNF, 2010). The pre-settlement risk relates to the potential loss on the concluded transaction as a result of market fluctuations in the period starting from deal date until the final settlement date due to, for instance, the counterparty's insolvency (default). Settlement risk is the potential loss that occurs at the contract maturity should the counterparty fail to deliver the agreed amount.

[1] Since that time the importance of counterparty credit risk management in the over-the-counter (OTC) market is particularly emphasized. A reform of the global derivatives market was initiated, aimed at reducing counterparty credit risk especially in the OTC market (*G20 Leaders' Statement…*, 2009). As initially agreed (i) all standardised OTC derivatives should be traded on exchanges or electronic platforms; (ii) all standardised OTC derivatives should be cleared through central counterparties (CCPs); (iii) OTC derivatives contracts should be reported to trade repositories (iv) non-centrally cleared derivatives contracts should be subject to higher capital requirements and (v) global standards for margin requirements on non-centrally cleared derivatives should be developed.

The study covers selected issues related to one of the ways used to mitigate pre-settlement risk in the Polish OTC market, namely the application of treasury limits (according to KNF, 2010). The main goal is to analyse determinants of treasury limits setup in a financial institution and indicate different types of pre-settlement risk limits in the OTC market required for derivative contracts concluded with a non-financial counterparty.

Pre-settlement risk limits play a crucial role in a bank. Not only do they help mitigate the counterparty's risk but also support the entire management process in the area of day-to-day treasury operations. They are used to determine the possible notional position size to a given derivative transaction (asset class) and counterparty. They set the amount of acceptable risk the bank can accept (institute's risk appetite). They indicate both the type of financial instrument available or point out the acceptable legal form of collateral. And finally treasury limits utilization informs if (or when) margin call appears and how much additional collateral should be posted in order to maintain the open position.

The investigated issue is covered in many ways. First, there is a scientific literature or studies conducted especially in finance devoted to different parts/topics/sections in that area. Secondly, there are many professional works of business and consulting nature in the financial industry on issues described in this study. Thirdly, there are various legal regulations of international, European or local/national character. The issues raised in this study are of an interdisciplinary nature. In terms of research contribution it deals with subjects on market risk estimation and VaR application approaches. In terms of practical aspects, it analyses single or multiple treasury limit setup used to manage counterparty credit exposures (handle margin call rules, etc.). It fits also into the generally applicable legal area requiring the formal establishment of treasury limits and risk management procedures/systems controlled by the market authority.

On the other hand, the paper differs from other studies because it concentrates mainly on treasury limits employed to manage pre-settlement risk in the relation between financial institution and non-financial institution, especially in the Polish OTC derivatives market. This is a very individual-specific area of a given financial institution and can be handled in various ways. The paper also aims to shed light on selected solutions to be used in practice.

The subject seems to be of particular interest for financial institutions that can identify different determinants and various concepts of treasury limit setup applied under counterparty credit risk policy. Non-financial institutions, as end-users, benefit due to expanding their knowledge and practical competences from treasury limits application in practice. Academics may recognize selected practical challenges and try to address them in their research in order to identify alternative solutions both on theoretical as well as application ground, thus, additionally emphasizing the social impact of science.

The remainder of the paper is structured as follows. The first section reviews literature on selected methods and approaches to mitigate CCR in the OTC deriva-

tives market. The second part describes the research methods and data used in this study as well as gives context analysis based on the 2022 Triennial Central Bank Survey of Foreign Exchange and OTC Derivatives Market Activity in Poland. The third section covers different treasury limit determinants and points out a directory of pre-settlement treasury limits to be applied in a financial institution. The last part tries to asses and summarize the risk limit-based approach indicating advantages and challenges. It gives also some implications and recommendations for practice as well as suggestions for future research.

Literature review

Among many approaches to mitigate the CCR, there are a few especially worth mentioning (due to common practical application), namely the trade novation with the use of a central counterparty, the application of credit valuation adjustment (CVA) and the implementation of various risk limits.

The contract's settlement mechanism with a central counterparty (CCP), most often a clearing house, is aimed at ensuring the high efficiency of settlements resulting from transactions concluded between counterparties. When transactions are centrally cleared there is a so-called transaction novation, which means that the CCP becomes the buyer to the original seller and the seller to the original buyer (Duffie & Zhu, 2011; Norman, 2011; Rehlon & Nixon, 2013; Widz, 2017, Berndsen, 2021). The counterparty risk is mitigated by multilateral netting of liabilities of parties involved in the transaction and collaterals posting in form of initial and variation margins. If one counterparty fails to deliver the payment, the other counterparty's settlements are secured by default management procedures and funds allocated for this purpose, including the clearing house's own resources.

Despite many benefits of centralized clearing, there may be some pitfalls of the system. Some researchers emphasize the systemic incentives to generate moral hazard in the case of central clearing of transactions by reducing encouragements for individual institutions to properly assess the counterparty creditworthiness (Koeppl, 2013). Other researchers stress that the trade novation does not lead to risk reduction but simply concentrating all risks within the CCP, it can become a significant point of failure generating systemic risk (Pirrong, 2012). While CCP allows mutualization of the idiosyncratic risk faced by individual institutions, it cannot provide protection against the aggregate risk that affects all institutions (Biais et al., 2012). Some researchers claim that standard risk management strategies used at CCPs overlook risk associated with crowded trades, which place severe stress on a CCP (Menkveld, 2015). Taking into account a few historical CCPs failures there may be some concerns about whether CCPs really mitigate risk or just repackage it (Gregory, 2010).

Another way to mitigate the CCR is the application of credit valuation adjustment (CVA). In this method the institution offering the transaction to its counterparty ad-

justs the contractual price by appropriate risk spread. When entering into transaction, the institution modifies the contractual price by appropriate counterparty risk amount (Brigo et al., 2013). Collecting additional revenues, an institution creates an internal default fund. As such, CVA's amount is the market value of the CCR embedded in derivative contracts. CVA includes only the adjustment to reflect the counterparty's credit quality (a one-sided CVA or just CVA) or it may include an adjustment to reflect also the financial institution's own credit quality (two-sided CVA or CVA plus a debt valuation adjustment – DVA). The CVA calculation should incorporate counterparty-specific master netting agreements and margin terms (considering the offsetting effect of collateral).[2]

Under this framework an institution is required to estimate the risk premium for each trading counterparty separately in order to reflect the counterparty's credit quality. This, however, may be very problematic in practice (Gregory, 2010; Cesari et al., 2010; Barucca et al., 2020; Banerjee & Feinstein, 2021). The CVA-based approach is also not suitable for assets traded on an exchange in which many institutions access the same quotes and liquidity (Gould et al., 2013).

Another approach to counterparty risk management is the use of various types of risk limits. They cap the maximum exposure that an institution can face from any other counterparty. The application of counterparty credit limits (CCLs) enables institutions to specify an upper bound on each of their counterparty exposures and thereby to mitigate counterparty risk by selective diversification of their exposures (Gould et al., 2017a, 2017b; Gregory, 2010). Treasury limits are granted on counterparty's request, after an appropriate credit application in a bank, usually similar to processes for working capital financing.

There are professional works of business and consulting nature prepared by financial institutions, brokerages and other companies in terms of hedging activity with the application of treasury limits (including risk profile, derivatives valuations in different market scenarios, etc.). It must be stressed that the subject of the study is a highly regulated one. There are many regulations of international, European or national character (such as Basel capital requirements, CRD, MiFID, EMIR, etc. and locally, *inter alia*, KNF, 2010) or prepared by various associations of a global nature (such as ISDA) or local ones (ZBP in Poland) that deal, to some extent, with the subject covered.

The Polish literature on this subject includes theoretical works on various risk limits, especially in the Polish inter-bank market (Zając, 2002, Konopczak et al., 2011; Mrzygłód & Szmelter, 2014; Samborski, 2015; Wybieralski, 2016). The investigated area can be handled differently among institutions. Hence, the paper intends to shed light on selected solutions in terms of treasury limit setup to manage coun-

[2] There are several types of Valuation Adjustments (VAs), including Credit (CVA), Debt (DVA), Funding (FVA), Margin (MVA), and capital (KVA); collectively they may be referred to as "XVAs" (https://www.pm-research.com/iij-glossary/valuation-adjustments-xvas).

terparty credit risk to be used in practice. It gives a broader view on this topic from the perspective of the relationship between a financial institution and a non-financial enterprise in the Polish OTC derivatives market.

Research methods

The paper concentrates on treasury limits employed to manage pre-settlement risk in the Polish OTC derivatives market in the relation between financial institution and non-financial institution.[3] The study indicates different pre-settlement treasury limits to be applied in practice both for daily and credit-related transactions as well as procedure in case of breaching certain thresholds.

The pre-settlement treasury limit is not only used to cover the counterparty credit exposure but also support and enhance the entire market risk management process in the financial institutions. Pre-settlement treasury limit is determined by the counterparty type, the derivative instrument planned to conclude (the type of transaction), underlying asset class, the transaction tenor and established collateral (including an adopted approach to margin call rule). Research methods comprise the analysis of guidelines and recommendations of the Polish Financial Supervision Authority as well as reports, documents and market risk management principles of selected financial institutions (Polish banks listed on the WSE). Based on the document analysis of legal backgrounds and guidelines on treasury limits in Poland (KNF, 2010) and bank's sources (in particular: master agreements, general conditions of cooperation in the field of treasury products, regulations, information brochures, etc.), a directory of pre-settlement treasury limits is developed.

In order to capture the relevance of the investigated area it is worth to look closer at the market structure. The context analysis is based on the results of the 2022 Triennial Central Bank Survey of Foreign Exchange and OTC Derivatives Market Activity in Poland (see Tables 1–4).

In accordance with the BIS methodology, the foreign exchange market comprises of spot transactions, outright forwards (including non-deliverable forwards), fx swaps, CIRS and currency options. Average daily turnover on the domestic foreign exchange market in April 2022 amounted to USD 13 019 million, that is an increase by almost a half as compared to April 2019. FX derivatives represent more than ¾ of domestic currency turnover (USD 9 889 million/day). Volumes increase is observed across all instruments (outright forwards, fx swaps, CIRS and options). As far as the research goal of this paper is concerned the currency derivatives turnover in the relation between residents and non-financial enterprises is in particular interest

[3] Used in practise under different terms, such as "credit lines", "pre-settlement treasury limits", "counterparty limits", "transaction limit", "counterparty risk exposure limits", etc. In this research the pre-settlement limit is defined in accordance with (KNF, 2010, p. 18 (1.6.4.a)).

(Table 2). The volumes in forwards, fx swaps, CIRS and FX options amounts to USD 932 million/day in that area, it is an increase of 42% vs previous survey (USD 657 million/day).

Table 1. Average daily turnover on the domestic foreign exchange market in April 2019 and April 2022 (in USD million)

	2019	2022	Percentage change (at current exchange rates)	Percentage change (at constant exchange rates)
Foreign exchange market	**8 864**	**13 019**	**47**	**55**
Spot transactions	2 556	3 130	22	30
Outright forwards	959	1 125	17	23
of which non-deliverable forwards	473	445	-6	-4
Fx swaps	5 190	8 551	65	74
CIRS	41	87	112	128
Currency options	118	127	8	15

Source: (NBP, 2022, p. 4).

Table 2. Average daily turnover on the domestic foreign exchange market by counterparty in April 2019 and April 2022 (in USD million)

	2019			2022		
	Resident	Non-resident	Total	Resident	Non-resident	Total
Foreign exchange market	**2 636**	**6 228**	**8 864**	**3 816**	**9 204**	**13 019**
with financial institutions	**1 221**	**6 208**	**7 429**	**1 607**	**9 133**	**10 739**
with non-financial institutions	**1 414**	**21**	**1 435**	**2 209**	**71**	**2 280**
Spot transactions	1 262	1 294	2 556	1 748	1 381	3 130
with financial institutions	505	1 281	1 786	471	1 317	1 788
with non-financial institutions	757	13	770	1 277	64	1 341
Outright forwards	702	257	959	922	202	1 125
with financial institutions	213	252	465	223	197	420
with non-financial institutions	490	4	494	699	6	705
Fx swaps	616	4 575	5 190	1 099	7 452	8 551
with financial institutions	492	4 571	5 063	897	7 451	8 347
with non-financial institutions	124	3	127	202	1	204
CIRS	7	33	41	17	70	87
with financial institutions	7	33	41	14	70	84
with non-financial institutions	0	0	0	3	0	3
Currency options	48	70	118	29	98	127
with financial institutions	4	69	73	1	98	99
with non-financial institutions	44	0	44	28	0	28

Source: (NBP, 2022, p. 5).

In accordance with BIS methodology, the OTC interest rate derivatives consist of FRA, OIS, IRS and interest rate options. The average daily turnover on the market for these instruments in April 2022 totalled USD 2 332 million and it was 10% higher than in April 2019 (see Table 3).

Table 3. Average daily turnover on the domestic OTC interest rate derivatives market in April 2019 and April 2022 (in USD million)

	2019	2022	Percentage change (at current exchange rates)	Percentage change (at constant exchange rates)
Interest rate derivatives	**2 112**	**2 332**	**10**	**21**
FRA	1 206	1 383	15	24
OIS	12	0	-100	-100
IRS	878	941	7	19
Interest rate options	16	9	-43	-38

Source: (NBP, 2022, p. 14).

Transactions with residents accounted for 14% of market turnover (USD 327 million/day, see Table 4), a 6.6% decrease vs previous survey (USD 350 million/day). The most significant market share, almost 86% of market turnover (USD 2 005 million/day, a 14% increase vs previous survey), belongs to transaction with non-residents. OTC interest rate derivatives concluded by residents with non-financial institutions amounted to USD 39 million/day in April 2022, that is a 50% increase compared to the previous survey (USD 26 million/day in April 2019).

Table 4. Average daily turnover in the domestic OTC interest rate derivatives market by counterparty in April 2019 and April 2022 (in USD million)

	2019			2022		
	Resident	Non-resident	Total	Resident	Non-resident	Total
Interest rate derivatives	**350**	**1 763**	**2 112**	**327**	**2 005**	**2 332**
with financial institutions	323	1 763	2 086	289	2 005	2 294
with non-financial institutions	26	0	26	39	0	39
FRA	**45**	**1 161**	**1 206**	**118**	**1 264**	**1 383**
with financial institutions	45	1 161	1 206	118	1 264	1 383
with non-financial institutions	0	0	0	0	0	0
OIS	**0**	**12**	**12**	**0**	**0**	**0**
with financial institutions	0	12	12	0	0	0
with non-financial institutions	0	0	0	0	0	0
IRS	**296**	**582**	**878**	**203**	**737**	**941**
with financial institutions	278	582	860	170	737	907
with non-financial institutions	19	0	19	33	0	33
Interest rate options	**8**	**8**	**16**	**5**	**4**	**9**
with financial institutions	0	8	8	0	4	4
with non-financial institutions	8	0	8	5	0	5

Source: (NBP, 2022, p. 15).

Results

In order to mitigate the market risk resulting from concluded transactions, the bank may request the counterparty to establish appropriate collateral that covers both present value (mark-to-market, MtM) of all outstanding contracts and potential future exposure (estimated market risk value computed very often similarly to the

VaR approach). The valuation of transaction portfolio is based on the current market conditions. Usually one of the following methods is used, namely (i) net present value (NPV) of all outstanding contracts or (ii) the value of reverse transactions in order to close a given position. Potential risk is determined by the respective Add-ONs.

> Required Collateral = max (MtM (positive from bank's perspective) + Add-ON (the longer transaction, the higher risk) – Pre-Settlement Limit – Additional Collateral (for instance cash); 0)

The application of pre-settlement limit reduces the amount of required collateral. However, if the MtM of non-matured transactions utilizes the whole pre-settlement limit amount and there is no additional collateral posted, the transaction should be prematurely closed.[4] The treasury limit is set upon financial and legal analysis of client's situation.[5] The counterparty should be informed about the amount of the pre-settlement treasury limit granted as well as procedure and consequences in case of exceeding/breaching it (should be confirmed by the client's written statement – KNF, 2010).

First of all, the treasury limits depend on the counterparty and transaction type.[6] Banks usually differentiate their retail counterparties by giving them a specific profile. The profile for a new client is determined mainly on the basis of the currency turnover estimates presented by the client in the application form for a treasury limit. Hence financial institution identifies counterparty as:

– importer – counterparty hedging currency risk by concluding purchase of foreign currency in forward transactions (estimated annual export to import ratio, for instance, less than or equal to 0.2),

– exporter – counterparty concluding sales of foreign currency in forward contracts (export to import ratio greater than or equal to 5),

– mixed – counterparty performing both purchases and sales of foreign currency in derivatives (relation of export to import volumes in the range of 0.2–5).[7]

The profile for already existing counterparty is verified on regular basis by checking the currency volumes and transactions concluded. In case of any discrepancies, the counterparty is asked to clarify its currency position or update its profile.

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[4] Before the margin call rule applies, bank sends a collateral report usually at the 75–95% ratio of treasury limit utilization (depends on the individual bank policy in this regard).

[5] Under the ISDA Master Agreement, a Credit Support Annex is signed that regulates and defines the credit support (collateral) for OTC derivatives. A threshold amount is indicated that is the reference value of the mark-to-market of contract above which collateral has to be posted. In other words, the threshold amount is the level of unsecured exposure that each counterparty will allow the other before any margin call is made (Deloitte, 2018). Under standard master agreements on derivative transaction of Polish commercial banks a treasury limit amount plays a similar role.

[6] This study focuses only on the pre-settlement risk limits for non-financial counterparties (interbank market is omitted). The settlement risk limits are also not taken into account.

[7] Some banks only distinguish exporters and importers, indicating the hedge ratio (covered to uncovered FX exposure).

The above-mentioned classification usually does not apply to a professional client or eligible counterparty.

In addition when granting a treasury limit, the bank divides counterparties into two groups based on the expected nature of the transactions concluded – classifying the customer status as speculating or non-speculating (hedging).[8] Assignment to one of the groups affects:

– type of treasury limit granted (including collateral requirements),[9]
– documents received by the counterparty,
– monitoring of the client's position,
– counterparty risk assessment carried out during the use of the treasury limit.

The counterparty's profile and status are determined on the basis of documentation provided in the credit process. The bank (credit analyst) may additionally request the client to provide a statement and information on treasury transactions concluded with other banks or another document justifying the non-speculative nature of the planned transaction. Moreover, the customer is usually classified according to the expected nature of the transactions concluded using an algorithm that compares the share of the customer's net- and gross-settled transactions.

The scope of financial instruments to be concluded under treasury limit should correspond to business needs or financial operations carried out or planned to be performed by the counterparty in the period for which the limit is applied. The treasury limit amount should cover the exposure arising from planned transaction usually on an annual basis using appropriate risk requirements. It may be estimated as the sum of treasury sub-limits calculated for individual transactions by multiplying the risk requirements for the relevant date (tenor) and the nominal value of the transaction (including transaction type as well). Usually limits and transactions concluded by the counterparty in other banks are also taken into account when determining the size of the treasury limit amount. It may also change, for instance, as a result of the implementation of monitoring recommendations.

The transaction type depends on underlying asset class, namely exchange rate, interest rate or commodity (Figure 1). The following sub-limits can be pointed out as part of the pre-settlement limit for a non-financial client: sublimit for currency transactions (LFX), sublimit for interest rate derivative transactions (LIR), sublimit for transactions on commodity contracts (LCM).

The product availability depends on the results of MiFID Appropriateness Questionnaire (test of instruments knowledge and trading experience).[10] Hence there are offered simple products (such as outright forwards or plain vanilla option purchase) and complex products, such as structures or strategies (including different options).

[8] This classification does not usually apply to a professional client or eligible counterparty.

[9] In some financial institutions non-hedging transaction are not allowed at all or allowed for cash collateral only.

[10] This does not usually apply to a professional client or eligible counterparty.

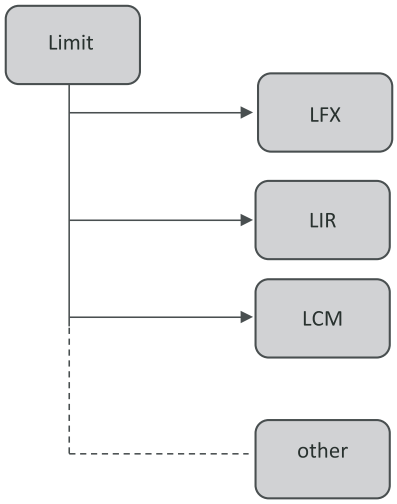

Figure 1. The breakdown of pre-settlement limits for a non-financial counterparty

Source: Author's own study.

Among many financial instruments available in the market some of them involve counterparty credit risk (see Table 5). Cash transaction usually do not require collateral (in form of treasury limit). For instance, spot foreign exchange or term deposits concluded for cash only are free from this risk. Before a transaction is concluded, a corporate dealer verifies the amount of funds available in the counterparty current account and if sufficient only then can the transaction be confirmed. As for derivative instruments, most of them generate counterparty risk with a few exceptions such as option purchase with premium payment on the deal date. However, when the premium is shifted to the option maturity then a treasury limit is required.

Table 5. Financial instrument type vs counterparty risk

Financial instrument	Instrument type	Does it involve counterparty risk?	Is treasury limit required?
Cash instruments	Term deposit, structured investment deposit, spot foreign exchange, etc. (for cash only)	N	N
Derivatives	Long positions in options (FX, IR, CM). Premium paid in advance (on deal date)	N	N
Derivatives	Other options (FX, IR, CM), outright forwards, foreign exchange swaps, FX structures, currency swaps, interest rate swaps, forward rate agreements, exotic derivatives, etc.	Y	Y

N – "no", Y – "yes"
Source: Author's own study.

Collateral type for treasury limits for non-financial customers is set after creditworthiness assessment in accordance with the credit methodology used for respective counterparty (business line: small, medium or large companies). The treasury limit

may be unsecured or secured. The latter can be in cash (such as financial pledge or a deposit blocked) or in a non-monetary form.

For each of the treasury limits it is possible to set time sublimits, which determine the maximum credit exposure in a given time period/tenor (for instance, transactions up to 1 month, up to 1 year or transactions over 1 year). Time limits depend usually, *inter alia*, on underlying assets, namely for interest rate risk hedging – the limit tenor corresponds to/matches tenor (maturity) of transaction concluded with the bank (for instance, up to 5–10 or more years). For daily transactions used for currency risk hedging very often shorter limit tenors apply (for instance, up to 1–2 year). The treasury limit expiry date for a given counterparty is recorded in the bank's system. After its expiry, if a non-financial client has positions requiring a treasury limit, the procedure of supplementing the required collateral is initiated (margin call rule applies). If the limit expires, it is not allowed to enter into new transactions or rollover existing ones. Usually it is possible to close open positions.

Taking into account the above-mentioned criteria, a list of applicable pre-settlement treasury limits can be prepared. They consider the type of counterparty, derivative instrument, underlying asset class as well as the form of collateral set for the treasury limit (see Table 6). The catalogue of treasury limits is an open source meaning it may be expanded with the addition of new types of instruments, underlying assets, collateral forms (for instance, mixed forms). In addition to the above-mentioned types of treasury limits, there may be other specific limits as well, such as technical ones (used in emergency situations). It may be granted with the approval of the relevant committee for a specific period (e.g. no longer than 1 month). This limit is granted to counterparties whose current treasury limit expired or has not been renewed on time. Technical limit usually allows the counterparty to conclude reverse transactions in order to close open positions. No new trades or no rollovers are allowed.

Table 6. Pre-settlement treasury limits directory

No.	Name	Asset class	Collateral type	Instrument scope	Collateral
1	AL_COL	AL	COL	All instruments	Collateral in advance
2	AL_CTR	AL	CTR	All instruments	Current collateral
3	AL_USE	AL	USE	All instruments	Unsecured
4	FI_COL	FI	COL	FX Forward & Interest Rate Instruments	Collateral in advance
5	FI_CTR	FI	CTR	FX Forward & Interest Rate Instruments	Current collateral
6	FI_ USE	FI	USE	FX Forward & Interest Rate Instruments	Unsecured
7	FC_COL	FC	COL	FX Forward & Commodity	Collateral in advance
8	FC_CTR	FC	CTR	FX Forward & Commodity	Current collateral
9	FC_ USE	FC	USE	FX Forward & Commodity	Unsecured
10	FW_COL	FW	COL	FX Forward	Collateral in advance
11	FW_CTR	FW	CTR	FX Forward	Currentcollateral
12	FW_ USE	FW	USE	FX Forward	Unsecured
13	FX_COL	FX	COL	All FX instruments	Collateral in advance
14	FX_CTR	FX	CTR	All FX instruments	Current collateral

No.	Name	Asset class	Collateral type	Instrument scope	Collateral
15	FX_ USE	FX	USE	All FX instruments	Unsecured
16	IR_COL	IR	COL	Interest rate	Collateral in advance
17	IR_CTR	IR	CTR	Interest rate	Current collateral
18	IR_ USE	IR	USE	Interest rate	Unsecured
19	IC_COL	IC	COL	Interest rate & Commodity	Collateral in advance
20	IC_CTR	IC	CTR	Interest rate & Commodity	Current collateral
21	IC_ USE	IC	USE	Interest rate & Commodity	Unsecured
22	C_COL	TW	COL	Commodity	Collateral in advance
23	C_CTR	TW	CTR	Commodity	Current collateral
24	C_ USE	TW	USE	Commodity	Unsecured
25	XI_COL	XI	COL	All FX and Interest Rate instruments	Collateral in advance
26	XI_CTR	XI	CTR	All FX and Interest Rate instruments	Current collateral
27	XI_ USE	XI	USE	All FX and Interest Rate instruments	Unsecured
28	XC_COL	XC	COL	All FX and Commodity instruments	Collateral in advance
29	XC_CTR	XC	CTR	All FX and Commodity instruments	Current collateral
30	XC_ USE	XC	USE	All FX and Commodity instruments	Unsecured

Source: Author's own study.

A special department in a bank (treasury back office) is responsible for treasury limit implementation into the system. The limit is introduced after receiving confirmation of signing the framework agreement and fulfilment of the conditions contained in the credit decision. The required data includes:

– counterparty details,
– customer profile (for a retail customer),
– customer status (for a retail customer),
– the treasury limit amount,
– treasury limit type and product scope,
– time sublimits (if defined) and amounts for individual sublimits,
– period or expiration date of treasury limit,
– list of collaterals for the treasury limit along with their value and allocation to the product,
– additional terms and conditions.

The application of different treasury limits in a financial institution makes it much easier for corporate dealers to conclude the proper and adequate contracts with a given counterparty. Checking the limit type and its utilisation it is very easy to choose the financial instrument and determine acceptable risk exposure (thus, notional position size) as well as collateral type. After contracts conclusion, the treasury limits utilisation is carried out on a regular basis. The daily review consists of reports on limits utilisation and additional collaterals for all counterparties that have open positions in any derivatives. In case any threshold is breached, the proper action is undertaken (see Table 7).

Table 7. Procedure in the case of breaching certain levels of treasury limit amount*

Utilisation ratio of treasury limit amount	The steps to be taken
80%**	– information on 80% ratio of the treasury limit utilization is prepared as well as a request to establish additional collateral in cash form (margin) – no new transactions or roll-overs under treasury limit are allowed (the possibility of using a treasury limit for new derivatives is temporally blocked; it may be restored when treasury limit utilisation falls back below this level, namely when the current value of concluded instruments will change accordingly) – the counterparty may only conclude reverse trades aimed at closing existing open positions (or shortening/terminate non-matured contracts) – the client's case is immediately presented to the relevant committee along with an analysis of economic and financial situation backed by the recommendation of a further strategy in the event of additional deterioration of the transaction valuation – strategies for next steps may include: 1) application for increasing the treasury limit amount 2) closing the client's all or selected open positions 3) posting additional collateral for existing exposures in cash collateral (margin) or establishing other acceptable collateral (may require a credit decision) 4) setting a stop-loss order
100%	– A close-out decision of client's position is made. In justified/certain cases, this decision may be delayed, provided that: there is a contact with the counterparty, the client declares posting cash collateral (additional margin) and the client accepts the stop-loss order at a certain level (for instance, not higher than 130% of treasury limit amount). – After receiving approval for early closing/termination of the transaction, it will be closed by a dealer. The counterparty receives an appropriate confirmation of the early settlement of the transaction.

*Does not apply to limits without margin call.

**This depends on individual bank policy in this regard.

Source: Author's own study.

Discussion

There are many advantages of the risk management approach based on the pre-settlement limits, however, several shortcomings should be pointed out. A significant challenge is related to the market risk assessment. Usually the estimation of this parameter (reflected in Add-ONs) is based to some extent on historical data (time series), assuming repetition in the future. This means that probably in the crisis conditions characterized by higher volatility, the pre-settlement risk will not be properly valued. The described situation is particularly difficult if allocated treasury limit is fully utilised on the deal date (especially in the long term non-flexible instruments). This topic is quite well recognized in the literature on finance but it is still a practical challenge (Wybieralski, 2021). Hence, it is always recommended carrying out an additional scenario analysis in search for exchange rates at which the available treasury limit is fully used. Then, it is possible to prepare various preventive actions, such as an increase in the treasury limit amount, preparation of additional funds for collateral or partial modification of concluded contracts. An appropriate foreign exchange risk management policy with regard to the selection of financial

instruments is particularly important. In this context, flexible contracts should be also taken into account (allowing participation in positive exchange rate movements). They are characterized by a different risk profile and a lower impact on the treasury limit utilization (compared to fixed ones – see Wybieralski, 2014, 2015a, 2015b). In some cases (rarely), treasury limits with "no margin call" clause are offered. This rule means a permanent suspension of the client's calls to supplement or establish collateral (usually in this case increased risk Add-ONs apply).

Treasury limits are granted for a specific-time period. Depending on the financial institution, a derivative transaction should be concluded within the treasury limit tenor, some institutions, however, allow longer transactions maturing over treasury limit tenor. In this case it is important to timely start the renewal process. Furthermore, it should be also taken into account that this application will be based on the current financial results of the enterprise (financial standing) which may deteriorate. In such conditions the treasury limit amount may change or it will not be granted again. It is also important to recognize well all events of default indicated in master agreements. If breached, a financial institution is entitled to unilaterally close-out the open position. Hence it is worth clarifying them at the very beginning in order to avoid any misunderstanding in the future.

Conclusions

The paper concentrates mainly on treasury limits employed to manage pre-settlement risk in the relation between financial institution and non-financial institution in the Polish OTC derivatives market. The pre-settlement treasury limits act as a mitigant of the counterparty credit risk starting from deal conclusion until the transaction settlement date. They play a crucial role for day-to-day treasury operations in order to determine the size of the open position in the contracts and the risk exposure a bank can accept. Instead of one single pre-settlement limit for all derivative instruments there may be a wide range of different treasury limits applied in order to support, simplify and control the entire market risk management process in financial institutions. This area can be handled differently in a given financial institution. In this study a selected solution is introduced to be used in practice. This study highlights the determinants of treasury limits setup in a financial institution and develops a pre-settlement limits directory to be applied. It is an open catalogue that can be supplemented or extended when adding or modifying various factors, such as collateral type, counterparty, asset class, instrument type, etc. The topic is particularly important for financial institutions that can identify different determinants and various concepts of treasury limit setup applied under counterparty credit risk policy. Non-financial institutions may benefit from a deeper insight and awareness surrounding practical challenges of treasury limits application, such as breaches of contractual terms (events of default), timely renewal of treasury limit or issues regard-

ing the market risk estimation. Academics may identify practical issues and address them in their researches in order to identify alternative solutions both on theoretical as well as application ground, thus emphasizing the social impact of science. Interesting subject relates, for instance, to the treasury limit utilization schemes, which may assume fixed risk requirements (Add-ONs) over the lifetime of the contract or decreasing risk weights with time decay. Another research topic may relate to margin call policy of a given financial institution. It can be observed in some institutions that margin call is triggered when the ratio of treasury limit utilisation is approaching a certain threshold (for instance, 90–95%). In other institutions, however, additional collateral should be posted when the current exposure exceeds both the amount of treasury limit granted together with minimal transfer amount. The question arises whether financial institutions using the latter system apply a lower confidence level to market risk estimation models? These issues also require further investigation.

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