Robust and resilient:

FX in times of (poly) crisis

CLS, which runs the settlement engine for the foreign exchange (FX) market, processes around USD6.5 trillion of payment instructions every day. Since its creation in 2002, CLS has successfully served its main purpose of mitigating FX settlement risk in the market, providing reliable business as usual service even during unusual times. This paper looks under the hood of the CLS engine, with a particular focus on operations during market turbulence.

18 business days, 5-hour operations, zero balances

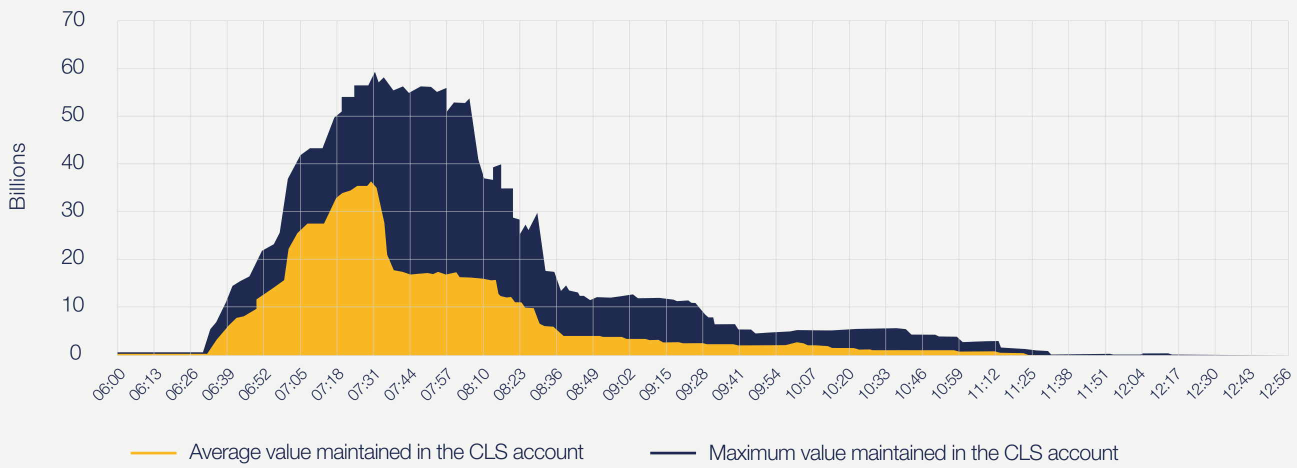
The CLS operating model is unique in its design. CLSSettlement is a multicurrency settlement system that supports 18 currencies.[1] For payments to and from CLS, it draws on the RTGS (real-time gross settlement) systems of the corresponding central banks in the respective jurisdictions.[2] The CLSSettlement system spans multiple time zones, and it operates over a five-hour window (07:00 to 12:00 CET) during which the 18 RTGS systems have overlapping processing hours.[3 4]

By design, CLS therefore runs 18 business days in less than half a day, with the actual settlement phase *de facto* requiring less than two hours (i.e., finishing before 09:00 CET). Participants inject money ahead of and during the settlement session, and all funds are re-distributed by the end of the session (figure 1).[5] Consequently, account balances in CLS revert to zero at the end of the business day, and CLS does not hold overnight balances.[6]

The sum of the daily payment instructions in CLSSettlement totals approximately USD6.5 trillion. However, the actual liquidity that needs to be mobilized via the RTGS systems is only a fraction of this amount. Multilateral netting and additional optimization tools reduce funding needs by around 99%, so only around USD65 billion of liquidity is actually required for a successful settlement day.[7]

The hugely positive impact of CLS's liquidity optimization on the FX ecosystem is reflected in the CLS-related traffic channeled through the 18 RTGS systems. The share of CLS-related business in one currency represents around 0.5% to 1% of the domestic RTGS system's overall traffic (figure 2).[8] If there were no netting and CLS transaction values had to be mobilized on a gross basis, CLS-related business would substantially increase RTGS system traffic, in some cases even doubling the RTGS system processing values.[9]

Figure 1: **Funds maintained by CLS, 2022 data**



Source: CLS

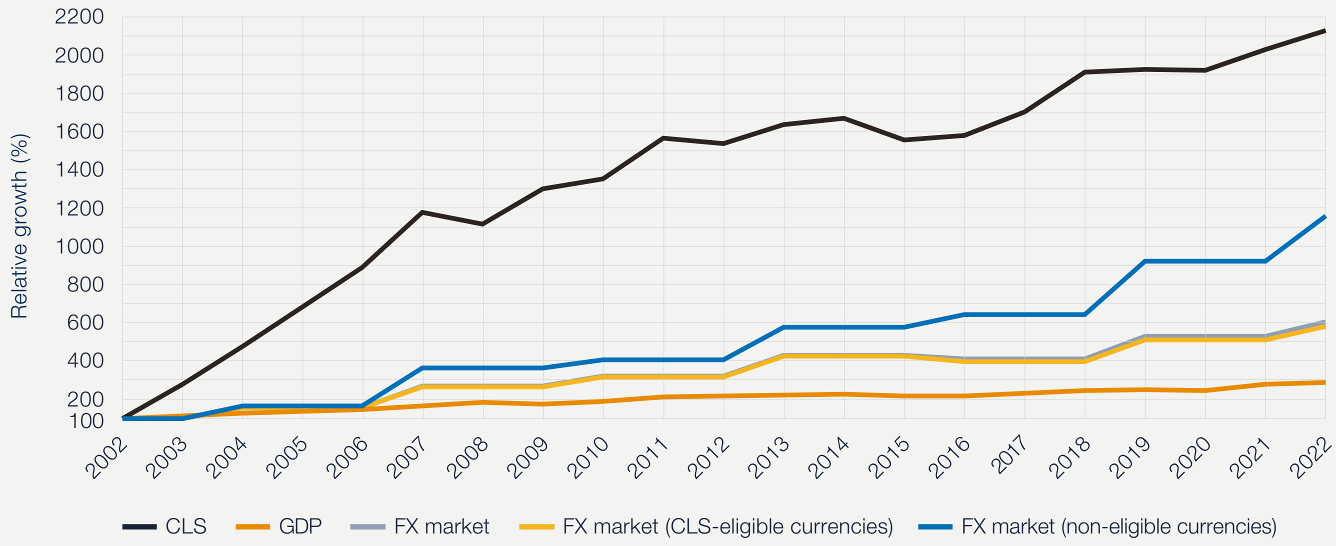
Figure 2: **CLS-related traffic channeled through RTGS systems**

Currency	Average daily value (in USD) processed through RTGS system (2022)	Average daily value (in USD) settled through CLS (2022)	Average daily value sent via respective RTGS systems (in USD) to CLS (1%)	CLS % contribution to average daily RTGS value (net)
USD	4,241bn	2,910bn	29,10bn	0.7%
EUR	2,331bn	1,180bn	11.80bn	0.5%
JPY	1,425bn	561bn	5.61bn	0.4%
GBP	489bn	523bn	5.23bn	1.1%

Source: CLS

1 The 18 CLS-eligible currencies are: AUD, CAD, CHF, DKK, EUR, GBP, HKD, HUF, ILS, JPY, KRW, MXN, NOK, NZD, SEK, SGD, USD and ZAR.
2 See also BIS (2008). How CLS works – a simplified example, Quarterly Review September.
3 For details, see Shaping FX // 01 The FX ecosystem, Taking a central role: Cause and FX.
4 Beyond the 5-hour window for CLSSettlement operations, the system also provides a 24-hour trade capture and matching service for the payment instructions on underlying FX trades.
5 The 'maximum value' shown leaves out the very top 1% in each minute and thus does not reflect unrepresentative outlier days where pay-outs had to be delayed.
6 However, in very exceptional circumstances where all pay-outs cannot take place on the day, some accounts may not revert to zero. In such rare cases, CLS may hold an overnight balance.
7 For details, see Shaping FX // 03 The FX ecosystem, Liquidity benefits: Do (not) settle for less.
8 Data taken from Fedwire Funds Service – Annual Statistics (frbservices.org), CHAPS | Bank of England, pboj230731a.pdf (BoJ report 2022), TARGET Annual Report 2022 (europa.eu)
9 For example, the funding submitted to the UK RTGS system (CHAPS) would increase from an equivalent of USD5.23 billion per day to USD523 billion and lead to a doubling of processed values (from USD489 billion to USD1,007 billion).

Figure 3: **CLS evolution relative to GDP and the FX market growth**



Source: BIS Triennial central bank survey, CLS, World development indicators database

Reaching saturation point?

Over its early years of existence, CLS saw steep growth in CLSSettlement volumes (from USD0.3 trillion per day in 2002 to USD4 trillion per day in 2008) as a large share of previously unprotected FX settlement shifted to the service. In recent years, turnover has continued to increase, but it now largely follows overall economic growth rates (figure 3) because CLS's risk mitigation for eligible currencies is reaching its saturation point.

Over the last decade, as CLS non-eligible currencies gained ground, growth in CLS traffic has been increasingly outpaced by FX market growth. FX trades in the 18 CLS currencies increased by around 30% over this period, while trading in non-eligible (primarily emerging market) currencies doubled over the same timeframe.[10] This development clearly calls for action, and work is ongoing in the context of the G20 Cross-border Payments Roadmap, a multi-year public/private initiative.[11]

[10] FX trades in CLS-eligible currencies (counting each currency leg): USD10.0 trillion in 2013 / USD13.7 trillion in 2022; FX trades in non-CLS eligible currencies: USD0.6 trillion in 2013 / USD1.3 trillion in 2022.
[11] For details, see Shaping FX // 01 FX Policy, The G20 cross-border roadmap: Navigating the FX lane.

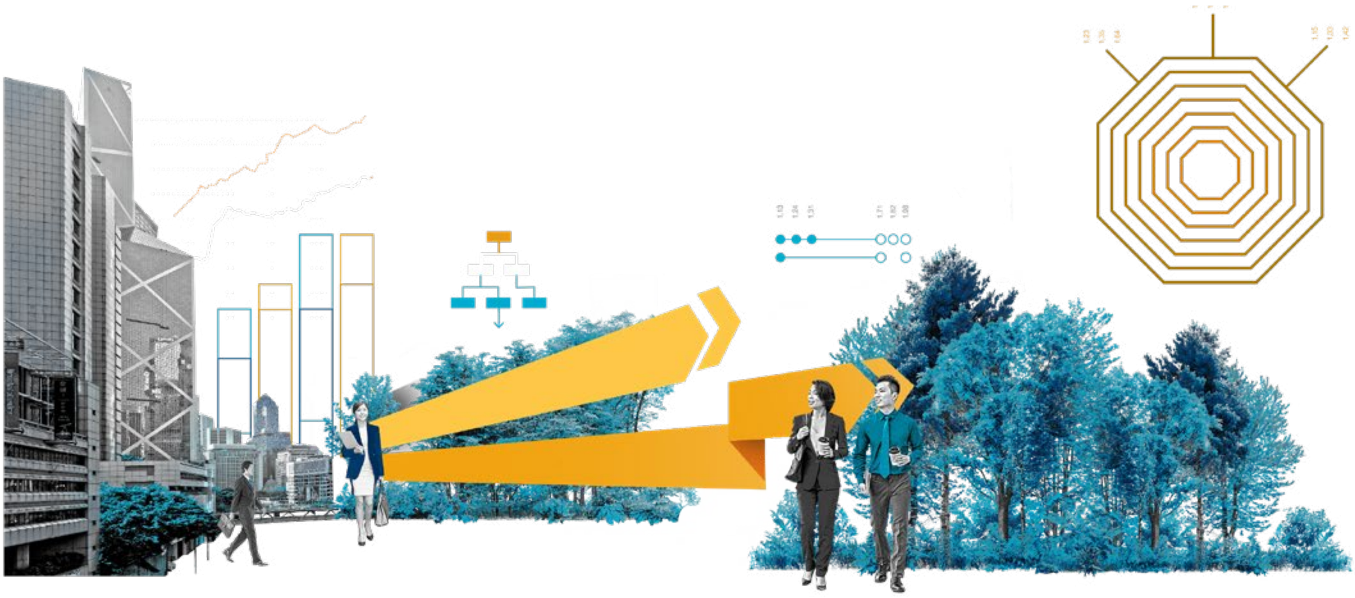
Anchor in stormy times

The recent past is characterized by repeated market turbulence, either caused by economic events (such as the global financial crisis of 2007-2008 and the more recent Credit Suisse rescue) or non-economic shocks (e.g., the Covid-19 pandemic and war in Ukraine). These events, alongside the risk of irreversible global warming, have led commentators to describe today's world as on the brink of 'polycrisis'.[12]

These triggers, whether domestic[13] or cross-border in nature, can create a ripple effect across the global FX market that quickly changes currency prices. In fact, the FX market is quite sensitive to external events and subject to considerable volatility.[14] At the same time, the FX market is normally very liquid, at least with respect to major currency pairs, which minimizes the risk of erratic fluctuations.

Historically, FX market turnover increases in tandem with volatility. In times of elevated uncertainty and risk, market participants create additional traffic by adjusting positions to hedge risk. Specifically, inter-dealer trading tends to increase, and derivatives business appears to shift towards shorter maturities.[15]

Times of stress and uncertainty are clearly visible in CLSSettlement traffic, though it might not always directly mirror FX trading activity. This is due to payment obligations from derivatives that partially materialize weeks or even months after the underlying trade.



The collapse of Lehman Brothers and the global financial crisis of 2007-2008

In the second half of 2008, the global financial crisis that began in the US in 2007 intensified and spread across the globe. Markets froze as a growing list of large financial institutions failed.[16] In September, the collapse of Lehman Brothers ushered in the largest bankruptcy in US history. Immediately following Lehman's bankruptcy announcement, the interbank lending market dried up, and governments had to step in to provide liquidity and guarantee deposits.[17]

Yet the FX market remained vibrant (box and figure 4). Indeed, the volume in the FX market grew considerably due to the increased volatility in exchange rates. Consequently, market infrastructures like CLS processed unprecedented volumes.

[12] Polycrisis is "a cluster of related global risks with compounding effects, such that the overall impact exceeds the sum of each part"; see World Economic Forum (2023). The Global risks report. The term 'polycrisis' was coined by the French social scientist Edgar Morin in 1999.
[13] Beyond global developments as described in this white paper, various regional and national events led to volatility increases that were clearly visible in CLS traffic; for example: the Swiss National Bank's abandonment of the minimum exchange rate of CHF1.20 per euro in January 2015; the Brexit vote in June 2016; and the US presidential elections in November 2016.
[14] Melvin, M., Taylor, M. (2009). The crisis in the foreign exchange market, CESifo working paper No. 2707; Bech, M. (2012). FX volume during the financial crisis and now.
[15] Drehmann, M., Sushko, V. (2022). The global foreign exchange market in a higher-volatility environment, BIS Quarterly Review December 2022.
[16] Most notably, Bear Stearns collapsed and was acquired by JPMorgan Chase in March 2008. By the summer of 2008, IndyMac Bank became one of the largest banks ever to fail in the US, and the county's two biggest home lenders, Fannie Mae and Freddie Mac, had been seized by the US government.
[17] ECB FX Contact Group and Operations Managers Group (2009). Report on Operational Lessons From the Demise of Lehman Brothers in Autumn 2008, March 2009.

Under the magnifying glass: CLS traffic in 2008

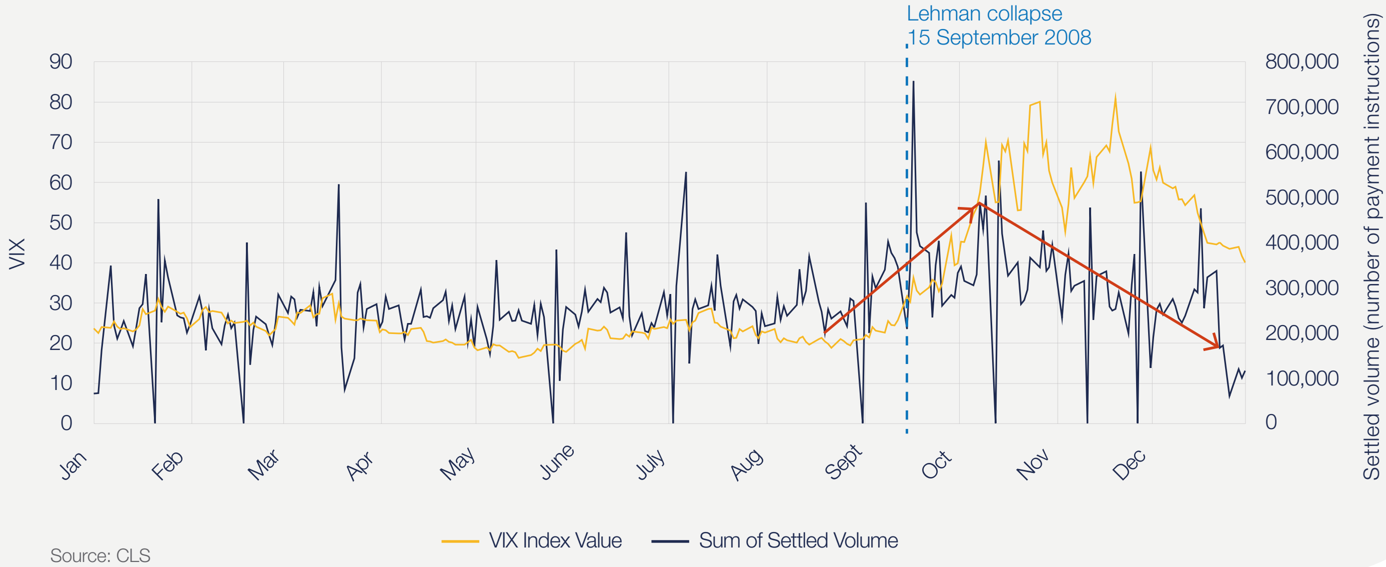
In the aftermath of the Lehman Brothers collapse on 15 September 2008, the volatility in the global financial market reached unprecedented levels. The VIX 'fear index',[18] which under normal market conditions ranges between 10 and 30, climbed to a historic peak of 80.86 on 20 November 2008.[19]

CLS saw extraordinarily high settlement volumes during this time, as shown in figure 4.[20] In the midst of this global crisis and at the peak of the freeze in interbank lending, the direct market reaction to the Lehman Brothers collapse was clearly visible in CLS on 17 September 2008 (two days later, since FX spot settlement occurs T+2, i.e., two business days after the trade).

This date coincided with the International Money Market (IMM) quarterly date,[21] when processing volumes and values are already typically very high. With ca. 750,000 settled transactions (and a total value of USD4.3 trillion), CLS traffic was around 40% higher than on a normal IMM date.[22]

The volatility in daily CLS settlement volumes increased after the Lehman Brothers collapse, and this is mirrored by the rise in the VIX. While CLS volumes and the VIX show similar trends around the Lehman Brothers bankruptcy, it appears that CLS volumes started to increase earlier (albeit on a more moderate path) than the VIX, and also began their decline ahead of the VIX. This phenomenon may warrant further detailed analysis.

Figure 4: **VIX and CLSSettlement volume 2008**



Source: CLS

The fact that Lehman Brothers settled its FX trades through CLS was crucial. Although there was uncertainty as a result of its bankruptcy filing, Lehman's participating entity[23] safely settled in CLS, and the CLS system proved successful. Despite the interconnectedness of the markets, the failure of one large institution did not cause severe disruption throughout the entire ecosystem. Put simply, the Lehman crisis was not a Herstatt crisis. Instead, CLS effectively demonstrated that it could achieve its design objectives, i.e., to prevent a systemic crash by removing principal risk.

"Given the significant increase in counterparty risk in the last two years, it does not require much imagination to picture what would have happened without CLS. Many trading partners would have feared (in some cases, rightly) that their business partners would not meet their obligations. This would have caused them to be wary of concluding any foreign exchange transactions at all. The associated drop in market liquidity would have significantly impacted banks' liquidity management and impaired the management of currency risk, with potentially devastating consequences."

Philipp M. Hildebrand, Vice Chair of the Governing Board, Swiss National Bank, Lessons From the Crisis for Global Financial Market Infrastructure, August 2009

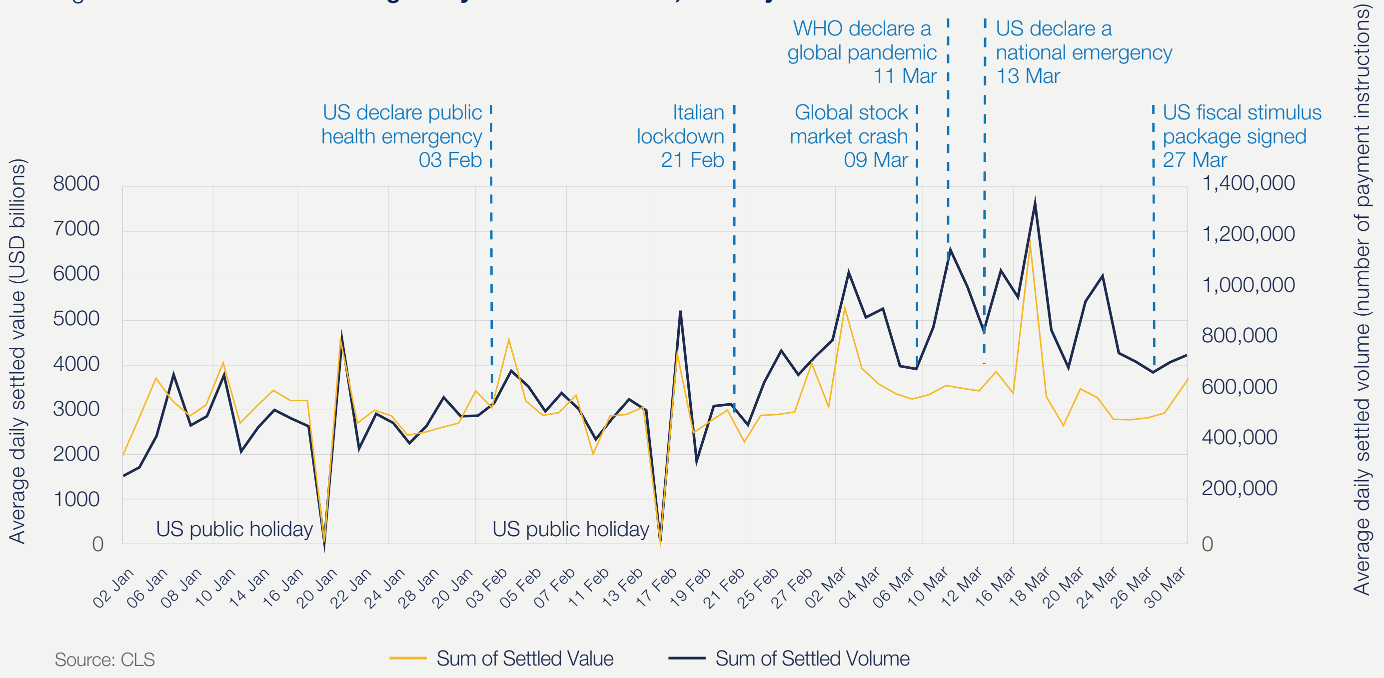
[18] The Chicago Board Options Exchange's Volatility Index (VIX) is a popular measure of the stock market's expectation of volatility over the next 30 days based on S&P 500 index options.
[19] See Securities Industry and Financial Markets Association (2020). The VIX's wild ride, SIFMA insights spotlight.
[20] Note that on US bank holidays, traffic is often down to less than 1%, owing to the USD dominance in the FX market. The day after US bank holidays, traffic normally spikes to levels above the quarterly IMM date peaks.
[21] IMM dates are the four quarterly dates of the year (third Wednesday of March, June, September and December) when futures and option contracts mature or terminate.
[22] There was a 43% increase when comparing 2007 to 2008, followed by a 33% drop from 2008 to 2009 (19/09/2007: 429,970 transactions, 17/09/2008: 757,187 transactions, 16/09/2009: 505,762 transactions).
[23] The entity was a User Member which utilized Citigroup as its Designated Settlement Member to settle its FX transactions.

Covid-19 pandemic 2020-2022

The more recent Covid-19 pandemic presented a new test for the post-financial crisis economy. Beginning in late February and early March 2020, lockdowns imposed to curtail transmission led to an abrupt drop in productive economic activities. Containment and social distancing measures further reduced the demand for goods and services. As the pandemic spread, uncertainty rose, and equity markets came under stress. Central banks reacted quickly, using a range of measures to stabilize financial markets and prevent the pandemic from turning into a new financial crisis.[24]

Fear and uncertainty brought high volatility in the global markets, which again translated into sharp increases in CLS processing volumes. As in the global financial crisis, banks turned to CLS knowing their FX trades would settle on time and with finality.[25] The market turmoil in the early stages of the Covid-19 pandemic again underscored the critical role that financial market infrastructures like CLS play in the global economy.

Figure 5: **CLSSettlement average daily value and volume, January – March 2020**



Source: CLS

Under the magnifying glass: CLS traffic in Q1 2020

Between the Italian lockdown (21 February 2020) and the US stimulus announcements (27 March 2020), CLS traffic increased sharply. In March 2020, the average value of payments settled daily totaled close to USD7 trillion – about 20 percent higher than normal.[26]

It is noteworthy that volumes and values, which normally move in sync, diverged following the start of the Covid-19 pandemic. This can be explained by a relative growth in low value spot trades, which tend to increase in times of economic uncertainty when market participants need to move money and balance positions within short time frames. Under normal circumstances, spot trades represent around 90% of the CLS settlement volume (and 15% of settled value),[27] while in March 2020 this figure grew to 95%.

As the graph shows, volumes and values spiked on 18 March 2020, with around 1.3 million transactions (around 75% higher than the volume processed on the peak day of the global financial crisis on 17 September 2008) having a total value of almost USD6.7 trillion.

This was shortly after jurisdictions around the globe began to implement shutdowns to prevent the spread of Covid-19 and the VIX 'fear index' surpassed the levels reached during the global financial crisis (82.69 on 16 March 2020 as compared to 80.86 on 20 November 2008). It furthermore coincided with the quarterly IMM date when traffic is already comparably high.

It is also worth noting that the high volumes on 11 March 2020 cannot be a direct response to the WHO declaring the Covid-19 outbreak a pandemic. As spot trades are in most cases settled T+2, CLS traffic normally lags market events by two days. It is therefore more likely that the peak on 11 March 2020 is the result of the global stock market crash on Monday, 9 March 2020. Similarly, the two stock market crashes on Thursday, 12 March 2020 and Monday, 16 March 2020 produced spikes in CLS settlement volumes two business days later on 16 and 18 March 2020, respectively.

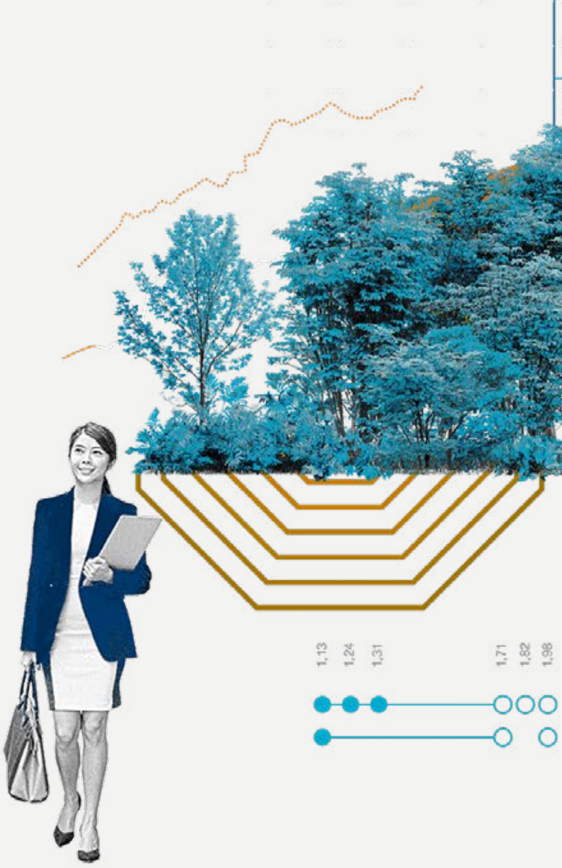
During the Covid-19 pandemic, CLS not only had to cope with exceptionally high volumes, but also had to close its offices in London and New York to all but critical staff for settlement operations. None of this disrupted the services CLS provided.

[24] Cantú, C., Cavallino, P., De Fiore, F. & Yetman, J. (2021). A global database on central banks' monetary responses to Covid-19, BIS Working Papers No 934.
[25] Marc Bayle de Jessé (2020). Views on the Covid-19 crisis impacts, Eurofi, April 2020.
[26] For further details, see: cls-group.com/insights/fx-global-landscape/clsmarketdata-insights-around-covid-19/
[27] While FX swaps and outright forwards represent 10% of the settled volume and 85% of the settled value; 2022 average data.

The new normal? Market infrastructures in times of crises

Today's world is characterized by national crisis events of economic and non-economic nature which, in a fast-paced interconnected world, can quickly lead to global contagion. Moreover, these crises increasingly seem to converge and potentially amplify one another. Once a theoretical possibility, 'polycrisis' has become a reality. Robust and resilient financial market infrastructures have never been more important.

CLS's unique settlement mechanics and its risk mitigation and liquidity savings benefits have been widely recognized. While it directly serves the FX market, any larger disruption could potentially impact the wider financial ecosystem. Since its go-live in 2002, CLS has reliably delivered its services through good times and bad. As the post-trade backbone of the FX market, CLS has helped – and continues to help – the global financial ecosystem to weather all crises.



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