DTCC

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SEPTEMBER 2018

THE NEXT CRISIS WILL BE DIFFERENT

OPPORTUNITIES TO CONTINUE ENHANCING FINANCIAL STABILITY 10 YEARS AFTER LEHMAN'S INSOLVENCY

A WHITE PAPER TO THE INDUSTRY

TABLE OF CONTENTS

FOREWORD 1

EXECUTIVE SUMMARY 2

POST-CRISIS RESILIENCE 4

MACROECONOMIC RISKS 10

MARKET-RELATED RISKS 13

TECHNOLOGY-RELATED RISKS 16

CONCLUSION 19

BIBLIOGRAPHY 20

FOREWORD

The 10th anniversary of the Lehman insolvency marks a fitting milestone to reflect on the dramatic changes that have transformed global financial markets and risk management over the last decade. But looking back is not a nostalgic exercise. Rather, it is a necessary undertaking to understand how the markets and risk itself have evolved so that the industry is better prepared to prevent or mitigate the impact of future events that could have global systemic implications. That is our goal in this paper.

Despite the many enhancements to financial stability that have been implemented since 2008, the nature of risk has morphed dramatically. Some of the most dangerous and challenging risks we face today barely registered or didn't even exist on the morning of September 15 when Lehman filed for Chapter 11 bankruptcy and the financial system began to melt down.

The emergence of flash crashes in major markets, as well as the creation of digital currencies and other crypto-assets, are just two examples of new developments that are requiring us to rethink all aspects of risk management. They also illustrate the possibility that the next crisis might be fundamentally different than anything we can envision right now, triggered by new types of risks that didn't exist 10 years ago or even today.

In this dynamic environment of constant change, the risk management function has evolved to keep pace with and, at times, stay ahead of the risk curve. Shortly after the Lehman insolvency, DTCC established its Systemic Risk Office (SRO) to complement our existing risk disciplines by adding a specific focus on interconnectedness risk, as well as internal and external sources of systemic risk.

The SRO's mandate also includes the promotion of systemic risk awareness and mitigation across the global financial industry – through white papers and other industry outreach initiatives.

Recognizing that "fighting the last war" won't adequately prepare us for the next crisis, we have developed this paper to raise awareness of key risks facing the industry and have provided a series of forward-looking opportunities to help strengthen financial stability for the future.

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We very much look forward to your thoughts and feedback on these ideas.

EXECUTIVE SUMMARY

Over the past decade, the financial industry has made substantial progress in strengthening global market stability and enhancing resilience. Financial firms have deleveraged significantly and banks have strengthened their capital structure. During this same period, supervisors have dramatically increased requirements designed to create a more robust financial ecosystem. Central bankers have skillfully applied monetary policy tools to mitigate the impact of the crisis while keeping inflation in check. While this delicate balancing act has been successful so far, it has required unprecedented asset purchases and pushed interest rates to historically low levels in large parts of the world – leaving significantly less ammunition to fight another crisis with monetary policy tools.

Despite significant efforts to improve **post-crisis resilience**, which are covered in the first section of this paper, we have identified additional opportunities to further strengthen financial stability through enhanced system-wide resilience:

✓ Global financial stability can be further enhanced by expanding central clearing for both cash and derivatives markets;

✓ Increased regulatory harmonization and cooperation among all stakeholders is required to harness the full potential of derivatives trade repositories as early warning signals for the buildup of systemic risk;

✓ The use of Legal Entity Identifiers (LEIs) in regulatory reporting should be mandated globally to increase risk transparency; and

✓ Enterprise data management capabilities should become foundational to financial firms' risk management frameworks.[1]

Additionally, while many aspects of financial resilience have markedly improved since 2008, multiple new challenges have emerged during this period with respect to the macroeconomic environment, market-related risks and concerns related to technology.

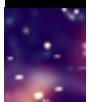
- Despite a generally positive short-term outlook, several medium-term **macroeconomic concerns** are emerging related to trade tensions, rising geopolitical risks and high levels of global debt. Additionally, stretched asset valuations have added to the risk of sudden price drops. While these potential threats are hard, if not impossible, to control or predict, they are highly interdependent and should be addressed through a cross-disciplinary approach:

✓ Risk management organizations should become increasingly holistic and include cross-disciplinary experts to address an ever-widening array of interconnected risks.

- With respect to **market-related risks**, the rising popularity of ETFs has the potential to become a growing source of concern, especially if these offerings continue to evolve towards increasingly esoteric and opaque products with highly complex risk profiles. The level and robustness of market liquidity is another market-related risk that continues to be debated. Opportunities to enhance financial stability with respect to market-related risks include the following:

✓ The exposure associated with the proliferation and increasingly esoteric nature of certain ETFs should be managed more closely to match their specific risk profiles.

1 *Enterprise Data Management* is the development and execution of policies, procedures and standards to effectively manage data at the enterprise level, providing data that is fit for purpose, with minimal transformation and reconciliation.



✓ **Opportunities to optimize and accelerate the U.S. equity settlement cycle beyond T+2 should be pursued to further reduce the exposure associated with unsettled trades.**

- **Technology-related risks** comprise a very wide and diverse array of risks, including, but not limited to, a series of innovative technologies that are generally characterized as fintech developments. While fintech-related risks should be assessed on a case-by-case basis, there is widespread agreement that digital currencies and other types of crypto-assets, as well as the growth of technologies such as cloud-based computing, do not threaten financial stability at present. At the same time, there is also a growing consensus that fintech developments are fast-moving along a relatively unpredictable path, which demands that they be carefully monitored and thoughtfully supervised to balance the associated risks and rewards. Cybersecurity concerns, while not new, have grown exponentially to the point where they are considered by many as the single most important near-term systemic risk. The associated opportunities to enhance financial stability are listed below:

While many aspects of financial resilience have markedly improved since 2008, multiple new challenges have emerged during this period with respect to the macroeconomic environment, market-related risks and concerns related to technology.

✓ **Supervisors should continue to focus on harmonizing regulatory requirements and encouraging innovation in a way that carefully balances the associated risks while ensuring a level playing field.**

✓ **Cybersecurity capabilities and plans should continue to be prioritized, emphasizing resilience and recovery as much as prevention, incorporating tabletop exercises and promoting public-private partnerships.**

POST-CRISIS RESILIENCE

KEY TAKEAWAYS

- ***Post-crisis regulatory measures to increase banks' resilience have been generally successful. However, low profitability and other specific vulnerabilities continue to persist, particularly in the European banking sector.***
- ***While monetary policies have effectively addressed post-crisis challenges, they have left central banks with considerably less latitude to combat the next crisis.***
- ***Further work remains to be done in order to fully implement two major post-crisis areas of reform: the use of LEIs to improve risk aggregation and central clearing of over-the-counter (OTC) derivatives.***
- ***Equivalence determinations by the European Commission in regard to the U.S. cash-securities markets under the jurisdiction of the U.S. Securities and Exchange Commission (SEC) remain outstanding and require urgent attention.***

Risk management is as much about trying to prevent a financial crisis as it is about building resilience in case one materializes. This section reviews to what extent banks, CCPs and the public sector have managed to strengthen their capacity to absorb potential shocks:

- **Banks have significantly strengthened their balance sheets** and enhanced their funding resilience in line with the objectives of post-crisis regulatory reforms. Banks' liquidity buffers have also been strengthened, largely thanks to the introduction of the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR).[2] From a systemic point of view, a decline in interbank lending and derivatives exposures is noteworthy as well. The increased use of stress testing and ongoing progress towards the creation of a global recovery and resolution framework are additional measures aimed at enhancing banks' resilience.

  At the same time, however, bank profitability has declined across several countries, potentially necessitating further restructuring and cost-saving efforts. Weaker profitability could also encourage banks to take on new risks in search of higher profits. Profitability has been particularly low within Europe, and many banks in the Eurozone were also negatively affected by sovereign debt concerns, which added to post-crisis challenges. Non-performing loans (NPLs) continue to be a cause of concern within the Eurozone, particularly for the Italian and Spanish banking sectors.

- **CCPs have continued to strengthen their resilience.** While CCPs have been a key component of the financial system for many decades – and while they proved their value and resilience in the wake of the Lehman insolvency – the introduction of mandatory central clearing for standardized OTC derivatives in some jurisdictions has made them more critical than ever.

  In recognition of the importance of CCPs and other types of market infrastructures, the Financial Stability Oversight Council (FSOC) designated eight financial market utilities (FMUs) as systemically important under Title VIII of the Dodd-Frank Wall Street Reform and Consumer Protection Act in

2 Following the failure of many banks to adequately measure, manage and control their liquidity risk in 2007 and in subsequent years, the Basel Committee on Banking Supervision (BCBS) introduced two liquidity standards as part of the Basel III post-crisis reforms: (i) the *Liquidity Coverage Ratio (LCR)*, which is designed to enhance banks' short-term resilience to liquidity shocks by requiring them to hold a sufficient reserve of high-quality liquid assets (HQLA) to allow them to survive a period of significant liquidity stress lasting 30 calendar days; and (ii) the *Net Stable Funding Ratio (NSFR)*, which is expressed as a ratio of Available Stable Funding (ASF) over Required Stable Funding (RSF) and which aims to promote structural resilience over a longer time horizon by creating incentives for banks to fund their activities with more stable sources of funding on an ongoing basis.

July 2012.[3] Earlier that year, the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) published the Principles for Financial Market Infrastructures (PFMI) in 2012.[4] These principles served to harmonize and, where appropriate, strengthen three previously issued sets of international standards for systemically important payment systems, securities settlement systems and CCPs.[5]

Rules set by national regulators are consistent with these principles, which have been supplemented since 2012 by a series of related documents that provide further guidance. These standard-setting initiatives have been a key driver of significant enhancements by CCPs around the globe in areas as varied as cybersecurity, recovery and resolution, stress testing, loss allocation models, capital structure and governance.

- **The public sector is left with less ammunition than it had a decade ago.** Over the past decade, central banks around the world have conducted quantitative easing (QE) programs on an unprecedented scale, pushing interest rates down – in some cases into negative territory – while amassing multi-trillion dollar balance sheets in the process. While these programs have been remarkably successful so far, both in terms of addressing the impact of the financial crisis and controlling inflationary risks, they have undeniably left central banks with less latitude to combat another crisis. The reversal of these QE programs presents an unprecedented monetary policy challenge that may have myriad ramifications that are hard, if not impossible, to predict. As such, it is certainly possible that unexpected or unintended effects of this reversal process could cause troubles in the years ahead.

  Additionally, the growth of public debt levels over the last 10 years has left governments with less flexibility to implement countercyclical fiscal measures in case another recession were to occur.

  Finally, it is worth pointing out that restrictions imposed by certain post-crisis regulatory reforms on the Fed, the Treasury and the Federal Deposit Insurance Corporation have constrained their ability to make the types of emergency loans that were extended to support troubled banks in 2008.

- **A considerable portion of OTC derivatives trading has moved to central clearing.** The financial crisis highlighted the systemic importance of OTC derivatives, a sector of the financial market that had expanded rapidly, yet remained largely opaque. In 2009, the G20 adopted a series of reforms designed to improve transparency and mitigate systemic risks posed by OTC derivatives.[6] The promotion of central clearing has been a key component of the 2009 reforms and has substantially improved the transparency and risk management of OTC derivatives. Since the adoption of these reforms, central clearing of OTC derivatives has rapidly expanded globally, with the Bank for International Settlements estimating that approximately 55% of credit and 75% of interest rate OTC derivatives were centrally cleared as of 2017 year-end.[7]

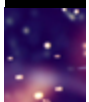
3 The designated FMUs are: The Clearing House Payments Company L.L.C. (PaymentsCo), on the basis of its role as operator of the Clearing House Interbank Payments System (CHIPS); CLS Bank International (CLS Bank or CLS); Chicago Mercantile Exchange, Inc. (CME); The Depository Trust Company (DTC); Fixed Income Clearing Corporation (FICC); ICE Clear Credit L.L.C. (ICE Clear Credit); National Securities Clearing Corporation (NSCC); and The Options Clearing Corporation (OCC).

4 *Committee on Payment and Settlement Systems – Technical Committee of the International Organization of Securities Commissions. (2012, April). Principles for financial market infrastructures.*

5 These previously existing standards were the Core principles for systemically important payment systems (CPSIPS), the Recommendations for securities settlement systems (RSSS) and the Recommendations for central counterparties (RCCP).

6 *European Central Bank. (2016). Looking back at OTC derivative reforms – objectives, progress and gaps.*

7 *Bank for International Settlements (BIS). (2018, May 3). Statistical release: OTC derivatives statistics at end-December 2017.*



- **Efforts intended to enhance transparency through the use of LEIs have only been partially successful so far.** While significant progress has been made over the last decade, additional work is required to realize the full benefits of global data standardization, especially those which would improve systemic risk analysis.

  The LEI system was intended to help financial firms and regulators assess financial exposures across a network of connected entities more quickly and accurately – a challenge that proved daunting, if not practically impossible, in the wake of the Lehman insolvency.

  While the creation of the global LEI system itself was a necessary first step, its intended goal of enhancing transparency remains elusive as universal adoption of LEIs remains inconsistent. While regulatory mandates have moved forward in Europe, they have stalled in Asia-Pacific and the Americas. In fact, the use of LEIs is only one of several broader post-crisis enterprise data management initiatives that most banks are still in the process of implementing. According to the Bank for International Settlement's 2017 assessment, only three global systemically important banks (GSIBs) have achieved full compliance with the "Principles for effective risk data aggregation and reporting" (January 1, 2016 was the initial implementation target for GSIBs).[8] This assessment serves as a reminder that, while much progress has been made in this area, significant work remains to be done to enhance enterprise data management practices of financial services firms to improve their ability to quickly and accurately aggregate their risk exposures, especially in times of market stress and to realize the full benefits of LEIs and other post-crisis global data standardization initiatives.

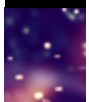
- **Equivalence determinations by the European Commission in regard to the U.S. cash-securities markets under the jurisdiction of the SEC remain outstanding and require urgent attention.**

  Efforts are ongoing by the European Commission to make equivalence determinations for jurisdictions where third-country CCPs that provide services to EU firms are established. EU firms and their clients increasingly require access to the global financial markets, including the equity and fixed-income markets in the U.S., which necessitates access to trading venues and post-trade infrastructure directly or through branches. For example, an EU bank operating through its branch in a third country that wishes to access liquidity for the local currency will need to become a clearing member of the local, third-country CCP to participate in and access that liquidity, through the local trading and repurchase markets. If the EU firm cannot access those local markets, its ability to compete on a global basis would be negatively impacted.[9]

  As part of the equivalence determination process, a current legislative proposal would require ESMA to determine if a CCP is systemically important or likely to become systemically important. DTCC believes this assessment is unnecessary for third-country CCPs whose clearing services predominantly relate to third-country securities, rather than derivatives. CCPs clearing securities markets have a fundamentally different risk profile than that of CCPs providing clearing services for derivatives markets, and inherently present lower levels of risk. U.S. regulators have also expressed concern about the proposed third-party CCP assessment. In follow-up to a Congressional hearing, Chairman Jerome Powell of the U.S. Board of Governors of the Federal Reserve System stated, "This aspect of the proposed legislation presents a risk of splintering central clearing by currency area,

8 *Basel Committee on Banking Supervision. (2018, June). Progress in adopting the Principles for effective risk data aggregation and risk reporting.*

9 Under the European Market Infrastructure Regulation (EMIR), third-country CCPs must receive recognition from ESMA to be deemed a Qualifying Central Counterparty (QCCP) under the EU Capital Requirements Regulation and Directive (CRR/CRD). A lack of recognition for third-country CCPs would severely impact EU firms because EU banks and investment firms would not be able to continue to apply QCCP capital treatment to third-country CCPs not recognized by ESMA.



which could fragment liquidity and reduce netting opportunities."[10]

Equivalence determinations by the European Commission in regard to the U.S. cash-securities markets under the jurisdiction of the SEC remain outstanding and require urgent attention. The impact would be significantly negative if the U.S. equity and fixed income markets were not recognized by ESMA and thus could no longer be accessed by EU banks and EU domiciled clients.

OPPORTUNITIES TO ENHANCE FINANCIAL STABILITY

✓ Global financial stability can be further enhanced by expanding central clearing for both cash and derivatives markets

While the risk that is concentrated in central counterparties must be carefully managed, the benefits of central clearing are undeniable and have been demonstrated repeatedly in real-life financial crises over many decades. As dramatic as the consequences of the Lehman insolvency were, they would have been even more devastating without the trade guarantees provided by central counterparties.

In order to more fully leverage the risk management benefits provided by central counterparties, the promotion of central clearing of standardized OTC derivatives transactions was a key component of the post-crisis reform agenda. As described in the latest progress report on OTC Derivatives Market Reforms by the Financial Stability Board (FSB), countries around the world continue to make progress to further promote central clearing of standardized OTC derivatives transactions. These advancements are driven by an increasing number of jurisdictions with regulatory frameworks that support central clearing of these products and the growing availability of CCPs that are authorized to clear specific OTC derivatives.[11]

As dramatic as the consequences of the Lehman insolvency were, they would have been even more devastating without the trade guarantees provided by central counterparties.

In addition to these continuing enhancements, DTCC also sees opportunities to further strengthen financial stability by expanding the benefits of central clearing to specific areas within cash markets. For example, in order to mitigate fire sale risk in the $1.6 trillion institutional tri-party repo market, DTCC's Fixed Income Clearing Corporation (FICC) has extended its CCP trade guarantee to tri-party repo transactions between its Government Security Division (GSD) dealer members and eligible tri-party money lenders, as part of its Centrally Cleared Institutional Triparty (CCIT) Service.

In another initiative to extend central clearing capabilities to the institutional market, FICC recently expanded its Sponsored Membership program by making it available to a wider range of Sponsored Members and institutional clients. Additional steps for further expansion are currently under consideration.

10 From Chairman Jerome Powell, U.S. Board of Governors of the Federal Reserve System, response to QFR following his July 17, 2018 testimony.

11 *Financial Stability Board (FSB). (2017, June 29). OTC Derivatives Market Reforms – Twelfth Progress Report on Implementation.*

Finally, potential measures to counter the recent shift in the interdealer Treasury market away from centrally cleared activity to bilateral trading should also be examined in detail.[12]

✓ Increased regulatory harmonization and cooperation among all stakeholders is required to harness the full potential of derivatives trade repositories as early warning signals for the buildup of systemic risk

The G20 call to establish derivatives trade repositories as a way to mitigate systemic risk associated with OTC derivatives was a direct response to the 2008 financial crisis. While derivatives trade repositories have been implemented in various jurisdictions to date, the goal of providing supervisors with a comprehensive picture of market risk remains elusive. One important obstacle to achieving the transparency that is necessary to regulate systemic risk in this global market is a lack of regulatory harmonization.

In order for derivatives trade repositories to serve their purpose and help regulators identify emerging pockets of systemic risk, standard-setting bodies, trade associations, derivatives trade repositories and regulators, together with any other stakeholders, must continue to cooperate to refine technical guidelines around data consistency, data standardization and harmonized reporting practices. Once these enhanced standardization efforts have been implemented, derivatives trade repositories will be able to provide the foundation for additional developments designed to further reduce operational and systemic risks.[13]

DTCC will continue to collaborate with the industry and regulators to achieve these goals and develop more streamlined and cost-effective reporting solutions.

At the same time, legal and regulatory barriers to data use in value-added services (such as reconciliation, compression or margin calculation)[14] as well as those related to data sharing and third-party access must be removed across jurisdictions.

DTCC will continue to collaborate with the industry and regulators to achieve these goals and develop more streamlined and cost-effective reporting solutions.

✓ The use of Legal Entity Identifiers (LEIs) in regulatory reporting should be mandated globally to increase risk transparency

The creation of the LEI system is arguably one of the most tangible achievements that resulted directly from the financial crisis. This system of global and unique entity identifiers was specifically designed to promote financial stability in two ways. First, it allows supervisors to better monitor and analyze systemic threats. Second, it helps companies improve the consistency and usability of their own internal risk management practices, as well as reduce costs associated with collecting, cleaning, aggregating and reporting data.

12 This shift was documented in *The Treasury Markets Practice Group (TMPG). (2018). White Paper on Clearing and Settlement in the Secondary Market for U.S. Treasury Securities* and it is also referred to in *McCormick, L. (2018, July 13). Treasury Market Group Warns of Clearing Risks in Benchmark Debt. Bloomberg.*

13 For additional details, refer to DTCC Paper *A Progress Report on OTC Derivatives Trade Repositories – Many Miles Travelled, More Yet To Go (April 2018)*

14 While the data reported to regulators must continue to be protected, its use in value-added services (as opposed to purely commercial use) by a trade repository, or by its affiliate using data across jurisdictions, would lead to higher-quality data that is correct, consistent and complete.

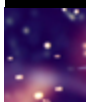
While the industry's use of LEIs has progressed significantly,[15] the full benefits of this system – for the public and the private sector – will only be achieved if it is adopted universally. For this reason, we support the further expansion of the mandatory use of LEIs for reporting purposes as a regulatory requirement across all jurisdictions and financial markets worldwide.[16]

✓ Enterprise data management capabilities should become foundational to financial firms' risk management frameworks

Data management practices are often too inconsistent and/or incomplete to ensure the level of data accuracy and timeliness that is required to enable fully informed risk management decisions. Additionally, the scope and complexity of data management issues, as well as the organizational challenges associated with addressing them, tend to be underestimated. Given the foundational importance of monitoring and improving enterprise-wide data quality, both at source and at point of consumption, enterprise data management functions should become an integral part of financial firms' risk management organizations. A robust enterprise data management program, featuring high-quality data, with strong governance, housed and accessed via an advanced data architecture, is not only a critical foundation for today's risk management capabilities, it is also required to achieve the benefits of new technologies that can play a critical role in building resilience.

15 At the end of the second quarter of 2018, the total LEI population neared 1.2 million (see *Wolf, S. (2018, August 8). GLEIF Published the Quarterly Global LEI System Business Report Covering the Second Quarter of 2018 – The Global LEI System Business Reports highlight main trends relevant to the adoption of the LEI and provide in-depth analysis of the LEI data pool.)*

16 Several financial regulators in the U.S., Europe, Canada, Australia, and Singapore have already adopted reporting rules that require companies to use the LEI. So far, the Federal Reserve System, Commodity Futures Trading Commission (CFTC), and National Association of Insurance Commissioners require the LEI in various reports submitted by the industry about bank holding companies, swap transactions, and insurance investments. Additionally, the U.S. Securities and Exchange Commission (SEC), Municipal Securities Rulemaking Board, and CFTC have recommended that the LEI be included in credit rating disclosures, money market funds' monthly submissions, private fund managers' reports, and futures clearing merchants' ownership reports (an overview of all regulatory requirements concerning the LEI is available on the LEI Regulatory Oversight Committee website at https://www.leiroc.org/lei/uses.htm). The SEC and the Consumer Financial Protection Bureau have pending proposals that would require the LEI to appear in swap transactions and home mortgage disclosure submissions. (https://www.financialresearch.gov/data/legal-entity-identifier-faqs/)



MACROECONOMIC RISKS

KEY TAKEAWAYS

- ***While the short-term global macroeconomic outlook remains positive, several medium-term areas of concern are emerging with respect to trade tensions, rising geopolitical risks and high levels of global debt.***
- ***Stretched asset valuations add to the risk of sudden price drops.***

The past several years have been characterized by a worldwide economic expansion that is broadly synchronized between the U.S., Europe and Asia. In 2017, the global economy grew by 3.7%, the fastest increase seen in seven years. Asia, which currently accounts for more than 60% of global growth, remains the most significant driving factor behind the world's economic expansion.[17]

While Japan continues to battle deflation, inflationary risks have been successfully contained in most advanced economies so far. Even in most Asian countries, inflation has remained subdued in spite of solid growth, relatively tight labor markets and rising domestic consumption. That said, vigilance is warranted as the convergence of low commodity prices, low yields in the capital markets and consistent underestimation of inflation expectations in Asia may soon come to an end. Additionally, foreign monetary policy decisions may also have a considerable direct or indirect effect on Asian economies.

Even though the short-term macroeconomic outlook remains generally positive, the expansion is starting to diverge geographically and growth rates seem to be peaking in several countries. Additionally, while financial conditions remain generally favorable across most economies worldwide, several risks are starting to mount, most notably escalating tensions and uncertainty around international trade, rising geopolitical risks, high levels of global debt and stretched valuations in certain markets.

- **Tensions and uncertainty around international trade** have increased for several years as part of a global trend towards increased protectionism. Since the financial crisis, the world's top 60 economies have collectively introduced more than 7,000 protectionist trade measures.

  This trend has escalated considerably by recent tariff announcements made by the U.S. and retaliatory measures from its trading partners. Modeling studies by the International Monetary Fund (IMF) suggest that if current trade policy threats are realized and business confidence falls as a result, global output could be about 0.5% below current projections by 2020.[18] While several tariffs are directed specifically at Chinese imports, many other Asian countries are affected by U.S.-China commercial links as well through their supply chains.

  Beyond trade, the effects through non-trade channels could be even more damaging. According to studies by the IMF, they could also impact financial markets, business and consumer confidence as well as foreign and domestic direct investment.

  Continued uncertainty surrounding the U.K.'s post-Brexit trade relationship with the EU is another significant source of concern even though the ultimate macroeconomic impact of the U.K.'s decision to leave the European Union remains hard to predict at this point. A further escalation of

17 See *International Monetary Fund (IMF). (2018). Regional Economic Outlook: Asia Pacific – Good Times, Uncertain Times: A Time to Prepare.*

18 *Obstfeld, M. (2018, July 16). The Global Expansion: Still Strong but Less Even, More Fragile, Under Threat. IMFBlog.*

tensions and uncertainty with respect to international trade – which could affect market sentiment, investment flows and asset prices – is arguably the greatest near-term threat to global growth.

- **Geopolitical risks** seem to be growing on different fronts, driven by rising nationalism and tectonic shifts in global order. Even though financial markets tend to recover relatively quickly from geopolitical events that occur in isolation, a succession of shocks could have a more meaningful and significant impact, especially when they materialize in deteriorating economic conditions.

  The situation on the Korean peninsula remains a source of potential concern in this respect. While tensions in the region have de-escalated in recent months, agreements between U.S. President Donald Trump and North Korean leader Kim Jong Un to work towards a complete denuclearization of the Korean Peninsula stand only in principle and have yet to be operationalized.

  Other areas of geopolitical tension include Russia's use of military action in Ukraine and its role in the Syrian Civil War as well as China's claim over most of the South China Sea. While this last issue has largely faded away from public attention, competing territorial claims continue to be made between China and several Asian nations.

  The U.S. decision to withdraw from the multilateral Iran nuclear deal and impose new sanctions on the regime may increase tensions in the Middle East in addition to straining U.S. alliances and affecting oil markets. In this context, it is worth noting that the Trump administration's stated goal of "energy dominance" is another development that could have significant geopolitical ramifications as the U.S. is on target to become the world's biggest producer of crude oil in the next five years.

  More broadly, long-standing international partnerships and alliances are increasingly being challenged or called into question – from strategic alliances such as NATO, which have formed the foundation for transatlantic relations in the post-World War II era, to the cohesion of the European Union itself, which is being tested by internal and external forces alike. While indications of a profoundly shifting world order abound, it is unclear at this point how the geopolitical ambitions of countries such as China and Russia will ultimately play out and which new geopolitical equilibria will eventually emerge.

- **Global debt** continues to hit record highs, reaching a peak of US$164 trillion (equivalent to 225% of global GDP) according to the most recent IMF data.[19] This level is 12% higher than the previous peak in 2009, with China as a driving force. China, Japan and the U.S. account for more than half of global debt, while their collective share of global output is significantly smaller. Debt-to-GDP ratios for advanced economies have reached levels not seen since World War II and are expected to fall only marginally over the medium term.

  The rise of public debt, which largely reflects the impact of, and response to, the financial crisis, is an important factor in the overall growth of global debt. Over the last 10 years, government debt more than doubled in the U.S., as it did in other economies. In addition to making countries more vulnerable to interest rate hikes and rollover risk, excessive government debt levels also leave countries more susceptible to political risk, as demonstrated earlier this year in the wake of the Italian elections. Additionally, high levels of public debt make it harder for authorities to implement countercyclical policies to combat a financial crisis. As a result, even in cases where excessive debt levels do not trigger a financial crisis directly, they can exacerbate economic downturns and prolong recessions.

19 See *International Monetary Fund (IMF). (2018). IMF Fiscal Monitor: Capitalizing on Good Times, April 2018.*

According to a model developed by the IMF, if equity and housing prices continue to rise, the ongoing buildup of debt could breach critical limits as soon as 2020 – and reach a tipping point where debt sustainability concerns could trigger a 15% drop in stock prices and a 9% decline in housing prices.[20]

- **Stretched asset valuations** may cause sudden price corrections if growth expectations were to prove unrealistic or if an unrelated shock were to materialize.

A prolonged bull market in both bonds and equities over the past decade has pushed asset valuations to levels that can generally be qualified as elevated. While valuation levels by themselves cannot be used to reliably predict future price trajectories, they do increase the potential for sudden re-pricing in case of a systemic shock or other negative developments. The increased popularity of passive investment strategies and the associated risk of herd behavior further add to this potential risk.

U.S. real estate prices (as measured by the Case-Shiller U.S. National Home Price Index) have recovered to the point where they have exceeded their pre-crisis historical peaks. While this may seem indicative of another bubble, mortgage debt levels have not yet exceeded their peak, suggesting that the growth in real estate prices does not carry the same level of underlying risk that led to the financial crisis.

The continued and rapid increase in Chinese real estate prices is causing many analysts to be concerned about a genuine asset bubble. Although the housing boom seemed to slow in 2017, this year has seen a rebound. Given that more than 25% of China's GDP is estimated to be connected to demand from the property and construction sectors,[21] even slight fluctuations in real estate demand can have a considerable impact on the country's economy. In an attempt to slow the growth of housing prices, the Chinese government has imposed limits on mortgage lending.

OPPORTUNITIES TO ENHANCE FINANCIAL STABILITY

✓ Risk management organizations should become increasingly holistic and include cross-disciplinary experts to address an ever-widening array of interconnected risks

The scope of the risk management function has grown considerably over the past decade, driven by the fallout of the financial crisis and the accompanying regulatory response, new technology and the growing interconnectedness of global markets – just to name a few factors.

Given the wide variety of threats facing the industry and the fact that most risks are interdependent, a holistic approach that includes cross-disciplinary experts is more important than ever. Organizations need to look beyond credit, market and liquidity risk and include experts in areas as diverse as operational, systemic, technology, information security, data management, vendor, geopolitical and physical security risks. In the same spirit, industry-wide tabletops and simulation exercises are a crucial component of a truly comprehensive risk management discipline.

20 See *Mayeda, A. (2017, October 11). Bloated Valuations and Debt Spell Trouble for Growth, IMF Says. Bloomberg.*

21 See *Moody's Investors Service. (2018, May 25). Property sector remains central to China's economy, tighter credit supply constrains growth.*

MARKET-RELATED RISKS

KEY TAKEAWAYS

- ***The rising popularity of ETFs may become a growing source of concern, especially if these offerings continue to evolve towards increasingly esoteric and opaque products with highly complex risk profiles.***
- ***While there is agreement on the observation that the provision of liquidity has changed considerably since the financial crisis, the current level and robustness of market liquidity continues to be debated.***

The rapid rise of exchange-traded funds and the changing nature of liquidity are two of the most significant post-crisis evolutions that could be potential sources of systemic market-related risks:

- The growing popularity of **exchange-traded funds (ETFs)** has arguably been the most significant development in the investment management industry over the past decade as ETF assets under management have risen from roughly $0.5 trillion in 2008 to over $3 trillion by the end of 2017.[22] The success of ETFs is driven by several factors – in addition to offering lower fees than those charged by other investment funds, they provide an additional source of liquidity, they can be used to hedge and diversify exposures and they can also contribute to price discovery.

  At the same time, the growth of ETFs – especially those invested in less liquid assets – has also raised concerns with respect to two potential sources of risk:

  – **There could be a mismatch between the liquidity of the ETF itself and the liquidity of the underlying assets.** Concerns typically focus on ETFs that invest in less liquid asset classes, such as corporate bonds and emerging markets. Some analysts assert that ETFs have become so large in certain markets that the underlying securities may no longer be sufficiently liquid to facilitate ETF creation/redemption activity during periods of stress and could result in price dislocations.

  – **Certain ETFs could increase contagion risk and possibly amplify price moves in stressed markets.** In its most recent Global Financial Stability Report, the IMF included an analysis suggesting that ETFs, particularly those investing in relatively illiquid assets, may heighten contagion risk and possibly amplify price moves across asset classes during periods of stress.[23] The rise in cross-asset correlations during periods of stress, one of the main attributes of contagion, may also be related to the growing popularity of ETFs and other passive investment vehicles.[24]

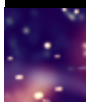
  Given that the risks described above are particularly relevant for ETFs invested in less liquid assets, it should be noted that some of these ETF subsectors, while still small in relative terms, are growing rapidly. For example, the assets under management of ETFs invested in global bank loans, emerging market bonds and global high-yield bonds have increased from less than $10 billion a decade ago to more than $140 billion by the end of 2017.[25]

22 See *Investment Company Institute (ICI). (2018). 2018 Investment Company Fact Book: A Review of Trends and Activities in the Investment Company industry.*

23 *International Monetary Fund (IMF). (2018). Global Financial Stability Report April 2018: A Bumpy Road Ahead.*

24 As of June 2017, approximately 20% of global investment assets were passively managed, up from 8% in 2007 (see *Sushko, V., & Turner, G. (2018, March 11). The implications of passive investing for securities markets. BIS Quarterly Review.*)

25 The subsection of ETF products that is known as "Non-1940 Act" ETFs, which are not registered with or regulated by the SEC under the Investment Company Act of 1940, primarily track futures, currencies, and commodities. "Non-1940 Act" ETFs have expanded at a much slower rate than the broader ETF market over the past decade, and constituted only 2% of total net ETF assets as of 2017 year-end. For more information on the classification of "Non-1940 Act" ETFs, see *Investment Company Institute (ICI). (2018). 2018 Investment Company Fact Book: A Review of Trends and Activities in the Investment Company industry.*



Complexity risk and opacity are other sources of increasing concern as the universe of exchange-traded products expands to encompass more esoteric and hard-to-price asset classes, sometimes in combination with leveraged and/or inverted payoff structures.[26] The overnight collapse of several short-VIX futures ETFs in February 2018 illustrated the extreme volatility of these products. Given the important lessons about the risks associated with complex and opaque financial products that were hard-learned in the wake of the financial crisis, this evolution should be closely monitored.

In conclusion, while we do not think that ETFs currently pose a major systemic threat, we do believe that the emerging risks associated with the proliferation and increasingly esoteric nature of some of these products should be managed more closely, given their growing potential to create or exacerbate market disruptions.

- **Insufficient funding and market liquidity** was a major force driving contagion during the 2008 financial crisis. While it appears that funding liquidity risk has been adequately mitigated by a number of measures (including, but not limited to, higher liquidity requirements and better reporting about firms' liquidity buffers in stress test scenarios), concerns around market liquidity continue to persist 10 years after the Lehman insolvency.

  Even though certain measures of U.S. bond market liquidity have deteriorated since the financial crisis, evidence that supports claims of diminished market liquidity is inconclusive – leading to heated and protracted debates about which liquidity metrics are more relevant. While there seems to be a general consensus that stricter capital rules are an important driver in the decrease in bond dealer inventories (bond dealers' assets fell to $3 trillion at the end of 2016, down from $5 trillion in early 2008), there appears to be less agreement on the extent to which this change has affected liquidity.

  Regulators generally seem to have a more positive view of market liquidity than market practitioners – even after examining the perplexing Treasury market "flash rally" on October 15, 2014, which raised new questions about the nature of liquidity in markets that have been profoundly impacted by electronic trading and other structural changes.

  Regardless of the levels of liquidity observed during normal market circumstances, the key question that remains is to what extent liquidity is robust enough to hold up when it is most needed, i.e., during periods of prolonged stress. Absent another systemic crisis, that question may remain unanswered.

OPPORTUNITIES TO ENHANCE FINANCIAL STABILITY

✓ The exposure associated with the proliferation and increasingly esoteric nature of certain ETFs should be managed more closely to match their specific risk profiles

Over the past decade, the range of underlying ETF assets has expanded significantly and now includes commodities, cryptocurrencies and a host of other non-traditional asset classes. At the

26 According to data compiled by Bloomberg, the total amount of leveraged ETFs worldwide stood at $70 billion at the end of March 2018. It is interesting to note geographical differences in this context. While leveraged ETFs in the U.S. and Japan only account for about 1% and 3% of their respective domestic ETF markets, they are much more prevalent in other countries. In South Korea, for instance, more than 20% of the domestic ETF market is made up of leveraged funds – and in Taiwan that proportion is as high as 40% (see *Lee, M. J., & Oda, S. (2018, April 29). The 'Father of ETFs' Warns About the Dangers of Leveraged Funds. Bloomberg.)*

same time, ETFs with leveraged and/or inverted structures have come to market, further expanding and diversifying the risk profile of these types of products.

As a result of this evolution, concerns have been raised about potential mismatches between the liquidity of ETFs and their underlying assets – particularly with respect to less liquid asset classes. Other concerns focus on the impact of ETFs on pricing mechanisms and the risk of sudden sharp price drops.

In light of the above, we support the development of an industry-wide classification system for the broad category of Exchange Traded Products that identifies the unique attributes of products and that will help investors better differentiate between the risk/return profiles of "plain vanilla" versus more complicated products.

We support the development of an industry-wide classification system for the broad category of Exchange Traded Products that identifies the unique attributes of products and that will help investors better differentiate between the risk/return profiles of "plain vanilla" versus more complicated products.

✓ **Opportunities to optimize and accelerate the U.S. equity settlement cycle beyond T+2 should be pursued to further reduce the exposure associated with unsettled trades**

In September 2017, the standard settlement cycle for U.S.-based transactions in equities, corporate bonds, municipal bonds, unit investment trusts, and financial instruments comprised of these security types (e.g., ADRs and ETFs) was shortened from T+3 to T+2. This change, which was one of the most significant to post-trade processing in two decades, greatly reduced counterparty risk and cut capital requirements for financial firms by approximately 25%, or $1.36 billion.[27] In addition to aligning the U.S. with European settlement practices and other T+2 markets around the world, the move to T+2 reduced operational and market risk, and limited the pro-cyclicality that can occur during times of volatility. The industry-wide move to T+2 settlement has significantly reduced systemic risk.

While the industry continues to analyze the longer-term feasibility of a potential industry-wide move to a T+1 U.S. equity settlement cycle, DTCC sees other opportunities to reduce the time from trade execution to settlement that would have less impact on the industry and that could be implemented sooner. A recently published paper by DTCC describes two proposals – settlement optimization and accelerated settlement – to achieve a further settlement cycle reduction, while maintaining the substantial benefits of centralized netting and risk management.[28]

27 *DTCC. (2017, September 5). Financial Services Industry Shortens Trade Settlement Cycle in the U.S., Marking the Most Significant Change in Two Decades.*

28 *Modernizing the U.S. Equity Markets Post-Trade Infrastructure* – DTCC White Paper (January 2018)

TECHNOLOGY-RELATED RISKS

KEY TAKEAWAYS

- ***Potential risks associated with fintech applications can be considered a new area of concern that has only emerged over the last decade.***
- ***While there is widespread agreement that fintech developments do not threaten financial stability at present, there is also a growing consensus that the use of fintech should be carefully monitored and thoughtfully supervised to balance the associated risks and rewards.***
- ***By contrast, cybersecurity concerns, while not new, have grown exponentially to the point where they may be the most important near-term threat to financial stability.***

Whether fintech applications existed a decade ago is a definitional question that may be up for debate. That said, the wave of fintech developments that has emerged over the last 10 years is too significant to ignore. While these applications hold tremendous potential to enhance many parts of the financial ecosystem, including risk management itself, they also have the potential to become a new source of risks – and, as such, they should be closely monitored.

National and international policymakers and standard-setting bodies around the globe have taken a significant interest in fintech, seeking to understand the associated benefits and risks, and analyzing how to support the development of innovative solutions in a way that ensures adequate oversight and controls.[29]

In November 2017, the FSB released a report that focuses specifically on the financial stability implications of the growing use of artificial intelligence (AI) and machine learning in financial services.[30] Earlier this year, the European Commission published a paper that proposes a three-pronged approach with respect to the use of AI and machine learning: increasing public and private investments; preparing for socio-economic changes brought about by AI; and ensuring an appropriate ethical and legal framework.[31]

The range of fintech applications is so vast that the related risks must be assessed on a case-by-case basis. Cryptocurrencies and cloud-based computing are two well-documented examples of specific fintech applications that warrant a closer analysis:

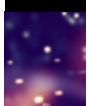
- **Cryptocurrencies**, given their nature and their relative novelty, are exceptionally difficult to value. While history may show that cryptocurrencies are presently overvalued – even at current prices, which are well below peak levels that were recorded towards the end of 2017 – overall volumes are relatively modest from a systemic risk point of view. As a result, unless system-wide adoption and outstanding volumes increase significantly from current levels, the potential for a cryptocurrency crash or operational incidents to affect financial stability remains fairly limited.

  Regulators around the world are responding to the growth of crypto-assets in a variety of ways, which include indirect interventions via the banking system, outright bans and other types of enforcement

29 Examples of publications by international standard-setting bodies include *International Organization of Securities Commissions (IOSCO). (2017, February). IOSCO Research Report on Financial Technologies (Fintech)*, as well as two papers by the FSB: *Financial Stability Board (FSB). (2017, June 27). Financial Stability Implications from FinTech* and *Financial Stability Board (FSB). (2017, May 22). FinTech Credit: Market Structure, Business Models and Financial Stability Implications.*

30 See *Financial Stability Board (FSB). (2017, November 1). Artificial intelligence and machine learning in financial services.*

31 See *European Commission (EU). (2018, April 25). Communication Artificial Intelligence for Europe.*



actions. Nonetheless, several central banks around the world are investigating the issuance of central bank digital currencies.[32]

On July 16, 2018, the FSB reported to the G20 Finance Ministers and Central Bank Governors on its work with respect to crypto-assets.[33] While the FSB believes that crypto-assets do not pose a material risk to global financial stability at this time, it has developed a framework, in collaboration with the Committee on Payments and Market Infrastructures (CPMI), to monitor the financial stability implications of developments in crypto-asset markets. The crypto-asset monitoring framework is part of an ongoing assessment of vulnerabilities in the financial system and focuses on transmission channels that may give rise to financial stability risks.

- The growing importance of **cloud-based computer services** and the increasing interest for the use of cloud outsourcing solutions within the banking industry have prompted the European Banking Authority (EBA) to develop a set of recommendations for the use of cloud service providers by financial institutions. These recommendations, which apply to credit institutions, investment firms and competent authorities as of July 1, 2018, address five key areas of concern: the security of data and systems; the location of data and data processing; access and audit rights; chain outsourcing; and contingency plans and exit strategies.

Even though **cybersecurity concerns** predate the Lehman insolvency, they undoubtedly pose a much more serious risk now than they did a decade ago. The scale and sophistication of cyberattacks has grown exponentially, and it is not surprising that cyber threats have consistently been ranked as the number one concern by respondents to DTCC's Systemic Risk Barometer since the inception of this survey in 2013.

In line with this evolution, regulators around the world have considerably heightened their focus on this type of risk and have issued a wide variety of rules, guidelines and standards designed to enhance cyber resilience.[34] This increased regulatory attention will likely continue; in a survey published in October 2017 by the Financial Stability Board (FSB), 72% of FSB member jurisdictions reported publicly released plans to issue new regulations, guidance or supervisory practices that address cybersecurity for the financial sector within the next year.[35]

The most alarming evolution over the past 10 years is the shift from cyberthefts and other cybercrimes motivated by monetary gains to the use of cyberattacks as a geopolitical weapon, developed by state-sponsored actors and specifically targeted to compromise vital infrastructure components. In this context, it should be noted that even central banks and other critical public-sector organizations have been hit by data breaches, with several incidents described internally as "espionage" – demonstrating both the increased capabilities of cyber attackers, as well as their malicious intent.[36]

Several cyberattacks have also exposed potential threats associated with vendors, contractors and other service providers – adding another challenging dimension to third-party risk management.

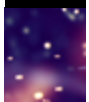
32 For example, the Bank of Thailand announced on August 21st, 2018 that it has started developing a central bank backed digital currency. See also *International Monetary Fund (IMF). (2018). Global Financial Stability Report April 2018: A Bumpy Road Ahead.*

33 The Financial Action Task Force (FATF) will report separately to the G20 on its work concerning the money laundering and terrorist financing risks relating to crypto-assets.

34 For a periodically updated compilation of recent cybersecurity laws, regulations, guidelines and other significant documents on cybersecurity for the financial sector, see *World Bank Group – Financial Sector Advisory Center (FinSAC). (2017, October). Financial Sector's Cybersecurity: A Regulatory Digest.*

35 See *Financial Stability Board (FSB). (2017, October 13). Summary Report on Financial Sector Cybersecurity Regulations, Guidance and Supervisory Practices.*

36 See *Lange, J., & Volz, D. (2016, June 1). Exclusive: Fed records show dozens of cybersecurity breaches. Reuters.*



While the resources that are allocated to combat this threat have grown dramatically, additional efforts are required to create new and strengthen existing cybersecurity public-private partnerships. According to the Intelligence and National Security Alliance, these partnerships have a threefold mission: (i) identify and detect behaviors of concern; (ii) ensure that actors from both sectors comply with the standards of the partnership; and (iii) arguably most importantly, provide a mechanism for response after a cyberthreat; this entails increased focus, investment and cooperation in incident response planning, as well as conducting examinations of attacks that occur and addressing any necessary shortcomings in the current defense system.[37]

OPPORTUNITIES TO ENHANCE FINANCIAL STABILITY

✓ Cybersecurity capabilities and plans should continue to be prioritized, emphasizing resilience and recovery as much as prevention, incorporating tabletop exercises and promoting public-private partnerships

Cyber-attacks on financial institutions have become more frequent, complex, and sophisticated, with an unprecedented potential for far-reaching, systemic impacts. The motivation of cyber-attackers is shifting from purely achieving financial gains to disrupting critical infrastructures, such as through nation-state attacks, which threatens the basis for confidence in the financial system and even national or international stability. In today's world of geopolitical turmoil and the ever-increasing speed of technological innovation, the occurrence of a successful large-scale cyber-attack is likely a matter of "when", not "if."

In response to this ever-increasing threat, it is more crucial than ever to continue developing and promoting public-private partnerships that effectively leverage the complementary strengths of both sectors. DTCC and Oliver Wyman have made a joint effort to bring together financial services and non-financial services practitioners to investigate cross-industry coordination on response and recovery mechanisms to mitigate the systemic consequences of a large-scale cyber-attack.[38]

✓ Supervisors should continue to focus on harmonizing regulatory requirements and encouraging innovation in a way that carefully balances the associated risks while ensuring a level playing field

There is broad agreement that more stringent post-crisis rules and regulations have effectively helped mitigate systemic risk. That said, more work is required to achieve the level of transparency and risk reduction sought by policymakers almost a decade ago. In addition to the lack of standardization with respect to derivatives trade repositories mentioned above, there continues to be a need for greater harmonization and coherence in other post-trade services such as collateral management, clearing and settlement.

Specifically with respect to fintech developments, we feel it is imperative for policymakers to create a regulatory framework that encourages responsible innovation by allowing the potential of these new technologies to materialize while providing the level of oversight that is necessary to ensure financial stability. As part of this balancing act, supervisors should coordinate internationally to ensure a level playing field and avoid opportunities for regulatory arbitrage.

37 See Jagasia, A. (2017, April 18). A Look into Public Private Partnerships for Cybersecurity. University of Pennsylvania Public Policy Initiative and Intelligence and National Security Alliance (INSA). (2009, November 1). Addressing Cyber Security Through Public – Private Partnership: An Analysis of Existing Models.

38 The outcome of this joint effort is described in the DTCC Paper Large-Scale Cyber-Attacks on the Financial System - A Case for Better Coordinated Response and Recovery Strategies (March 2018).

CONCLUSION

Regulators and policymakers, as well as the financial services industry at large, have made substantial efforts over the last decade to mitigate many of the key systemic risks that materialized in the wake of the Lehman insolvency. While these efforts have considerably enhanced the financial sector's resilience, further work remains to be done to fully address some of the vulnerabilities that triggered or exacerbated the financial crisis as well as new risks that have emerged over the past decade.

Despite the progress that has been made, we as an industry cannot become complacent. The sheer unpredictability of financial crises, as well as their myriad potential causes and effects, warrant continued vigilance and caution above anything else.

Additionally, the financial ecosystem – and the world at large – has changed considerably over the last 10 years, giving rise to new and ever-changing threats. As such, we feel that the best defense against these risks is to take a forward-looking approach that anticipates and mitigates threats that haven't materialized yet.

In that spirit, this paper has outlined a series of forward-looking opportunities to further increase financial stability. While the tools to implement these opportunities are not all under DTCC's control, we are developing several initiatives that are designed to promote or support some of their underlying objectives.

This paper is designed to foster dialogue and discussion rather than provide definitive answers. As such, we encourage you to share your comments and feedback with us.

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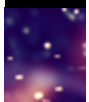

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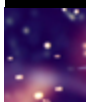

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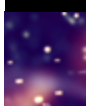

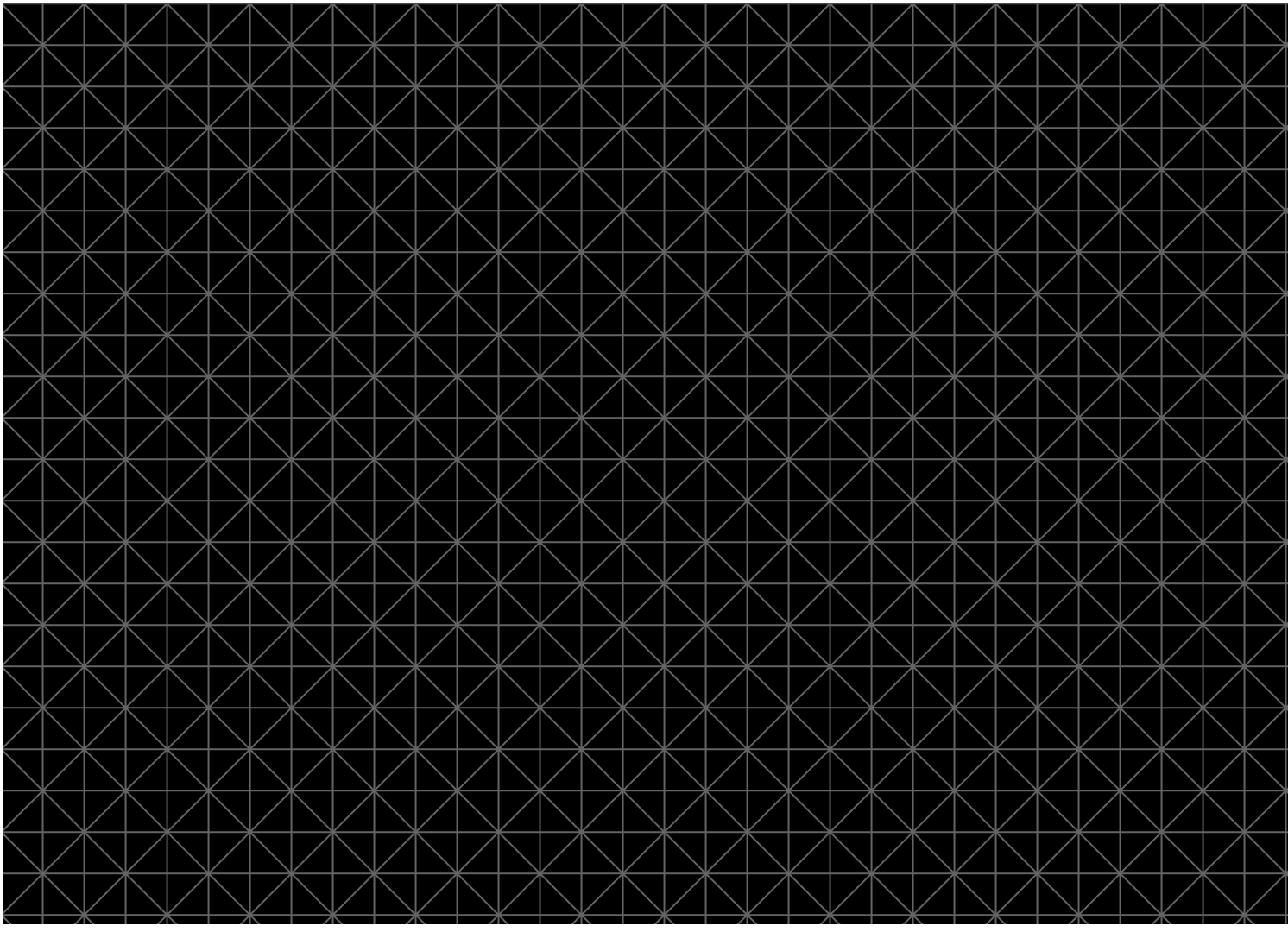

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