

Reforming Over-the-Counter Markets: The role of central counterparties

Oshani Perera

June 2012

© 2012 The International Institute for Sustainable Development
Published by the International Institute for Sustainable Development.

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change and energy, and management of natural and social capital, as well as the enabling role of communication technologies in these areas. We report on international negotiations and disseminate knowledge gained through collaborative projects, resulting in more rigorous research, capacity building in developing countries, better networks spanning the North and the South, and better global connections among researchers, practitioners, citizens and policy-makers.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Government of Canada, provided through the Canadian International Development Agency (CIDA), the International Development Research Centre (IDRC), and from the Province of Manitoba. The Institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations and the private sector.

Head Office

161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4
Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Website: www.iisd.org

Reforming Over-the-Counter Markets: The role of central counterparties

June 2012

Written by Oshani Perera

The author is grateful to the following individuals for their comments and contributions: Thomas A. Myers, T.A. Myers and Co; Paul Clements Hunt, Former Head of UNEP Finance Initiative and Founder, The Blended Capital Group; Ivetta Gerasimchuk, IISD; Daiana Geninasca, University of St Gallen; Salvatore Cantale, IMD Business School, Lausanne; Marlene Roy, IISD; and Kai Buntrock, KfW.

Abstract

The opacity, size and complexity of over-the-counter (OTC) markets are under forensic examination by lawmakers, as they have led to the significant build-up of systemic risks across the global financial system and were at the heart of the 2007–2008 global financial crisis. The rapid expansion and diversity of OTC markets can be largely attributed to the increased innovation and financial engineering that was triggered by the rising demand for speculation and the securitization of debt. Central counterparties (CCPs) are one method to contain systemic risks in the financial market system. This paper comments on their contributions to both reducing and increasing these risks. On the one hand, CCPs can contribute to reducing counterparty credit risk in OTC derivatives contracts. CCPs can indeed increase financial system stability, reduce price volatility, diminish defaults and reduce the procyclicality of the financial system. On the other hand, CCPs can give rise to system risks. For instance, margin requirements may prompt inflated and systemically destabilizing price movements, CCP insolvencies pose serious systemic risks and systemic complications can furthermore arise from hidden risks when derivative contracts are sold to unregulated counterparties. From a regulation point of view, although derivatives represent only a part of the risk exposures of financial firms, and only a fraction of the linkages between them, CCPs and derivatives data repositories can still provide valuable information to regulators, facilitating the disclosure of positions and respective risks. Furthermore, the increasing importance of CCPs and the related need to control their activities have given rise to regulatory reforms, which develop risk management standards and implement closer oversight of CCPs. The current regulatory efforts are, however, reallocating risk—not reducing it. Upcoming policy guidelines should ensure that CCPs do not become the catalyst for future systemic failures.

Introduction

The collapse of the U.S.-subprime mortgage market, together with the problem of the widespread housing boom in other industrialized countries, gave rise to the recent global financial meltdown. There are many technical justifications of the stages leading to the subprime mortgage crisis and then to the financial instability. One of the demystifying elements of the financial system regards the derivative instruments traded on the over-the-counter (OTC) markets. The golden years preceding the financial crisis in 2007–2008 were indeed the foundation for complex financial instruments, especially in the derivative markets. The complexity of these instruments, along with the exaggerated risk-taking behaviour of the derivatives traders, represented two of the weak points of the financial system. The global OTC derivatives market grew from US\$72 trillion in 1998 to US\$684 trillion in June 2008, as measured in notional amounts outstanding (European Central Bank, 2009), whereas the world Gross Domestic Product grew from US\$29,861.165 billion in 1998 to US\$60,109.392 (International Monetary Fund, 2009), as measured in current prices. The volume of OTC derivative contracts traded has hence grown very quickly during the last decade, exhibiting extensive speculations, which have been possible because the current regulatory system authorizes, and to some extent, propels them. As Mark Lange, former United States presidential speechwriter, pointed out, “because [derivatives are] entirely unregulated and trade on no public exchanges, their originators can deliberately hide their vulnerabilities.” The complexity of the instruments, together with the systems governing their trades, turn out to have devastating effects on the entire financial system.

The current crisis has indeed revealed some shortcomings of OTC trading in credit derivatives, which will be extensively highlighted in the first chapter of this paper. Foremost, the bilateral nature of the OTC market transactions contains counterparty risk, for which parties are affected by solvency of the direct counterparty as well as of other intermediaries along the chain of transactions. The counterparty risk is aggravated due to inadequate transparency about the counterparty's other positions and its interdependency with the rest of the market. The counterparty risk, together with the lack of operational transparency, leads then to systemic risk. The definition of systemic risk can vary according to the complexity of the relationships it wants to describe. G.G. Kaufman (1999) refers to systemic risk as "risk or probabilities of breakdowns (losses) in an entire system as opposed to breakdowns in individual parts or components and is evidenced by co movements (correlations) among most or all the parts." This definition at best captures the spill over or the repercussions of a contagion effect of a failure of a (small) part of the financial system: the systemic risk is indeed the risk of a chain reaction of interconnected parties. In this regard, the institutionalization of a centralized clearing house or central counterparty (CCP) may mitigate the different risks on OTC credit derivatives and hence correct the incentives of large financial institution to become "too interconnected to fail" (Acharya, Engel, Figlewski, Lynch & Subrahmanyam, 2009). The second part of this paper will be dedicated to the contributions of CCPs, which would act as counterparties, ensuring minimal counterparty risk and providing liquidity and transparency on prices and volumes traded. The paper concludes with reflections on the proliferation of CCPs, which may increase the systemic risks and pose new challenges for the regulators.

Lowering Systemic Risks in OTC Markets: Are Clearing Houses the Best Answer?

The Rise of OTC Markets

OTC markets are under forensic examination by lawmakers, as they have led to the significant build-up of systemic risks across the global financial system. In the aftermath of the 2007-2008 financial crisis, the size, opacity and complexity of OTC markets have come to light and improving their transparency and regulation has become a political priority. Governments are going to great lengths to assure their citizens that OTC derivatives and derivative dealers will be appropriately regulated, that all swap instruments will be closely scrutinized and that no new swap instrument will slip between the "regulatory cracks." Moreover, the G-20 in September 2009 agreed in Pittsburgh that all standardized OTC derivatives contracts should be traded on exchanges or electronic trading platforms, where appropriate.

According to statistics from the Bank of International Settlements, total notional amounts outstanding of the global derivatives market was \$1.2 quadrillion, which is 20 times the size of the world economy. Trading turnover on public markets amounted to US\$5 trillion the same year. Growth in some derivatives markets such as credit default swaps outpaced Moore's Law.

The rapid expansion and diversity of OTC markets can be largely attributed to the increased innovation and financial engineering that was triggered by the rising demand for speculation and the securitization of debt. (Securitization is a process by which less marketable assets are turned into structured products with a broader market exposure. Securitized assets, most notably subprime residential mortgage backed securities, became collateral for the most infamous collateralized debt obligations [CDOs] that ushered in the 2007–2008 financial crisis). In tandem, the demand for credit instruments increased with the decapitalization of firms through the substitution of equity by debt through leverage buyouts and mergers and acquisitions. The International Monetary Fund (2009) reports that over the past 5 years, the debt of non-financial corporations in the United States increased by approximately US\$ 840 billion, while their equity position has been reduced by approximately US\$300 billion. As Adam Smith stressed in *Wealth of Nations* as long ago as 1776, the risk of unregulated credit instruments lead to a “merry go round of money and credit that becomes even more dangerous as it become opaque through the involvement of many different actors.” What triggered these mergers, acquisitions and buyouts falls outside the ambit of this discussion; suffice it to say that a combination of low-interest rates, affordable credit, pro-credit tax policies and the globalization of the financial services industry were largely responsible. But what emerged from this trend were financial and non-financial firms that began to become increasingly interwoven, heightening the demand for derivatives, especially credit and interest rate products. In addition, the fusion of financial and non-financial firms prompted various forms of government intervention, including direct capital injection in the form of bailouts of too big and too-systemic-to-fail entities. For instance, the United States government started a program in 2008 called Troubled Asset Relief Program (TARP), which aims at purchasing assets and equity from financial institutions to support their financial position, financially assisting the automotive industry, investing in partnerships designed to increase liquidity and assisting mortgage programs (Congressional Budget Office, 2012). This trend also contributed to the demand for derivative instruments over the last 10 years.

OTC markets are also associated with sophisticated electronic trading platforms, which have attracted what have become known as “dark pools” (Braithwaite, 2010) of capital or liquidity that seek to benefit from the more lightly regulated markets and that enable trading in equities and other instruments to be masked. Within this so-called “shadow” side of finance are the trading and speculative roles played by, for example, hedge funds and the proprietary trading arms of banks, dealing for themselves or on behalf of large institutional investors. This has led to a manifestation of transparency and liquidity concerns at the forefront of OTC market reforms. Indeed, the so-called “flash crash” in May 2010, when trading activity saw “some stocks briefly losing 99% of their value” (Gordon, 2010) and the major indexes dropped by 9 per cent—including “a 7% decline in a roughly 15 minute span” (Corkery, 2010)—provides evidence of how high-frequency trading combined with speculation can radically destabilize markets.

Proponents of OTC markets contend that they improve the pricing of risk, help participants manage risks, lower transaction costs, reduce “information leakage” and give large institutions more freedom to trade without the “retail herd” tracking their every move. But due to the lack of transparency surrounding these markets, they also rob or restrict information from both the regulators and participants and pose the risk of spreading liquidity too thin. It also blocks the collection of high-frequency market-wide information on market activity, transaction prices and counterparty exposures.

Ongoing Reforms of OTC Markets: The Reliance on Counterparties

Of course, increased reliance on clearinghouses to address problems in other parts of the system increases the need to ensure the safety of clearinghouses themselves. As Mark Twain's character Pudd'nhead Wilson once opined, if you put all your eggs in one basket, you better watch that basket.

—Ben Bernanke (2011)

A cornerstone of the ongoing reforms to increase transparency and stability across OTC markets focuses on counterparty credit risk in OTC derivatives contracts and advocates the widespread adoption of central clearing as a means of risk reduction. This is required in both the Dodd-Frank Wall Street Reform and Consumer Protection Act (2010) and the European Market Infrastructure Regulation currently pending in the European Union.

In a traditional OTC transaction, the original counterparties are required to fulfill their obligations for the life of the contract. When trades are cleared centrally, the original counterparties' contracts with one another are replaced with two separate contracts with a central counterparty. The central counterparty (CCP) then becomes the buyer to the original seller and the seller to the original buyer. If either defaults, the CCP is contractually committed to pay all that is owed to the non-defaulting party. To enable the CPP to meet this obligation, it has to hold resources that include collateral posted by those who clear through it, financial commitments made by its members and owners, insurance, equity and in some cases mutualization. Hence, CPP clearing will not remove inherent derivate risks but, rather, will reallocate them.

CCPs have been widely used in exchange-traded futures and options in the past and were originally designed by futures exchanges to serve interested members by allocating and managing the risk of default. As derivative markets expanded, the size and systemic nature of CCPs have also increased. We can expect further exponential growth in these entities, given their catalytic positioning in the ongoing OTC market reforms,¹ and better regulating OTC transitions can reduce systemic risks across entire financial markets. In June 2007 OTC market had grown to US\$516.4 trillion and the exchange-traded market had grown to US\$96.7 trillion.

The issue is that CCPs were not designed to serve as macroprudential institutions with the responsibility to improve the stability of the financial system. This role has been thrust upon them by the ongoing reforms, and there is mounting concern that even with proposed remodelling of CCPs, they might not be fit for the purpose.

Instances when CCPs Can Contribute to Stability

CCPs can contribute to financial system stability by providing for the efficient and coordinated replacement of defaulted positions and by reducing (by position netting) the positions that need to be replaced in the event of a default. CCPs can also reduce price volatility and the incidence of extreme price moves that can occur when a large derivatives trading firm defaults. Moreover, by allocating default losses more efficiently (and in particular, by reducing the concentration of default exposures), CCPs can also help reduce defaults.

¹ Derivative traders have the choice to trade both cleared and non-cleared derivatives.

Some commentators also credit CCPs for reducing the procyclicality of the financial system. The growth of derivatives (especially credit default swaps) has arguably increased the procyclicality of the financial system. In other words, greater notional quantities of derivatives outstanding could be a source of reinforcing feedback between the real economy and the financial system. Through the use of CCP, the tendency for derivative markets to exacerbate the procyclicality of the financial system may be reduced. For example, by lowering counterparty risk concerns in periods of market stress, a CCP can help ensure that trading in credit default swaps continues when otherwise it may cease. Increased netting could also result in less use of collateral, which would tend to reduce procyclicality. CCP also has the potential to internalize market externalities by lowering margin requirements. However, many commentators have pointed out that because of their higher frequency, centralized and uniform margin calls (compared with decentralized and less uniform collateral practices in bilateral OTC markets) could aggravate procyclicality (Cecchetti, Gytelberg & Hollanders, 2009).

Instances when CCPs can Increase Systemic Risks

Even as policy-makers remodel CCPs to live up to macroprudential expectations, they need to note that the inherent character of CCPs can give rise to systemic risks. For example, while margins provide protection against default, changes in margin requirements can destabilize trading. This can occur when market participants that are required to meet higher margin calls begin to respond by selling assets and reducing positions in ways that exacerbate the price changes that caused the initial margin calls in the first place. This margin dynamic can lead to inflated and systemically destabilizing price movements. Moreover, CCPs are able to increase initial margin requirements with little notice and leave market participants to scramble to secure liquid assets in very short time frames to meet their obligations. This can lead to hikes in interest rates and credit rationing. Increases in demand for liquidity can also lead to inefficient asset sales—even by participants not subject to margin calls, but who will find access to normal sources of liquidity expensive and difficult to secure (Pirrong, 2011).

CCPs can also be threatened by defaults, and given that CCPs have been made an important intersection of the post 2007–2008 crisis financial system, CCP insolvencies now pose serious systemic risks. Financial history indicates that CCPs have defaulted: New York Gold Exchange Bank failed in the aftermath of the defaults by two large gold speculators in 1876, Caisse de Liquidation failed in 1974, the Kuala Lumpur Commodity Clearinghouse failed in 1983, and the Hong Kong Futures Exchange Clearing Corporation failed in the aftermath of “Black Monday,” October 19, 1987 (Davidson, 1989).

Systemic complications can arise from hidden risks when derivative contracts are sold to unregulated counterparties. For example, the steep currency depreciations in Brazil, Korea and Mexico in the second half of 2008 brought to light the large foreign exposures of domestic corporations that arose from OTC derivatives transactions (Bank of International Settlements, 2009). The Bank of International Settlements reports that domestic regulators had little information on the extent of local OTC derivatives exposures in which foreign financial institutions served as counterparties (Cecchetti & Hollanders, 2009).

A final problem may be the moral hazard: if the counterparty does not take full responsibility for its actions, it may undertake riskier transactions if it knows that a CCP would replace their positions in case of default.

Are Derivatives Suitable for Clearing?

Commentators also suggest that regulators bear in mind the extent to which derivative products are indeed suitable for central clearing. For example, while standardization may make clearing easier, it is less suited to the needs and trading objectives of users. More complex, more volatile and less liquid instruments are often more difficult to value and this makes under- or over-collateralization more likely. This, in turn, affects CCP margins and the ability to manage default. Hence, standardizing contract conditions alone will not be sufficient to make a derivative suitable for clearing. And even contractually standardized products that are liquid at one point can become illiquid in the later cycles of trade (Pirrong, 2006). As such, the principles of sustainable finance suggest that product characteristics over the entire life cycle of the product need to be considered when determining the suitability of derivative contracts for central clearing.

The Extent to Which CCPs will Facilitate Disclosure

As a part of its macroprudential obligations, CCPs need to also fulfill disclosure requirements and even work with regulators. It is indeed expected that the large-scale movement of derivatives trading to CCPs will facilitate the disclosure of positions and risks. By knowing who holds what positions, CCPs can assist regulators in mapping risk exposures in the financial system. However, commentators again point out that CCPs will not have a complete view of the risk profiles of products across their life cycle. And as the number and systemic nature of CCPs increase, regulators would need to map information from a number of them to recognize potential risks. This can be difficult when CCPs have cleared positions in CCPs located across multiple jurisdictions (Glass, 2009).

It is also critical to note that market participants will continue to use both cleared and non-cleared derivatives, therefore regulators will need look well beyond CCPs for risk mapping and derivatives data repositories that include both cleared and non-cleared positions should perhaps be the primary data source. Derivatives represent only a portion of the risk exposures of financial firms, and only a fraction of the linkages between them. Thus, although CCPs and derivatives data repositories can provide valuable information to regulators, they are not sufficient to permit regulators to understand all relevant exposures and interconnections.

Are the Ongoing Policy Responses Sufficient to Increase Systemic Stability in OTC Markets?

If CCPs are to become the systemic safeguards of future financial systems, the ongoing regulatory reforms need to increase their macroprudential characteristics. For one, CCPs need to be required to hold resources that cannot be used to satisfy obligations on derivatives contracts, but that are sufficient to permit the CCP to continue to undertake its operational (as opposed to risk-bearing) functions in the event of its inability to perform its contractual obligations (Pirrong, 2011).

CCPs could also be allowed to transfer the positions of a defaulted CCP to solvent counterparties, but this has important multiplier ramifications. Some experts are also touting the idea of expanding the CCP “default waterfall,” which would result in an outcome that approximates the economic outcome of a CCP bankruptcy, but which would not require an actual bankruptcy filing (Gregory, 2010).

Another question arises if CCPs had access to central bank funds—the primary concern being that the prospect of receiving a bailout could create a moral hazard and CCPs would pursue riskier strategies if a bailout was assured.

The issue is that in periods of stress, CCPs and their members can be illiquid but solvent (Gregory, 2009). These and related difficulties are directly comparable to liquidity issues that banks can face and when central bank intervention as a lender of last resort can be justified. Hence, failure to extend central bank support to CCPs could produce the kinds of market distortions that lenders of last resort powers are intended to address. There is also evidence that CCP members can experience extraordinary needs for liquidity during periods of large price movements that arise from their need to meet margin obligations. For example, in the crash of 1987, several large CCP members faced acute liquidity constraints and the Federal Reserve stepped in to provide liquidity to broker-dealers and futures commission merchants. Without this intervention, there would have been a serious risk of CCP default (Bernanke, 1990). Given that CCPs are poised for exponential growth in light of the ongoing reforms, central banks will need to support CCPs and CCP members as they do banks. And as with banks, moral hazard concerns would need to be addressed through prudential oversight and capital requirements.

Efforts to increase the prudential oversight of CCPs are certainly underway. In the United States, the Dodd-Frank Wall Street Reform and Consumer Protection Act, 2010, mandates that regulators including the Federal Reserve, the Securities and Exchange Commission and the Commodity Futures Trading Commission establish enhanced risk management standards and implement closer oversight of CCPs (and other market actors). The European Union is in the process of formulating legislation that will govern the prudential oversight of CCPs. International organizations are developing standards and are working to facilitate coordination among regulators in different jurisdictions. For example, the International Organisation of Securities Commission is in the process of developing standards for the operation of CCPs.

Why Regulators Need to be Vigilant

The main concern about existing proposals on CCPs is that they incorporate provisions that are microprudentially sound, but macroprudentially problematic. For example, regulations in the United States related to CCPs margins will serve to reduce risks for the entity but may result in margin increases during periods of heightened market volatility; this has important systemic implications. A similar example, albeit related to banking regulations, is described by Andrew G. Haldane and Robert M. May (2011) in their paper, *Systemic Risk and Banking Ecosystems*. The author's state:

Conventionally calibrated capital regulation seek to equalise failure probabilities across individual institutions to a given tolerance threshold such as a 0.1% probability of failure. Approaching this problem from a system-wide angle indicates a rather different calibration. Instead, the objective would be to set firms' capital requirement to equalise the marginal costs to the system as a whole of failure. In other words, regulatory requirements would be set higher for those banks bringing greatest risk to the system, for example, because of their size and connectivity.

The proliferation of clearing houses will pose many new challenges, including regulatory, legal and financial arbitrage, which will increase systemic risks across a wide subset of geographies. Clearing houses have already been established in Singapore, India, Japan and Hong Kong; South Korea and China are following suit. Canada, Australia and Taiwan are contemplating setting up a local CCP (Direct communication, International Swaps and Derivatives Association, August 2011).

It is also critical to note that the new reforms only require standardized derivatives to be traded on exchanges. Individually negotiated contracts, customized deals (or swaps) that are negotiated between two market participants are not required to be publicly traded on exchanges. Rather, they are to be reported to trade repositories, which would

make aggregate information available to regulators. This gives rise to an important regulatory loophole, as a large number of derivatives can be deemed to be individually negotiated. Regulators are hence creating the same loophole as in 1989, when the Commodity and Futures Commission issued a policy statement splitting derivatives into the same two categories (Partnoy, 2011). This leads the way to the deregulation of derivatives, which have since then been at the core of several financial disasters—from the collapse of Enron and Long Term Capital Management to the bankruptcy of Orange County, California. The 2007–2008 crisis aptly demonstrated how financial firms used derivatives to evade investment limitations and take on excessive leverage without informing investors or counterparties.

Lawmakers, regulators and stakeholders need to be vigilant. The financial system is global and extremely complex and the regulation of OTC markets will lead to changes that will have implications for systemic stability that few can anticipate at the present time. It is likely that CCPs will certainly increase the overall size of derivatives markets, but would this lead to improvements in position and exposure netting, and thereby capital utilization? How will CCPs affect the allocation of trading among traders? How can moral hazard be controlled to prevent it from increasing default risks? How will derivatives trading firms finance themselves? The ongoing reforms of OTC markets are reallocating risks (and not reducing them), and clear policy guidelines are critical to ensure that CCPs do not become the catalyst for future systemic failures.

References:

- Acharya, V.V., Engel, R.F., Figlewski, S., Lynch, A.W., & Subrahmanyam, M. G. (2009). Centralized clearing for credit derivatives. In V.V. Acharya, & M. Richardson (Eds.). *Restoring financial stability: How to repair a failed system* (pp. 251-268). New York: Wiley Finance.
- Bank for International Settlements, Committee of the Global Financial System. (2009). *The role of valuation and leverage in procyclicality*. CGFS Publication No 34. Switzerland: Bank for International Settlements.
- Bernanke, B.S. (1990). Clearing and settlement during the crash. *Review of Financial Studies*, 3(1). Retrieved from: <http://rfs.oxfordjournals.org/content/3/1/133.abstract>
- Braithwaite, T. (2010, May 16). Democrats open to derivative talks. Retrieved from: www.ft.com/cms/s/0/6b82d576-611a-11df-9bf0-00144feab49a.html#axzz1wtMfmWmK
- Cecchetti C., Gyntelberg J. & Hollanders M. (2009, September). Central counterparties for over-the-counter derivatives. *BIS Quarterly Review*.
- Congressional Budget Office (2012, March). *Report on the Troubled Asset Relief Program*. Retrieved from: www.cbo.gov/publication/43138
- Corkery, M. (2010, May 11). SEC chairman admits: We're outgunned by market supercomputers. Retrieved from: http://www.hpcwire.com/hpcwire/2010-05-11/sec_chairman_admits_we_re_outgunned_by_market_supercomputers.html
- Davidson, I.H. (1989). *Failure of the Hong Kong Exchanges and Clearing Ltd*. The Davidson Report for Securities Review Committee.
- European Central Bank. (2009). *OTC derivatives and post-trading infrastructures*. Retrieved from: www.ecb.int/pub/pdf/other/overthecounterderivatives200909en.pdf
- Glass, A.W. (2009). The regulatory drive towards central counterparty clearing of OTC credit derivatives and the necessary limits on this. *Capital Markets Law Journal*, 4. Retrieved from: http://cmlj.oxfordjournals.org/content/4/suppl_1/S79.extract
- Gordon, M. (2010, June 8). Move towards "progressive" equity trading no longer rocks. Retrieved from: <http://www.ft.com/intl/cms/s/0/ccd5adc2-7294-11df-9f82-00144feabdc0.html#axzz1x71l92lr>
- Gregory, J. (2009). *Counterparty credit risk: The new challenge for global financial markets*. New York: John Wiley & Sons.
- Gregory, J. (2010). *Impact of regulatory reform on clearing and settling OTC derivatives*. Retrieved from: http://oftraining.com/files/ccp_incisive.pdf
- Haldane A.G. & May, R.M. (2011). Systemic risk in banking ecosystems. *Nature*, 469. Retrieved from: www.nature.com/nature/journal/v469/n7330/full/nature09659.html
- International Monetary Fund. (2009). *World economic outlook database*. Retrieved from: www.imf.org/external/pubs/ft/weo/2008/01/weodata/weorept.aspx?pr.x=44&pr.y=16&sy=1998&ey=2009&scsm=1&ssd=1&sort=country&ds=.&br=1&c=001&s=NGDPD&grp=1&a=1

Kaufman, G.G. (1999). *Banking and currency crisis and systemic risk: A taxonomy and review*. Conference on Regulation and Stability in Banking Sector.

Kress, J. (2011). Credit default swaps and clearinghouses: Why central counterparties must have access to central bank liquidity. *Harvard Journal of Legislation*, 2.

Partnoy, F. (2009, May 15). Danger in Wall Street's shadows. *New York Times*. Retrieved from: www.nytimes.com/2009/05/15/opinion/15partnoy.html

Pirrong, C. (2006). *Rocket science, default risk and the organization of derivatives markets*. Houston: Bauer College of Business, University of Houston. Retrieved from: www.bauer.uh.edu/spirrong/Derivorg1.pdf

Pirrong, C. (2011, May). *The economics of central clearing: Theory in practice*. Discussion Paper Series. International Swaps and Derivatives Association.

Published by the International Institute for Sustainable Development.

International Institute for Sustainable Development

Head Office

161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4

Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Website: www.iisd.org