

Don't Forget the Plumbing: Payment, Clearing, and Settlement Companies in the Dodd-Frank and Financial CHOICE Acts

By Bruce Tuckman*

Introduction

On an average day, about \$15 trillion in U.S. dollar-denominated payments settle around the world.¹ The operations behind this massive volume of transactions are known as the “plumbing” of the financial system, which is managed by central banks and by a relatively small number of large payment, clearing, and settlement (PCS) companies.²

PCS companies have always been systemically important. Should a large PCS company cease operations, it would become difficult, or even temporarily impossible, to conduct a wide range of transactions. The resulting disruption of retail or securities trading could easily have severe economic and financial consequences.

Title VIII of Dodd-Frank aims to protect systemically important PCS companies, or Financial Market Utilities (FMUs), by subjecting them to heightened regulation and by giving them access to emergency liquidity at the discretion of the Federal Reserve.

Title VIII might have been a response to some plumbing issues that arose during 2008,³ and might, in the post-crisis spirit, be understood as filling holes in the regulatory landscape. Most directly, however, Title VIII was deemed necessary in the wake of Title VII.

Title VII mandated that most over-the-counter (OTC) derivatives be cleared. In other words, a derivative contract that had previously been settled between its two counterparties would now have to be settled through a PCS company known as a clearinghouse.

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¹ Payments Risk Committee (2016), p. 9.

² Payment refers, obviously enough, to transfers of cash. Clearing refers to the preparation of trades for settlement. Settlement refers to the exchange of cash for securities and the discharge of derivatives obligations.

³ On the whole, the PCS system worked well in 2008. See Bech, Martin, and McAndrews (2012). Intraday credit provision in tri-party repo was seriously flawed, however, and contributed to stresses around Bear Stearns and Lehman Brothers. See Tuckman (2010). But it is not clear that tri-party repo issues motivated Title VIII. First, tri-party repo clearing was at two banks, not a PCS company. Second, the issues were mostly corrected by regulators and the industry soon after the crisis, without Dodd-Frank. Third, tri-party repo and the clearing banks were never designated as Title VIII FMUs.

Proponents of Title VII argue that, overall, the clearing mandate reduces systemic risk. But it certainly increases the systemic risk of OTC derivatives clearinghouses. Were these to fail, it would become operationally difficult, if not impossible, and also illegal, to trade many OTC derivatives. From this perspective, Title VIII contends with the systemic risk created as a by-product of Title VII.

The CHOICE Act argues that Title VIII designations and access to emergency liquidity increase moral hazard and, thereby, increase the likelihood that PCS companies will fail. The CHOICE Act proposes, therefore, to repeal Title VIII.

This paper argues that both the implementation of Dodd-Frank to date and the CHOICE Act unwisely neglect the need for a resolution plan for PCS companies.

Given the systemic importance of the PCS system, government cannot credibly claim to let failing PCS companies cease operations. It is highly preferable, therefore, to develop a resolution plan in advance, rather than devise one, on the fly, during a crisis. Any such plan should certainly be sensitive to moral hazard by wiping out clearinghouse equity and other interests. But a workable resolution plan may very well require the use of public funds.

We find no harm in allowing PCS companies access to the Federal Reserve, but object to a designation process that restricts such access to incumbent PCS companies. At present, with rapid advances in financial technology, the regulatory apparatus should not entrench incumbents. A better approach would aim to level the playing field by permitting new entrants to accept regulation by the Federal Reserve in exchange for equal access to the system.

The Benefits and Risks of PCS Systems and Central Counterparties (CCPs)

To illustrate the benefits and risks of PCS systems, consider the following simple example: a broker-dealer (B/D) makes markets in a particular stock on a particular day; the stock trades at \$1 per share; and the B/D executes ten trades with ten different counterparties, five purchases of 100 shares and five sales of 100 shares. Each trade is “bilateral,” meaning that settlement obligations lie with the two counterparties to each trade.

If trades settle individually, the B/D executes ten different transactions, even though, at the end of the day, it has neither bought nor sold any stock on a net basis. These ten settlements, therefore, introduce needless operational expense and risk.

Settling trades individually also requires intraday financing. If the first trade to settle is a purchase, the B/D has to raise \$100 to buy the stock. If the first trade to settle is a sale, the B/D has to borrow 100 shares to deliver. But intraday financing is both costly and risky: If the B/D cannot raise the needed cash or securities, it will fail to settle.

Furthermore, the B/D's failure to settle could cascade through the system by causing its counterparties to fail on their trades with others.

Many PCS systems use a CCP to reduce the costs and risks just described. When a CCP clears a trade, it steps in as the legal counterparty to both sides of the trade. In the example, with CCP clearing, the B/D's ten trades would all legally face the CCP rather than its ten trading counterparties. Similarly, all of these counterparties would legally face the CCP.

With CCP clearing, the B/D settles its five purchases and five sales of the stock with a single counterparty, namely, the CCP. The CCP can, therefore, net the ten trades and inform the B/D that it has no settlement requirements that day. Through netting, then, in this stylized example, the number of required settlements and the need for intraday financing has vanished.

Changing the example somewhat, say that the B/D makes five purchases but only four sales that day. Its netted requirement would be to pay \$100 in exchange for 100 shares of stock. If the B/D cannot come up with \$100 according to schedule, the chain of settlements might be delayed or disrupted. Worse, if the B/D defaults on its settlement obligation, the CCP is on the hook to purchase the stock for \$100.

To protect itself against such an eventuality, the CCP requires that the B/D post margin in proportion to its obligations. To calculate an appropriate margin amount, the CCP might assume that the stock price could fall over the day by at most \$0.10, to \$0.90 per share. Under that assumption, the CCP would require \$10 in margin.

If the B/D defaulted and the stock did fall to \$0.90, the CCP would: substitute itself for the B/D and buy 100 shares for \$100; sell these 100 shares at market for \$90; and use the B/D's \$10 of margin to make up for the loss.

If the CCP's assumption was too optimistic, however, and the stock falls to \$0.85 per share, the CCP would suffer a loss of \$15 from taking over the B/D's position. With only \$10 of margin on hand, the CCP would be left with a loss of \$5.

In practice, a CCP clears trades only for its members. These members must demonstrate financial wherewithal, post required margin, and contribute to a "guarantee fund" to help the CCP withstand losses over and above posted margin.

This structure reveals that CCPs mutualize the risks of their members. In bilateral trades, members bear the risks of their counterparties' defaulting directly. With CCP clearing, members bear these risks through their contributions to the CCP.

CCPs establish a "waterfall" that assigns any losses it incurs. Typically, losses are first absorbed by the margin of the defaulting member, as in the example, along with that member's guarantee fund contribution. Additional losses would be absorbed first by the

CCPs own capital and then by the margin and guaranty funds of the non-defaulting members, plus, if the bylaws allow, by additional assessments on those surviving members.

If CCP losses exceed all of these resources, it reaches the “end of the waterfall” and fails. In this dire scenario, the CCP is unable to honor all of its commitments to settle the trades of its members.

At some threshold of losses before the end of the waterfall, however, members would stop trusting the CCP’s ability to honor settlements. At this point the CCP would have to either replenish capital and guarantee funds—which may be hard to do in a crisis—or shut down. And if a CCP with a dominant market position does shut down, trading in the securities it clears would, at least for some time, shut down as well.

Over-the-Counter (OTC) Derivatives Clearing

Before the financial crisis of 2007-2009, derivatives were traded either on an exchange or OTC. Derivatives that traded on an exchange had standardized terms and were cleared through a CCP. By contrast, derivatives that traded OTC before the crisis had customized terms and were traded bilaterally.

There is disagreement on the extent to which OTC derivatives played a role in the financial crisis and the extent to which bilateral trading poses risks to the financial system.⁴ Underlying the Dodd-Frank Act, however, is the strong belief that OTC derivatives markets should be much more highly regulated than they were before the crisis.

Title VII of Dodd-Frank mandates CCP clearing of OTC derivatives whenever possible.⁵ As illustrated in the simple examples earlier, netting across cleared positions reduces risk by reducing total settlement obligations. More generally, a portfolio of trades against a CCP, by the principle of diversification, has less counterparty risk than isolated bilateral trades against individual member firms.

This does not necessarily imply that mandatory clearing reduces systemic risk. Taking into account how OTC derivatives are used, forcing all trades to be cleared sacrifices certain benefits of bilateral trading. An important example is risk reduction across cleared and noncleared products.

Consider a B/D that lends money to a client against a portfolio of corporate bonds and has sold the client, bilaterally, Credit Default Swap (CDS) protection on corporate bonds.

⁴ On the dangers of uncleared OTC derivatives, see, for example, Financial Crisis Inquiry Commission (2011) and Cecchetti, Gyntelberg, and Hollanders (2009). In their defense, see, for example, Duffie and Zhu (2011), Pirrong (2010), Pirrong (2012), and Tuckman (2015).

⁵ Some exemptions are available for end-users—that is, commercial firms that use derivatives to hedge, as opposed to financial firms engaged in the derivatives businesses.

If the value of the bonds increases, the B/D returns margin to the client against the loan but takes back margin from the client against the sale of protection. Similarly, if the value of the bonds decreases, the B/D takes additional margin against the loan but posts additional margin against the CDS. Hence, the B/D's counterparty risk exposure to the client is small, as is the client's exposure to the B/D.

Under mandatory clearing of CDS, however, the B/D's exposure to the CDS is against the CCP, while its loan exposure, which is not cleared, is against the client. The risks no longer offset, and the B/D's counterparty risk exposure is greater than under the bilateral arrangements. More generally, a clearing mandate sacrifices risk reduction across cleared and non-cleared products.

For this and a number of other reasons, it can be argued that, while clearing has great advantages, mandatory clearing does not minimize systemic risk.⁶

Dodd-Frank's Title VIII on PCS Companies

Title VIII of Dodd-Frank is designed to identify and protect systemically important PCS companies. This title empowers the Financial Stability Oversight Council (FSOC) to designate individual PCS companies as systemically important financial market utilities (FMUs). Once designated, an FMU is subject to supervision and regulation by the Federal Reserve in addition to the Securities and Exchange Commission (SEC) or the Commodity Futures Trading Commission (CFTC).

Title VIII also permits the Federal Reserve to grant FMUs privileges that have historically been available only to member banks. In particular, FMUs may hold interest-bearing accounts in the Federal Reserve system and, in "unusual or exigent circumstances," be given access to the "discount window," or liquidity facility, under Section 10B of the Federal Reserve Act.

To date, FSOC has designated eight FMUs as systemically significant. Three are payment and settlement systems that do not take any credit risk, though there are always, of course, operational risks: The Clearing House Interbank Payment System (CHIPS), for large dollar payments; Continuous Linked Settlement Bank (CLS), for settlement of foreign exchange transactions; and The Depository Trust Company (DTC), for settlement of various securities transactions.

⁶ See, for example, Duffie and Zhu (2011), Pirrong (2010), Pirrong (2012), and Tuckman (2015). Another drawback of mandatory clearing is that dealers are not free to set up alternative risk protocols. To take one example, a dealer might charge a "credit value adjustment" instead of requiring margin. Relative to clearing, this arrangement has more counterparty risk but less liquidity risk. To take another example, dealers may choose to fix initial margin requirements for some term, which reduces the procyclicality of margin calls. Clearinghouse margin, by contrast, can typically be changed at any time. Finally, while a CCP naturally nets payments and exposures, bilateral contracts can and have been netted—at some cost—through a multilateral process known as compression.

Two other designated FMUs are CCPs for securities settlement: National Securities Clearing Corporation (NSCC), for settlement of equities, corporate bonds, municipal bonds, and money market instruments; and Fixed Income Clearing Corporation (FICC), for settlement of government bonds and government-sponsored mortgage-backed securities.

The remaining three designated FMUs are derivatives CCPs: Chicago Mercantile Exchange Clearing (CME), for a wide variety of derivatives; ICE Clear Credit (ICC), for credit default swaps; and The Options Clearing Corporation (OCC), for a variety of options.

Analysis

Dodd-Frank: No Resolution Protocol for PCS Companies

PCS companies pose systemic risk because there are no ready alternatives to their services. Were they to shut down, massive volumes of retail and security transactions would shut down as well.

Dodd-Frank's Title VII makes OTC derivatives clearinghouses systemic in the same way. The legal requirement to clear most derivatives will atrophy the operational ability to clear those derivatives bilaterally. Hence, after the failure of a CCP, it would be illegal, and also operationally difficult or impossible, to trade most derivatives.

Title VIII partially addresses the systemic risk of PCS companies. Once a company is designated as an FMU, it is subject to heightened supervision, may be allowed to keep an interest-bearing account at the Federal Reserve, and may be given access to Federal Reserve liquidity in a crisis.

The accounts at the Federal Reserve play a number of roles. First, receiving interest on these super-safe accounts is a perk in a world of low interest rates, both for an FMU and its customers.⁷ Second, these accounts allow an FMU direct access to the payment systems run by the Federal Reserve, are convenient for holding reserves or liquidity buffers required by regulators, and simplify operations should the Federal Reserve ever decide to provide emergency liquidity to the FMU.

By itself, however, Title VIII is not an adequate solution to the systemic risk of FMUs. While the failure of an FMU is very unlikely, it is not impossible.⁸ Nevertheless, more than six years after the passage of Dodd-Frank, there is still no plan for the resolution of a failing CCP.

⁷ In addition to depositing its own funds, a CCP can hold some of its customers' funds in segregated accounts at the Federal Reserve. See Burne (2016).

⁸ The CME nearly failed after the stock market crash of 1987. See Melamed (2009), pp. 149-151.

With respect to the Federal Reserve, there are limits as to what it could do. Under Title VIII, it can lend money to an FMU against satisfactory collateral. But this might very well not be enough to keep an FMU up-and-running, even under optimistic collateral valuations.

The Federal Reserve also has emergency lending powers under Section 13(3) of the Federal Reserve Act. These were limited by Dodd-Frank, however, to programs of “broad eligibility,” which do not seem to fit the case of a failing FMU. In addition, these powers are not meant to be used in the case of a clearly insolvent FMU.

Another possibility of FMU resolution under Dodd-Frank might be Title II’s “Orderly Liquidation Authority.” Not all scholars believe, however, that this would be legal, and, in any case, no plans are in place for resolving an FMU under Title II.⁹

Title VIII and Competition Among PCS Companies

Title VIII raises a concern with respect to market structure. PCS incumbents are already entrenched by large fixed costs, which include those of regulatory compliance. FMU designations, which grant special access to Federal Reserve accounts and emergency liquidity facilities, further entrench these incumbents.

The general problem with a policy of entrenching incumbents is that it stifles competition and, in the process, lessens market discipline and innovation. Stifling innovation in the PCS industry today is particularly troubling in light of the rapidly developing field of financial technology, which holds great promise for improving PCS systems.¹⁰ Singing the praises of competition in this industry is not new, by the way. The Monetary Control Act of 1980 required the Federal Reserve to price its own PCS services so as to encourage competition and innovation.¹¹

Competition across PCS companies does present some challenges. PCS systems have traditionally enjoyed significant economies of scale that might be lost in an industry with many smaller players. On the other hand, new developments in financial technology may very well achieve more than offsetting efficiencies.

Concerns have also been raised that competition in the PCS space might lead to a race-to-the-bottom, in which risk standards are lowered to gain market share. The incentives to engage in such a race, however, have historically been significantly blunted by the nature of the business. Clearing members have a lot of skin in the game through their posting of margin and guarantee funds. Furthermore, several PCS companies do not operate for profit but, instead, merely recover costs from their member firms. In any case, the industry should certainly be monitored to detect any such race-to-the-bottom.

⁹ On the legal question, see Lubben (2015). With respect to the absence of CCP resolution plans, see, for example, Duffie (2016) and Massad (2016).

¹⁰ See, for example, Michel (2015), Philippon (2016), and Tapscott and Tapscott (2016), Chapter 3.

¹¹ See, for example, Schultz (1980).

The CHOICE Act, Resolution, and Competition

The CHOICE Act proposes to repeal Title VIII in the expectation that removing FMU designations and access to Federal Reserve facilities will lower moral hazard and, therefore, reduce the likelihood that an FMU will take on too much risk and fail.

But even if moral hazard can be significantly reduced, there will always be some probability that a PCS company will fail. Furthermore, given the systemic importance of PCS systems, the government cannot credibly pre-commit to allow such a failure.¹² Hence, like Dodd-Frank, the CHOICE Act unwisely neglects to provide a resolution plan for a failing PCS company.

With respect to competition, of course, repealing Title VIII would remove the advantages conferred on incumbents by Dodd-Frank.

Repeal Mandatory Clearing?

Many provisions of Title VII aim to make OTC derivatives markets safer, namely, regulation of trades that are cleared, minimum margin requirements for non-cleared trades, and reporting requirements for all trades.

The mandatory clearing provision, however, has the drawback of making OTC derivatives CCPs too-big-to-fail. Proponents of the provision argue that mandatory clearing reduces systemic risk sufficiently to justify dealing with its undesirable consequences.

As discussed earlier, others disagree. From their perspective, repealing the mandate would not necessarily increase overall systemic risk, but would reduce the systemic importance of CCPs. Fewer derivative trades would pass through CCPs, and the plumbing of bilateral trades would be operational in the event of a CCP failure.

With or without mandatory clearing, however, the systemic risk of CCPs is significant enough to warrant well-developed resolution plans.

It might be noted, in passing, that repeal of mandatory clearing is very unlikely. The clearing mandate has many adherents, and the financial industry is not pressing for repeal.¹³

¹² Governments have historically changed, stretched, or outright violated existing law to bail out financial systems in crisis. Examples range from the suspension of specie payments in New York in the 19th century, despite repeated prohibitions of such suspensions (see Gorton (2012), pp. 103-107), to various actions taken by the government in 2008, e.g., the Treasury's creative use of its exchange stabilization fund to guarantee money market funds, the enactment of the Troubled Asset Relief Program (TARP), and the Treasury's diversion of TARP funds from troubled asset purchases to large bank recapitalizations.

¹³ One reason is that the industry has largely adjusted to the current regulatory framework and wants to move on. Citigroup's CFO, for example, said after the 2016 election, "The first thing I would ask for is

Other Ways to Reduce the Systemic Risk of OTC Derivatives CCPs

Two proposals, not included in either Dodd-Frank or the CHOICE Act, have been put forward to reduce the systemic risk of OTC derivatives CCPs.

First, provide higher quality transparency as to how firms' derivatives positions affect their holistic risks. Such transparency would allow investors, creditors, and regulators to better monitor both individual and systemic risks.¹⁴

Second, derivatives safe harbors should be narrowed. These exemptions from the bankruptcy code enable counterparties to manage through a crisis by allowing them to tear up derivatives trades with a defaulting entity and to liquidate collateral held against those trades. At the same time, however, these tear-ups and liquidations complicate the resolution or liquidation of the defaulting entity, which could be a CCP.¹⁵

Some academic and policy analysts argue that derivatives safe harbors should be completely eliminated, while others argue that they should be retained only for relatively liquid derivatives. Opinion is nearly unanimous, however, that the safe harbors should be narrowed in some way.¹⁶

Recommendations

If a PCS company were to fail, the government would almost certainly intervene to keep it operating. This reality suggests a resolution protocol in the form of nationalization.¹⁷ The word "nationalization" implies that all margin, equity, and guarantee funds would be wiped out, which is consistent with the intention of the CHOICE Act to reduce moral hazard.

Contrary to the intention of the CHOICE Act, however, such a nationalization would allow for the temporary infusion of public funds to keep the PCS system running and to keep retail and securities transactions flowing. While the necessity of using public funds is regrettable, there is some comfort in the argument that authorities might be more

nothing new, no new rules." Rexrode and Glazer (2016). Another reason is that the extensive fixed costs of complying with Dodd-Frank, including the clearing mandate, have raised barriers to entry to the benefit of large derivatives dealers. Jamie Dimon, CEO of JPMorgan Chase, was quoted as saying that "higher capital rules, Volcker [Rule], and OTC derivative reforms... make it more expensive and tend to make it tougher for smaller players to enter the market, effectively widening JPM's 'moat.'" Weisenthal (2013). Lloyd Blankfein, CEO of Goldman Sachs, said that "More intense regulatory and technology requirements have raised the barriers to entry higher than at any other time in modern history." *The Wall Street Journal* (2015).

¹⁴ See, for example, Acharya (2014) and Acharya, Sachar, and Subrahmanyam (2011).

¹⁵ Some progress has been made with respect to limiting the safe harbors in the case of a government resolution. See Duffie (2016).

¹⁶ See, for example, Acharya et al. (2011), pp. 229-231, Duffie and Skeel (2012), Lubben (2010), and Tuckman (2010).

¹⁷ See Lubben (2015) for a detailed proposal along these lines.

likely to let individual financial firms fail when those failures would be prevented from shutting down the operations of PCS companies.

Title VIII's idea of formalizing the relationship between PCS companies and the Federal Reserve is sensible. The practice of a clearinghouse providing temporary liquidity to its members precedes the creation of the Federal Reserve, and in today's system, the Federal Reserve is the only sure supplier of liquidity in a crisis. Indeed, in the PCS services managed by the Federal Reserve (i.e., Fedwire and the National Settlement Service), the Federal Reserve regularly supplies intraday liquidity to participants.

A formal relationship between PCS companies and the Federal Reserve can also head off the need for a much more intrusive government intervention or resolution. In 1985, for example, the Federal Reserve made the largest discount window loan in its history to Bank of New York, which was temporarily unable, because of a computer system malfunction, to settle government bond trades for customers.¹⁸

With respect to market structure, however, Title VIII worryingly entrenches incumbents in the PCS industry. An alternative approach would be for the Federal Reserve to permit PCS companies to subject themselves to regulation and supervision in exchange for access to Federal Reserve accounts and liquidity facilities.

A framework of this sort would be analogous to small and large banks competing on the even playing field of membership in the Federal Reserve System. Furthermore, both the Reverse Repo Facility¹⁹ and Title VIII have already set the precedent of the Federal Reserve's dealing directly with entities other than banks.

References

Acharya, V., (2014), "A Transparency Standard for Derivatives," in Risk Topography, M. Brunnermeier and A. Krishnamurthy, eds., Chapter 6.

Acharya, V., et al. (2009b), "Derivatives: The Ultimate Financial Innovation," in Restoring Financial Stability, Wiley, Chapter 10.

Acharya, V., et al. (2009a), "Centralized Clearing for Credit Derivatives," in Restoring Financial Stability, Wiley, Chapter 11.

Acharya, V., et al. (2011), "Resolution Authority," in Regulating Wall Street, Wiley, Chapter 8.

Acharya, V., and Bisin, A. (2013), "Counterparty Risk Externality: Centralized versus Over-the-Counter Markets," Working Paper.

¹⁸ See Zweig and Sullivan (1985).

¹⁹ Through the Reverse Repo Facility, banks, broker/dealers, government-sponsored entities, and money market funds can all lend money directly to the Federal Reserve, taking its securities as collateral.

Acharya, V., Iyer A., and Sundaram, R. (2016), "Risk Sharing and the Creation of Systemic Risk," Working Paper.

Acharya, V., Sachar, O., and Subrahmanyam, M. (2011), "Regulating OTC Derivatives," in Regulating Wall Street, Wiley, Chapter 13.

Bech, M., Martin, A., and McAndrews, J. (2012), "Settlement Liquidity and Monetary Policy Implementation—Lessons from the Financial Crisis," March.

Burne, K. (2016), "Clearinghouses Park Billions in New Fed Accounts," *The Wall Street Journal*, November 23.

Cecchetti, S., Gyntelberg, J., and Hollanders, M. (2009), "Central Counterparties for Over-the-Counter Derivatives," *BIS Quarterly Review*, September.

Duffie, D. (2016), "Financial Regulatory Reform After the Crisis: An Assessment," ECB Forum on Central Banking, June 27-29.

Duffie, D., and Skeel, D. (2012), "A Dialogue on the Costs and Benefits of Automatic Stays for Derivatives and Repurchase Agreements," *Faculty Scholarship*, University of Pennsylvania Law School.

Duffie, D., and Zhu, H. (2011), "Does a Central Clearing Counterparty Reduce Counterparty Risk?" *The Review of Asset Pricing Studies* 1(1), pp. 74-95.

Financial Crisis Inquiry Commission (2011), "Financial Crisis Inquiry Report," Government Printing Office, Washington.

Gorton, G. (2012), Misunderstanding Financial Crises, Oxford.

ISDA (2016), "Key Trends in Clearing for Small Derivatives Users," ISDA Research Note, October 2016.

Lubben (2010), "Repeal the Safe Harbors," *American Bankruptcy Institute Law Review* 18.

Lubben, S. (2016), "Failure of the Clearinghouse: Dodd-Frank's Fatal Flaw?" *Virginia Law & Business Review* 10(1), pp. 127-160.

Massad, T. (2016), "Taking Stock of Financial Resilience," OFR-FSOC 2016 Annual Conference, February 5.

Melamed, L. (2009), For Crying Out Loud, John Wiley & Sons.

Michel, N. (2015), "Financial Market Utilities: One More Dangerous Concept in Dodd-Frank," Background, Heritage Foundation.

Payments Risk Committee (2016), "Intraday Liquidity Flows," November 16.

- Philippon, T. (2016), "The FinTech Opportunity," Working Paper, July.
- Pirrong, C. (2010), "Derivatives Clearing Mandates: Cure or Curse?" *Journal of Applied Corporate Finance* 22(3), Summer.
- Pirrong, C. (2012), "Clearing and Collateral Mandates: A New Liquidity Trap?" *Journal of Applied Corporate Finance* 24(1), Winter.
- Rexrode, C., and Glazer, E. (2016), "Banks to Donald Trump: Don't Kill Dodd-Frank," *The Wall Street Journal*, December 8.
- Schultz, F. (1980), "The Monetary Control Act of 1980 and the Payment System," remarks at the Banking and Payment Systems International Conference, April 4.
- Tapscott, D., and Tapscott A., (2016), *Blockchain Revolution*, Portfolio/Penguin.
- The Wall Street Journal* (2015), "Regulation is Good for Goldman," Opinion: Review & Outlook, February 11.
- Tuckman, B. (2010), "Systemic Risk and the Tri-Party Repo Clearing Banks," CFS Policy Paper, February 2.
- Tuckman, B. (2010), "Amending Safe Harbors to Reduce Systemic Risk in OTC Derivatives Markets," *Policy Paper*, Center for Financial Stability, April 22.
- Tuckman, B. (2015), "In Defense of Derivatives: from Beer to the Financial Crisis," *Policy Analysis* (781), Cato Institute, September 29.
- Weisenthal, J. (2013), "The 4 Things That Worry Jamie Dimon," *Business Insider*, February 4.
- Zweig, P, and Sullivan, A. (1985), "A Computer Snafu Snarls the Handling of Treasury Issues," *The Wall Street Journal*, November 25.