2013

Transitive Counterparty Risk and Financial Contracts

Manuel A. Utset

Follow this and additional works at: https://brooklynworks.brooklaw.edu/blr

Transitive Counterparty Risk and Financial Contracts

Manuel A. Utset[†]

INTRODUCTION

Before the Great Recession of 2007–2009 (the Great Recession), Congress, regulators, and many commentators had assumed (often implicitly) that the best way to prevent financial crises and contagion was to ensure that each financial institution subject to regulatory oversight—primarily depository institutions, such as commercial banks—remained financially sound. To accomplish this, Congress required depository institutions insured by the FDIC to retain sufficient amounts of capital (to avoid bank runs and insolvency) and to subject themselves to active (often on-site) oversight by the FDIC.

The Great Recession exposed a number of flaws with extant financial regulations. First, many financial institutions acted just like banks but escaped banking regulation by not accepting deposits subject to FDIC insurance. Many of these "shadow banks," as well as regulated banks (collectively, "financial institutions"), failed or received bailout funds from the government. This occurred not because they became insolvent but because they suffered from liquidity problems—they were unable to continue raising capital to finance their ongoing operations, or they were forced to pay much higher returns to entice investors to make investments. Second, these failing financial institutions were parties to thousands or, in some cases, millions of financial contracts,[1] many of which were highly complex and not well understood by regulators, rating agencies,

---

[1] For example, when Lehman Brothers filed for bankruptcy, it had nearly one million open derivatives contracts, a large number of them with other financial institutions. *See* Henry A. Barkhausen, *Derivatives in Bankruptcy: Some Lessons from Lehman Brothers*, J. STRUCTURED FIN., Winter 2010, at 7, 7.

and even the parties themselves in some cases.[2] Third, regulators, financial institutions, and market participants did not have available sufficiently robust mechanisms to keep track of financial contracts and the aggregate, system-wide risks they created.

As financial regulators continue to adopt rules under the Dodd-Frank Act, they will have to answer a number of foundational questions. What does it mean for a financial institution to be interconnected to another, or two other, or n other institutions? How can regulators distinguish between socially beneficial and socially harmful interconnections? Is it possible for regulators to identify growing, system-wide risks, and to devise and implement solutions in a timely fashion? What does it mean for two or more financial contracts to be interconnected? What are the risks of having n interconnected contracts involving k institutions (and other types of counterparties)? What type of information about interconnected financial institutions and interconnected financial contracts must parties possess to make optimal contracting and risk allocation decisions? What type of information must regulators possess to engage in real-time oversight of the financial system?

Almost three years into the Act, regulators have adopted only a relatively small number of the rules dealing with these foundational questions. This delay in fleshing out Dodd-Frank is due in part to political factors and regulatory overload. But it is also due to a deeper and more basic theoretical issue: we still lack an adequate account of an increasingly common type of financial transaction, which I will refer to as "n-contracts-transactions." In these transactions, multiple parties are bound together, often indirectly and without privity of contract or knowledge of the identities of the other parties in the $n - 1$ contracts that comprise the one, global transaction. These transactions are not innocuous. They can lead to the spillover of counterparty risks among parties that are not in privity of contract. They are also not well understood, notwithstanding their ubiquity.

More generally, transitive-risk contracts involve three or more interconnected parties, such as when A enters into a contract with B, and B enters into a contract with C. Although A and C are not in contractual privity, the transactional risks

---

[2] *See* COUNTERPARTY RISK MGMT. POLICY GRP. III, CONTAINING SYSTEMIC RISK: THE ROAD TO REFORM 4 (2008), *available at* http://www.crmpolicygroup.org/docs/CRMPG-III.pdf (describing the complexity faced by financial institutions in the day-to-day risk management of portfolios of complex securities).

of the first contract may spill over to *C*, and those of the second contract may spill over to *A*. I will refer to this sort of externality as "transitive counterparty risk." On the other hand, if *A*, *B*, and *C* were parties to a single contract, *A* and *C* could protect themselves by including the necessary provisions in the contract. This article's theory of transitive-risk contracts will offer an account of the role of *n*-contracts-transactions in transferring transitive counterparty risk.

Transitive-risk contracts are common in financial settings. The relationship between bank depositors and bank borrowers involves transitive-risk contracts. Bank depositors are also in a transitive-risk relationship with each other, as are lenders in repo transactions. Transitive-risk contracts are also present in securitizations and more general transactions involving derivatives. It turns out that the most basic transaction involving financial institutions—that in which they act as financial intermediaries—is the prototypical transitive-risk contract.

If we are to fully understand what caused the Great Recession and how to avoid a recurrence, we must first answer two basic questions. Why so many financial contracts? And why so many transitive-risk contract relationships? One explanation is that financial institutions, their customers, and rating agencies, engage in self-serving opportunistic behavior. They used financial contracts—in express or tacit collusion—to transfer risks to unsuspecting, underinformed (or, in some instances, misinformed) third parties. A second possible explanation is far less nefarious. Pursuant to this explanation, in the period leading to the Great Recession, financial engineers took standard securities and divided them into a series of new rights and obligations that allowed parties to better allocate risks.[3] This disaggregation–reaggregation process eventually led to the creation and distribution of a large number of new securities—some relatively simple, others extremely complex.

In detailing the operation of transitive-risk contracts and their role in transferring transitive counterparty risk, the analysis developed in this article provides a positive account of

---

[3] This fragmentation of standard transactions into a sequence of subtransactions had an important aim: to approximate the type of state-contingent securities introduced by the economists Kenneth Arrow and Gerard Debreu. But once disaggregated into myriad subtransactions, it became possible to recombine them in various different ways, both to disperse risk and engage in speculation. *See infra* Part II.C.

modern financial markets, financial contracting, and complex financial institutions, including the interconnectedness between financial institutions that led to the collapse of Bear Stearns and Lehman Brothers. The next step—which is beyond the scope of this article—will be to provide an account of how to design legal rules (and contracts) to deal with transitive counterparty risks.

Part I provides an overview of financial contracts and financial institutions. Part II develops a positive account of the fragmentation of financial transactions, and, in doing so, provides an account of contractual relationships among financial institutions and between institutions and their customers. Part III sets forth a new theory of the interconnection of financial contracts and, by extension, the interconnection among financial institutions that are either parties to those contracts or indirectly affected by them. In the absence of any such theory, regulators will find it virtually impossible to craft and implement the kind of macroprudential regulations required by the Dodd-Frank Act, and to test, in real time, whether those regulations are working as expected and address any shortcomings. Part IV applies the theory to a number of general scenarios involving financial institutions and financial contracts.

I.   FINANCIAL INSTITUTIONS: BACKGROUND

Households and business firms own real assets, such as personal and real property, and, in the case of firms, raw materials and equipment, which they use to produce and market goods and services; both also may own intangible assets,[4] including intellectual property and human capital,[5] and financial assets, such as equity[6] or debt[7] securities. A financial

---

[4]   Real assets also include intangible assets, such as intellectual property. *See* THOMAS S.Y. HO & SANG BIN LEE, THE OXFORD GUIDE TO FINANCIAL MODELING 17 (2004) (drawing a distinction between two types of real assets, tangible and intangible assets).

[5]   *See* GARY S. BECKER, HUMAN CAPITAL 33-51 (3d ed. 1993) (discussing value of education as investment in human capital).

[6]   An equity security such as common stock creates ownership rights, including the right to vote on certain corporate matters and to receive dividends, when declared by the board, and liquidation distributions. Preferred stock is a second type of equity security, one that has certain preferences over common stock, such as a priority over dividends and liquidation distributions. *See, e.g.*, Del. Code Ann. tit. 8, § 151 (2013) (describing common and preferred stock).

[7]   For example, a debt contract creates a contractual claim on assets that backs up the debtor's promise to pay the interest and principal when due; it also provides the creditor with contingent control rights, in case the debtor defaults *See* JEAN TIROLE, THE THEORY OF CORPORATE FINANCE 80-87 (2006) (describing various aspects of loan agreements and debt securities, including the pledging of collateral, the use of positive and negative covenants, and consequences of default and bankruptcy).

asset is a claim on the cash flows produced by real assets, and, as such, it is a useful device for valuing those underlying assets[8] and controlling their use and disposition.[9] Financial institutions help households and firms (including other financial institutions) manage investment risks associated with holding financial assets and the liquidity risks associated with varying cash flows and investment or consumption opportunities. Financial institutions, however, own primarily financial assets, and they finance their operations mostly by borrowing funds, often on a short-term basis. These characteristics of their balance sheet expose them to liquidity and insolvency risks that can spill over to other financial institutions, as well as to households and non-financial firms.[10]

This part begins by describing liquidity problems and how financial institutions help alleviate them. It continues by explaining how financial institutions act as investment intermediaries, helping firms and households deal with the informational asymmetry problems inherent in investment decisions. The part concludes by analyzing liquidity problems within financial institutions and by providing a normative account of why the fragility of institutions matters.

A.   *Liquidity Problems and Financial Intermediaries*

The actors charged with running firms and households operate within an intertemporal framework: in each period they make decisions that can affect their current and future welfare.[11] More specifically, at time t, an actor will choose the

---

[8]   *See* HO & LEE, *supra* note 4, at 17 (defining financial assets as claims on real assets, and describing their use in valuing those assets). Financial assets may also involve claims over intangible assets such as human capital. An individual can, for example, borrow against her expected future earnings. *See* Theo S. Eicher, *Human Capital and Technological Change*, 63 REV. ECON. STUDIES 127, 129 (1996) (developing theory in which individuals borrow to acquire human capital, in expectation of future income); Oliver Hart & John Moore, *A Theory of Debt Based on the Inalienability of Human Capital*, 109 Q. J. ECON. 841, 841-42 (1994) (discussing borrowing constraints based on ability of debtors to threaten to withdraw their human capital after they have received money, a strategy that they would use in order to renegotiate the original debt contract on more favorable terms).

[9]   *See* OLIVER HART, FIRMS, CONTRACTS, AND FINANCIAL STRUCTURE 56-59 (1995) (describing role of real assets in establishing authority and power within business firms).

[10]   *See* Jean Tirole, *Illiquidity and All Its Friends*, 49 J. ECON. LIT. 287, 297-98 (2011).

[11]   *See* George Loewenstein & Richard H. Thaler, *Inter-temporal Choice*, J. ECON. PERSP., Fall 1989, at 181, 181 (defining intertemporal choices as "decisions in which the timing of costs and benefits are spread out over time"). In choosing a course

consumption or investment strategy that will maximize her intertemporal utility. In doing so, she will take into account the instantaneous utility from using part of her wealth to consume goods in the current period. She will also take into account the expected returns (properly discounted to account for her impatience), if she decides to invest that portion of her wealth and delay her consumption.[12]

As a general matter, firms and households prefer to "smooth" their consumption over time.[13] In order to smooth consumption effectively and ensure that funds will be available if an investment opportunity arises, both firms and households must predict: (1) when they expect to need the funds; and (2) the likelihood that they will have access to those funds, either by using cash savings, transforming some of their assets into cash, borrowing funds, or in the case of firms, selling equity or debt securities.[14] A firm or household has a "liquidity problem"[15] if it needs funds—to consume, pay debts, or invest in a valuable project—at a particular point in time and does not have access

---

of action, at time t, a rational actor will take into account the instantaneous utility, if any, that it will receive immediately, u_t, which will depend on the current state of the world, s_t, and the payoffs, x_t, given that state of the world. This may be expressed as u_t $(x_t|s_t)$. It will look into the future, and thus choose the course of action that will maximize the sum of instantaneous utility in the current period and in each relevant future period; it will discount the latter to account for: (1) the uncertainty regarding future states of the world, using its subjective probability distribution over these future states; and (2) the actor's impatience, as captured by her discount factor, δ. If we let $p(s_{t+1})$ capture the probability distribution over possible states in period $t + 1$, then, in period t, the actor will determine the expected payoffs, discounting them, in turn, by δ, to account for its impatience. Under the standard intertemporal model individuals are assumed to use an intertemporal utility function that captures the sum of their utility over their whole life. *See* Robert J. Barro and James W. Friedman, *On Uncertain Lifetimes*, J. POL. ECON. 843, 844-46 (1977) (developing intertemporal utility model in which individuals maximizes the sum of their utility over a lifetime and where positive discounting is due to the potential that individual will die before being able to consume goods).

[12] That is, the actor may invest funds, at time t, in order to produce greater wealth at time $t + 1$. Alternatively, it may choose to consume in period t and borrow funds at time $t + 1$ to finance further consumption or to make investments. The actor will save at time t only if the rate of return on that investment is at least as high as its personal impatience captured by δ.

[13] *See* John H. Cochrane, *A Simple Test of Consumption Insurance*, 99 J. POL. ECON. 557, 557-59 (1991) (summarizing arguments regarding preference for income smoothing in households). *See* TIROLE, *supra* note 7, at 212-13 (discussing reaction of firms to uncertainty regarding future liquidity, and incentive to hoard cash, to smooth over low cash flow periods).

[14] *See* Tirole, *supra* note 10, at 288 (describing liquidity as "stores of value").

[15] *See* TIROLE, *supra* note 7, at 199-201 (describing fact that firms will worry about future ability to finance valuable projects, make further investments in existing projects, or pay creditors on a timely fashion, stating that such "liquidity shortages reflect an inadequacy between available resources and refinancing needs," and providing examples of typical types of liquidity problems).

to them or the cost of acquiring them (by selling assets, borrowing, or selling equity) is sufficiently high.[16]

Banks,[17] investment banks,[18] insurance companies,[19] hedge funds,[20] and private equity funds,[21] are in the business of creating and dealing with financial claims.[22] As such, they play an important role in helping firms and households smooth consumption, and thus to deal with liquidity problems. Some types of financial contracts allow investors to borrow funds

---

[16] *See* Douglas W. Diamond & Philip H. Dybvig, *Bank Runs, Deposit Insurance, and Liquidity*, 91 J. POL. ECON. 401 (1983) (setting forth such a model to explain role of banks in helping reduce liquidity risks).

[17] *See* XAVIER FREIXAS & JEAN-CHARLES ROCHET, MICROECONOMICS OF BANKING 1 (1997) (defining a bank as a firm whose "operations consist in granting loans and receiving deposits from the public"). The Bank Holding Company Act of 1956 defines a "bank" as an "insured bank" under the FDIC Act or any institution organized under Federal or state law which both accepts demand deposits and is in the business of making commercial loans. 12 U.S.C. § 1841(c)(1) (2006). Under the FDIC Act, an "insured bank" is a state or federally chartered bank whose deposits are insured by the FDIC. *Id.* § 1813(a) and (h).

[18] Investment banks act as underwriters, brokers and dealers, and advisors in takeovers and other types of transactions. *See* Section 2(a)(11) of Securities Act of 1933 (defining "underwriter" as "any person who has purchased from an issuer with a view to, or offers or sells for an issuer in connection with, the distribution of any security"). Securities Act of 1933, ch, 38, 48 Stat. 74 (codified as amended at 15 U.S.C. §§ 77a-77aa (2006)). Section 3(a)(4)(A) of the Securities Exchange Act of 1934 defines a "broker" as any person "engaged in the business of effecting transactions in securities for the account of others." Section 3(a)(5)(A) of the Securities Exchange Act of 1934 defines a "dealer" as "any person engaged in the business of buying and selling securities . . . for such person's own account through a broker or otherwise." Securities Act of 1934, ch. 38, 48 Stat. 74 (codified as amended at 15 U.S.C. § 78a (2006)).

[19] Section 201(a)(13) of the Dodd-Frank Act defines an "insurance company" as "any entity that is—(A) engaged in the business of insurance; (B) subject to regulation by a State insurance regulator; and (C) covered by a State law that is designed to specifically deal with the rehabilitation, liquidation, or insolvency of an insurance company." Dodd Frank Act, Pub. L. No 111-203 (2010).

[20] *See* Nicholas Chan et al., *Do Hedge Funds Increase Systemic Risks?*, ECON. REV. FEDERAL RESERVE OF ATLANTA 49, 49 (Fourth Quarter 2006) (defining hedge funds as "investment partnerships that engage in a variety of active trading strategies" on behalf of investors).

[21] *See* Dodd-Frank Act, § 619 (h)(2) (defining private equity and hedge funds as "issuers that would be an investment company, as defined in the Investment Company Act of 1940 . . . , but for section 3(c)(1) or 3(c)(7) of that Act, or such similar funds as the appropriate Federal banking agencies, the Securities and Exchange Commission, and the Commodity Futures Trading Commission may, by rule, as provided in subsection (b)(2), determine").

[22] More generally, financial intermediaries transform one type of financial claim into another by entering into financial contracts with investors and firms that need capital. *See* FREIXAS & ROCHET, *supra* note 17, at 15 (defining financial intermediaries as firms that "specialize[] in . . . buying and selling (at the same time) financial contracts and securities" and who are in the business of transforming financial inputs into outputs); *see also* Evan Gatev & Philip E. Straham, *Banks' Advantage in Hedging Liquidity Risk: Theory and Evidence from the Commercial Paper Market*, 61 J. FIN. 867, 870-71 (describing role played by commercial paper facilities in providing liquidity, as an alternative to funding by financial intermediaries such as banks).

from institutions;[23] others, allow them to lend funds to institutions on a short-term basis, which is important, given that short-maturities help alleviate liquidity risks.[24] More generally, a financial institution enters into contracts with its customers whereby the latter makes one or more payments in return for the institution's promise to distribute funds, deliver commodities or securities, or perform some other activity at a later time.[25]

For example, a demand deposit[26] account allows depositors to lend money to a bank in return for a promise that they can withdraw their funds, without penalty, whenever they need them, simply by making a "demand" on the bank.[27] An

---

[23]   For example, business firms and households can set up lines of credit with banks to deal with liquidity shocks that require quick access to funds. *See* Arie Melnik & Steven Plaut, *Loan Commitment Contracts, Terms of Lending, and Credit Allocation*, 41 J. FIN. 425, 426-27 (1986) (discussing role of line of credits in providing contingent liquidity).

[24]   *See* FRANKLIN ALLEN & DOUGLAS GALE, UNDERSTANDING FINANCIAL CRISES 58-59 (2007) (discussing problem of consumers' uncertain future liquidity preferences and role of banks in reducing risk).

[25]   *See* Robert C. Merton, *A Functional Perspective of Financial Intermediation*, 24 FIN. MANAGEMENT 23, 24 (1995) (describing role of financial intermediaries in "issuing contingent-payment contracts to their customers"); FREIXAS & ROCHET, *supra* note 17, at 2-4 (describing various liquidity and payment services provided by banks.

[26]   When a customer opens a demand deposit account at a bank, it acquires a financial contract that allows it to make withdrawals at any time and potentially receive interest payments in the meantime. *See* 12 C.F.R. § 204.2 (b)(1) (2009) (defining a "demand deposit" as a deposit with a bank that is payable on demand).

[27]   Assume that in Period 0, a group of individuals deposit funds in a bank. In Period 1, the short-term depositors will need liquid assets and will withdraw their funds; the long-term depositors, on the other hand, will leave their money in the bank until Period 2. The problem is that in Period 0, none of the individuals know whether they will be short-term or long-term depositors. In other words, each individual is making an intertemporal decision in which its future utility, u_1, in Period 1, depends on which state of the world, s_1, emerges and the payoffs, x_1, under the possible states. There are two possible states of the world: the individual will have no need for the liquid assets, or the individual will need them to consume or make an investment. If the individual can correctly predict that she will not need liquid assets during Period 1, then she would maximize her return by making a long-term investment, lasting two periods, and producing a Period 2 payoff that is larger than if she had preserved the option to withdraw funds during Period 1. On the other hand, if she misjudges and commits to a long-term investment but turns out to need the funds in Period 1, then she will experience a liquidity problem. Banks can help reduce this liquidity risk by providing depositors with a "real option": a depositor with a demand deposit account can wait until she learns whether she is a short-term or long-term depositor during Period 1. In Period 0, the bank will lend a portion of those deposits to borrowers, who agree to repay in Period 2, at an interest rate that is high enough to reflect the fact that they will keep the funds for two periods. Borrowers that want uninterrupted access to funds are willing to pay a premium for a long-term two-period loan as opposed to two short-term one-period loans (given that there is some probability the bank will refuse to roll over the loan in Period 1). In determining how much it can lend, a bank will predict how many depositors will withdraw their funds in Period 1 and it will keep

insurance company sells policies to customers who pay premiums in return for the company's obligation to pay out a certain amount upon the occurrence of a specified event, such as a fire or death.[28] Insurance, therefore, allows households and businesses to deal with unforeseen contingencies that can affect their cash flows. Moreover, non-insurance companies can sell products that are functionally equivalent to insurance, such as credit default swaps, in which the owner of a debt security makes "premium" payments to a third party in return for a promise to make a "payout" to it if the issuer of the security defaults. Mortgage-backed securities and other more traditional types of pooling and selling future cash flows—such as the sale of account receivables to a factor—allow lenders to manage their liquidity needs.[29] Mortgage-backed securities in turn help reduce the cost of borrowing for homeowners, allowing easier access to second mortgages and lines of credit.[30]

B.   *Financial Institutions as Investment Intermediaries*

A shareholder's returns will depend on the actions of the company's managers, creditors, and other shareholders; it will also depend on her own vigilance and diversification decisions. The same is true of debtholders, although their risk of loss is not as great, given that they have a contractual right that is prior to that of shareholders. Both types of investors can search for their own investment opportunities—the screening process—and

---

the appropriate reserves. Because banks have a large number of depositors, they can achieve some degree of diversification regarding the different maturity dates of depositors and better match the longer-term maturity dates of borrowers. *See* Gary Gorton, *Bank Regulation When 'Banks' and 'Banking' Are Not the Same*, 10 OXFORD REV. ECON. POL'Y 106, 117 (1994) (describing role of bank in reducing depositors' liquidity risks while providing almost risk-free security); ALLEN & GALE, *supra* note 24, at 52-54 (explaining why borrowers are willing to pay a bank a higher rate in order to achieve longer maturities than they would get if they directly transacted with depositors, who, as a general matter, want to keep their assets relatively liquid).

    [28]   *See* Paul v. State of Virginia, 75 U.S. 168, 172 (1868) (stating that an insurance contract involves "exchanging sums of money for promises of indemnity against losses").

    [29]   Loans are assets on a bank's balance sheet and are relatively illiquid. Loan participations and securitization transactions are two devices used by banks to sell parts or all of a loan before maturity. *See* Richard Y. Roberts & Randall W. Quinn, *Leveling the Playing Field: The Need for Investor Protection for Bank Sales of Loan Participations*, 63 FORDHAM L. REV. 2115, 2117-20 (1995) (providing an overview of loan participation transactions); Tamar Frankel, *Securitization: The Conflict Between Personal and Market Law (Contract and Property)*, 18 ANN. REV. BANKING L. 197, 202-09 (1999) (giving an overview of the securitization process).

[30]   BOND MKT. ASS'N, AN INVESTOR'S GUIDE TO PASS-THROUGH AND COLLATERALIZED MORTGAGE SECURITIES 2, available at http://www.freddiemac.com/mbs/docs/about_MBS.pdf.

monitor managers after the fact. On the other hand, they may delegate some or all of these screening and monitoring tasks to financial institutions, thereby avoiding wasteful duplication of effort[31] and making use of economies of scale.[32] More generally, financial intermediaries use their expertise to reduce two informational risks faced by investors: the adverse selection[33] and agency[34] problems.[35] For example, investors entrust their money to mutual funds,[36] hedge funds, private equity firms, and venture capital partnerships, who promise to invest it on their behalf in return for a management fee.[37]

---

[31] *See* Sudipto Bhattacharya et al., *Monitoring by and of Banks: A Discussion*, *in* CREDIT, INTERMEDIATION, AND THE MACROECONOMY: READINGS AND PERSPECTIVES IN MODERN FINANCIAL THEORY 122 (Sudipto Bhattacharya et al. eds., 2004) (stating that informational intermediaries are able to avoid duplicative screening).

[32] *See* Ram T.S. Ramakrishnan & Anjan V. Thakor, *Information Reliability and a Theory of Financial Intermediation*, 51 REV. ECON. STUD. 415-32 (1984) (making an economies of scale argument in the context of delegated monitoring to intermediaries).

[33] Adverse selection problems arise whenever a firm seeks funds from outside investors. Because managers know more about the firm's current financial state, potential investors will discount for the risk that they may be buying into a "lemon." Unless "good firms" can credibly signal that they are not lemons, they will face higher funding costs and, in some cases, may not be able to raise funds. In order for the signal to be credible and effective it has to be one that cannot be mimicked by an entrepreneur with a bad project. *See* George Akerlof, *The Market for Lemons: Qualitative Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488 (1970) (setting forth standard treatment of adverse selection problem in context of used car dealers, which have informational advantage over potential purchases of "lemons"); Stewart C. Myers & Nicholas Majluf, *Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have*, 13 J. FIN. ECON. 187, 188 (1984); TIROLE, *supra* note 7, at 52 (discussing adverse selection problem when companies try to raise additional funds by selling equity or debt securities to capital markets).

[34] After an investment is made, managers may fail to act in the best interest of investors. This type of agency problem is sometimes referred to as a "moral hazard" problem. *See* TIROLE, *supra* note 7, at 113.

[35] Financial institutions have special expertise in dealing with adverse selection and agency problems, by screening and monitoring investments on behalf of their customers. *See* FREIXAS & ROCHET, *supra* note 17, at 29-32 (discussing role played by banks in reducing adverse selection and agency problems).

[36] A mutual fund is subject to the Investment Company Act because it falls under the definition of an "investment company." An investment company is an issuer that "is or holds itself out as being engaged primarily, or proposes to engage primarily, in the business of investing, reinvesting, or trading in securities." *See* the Investment Company Act of 1940, 15 U.S.C. § 80a-3(a)(1)(A) (2006).

[37] These institutions are obligated to safeguard these funds and return them to the clients, either on demand or on a delayed basis. For example, hedge funds will generally restrict the ability of clients to withdraw funds without providing a sufficient amount of notice. This will allow the funds to invest in more illiquid assets. *See* Andrei Shleifer & Robert W. Vishny, *The Limits of Arbitrage*, 52 J. FIN. 35, 47 (1997) (discussing problem faced by hedge funds if investors withdraw funds en masse and describing contractual provisions in some fund contracts that restrict the ability to withdraw capital at will).

C.   *Leverage and Insolvency Risks for Financial Institutions*

Financial institutions fund their businesses primarily by borrowing funds,[38] and thus, compared to non-financial firms, they are more highly leveraged[39] and more susceptible to insolvency and failure.[40] Their obligations, moreover, include standard long-term and short-term debt, as well as nonstandard liabilities, such as the contractual obligations to customers discussed above. As a general matter, a financial institution will have an incentive to increase its leverage whenever it believes that an investment will yield a higher return than the interest it will pay to finance it.[41] Moreover, if it has easy access to credit, it will be able to enter into a greater number of investments than if it had to sell equity or rely solely on internally produced cash flows.[42] While easy access to

---

[38]   *See* James Bullard et al., *Systemic Risk and the Financial Crisis: A Primer*, 91 FED. RES. BANK ST. LOUIS REV. 403, 409 (2009), *available at* http://research.stlouisfed.org/publications/review/09/09/part1/Bullard.pdf.

[39]   *See* TIROLE, *supra* note 7, at 98-99 (stating that banks have large debt-to-equity ratios). A firm's leverage or debt-to-equity ratio captures the extent to which equity holders are relying on other people's money to finance operations. A number of related leverage ratios are useful in assessing the risk that a firm has borrowed too much money. *See* ASWATH DAMODARAN, INVESTMENT VALUATION: TOOLS AND TECHNIQUES FOR DETERMINING THE VALUE OF *ANY* ASSET 51 (2d ed. 2002) (discussing debt-to-equity, long-term debt-to-total-capital, and market-value-debt-to-equity ratios).

[40]   *See* ALLEN & GALE, *supra* note 24, at 126-27 (discussing fragility of financial institutions and the effect of their failure on financial markets, as well as the role of market volatility in threatening viability of institutions).

[41]   Borrowing money is like renting an apartment. In both cases, one takes possession of someone else's property for a period of time, paying for the privilege of using that property and agreeing to return it at the end of the term. The goal is to create a return from renting and using the property that exceeds the "rental" payments.

[42]   Some theorists have argued that increasing a firm's leverage is an important tool in reducing the agency costs created by managers, since unlike equity, debt obligates managers to distribute a portion of its cash flows back to the capital markets. This pay-out obligation restricts the ability of managers to use the cash for wasteful investment projects. *See* Michael C. Jensen, *Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers*, 76 AM. ECON. REV. 323 (1986) (developing free cash flow theory in which agency costs are reduced by tying managers hands with debt payout obligations). This theory fails, however, to take into account the fact that the decision to borrow money is made endogenously by the same managers, who presumably would tie their hands only if they anticipated a need to pay out free cash flows in the future. Without such a need, managers would see no reason to so bind themselves unless they anticipated self-control problems that could lead them to engage in suboptimal investments in the future. Nevertheless, the free cash flow theory adopts the standard economic assumption that actors are fully rational and thus have perfect self-control. *See generally* Manuel A. Utset, *Procrastination and the Law*, *in* THE THIEF OF TIME: PHILOSOPHICAL ESSAYS ON PROCRASTINATION 253 (Chrisoula Andreou & Mark D. White eds., 2010) (developing a procrastination model in which actors with preferences for immediate gratification would repeatedly delay carrying out actions they believed to be optimal in the long-term).

credit helps magnify potential profits, it also magnifies potential losses.[43]

Highly leveraged firms can become insolvent[44] if the value of their marketable assets or their cash flows are subjected to unexpected outside shocks.[45] In the case of financial institutions these assets are primarily intangible in nature, such as loans and securities,[46] including complex derivatives, that are difficult to value and sell quickly, when an institution is facing a liquidity crisis;[47] and their cash flows are generated primarily from proprietary investments and transactions with customers, who may withdraw their business upon the first sign of trouble. Insolvency can trigger defaults in credit agreements, leading to bankruptcy proceedings[48] in a bankruptcy court or, in the case of insured financial institutions, through the resolution authority granted to the FDIC.[49]

D.   *Liquidity Problems Faced by Financial Institutions*

Modern financial institutions are in the business of borrowing on a short-term basis and using those funds to make

---

[43]   *See* Chan et al., *supra* note 20, at 50 (stating that leverage helps to expand small profit opportunities into large ones while also increasing the potential for transforming small losses into larger ones).

[44]   As a general matter, a firm is insolvent if it has more liabilities than assets. *See* Edward I. Altman, *Financial Rations, Discriminant Analysis and the Predictions of Corporate Bankruptcy*, 23 J. FIN. 589, 595 (1968) (defining insolvency as state in which the "total liabilities exceed a fair valuation of the firm's assets with value determined by the earning power of the assets.").

[45]   *See* ZVI BODIE ET AL., INVESTMENTS 472 (2005) (stating that if leverage ratio is too high it may be a sign that firm has taken on too much debt and may be unable to generate enough earnings to pay the principal and interest as it becomes due).

[46]   Financial assets, such as securities, are more complex than tangible assets such as equipment and inventory, in part because they are more volatile and deal with a large number of potential future states of the world. *See* Karen Eggleston et al., *The Design and Interpretation of Contracts: Why Complexity Matters*, 95 NW. U. L. REV. 91, 97-100 (2000) (arguing that contractual complexity increases with "(1) the expected number of payoff-relevant contingencies specified in the contract; [and] (2) the variance in the magnitude of the payoffs contracted to flow between the parties," since these create more states of the world for a decisionmaker to take into account).

[47]   *See* Viral Acharya et al., *The Financial Crisis of 2007–2009: Causes and Remedies*, 18 FIN. MARKETS, INSTITUTIONS & INSTRUMENTS 89, 92 (2009).

[48]   *See* TIROLE, *supra* note 7, at 52 (discussing the expected costs of bankruptcy associated with borrowing more money).

[49]   *See* 12 U.S.C. § 1831*o* (2006) (discussing triggering events for FDIC intervention and prompt corrective actions). After the Dodd-Frank Act, systemically important institutions will also be treated in this manner. *See* Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. No. 111-203, 124 Stat. 1376, 201-17 (2010).

long-term loans or purchase relatively illiquid assets.[50] Financial institutions borrow on a short-term basis, with the expectation that they will be able to continually renew their short-term loans (that is, to roll over those loans) each time they mature. If a financial institution successfully matches its short-term borrowings with its long-term loans[51] and illiquid investments, it will make a profit equal to the difference between the amount it pays to borrow on a short-term basis and the higher return from these riskier, longer-term transactions. If, on the other hand, a financial institution cannot continue borrowing on a short-term basis or secure longer-term financing quickly, it will face a liquidity problem.[52] The institution will thus have to pay more to borrow, post more collateral,[53] or, alternatively, sell some of its long-term assets, usually at a discount. This sort of liquidity risk is referred to as the "maturity mismatch problem," because it stems from the difference in maturity between an institution's sources of funds and the loans or investments made with those funds.[54]

E.   Why the Failure of Financial Institutions Matters

The period leading to the Great Recession was one of great creativity in liquidity and portfolio management: some innovations helped increase overall social welfare; others, however, ended up creating unforeseen insolvency and liquidity risks for financial intermediaries. Parties to a contract always bear a risk that the other party will default on its obligations—the "counterparty risk." Given the relative fragility of financial institutions, due to the insolvency and liquidity risks discussed in the previous two sections, one would expect that financial contracts involve higher levels of counterparty risk than contracts between business firms and their customers or suppliers.[55] Moreover, the failure of a financial institution can

---

[50] *See* Gary Gorton & Andrew Winton, *Financial Intermediation*, *in* HANDBOOK OF THE ECONOMICS OF FINANCE 435 (G.M. Constantinides et al. eds., 2003) (describing the differences between securities issued to borrowers and lenders).

[51] Long-term loans command a higher return because they are riskier: they require purchasers to lock in their funds until the assets are sold or mature. *See supra* note 26.

[52] *See generally* Tirole, *supra* note 10 (providing an overview of different aspects of liquidity in financial institutions and the role played by sudden illiquidity in precipitating Great Recession).

[53] *See id.* at 288-90 (discussing the role played by funding and market illiquidity).

[54] *See* Leonardo Gambacorta & Paolo Emilio Mistrulli, *Does Bank Capital Affect Lending Behavior?*, 13 J. FIN. INTERMEDIATION 436, 437 (2004).

[55] *See* Mathias Dewatripont & Jean Tirole, *Efficient Governance Structure: Implication for Banking Regulation*, *in* CAPITAL MARKETS AND FINANCIAL INTERMEDIATION

impose negative externalities on a larger portion of society. When a business firm fails, the consequences are felt primarily by its shareholders, creditors, and employees, not by its customers.[56] By contrast, a financial institution's customers enter into contractual relationships that place them in a particularly vulnerable position if the institution fails.[57] The managers of financial institutions, in short, can impose agency costs both on investors[58] and customers.[59] This risk of loss for customers is one of the reasons why financial institutions face more strenuous regulatory oversight than do business firms.[60]

12, 18-26 (Colin Mayer & Xavier Vives eds., 1993) (developing informational asymmetry and agency model and extending it to financial firms, such as banks).

[56] There are of course exceptions. A customer that is relying on a producer to supply unique or custom-made products will suffer some transitional costs until it can find an alternate supplier. A customer of this type enters into the contract in order to assure that it will have the requisite supply of goods at the time that it needs them. One would expect that customers who are entering into long-term contracts for the provision of specialized goods to discount for the risks of unforeseen contingencies as well as for the potential opportunistic seller. *See* Merton, *supra* note 25, at 35 (discussing the difference between business firms that sell products with warranty and financial firms).

[57] The customers of a financial institution will include both the providers of funds, such as bank depositors, and borrowers. While depositors are in a more vulnerable position than borrowers, a bank's failure can create harm for both types of customers, particularly short-term borrowers who were expecting that the bank would continue to roll-over the loans. *See* Graciela L. Kaminsky et al., *The Unholy Trinity of Financial Contagion*, 17 J. ECON. PERSP. 51, 54 (2003). For example, a bank that is a repeat player with a borrower will have private information about the borrower's business that will allow it to better price the loan transaction and adopt the requisite loan covenants. If a bank fails, the borrower will have to find a new lender who will not have access to this private information and will protect itself by charging a higher interest rate. As a result, one cost of a bank's failure is that valuable information about borrowers is lost. *See* Xavier Freixas & Anthony M. Santomero, *An Overall Perspective on Banking Regulation*, *in* FINANCIAL REGULATION 429 (A. Boot et al. eds., 2002) (describing social cost of lost information about borrowers); Myron B. Slovin, Marie E. Sushka & John A. Polonchek, *The Value of Bank Durability: Borrowers as Bank Stakeholders*, 48 J. FIN. 247, 256-57 (1993) (empirical study finding that the failure of Continental Illinois had a negative effect on market value of firms with a known borrowing relationship with the bank); Nobuyoshi Yamori & Akinobu Murakami, *Does Bank Relationship Have an Economic Value?: The Effect of Main Bank Failure on Client Firms*, 65 ECON. LETTERS 115, 117-18 (1999) (empirical study after failure of large Japanese bank, finding that customers with closest borrowing relationship with bank suffered large negative reaction in stock price after announcement of bank's problems).

[58] Moreover, since managers owe a fiduciary duty to shareholders, they will sometimes have incentives to manage a firm to maximize returns to shareholders, at the expense of other constituencies, including a firm's customers.

[59] *See* Merton, *supra* note 25, at 34 (arguing that customers of financial firms enter into transactions expecting that firms will be able to perform their obligations at the allotted time, while investors value firms based on expected returns but also taking into account risk of insolvency).

[60] *See* FREIXAS & ROCHET, *supra* note 17, at 263-65. An additional reason for the prevalence of regulations to protect the customers of financial institutions is that as they get closer to insolvency, their shareholders will have an incentive to undertake very risky transactions to "gamble for resurrection." *See* Dewatripont & Tirole, *supra*

Many of these regulations, however, were designed to reduce the risk that a financial institution's failure would harm the real sector of the economy, households, and nonfinancial firms.[61]

The spillover effect of an institution's failure extends beyond the losses borne by customers. The failure of a sufficiently large, highly interconnected financial institution can lead to the failure of other institutions. In fact, even relatively small shocks to one part of the financial system can quickly spread to others,[62] precipitating a crisis[63] that could threaten the entire system[64] if market participants and regulators fail to take corrective steps quickly enough.[65]

---

note 55, at 26-28 (discussing perverse incentive of shareholders to increase risks at expense of customers of financial intermediaries and increased incentive of managers to hide problems).

[61] *See* Ben Bernanke & Mark Gertler, *Agency Costs, Net Worth, and Business Fluctuations*, 79 AM. ECON. REV. 14, 14 (1989) (discussing interaction between systemic problems in the financial sector and the real sector and a potential for contagion from one to the other).

[62] The likelihood that a financial shock will spill over to other parts of the system is called "systemic risk." *See* Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 204, 204 (2008) (defining systemic risk as the "risk that (i) an economic shock such as market or institutional failure triggers (through a panic or otherwise) either (X) the failure of a chain of markets or institutions or (Y) a chain of significant losses to financial institutions, (ii) resulting in increases in the cost of capital or decreases in its availability, often evidenced by substantial financial-market price volatility"); *Hedge Funds, Systematic Risk, and the Financial Crisis of 2007–2008*, *Hearing Before the Comm. On Oversight of Gov. Reform* (written testimony of Prof. Andrew Lo, MIT School of Management) [hereinafter Lo] (defining systemic risk as the risk of a "broad-based breakdown in the financial system, often realized as a series of correlated defaults among financial institutions, typically banks, that occurs over a short-period of time and typically caused by a single major event").

[63] A "financial crisis" arises whenever a relatively small change in the financial system triggers a wide swing in the overall or aggregate state of the system. *See* MARKUS K. BRUNNERMEIER, ASSET PRICING UNDER ASYMMETRIC INFORMATION: BUBBLES, CRASHES, TECHNICAL ANALYSIS, AND HERDING 220 (2001) (as a general matter, a "financial crisis" is a system-wide crisis affecting one or more parts of a financial system).

[64] *See* James Crotty, *Structural Causes of the Global Financial Crisis: A Critical Assessment of the "New Financial Architecture"*, 33 CAMB. J. ECON. 563, 572-73 (2009) (describing system-wide risk in the context of financial crises).

[65] In fact, while the subprime crisis created great harm for many households, it played only a relatively small role in the Great Recession. *See* Markus K. Brunnermeier, *Deciphering the Liquidity and Credit Crunch 2007–2008*, 23 J. ECON. PERSP. 77, 77 (2009) (describing the losses due to subprime loans as "relatively modest" compared to the losses when the stock market subsequently crashed); Gary Gorton, *The Subprime Panic*, 15 EUR. FIN. MGMT. 10, 30-31 (2009) (arguing that losses in the subprime market were not enough to trigger the crisis until it became "common knowledge" due to introduction of the ABX index, which allowed traders to hedge and speculate vis-à-vis deteriorating portfolios of asset-backed securities).

II.   DERIVED FROM ARROW: THE FRAGMENTATION OF
       FINANCIAL TRANSACTIONS

In a world of complete capital markets, parties would be able to hedge against all possible risks. But capital markets work best when the traded securities are not too complex, so that market participants can understand them and value them accurately, in a timely fashion.[66] This part examines the extent to which it is possible to design and implement complete markets and the costs of attempting to do so but falling short. It begins by examining the role of securities markets and the problems of excessive speculation and self-dealing in market transactions. It then describes the general theory of complete markets and state-contingent securities. It concludes by arguing that the quest for complete markets has led to a fragmentation of transactions and the emergence of *n*-contracts-transactions.

A.   *Securities Markets and the Great Recession*

Parties will create and administer securities markets only to the extent that the benefits exceed the costs.[67] So how do securities markets create value? First, they provide a venue for hedging—that is, distributing risk from risk-averse actors to

---

[66] *See* Robert C. Merton, *A Functional Perspective of Financial Intermediation*, 24 FIN. MGMT. 23, 26 (1995) (arguing that financial markets are efficient alternatives to financial intermediaries but only to the extent that securities are standardized, widely distributed, and "well-enough 'understood' for transactors to be comfortable in assessing their prices").

[67] *See* Stephen A. Ross, *Options and Efficiency*, 90 Q.J. ECON. 75, 76 (1976) (discussing cost-benefit analysis involved in setting up contingent-state markets). Financial institutions play an important role in reducing the transaction costs of using financial markets, including establishing and administering payment and clearing facilities for financial transactions. *See* MAUREEN O'HARA, MARKET MICROSTRUCTURE THEORY 14-16 (1995) (describing ways in which financial institutions help create markets, including helping facilitate transactions and assuring that there is sufficient liquidity for those wishing to trade); Xavier Freixas & Bruno Parigi, *Contagion and Efficiency in Gross and Net Interbank Payment Systems*, *in* CREDIT, INTERMEDIATION, AND THE MACROECONOMY, *supra* note 31, at 297, 299-302 (describing interbank payment systems and the role of financial institutions in assuring that they operate without interruptions); *see also* Dodd-Frank Wall Street Reform and Consumer Protection Act § 803(7)(A)-(B), 12 U.S.C. § 5462(7) (2010) (defining "payment, clearing, or settlement activity" as "an activity carried out by 1 or more financial institutions to facilitate the completion of financial transactions", including "(i) funds transfers; (ii) securities contracts; (iii) contracts of sale of a commodity for future delivery; (iv) forward contracts; (v) repurchase agreements; (vi) swaps; (vii) security-based swaps; (viii) swap agreements; (ix) security-based swap agreements; (x) foreign exchange contracts; (xi) financial derivatives contracts; and (xii) any similar transaction that the Council determines to be a financial transaction for purposes of this title.").

those who are either *less* risk averse or have the expertise or tools to deal with the risk more effectively. In other words, a hedge transaction occurs when party *A* sells its risk to party *B* for a premium, in a transaction where both parties benefit.[68] Second, securities markets allow parties to speculate. The speculator purchases a security not for its dividends or interest payments, but for the potential capital gain.[69] Third, securities markets help aggregate and transfer[70] information regarding the securities traded. In a perfectly efficient market, the market price will reflect the aggregate beliefs and expectations of market participants.[71]

The Great Recession was caused in part by parties who engaged in excessive "hedging" using securities that provided them with a false sense of security and by excessive speculation in markets with critical inefficiencies.[72] This, in turn, led to the demand for a greater number of financial contracts for hedging and speculating, and the introduction of a plethora of new securities. Self-dealing, gross negligence, and fraud also played a role in the proliferation of transactions, such as those involving

---

[68]   In an insurance contract, a risk-averse individual sells a risk—for example, the risk of a fire, automobile accident, or illness—to an insurance company, which has the expertise, technology (in the form of actuarial tables), and ability to diversify that risk. In return for buying that risk, the insurance company receives a premium. *See generally* Neil A. Doherty & Harris Schlesinger, *Rational Insurance Purchasing: Consideration of Contract Nonperformance*, 105 Q.J. ECON. 243 (1990).

[69]   *See* TIROLE, *supra* note 7, at 290, 314-15 (describing speculation as wasteful since the speculator acquires information solely for the purpose of redistribution, instead of increasing aggregate welfare).

[70]   When parties trade securities they reveal information to each other and third parties. *See* JACK HIRSHLEIFER & JOHN G. RILEY, THE ANALYTICS OF UNCERTAINTY AND INFORMATION 278-92 (1992) (discussing role of unintentional information leakage due to market transactions); Ronald J. Gilson & Reinier H. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549, 573-74 (1984) (discussing trade decoding and information leakage from informed traders to uninformed ones).

[71]   *See* Friedrich A. Hayek, *The Use of Knowledge in Society*, *in* INDIVIDUALISM AND ECONOMIC ORDER 77, 86 (1948) (arguing that the price system allows individuals to make the right decisions by merely acting on the price, through which "only the most essential information is passed on and passed on only to those concerned").

[72]   *See* Gorton, *supra* note 65, at 30-37 (describing collapse of subprime and repo markets); Amir E. Khandani & Andrew W. Lo, *What Happened to the Quants in August 2007? Evidence from Factors and Transaction Data*, 14 J. FIN. MARKETS 1, 2-3 (2011) (describing the large losses experienced by hedge funds using quantitative trading strategies (quant funds) in August 2007); U.S. DEP'T OF TREASURY, FINANCIAL REGULATORY REFORM, A NEW FOUNDATION: REBUILDING FINANCIAL SUPERVISION AND REGULATION 38-39 (2009) [hereinafter DEP'T OF TREASURY, FINANCIAL REGULATORY REFORM], *available at* http://www.treasury.gov/initiatives/Documents/FinalReport_web.pdf (describing run on money market).

securities that were significantly overvalued, worthless,[73] or difficult to understand,[74] and, ultimately, to the accumulation of toxic assets on the balance sheets of financial institutions.[75]

B. *The Quest for Complete Markets*

Of the factors that led to the proliferation of transactions in the period leading to the Great Recession—excessive hedging—may at first glance appear to be the most benign. However, one can make a strong case that the incessant quest for the hedge, for insurance and the reallocation of risk, was what led to the proliferation of new, highly complex derivative securities, and eventually to self-dealing, fraud, and excessive speculation. To see why this is the case, we must examine how derivative securities help make markets more complete.

Financial derivatives act as "state-contingent securities": they help actors make investment decisions that take into account both uncertainty[76] and time. Kenneth Arrow and Gerard Debreu developed a model of pure state-contingent securities[77] in which actors are able to effectively hedge for all possible risks,[78]

---

[73] *See, e.g.*, Press Release, Sec. & Exch. Comm'n, Goldman Sachs to Pay Record $550 Million to Settle SEC Charges Related to Subprime Mortgage CDO (July 15, 201), *available at* http://www.sec.gov/news/press/2010/2010-123.htm.

[74] *See* DEP'T OF TREASURY, FINANCIAL REGULATORY REFORM, *supra* note 72, at 2 (discussing the lack of transparency of complex financial derivatives).

[75] *See* CONG. BUDGET OFFICE, REPORT ON THE TROUBLED ASSET RELIEF PROGRAM (Oct. 11, 2012), *available at* http://www.cbo.gov/sites/default/files/cbofiles/attachments/TARP10-2012_0.pdf (providing an overview of the toxic assets held by financial institutions who participated in the TARP program).

[76] The most common way to model uncertainty is to posit that at any one point in time, the environment is in a particular state, reflecting a set of properties true to the environment at that time. *See* KENNETH J. ARROW, THE LIMITS OF ORGANIZATION 33-34 (1974) (stating that a decision-maker will "consider the world to be in one or another of a range of states," where a state of the world is "a description which is complete for all relevant purposes").

[77] *See* Kenneth J. Arrow, *The Role of Securities in the Optimal Allocation of Risk-Bearing*, 31 REV. ECON. STUD. 91, 92-94 (1964) (originally published in French, in 1953). The economist Gerard Debreu also played a critical part in developing the state-contingent claim theory, and extending it. *See* GERARD DEBREU, THEORY OF VALUE: AN AXIOMATIC ANALYSIS OF ECONOMIC EQUILIBRIUM 98-102 (1959).

[78] To see this, suppose that Anne is trying to make an intertemporal decision, in which she has to choose to invest $100 that will produce an uncertain set of payoffs in future periods. And suppose further that, for each future period, the possible states of the world can be partitioned into mutually exclusive states and that, for each of these possible states, Anne knows the expected payoffs that will result. A pure state-contingent security, introduced by Kenneth Arrow and Gerard Debreu, pays one unit (for example, $1) if an event occurs and zero if it does not. If, at the time of making her decision, Anne knew the value of each of these state-contingent securities, then she would calculate the value of making that $100 by taking the sum of the expected

but with a catch: in order to work one must create and implement a state-contingent security for each possible state of the world.[79] Only then, when markets are "complete," is it possible to fully allocate risk in a Pareto optimal manner.[80] With this in mind,[81] financial theorists[82] and practitioners[83] set out to design and market state-contingent securities. In accepting the Nobel Prize for economics, Robert Merton provided the best possible summary of the marriage of Arrow and financial innovation:

> During the last 25 years, finance theory has been a good predictor of future changes in finance practice. That is, when theory seems to suggest that something "should be there" and it isn't, practice has evolved so that it is. The "pure" securities developed by Kenneth J. Arrow . . . that so clearly explain the theoretical function of financial instruments in risk bearing were nowhere to be found in the real world until the broad development of the options and derivative-security markets. It is now routine for financial engineers to disaggregate the cash flows of various securities into their elemental Arrow-security component parts and then to reaggregate them to create securities with new patterns of cash flows.[84]

The proliferation of derivative securities can thus be explained, at least in part, as an attempt to create securities that come closer to the state-contingent securities posited by

---

returns for each state of the world. The expected return will be $0 if the state does not occur, and the expected return will equal expected value ($1 × Expected Value) if the state does occur. Thus, state-contingent securities allow Anne to value investments based on each possible states of the occurring in each future period.

[79] *See* ANDREU MAS-COLELL ET AL., MICROECONOMIC THEORY 709 (1995) (describing an incomplete market as one in which there are fewer tradable assets than there are states of the world); *see also* Ross, *supra* note 67, at 75 (stating that Arrow's theory of state-contingent securities "brought the recognition that an inadequate number of markets in contingent claims would be a source of inefficiency").

[80] *See* MAS-COLLEL ET AL., *supra* note 79, at 692 (stating that if the Arrow-Debreu conditions of the existence and tradability of state-contingent securities hold, then, at equilibrium, one would have "an efficient allocation of risk").

[81] *See* Douglas T. Breeden & Robert H. Litzenberger, *Prices of State-Contingent Claims Implicit in Option Prices*, 51 J. BUS. 621, 621 (1978) (stating that the Arrow-Debreu, state-contingent model is "one of the most general frameworks available for the theory of finance under uncertainty").

[82] *See* Ross, *supra* note 67, at 75 (stating that Arrow's theory of state-contingent securities "brought the recognition that an inadequate number of markets in contingent claims would be a source of inefficiency.").

[83] *See* Merton, *supra* note 66, at 28-32 (describing role of financial institutions in financial innovation, including customizing and designing securities to help customers engage in hedging activities).

[84] Robert C. Merton, *Applications of Option-Pricing Theory: Twenty-Five Years Later*, 88 AMER. ECON. REV. 323, 341 n.31 (1998). *Compare with* Ross, *supra* note 67, at 76 (writing in 1976, trying to address why there was such a paucity of Arrow securities).

Arrow and Debreu.[85] Standard equity and debt securities were too coarse; their value depended on too many contingencies, and, thus too many "intermingled" possible states of the world.

The financial engineering project described and endorsed by Merton[86] involved partitioning securities into different components, each coming closer to the ideal Arrow-Debreu security: one whose value depended on whether a particular state of the world came to pass on a particular date.[87] Stand-alone transactions involving coarse securities were each divided into multiple transactions. This led to a proliferation of transactions involving a larger number of parties. Some of these transactions were subsequently combined into composite derivative securities. This disaggregation–reaggregation process increased the level of complexity,[88] and over time made it increasingly difficult to describe, understand, and properly value the securities.[89] The greater the complexity, the greater the transaction costs[90] of implementing and monitoring state-contingent securities.[91]

---

[85]   *See* Ross *supra* note 67, at 76 (discussing possibility of using derivative products to make contingent-state markets more complete).

[86]   *See* Robert C. Merton, *Financial Intermediation in the Continuous Time Model*, *in* CONTINUOUS TIME FINANCE 370 (1992) (providing a sustained defense of financial engineering, notwithstanding the fact that the "products" that they produce mimic "high-speed passenger trains": socially beneficial but open to a few derailings before all of the kinks are worked out).

[87]   *See id.* (stating that the "overriding theme of the theory has financial innovation as the engine driving the financial system on its prospective journey to efficiency and complete markets").

[88]   A complex system is "one made up of a large number of parts that have many interactions," where complexity will increase whenever, given "the properties of the parts and the laws of their interaction, it is not a trivial matter to infer the properties of the whole." *See* HERBERT A. SIMON, THE SCIENCES OF THE ARTIFICIAL 183-84, 207 (3d ed. 1996).

[89]   *See* DEP'T OF TREASURY, FINANCIAL REGULATORY REFORM, *supra* note 72, at 2 (discussing the use of complex financial products in the period leading up to the Great Recession). Asset-backed securities pose particular challenges because the same piece of collateral is often used to secure the obligations of multiple parties (tranching) or as security in multiple transactions (pyramiding). *See* John Geanakoplos, *Liquidity, Default, and Crashes: Endogenous Contracts in General Equilibrium*, *in* II ADVANCES IN ECONOMICS AND ECONOMETRICS APPLICATIONS: THEORY AND APPLICATION: EIGHTH WORLD CONGRESS 170, 173-74 (Mathias Dewatripont et al. eds., 2003) (defining tranching and pyramiding).

[90]   A "transaction cost" is the cost of carrying out a transaction, including the costs of identifying valuable transactions and suitable parties, foreseeing contingencies and potential conflicts, bargaining, and drafting contracts. *See* HART, *supra* note 9, at 23 (emphasizing transaction costs due to foreseeing future contingencies, bargaining, and drafting contracts that a third-party enforcer, such as a court, will be able to interpret and determine whether it has been breached); Luca Anderlini & Leonardo Felli, *Incomplete Written Contracts: Undescribable States of Nature*, Q.J. ECON. 1085 (1994) (describing the computational intractability problems when trying to write complete contracts); Pierpaolo Battigalli & Giovanni Maggi, *Rigidity, Discretion and*

C.   n-Contracts Financial Transactions

We must now get a better sense of the fragmentation of financial transactions. Fragmentation occurs when a single transaction is partitioned into *n* number of subtransactions, where each subtransaction has its own contract—an *n*-contracts-transaction. To do this we first need to settle on a definition of *transactions*. As a general matter, a *transaction* involves the transfer of a good, service, or security.[92] This definition is useful when considering the general problem of transaction-cost economics. However, we are concerned with the following questions. How does one determine the optimal number of parties that should be involved in a transaction? For example, given a transaction, *M*, for the sale of a good, service, or security, should that transaction involve only the buyer and seller, or should other parties be involved? Should it be carried out through one global transaction, *M*, or should it be partitioned into *n* number of subtransactions?

In order to answer these questions, we must use a more precise definition of *party*, *transaction*, and *subtransaction*. Two parties participate in a transaction if they have rights and/or obligations in relation to each other that are either enforceable in a court—as when the parties are in privity of contract—or indirectly enforceable through reputational constraints. A transaction may involve *n* number of subtransactions (where *n* may equal 1). As a general matter, then, a transaction can be defined as a "relationship" between two or more parties to accomplish a goal related to the purchase or sale of a good, service, or security.

While these definitions are intentionally fuzzy, they will serve for the purposes of this article. Our principal goal is to examine the fragmentation of securities transactions that arises from the disaggregation and reaggregation of relationships, as

---

the Costs of Writing Contracts, 92 AM. ECON. REV. 798 (2002) (setting forth detailed theory of the effect of writing costs on contract incompleteness).

[91] In fact transaction costs are a major obstacle to achieving complete markets. *See* Merton, *supra* note 86, at 431-32 (discussing role of transaction costs in connection with state-contingent securities and discussing role of financial intermediaries in reducing transaction cost of producing and trading state-contingent securities); Kenneth J. Arrow & Frank Hahn, *Notes on Sequence Economies, Transaction Costs, and Uncertainty*, 86 J. ECON. THEORY 203, 213 (1999) (discussing general problem of "missing securities" and role played by transaction costs).

[92] *See* PAUL MILGROM & JOHN ROBERTS, ECONOMICS, ORGANIZATION, & EFFICIENCY 21 (1992) (describing a "transaction" as "the most fundamental unit of analysis in economic organization theory" and defining it as "the transfer of goods or services from one individual to another").

described by Merton in the excerpt quoted above.[93] At the same time, this article aims to develop an account of the social costs created by this disaggregation–reaggragation process. Ultimately, a more precise definition must account for the boundary between transactions and subtransactions.

This article argues that the question of whether a transaction should be internalized into a single contract or partitioned into *n* number of subtransactions (each with its own contract) is analogous to the question raised by Ronald Coase in *The Nature of the Firm*: when should a transaction be internalized within a firm and when should it be carried out externally through transactions with other market participants?[94] A party who wants to achieve a particular goal via a transaction will either carry it out within one global transaction, *M*, or subdivide it into two or more subtransactions. It will internalize the transaction within *M* only when the transaction costs of doing so are lower than achieving that same transactional goal via two or more subtransactions.[95]

For example, a transaction where *A* would lend money to *C* could be partitioned into two subtransactions: one where *A* lends money to *B*, a bank, and *B* lends money to *C*. These initial transactions can be further partitioned. For example, *G* could insure *A*'s deposits just as the FDIC does for bank deposits. And *C*, who has borrowed money from the bank, could use the loan to invest in *E*. A similar process occurs when an equity fund, hedge fund, or venture capital firm borrows funds and uses them to make further investments.

Similarly, a transaction where *C* borrows money from *B* could be partitioned by having *C* borrow through *n*-debt transactions with investors, who purchase debt securities. *C* may hire a financial intermediary to act as an underwriter for the issuance of those securities. The underwriter would then act as agent for the ultimate purchasers. In turn, the company

---

[93]   *See supra* note 85.

[94]   Ronald H. Coase, *The Nature of the Firm*, *in* THE FIRM, THE MARKET, AND THE LAW (1988).

[95]   *See id.* at 43 (arguing that transactions will be carried out within the firm when the transaction costs of doing so are lower than carrying them out through market transactions); *see also* Benjamin Klein, Robert Crawford & Armen Alchian, *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J. L & ECON. 297 (1978) (examining boundary between firm and markets, in contexts where one party's investment in the transaction can lead to opportunistic behavior by other party); HART, *supra* note 9, at 29-55 (formal analysis of decision of whether to internalize productions, and general difficulties of delineating where a firm ends and market begins).

and the purchasers would enter into a transaction with an indenture trustee.

III.   A THEORY OF "TRANSITIVE-RISK" CONTRACTS

This part develops a new theory of interconnected financial institutions and interconnected contracts. It begins by analyzing the provisions of the Dodd-Frank Act that are relevant to the interconnectedness of financial institutions. It then sets forth the theory of transitive-risk contracts. The theory offers a bottom-up approach to understanding interconnectedness.

A.   *The Dodd-Frank Act and the Interconnectedness of Financial Institutions*

One stated goal of the Dodd-Frank Act[96] is to strengthen the supervision of all large, complex financial organizations,[97] including subjecting them to "more stringent capital and liquidity standards"[98] and requiring financial regulators to continually monitor financial markets and the contracts market participants use to hedge risks and engage in speculation.[99] The Financial Stability Oversight Council (Council)[100] is required to "monitor the financial services marketplace in order to identify potential threats to the financial stability of the United States";[101] to take into account "the nature, scope, size, scale, concentration, interconnectedness, and mix of the activities"[102] of a nonbank financial institution when determining whether the institution should be subject to

---

[96]   Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. No. 111-203, 124 Stat. 1376 (2010) (to be codified in scattered sections of 5 U.S.C., 7 U.S.C., 12 U.S.C., 15 U.S.C., and 31 U.S.C.).

[97]   S. REP. NO. 111-176, at 2 (2010); *see also* Dodd-Frank Act § 102(a)(1), (a)(4)(A) (defining "bank holding company" and "foreign nonbank financial company," respectively); *id.* § 102(a)(4)(D) (defining "nonbank financial company supervised by the Board of Governors" as a nonbank financial company that the Financial Stability Oversight Council has determined shall be supervised by the Board of Governors); *id.* § 102(a)(7) (delegating to the Federal Reserve Board the authority to define "significant nonbank financial companies" and "significant bank holding companies").

[98]   S. REP. NO. 111-176, at 3 (summarizing the testimony of Federal Reserve Board Chairman Ben Bernanke to the Banking Committee on July 22, 2009).

[99]   *See* Dodd-Frank Act, Title VII, Subtitle A—Regulation of Over-the-Counter Swap Markets; Subtitle B—Regulation of Security-Based Swap Markets; Title VIII—Payment, Clearing, and Settlement Supervision; Title IX, Subtitle D—Improvements to the Asset-Backed Securitization Process.

[100]   *See* Dodd-Frank Act §§ 111-112 (establishing the Financial Stability Oversight Council and setting forth authority).

[101]   *Id.* § 112(a)(2)(C).

[102]   *Id.* § 113(a)(2)(G).

enhanced supervision by the Federal Reserve;[103] and to determine whether it should restrict an institution's ability to offer particular financial products or to require the institution to terminate risky activities (or, alternatively, to impose conditions on the manner in which it carries them out).[104]

This is a difficult task, even in the best possible scenario, an idealized world in which regulators and regulated parties have identical interests and combine forces to identify and resolve problems, in a spirit of cooperation. The task, however, becomes increasingly difficult in a regulatory context, such as that of modern financial markets, in which financial institutions compete with each other to identify and exploit legal loopholes, and where the avant-garde financial engineer gets compensated more handsomely than the "retro-garde" risk manager. But even in the idealized regulatory context, the Council and Federal Reserve would need to identify growing system-wide risks in a timely fashion. And once they have done that, they must find and implement a solution before a system-wide problem has tipped over into systemic risk, and triggered a financial crisis.

The financial health of an individual financial institution can change quickly, insidiously, and sometimes catastrophically, as in the case of a bank run. New financial contracts (or types of transactions) that work perfectly under normal parameters, or when used sparingly, can change quickly into toxic assets due to unforeseeable contingencies. Real-time governance by regulators of individual financial institutions and financial contracts is a difficult, complex undertaking; real-time governance of financial systems—an agglomeration of institutions and financial contracts—is exponentially more difficult. And not just for regulators, but for shareholders, creditors, managers, and counterparties in financial contracts.

It follows that the macroprudential oversight that the Council and Federal Reserve are charged with is a far more daunting task than the microprudential (single-institution) approach under traditional banking regulations. The first step in achieving real-time macroprudential regulation is that of gathering large amounts of information, processing it (including aggregating it into manageable data sets), testing it,

---

[103]   *See id.* § 113(a)(1) (allowing the Council to vote to require enhanced supervision with Federal Reserve of U.S. nonbank financial institutions).
[104]   *See id.* § 121(a).

analyzing the results, and transferring them to the right regulator, in a usable format, so that it can understand and use them, before the information has become stale.[105] Again, the task is not an easy one: information about dynamic environments, such as financial markets, will remain fresh—accurate and usable—for much shorter periods than that about more static environments in other industries. To help in this endeavor, Title I of the Dodd-Frank Act creates a new Office of Financial Research.[106]

Of critical importance for purposes of this article is the question of how one goes about characterizing interconnections between financial institutions. The Council has defined "interconnectedness" of financial institutions to mean the "direct or indirect linkages . . . that may be conduits for the transmission of the effects" of a financial institution's "material financial distress or activities."[107] But there is still no adequate account of how direct and indirect linkages between financial institutions and financial contracts can lead to the spillover of counterparty risk discussed below. Moreover, and somewhat problematically, Dodd-Frank draws a relatively sharp distinction between the regulation of systemically important financial institutions,[108] financial contracts and financial markets,[109] and clearing and settlement facilities.[110]

B.   *Transitive-Risk Contracts*

A transitive-risk contract relationship involves two or more contracts that are linked together by the participation of a common party, which I will refer to as the *conduit*. As a general matter, a transitive relation between the members of a set, *A*, *B*, and *C*, meets the following condition: if *A* and *B* are in relation *R* to each other, and *B* and *C* are in a relation *R*,

---

[105] *See* Ben Kao et al., *Updates and View Maintenance in Soft Real-Time Database Systems*, *in* PROCEEDINGS OF THE 8TH ACM INTERNATIONAL CONFERENCE ON INFORMATION AND KNOWLEDGE MANAGEMENT (CIKM) 300, 300-01 (1999) (distinguishing between "transaction timeliness"—how fast a system carries out a requested transaction—and data "timeliness"—which refers to the relative freshness or staleness of data).

[106] Dodd-Frank Act §§ 151-156.

[107] Authority to Require Supervision and Regulation of Certain Nonbank Financial Companies, 76 Fed. Reg. 64264, 64279 (proposed Oct. 18, 2011) (to be codified at 12 C.F.R. tit. 1310).

[108] *See* Dodd-Frank Act §§ 113, 115, 161-176 and Title II.

[109] *See id.* Title VII.

[110] *See id.* Title VIII.

then *A* and *C* are also in a relation *R* to each other.[111] In the case of transitive-risk contracting, both *A* and *B* and *B* and *C* are in contractual relationships with each other. We can thus say that *A* and *C* are in an indirect contracting relationship, through *B*, who acts as the conduit. The conduit brings together two external parties within a common contracting sphere, where they can influence the other's welfare, for better or worse. The conduit, in short, is a vehicle through which the two external parties can transmit positive and negative externalities to each other. Whenever two parties enter into a contract, their actions under the contract may create costs or benefits to third parties who are not party to the contract.[112] For example, a contract between a homeowner and a contractor to effectuate extensive renovations to the outside of her home may create negative externalities to her neighbors during the renovations, but it may also produce positive externalities to the extent it increases neighboring property values. This standard type of externality problem has received a large amount of attention in the legal literature.[113] However, this article focuses not on general externality problems but instead on the way that one particular class of externalities—contract risks—are created and transferred in multiparty transactions.

So far we have assumed that the transitive-risk relationships involve three parties, but they can involve more parties. For example, suppose a company has 100 short-term and 10 long-term creditors. One could model this relationship as involving 110 creditors, all linked together by the corporation (the conduit). Or, depending on the context, we could model it as a three-party relationship, with the short-term and long-term creditors, as a group, linked together by the corporation. One would take the first approach if, for example, one were concerned with the way that cross-default provisions link all the creditors together. One would take the second approach, however, if one were concerned about the counterparty risks borne by long-term creditors in the event

---

[111] *See, e.g.*, Edi Karni & David Schmeidler, *Utility Theory with Uncertainty*, *in* IV HANDBOOK OF MATHEMATICAL ECONOMICS 1763, 1766 (W. Hildenbrand & H. Sonnenschein, eds. 1991) (defining a transitive relation as one in which, given a binary relation $\geq$, on a set A, the relation is transitive, if for all a, b, and c, in A, if a $\geq$ b & b $\geq$ c, then a $\geq$ c).

[112] *See* James M. Buchanan & William Craig Stubblebine, *Externality*, 29 ECONOMICA 371, 371 (1962) (defining externality).

[113] For an overview of the standard externality theory *see* RICHARD CORNES & TODD SANDLER, THE THEORY OF EXTERNALITIES, PUBLIC GOODS, AND CLUB GOODS 39-142 (2d ed. 1996).

short-term creditors, as a group, were to withdraw their financing, increase the interest rate of their loans, or require the corporation to pledge additional collateral. All other things being equal, the greater the number of simple contracts combined into a composite, transitive-risk contract, the greater the complexity and thus, time, it would take parties to understand the myriad interconnections.
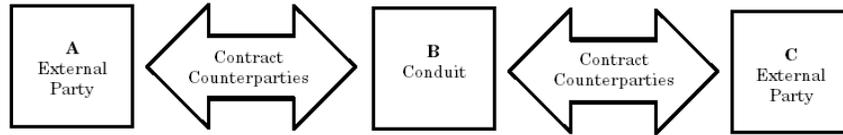
C.   *Transitive Counterparty Risk*

Transitive-risk contract relationships raise a number of important informational problems that might be overlooked if one failed to fully account for the role the conduit party plays in transmitting and obscuring information about the various external parties. An external party may not know about the existence of other external parties, and even if they know they exist, they may not know their identity or have the capacity to observe their behavior. For example, as we will see below, while depositors know that their collective contractual relationships with a bank binds them together in a special way, they also know that they lack complete information about each of their private relationships with the bank. These two facts can increase the likelihood of a bank run. Finally, in some instances, confidentiality and anonymity make all of the parties better off.[114]

It is helpful to specify the various ways in which counterparty risks can be transmitted through transitive-risk contracting relationships. First, suppose that *A* and *B* enter into a contract in which they are both subject to a counterparty risk vis-à-vis the other, and *B* and *C* enter into an analogous contract in which they both bear counterparty risks. It follows that *A* and *C* are in a transitive-risk relationship, where *B* is a conduit for the transmission of counterparty risks. Suppose that *A* breaches on its contract with *B*. In that instance, *C*'s counterparty risk will increase due to the greater likelihood that *B* may need to breach its contract with *C*. A breach by *C* could increase *A*'s counterparty risk in the same manner.

---

[114]   A transaction between an external party and the conduit is confidential vis-à-vis another external party if that party is not aware of the transaction. On the other hand, in an anonymous transaction, the external party knows that the conduit has entered into a transaction with another external party but does not know the identity of that party. *See* Marc Rennhard et al., *An Architecture for an Anonymity Network*, 2001 IEEE 165, 166 (developing distinction between confidentiality and anonymity in the context of network security protocols).

Second, suppose there are three contracts, each involving one-sided counterparty risks: (1) *A* to *B*; (2) *B* to *C*; and (3) *C* to *D*. If *A* breaches its contract with *B*, both *C* and *D* may be negatively affected.

This last example could include a larger number of parties linked through a series of transitive-risk contracts. This is important because the decisional complexity facing the parties is likely to increase with each additional link in a transitive-risk contracting chain, and a greater amount of information is likely to be lost along the way.

IV.   TRANSITIVE-RISK CONTRACTS AND FINANCIAL
         INSTITUTIONS

Transitive-risk contracts are particularly important in financial transactions because of the frequent involvement of financial institutions acting as financial intermediaries.[115] This part analyzes the role of transitive-risk contracts in a number of contexts involving financial institutions. It begins by examining transitive-risk contracts in commercial banking, and identifies transitive counterparty risks flowing from depositors to borrowers and vice versa, as well as transitive risks among depositors. The following section extends the general insights to show how transitive counterparty risks can fuel bank panics and financial contagion. The part continues by

---

[115]   Because of the coordination problems involved in many types of financial intermediation contexts, it is useful to model financial intermediation relationship as a multi-party relationship, as opposed to two or more independent financial contracts tied together by the fact that there is a common intermediary involved. *See* Martin F. Hellwig, *Financial Intermediation and Risk Aversion*, 67 REV. ECON. STUD. 719, 719-20 (2000) (arguing that we should model intermediation as a relation between intermediaries, the investors providing the funds and the firms making use of these intermediated funds, and complaining that many studies fail to approach the two sets of financial contracts in a holistic fashion).

analyzing transitive-risk contracts in repo transactions. In doing so it identifies transitive counterparty risks among repo borrowers as well as transitive risks flowing from the financiers of repo lenders to repo borrowers and vice versa. The part then looks at transitive counterparty risks in securitization transactions. It then provides a more general account of how transitive-risk contracts can exacerbate liquidity problems among financial institutions. The last section analyzes transitive counterparty risks in derivative contracting contexts.

A.   *Transitive-Risk Contracts Between Depositors, a Bank, and the Bank's Borrowers*

Commercial banks finance their operations primarily by borrowing from their depositors on a short-term basis. A demand deposit agreement is structured so deposits will roll over automatically, daily, until the depositor terminates all or part of the loan by making a withdrawal.[116] A bank aggregates the depositors' funds, keeps some on reserve to satisfy anticipated withdrawals, and lends the rest. While a bank can choose the maturity of its loans to third parties, it cannot demand early repayment, unless the borrower has defaulted.[117]

This tripartite relationship between banks, its short-term lenders (the depositors), and its long-term borrowers exposes a bank to the maturity mismatch problem discussed in Part I. This section examines that problem in greater detail, using the transitive-risk contract theory developed in Part III. It begins by analyzing the transitive counterparty risk associated with the relationship between depositors and borrowers. A maturity-mismatch problem can arise if a sufficient number of depositors decide to make withdrawals at the same time, or whenever a large enough group of borrowers default on their obligations to the bank within a short period of time. In other words, a bank can become insolvent or face a liquidity problem whenever its loan portfolio loses a sufficient

---

[116] *See* Charles W. Calomiris & Charles M. Kahn, *The Role of Demandable Debt in Structuring Optimal Banking Arrangements*, *in* CREDIT, INTERMEDIATION, AND THE MACROECONOMY: MODELS AND PERSPECTIVES, *supra* note 31, at 36-41 (providing an overview of demand deposits and their role in providing liquidity to depositors).

[117] Some loan agreements will include "insecurity clauses" that allow banks to accelerate payment of the principal and interest due, but if the debt is secured by collateral subject to Article 9 of the UCC, then the acceleration will be allowed if the creditor "in good faith believes that the prospect of payment or performance is impaired." *See* UCC § 1-309 (2011).

amount of value or if depositors and other lenders refuse to roll over their loans. The section then examines the transfer of transitive counterparty risk among depositors.

1. Transitive-Risk Contracts Between Depositors and Borrowers, with the Bank as Conduit

In order to manage its liquidity risks, a bank must predict the expected inflow and outflow of deposits and loan proceeds. A bank's credit risk refers to the likelihood that the expected returns from its loan portfolio will fail to materialize due to borrowers' defaults.[118] In order to properly account for it, a bank must anticipate outside shocks that could negatively impact its borrower base—both current and potential borrowers. These include shifts in the business cycle[119] and declines in the value of collateral, such as real estate, equipment, securities, and inventory.[120]

The demand deposit contracts between depositors and a bank create a positive externality for borrowers, given that it is the depositors' cash that funds the loan contracts. In a similar fashion, loan agreements create a positive externality for depositors: the bank will use a portion of the interest from these loans to pay depositors interest on their accounts.
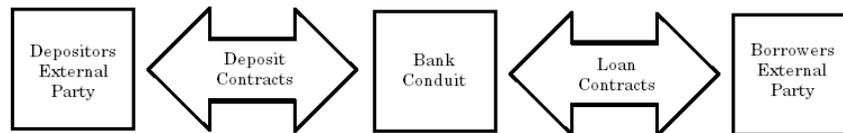
But this transitive relation can also lead to the transfer of counterparty risk from borrowers to depositors and vice versa, with the bank, again, acting as the conduit. If enough borrowers default on their loans or take their business to another institution, the value of the bank's assets and its cash

---

[118] *See* COMPTROLLER OF THE CURRENCY (OCC), ASSET SECURITIZATION: COMPTROLLERS HANDBOOK 37 (Nov. 1997) (defining credit risk as the "risk to earnings or capital arising from an obligor's failure to meet the terms of any contract with the bank or otherwise to perform as agreed").

[119] *See* Anil K. Kashyap & Jeremy C. Stein, *Cyclical Implications of The Basel II Capital Standards*, ECON. PERSPECTIVES 18, 21 (1st Q., 2004) (arguing that instead of setting capital requirements based on a single, static risk curve, regulators should instead use "a family of point-in-time risk curves, with each curve corresponding . . . to different macroeconomic conditions").

[120] *See* Mark H. Adelson & David P. Jacobs, *The Subprime Problem; Causes and Lessons*, 14 J. STRUCTURED FIN. 12 (2008).

flows would be negatively affected. This, in turn, would increase the counterparty risk faced by depositors, who may be unable to withdraw their funds if the bank becomes insolvent or experiences a liquidity problem. At the same time, if enough depositors withdraw their funds, they create a transitive counterparty risk for borrowers, to the extent that it leads the bank to breach commitments on revolving loan agreements[121] or to cut back on its lending activities, thereby affecting borrowers with more short-term loans who cannot renew them.[122]

2. Transitive-Risk Contracts Among Depositors, with the Bank as Conduit

As we just saw, each depositor is in a contractual relationship with the bank and thus is subject to the risk that the bank will breach its obligation to return the funds on demand. In addition, each depositor is in a transitive-risk relationship with each other depositor, with the bank as a conduit. This "hub-and-spoke" transitive contracting relationship among depositors can lead to the transfer of positive externalities as well as counterparty risk.
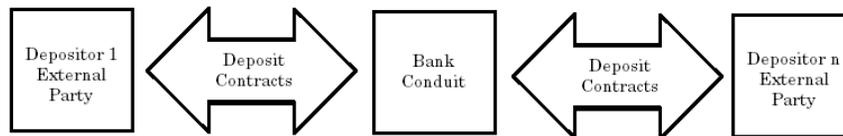
Whenever a depositor rolls over its deposits for an additional period, it provides a positive externality to other depositors; if the other depositors do the same, they all benefit from continuing the status quo equilibrium. If, on the other hand, a depositor closes its account it creates a counterparty risk for other depositors; while this risk may be small if only a handful of depositors withdraw their funds, it can over time increase in magnitude, given the transitive-risk relationship between depositors and borrowers. As depositors withdraw funds, a bank will have to cut-back on its lending activities or make less profitable short-term loans. This in turn can lead a bank to reduce the interest that it pays on its deposit accounts, which can increase the likelihood that depositors will move

---

[121]   In a revolving loan agreement, a bank agrees to lend funds to a borrower whenever the borrower chooses to draw down on the loan.

[122]   *See supra* note 53.

their funds to another bank. These feedback loops play an important role in financial contracts involving financial intermediaries; the transitive-risk contracting model allows us to bring them to the foreground and provides a straightforward, intuitive way of identifying the types of relationships in which transitive counterparty risks can produce a quickly destructive transitive-risk-feedback loop. A bank run is one such transitive-loop.

A bank run occurs whenever depositors suddenly withdraw their funds based on a belief that, if they delay, the bank will run out of cash.[123] As a general matter, a bank run will occur whenever a sufficiently large number of depositors[124] believes that the bank is in financial trouble due to a reduction in liquidity, a deterioration of its loan portfolio, or the possibility that the bank is otherwise in danger of becoming insolvent.[125] But what ultimately causes bank runs is the fact that depositors are in a transitive-risk relationship with each other, they know about the relationship, and they have incomplete information about why some depositors have chosen

---

[123] *See* Diamond & Dybvig, *supra* note 16, at 401 (defining a bank run as a situation in which "depositors rush to withdraw their deposits because they expect the bank to fail"). Bank runs are often triggered by depositors' herding behavior. For example, suppose a bank has three depositors. Depositor 1 withdraws her money from the bank. Depositor 2, after observing this, follows suit, believing that Depositor 1 acted on private information that the bank was insolvent. Now Depositor 3, after observing the behavior of the first two depositors, is even more likely to believe they acted on the basis of useful private information about the bank's financial condition. Depositor 2 and Depositor 3, however, do not know whether Depositor 1 withdrew funds because it needed cash—for example, because it needed to pay its taxes—or because it knew the bank was in financial trouble. This informational asymmetry between depositors can lead to inefficient herding, whereby otherwise healthy banks suffer bank runs. A bank run might be triggered when uninformed depositors observe longer-than-usual lines of depositors withdrawing funds or when false rumors begin circulating that a bank is facing financial trouble. *See* V.V. Chari & Ravi Jagannathan, *Banking Panics, Information, and Rational Expectations Equilibrium*, *in* CREDIT, INTERMEDIATION, AND THE MACROECONOMY: MODELS AND PERSPECTIVES, *supra* note 31, at 265-79 (offering a bank run model in which a sufficiently large set of individuals withdraw at the same time for private reasons not necessarily related, and these withdrawers are observed by others that infer that those withdrawals are due to liquidity problems in that bank).

[124] To the extent that a sophisticated depositor's funds comprise a sufficiently large portion of a bank's deposit, the possibility of a bank run may depend on the decision of the large depositor to stay put or pull its funds out of the bank. *See* TIROLE, *supra* note 7, at 456 (stating that if large depositors are patient then bank runs may be averted, even if small depositors begin to withdraw funds).

[125] *See* Charles J. Jacklin & Sudipto Bhattacharya, *Distinguishing Panics and Information-Based Bank Runs: Welfare and Policy Implications*, 96 J. POL ECON. 568 (1988).

to withdraw their funds.[126] Bank withdrawals occur on a "first-come, first-served" basis, which creates a race to the withdrawal window.[127] As a result, if a depositor has any doubt regarding whether a bank run is about to begin or has already begun, she has ample incentive to withdraw her money immediately instead of trying to ascertain the motives of other depositors or to make sense of the bank's complex financial condition.

Bank runs could be avoided altogether by bringing in an additional counterparty to insure deposits—such as the FDIC—or replacing the fractional reserve system with a system in which banks must keep 100 percent of their deposits on reserve.[128] Of course, such a bank would have to limit its business to "storing" deposits or would need to raise capital from other sources, such as by issuing equity or long-term debt.[129]

The transitive-risk contract model allows us to better understand the relationship between these two approaches. In the case of an outside insurer, one is merely replacing one type of transitive-risk relationship with another. The FDIC now stands in the shoes of depositors, so it will be in a transitive relationship with the bank's borrowers. As such the bank will act as a conduit to transfer counterparty risks between the FDIC and borrowers: if borrowers default on their loans, depositors may trigger a bank run, and the FDIC will bear the loss. Similarly, if the FDIC determines that the bank should keep higher reserves and thus cut back on its lending activities, the bank's borrowers would be affected. Under the second approach, in which the bank is required to keep 100 percent of deposits on reserve, one is merely severing the transitive counterparty risk relationship between depositors and borrowers, but creating a functionally equivalent transitive relationship between borrowers and the holders of the bank's equity and debt securities. Both types of solutions to bank runs are just ways of changing the identity of the parties who are in

---

[126] *See* BRUNNERMEIER, *supra* note 63, at 28 (drawing distinction between traders who sell assets due to own private reasons and those who sell for common reasons, such as private information that the assets are over-valued).

[127] *See* Diamond & Dybvig, *supra* note 16, at 403 (model in which bank run occurs due to liquid liabilities and illiquid assets and the sequential nature in which depositors must withdraw funds; depositors will have an incentive to be the first to withdraw).

[128] *See* Jean-Charles Rochet, *Bank Runs and Financial Crises: A Discussion*, *in* CREDIT, INTERMEDIATION, AND THE MACROECONOMY *supra* note 31, at 324-25 (arguing that fractional reserve system is principal reason for general fragility of banks).

[129] *See* Biagio Bossone, *Should Banks Be Narrowed?* (Levy Institute Working Paper No. 354), available at http://www.levyinstitute.org/pubs/wp354.pdf (discussing the concept of "narrow banks" which do not rely on depositors' funds).

a transitive contracting relationship with each other. The transitive-risk contracting model, therefore, offers a deeper account of bank runs and potential policy solutions. As we will see in the rest of the article, it also helps us to better understand the dynamics of bank panics, financial contagion, and "runs" in shadow banks.

B.   *Bank Panics and Financial Contagion*

A bank panic occurs when the failure of one bank leads to the failure of a large number of banks, possibly affecting the whole industry;[130] problems within the banking system can spill over to other financial institutions, financial markets, and currency markets (problems within any of those markets can also spread to other parts of the financial system). This sort of intra-system spillover comes under the rubric of financial contagion.[131] Both bank panics and financial contagion can be explained using the transitive-risk contracting model.

Banks are in a transitive contracting relationship with each other, through which positive externalities and negative counterparty risk gets transmitted. One type of transitive contract linkage stems from the fact that banks routinely lend money to each other through the interbank lending system.[132] The interbank lending system provides a positive externality to those involved, since it allows banks to withstand outside shocks or address liquidity needs created by the random ebb and flow of deposits and withdrawals.[133] At the same time, it can act as a conduit for the transfer of transitive counterparty risk: financial problems within one or more participating banks can lead other banks to hoard cash and cut-back on their lending activities.[134] This in turn can have a transitive-risk-

---

[130]   *See* FREIXAS & ROCHET, *supra* note 17, at 191-92 (distinguishing between a "bank run" affecting one bank and a "bank panic" affecting the whole banking industry).

[131]   *See* Franklin Allen & Douglas Gale, *Financial Contagion*, 108 J. POL. ECON. 1, 2 (2000) (describing contagion across different parts of financial system).

[132]   *See* Rochet, *supra* note 128, at 329-34 (describing linkages through interbank lending and payment systems and discussing reasons why these interconnections can increase the likelihood of contagion).

[133]   *See* João F. Cocco, *Lending Relationships in the Interbank Market*, 18 J. FIN. INTERMEDIATION 24, 25-26 (2009) (summarizing literature on use of interbank lending to meet liquidity needs).

[134]   *See* Allen & Gale, *Financial Contagion*, 3-5 (arguing that interbank markets help decrease the probability of individual bank failure, but increases likelihood of financial contagion).

feedback effect that can lead the whole market to freeze, as it did at the beginning of the Great Recession.[135]

Depositors in different banks within a financial system are in a transitive-risk relationship with each other; these interconnections can help explain bank panics. Depositors of Bank *A* could interpret the failure of Bank *B* in two ways: as a problem unique to that bank, or as a problem affecting all banks within the system, such as nonperforming loan portfolios or a decrease in the value of investment securities.[136] If depositors conclude that the problem is attributable to system-wide problems, they will stage bank runs in each of their institutions, thereby producing a full-fledged panic.[137]

C.   *Transitive-Risk Contracts in the Repo Market*

1. Repos

The repo market is a principal source of financing for financial institutions; it enables them to raise short-term funds by using securities as collateral.[138] A repo transaction is functionally equivalent to a short-term secured loan. It involves two contracts: under the first one, a "lender" purchases, at a discount, a security, which will act as a form of "collateral";[139] under the second contract, the "borrower" agrees to repurchase the security, at a price higher than what it sold it to the lender.[140] The difference between the sale and repurchase prices

---

[135]   *See* Stephen G. Cecchetti, *Crisis and Responses: The Federal Reserve in the Early Stages of the Financial Crisis*, 23 J. ECON. PERSPECTIVES 51, 57-58 (2009) (stating that interbank lending among U.S. banks is $2 trillion and that hoarding of funds in this market was one of the triggers of the Great Recession); Jean-Charles Rochet & Jean Tirole, *Interbank Lending and Systemic Risk*, 28 J. MONEY, CREDIT, & BANKING 733, 734-35 (1996) (arguing that interbank lending will provide incentive to monitor and that this incentive will tend to decrease to the extent that governments insure these loans).

[136]   *See* Philippe Aghion et al., *Contagious Bank Failures in a Free Banking System*, 44 EUR. ECON. REV. 713, 715-17 (2000) (developing a global coordination failure model of contagion in which the failure of one bank can lead depositors to conclude that failure is due to liquidity problems in banking system as a whole).

[137]   *See* Rochet, *supra* note 128, at 328-29 (describing global coordination failures in financial markets analogous to a single institution coordination problem).

[138]   *See* Peter Hordahl & Michael R. King, *Developments in Repo Markets During the Financial Turmoil*, BIS Q. REV. 37, 38-39 (Dec. 2008) (describing basic characteristics and uses of repo transactions).

[139]   The collateral may range from relatively safe and liquid securities (such as T-bills) to much riskier ones (such as asset-backed securities).

[140]   A repo seller owning a security valued at $1000 can sell it to the repo buyer for $900, agreeing to repurchase it at a later date for $1000. The $100 difference between the sale and repurchase price is the haircut, equivalent to a cash margin but

is equivalent to the interest that would have been paid on a standard loan. If the borrower breaches by refusing to repurchase the collateral, the lender will sell the collateral.[141] Although this may mitigate the lender's damages, it still bears the risk that the value of the collateral will go down or that it will be unable to resell it.

The repo market represents a principal source of secured financing for shadow banks, and it has become an increasingly important part of financing for traditional banks, as well. In fact, by the end of 2007, the repo market was larger than the total assets of the U.S. banking system[142] and provided a principal source of funds for investment banks, hedge funds, and traditional banks. Indeed, in the period leading to the Great Recession, U.S. investment banks used the repo market for approximately fifty percent of their funding needs.[143]

2. Transitive Contracts Among Repo Lenders, and Shadow-Bank Runs

As we have seen, bank runs occur whenever depositors stop "rolling over their deposits" en masse. By analogy, a *shadow-bank run* can be defined as the sudden withdrawal of short-term financing from a shadow bank. Repo lenders are in a transitive contracting relationship with each other, with the borrower acting as a conduit. Repo lenders may stop rolling over their repos because they believe that the borrower may be unable to meet its repurchase obligations or that there has been a material decline in the value of the collateral; they may

---

is, in fact, higher, because the collateral may lose value before the repurchase date. On that date, the parties can either settle or roll over the repo.

[141] The transaction is structured as a sale for bankruptcy purposes. If the borrower goes into bankruptcy during the term of the repo, the collateral does not become part of the bankruptcy estate, since the lender already owns it. *See, e.g.*, William F. Hagerty, IV, *Lifting the Cloud of Uncertainty over the Repo Market: Characterization of Repos as Separate Purchases and Sales of Securities*, 37 VAND. L. REV. 401, 409 (1984) (noting that characterizing a repo transaction as a purchase rather than a loan protects the collateral from the bankruptcy trustee). This is different than if the transaction had been structured as a loan secured by the security. *See* Bankruptcy Code § 559, 11 U.S.C. § 559 (2006) (exempting repos from the automatic stay); 11 U.S.C. § 362(b)(7) (exempting the applicability of stays to exercise of contractual rights by a repo participant).

[142] *See* Gary B. Gorton & Andrew Metrick, *Securitized Banking and the Run on Repo* 10 (Nat'l Bureau of Econ. Research, Working Paper No. 15223, 2009), *available at* http://www.nber.org/papers/w15223 (estimating that at the end of 2007, the size of the repo market and bank assets was approximately $12 trillion and $10 trillion, respectively).

[143] *See* Hördhal & King, *supra* note 137, at 38.

also stop rolling over a repo if they themselves are experiencing a liquidity shortage or other financial problem. As in the case of depositors, a repo lender who sees a second lender failing to renew its repo may not know if it is due to private information that it has about the borrower or because of its own financial needs. This informational asymmetry between repo lenders can lead to a run on a borrower.

The transitive-contracting problem is more complex in repos than in bank-depositor transactions. First, while depositors can withdraw their funds at any time, a repo lender commits to relinquishing its funds to the borrower for the entire term of the loan (its "exposure interval"), which can range anywhere from overnight to a year or more. As a result, in order to decide whether to roll over a repo, a lender must try to predict what other repo lenders and long-term lenders will do during its exposure interval. Second, depositors in a well-diversified pool are unlikely to withdraw their funds simultaneously because they are all experiencing a liquidity problem. On the other hand, repo lenders and those who provide financing to them—hedge funds, investment banks, bank holding companies, and other institutional investors—are more likely to experience liquidity and other financial problems at the same time, particularly in the midst of macroeconomic shocks or financial crises.[144] As a result, repo borrowers are in a transitive risk relationship with those who provide funds to its repo lenders (the "repo-lender financiers"). If the repo-lender financiers withdraw their funding, repo borrowers will inherit the counterparty risk. Similarly, if repo borrowers fail to meet their obligations, the repo-lender financiers will inherit the transitive counterparty risk.
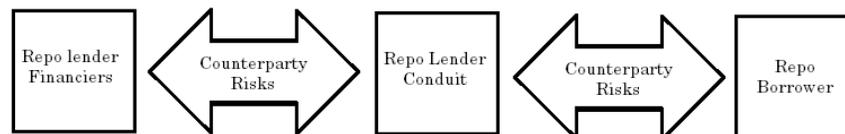
3. The Transitive-Risk Problem and Repo Collateral

Repo borrowers often use securities from their portfolios to secure their repos. Thus, a decline in the value of those securities can lead a repo lender to withdraw its funding, since it would be

---

[144] *See* Lo, *supra* note 62, at 35 (discussing the risk related to correlated needs among those supplying and demanding liquidity).

an indication that the borrower's overall portfolio may have lost value. Repo lenders will either request additional collateral or require that the borrower take a bigger haircut on the repo. In either case, the borrower will face a potential liquidity problem and will be forced to operate with a lower amount of leverage. This, in turn, may place it at a disadvantage in relation to other borrowers that can achieve a greater amount of leverage.[145] Moreover, since repo borrowers often use the same securities as collateral—e.g., the same type of mortgage-backed securities—a decline in the value of these securities can expose repo borrowers to transitive counterparty risk from other repo borrowers. In other words, even if a repo borrower is doing well financially, the fact that similarly situated borrowers are doing poorly may lead repo lenders to withdraw their funding.

To see the nature of this transitive counterparty risk among repo borrowers, suppose that two borrowers are dealing with the same repo lender, using the same collateral, and that one of them defaults on its repo agreement. In order to salvage its investment, the lender would try to sell the collateral, which would put downward pressure on its value. This, in turn, would affect the "good" borrower's ability to use that collateral when it tries to roll over its repo. The problem is further exacerbated if the "bad" borrower is shut out of the repo market and forced to sell more of that same type of securities in the open market. Finally, these sales may reveal a more accurate valuation of the securities in question, which may require both types of borrowers to write down the value of the asset on their balance sheets.

This type of scenario was exactly what occurred in the repo markets beginning in August 2007, as lenders—worried about the declining value of the mortgage-backed securities that secured countless repo transactions—began to impose higher haircuts and require safer, more liquid securities, such as T-Bills.[146] In fact, the haircut on some classes of asset-backed securities rose to 100 percent; in other words, they were no longer accepted as collateral.[147]

---

[145] One of the reasons why shadow banks have a competitive advantage over traditional banks is that banking regulations limit the amount of leverage that a bank can undertake. *See* Lo, *supra* note 62, at 4.

[146] *See* Gorton, *supra* note 65, at 35-36.

[147] *Id.*

D. *Transitive-Risk Contracting and Securitization*

Securitization helps reduce the liquidity risks of lenders and provides them with funds to originate new loans.[148] In a typical securitization transaction, one party (the originator) forms a special purpose vehicle (SPV), usually a trust, and sells it a pool of illiquid assets. In order to pay for the assets, the SPV sells securities that entitle the holders to receive part of the income stream produced by those assets. The securities are marketed to sophisticated investors, such as pension funds, hedge funds, mutual funds, and sovereign funds.[149]

In order to reduce the risk that securitized assets pose to purchasers, the originator will either contract with a third party to provide a credit enhancement—that is, insurance—or structure the SPV in a way that will act as a form of internal insurance. Originators use two general techniques to provide this internal insurance. First, they may over-collateralize the SPV; that way, if some debtors default on their obligations, the additional collateral will cover part of the losses. Second, originators may use a capital structure for the SPV that stratifies the risk to investors.[150] One common structure divides the securities into senior and junior tranches, so that the junior securities will be the first to absorb any losses. Moreover, prepayments made by debtors of the securitized assets will be distributed first to the senior security holders.[151]

The types of assets used in these transactions include home and commercial mortgages, consumer loans, student loans, credit-card and automobile receivables, and other types of assets that will produce a stream of cash over time.[152] Traditionally, lenders held onto these assets and received the income stream as debtors repaid the principal and interest on their loans. But lenders also retained the risk that some of these payments would not materialize—that is, that some of the loans would not be repaid and would need to be written down.

---

[148]　*See* Brunnermeier, *supra* note 65, at 82 (describing use of securitization by lenders to sell illiquid assets in order to get funds that they can use to create additional loans or meet other liquidity needs).

[149]　*See* Gary B. Gorton & Nicholas S. Souleles, *Special Purpose Vehicles and Securitization*, *in* THE RISKS OF FINANCIAL INSTITUTIONS 549, 560-65 (Mark Carey & René M. Stulz eds., 2007) (providing overview of securitization process).

[150]　*See* Gorton, *supra* note 65, at 19-20.

[151]　*Id.*

[152]　*See* Brunnermeier, *supra* note 65, at 78-79.

Securitization, however, allows a lender to sell the right to receive the future income stream from its loan portfolio to third parties. This has three principal advantages. First, the lender shifts the risk of owning the assets to buyers who, in theory, are better positioned to bear the risk. Second, the lender recognizes income immediately and can finance new loans, without having to raise additional short-term financing or, in the case of a commercial bank, grow its depositor base.[153] This, in turn, allows lenders to shift large portions of their business to off-balance-sheet transactions.[154] Third, by shifting the risk of nonperforming loans to purchasers and transforming its loan portfolio into cash, a lender can reduce the risk of an assets-liabilities mismatch of the sort that plagued banks before the introduction of deposit insurance.

It is helpful to examine the transitive-risk contracting relationships involved in mortgage-backed securities. If borrowers breach their residential mortgage loans with a bank, the counterparty risks of depositors increase; if those loans have been turned into mortgage-backed securities, the counterparty risks of the holders of those securities will increase. Since the originator will keep some of those mortgage-backed securities to use as collateral for repo transactions, the repo purchasers holding those securities will inherit some of the increased counterparty risk that was first set in motion when the residential mortgage borrowers defaulted on their loans.

Home Mortgage Borrowers → Counterparty Risks → Lending Institution / Originator → Counterparty Risks → Holders of Mortgage-Backed Securities → Counterparty Risks → Repo Market Participants

Suppose that a lending institution or originator has built a loan portfolio and that the demand for that particular type of loan has subsided. The originator will either be required to keep the loans on its books or sell them at a discount. If it failed to anticipate this change in the market, then the

---

[153] *See* Tirole, *supra* note 10, at 299 n.17.

[154] Because banks are required to meet certain capitalization requirements, they will have an incentive to securitize loans in order to meet such requirements. This means that as banks face financial difficulties, they will have an incentive to securitize even more of these loans in order to meet the capitalization requirements. *See* OCC, *supra* note 118, at 4 (stating that by securitizing loans, banks can remove assets from balance sheets in a manner that allows them to raise more funds on on-balance sheet transactions).

originator may face a liquidity problem. Indeed, if it was depending on the proceeds from that sale to meet its repurchase obligation under the repo contract and defaults, then the repo lender will keep the collateral and sell it. But the transitive counterparty risk will also flow in the opposite direction. Defaults by the originator can lead repo lenders to curb their lending which in turn may lead to higher interest rates on mortgages, and a reduction in the demand for home purchases. The transitive-risk contracting model again captures a transitive-counterparty risk feedback loop; it is a loop that can fuel asset bubbles in good times and lead to sharp retrenchments when the bubble bursts.

It is helpful to examine the incentives of loan originators to package loans strategically, thereby exacerbating the transitive risk problem. Suppose that an originator holding a loan portfolio categorizes its loans into three types: good, neutral, and bad. The originator knows it can sell the good loans and the neutral loans (but only if they are combined with some good loans). If it believes that it will have access to good loans in the future, it may decide to sell the good loans first, since they will provide the highest return. It will then use the funds from the sale to buy additional loans, and it will combine the good loans with the neutral ones. As long as a sufficient supply of good loans remains, the originator will continue to securitize. But, if the originator senses that the supply of good loans is diminishing, it will begin adding some neutral loans into the mix. Doing so, however, will yield a lower return and make it more difficult to bid for good loans that are in short supply and thus more expensive. At some point, the originator will be left with only bad and neutral loans. Left with few options, it will be tempted to package and sell them off, since this will give it an option value; it will be able to delay its financial reckoning, in the hopes that things will get better. But, over time, ratings agencies will prevent the originator from pursuing this strategy. It will become common knowledge that the market is in trouble and that outstanding asset-backed securities are worth less than thought. By this point, the originator will hold a portfolio of relatively bad loans that cannot be packaged and sold.

E.		*Liquidity and Transitive Counterparty Relationships*

Financial institutions are linked through a number of contractual transactions involving derivative securities, such as

BROOKLYN LAW REVIEW [Vol. 78:4]

interest rate swaps, exchange rate derivatives, mortgage-backed securities, and a number of other types of exotic financial instruments.[155] Counterparties must remain solvent in order to perform their end of the bargain at the allotted time. A failure by one of these counterparties can lead to a default, which may require the promisee to readjust its securities portfolio or sell assets to meet the obligations that would have been covered by the counterparty. The next section will examine other transitive counterparty risks involving complex derivatives. This section will focus on how transitive contracting relationships can lead to the transfer of liquidity risks across institutions.

One institution's failure can cause liquidity problems for other institutions, and this systemic liquidity problem can cause financial markets to freeze up. Financial institutions often act both as borrowers and lenders, making a profit on the difference between what they have to pay to borrow funds and what they charge for their borrowers. When systemically important institutions fail, they will no longer be able to lend or borrow funds, a transitive counterparty risk that is transmitted to other institutions, even if they did not transact regularly with the failing institutions. In other words, when institutions fail, other institutions may reason that both their lenders and borrowers may enter into fewer transactions with them. This will in turn affect their cash flows both on the funding and supply sides. Fearing a liquidity crunch, institutions therefore will have an incentive to protect themselves by hoarding liquid assets—that is, by not lending. If they are afraid that other institutions will start selling securities from their portfolio, they will have an incentive to sell those securities first, which may lead to a fire-sale.[156] Moreover, a decision to sell a particular security will send a signal to the market about the value of the seller's security portfolio. Given the adverse selection problem,[157] it is more likely that bad

---

[155] *See* Rochet & Tirole, *supra* note 135, at 733 (describing transactional interconnections, particularly through over-the-counter traded derivatives).

[156] *See* Andrew G. Haldane, Exec. Dir., Bank of England, Speech: Rethinking the Financial Network (Apr. 2001), *available at* http://www.bis.org/review/r090505e.pdf (describing dynamic in which financial institutions with risky assets engaged in liquidity hoarding and fire-sale of assets, and analogizing their response to the common reaction of people to outbreak of epidemic).

[157] *See* Guillermo Calvo, *Capital Market Contagion and Recession: An Explanation of the Russian Virus*, *in* WANTED: WORLD FINANCIAL STABILITY 49, 50-51 (Eduardo Fernandez-Arias & Ricardo Hausmann eds., 2000) (arguing that during a financial crisis buyers will face a market for "lemons" problem, in which they will require discounts due to uncertainty about the assets' value; when liquidity is needed quickly, the affected institutions will have to sell their best assets first in a fire-sale).

financial institutions will sell the better assets first in order to send a deceptive signal to the market: that they are in a better financial position than they really are.[158] This will lead good institutions to also sell their better assets first. If the liquidity problems persist, the bad institutions will fail, and the good ones will be left with securities portfolios containing poorly performing securities. We can refer to this phenomenon as the "toxic-asset-transitive risk" dynamic.

To see its full implications, suppose that a financial institution has three types of assets: those at each extreme of the good-to-bad spectrum, which can be easily identified as such by a buyer, and those that are too complex or otherwise too difficult to put into either category. The institution will be unable to sell the bad assets unless it offers a steep discount, but that would not yield enough cash to confront its pressing liquidity problem. Moreover, the assets that are difficult to categorize may require more time and due diligence to properly value, but given the time constraints, the institution will have an incentive to sell its most valuable assets first. The fact that the institution is selling large amounts of good assets at the same time may lead some market participants to conclude that they are not good after all. And buyers will know that they have a bargaining advantage, in light of the time constraint faced by sellers during a liquidity crunch. Accordingly, potential buyers will have incentive to delay in order to exacerbate the problem and increase their bargaining advantage.

F.   *Transitive-Risk Contracting and Complex Derivatives*

The customers of modern financial intermediaries often enter into very complex transactions with both intermediaries and third parties. In doing so, they may rely on other intermediaries such as rating agencies.[159] As these interconnections between parties increase in number and complexity, the risks to all parties involved become harder to understand and manage. This risk management problem is exacerbated by the competition among intermediaries to introduce financial products to exploit new markets. This, in turn,

---

[158] For a discussion of the use of deceptive signaling, see Manuel A. Utset, *Fraudulent Corporate Signals: Conduct as Securities Fraud*, 54 B. C. L. REV. 645 (2013).

[159] *See* Patrick Bolton, Xavier Freixas & Joel Shapiro, *The Credit Rating Game*, 67 J. FIN. 85, 108-09 (2012) (summarizing literature on how issuers shop for credit agencies in order to get favorable ratings and "exploit trusting investors").

leads to the introduction of increasingly specialized and complex financial products, which are created on the fly by making slight changes to previous securities. As a result, these new financial products are usually sold to customers and "tested" simultaneously.[160] Untested and poorly understood investments can quickly threaten the reliability of underlining risk management systems. If these systems are not updated in a timely fashion, they may give managers a false sense of security and lead them to enter into transactions they would have avoided had they known about the true extent of the existing risk.

These securities are often created by combining two or more simpler contracts—or sets of promises—into a more complex one, which is more difficult to understand and value.[161] To deal with the valuation problem, parties use financial models that are themselves highly complex and difficult to verify—both *ex ante* and *ex post*—whether they are working correctly.[162] For example, suppose a financial manager has identified a business problem, such as hedging a portfolio of securities, managing foreign currency risks, or meeting regulatory capitalization requirements. She will then choose an appropriate model to reduce the problem's overall complexity and formulate a solution.[163] The reliability of this solution will depend on the robustness of the model's assumptions.

In order to test the reliability and robustness of financial models, financial firms turn to "quantitative experts" who use computer simulations to predict how the models will play out in the real world. One important part of this exercise is to create

---

[160] One reason why investment banks may rush to market new financial products is that once the products becomes public, other investment banks can copy them and sell them to their own clients. Unlike standard innovations, getting effective intellectual property protection of financial innovations is much more difficult. As a result, the first investment bank to reach the market with a new product will be able to acquire some market share and reputational capital before others copy its innovation. *See* FRANKLIN ALLEN & DOUGLAS GALE, FINANCIAL INNOVATION AND RISK SHARING 50-55 (1994). It is possible to get patent protection on some types of financial innovations. *See* State St. Bank & Trust Co. v. Signature Financial Grp., Inc., 149 F.3d 1368 (Fed. Cir. 1998) (allowing patents on financial innovation to consolidate information flow among group of mutual funds), *abrogated by In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008).

[161] *See* Merton, *supra* note 84, at 341 (describing aggregation of contracts to form complex derivatives with new patterns of cash flows).

[162] Firms, financial intermediaries, and regulators use financial models to make sense of the complex, real-world environment in which financial decisions are made and played out. *See* HO & LEE, *supra* note 4, at 8-9, 546-48 (describing use of models to value securities, formulate trading strategies, and evaluate risk of trading decisions in financial engineering, and in evaluating regulated financial companies).

[163] *See* HO & LEE, *supra* note 4, at 8 (stating that models are developed to solve specific financial problems).

"stress tests," in which a model's standard assumptions are replaced with ones involving extreme scenarios. In theory, models that are not sufficiently robust to pass the stress test will be replaced with better ones. But "better" models often require a greater number of assumptions to better reflect real-world environments, which in turn increase the model's complexity. In the end, financial firms will be required to make a number of tradeoffs, any of which increases the risk that they will enter into a transaction with an incorrect understanding of the myriad transitive-risk contractual relationships involved and how to value and revalue them over time.

CONCLUSION

This article develops a new theory of financial contracts and the interconnectedness of financial institutions. The theory describes the role played by transitive-risk contractual relationships where multiple parties are tied to each other, directly or indirectly, through a series of interconnected contracts (contracts within a contractual chain). Transitive-risk contracting meshes well with our understanding of the factors that caused the Great Recession and thus led to the adoption of the Dodd-Frank Act. The Act requires financial regulators to adopt rules to reduce the risk of future financial crises due to the interconnectedness of financial institutions and the proliferation of complex financial contracts whose true risk remains hidden from the parties to the contract, other actors affected by those contracts, and financial regulators. The transitive-risk contracting model provides regulators with a way to identify problematic interconnections between financial institutions, and to identify financial contracts whose proliferation can lead to an increase in system-wide risk and the potential of a financial crisis and financial contagion.