

AN INFORMATION MARKET PROPOSAL FOR REGULATING SYSTEMIC RISK

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Secretary Geithner's remarks highlight a fundamental policy-concern about the recent financial system turmoil – “systemic risk”. Not only have parties to various financial transactions incurred considerable losses, but so have third parties. The costs of those transactions thus appear to have spread from immediately interested parties, where market discipline tends to work well, to the social domain, where more centrally developed laws and regulations can do better. As far as concerns for this type of spillover go, policymakers appear well motivated in calling for a systemic risk regulator that might check the potential for future bouts of financial contagion.¹

Before we can better manage systemic risk, however, we need a forward-looking measure of it. A number of authoritative commentators

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1. Widespread calls for improved systemic risk regulation include, VIRAL ACHARYA & MATTHEW RICHARDSON, RESTORING FINANCIAL STABILITY: HOW TO REPAIR A FAILED SYSTEM (2009); ENRICO PEROTTI & JAVIER SUAREZ, CENTRE ECON. POL'Y RESEARCH, LIQUIDITY INSURANCE FOR SYSTEMIC CRISES (2009); and Lasse Pedersen & Nouriel Roubini, *A Proposal to Prevent Wholesale Financial Failure*, FIN. TIMES, Jan. 29, 2009, <http://www.ft.com/cms/s/0/4d0add58-ee27-11dd-b791-0000779fd2ac.html?catid=9&SID=a527e1b4ae044f959a1101c9c34ccb2c>. In addition, the Obama Administration recently proposed significant regulatory reforms that provide for a systemic risk regulator. See U.S. DEP'T OF TREASURY, FINANCIAL REGULATORY REFORM: A NEW FOUNDATION (2009), http://financialstability.gov/docs/regs/FinalReport_web.pdf (recommending regulatory changes); see also Jon Hilsenrath, *The Task of Taming Highs and Low*, WALL ST. J., June 19, 2009, <http://online.wsj.com/article/SB124526883036724391.html> (describing proposed regulatory changes and potential consequences).

have made similar observations. For example, Michael Spence (a Nobel Laureate in economics) recently applauded British Prime Minister Gordon Brown's call for an "an early warning system" (an idea that subsequently gained traction in G-20 meetings) but also cautioned that an adequate measure of systemic risk is not yet available.² Thomas Cooley and Ingo Walter (dean and vice dean, respectively, at New York University's Stern School of Business) similarly argued that "[t]he key to restoring stability and robustness is to recognize, measure and price the systemic risk created by private financial activities. . . ."³ And testifying before the U.S. Senate Committee on Banking, Housing, and Urban Affairs, Federal Reserve Board Governor, Daniel K. Tarullo, identified several tools which would strengthen administrative and Congressional efforts to productively manage systemic risk, including "better and more formal mechanisms . . . to help identify, monitor, and address potential or emerging systemic risks across the financial system as a whole"⁴

Taking these observations as motivation, we consider how an information market security might provide an early warning of systemic risk. This security would build on the fundamental nature of systemic risk referred to by Secretary Geithner. A legitimate policy concern is that parties to financial transactions need not face the full costs of their actions but can instead pass a considerable portion of those costs onto third parties.⁵ When participants in a transaction create such external effects they necessarily draw the performance of third party businesses closer to their own. A security that derives from how closely the performance of "third party businesses" and "financially dependent businesses" correlates

2. Spence observed that this early warning system "is a good idea, but acting on it will require a nontrivial extension of our current knowledge and capabilities. We have been operating with indicators that, while relevant, do not add up to a complete picture of systemic risk. . . ." A. Michael Spence, *Lessons from the crisis*, PIMCO VIEWPOINTS, Nov. 2008,

<http://www.pimco.com/LeftNav/Viewpoints/2008/Viewpoints+Lessons+from+the+Crisis+Spence+November+2008.htm>.

3. Thomas Cooley & Ingo Walter, *Financial Polluters Need to Pay*, BLOOMBERG, Feb. 12, 2009, http://www.bloomberg.com/apps/news?pid=20601039&refer=columnist_&sid=ajotwjBIIZSM.

4. *Establishing a Framework for Systemic Risk Regulation: Hearing Before the S. Comm. on Banking, Housing, & Urban Affairs*, 111th Cong. (2009) (statement of Daniel K. Tarullo, Governor, Bd. of Governors of the Fed. Reserve Sys.), available at http://banking.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=a915ab53-be05-457e-8dc6-bf12d25d9d6f.

5. Ronald Coase carefully addressed the question of when the law can productively address this type of problem. Ronald Coase, *The Problem of Social Cost*, 3 J. L. & ECON. 1 (1960). We argue below that Coase's conditions are met in the case of systemic risk, and that an information market contract that provides an early warning about that risk can augment more conventional regulatory mechanisms.

might thus reveal information about the nature of systemic risk in real-time, and do so in a more productive manner than is currently available to regulators and market participants.⁶

The remainder of our article evaluates how this kind of security can work in principle, and offers a statistical illustration and legal/regulatory review of how it can work in practice. The article's theory ultimately derives from the Coase theorem, which shows that if the cost of transacting is negligible, then the law's first order effect is on distribution rather than efficiency.⁷ The theorem's contrapositive, then, is that laws can improve economic performance only when the cost of transacting is considerable. Viewed in this light, because parties to a financial transaction face fewer search, bargaining, and enforcement costs (transaction costs) than do affected third parties, the law has an opportunity to productively address systemic risk.

Our question then becomes how the law can do better at fulfilling this opportunity. A standard approach is to coarsely impose capital requirements, and thus increase the exposure of transacting parties to the costs of their own actions. But while prescriptive capital requirements can mitigate moral hazard, they can also take away leverage that may be necessary to pursue truly productive projects. Ideally, then, a social planner would allow more leverage in systemically "safe" times (when the relative cost of foregoing good projects is high) and demand more stringent capital requirements as the risk of systemic crisis increases (when the relative cost of allowing external effects is high). The derivative security that we consider in this article would provide a regulator with the real-time information necessary to implement such a standard, and thus facilitate a productive refinement of the coarse requirements now used to govern the financial sector.

It would also offer a productive refinement to the conventional regulatory tool of "bank" examination. Relative to market participants, for example, bank examiners find themselves working at a distance from

6. In other words, if the fundamental concern about systemic risk is the ability of parties to enjoy the benefits of a transaction and pass the costs off to others, then the performance of third parties should track more closely with that of transacting parties when the external effects of financial activity grow stronger. Myron Scholes (a Nobel Laureate in economics) anticipated how such a measure can be informative, noting that "at times of crisis, things that were seemingly unrelated all of a sudden become related." Best of Bloomberg on the Economy with Tom Keene, Scholes, Ross, Merton Discuss Credit Crisis, Hedge Funds (Internet Podcast May 16, 2008) (*on file with authors*).

7. See Coase, *supra* note 5, at 8 ("It is necessary to know whether the damaging business is liable or not for damage caused since without the establishment of this initial delimitation of rights there can be no market transactions to transfer and recombine them. But the ultimate result (which maximises [sic] the value of production) is independent of the legal position if the pricing system is assumed to work without cost.").

information about who is (and is not) affected by financial transactions. Our derivative security would address this difficulty by directly soliciting market participants (those who are closest to the information of interest), and do so in a manner that encourages truthful revelation of pertinent information.⁸ At the same time, that solicitation would allow participants to retain a considerable level of anonymity, and may thus produce regulatory-relevant information (i.e., the exposure of third parties to financial transactions) without putting productive trade secrets of financial firms at undue risk (as necessarily intrusive “bank” examination might do) or discouraging legitimate whistle-blowers.

In this theoretical light, an information market contract appears capable as an efficiency-enhancing mechanism in the systemic regulator’s toolbox. To illustrate how such a contract might work in practice, we build on Raghuram Rajan’s and Luigi Zingales’ seminal comparison of how finance dependent firms (those who are likely to transact with a financial services enterprise) perform relative to firms that are less reliant on external finance (firms that are insensitive to the financial service sector’s health, except for their exposure to the *external* effects of financial transactions).⁹ In particular, we find that daily stock market returns of these otherwise very different firms begin to exhibit historically strong correlations in the third quarter of 2007 and continue to do so through the first quarter of 2009 (the end of our dataset). We also offer corroborating evidence from analyzing the text of financial news that this heightened correlation reflects systemic risk per se and not some unrelated force. Finally, we show how an information market contract that derives from this correlation might provide an early warning to systemic risk regulators (as well as market participants), and conclude by highlighting the political obstacles that such a contract might confront, even if the potential that it shows here proves to be robust.

I. HISTORY OF THE CRISIS (SO FAR)

A diverse array of factors has resulted in the most severe economic and financial contraction since the Great Depression. Many agree, however, that financial sector regulators were slow to identify and address the systemic nature of the crisis. A surplus of liquidity flowed through

8. In short, relative to alternative methods of soliciting information (e.g., surveys of economists), an information market rewards good information and punishes bad information, and can thus encourage a self-selection of those with the best information to reveal what they know in a truthful manner.

9. See Raghuram Rajan & Luigi Zingales, *Financial Dependence and Growth*, 88 AM. ECON. REV. 559 (1998) (examining the relationship between developed financial markets and business growth).

U.S. capital markets over much of the last decade. Innovations in mortgage securitization directed much of this capital into real estate. High valuations in housing proved excessive, and prices declined as investment flowed from the sector. Most importantly, the effects of the contraction proved systemic as the quality of banks' securitized investments deteriorated. Market incentives proved insufficient to fully discipline investor risk-taking in the presence of risk-sharing through financial intermediation. And public regulators failed to identify where market inefficiencies would result in systemic consequences.

Economists continue to debate the source of excess liquidity that flowed into housing over the decade. Some suggest that a glut of savings in emerging nations helped to finance excessive investment in the U.S.¹⁰ In this view, liberalized global financial markets allowed investors from fast-growing emerging market economies to access more stable investment opportunities in developed nations. Investor protections in the established institutional environments of mature democracies made them desirable places to store financial capital. In fact, net inflows of foreign capital to the U.S. rose from approximately two percent of GDP in 1997 to six percent of GDP in 2006.¹¹

Others suggest the principal source of excess liquidity was overly accommodative monetary policy.¹² Concurrent with the rise in foreign savings, the Federal Reserve reduced interest rates in order to combat the effects of the 2001 recession. The target rate for Federal Funds, the overnight, inter-bank lending rate, was reduced from 6.5 percent at the beginning of 2001 to one percent in mid 2003, where it remained for another 12 months.¹³ Even more importantly, the Federal Funds rate target remained below conventional measures of neutrality.¹⁴ Because the Fed

10. See, e.g., Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Reserve Sys., Speech at the Bundesbank Lecture, *Global Imbalances: Recent Developments and Prospects* (Sep. 11, 2007), available at <http://www.federalreserve.gov/newsevents/speech/bernanke20070911a.htm> (describing increasing investment from developing nations).

11. Authors' calculations. Data from U.S. Dept. of Commerce, Bureau of Economic Analysis (BEA), available at <http://www.bea.gov/>, retrieved July 12, 2009. The balance of payments identity requires that a current account, or trade, deficit be offset by a foreign capital flow surplus of the same magnitude.

12. See, e.g., John B. Taylor, *The Financial Crisis and Policy Responses: An Empirical Analysis of What Went Wrong* (Nat'l Bureau of Econ. Research, Working Paper No. 14631, Jan. 2009) (examining the relationship between monetary policy and economic cycles).

13. FED. RESERVE BD., OPEN MARKET OPERATIONS, <http://www.federalreserve.gov/fomc/fundsrate.htm> (last visited February 22, 2010).

14. See John B. Taylor, Professor of Econ., Stanford Univ., and Senior Fellow, Hoover Inst., Remarks at Fed. Reserve Bank of Kan. City Symposium on Housing, Housing Finance, and Monetary Policy (Sept. 1, 2007) (transcript available at <http://www.stanford.edu/~johntayl/Housing%20and%20Monetary%20Policy--Taylor--Jackson%20Hole%202007.pdf>).

implements monetary policy through purchases and sales of Treasury securities,¹⁵ yields on the safest investments declined as foreign capital inflows continued apace.

Whatever the source of excess liquidity, innovations in mortgage securitization appeared to provide investors with an opportunity for greater returns in the historically low-risk U.S. housing market. Both public and private issuers responded to the growing demand for housing-related investment. Outstanding balances of total mortgage-backed securities (MBS) in the U.S. averaged \$4.8 trillion in 2004, or 41 percent of GDP, and by the end of 2007, MBS balances had grown to \$7.4 trillion, or 54 percent of GDP.¹⁶ Innovation by private mortgage conduits accounted for much of the growth in mortgage securitization. Though they only represented 30 percent of total balances in mortgage pools and trusts in 2004, private conduits accounted for 58 percent of the growth in securitized mortgage balances through 2007.¹⁷ Government sponsored enterprise (GSE) conduits, however, still accounted for 60 percent of MBS balances in 2007.¹⁸ Moreover, GSE securitization continued to grow through 2008, as the severity of the crisis came into relief.¹⁹

Excess liquidity and financial innovation also had significant consequences for business finance. Outstanding balances of asset-backed commercial paper in the U.S. averaged \$0.7 trillion in 2004, or six percent of GDP.²⁰ Asset-backed commercial paper peaked in early August of 2007 at \$1.2 trillion, or nine percent of GDP.²¹ Over that same period, outstanding balances of unsecured commercial paper for both nonfinancial

15. See Cheryl L. Edwards, *Open Market Operations in the 1990's*, 1997 FED. RESERVE BULL. 859 (1997) (describing the mechanisms by which the Federal Reserve implements its money policies).

16. Authors' calculations. GDP data from: U.S. Dept. of Commerce, Bureau of Econ. Analysis, National Income and Product Accounts Table, <http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=5&ViewSeries=NO&Java=no&Request3Place=N&3Place=N&FromView=YES&Freq=Year&FirstYear=2004&LastYear=2005&3Place=N&Update=Update&JavaBox=no#Mid> [hereinafter National Income] (last visited Feb. 5, 2010). Mortgage debt data from: Bd. of Governors of the Fed. Reserve Sys., Mortgage Debt Outstanding, <http://www.federalreserve.gov/econresdata/releases/mortoutstand/mortoutstand20090331.htm> [hereinafter Mortgage Debt Outstanding] (last visited February 22, 2010).

17. National Income, *supra* note 16; Mortgage Debt Outstanding, *supra* note 17.

18. National Income, *supra* note 16; Mortgage Debt Outstanding, *supra* note 17.

19. National Income, *supra* note 16; Mortgage Debt Outstanding, *supra* note 17.

20. Asset backed commercial paper are loans used for short-term financing needs (typically between 90 and 120 days) and secured by physical assets, such as traded receivables. Authors' calculations from commercial paper data from Federal Reserve Board of Governors data download program. Bd. of Governors of the Fed. Reserve Sys., Commercial Paper Rates and Outstandings, <http://www.federalreserve.gov/releases/cp/> [hereinafter Commercial Paper Rates] (data retrieved July 14, 2009).

21. *Id.*

and financial firms also rose, growing 69 percent and 44 percent, respectively.²²

Eventually, credit levels proved to be unsustainable, resulting in reverberations between real and financial activity. The National Association of Home Builders (NAHB)/Wells Fargo Housing Market index peaked in June of 2005.²³ This measure would decline by 42 percent over the following 12 months, and an additional 28 percent by the summer of 2007.²⁴ The Case-Shiller National Home Price Index would peak in the second quarter of 2006,²⁵ and home foreclosure activity would rise 75 percent in 2007.²⁶

Real businesses' activity would also suffer the consequences of the credit market freeze-up. Total commercial paper outstanding would contract by 20 percent over the last five months of 2008.²⁷ This decline was entirely attributable to a contraction in nonfinancial commercial paper (down 14 percent) and asset-backed commercial paper (down 37 percent).²⁸

In the first quarter of 2007, loan loss provisions at FDIC-insured banks posted their largest increase in since 2002, increasing by \$3.2 billion from 2006.²⁹ The systemic implications became apparent as large subprime lenders warned of significant losses.³⁰ On June 16, Merrill Lynch seized \$400 million in assets of a Bear Stearns fund that incurred heavy losses in

22. *Id.*

23. See National Association of Home Builders, NAHB/Wells Fargo Housing Market Index (Historical Data), <http://www.nahb.org/generic.aspx?sectionID=134&genericContentID=530> (last visited Feb. 5, 2010) (displaying data). NAHB/Wells Fargo Housing Market Index is based on a monthly survey of NAHB members. The survey measures the strength of the market for new, single-family homes.

24. *Id.*

25. Standard & Poors, S&P/Case Schiller National Home Price Index, http://www2.standardandpoors.com/spf/pdf/index/csnational_value_052619.xls (last visited February 22, 2010). The Case-Shiller Home Price Indices are constant-quality indexes derived from data on repeat sales of existing homes. The national index is a composite of regional single-family home price indices.

26. Press Release, RealtyTrac, U.S. Foreclosure Activity Increases 75 Percent in 2007 (Jan. 29, 2008), *available at* <http://www.realtytrac.com/ContentManagement/PressRelease.aspx?channelid=9&ItemID=3988>.

27. Authors' calculations. For data, see Commercial Paper Rates, *supra* note 21.

28. *Id.*

29. *Quarterly Banking Profile*, FDIC Q., First Q. 2007, at 1, *available at* <http://www2.fdic.gov/qbp/2007mar/qbp.pdf>. The report noted that net charge-offs rose 48.4 percent from the first quarter of 2006, increasing in most loan categories. *Id.* at 2. The report also noted that "net charge-offs of 1-4 family residential mortgage loans were up by \$268 million (93.2%) [from year ago levels]." *Id.*

30. See *Timeline: Subprime Losses*, BBC NEWS ONLINE, May 19, 2008, <http://news.bbc.co.uk/2/hi/business/7096845.stm> (chronologically representing events).

mortgage-backed investments.³¹ When markets opened two days later, the TED spread, a headline measure of overnight default risk, rose to nearly 84 basis points.³² Historically, the TED spread had remained under 50 basis points.³³ However, on broader concerns about banks' mortgage investment exposure, the TED spread would surge to 240 basis points on August 20.³⁴ The measure would remain above 75 basis points over the next 12 months, before peaking at 464 basis points in October of 2008.³⁵

Some of the excesses in credit markets may have been attributable to social policy that encouraged higher-risk lending. For example, the Federal Housing Enterprises Financial Safety and Soundness Act of 1992 required the Department of Housing and Urban Development to establish goals encouraging GSEs to promote home ownership among low-income borrowers and borrowers in historically underserved areas.³⁶ Research suggests these goals may have increased mortgage lending to low- and moderate-income households, primarily in 1998.³⁷

However, credit market excesses also revealed weaknesses in the capacity for decentralized markets to manage lending risks. If transactions costs are significant, securitization can affect how loans are managed once risks are realized. Loans in default that are held by lenders are more likely to be restructured, as lenders often find renegotiation preferable to foreclosure. However, varied interests among the large number of parties

31. *Merrill Lynch Seizes Bear Stearns Fund Assets*, REUTERS, June 16, 2007, <http://www.reuters.com/article/ousiv/idUSN1631437620070618>.

32. Bloomberg.com TED Spread Charts, <http://www.bloomberg.com/apps/cbuilder?ticker1=TEDSP%3AIND> (last visited Jan. 27, 2010). The TED spread is defined as the difference between the yields on the three-month U.S. Treasury Bill and the three-month London Inter-bank Offered Rate (LIBOR). The former represents a risk-free rate; latter represents the rate that banks charge for lending over the same term. Thus, the difference is viewed as a measure of credit risk of large financial institutions that manage liquidity by borrowing funds at LIBOR.

33. Posting of James Hamilton to Econbrowser, *Understanding the TED Spread*, http://www.econbrowser.com/archives/2008/09/understanding_t.html (Sept. 28, 2008, 21:09).

34. Bloomberg.com TED Spread Charts, *supra* note 32.

35. *Id.*

36. *See* Federal Housing Enterprises Financial Safety and Soundness Act of 1992 § 1332, Pub. L. No. 102-550 § 1332 (codified as amended at 12 U.S.C.S. § 4562 (LexisNexis 2010)); *see also* OFFICE OF POLICY DEV. & RESEARCH, U.S. DEP'T OF HOUS. & URBAN DEV., ECONOMIC ANALYSIS FOR THE SECRETARY OF HOUSING AND URBAN DEVELOPMENT'S REGULATION OF THE FEDERAL NATIONAL MORTGAGE ASSOCIATION (FANNIE MAE) AND THE FEDERAL HOME LOAN MORTGAGE CORPORATION (FREDDIE MAC) (1995).

37. Brent W. Ambrose & Thomas G. Thibodeau, *Have the GSE Affordable Housing Goals Increased the Supply of Mortgage Credit?*, 34 REGIONAL SCI. & URB. ECON. 263, 271 (2004) (finding "a limited relationship between mortgage volume and the proportion of underserved census tracts in an MSA . . . [as suggested by] a significantly positive relationship between the level of mortgage activity and the purchase of seasoned loans by the GSEs.").

to a securitized loan make them much more costly to restructure.³⁸ Sufficiently large financial institutions have an incentive to undertake excessive risks if they account for implicit insurance from a systemic risk regulator concerned that complex intermediation cannot be quickly unwound.

In fact, recent research suggests that mortgage securitization diminished incentives for lenders to screen borrowers.³⁹ Indeed, as mortgage securitization grew, subprime mortgage lending expanded contemporaneously with flat and declining income among subprime borrowers.⁴⁰ Conversely, lenders devote more effort to assessing the risks of loans they hold on their books. Large, complex financial intermediaries will discount risk if they anticipate that the regulatory authority will have an incentive to intervene in the event of correlated loan losses.

Public regulation appears to have failed as well where market discipline was lacking. Some accounts suggest that financial regulators may have been “captured” by industry interest, resulting in less stringent regulatory controls and enforcement.⁴¹ Others suggest that regulators adopted more flexible standards in a failed attempt “to compensate for earlier deregulatory efforts by Congress that had left the SEC unable to

38. See Joseph Stiglitz, *Houses of Cards*, GUARDIAN.CO.UK, Oct. 9, 2007, <http://www.guardian.co.uk/commentisfree/2007/oct/09/housesofcards>.

39. See Benjamin J. Keys et al., *Did Securitization Lead to Lax Screening? Evidence from Subprime Loans* (EFA 2008 Athens Meetings Paper, 2008), available at <http://ssrn.com/abstract=1093137>. The authors use the GSE-established 620 FICO credit score underwriting cut-off in order to distinguish securitizable and non-securitizable loans of similar riskiness. *Id.* at 2. They find that portfolios of subprime mortgage loans that are more likely to be securitized are 10 to 25 percent more likely to default than are portfolios of similarly risky subprime mortgage loans that are less likely to have been securitized. *Id.* at 28.

40. See Atif R. Mian & Amir Sufi, *The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis* (Working Paper Series, 2008), available at <http://ssrn.com/abstract=1072304>. The authors study changes in mortgage lending by zip code. They report that “[t]he expansion in mortgage credit from 2002 to 2005 to subprime zip codes occurs despite sharply declining relative (and in some cases absolute) income growth in these neighborhoods. In fact, 2002 to 2005 is the only period in the last eighteen years when income and mortgage credit growth are negatively correlated.” *Id.* at Abstract. Most importantly for the present interest, the authors also find that the dissociation of income growth from subprime credit growth is closely correlated with the increase in securitization of subprime mortgages. *Id.*

41. See Stephen Labaton, *Agency’s ’04 Rule Let Banks Pile Up New Debt, and Risk*, N.Y. TIMES, Oct. 2, 2008, at A1 (examining investment banks’ successful efforts to lobby the SEC to reduce the net capital rule, which would allow banks to lend capital that was then held in reserve against expected loan and investment losses). The author suggests that oversight of the new capital regime may have been inadequate: “[t]he commission assigned seven people to examine the parent companies – which . . . controlled financial . . . assets of more than \$4 trillion [in 2007]. . . . And [from early 2007 through September 2008], the office had not completed a single inspection” *Id.*

monitor the overall financial position and risk management practices of the parent companies controlling . . . investment banks.”⁴² In either case, public regulation proved to be an inadequate safeguard to failures of market discipline that were exposed when excess liquidity and public policy encouraged high-risk lending and borrowing.

II. MARKET DISCIPLINE WON’T STOP “FINANCIAL POLLUTERS”, AND CURRENT REGULATIONS FALL SHORT OF PRACTICAL IDEALS

A. *Markets Work, At Least Where Laws Lower Transactions Costs*

In a series of influential articles, Nobel Laureate in economics Ronald Coase showed that the visible hand of the law (i.e., governance mechanisms, such as public laws, regulations, or business associations) improves economic performance (as measured by total welfare) only through its ability to reduce transaction costs.⁴³ These costs refer to resources that individuals must forego while searching for suitable trading partners, bargaining over the terms of an exchange, and enforcing those terms. And a wealth of economic theory and evidence supports the hypothesis that “free markets” work better when the law provides a low-transaction-cost environment. The Federal Reserve Act of 1913, for example, provides a foundation for sound monetary policy and thus economizes on costs from searching for suitable trading partners when a “double coincidence of wants” is necessary for economic exchange.⁴⁴ Markets also work better when competition policy facilitates trades that are mutually beneficial, except for the bargaining costs that either party would incur to productively address the other’s market power.⁴⁵ And laws that

42. See John C. Coffee, Jr., *Analyzing the Credit Crisis: Was the SEC Missing in Action?* N.Y.L.J., Dec. 5, 2008, <http://www.law.com/jsp/ihc/PubArticleIHC.jsp?id=1202426495544>. The author argues that investment banks lobbied the SEC for oversight in order to avoid regulation under the European Union Financial Conglomerates Directive, adopted in 2002. *Id.* The directive exempted entities subject to “equivalent”, group-level supervision by U.S. banking regulators. *Id.*

43. See Coase, *supra* note 6; see also Ronald H. Coase, *The Nature of the Firm*, 4 *ECONOMICA* 386 (1937).

44. See DINO FALASCHETTI & MICHAEL J. ORLANDO, *MONEY, FINANCIAL INTERMEDIATION, AND GOVERNANCE* 3 (2008).

45. See *e.g.*, DINO FALASCHETTI, *DEMOCRATIC GOVERNANCE AND ECONOMIC PERFORMANCE: HOW ACCOUNTABILITY CAN GO TOO FAR IN POLITICS, LAW, AND BUSINESS* 70 (2009) [hereinafter FALASCHETTI, *DEMOCRATIC GOVERNANCE*] (discussing the role of law in market efficiency); Dino Falaschetti, *Can Lobbying Prevent Anticompetitive Outcomes? Evidence on Consumer Monopsony in Telecommunications*, 4 *J. COMPETITION L. & ECON.* 1065 (2008) (examining industry-specific regulation and the relationship between regulators

govern business associations, such as the fiduciary duties of directors, officers, and controlling shareholders, can free up resources from the acts of forming and enforcing agency relationships so that those resources may be put to work in more productive endeavors.⁴⁶

B. Regulation can Improve on Market Discipline when Transactions Costs are High

This transaction cost approach has offered keen insights to how legal doctrines might become not only more internally consistent but also more productive. The question about whether creditors should be able to pierce the corporate veil is illustrative. From a transaction cost perspective, tort creditors should have more ready access to this equitable remedy than do contract creditors. Indeed, limited liability is black letter corporate law, and contract creditors are parties to the transactions that fall within that law's scope. In cases where limited liability is not a mutually agreeable term, then, contract creditors would incur relatively little in the way of costs in bargaining around it. Small businesses, for example, routinely forego limited liability in return for credit terms that are more attractive on net.

Transactions costs that tort creditors must incur are considerably greater. Notice that tort creditors, by definition, aren't parties to "transactions" that harmed them. Indeed, the cost of finding "suitable trading partners" to mitigate damages before the fact would be prohibitive. And Coase's theorem tells us that this type of high transaction cost environment is where the law can improve upon private contracting by encouraging parties to a transaction to more fully internalize the costs and benefits of their actions.⁴⁷

The theorem has also been productively applied to developing regulations for pollution,⁴⁸ and we essentially extend that development here to the case of "financial pollution".⁴⁹ Market discipline is not enough to

and producers in promoting market efficiency).

46. See, e.g., FALASCHETTI, *DEMOCRATIC GOVERNANCE*, *supra* note 45, at 119 (discussing the economization of transaction costs arising from the use of managers, lawyers, and politicians); see generally Dino Falaschetti, *Shareholder Democracy and Corporate Governance*, 28 *REV. BANK. & FIN. L.* 553 (2009) (arguing for limits to the shareholder franchise in order to obtain maximal efficiency in corporate governance).

47. See Henry Hansmann & Reinier Kraakman, *Toward Unlimited Shareholder Liability for Corporate Torts*, 100 *YALE L.J.* 1879, 1931-32 (1991) (discussing liberalized veil-piercing as merely another form of unlimited liability). Hansmann and Kraakman are frequently credited with having developed this externalities-based approach to veil-piercing doctrines. See, e.g., STEPHEN M. BAINBRIDGE, *CORPORATION LAW AND ECONOMICS* 141 (2002).

48. See DAVID P. BARON, *BUSINESS AND ITS ENVIRONMENT* 363-66 (5th ed. 2006).

49. For a detailed discussion of the term, see Matthew Beville, Comment, *Financial*

stop inefficient pollution because it does not confront polluters with the full costs of their actions. Instead, to the extent that firms can pass pollution-costs onto others, cash flows that are available to the firms' various claimants (direct parties to transactions with firms) will increase, and financial markets will thus reward firms for the negative externalities that they create. In cases like this, regulation can do better from a social welfare standpoint.

Systemic risk is such a case. As Secretary Geithner observed in our introductory quotation, this risk refers to the potential for parties to a financial transaction to adversely affect those who are not party to the transaction. But this problem is qualitatively identical to that of pollution: transactions amongst the firm's various claimants ultimately produce pollution, the costs of which are passed (to a considerable extent) onto others. Consequently, the potential for productive regulation here is considerable too. For example, transactions costs will weaken the ability of decentralized markets to confront producers of systemic risk with the external costs of their actions.

C. Although Regulation Can Do Better, It Will Not Necessarily Do So

Transactions costs create opportunities for regulation to mitigate the systemic consequences of decentralized allocations. However, challenges to effective regulation are not trivial. Regulators must first determine those behaviors that are creating transactional externalities. In the case of finance, time-varying macroeconomic conditions will determine who should be regulated, and when and how regulators can intervene most effectively. While the merits of various regulatory proposals will continue to be debated, more timely information about the expected level of systemic risk would represent a touchstone on the regulatory landscape.

Since 1993, international standards for regulating financial risks have trended towards greater flexibility.⁵⁰ The evolving standards have acknowledged that optimal prudential regulation of deposit-taking institutions will necessarily vary across institutions and over time. An

Pollution: Systemic Risk and Market Stability, 36 FLA. ST. U. L. REV. 245 (2008).

50. See Jean-Charles Rochet, *Solvency Regulations and the Management of Banking Risks*, 43 EUR. ECON. REV. 981, 981 (1999) (“[Since 1993] . . . , a movement towards flexibility has been acknowledged, notably with validation of internal models of the VaR type and the precommitment proposal of Kupiec and O’Brien.”). For discussion of precommitment proposal, see Paul H. Kupiec, & James M. O’Brien, *The Pre-Commitment Approach: Using Incentives to Set Market Risk Capital Requirements* (Bd. of Governors of the Fed. Reserve Sys., Finance and Economics Discussion Series No. 1997-14, 1997) (“Under the [pre-commitment approach], a bank sets its own market risk capital requirement with the knowledge that it will face regulatory penalties should its trading activities generate subsequent losses that exceed its market risk capital pre-commitment.”).

increment of leverage taken by one bank does not create the same systemic consequences as the same increment of leverage taken by another. Thus, the international capital adequacy framework specified in the Basel II Accord provides a significant degree of discretion to national bank regulators and regulated institutions.⁵¹

Nonetheless, many now argue that flexible standards are insufficient to discipline banks from excessive leverage when they also face incentives to take advantage of implicit governmental guarantees.⁵² Moreover, it may simply be impractical for a small number of regulators to manage the complexity of a regulatory regime characterized by flexible, bank-specific capital standards.⁵³ In any event, even former advocates argue that self-regulation of the financial industry may be an inadequate check on systemic risk.⁵⁴

If systemic considerations are the most consequential aspect of the crisis, however, then improvements in the regulation of individual banks can only address the problem indirectly. Indeed, regulators have much further to go to improve the regulation of systemic risk. Although systemic risk management is a principal objective of prudential regulation, capital requirements target individual bank risk, regardless of how they are devised.⁵⁵ Regulatory efforts to address systemic risk more directly do not

51. See BASEL COMM. ON BANKING SUPERVISION, BANK FOR INT'L SETTLEMENTS, INTERNATIONAL CONVERGENCE OF CAPITAL MEASUREMENT AND CAPITAL STANDARDS 2 (2006), available at <http://www.bis.org/publ/bcbs128.pdf> ("The revised Framework provides a range of options for determining the capital requirements for credit risk and operational risk to allow banks and supervisors to select approaches that are most appropriate for their operations and their financial market infrastructure.").

52. See, e.g., Sheila Bair, Chairman, Fed. Deposit Ins. Co., Remarks at the Risk Management and Allocation Conference (June 25, 2007), <http://www.fdic.gov/news/news/speeches/archives/2007/chairman/spjun2507.html> (discussing risks associated with flexible capital adequacy standards, as devised in Basel II).

53. See Coffee, *supra* note 42 ("Because each model was ad hoc, specifically fitted to a unique financial institution, no team of three SEC staffers was in a position to contest these individualized models or the historical data used by them. Thus, the real impact of the Basel II methodology was to shift the balance of power in favor of the management of the investment bank and to diminish the negotiating position of the SEC's staff. Basel II may offer a sophisticated tool, but it was one beyond the capacity of the SEC's largely legal staff to administer effectively.").

54. *Testimony Concerning the Role of Federal Regulators: Lessons from the Credit Crisis for the Future of Regulation: Hearings Before the H. Comm. on Oversight and Gov't Reform*, 110th Cong. 2 (2008) (testimony of Christopher Cox, Chairman, Secs. & Exch. Comm'n), available at <http://oversight.house.gov/images/stories/documents/20081023100525.pdf> ("[W]here SEC regulation is strong and backed by statute, it is effective – and . . . where it relies on voluntary compliance or simply has no jurisdiction at all, it is not.").

55. See Viral V. Acharya et al., *The Financial Crisis of 2007-2009: Causes and Remedies*, in RESTORING FINANCIAL STABILITY, *supra* note 1, at 23-24 (observing that financial institutions will make efficient use of implicit and explicit guarantees in their

appear to have been effective in the present crisis. For example, bank-level regulators had an incomplete view of the broader implications of an institution's risk-taking, and there did not appear to be any systematic method for linking the results of individual examinations to potential systemic risks.⁵⁶

Policymakers have only begun to debate the merits of alternative approaches to implementing banking capital controls. Regardless of what approach comes into favor, regulators will need to integrate the information learned through bank examinations and simulations for those efforts to also yield information relevant to managing systemic risks. Consequently, a direct and forward-looking measure of systemic risk would be a valuable contribution to any new regulatory landscape.

III. HOW INFORMATION MARKETS CAN HELP A SYSTEMIC RISK REGULATOR

Currently, systemic risk is only loosely regulated and regulations that do exist tend to lack rigorous theoretical underpinnings. It should come as no surprise, then, that regulators have had a hard time anticipating systemic events, let alone productively addressing them before they are realized.⁵⁷ A properly structured information market could improve regulatory capabilities on both margins. To be sure, this market would not prevent systemic events by itself, nor would it directly stabilize fragile markets. Rather, it would contribute, in real time, important information that is necessary to do so.

If our proposed market indicates the economy is becoming

investment decision-making).

56. See U.S. GOV'T ACCOUNTABILITY OFFICE, FINANCIAL REGULATION: REVIEW OF REGULATORS' OVERSIGHT OF RISK MANAGEMENT SYSTEMS AT A LIMITED NUMBER OF LARGE, COMPLEX FINANCIAL INSTITUTIONS (2009) (republishing testimony of Orice M. Williams, Dir., Fin. Mkts. & Cmty. Inv. before S. Subcomm. on Secs., Ins. & Inv. of the S. Comm. on Banking, Hous. & Urban Dev.) available at <http://www.gao.gov/new.items/d09499t.pdf> (examining "(1) how regulators oversee risk management at [large, complex financial] institutions, (2) the extent to which regulators identified shortcomings in risk management at certain institutions prior to the summer of 2007, and (3) how some aspects of the regulatory system may have contributed to or hindered the oversight of risk management").

57. See, e.g., Viral Acharya et al., *Regulating Systemic Risk*, in RESTORING FINANCIAL STABILITY, *supra* note 1, at 283 ("Current financial regulations seek to limit each institution's risk (for example market and credit risk) seen in isolation; they are not sufficiently focused on systemic risk."); Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 210-13 (2008) (noting current attempts to regulate systemic risk are "imperfect and messy"); Beville, *supra* note 49, at 255-60 (describing how Basel Accords may exacerbate financial crises). The Obama Administration has recently proposed significant regulatory reforms that will provide for a systemic risk regulator, though at this stage, the proposal does not attempt to analyze systemic risk in great detail. See U.S. DEP'T OF THE TREASURY, *supra* note 1; see also Hilsenrath, *supra* note 1.

systemically fragile due to the spillover of financial risk to the real economy, it will signal regulators to focus their attention at preventative measures as well as to prepare for any necessary intervention. Though regulators have access to a number of economic indicators, our market may be useful because it attempts to measure the dimension a systemic regulator should be most interested in, that is, a measure of the spillover of financial risk. However, to function as an early warning system, the contract must be written along a margin that measures the systemic risk present in the economy at any particular moment. This requires a careful analysis of systemic risk and the dangers it poses. Though not a perfect proxy, we believe that the correlation between finance dependent and independent firms provides a more direct measure the level of systemic risk present in the economy than is currently available.⁵⁸

This section proceeds in three parts. First, we show the benefits information markets may provide over traditional regulatory mechanisms and how these benefits are particularly important in the systemic risk context. Second, we offer evidence that the correlation of returns from finance dependent and independent firms may indeed be a systemically important indicator. Finally, we will show how an information market security, structured to reflect market-expectations of that correlation, would have performed over the past decade.

A. *Information Markets, Generally*

Information markets rely on the efficiency of freely traded exchanges to accurately aggregate privately held information about current and future states of the world.⁵⁹ Unlike traditional equity or debt markets, these markets trade contracts that pay a specified amount if a given condition obtains at the time the market closes.⁶⁰ These contracts are

58. See Rajan & Zingales, *supra* note 9, at 562-67 (describing measurement and effect of financial dependence).

59. Robert W. Hahn & Paul C. Tetlock, *Using Information Markets to Improve Public Decision Making*, 29 HARV. J.L. & PUB. POL'Y 213, 221 (2005) ("Markets are generally the best . . . mechanism for gathering and aggregating dispersed information from private, self-interested economic agents."); see also CASS R. SUNSTEIN, INFOTOPIA: HOW MANY MINDS PRODUCE KNOWLEDGE 118-21 (2006) [hereinafter SUNSTEIN, INFOTOPIA] (discussing efficiency advantages of price system over central planning); Cass R. Sunstein, *Group Judgments: Statistical Means, Deliberation, and Information Markets*, 80 N.Y.U. L. REV. 962, 1023-25 (2005) [hereinafter Sunstein, *Group Judgments*] (noting that a price signal can aggregate "the information and the tastes of numerous people, producing judgments that incorporate more material than could possibly be assembled by any central planner, even one who insists on deliberation with and among experts").

60. Michael Abramowicz, *Information Markets, Administrative Decisionmaking, and Predictive Cost-Benefit Analysis*, 71 U. CHI. L. REV. 933, 934 (2004). The event or condition specified in the contract must, of course, be objectively verifiable. *Id.* at 943.

written such that their prices aggregate a large number of individual views on the likelihood or wisdom of a particular decision.⁶¹ The price of each contract continuously fluctuates according to investors' predictions of the likelihood of the outcome of a particular event; if more people believe the contracted event will occur, they will buy the contract, raising its price.⁶² Conversely, if investors believe the event will not occur, they will sell or short the contract, driving the price downward.⁶³ In one common market structure, contracts pay \$1 if a specified event is realized; the contract's market price therefore represents the consensus probability, of interested traders, at any given time that the event will be realized.⁶⁴ These markets can produce remarkably accurate results: they are generally more accurate than "public opinion polls, public experts, and private experts."⁶⁵

Contracts have been written on a number of events including the outcome of elections, changes in the federal funds rate, and earnings for particular companies. *See, e.g.*, Iowa Electronic Markets, <http://www.biz.uiowa.edu/iem/index.cfm> (last visited Feb. 8, 2010); *see also* Michael Abramowicz & M. Todd Henderson, *Prediction Markets for Corporate Governance*, 82 NOTRE DAME L. REV. 1343, 1346 (2007). The Policy Analysis Market was a particularly interesting experiment designed to predict terrorist attacks and other "important events in the world." Sunstein, *Group Judgments*, *supra* note 59, at 1028-29; *see also* Abramowicz, *supra*, at 982-87. However, the project was cancelled after criticism that it allowed participants to profit from terrorist attacks; some critics were also concerned that terrorists could participate, and profit, by trading on their inside information about pending attacks. Sunstein, *Group Judgments*, *supra* note 59, at 1028-29; *see also* Abramowicz & Henderson, *supra*, at 1384 n.109.

61. So-called "conditional markets" can also be structured to predict the impact of an uncertain future event, such as the movement a company's stock if it decides to merge with a competitor. Abramowicz & Henderson, *supra* note 60, at 1353-54. If the merger takes place, participants will be paid under the same conditions as a normal prediction market; if the merger does not take place, the market is "unwound," and the invested funds are returned. *Id.* at 53.

62. *See* Tom W. Bell, *Prediction Markets for Promoting the Progress of Science and the Useful Arts*, 14 GEO. MASON L. REV. 37, 46-47 (2006) (discussing supply and demand in context of prediction markets).

63. *Id.* Some markets do not allow explicit short selling, but nearly all allow a functional equivalent. For instance in binary markets, the prices of corresponding securities may be linked, such that the decision to buy or sell one security will affect the prices of its counterpart. These contracts are written such that the prices of corresponding securities will always equal \$1. So, a decision to purchase a contract that pays off if the contracted event occurs will drive up the price of the contract, but it will drive down the price of the corresponding contract that will pay out if the contracted event does not occur.

64. JAMES SUROWIECKI, *THE WISDOM OF CROWDS* 18 (Anchor Books 2005) (2004).

65. Abramowicz & Henderson, *supra* note 60, at 1346 (internal citations omitted); *see also* SUNSTEIN, *INFOTOPIA*, *supra* note 59, at 113-16 (describing success of Google's internal market to assist in corporate decision making). The Google market is particularly noteworthy because not only did high prices on individual contracts correspond to successful projects, but the actual price corresponded nearly exactly with the probability the event would occur. *Id.* at 115-16. That is, projects that the market projected an 80% chance of success succeed roughly 80% of the time. *Id.* However, it is important to note that information markets "cannot predict what *will* happen; rather, they can only give us

As an example, political futures, designed to predict election outcomes, are traded on the Iowa Electronic Markets (IEM) or Intrade, and these political futures often outperform the consensus from survey-based predictions.⁶⁶ In the simplest versions, contracts are written for each candidate; if the candidate wins, the contract pays \$1.⁶⁷ The price of the contract therefore represents the market's prediction of each candidate's percentage chance of winning the election.⁶⁸ A more nuanced variant of the political market attempts to predict the share of the popular vote each candidate will receive; instead of receiving \$1 if the candidate wins, the "vote-share" contract pays "\$1 multiplied by the proportion of the popular vote that the candidate received."⁶⁹ Though these contracts are relatively simple, the IEM "outperform[ed] polls 451 out of 596 times" from its inception until 2004.⁷⁰ Further, IEM vote share contracts have predicted the distribution of the popular vote with an average error rate of only 1.37%.⁷¹

1. The Efficiency of Information Markets

Information markets owe their success to their ability to obtain and aggregate information that would be unavailable to any single analyst or regulator.⁷² People generally do not have strong incentives to disclose private information. If privately held information is useful, and not public, disclosure may be privately costly, even though it provides public

probabilistic predictions." Abramowicz, *supra* note 60, at 964. While information markets are amazingly accurate predictors of future events, they are not infallible and may occasionally be subject to common misconceptions. *See infra* part III.A.2.

66. *See* Sunstein, *Group Judgments*, *supra* note 59, at 1030; Intrade, <http://www.intrade.com/> (last visited Feb. 8, 2010); Iowa Electronic Markets, <http://www.biz.uiowa.edu/iem/index.cfm> (last visited Feb. 8, 2010). The IEM is run by the University of Iowa Tippie College of Business as a research and teaching tool and is currently one of the only legal, publically traded prediction markets in the United States. Iowa Electronic Markets, About IEM, <http://www.biz.uiowa.edu/iem/about/> (last visited Feb. 8, 2010).

67. Sunstein, *Group Judgments*, *supra* note 59, at 1029-30.

68. *Id.* at 1029; Ryan P. McCarthy, Comment, *Information Markets as Games of Chance*, 155 U. PA. L. REV. 749, 750 (2007) ("Prices of shares in the market would indicate whether participants thought certain events were probable or improbable.").

69. Sunstein, *Group Judgments*, *supra* note 59, at 1029; *see also* Abramowicz, *supra* note 60, at 944-45 (describing vote share contracts and discussing performance of the Iowa Electronic Markets during the 2000 presidential election).

70. Sunstein, *Group Judgments*, *supra* note 59, at 1030.

71. SUROWIECKI, *supra* note 64, at 18. The market was off less than four percent for other U.S. elections and less than 2.5 percent in foreign elections. *Id.*

72. This is, of course, identical to Hayek's insight that markets are superior to government experts at allocating prices. *See* SUNSTEIN, INFOTOPIA, *supra* note 59, at 118-21 (discussing Hayek's theories).

benefits.⁷³ For example, if a superior is personally invested in the success of a project, subordinates may be unlikely to truthfully disclose their personal estimates of the project's success, thereby producing unreasonably optimistic predictions about the project's success and leading to wasted resources.⁷⁴ For instance, Best Buy has implemented a prediction market to evaluate the success of various corporate projects, which has proven more accurate than official forecasts.⁷⁵ For instance, an early test asked employees to bet on the number of gift cards sold in a single month.⁷⁶ The result, obtained primarily through trades made by low-level employees, significantly outperformed executive estimates, suggesting subordinates were unwilling or unable to truthfully or completely disclose their personal estimates up the corporate hierarchy.

Similarly, traditional predictions and decision-making are generally informed by the transmission of information through subordinates, polls, or relying on experts.⁷⁷ Because a single analyst, regulator, or manager cannot possibly evaluate and incorporate every available fact, "distortions [can] occur when gatekeepers decide what information to present to their immediate superiors. . . ."⁷⁸ This selective disclosure necessarily impedes "efficient information flow," leaving some information unincorporated into final decisions or predictions.⁷⁹

Information markets, however, provide participants with a strong incentive to honestly disclose privately held information on the contracted event.⁸⁰ This attracts participants who can profit from sharing private

73. *Id.* at 67-70; *see also* Sunstein, *Group Judgements*, *supra* note 59, at 1024. As an example, consider the incentives facing a campaign insider with private information about the viability of his or her candidate's campaign. While professionally obligated to remain optimistic, especially in communications to the public, an insider may nonetheless disclose the impact of this information, and profit, by trading in political futures. This provides the public with the benefits of disclosure, without forcing the insider to bear the costs.

74. *See* Abramowicz & Henderson, *supra* note 60, at 1364 ("[P]rediction markets help avoid the danger that employees will keep information lest the information interfere with interpersonal relationships, reputation, or even job status; this is especially true if anonymous trading is permitted."); *see also* SUNSTEIN, *INFOTOPIA*, *supra* note 59, at 86-96 (describing group pressures, such as reputation concerns, that tend to prevent individuals from truthfully disclosing private information).

75. Phred Dvorak, *Best Buy Taps "Prediction Market": Imaginary Stocks Let Workers Forecast Whether Retailer's Plans Will Meet Goals*, *WALL ST. J.*, Sept. 16, 2008, at B1.

76. *Id.* at B8.

77. Abramowicz & Henderson, *supra* note 60, at 1361; *see also* Abramowicz, *supra* note 60, at 981 (noting distorting effect of experts on traditional governmental decision-making).

78. Abramowicz & Henderson, *supra* note 60, at 1364-68.

79. *Id.*

80. *See* Abramowicz, *supra* note 60, at 971 (noting that without financial incentives, people may vote or respond to polls according to their preferences instead of their true predictions).

information, which, through anonymous trading activity, provides better information than would otherwise be publicly available. Further, information markets give participants an incentive to actively seek out new information and trade against misperceptions or biases in the market.⁸¹ Individuals who recognize biases or common misperceptions can trade against those biases and “earn significant profits at the expense of other traders.”⁸² Such trading opportunities not only give participants the ability to “capture, rather than give to others, the benefits of disclosure,”⁸³ but they also incorporate new participants’ information into the market price, providing the public the benefits of a more accurate prediction.⁸⁴ This gives individuals with the best information the strongest incentive to participate, aligning the incentives of individuals with private information with the incentives of regulators or decision makers.

Even if traditional methods of aggregating information allow individuals to successfully obtain all private information, they are generally unable to weigh individual predictions or discern which information is valuable. However information markets can weigh valuable information, producing more accurate predictions. First, participants are self-selected; as it is costly to participate in the market, individuals will not trade unless they feel they have some insight into the probability the contracted event will, or will not, occur.⁸⁵ Second, individual trades will be “weighted by intensity of belief or knowledge.”⁸⁶ Rational traders have the incentive to increase their investment proportionate to the quality of their information.

81. *Id.* (“Depending on the amount of money at stake, traders may even have an incentive to gather information not previously publicly available to better inform their trading decisions.”); Abramowicz & Henderson, *supra* note 60, at 1367 (noting participants “have incentives to identify and correct distorted information, especially if they can trade anonymously”).

82. SUNSTEIN, INFOTOPIA, *supra* note 59, at 138-40; *see also* Abramowicz & Henderson, *supra* note 60, at 1368-70 (“Those who are aware of others’ cognitive imperfections will recognize profit opportunities, and their trading should at least partially correct for biases.”). These biases can take several common forms, such as the distortions caused by the availability heuristic, which leads people to overestimate the chances of rare events if they can easily recall such an event from the past. *See generally* SUNSTEIN, INFOTOPIA, *supra* note 59, at 75-81 (discussing various biases that can affect individual predictions or decisions).

83. SUNSTEIN, INFOTOPIA, *supra* note 59, at 104.

84. *See* Abramowicz & Henderson, *supra* note 60, at 1368 (“Individuals who might otherwise keep information to themselves nonetheless might trade on that information.”).

85. *See* Sunstein, *Group Judgments*, *supra* note 59, at 1034 (noting that participants “must believe that they have relevant information; it is costly for them to ‘vote,’ and they probably will not do so unless they think that they have something to gain.”).

86. Abramowicz & Henderson, *supra* note 60, at 1367; *see also* Sunstein, *Group Judgments*, *supra* note 59, at 1034 (“In addition, votes are not weighted equally. If people want to invest a few dollars, they are permitted to do so, but they can invest a great deal more if they are confident of their answer.”).

Though some participants will undoubtedly place large, incorrect bets, or try to manipulate the market, this activity may actually increase a market's overall accuracy.⁸⁷ As incorrect or opportunistic traders push the market price away from an accurate estimate of the probability of the contracted event, traders with private information have an incentive to enter the market or increase their investment, correcting the imbalance.⁸⁸

Indeed, anecdotal evidence suggests that an efficient market needs only a relatively small minority of informed traders to make accurate predictions. For example, IEM predictions are driven by only fifteen percent of its participants; the remaining eighty-five percent do little to aid the market's accuracy.⁸⁹ This holds true even though the IEM is not a particularly thick market. As of 2005, it had never had "more than eight hundred or so traders" and was disproportionately composed of men from Iowa.⁹⁰ Yet as noted above, its predictions still outperform paid analysts and national polls.⁹¹ Thus, an information market can still produce accurate predictions as long as there is some minority of active, informed traders, irrespective of the fact that the trading population is not representative of the entire population of interested parties.⁹²

Finally, traditional prediction methods will necessarily have some

87. See Robin Hanson & Ryan Oprea, *A Manipulator Can Aid Prediction Market Accuracy*, 76 *ECONOMICA* 304, 305 (2009) (arguing that "by increasing the expected rewards to informed trading, a larger manipulator variance motivates other traders to gather information and so indirectly increases the accuracy of the market price as an estimate of fundamental asset value."); see also Abramowicz & Henderson, *supra* note 60, at 1382 (arguing that overconfidence should not affect market accuracy); Hahn & Tetlock, *supra* note 59, at 223 (noting that attempts at market manipulation can increase efficiency by encouraging individuals with private information to enter the market).

88. See Abramowicz, *supra* note 60, at 972-76. Manipulation attempts create an obvious arbitrage opportunity for knowledgeable traders, so "as long as it is clear that a trader's activity has moved a security price away from its fundamental value, market forces should respond." *Id.* at 974.

89. Sunstein, *Group Judgments*, *supra* note 59, at 1035. This minority of informed traders tends to make frequent trades and set their own buy or sell offers. *Id.* The remaining traders simply "hold onto their shares for a long period and then simply accept someone else's prices." *Id.*

90. SUROWIECKI, *supra* note 64, at 18-19; see also Abramowicz, *supra* note 60, at 957, 977-78 (noting that IEM is not particularly thick, that relying on its last transaction price may be misleading, and that 1988 Presidential IEM predictions were still accurate despite all participants being "affiliated with the University of Iowa, including a disproportionate number of business students, producing a trading population that identified as Republican and favored George Bush somewhat more than the population as a whole.").

91. See *supra* notes 66-71, and accompanying text.

92. Biased or unrepresentative trading populations can affect the accuracy of the market. However, it seems that even in these situations, an information market can still outperform traditional prediction or cost benefit tools if it is relatively more objective, or immune from bias, than traditional prediction or cost benefit tools. Abramowicz, *supra* note 60, at 980-81.

lag between the time information is discovered and when it is incorporated. However, information markets allow participants to constantly trade, incorporating new information on an on-going basis.⁹³ Thus, information markets not only give participants the right incentives to disclose private information, but also give participants with the strongest beliefs, and generally the best knowledge, the most influence over the prediction.⁹⁴

2. The Limits of Information Markets' Potential

However, information markets will not work in all situations. Generally, "markets work well only when there is a great deal of dispersed information to aggregate."⁹⁵ Accordingly, markets will generally be poor predictors of events that are highly discretionary, such as Supreme Court appointments, or for which there is little information which participants can easily obtain.⁹⁶ Information markets may also be subject to bubbles or speculative behavior, distorting their predictive abilities.⁹⁷ Because contracts are freely traded, traders decisions are determined "not only that person's belief in the fruition of the event, but also a guess about how other participants estimate the occurrence."⁹⁸ While we are confident that opportunistic traders will generally take the opportunity to bet against speculative bubbles, "[l]arge-scale errors are always possible"⁹⁹

More serious problems can occur if markets cannot motivate traders to participate. Information markets are often designed as zero sum games and people will not participate unless they expect to win money or find

93. See Sunstein, *Group Judgments*, *supra* note 59, at 1035. Thus, an information market is not a "static, one-time prediction but rather a dynamic system that can respond instantaneously to the arrival of new information." *Id.* (quoting Joyce Berg et al., Accuracy and Forecast Standard Error of Prediction Markets 7-10 & n.6-7 (July 2003) (unpublished manuscript), available at <http://www.biz.uiowa.edu/iem/archive/forecasting.pdf>). Stated differently, information markets, like all publicly traded markets, are theoretically efficient and their price represents the aggregation of all available information at any given time. See generally RONALD J. GILSON & BERNARD S. BLACK, *THE LAW AND FINANCE OF CORPORATE ACQUISITIONS* 135-81 (2d ed. 1995) (discussing efficient capital markets hypothesis). However, as described below, efficient markets are not perfectly efficient and may be subject to the same distortions or mistakes that affect other markets.

94. Abramowicz & Henderson, *supra* note 60, at 1367.

95. SUNSTEIN, *INFOTOPIA*, *supra* note 59, at 135 (discussing failure of markets to predict Supreme Court nominees or whether Iraq had weapons of mass destruction).

96. *Id.* For example, prediction markets incorrectly predicted that Iraq had WMD before the 2003 invasion. However, detailed or confidential information on Iraq's classified weapons programs was generally unavailable. The only possible traders were intelligence service personnel whose legal obligations likely precluded their participation in the market.

97. Abramowicz & Henderson, *supra* note 60, at 1354.

98. Comment, *Prediction Markets and Law: A Skeptical Account*, 122 HARV. L. REV. 1217, 1222 (2009).

99. SUNSTEIN, *INFOTOPIA*, *supra* note 59, at 142.

trading entertaining.¹⁰⁰ While this incentive is sufficient in many markets, it may not be enough if the event is fairly remote or the population of potential traders is small.¹⁰¹ Some markets have overcome this obstacle by subsidizing trades, effectively paying people to participate.¹⁰² Additionally, depending on the market, a market scoring rule “can encourage trading activity” by ensuring that early participants receive some payout.¹⁰³ These rules provide that “after the initial prediction, anyone else can make a subsequent prediction, as long as the subsequent predictor in effect agrees to pay off the current predictor when the market closes.”¹⁰⁴ While this rule is not ideal in all scenarios, it can overcome problems in particularly illiquid markets.

B. An Information Market to Predict Systemic Risk

Though information markets can accurately aggregate information on the probability of an uncertain event, they have yet to see widespread use outside of internet wagers and academic experiments.¹⁰⁵ However, the ability to obtain objective predictions on the possibility of uncertain events, or the wisdom of proposed regulations, could be clearly beneficial to regulators or legislators. For our purposes, an information market could be used to indicate the level of systemic risk in the economy, which could then inform regulators when and how to allocate their limited resources. While we anticipate that this market could be developed and managed by the Federal Reserve or the Treasury, a private organization could also sponsor

100. Abramowicz & Henderson, *supra* note 60, at 1351. That is, many markets are designed that the potential upside for winning traders equals the downside for losing traders.

101. *See id.* at 1352, 1356.

102. *Id.* at 1351 (noting that subsidies can be in the form of cash or in-kind payments). Further, Abramowicz and Henderson believe that subsidies can be scaled to the importance of the decision so that for especially important predictions, “individuals will have incentives not only to participate, but also to seek out relevant information and to develop sophisticated models of whatever is being predicted.”

103. Robin Hanson, *On Market Maker Functions*, 3 J. PREDICTION MARKETS 61, 63 (2009); *see generally* Robin Hanson, *Combinatorial Information Market Design*, 5 INFO. SYS. FRONTIERS 107 (2003) (providing mechanics for market scoring functions).

104. Abramowicz, *supra* note 60, at 959-60. This encourages new entry because subsequent predictors “need only worry about coming up with a prediction that is likely to be better than that of the current predictor, but need not worry that a subsequent predictor will further refine his or her prediction.”

105. The Defense Department Policy Analysis Market, described above, was quickly abandoned. *See* Sunstein, *Group Judgments*, *supra* note 59, at 1028. Several corporate markets have been successful, but while the practice is growing, it is not yet widespread. *See* SUNSTEIN, *INFOTOPIA*, *supra* note 59, at 117 (noting that Google, Microsoft, Eli Lilly, Goldman Sachs, Deutsche Bank and Hewlett Packard have all adopted corporation information markets in some capacity); Abramowicz & Henderson, *supra* note 59, at 1349-50 (describing Hewlett-Packard’s experimental market).

the market, leaving regulators and private firms to rely on the predictions at their own discretion.¹⁰⁶

1. Information Markets as Regulatory Mechanisms

Several commentators have attempted to show how information markets can effectively aggregate information to aid in decision-making, or more ambitiously, as a benchmark to control the outcome of particular decisions.¹⁰⁷ Though agencies have not yet adopted these proposals, an information market could improve on current regulations where there are significant costs associated with aggregating information necessary to make informed policy decisions.¹⁰⁸

Scholars have proposed two primary ways information markets can improve regulation. First, normative markets have been suggested to serve as cost-benefit analyses for proposed regulations.¹⁰⁹ In a normative market, participants try to predict whether an unnamed analyst, or analysts, would recommend a particular decision.¹¹⁰ Because the particular analyst is unknown, participants essentially substitute their own views about the wisdom of the proposed regulation; the resulting aggregation of views can serve as a form of cost-benefit analysis and determine if a course of action is worth pursuing.¹¹¹ However, more applicable to the purposes of this Article, prediction markets can also be designed to estimate the probability of events that may affect regulatory decisions or responsibilities.¹¹² Scholars have already proposed information markets to monitor risk in the financial system. Michael Abramowicz has proposed FDIC sponsored markets to estimate the number of insured banks expected to fail in a

106. An educational institution could also sponsor this market, much like the IEM. *See infra* Part IV for a more detailed discussion of the practical considerations associated with sponsoring an information market.

107. Abramowicz, *supra* note 60, at 936-39; *see also* Abramowicz & Henderson, *supra* note 60, at 1390 (noting that information markets can be used to determine the effect on stock price of particular corporate decisions, potentially constraining directors' actions).

108. Abramowicz, *supra* note 60, at 962. If the costs of aggregating information are small, it is unlikely an information market will significantly improve on agency decisions. However, in situations where the costs of aggregating information are high, an information market may provide significant improvements on current approaches. *Id.*

109. *See id.* at 938 (noting their advantage over positive information markets in this area); Hahn & Tetlock, *supra* note 59, at 224 (proposing to expand on the Abramowicz approach).

110. Abramowicz, *supra* note 60, at 938-42 ("The market would be considerably more useful if the eventual decisionmaker were unknown, because the market prediction would then reflect an expectation of what an *average decisionmaker* would decide.").

111. *Id.* at 939. However, these markets may be biased if participants expect the final analyst will be biased or somehow lack complete information about the attractiveness of the proposal.

112. *Id.* at 988-89.

particular year or the chance of insolvency for particular institutions.¹¹³

Regulatory information markets may provide idiosyncratic benefits above and beyond the inherent benefits described above.¹¹⁴ A primary benefit of an information market is that it introduces a level of accountability to agency decisions. Information markets are theoretically objective; that is, predictions produced through an information market represent the aggregation of the best available information on the contracted event, absent any ideological interpretations or distortions.¹¹⁵ Though individual markets or traders may be biased, it appears information markets are at least less subjective than traditional decision making processes and offer a relative advantage over feasible competitors.¹¹⁶ This objectivity is, of course, not omniscience; however, the ability to reference concrete market predictions would lend agency decisions a level of accountability otherwise unattainable.¹¹⁷ Information market cost-benefit analyses could be used to check political pressures or the influence of interests groups.¹¹⁸ Conditional markets, which predict that proposed rules would produce significant efficiency gains and provide an “objective reflection on an agency’s decision make[] it easier to separate the claimed and real justifications” for particular policies.¹¹⁹ The information market would provide agencies’ predictions some legitimacy, and help defuse accusations that their decisions are politicized or that the stated reasons for a rule is merely a pretext for political gain.¹²⁰ Similarly, information markets could hold agencies accountable for their policy decisions and provide an incentive not to use the rulemaking process for political ends.

Information market objectivity can similarly ensure regulators take into account and properly weigh all available information. Though the ability to aggregate information is an inherent property of information markets, it may take on special significance when used in the regulatory context. Regulators often overreact to recent crises by enacting overly burdensome regulations.¹²¹ People tend to judge the chance of rare events

113. *Id.*

114. *See supra* Part III.A.

115. Abramowicz, *supra* note 60, at 964; *see also* SUNSTEIN, INFOTOPIA, *supra* note 60, at 106 (noting “prediction markets have been found not to amplify individual errors but to eliminate them . . .”).

116. Abramowicz, *supra* note 60, at 981. Further, this advantage is “likely to be greatest where talk is cheapest.” *Id.*

117. *Id.* at 964; *see also* Hahn & Tetlock, *supra* note 59, at 263-64 (linking increased transparency on key decision-making parameters with stronger accountability).

118. Abramowicz, *supra* note 60, at 966-71.

119. *Id.* at 970.

120. Hahn & Tetlock, *supra* note 59, at 264 (“Greater transparency could also reduce the scope for political manipulation.”).

121. Abramowicz, *supra* note 60, at 966-67. For example, fear of possible pesticide contamination in a small canal in upstate New York created a nationwide panic about toxic

“by asking whether examples come readily to mind . . .”; accordingly they will overestimate the risk that recent crises will reoccur.¹²² This availability heuristic may lead regulators to under-regulate prior to crises and over-regulate in their immediate aftermath.¹²³ This propensity is likely to be increased if constituents are alarmed or outraged and demand some regulatory response.¹²⁴ However, a properly structured information market may be able to inform regulators that an issue is overblown, despite popular concern.

For example, the EPA regularly has to decide issues which, depending on their resolution, could harm either particular industries, and economic efficiency, or the environment. These decisions are often highly contested by business and environmental groups, and fraught with accusations that the agency has been captured by interest groups.¹²⁵ A market could be structured either to predict a regulation’s effects on both the affected industry and environment or as a normative market, to judge whether the proposed regulation would be beneficial. Ambitiously, this market could be used to decide whether the proposed rule should be implemented; however, even the modest suggestion of using markets to verify agency impact statements could increase transparency and improve policy decisions.

This objectivity would be particularly helpful in the context of systemic risk. Systemic risk is difficult to measure, as the necessary information is widely dispersed, and its definition has proven somewhat amorphous.¹²⁶ More importantly, there may be political pressures that

waste sites, which culminated in the creation of the Superfund toxic waste remediation program. See Timur Kuran and Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 691-98 (1999). Though later research showed that neither the original contaminated site, nor toxic waste sites in general, pose any significant health risks, nearly \$14 billion has been allocated to the Superfund program. *Id.* at 694-97.

122. Sunstein, *Group Judgments*, *supra* note 59, at 991.

123. Abramowicz, *supra* note 60, at 966.

124. *Id.* at 966-67 (describing effect of “availability cascades” where “an event leads individuals to overestimate a risk, in turn affecting public discourse, which then exacerbates the initial overestimation”).

125. Businesses and property owners often challenge regulations that fail to properly weigh their interests, or unfairly place environmental interests above their personal or economic needs. See, e.g., *Bennett v. Spear*, 520 U.S. 154 (1997) (finding ranchers had standing to challenge Fish and Wildlife Service decision to keep reservoir levels high, limiting water available for downstream commercial uses). On the other hand, the Bush administration was routinely accused of placing business interests above environmental concerns. See, e.g., Holly Doremus, *Science Plays Defense: Natural Resource Management in the Bush Administration*, 32 *ECOLOGY L.Q.* 249 (2005) (criticizing use of scientific rhetoric to justify politically motivated environmental regulations); James Glanz, *Scientists Say Administration Distorts Facts*, N.Y. TIMES, Feb. 19, 2004, at A18.

126. Beville, *supra* note 49, at 246 (quoting John Kambhu et al., *Hedge Funds, Financial Intermediation, and Systemic Risk*, 13 *FRBNY ECON. POL’Y REV.* 1, 5 (2007)).

weigh against correctly identifying or correcting a systemically unstable economy. Because recognizing, and correcting, systemic instability is politically and economically costly, regulators have an incentive to allow the financial system to increase risk-taking in the hopes the crisis will resolve itself.¹²⁷ If a crisis does occur, the losses will often be put to future officials and taxpayers.¹²⁸ However, if the crisis is avoided, regulators avoid having to make politically unpopular decisions. Thus, at the regulatory level, reform may be costly individually, while failure will be socially catastrophic, but blame will not fall on any particular politician or regulator.

Many commentators warned that the implicit guarantee given to Fannie Mae and Freddie Mac created a moral hazard problem for secondary market investors.¹²⁹ However, Fannie and Freddie were politically powerful and provided popular services to a number of political constituencies.¹³⁰ Reforming Fannie and Freddie would have required immense political capital and would have been individually risky; allowing the firms to fail diffused responsibility throughout the government, despite coming at a much higher social cost. Similarly, it appears that the Federal Reserve's loose monetary policy may have also contributed to the crisis; excessively low rates created excess demand for loanable funds, while simultaneously forcing investment firms further down the yield curve.¹³¹

127. Cf. FALASCHETTI & ORLANDO, *supra* note 44, at 128-31 (discussing deposit insurance during the savings and loan crisis).

128. *Id.*

129. See, e.g., Dwight Jaffee et al., *What to Do About the Government-Sponsored Enterprises?*, in RESTORING FINANCIAL STABILITY, *supra* note 1, at 124-28; Richard Scott Carnell, *Handling the Failure of a Government-Sponsored Enterprise*, 80 WASH. L. REV. 565 (2005); Robert A. Eisenbeis et al., *An Analysis of the Systemic Risks Posed by Fannie Mae and Freddie Mac and an Evaluation of the Policy Options for Reducing Those Risks* (Fed. Reserve Bank of Atlanta, Working Paper No. 2006-2, 2006), available at <http://www.frbatlanta.org/filelegacydocs/wp0602.pdf>.

130. See, e.g., Carnell, *supra* note 129, at 592-93 (describing how agencies responsible for overseeing GSE's were particularly susceptible to regulatory capture); Editorial, *Fannie Mae's Political Immunity*, WALL ST. J., July 29, 2008, at A16 (criticizing influence of GSE's over Congress).

131. See, e.g., Editorial, *Geithner's Revelation*, WALL ST. J., May 12, 2009, at A16 (interviewing Treasury Secretary Timothy Geithner); John B. Taylor, Op-Ed., *How Government Created the Financial Crisis*, WALL ST. J., Feb. 9, 2009, at A19; John B. Taylor, Professor of Econ., Stanford Univ., and Senior Fellow, Hoover Inst., *Systemic Risk and the Role of Government*, Dinner Keynote Speech at the Conference on Financial Innovation and Crises for the Federal Reserve Bank of Atlanta (May 12, 2009), <http://www.frbatlanta.org/news/CONFEREN/09fmc/taylor.pdf>; see generally Marcus Miller et al., *Moral Hazard and the US Stock Market: Analysing the Greenspan Put*, 112 ECON. J. C171 (2002) (arguing that the Fed created moral hazard by cutting interest rates and increasing liquidity during periods of market instability); Raghuram G. Rajan, *Has Finance Made the World Riskier?*, 12 EUR. FIN. MGMT. 499 (2006) (describing the incentive to increase risk taking caused by low interest rates).

Though the Fed is relatively well insulated from political pressures, it may have been unwilling to increase low interest rates during a boom economy for fear that it would be politically unpopular or impair economic growth. Congress and the Treasury may have been unwilling to challenge low rates for the same reasons. Thus, even if we assume that regulators had all of the necessary information to make the correct decisions prior to the crisis, they still may have rationally avoided taking the necessary steps to protect the economy. If an information market can objectively aggregate information, it may be able to improve on regulation by forcing regulators to confront politically unpopular realities.¹³²

2. A Proxy for Systemic Risk

While we have shown how information markets can potentially improve on existing regulations generally, an information market is only useful to predict the level of systemic risk if we develop a theoretically strong benchmark of the level of systemic risk in the economy at any time. We believe the correlation between finance dependent and finance independent industries is a more sensitive indicator of systemic risk than a contract which simply pays upon the occurrence of a systemic event. Because systemic events occur so infrequently, such a market is unlikely to accurately measure the continuing level of systemic risk. Moreover, market based mechanisms will only measure private costs and benefits and not the systemic externality. However, the correlations upon which we build our model are a logical consequence of systemically important third party effects of risk spillover. By attempting to measure the spillover of risk, instead of the perception of whether a systemic event will occur, our market can provide a real time measure of how much systemic risk is present in the economy at any given time.

Unlike traditional information market contingencies, systemic risk is difficult to empirically verify and sufficiently rare to make ad hoc predictions challenging. Thus, proposals that attempt to measure the chance of systemic failure directly will likely prove too shortsighted to allow regulators to address systemic problems before they materialize.¹³³ For instance, Xin Huang, Hao Zhou, and Haibin Zhu propose a systemic risk indicator that relies on the correlations of daily trades and the price of

132. See Sunstein, *Group Judgments*, *supra* note 59, at 1042 (noting information markets might provide a “reality check” on regulatory deliberations).

133. For example, we could modify Abramowicz’s solvency market proposal, and write contracts attempting to estimate the direct probability of a systemic event over the specified timeline. See Abramowicz, *supra* note 60, at 988-89. Indeed, it appears this type of market would be less sensitive than our proposed measure. See *infra* notes 180-181 and accompanying text.

credit default insurance for major financial institutions to predict the level of systemic risk.¹³⁴ While this measure would undoubtedly be sensitive to systemic risks, it would not be able to accurately measure it. Because systemic events are so rare, participants would have little incentive to trade in such a market unless they believed a systemic event was imminent, far too late to be useful to regulators.¹³⁵ Thus, market prices of heavily traded securities reflect the price at which parties are willing to trade and are not a direct estimation of the systemic risk being created at any given time. For instance, the prices of credit default swaps reflect only the terms on which parties will exchange the risks associated with a particular default event; the effect such a default will have on third parties is not incorporated into the price. Similarly, these markets may be distorted by predictions of financial sector risk which does not necessarily correspond to systemic risk.¹³⁶ Thus, measures dependent on existing securities will not reflect the social costs and benefits that reflect the efficiency of a Coasean regulatory framework.

As we have discussed above,¹³⁷ systemic risk is the unpriced risk not borne by parties to financial transaction, imposed on third parties, and bearing a structural similarity to environmental pollution.¹³⁸ While we do

134. Xin Huang et al., *A Framework for Assessing the Systemic Risk of Major Financial Institutions* (Bank for Int'l Settlements, Working Paper No. 281, 2009), at 3, available at <http://www.bis.org/publ/work281.pdf?noframes=1> ("Our main contribution is to propose to use a new indicator to assess the systemic risk of the banking sector: the price of insurance against large default losses in the banking sector in the coming 12 weeks."). Though this market is not a proper information market, it can be considered functionally equivalent because it relies on the aggregating properties of highly traded markets to extract information about the likelihood particular firms will default on their outstanding debt. *Id.* at 2.

135. *Prediction Markets and Law: A Skeptical Account*, *supra* note 98, at 1233-36 ("Investment in catastrophe markets would be so high risk that individuals may not bet at more than novelty levels, like participation in a lottery. With the chance of winning so slight, participants may not have a sufficient incentive to educate themselves and purchase according to the confidence of their prediction."). Indeed, it appears that our proposed market is more sensitive than the CDS indicator proposed by Huang et al. See *infra* notes 181-182 and accompanying text. Further, though regulators and market participants did not have access to the precise indicator Huang et al., suggest, CDS prices were readily available during the subprime crisis and were not a sufficient indication of the economy's fragility.

136. Cf. Abramowicz & Henderson, *supra* note 60, at 1362-63 ("Any number of firm-specific or market-wide developments can thus be expected to affect the stock price in ways that may be difficult to unpack from the particular event being analyzed."). That is, a market dependent on financial sector CDS prices or failure of banking institutions will be sensitive to any changes in financial risk; however, we are only concerned with increases in financial risk that spills over to the real economy, introducing a significant amount of noise to systemic risk predictions.

137. See *supra* Part II.B.

138. Beville, *supra* note 49, at 246. Firms only price the internal costs and benefits of any particular transaction. *Id.* Thus, firms may find it internally advantageous to enter into transactions which create costs they do not have to fully bear. See *id.* If these risks

not have a strong understanding of the mechanics of systemic risk, systemic events have two common characteristics: first, by definition, financial risks begin to spillover and effect third parties to financial transactions; second, this causes seemingly unrelated events to become highly correlated.¹³⁹ However, instead of attempting to develop a pathway-dependent measure of systemic risk, we develop a reduced form measure of systemic risk that directly estimates the spillover of financial risk into the real economy.

We develop this model by extending Rajan and Zingales' distinction between finance dependent and finance independent firms, which was used to measure how financial sector performance affected economic growth across jurisdictions with differing levels of financial development.¹⁴⁰ Rajan and Zingales attempted to measure the direction of causation between financial sector performance and financial growth.¹⁴¹ While economists were confident that financial development was highly correlated with economic growth, there was no consensus on whether increased financial development led to economic growth, or if strong financial systems developed to support strong economies.¹⁴² Rajan and Zingales' insight was to distinguish finance dependent firms, those firms that rely heavily on external finance to fund their operations, and finance independent firms, which rely primarily on operating cash flow, and compare returns across time and jurisdictions.¹⁴³ They hypothesized that if "financial development affects economic growth" then "financial development should disproportionately help firms (or industries) typically dependent on external finance for their growth."¹⁴⁴ That is, because a developed financial system "reduces the cost of external finance by improving disclosure and information dissemination,"¹⁴⁵ improving financial market performance

materialize, they will threaten the stability of the financial system and affect the real economy. *Id.* For instance, while it may have been individually rational to invest in subprime mortgage securities, it left the entire system vulnerable to a negative housing market. *See id.* at 253-61.

139. *See* Viral Acharya et al., *Regulating Systemic Risk*, in RESTORING FINANCIAL STABILITY, *supra* note 1, at 283 (describing systemic risk as the spillover of financial risk to the real economy); Beville, *supra* note 49, at 246 (noting "systemic risk can be generally defined as the risk that a negative shock to a firm or asset will result in losses or failure across the financial system"); Schwarcz, *supra* note 57, at 200-01 (noting systemic risk is positively correlated with the market and cannot be diversified away).

140. Rajan & Zingales, *supra* note 9.

141. *Id.* at 559.

142. *Id.* at 559-60.

143. *Id.* at 563-67. Rajan and Zingales provide a continuum of industries and their relative dependence on external finance. Pharmaceutical companies are the most finance dependent, while tobacco firms are the least finance dependent.

144. *Id.*

145. RAGHURAM G. RAJAN & LUIGI ZINGALES, SAVING CAPITALISM FROM THE CAPITALISTS 111 (2003).

should lower the cost of capital for finance dependent firms, improving their performance relative to firms that rely primarily on operating cash flows.¹⁴⁶ As economists were already confident in the positive relationship between financial development and economic growth, this pathway would provide evidence of a “specific mechanism by which finance affects growth, thus providing a stronger test of causality.”¹⁴⁷

Their findings were significant: in high growth countries, with highly developed financial sectors, finance dependent industries significantly outperformed finance independent industries; in countries with underdeveloped financial systems, finance dependent industries significantly underperformed compared to finance independent industries.¹⁴⁸ This suggests not only that improving financial performance promotes economic growth but that certain industries should be more correlated with financial performance, while others should generally be immune to financial risk.¹⁴⁹

These findings were robust along several dimensions. Recent entrants generally do not have established cash flows and must disproportionately rely on external finance, relative to their particular industry.¹⁵⁰ As suggested by the model, the effect of financial development was even greater on these firms, suggesting “[f]inancial development could indirectly influence growth by allowing new ideas to develop and challenge existing ones.”¹⁵¹ Rajan and Zingales also use accounting standards as a proxy for financial development and compare the aggregate growth rate of the three most independent and dependent industries.¹⁵² In countries “below the median in accounting standards, the residual growth rate of the three least-dependent industries is positive, while the residual growth rate of three most-dependent industries is negative;” in countries above the median in accounting standards, the “pattern reverses.”¹⁵³

The distinction between finance dependent and finance independent firms may be particularly useful to understanding systemic risk. Systemic risk, by definition, is the materialization of risks imposed on third parties through financial transactions, and in times of systemic stress, it will affect

146. Rajan & Zingales, *supra* note 9, at 560 (“This would imply that, ceteris paribus, an industry such as Drugs and Pharmaceuticals, which requires a lot of external funding, should develop relatively faster than Tobacco, which requires little external finance, in countries that are more financially developed.”).

147. *Id.*

148. *Id.*

149. *Id.*

150. *Id.* at 579.

151. *Id.*

152. *Id.* at 576.

153. *Id.*

the economy as a whole.¹⁵⁴ Thus, in times of systemic stress, firms with no ties to the financial sector should find themselves subject to the same systematic stresses as financial firms and their counterparties. Finance dependent firms, which rely heavily on external finance, contract regularly with financial firms, thus exposing them to the same risks as the financial sector. However, firms that do not rely heavily on external finance rarely, if ever, contract with financial firms and should be relatively immune to financial sector risk.

If this hypothesis is true, the correlations of returns for finance dependent and independent firms may provide a measure of how much risk is spilling over from financial transactions and is affecting normally independent third parties at any point in time. During normal conditions, the returns of the financial sector should be somewhat correlated with finance dependent firms, but uncorrelated with finance independent firms. However, as systemic risk increases, the performance of finance independent firms should become subject to financial sector risks, increasing the correlation between the finance independent and dependent sectors. That is, as systemic risk increases, finance independent firms should begin to behave like finance dependent firms. Accordingly, the correlations of returns between finance dependent and independent industries should be a rough measure of systemic risk in the economy at any point in time.

While this correlation alone may provide some utility to regulators, an information market can allow our correlation to function as an early warning system. The correlation alone only measures systemic risk on a rolling basis; however, an information market which aggregates information on the expected movement of this correlation can provide a prediction of the level of systemic risk in the market at some point in the future. First, an information market will be able to provide a reliable forward-looking prediction of the movement of this correlation over time. While a running correlation, over some fixed time period, will give regulators a good picture of the systemic risk present in the system at any given time, the prediction market will provide regulators with information about whether they should prepare for a substantial increase in systemic risk or whether the chances of a systemic event remain remote. Second, an information market will force regulators to realistically address market conditions. Market participants may also proactively rely on this measure to limit their exposure or unwind risky positions; firms may also increase their monitoring of the credit markets beyond their counterparties in an attempt to identify firms with the potential to create or exacerbate financial contagion. As discussed above, there is some concern that even if

154. Schwarcz, *supra* note 57, at 198-201; Beville, *supra* note 49, at 246.

regulators know how much systemic risk is present at any time, they may have an incentive to provide overly optimistic assessments of the state of the economy. An information market provides an incentive to confront systemic risk early, as optimistic or pessimistic pronouncements can be checked against the information market's predictions. If official statements are consistent with information market predictions, then regulatory recommendations or actions will carry more authority than official pronouncements alone. Conversely, officials will need to substantially buttress any recommendations or actions that are inconsistent with the prediction market to avoid appearing biased or politically motivated.

If our proposed market does reliably indicate the level of systemic risk in the economy, regulators and market participants would be able to plan for and react to systemic crises before they materialize, significantly mitigating losses. For instance, if the market predicts that systemic risk will increase substantially over the next six months, regulators, such as the Federal Reserve, can begin to increase bank examinations and attempt to determine if a particular firm or asset is posing a systemic threat. If a central regulator identifies the threat, it can take steps to mitigate the risks and prevent a systemic event. For instance, a regulator could require firms to post additional collateral, provide liquidity or credit backstops, or otherwise reduce exposure to the affected market or firms. Further, the regulator could provide liquidity or credit guarantees itself, purchase assets outright, or takeover troubled entities before they collapse. If these measures work, regulators should be able to prevent illiquidity or insolvency in one firm or market from spreading, thus quarantining losses and mitigating the effects of a systemic threat. Additionally, the mere presence of a systemic risk indicator may facilitate more effective self regulation in market participants. If firms monitor the movement of our proposed market, they can anticipate regulatory action and respond accordingly.¹⁵⁵ This ability to proactively respond before a crisis materializes would be a beneficial addition to the list of tools currently available to regulators.

Conversely, if the systemic indicator was mistaken, the costs would be fairly low. It is possible that the correlation we suggest may be subject to other common pressures, and reasons other than systemic risk could cause the correlation of returns between finance dependent and independent returns to increase. In such a scenario, a regulator would likely initiate increased scrutiny of the financial sector to determine if it was susceptible to a systemic event.¹⁵⁶ While the cost of bank examinations may be high, it

155. Indeed, investors and firms routinely behave similarly in other contexts. Firms monitor inflation forecasts to anticipate changes in the Federal Reserve's monetary policy.

156. This of course assumes that regulators have the political incentives to address the problem, even if our market indicates systemic instability.

will not have any adverse affect on economic productivity. Thus, while an information market would not directly prevent systemic events, it places no ex ante restrictions on financial performance or innovation, and the costs of false positives would be minimal. Given the potentially huge costs involved in regulating systemic risk, an information market is a low cost solution that could significantly reduce the harm associated with systemic events.

3. Efficiently Regulating Systemic Risk

Regulation can only improve on market outcomes if it reduces transaction costs that would otherwise prohibit mutually beneficial trades. Our reduced form model helps illuminate the transaction costs involved in bargaining over systemic risk. Functionally, systemic risk is financial risk imposed on firms without the ability to contract away their exposure. When the correlations between the finance sector and finance independent firms are small, finance independent firms have few incentives to bargain over financial risk. However, during these periods, finance dependent firms have an interest in limiting their exposure to financial risk, and there are few obstacles standing in the way of these transactions. However, finance independent firms do have an incentive in bargaining over systemic risks. As systemically risky activity causes these correlations to increase, finance independent firms become increasingly interested in mitigating their exposure to financial risks, but they lack the ability to do so. Because they are independent from the financial sector, finance independent firms will face insurmountable transaction costs, preventing them from bargaining away their exposure.

In these situations regulation can improve on market outcomes by mitigating or preventing financial risks from affecting the real economy. This can be done by forcing financial firms to increase capital requirements during periods of increased systemic risk or by requiring highly leveraged firms to begin unwinding transactions before a negative market event.¹⁵⁷ In some scenarios preemptive bailouts or capital guarantees may be required. However, even if government intervention increases moral hazard and encourages future risk taking, it is important to realize that systemic risk is imposed on innocent third parties, who lack, even conceptually, the ability to transact away their exposure to the financial sector during periods of high systemic correlations.

157. There is some danger that regulatory intervention may actually set-off a systemic crisis. For instance, forcing firms to sell assets may spark a fire sale, depressing prices, reducing liquidity, and potentially forcing firms to sell off unrelated assets to maintain capital requirements. Ideally, a regulator would rely initially on market based intervention and only resort to more extreme measures when truly necessary to avoid systemic collapse.

4. Advantages Over Competing Proposals

Current proposals to regulate systemic risk appear costly and potentially ineffective. Further, many of these proposals threaten investment firms' intellectual property, providing a disincentive to develop unique or innovative investment strategies. Several commentators, conscious of these difficulties, have called for the creation of a market-based measure of systemic risk, which could act as an early warning system.¹⁵⁸ We believe our proposed information market is well adapted to this role and can significantly improve on systemic risk regulation without the costs associated with other proposals.

The defining feature of our proposed information market is that it attempts to directly measure the aspects of systemic risk that regulators should be most concerned about. Furthermore, its theoretical parsimony gives it a distinct advantage over more ambitious proposals.¹⁵⁹ Developing efficient regulatory responses to systemic risk is difficult;¹⁶⁰ the pathways by which financial risk affects the real economy are not well understood. Moreover, discovering and monitoring these pathways is expensive and time consuming; by directing bank examiners' attention to periods of high systemic instability, they can devote their scarce resources more productively. Similarly, though commentators believe systemic risk arises from a negative externality caused by inefficient incentives guiding financial actors' behavior, there is no consensus on regulation that can force firms to internalize the costs of their actions and prevent the consequences of these actions from affecting unrelated third parties.¹⁶¹ An

158. See e.g., Alan Greenspan, Fmr. Chairman, Bd. of Governors of the Fed. Reserve Sys., Remarks at the Journal of Financial Services Research and the American Enterprise Institute Conference, in Honor of Anna Schwartz, Remarks on Systemic Risk (June 3, 2009), available at <http://www.aei.org/docLib/Greenspan%20-%20Speech%20-final.pdf> ("Such evidence of failure is common to every crisis and points up the broader problem that forecasting the onset of financial crisis, except by chance, has always proved to be beyond our reach."); see also sources cited *supra* notes 3-4 and accompanying text.

159. That is, our model tries to explain "a lot" with "a little." Cf. FALASCETTI & ORLANDO, *supra* note 44, at 10-11 (describing characteristics of a good economic model). Though we may lack confidence in the precise mechanics of how systemic risk affects the larger economy, our data indicates we can have some confidence in the measure of that effect. *Id.* at 11-12 (discussing reduced form evidence). That is, regardless of how systemic risk spills over into the real economy, we know how that spillover will affect the correlation between finance dependent and independent firms.

160. *Id.*; See *supra* Part II.C.

161. Some commentators have proposed a tax on systemically risky assets. See Viral Acharya et al., *Regulating Systemic Risk*, in RESTORING FINANCIAL STABILITY, *supra* note 1, at 293-94 (proposing an "additional systemic risk fee to all financial institutions"). Others have suggested regulating financial sector compensation to reduce the incentives individual traders have to maximize short term gains in return for immediate compensation. See Deborah Solomon & Damian Paletta, *U.S. Eyes Bank Pay Overhaul*, WALL ST. J., May 13,

information market allows us to propose a reduced form model of systemic risk and ignore the mechanics of risk spillover. By limiting our inquiry to the correlation of returns between finance dependent and independent sectors, our proposal does not have to make difficult estimations such as the effects of particular investment decisions, asset bubbles, or compensation practices on financial stability. While this leaves room for future research to determine the exact pathways by which systemic risk affects the economy, this information is not necessary to formulate effective policy prescriptions.

Indeed, pathway-dependent regulations, such as systemic taxation policies and compensation reforms, will likely prove insufficient to protect the economy against future instability. While systemic risk may be caused by misaligned incentives, it appears unlikely to manifest itself along identical dimensions in the future. For instance, while it may make sense to reform the mortgage lending industry on its own merits, it will likely do little to reduce systemic risk.¹⁶² Mortgage lenders, investment banks, and ratings agencies now have information on how subprime mortgages perform in declining housing markets, making a similar crisis less likely. Moreover, increased regulatory scrutiny of structured financial products may allow risk to accumulate in a more loosely monitored market. This does not guarantee systemic stability but rather makes it more likely that the next systemic event will arise from an unexpected market or firm that may not neatly track the lessons learned from this crisis. Indeed, it is impossible to eliminate the incentive to export costs to third parties and for regulatory reforms to prevent every channel through which third party effects may travel. This suggests that relying too heavily on technical proposals to limit systemic risk may end up regulating around the problem or leaving significant gaps from which a new systemic crisis could develop.¹⁶³ However, because we remain agnostic on the precise mechanisms through which systemic risk travels, our proposal is robust to these considerations.

Though regulation is never costless,¹⁶⁴ we should be particularly

2009, at A1, available at <http://online.wsj.com/article/SB124215896684211987.html> (noting demand for “legislation that could strengthen the government’s ability both to monitor compensation and to curb incentives that threaten a company’s viability or pose a systemic risk to the economy”). Some proposals focus on regulating or banning derivatives, such as credit default swaps. Gretchen Morgenson, *Time to Unravel the Knot of Credit Default Swaps*, N.Y. TIMES, Jan. 25, 2009, at BU1, available at <http://www.nytimes.com/2009/01/25/business/25gret.html>.

162. See Beville, *supra* note 49, at 247 (“Subprime defaults served only as a trigger event for an endogenous response that amplified losses across the market.”).

163. Cf. Beville, *supra* note 49, at 265 (describing how Basel capital requirements legislate around misaligned incentives and fail to reduce systemic risk).

164. See generally Coase, *supra* note 5. See also Beville, *supra* note 49, at 261

wary of expensive or onerous proposals when the benefits are uncertain. While systemic risk is real, “it is important to note that the ideal level of systemic risk is not zero.”¹⁶⁵ Over-regulating systemic risk will negatively affect economic activity by deterring or prohibiting firms from maintaining sufficiently risky portfolios and by providing incentives for talented traders to defect to less regulated or better paid industries.¹⁶⁶ This could impair economic efficiency by leading firms to under-invest in risky ventures and stifling innovation and productivity. Similarly, giving the most talented individuals an incentive to leave the financial sector is unlikely to increase financial stability.

Because identifying the margins upon which systemic risk can be successfully regulated is difficult, the costs imposed by prohibiting otherwise beneficial trades may easily overwhelm whatever benefits a proposed regulation provides. However, information markets are relatively inexpensive, and they encourage an efficient allocation of a regulator’s scarce resources. Regulators can increase bank examinations and other resource-intensive functions during times of systemic stress, precisely the time when their resources will be the most productive. Similarly, a regulator can reduce its spending during periods of relative stability. A functioning market only needs a website, a secure server, and algorithms to price contracts and disperse funds at expiration.¹⁶⁷ Even if our proposed market required subsidies to induce trading volume, these costs would likely be offset by the risk of over-deterring legitimate business activity.¹⁶⁸ Further, though subsidies are needed only to increase liquidity in thin markets; as we will discuss below, our proposed market is structured to be sufficiently liquid to avoid the need for subsidies. Thus, an information market is a strong “next best” proposal to limit systemic risk in the absence

(“However, regulation is not costless, and the decision to impose liability or proscribe conduct will also impose costs elsewhere in the market.”).

165. Beville, *supra* note 49, at 273, citing Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Reserve Sys., Address at the Federal Reserve Bank of Atlanta’s 2006 Financial Markets Conference: Hedge Funds and Systemic Risk (May 16, 2006), <http://www.federalreserve.gov/newsevents/speech/bernanke20060516a.htm> (stating that the cost of eliminating systemic risk would stifle productivity).

166. See e.g., David Weidner, *The Perils of a Smaller Wall Street*, WALL ST. J., June 25, 2009, <http://online.wsj.com/article/SB124584871445047245.html> (noting that limiting size of banks may reduce their competitiveness, hindering economic activity).

167. See Hahn & Tetlock, *supra* note 59, at 266-67. This assumes that we establish a zero-sum market, where the prices of related securities are linked. See Bell, *supra* note 62, at 55-56. The IEM employs a similar mechanism to ensure that it never loses, nor makes, money. See Abramowicz, *supra* note 60, at 948.

168. Abramowicz and Henderson imagine that a large corporate market might require several million dollars worth of subsidies. While expensive, these costs would be dwarfed by costs of even deterring a tiny percentage of productive investment activity. See Abramowicz & Henderson, *supra* note 60, at 1351

of a clear understanding of how to force firms to internalize the systemic costs of their decisions.

Finally, an information market would not endanger firm's intellectual property in the way ongoing bank examinations or other onerous inspection requirements might. Financial innovation depends on developing proprietary investment strategies; like any form of intellectual property, investment strategies are non-rivalrous and can be adopted by anyone if disclosed.¹⁶⁹ This not only gives competitors the advantage of innovative strategies without investing in talented traders or market research, but may also reduce spreads as more firms attempt to exploit the same opportunity.¹⁷⁰ Thus, if systemic risk regulation increased disclosure of these strategies, it would reduce the incentive to innovate, harming financial development. One of the most elegant aspects of the information market is that it allows participants to disclose the effect their private information has on the perceived probability of the contracted event without disclosing the particulars of that knowledge. This protection of proprietary investment strategies may also help align financial sector interest groups with legislative interests. If investment firms are convinced their intellectual property will be protected, they are likely to be more willing to support regulatory reform.

C. *A Model Systemic Risk Prediction Market*

Our proposed contracts are straightforward and intuitive. We are attempting to judge the spillover of financial risk into the real economy—systemic risk at its most basic level. We should, theoretically, be able to measure the level of systemic risk in the economy by comparing the correlation of daily returns of companies traditionally heavily dependent on external finance and firms that generally have operating cash flows sufficient to meet their capital needs. To test this hypothesis we use the daily returns of pharmaceutical and tobacco firms, the industries most and least (respectively) dependent on external finance, according to Rajan and Zingales.¹⁷¹ As we will demonstrate below, this pattern appears to be supported by the data and is robust.

This section first writes and explains the contracts that could be

169. John Kambhu et al., *Hedge Funds, Financial Intermediation, and Systemic Risk*, 13 FRBNY ECON. POL'Y REV. 1, 3 (2007) (“[T]he success of a hedge fund often depends on proprietary trading strategies that, if made public, can be used by others to trade against them.”). See generally ROBERT P. MERGES, *INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE* 10-17 (rev. 4th ed. 2007) (discussing the problem of protecting intellectual property).

170. As the demand for an asset increases, its price will rise or its interest rate will drop, reducing returns.

171. Rajan & Zingales, *supra* note 9, at 566-67.

traded in our proposed information market. Then, we show that Rajan and Zingales' findings are consistent with our hypothesis and that the returns of finance independent firms appear independent from the financial sector. Finally, we use this data to show what our proposed market might have successfully predicted over the past decade.

1. The Contracts

Our market could be implemented with a number of different contracts. The precise language of the security is not particularly relevant as long as it elicits private information from market participants. For example, a simple contract could aggregate the market's predictions about whether the correlation between finance dependent and independent firms will increase over a specified period. A more nuanced contract, similar to the vote share contracts described above, could be written to predict what that correlation will actually be over the specified time period.

To determine the correlation between the pharmaceutical and tobacco sectors we rely on the daily returns of the Dow Jones Pharmaceutical Index (DJUSPR) and the Dow Jones Tobacco Index (DJUSTB). These indices are composed of a portfolio of industry specific firms and provide a more reliable estimate of industry wide performance. Indices will also, of course, minimize the impact of any single firm in our calculations. While these indices provide an easy way to test our hypothesis, these particular industries are not essential to our findings. For example, future researchers may attempt to develop synthetic indices based on the 50 or 100 most dependent and independent publicly traded firms. The contracts in this proposed market could read as follows:

Prediction that Tobacco:Pharma Correlation Increases: This contract pays \$1 if the correlation between the Pharmaceutical Tobacco indices increases over a specified time period.

Prediction that Tobacco:Pharma Correlation Decreases: This contract pays \$1 if the correlation between the Pharmaceutical and Tobacco indices decreases over a specified time period.

Threshold Prediction: This contract will pay \$1 if the correlation between the Pharmaceutical and Tobacco indices exceeds 0.50.

These contracts could be written to predict the movement of our correlation over any period of time. For example, a regulator may wish to create a long term contract to measure the level of systemic risk over the next year, or perhaps even longer, while relying on shorter term contracts to predict the level of systemic risk for the immediate future. These contracts could also be created several periods in advance to give regulators an extended view of the instability present in the market. This will provide regulators with an idea of the market's long or medium term view of

systemic risk without sacrificing the utility of discrete predictions over relatively short periods.

Using a shorter time frame may also increase liquidity in the market. As the contract terms come to an end, it will often become obvious whether the correlation will increase or decrease, causing more traders to enter the information market. As it becomes clear which way the correlation will move, the riskiness of the contracts decreases. Participants with less information should enter the market, driving the contract price toward its expected payout. This should provide sufficient liquidity to encourage disclosure of private information without requiring subsidies or market scoring functions.¹⁷² Similarly, a six-month time frame is not so extended that traders will be discouraged from participating.¹⁷³

2. Supporting Data

It appears that Rajan and Zingales' finance independent firms are relatively independent from the financial system. The returns of firms that rely heavily on external finance appear highly correlated with returns for the financial sector, indicating that they share many common risks. Similarly, as Rajan and Zingales' theory would predict, the returns of finance independent firms are normally only loosely correlated with the returns of the financial sector, indicating that they are not subject to the same pressures. However, during periods that have been characterized as systemic events, it appears that the "spillover" of financial risk into the real economy actually occurs, significantly increasing the correlations of returns between finance independent firms and the finance dependent firms.

This data was collected by comparing the correlations of daily returns of financial, pharmaceutical, and tobacco indices.¹⁷⁴ These correlations were measured over six month intervals, excluding dates that the indices were not traded.¹⁷⁵ These indices were chosen because, under

172. While this is not guaranteed, subsidies appear to be necessary only in markets with a limited number of participants or with a technical subject matter. For instance, Abramowicz and Henderson believe that subsidies may be necessary to evaluate whether proposed corporate decisions or transactions will have positive or negative effects on a firm's stock price. Abramowicz & Henderson, *supra* note 60, at 1351. The sort of calculation required to make informed decisions in these markets may discourage entry absent some sort of subsidy. However, our market appears relatively easy to understand. Further, because the outcome should become clear over time, it should induce even relatively unsophisticated traders to participate.

173. *See id.* at 1380 (noting that traders may be hesitant to trade in markets when the payout is distant).

174. This data was compiled from the daily returns of Dow Jones sector indices: Finance (DJUSFV), Pharmaceuticals (DJUSPR), and Tobacco (DJUSTB).

175. Explicitly, we measured the correlation between the Dow Jones Pharmaceutical and Tobacco indices over the first two quarters of the fiscal year, October 1st through March

Rajan and Zingales' framework, pharmaceuticals are the sector most heavily dependent on external finance, while tobacco companies are the least dependent on external finance.¹⁷⁶ By focusing on industries at opposite ends of the continuum, the resulting correlation should produce the clearest measure of systemic spillover possible. Table 1 shows the correlation between the target sectors over the entire time period studied in this Article. As is evident from Table 1, the pharmaceuticals share a fairly high correlation with the financial sector, while tobacco's correlation is fairly low. The correlation between tobacco and pharmaceuticals is, as would be expected, close to the average of the correlations of each sector with the financial sector.

TABLE 1
Daily Return Correlations: 2Q2000 through 1Q2009, (full sample)

	Financials	Pharmaceuticals	Tobacco
Financials	1.00	0.51	0.29
Pharmaceuticals	0.51	1.00	0.39
Tobacco	0.29	0.39	1.00

As tobacco firms rarely have to resort to external sources to meet their financial demands, they have relatively little direct interaction with the financial sector; these firms will generally be third parties to financial transactions. Pharmaceutical companies, on the other hand, require intensive research and development, which must generally be funded through capital markets; these firms regularly transact with the financial sector and can bargain over financial risk with their counterparties. The result is that, in normal scenarios, pharmaceutical companies are subject to the same risks that affect the financial sector, while tobacco companies are generally immune.

Table 2 supports this inference. Between the second quarter of 2000 and the second quarter of 2007, a period which appears to have generated little systemic risk, the correlation of returns between the financial and tobacco sectors was only 0.20; however the return between the pharmaceutical and financial sectors was double that at 0.41. The correlation of returns of the pharmaceutical and tobacco sectors was 0.27. This relationship is fairly weak, indicating that during systemically stable periods, the performance of finance dependent firms creates little spillover to third parties.

31st, and the second two quarters of the fiscal year, April 1st through September 30th.

176. Rajan & Zingales, *supra* note 9, at 565.

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TABLE 2
Daily Return Correlations: 2Q2000 through 2Q2007

	Financials	Pharmaceuticals	Tobacco
Financials	1.00	0.41	0.20
Pharmaceuticals	0.41	1.00	0.27
Tobacco	0.20	0.27	1.00

However, during periods of systemic stress, finance independent firms become more strongly correlated with the financial sector.¹⁷⁷ Between the third quarter of 2007 and the first quarter of 2009, the period associated with the current financial crisis, the correlation of returns of the tobacco and pharmaceutical indices increase nearly threefold, consistent with our expectation that third parties will become increasingly affected by financial transactions during periods of high systemic stress. As seen in Table 3, the correlations of the individual indices against the financial sector are also consistent with our predictions.

TABLE 3
Daily Return Correlations: 3Q2007 through 1Q2009

	Financials	Pharmaceuticals	Tobacco
Financials	1.00	0.67	0.51
Pharmaceuticals	0.67	1.00	0.75
Tobacco	0.51	0.75	1.00

As our model predicts, during times of systemic stress, the tobacco sector, which is the most finance independent industry, becomes highly correlated with the performance of the pharmaceutical sector, which is extremely dependent on external finance. Stated differently, during periods of high systemic risk, the returns for finance independent firms begin to behave like finance dependent firms, suggesting that both are subject to common risks or pressures. Because we have some certainty that the current crisis is a result of financial risk, it appears that our model tracks our intuitions on the nature of systemic risk. During periods of relative

177. During these periods the correlations between finance dependent firms also increase, but by less than the increase affecting finance independent firms. This makes intuitive sense if we see external finance as a necessary, but not sufficient, component for finance dependent firm performance. If the cost of external finance limits finance dependent firms' performance, they will be subject to common pressures and be relatively correlated. However, if external finance is relatively cheap, firms will be less correlated as other idiosyncratic, or business specific, factors will have a larger impact on finance dependent firms' returns.

stability, third parties are generally unaffected by financial risk; however, as systemic risk increases, the performance of finance independent firms is driven closer to the performance of finance dependent firms. Thus, by encouraging interested individuals to divulge their expectations on the level of financial pollution in the future, we can develop an early warning system for periods of high systemic risk.

Further, our model appears to be consistent across time. In Table 4 below, we track the correlation of returns for the tobacco and pharmaceutical industries over six month intervals from the second quarter of 2000 through the third quarter of 2009. The correlation of returns tracks our intuitions about the level of systemic risk over the last decade.

TABLE 4
Correlation of Daily Returns DJUSPR:DJUSTB

Date	Correlation
03/31/09	0.81
09/30/08	0.65
03/31/08	0.56
09/28/07	0.66
03/30/07	0.32
09/29/06	0.30
03/31/06	0.42
09/30/05	0.44
03/31/05	0.33
09/30/04	0.35
03/31/04	0.24
09/30/03	0.17
03/31/03	0.18
09/30/02	0.25
03/29/02	0.26

09/28/01	0.38
03/30/01	0.49
09/29/00	0.14

As our model would predict, the correlation of returns is low through much of the decade, consistent with a low level of systemic risk. From 2000-2007, the economy was booming and we would expect, fairly stable. However, the correlation of returns markedly increased after the second quarter of 2007 and remained elevated through the first quarter of 2009, consistent with our understanding of the progress of the financial crisis. This data also suggests that our model can, in at least some scenarios, anticipate periods of high systemic risk. Our data indicates that our correlation would have predicted an increase of systemic risk several months before Bear Stearns' hedge funds failed and more than six months before the investment bank failed completely.¹⁷⁸ An information market may have provided an even earlier prediction of systemic instability, alerting regulators to the systemic implications of these events. This information may have led regulators to increase bank examinations or capital requirements before the crisis reached its peak, giving regulators the ability to reduce the resulting costs to third parties.

Though it was unclear at the time, the collapse of the Bear Stearns' funds was the first sign that the mortgage market was collapsing and that a large number of financial firms were overexposed to asset backed securities and related derivatives.¹⁷⁹ Yet, it appears our market would have predicted an increase in systemic risk even before this initial shock; though the contract would have ended after the Bear Stearns funds filed for bankruptcy, the information market would have likely signaled that systemic risk was increasing. Indeed, this prediction would have been helpful even after the Bear Stearns funds collapsed. The market did not anticipate the collapse of the mortgage market, and even fewer people

178. Bear Stearns' High Grade Structured Credit Strategies and High-Grade Structured Credit Strategies Enhanced Leveraged Funds hedge funds first posted losses on June 14th 2007, and filed for bankruptcy two months later. *Timeline of a Crisis*, WALL ST. J. ONLINE, March 17, 2008, <http://online.wsj.com/article/SB120576387418941803.html>. To be clear, we are not directly interested in the failure of Bear Stearns or its hedge funds. However, these failures provide important data points when evaluating the predictive abilities of our model, as many experts believe that these were the first events of the financial crisis.

179. Viral Acharya et al., *Prologue: A Bird's-Eye View*, in RESTORING FINANCIAL STABILITY *supra* note 1, at 2 ("While subprime defaults were the root cause, the most identifiable event that led to systemic failure was mostly likely the collapse on June 20, 2007, of two highly levered Bear Stearns-managed hedge funds. . .").

believed it would lead to a full blown financial crisis. Even the Federal Reserve underestimated the gravity of the crisis; in July 2007, Chairman Bernanke estimated that there would only be \$50 to \$100 billion in “losses associated with subprime credit products.”¹⁸⁰ Thus, our information market could have provided an indication that the mortgage market problems posed a systemic risk, prompting faster reactions from the financial sector and financial regulators.

Further, as predicted, our correlation model appears more sensitive and more accurate than Huang, Zhou, and Zhu’s CDS indicator. While movements in the CDS price model roughly correlated with our measure of systemic risk, it did not respond to the subprime crisis until after the Bear Stearns funds collapsed.¹⁸¹ Further, the CDS indicator dropped dramatically after JP Morgan purchased Bear, while our model continued to anticipate a high level of systemic risk, consistent with the subsequent failure of Fannie Mae, Freddie Mac, Lehman Brothers, and AIG.¹⁸² It appears our intuitions regarding systemic risk were correct; markets that attempt to directly measure systemic events require such a high level of instability to induce trading that their predictive abilities are limited. Moreover, CDS contracts appear to measure only the price at which parties will trade the costs and benefits of a particular default and not the systemic externality with which we are truly concerned.

There is also a smaller increase in the correlation of returns between September 2000 and March 2001, which tapers off over the following year. It is not immediately clear what caused this increase, though the most obvious possibility is the wave of accounting scandals in the early part of the decade may have undermined firms’ confidence in the ability of their counterparties to repay.¹⁸³ However, regardless of the cause of this

180. *Federal Reserve’s Second Monetary Policy Report for 2007: Hearing Before S. Comm. on Banking, Housing, & Urban Affairs*, 100th Cong. 19 (2007) (statement of Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Reserve Sys.), available at <http://www.gpo.gov/fdsys/pkg/CHRG-110shrg696/pdf/CHRG-110shrg696.pdf>. By March, 2008 this estimate was revised upward to \$400 billion. Greg Ip, *Study Finds Wider Impact of Mortgage Losses*, WALL ST. J., March 1, 2008, at A2. In February 2009, the International Monetary Fund predicted that total losses associated with the credit crisis would exceed \$2.2 trillion. Steve Lohr, *Ailing Banks May Require More Aid to Keep Solvent*, N.Y. TIMES, Feb. 12, 2009, at A1.

181. See Huang et al., *supra* note 134, at 17 (noting the CDS indicator “rose sharply” after August 2007); see also *id.* at 39 (showing a graph of the CDS risk indicator).

182. *Id.* at 17.

183. See George G. Kaufman, *Banking and Currency Crises and Systemic Risk: Lessons from Recent Events*, ECON. PERSPECTIVES, Third Q. 2000, at 9, 15, available at <http://www1.worldbank.org/economicpolicy/managing%20volatility/contagion/documents/3qep2.pdf> (describing how lack of confidence in counterparties can lead to systemic instability). In this sense, an accounting scandal would reduce confidence in counterparties through the same mechanisms as a negative asset shock; unsure who was affected, firms would refuse to lend at reasonable, or any other rates, causing credit markets to freeze up.

increase, it highlights another benefit of our proposed market. We care about predicting susceptibility to systemic events, not necessarily the events themselves. While this uptick could be the result of a coincidental increase in the correlation of returns, it would not be prohibitively costly to increase bank examinations during these periods. If the increase in correlation turned out to be coincidental, there would be few negative consequences. However, if the increased examinations uncovered conditions susceptible to a systemic event, regulators could address the situation before it materialized.

Finally, as a robustness check, we track our systemic risk indicator against the number of times systemic risk appeared in both the Wall Street Journal and the LexisNexis “Major Newspapers” database.¹⁸⁴ Though this certainly does not establish a causal relationship, it does indicate that during periods we identify as having high levels of systemic risk, financial analysts were also discussing systemic risk. Similarly, it also indicates that during the periods we identify as stable, financial analysts were, by and large, unconcerned with systemic events. These results are reproduced in Table 5 below.

TABLE 5
Number of Mentions of Systemic Risk

DATE	WSJ	MAJOR PAPERS
10/1/2008- 4/31/2009	86	468
4/1/2008-9/31/2008	52	218
10/1/2007- 3/31/2008	21	86
4/1/2007-9/31/2007	16	77
10/1/2006- 3/31/2007	15	51
4/1/2006-9/31/2006	11	35

See id. (explaining how uncertainty can cause credit markets to freeze).

184. This table was produced by searching for “systemic risk” in the LexisNexis Wall Street Journal and Major Newspapers databases over six month intervals.

10/1/2005- 3/31/2006	9	32
4/1/2005-9/31/2005	15	39
10/1/2004- 3/31/2005	5	17
4/1/2004-9/31/2004	5	21
10/1/2003- 3/31/2004	6	26
4/1/2003-9/31/2003	2	19
10/1/2002- 3/31/2003	8	45
4/1/2002-9/31/2002	3	39
10/1/2001- 3/31/2002	5	48
4/1/2001-9/31/2001	5	22
10/1/2000- 3/31/2001	6	31
4/1/2000-9/31/2000	7	41

IV. PRACTICAL CONSIDERATIONS

Though we have shown how an information market employed to predict systemic risk can improve economic performance, its implementation raises some practical concerns. Information markets are fairly new, and their legality is not clearly settled. While we anticipate our market would be developed and managed by a regulatory body, it could also be sponsored by a non-agency private or public entity. Each possibility raises distinct issues, which are discussed below.

Private information markets currently operate in a form of legal limbo. They are neither clearly prohibited by state gambling laws nor subject to the jurisdiction of the Commodity Futures Trading Commission (the “CFTC”) but are similar enough to regulated subject matter to stifle innovation.¹⁸⁵ The only major public market in the United States is the IEM, which obtained a no-action letter from the CFTC allowing it to operate for “academic and experimental purposes” without being subject to CFTC regulation; in concession, the IEM was required to limit trader accounts to \$500 or less.¹⁸⁶ While the IEM is highly successful despite the account limitations, the CFTC is under no obligation to treat subsequent markets with the same generosity.¹⁸⁷

However, even absent a no-action letter, it is not clear whether our proposed information market would be subject to CFTC regulation.¹⁸⁸ The CFTC regulates the sales of commodities, including options, futures contracts, and some derivatives.¹⁸⁹ Most information market contracts are

185. See Abramowicz & Henderson, *supra* note 61, at 1379 n.94 (describing uncertainty about whether gambling or commodity futures trading regulations apply).

186. CFTC Staff Letter No. 93-66 [1992-1994 Transfer Binder] Comm. Fut. L. Rep. (CCH) ¶ 25,785 (June 18, 1993).

187. Tom W. Bell, *Gambling for the Good, Trading for the Future: The Legality of Markets for Science Claims*, 5 CHAP. L. REV. 159, 174-75 (2002).

188. Professor Bell argues that information markets deal in spot transactions and not futures contracts; accordingly, he argues, they are not commodities at all, but securities. See Bell, *supra* note 62, at 54-56 (comparing information and securities markets). His analysis, however, relies on characteristics of information markets that are shared with option contracts and other instruments which can be described as commodities without arousing controversy. Further, the CFTC appears to disagree with Bell’s arguments and has concluded that information market contracts are at least nominally commodities. See Concept Release on the Appropriate Regulatory Treatment of Event Contracts, 73 Fed. Reg. 25669, 25671 (May 7, 2009) (describing what qualifies as a commodity). Given the CFTC’s broad discretion to interpret the Commodity Exchange Act, arguing that information markets are not commodities markets is unlikely to be successful. See Bell, *supra* note 187, at 176 (noting that the decision to regulate information markets would be protected by *Chevron* deference); see also *Chevron U.S.A., Inc. v. Natural Res. Def. Council, Inc.*, 467 U.S. 837, 865 (1984) (holding courts should defer to agency decisions within the scope of their delegated authority if “the regulatory scheme is technical and complex, the agency considered the matter in a detailed and reasoned fashion, and the decision involves reconciling conflicting policies” (internal citations omitted)).

189. See 7 U.S.C. § 1a(4) (2006) (“The term ‘commodity’ means wheat, cotton, rice, corn, oats, barley, rye, flaxseed, grain sorghums, mill feeds, butter, eggs, *Solanum tuberosum* (Irish potatoes), wool, wool tops, fats and oils (including lard, tallow, cottonseed oil, peanut oil, soybean oil, and all other fats and oils), cottonseed meal, cottonseed, peanuts, soybeans, soybean meal, livestock, livestock products, and frozen concentrated orange juice, and all other goods and articles, except onions as provided in section 13-1 of this title, and all services, rights, and interests in which contracts for future delivery are presently or in the future dealt in.”). “Contracts for future delivery” has been read expansively to cover most options on securities. See *id.* § 1a(26), (32) (defining “option” and “security futures product”).

The Commission lacks complete jurisdiction over a narrower category of contracts

at least nominally commodities, as they are “designed to exhibit the attributes of either options or futures contracts.”¹⁹⁰ However, the Commodity Exchange Act excludes or provides jurisdiction over certain kinds of contracts. First, the CFTC has only limited jurisdiction over commodities that are derived from “any economic or commercial index based on prices, rates, values, or levels that are not within the control of any party to the relevant contract, agreement, or transaction.”¹⁹¹ While our proposed contract is clearly based on an economic index, excluded commodities are only exempt to the extent they are traded by institutional or qualified investors.¹⁹² Though a successful market need not be particularly thick, limiting eligible participants to institutional investors would be unlikely to result in the disclosure of sufficient private information to produce accurate predictions.

If a private sponsor wanted to ensure the legality of its market, it could attempt to register with the CFTC as a derivatives transaction execution facility or contract market.¹⁹³ However, the registration requirements are somewhat onerous; the CFTC requires minimum capital for registered markets and provides for ongoing disclosure obligations.¹⁹⁴

known as hybrid instruments. A hybrid instrument is “a security having one or more payments indexed to the value, level, or rate of, or providing for the delivery of, one or more commodities.” *Id.* § 1a(21). While Bell believes that information markets could fall under this exclusion, it appears exceedingly unlikely. *See* Bell, *supra* note 62, at 68-71 (explaining hybrid instrument exclusion). To be considered a hybrid security, an instrument must be either an equity security, debt security or a “demand deposit, time deposit or transaction account . . . offered by an insured depository institution,” 17 C.F.R. §§ 34.2(a), 34.3(a)(ii) (2009). Our proposed market is clearly not an equity or debt security, nor is it likely to be offered by a secured depository institution, unless sponsored by the Federal Reserve.

190. *See* Concept Release on the Appropriate Regulatory Treatment of Event Contracts, 73 Fed. Reg. at 25670 (requesting public comment on appropriate agency treatment of information markets and similar contracts).

191. 7 U.S.C. § 1a(13)(iii).

192. *See id.* § 2(d) (excluding from CFTC jurisdiction certain derivative transactions between institutional and qualified investors); *see also id.* § 1a(12) (defining eligible contract participants). While retail investors can conduct trades through futures commission merchants, which are generally eligible contract participants, excluded commodities must be traded on a “principal-to-principal basis.” *See id.* § 1a(20) (defining “futures commission merchant”); *id.* § 2(d) (excluding from CFTC jurisdiction certain derivative transactions between institutional and qualified investors); *id.* § 7(d) (outlining the responsibilities of the board of trade, including the enforcement of rules against abusive practices, that apply only toward market participants); *see also* Bell, *supra* note 187, at 177 (describing process by which scientists and educated lay people could trade through futures commission merchants).

193. *See* 7 U.S.C. § 7 (providing requirements for designating boards of trade as contract markets); *id.* § 7a (providing requirements for derivatives transaction execution facilities).

194. *See id.* § 6f (providing registration, financial, and risk assessment requirements for futures commission merchants and introducing brokers); *id.* § 6g (providing recording and record keeping requirements for futures commission merchants and introducing brokers); *id.* § 7 (detailing requirements for designating boards of trade as contract markets); *id.* § 7a

Further, while the requirements to establish a derivatives transaction execution facility are less onerous, they are also limited to transactions with qualified investors.¹⁹⁵ However, retail investors can trade on derivatives transaction execution facilities through futures commission merchants. Thus, if the registered exchange operated exclusively through registered merchants, retail investors would have access to our proposed market. However, it is unclear whether an information market can generate sufficient trading volume to justify the regulatory costs associated with registered exchanges. Accordingly, a private market would ideally receive a no-action letter or be adopted by an existing market where the regulatory costs could be absorbed by higher margin or volume exchanges. As a final note, the CFTC has solicited comments regarding future rulemaking and apparently is considering clarifying its stance on information markets.¹⁹⁶ Though the Commission has yet to issue its proposed rule, some commentators believe it will endorse publicly traded event contracts.¹⁹⁷

However, these concerns would be mooted if the Treasury or Federal Reserve decided to sponsor the market. Federal government sponsorship would preempt any state gambling laws which may otherwise prohibit information markets. Similarly, while a government sponsored market would likely conform its market to CFTC standards, there would be no question of its legality. However, it isn't immediately clear the Fed has the authority to sponsor an information market. For instance, the Fed prohibits regulated depository institutions from funding both "lotteries," which is likely defined broadly enough to cover information markets, and internet gambling.¹⁹⁸ However, neither of these prohibitions appears to

(detailing registration requirements for derivatives transaction execution facilities); *id.* 7a-1 (detailing registration requirements for derivatives clearing organizations); *see also* 17 C.F.R. § 1.17 (providing minimum capital requirements for futures commission merchants and introducing brokers).

195. *See* 7 U.S.C. § 7a(b)(3) (limiting traders in derivatives transaction execution facilities to "eligible contract participants" and individuals trading through futures commission merchants with assets exceeding \$20 million); *see also* 7 U.S.C. § 1a(12) (limiting definition of "eligible contract participant" to financial institutions, broker-dealers, and similar institutional investors or individuals with assets exceeding \$10 million, or \$5 million if the commodity is being used as a hedging strategy).

196. *See* Concept Release on the Appropriate Regulatory Treatment of Event Contracts, 73 Fed. Reg. at 25673-25674 (requesting public comment on appropriate agency treatment of information markets and similar contracts).

197. Ricky McRoskey, *Regulation Looms for Prediction Markets*, BUSINESSWEEK.COM, July 8, 2009, http://www.businessweek.com/bwdaily/dnflash/content/jul2008/db2008073_533950.htm?chan=top+news_top+news+index_news+%2B+analysis.

198. *See* 12 U.S.C. § 339 (prohibiting state member banks from sponsoring lotteries); 12 C.F.R. § 233.1—7 (applying provisions of the Unlawful Internet Gambling Enforcement Act of 2006 to institutions regulated by the Federal Reserve). Lottery is defined to include any arrangement where three or more parties "advance money or credit to another in

limit the Fed's permissible actions.¹⁹⁹

It seems the best avenue for allowing the Fed to implement an information market is through the Federal Advisory Council.²⁰⁰ The Federal Advisory Council is composed of members of the Federal Reserve districts and has the authority to "call for information and to make recommendations" related to monetary policy, reserve requirements, and open-market operations.²⁰¹ It seems an information market fits squarely within the Council's right to call for information. Further, the predictions produced from our market would certainly be relevant to the Council's recommendations. Additionally, current law may permit an information market if it is explicitly tied to the Fed's ability to impose emergency reserve requirements on depository institutions.²⁰² The Fed has the ability to set general reserve requirements for financial institutions; however it also has the right to impose additional reserve requirements in emergency situations.²⁰³ Thus, the Fed may be able to structure our proposed market for the purpose of informing its decision to impose emergency reserves. As a final note, the Obama Administration's plan considerably expands the Federal Reserve's authority, including the mandate to directly monitor systemic risk. However, while these proposed reforms explicitly authorize the Fed to collect information regarding systemic risk, they do not appear to resolve the uncertainty over whether the Fed may manage a prediction market.

exchange for the possibility or expectation that one or more but not all of the participants . . . will receive by reason of their advances more than the amounts they have advanced." 12 U.S.C. § 339(c). This includes arrangements where the "winners" are determined by "any record or tabulation of the result of one or more events in which any participant has no interest except for its bearing upon the possibility that he may become a winner." *Id.*

199. Which is not to say that the Fed is authorized to sponsor an information market but only that it is not specifically prohibited from creating one.

200. 12 U.S.C. § 262 (2006).

201. *Id.* §§ 261-262.

202. *See* 12 C.F.R. § 204.5 (describing the Fed's ability to impose additional reserve requirements).

203. A decision to impose emergency reserve requirements requires the consensus of at least 5 Board members, who must then confer with "the appropriate committees of Congress." *Id.* It appears these committees must only be consulted; congressional approval is not necessary. *Id.*