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How to Improve the Financial Architecture and Its Resilience

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Financial Resilience Survey: selected answers

This questionnaire was circulated on behalf of a working group of the Complexity Council of the World Economic Forum comprised of Prof. Eve Mitleton-Kelly of London School of Economics and Prof. Dirk Helbing at ETH Zurich's Risk Center. It was sent to a few dozens of financial experts with the aim to create an inventory of ideas of how the financial system might be improved and made more resilient. Unconventional ideas were also welcome.

Note: This is not an official World Economic Forum (WEF) document

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1) Impact-adjusted mark-to-market accounting

Jean-Philippe Bouchaud, Fabio Caccioli, J. Doyne Farmer

Problem addressed

Marking whole positions to the current clearing price as in mark-to-market accounting ignores the effect that liquidating a position can have. This encourages the built-up of huge positions on illiquid markets that appear to be profitable when in fact they are not. This is one of the mechanisms that increased the fragility of the financial world pre-2007 and lead to the crisis.

The worst negative side effects of mark-to-market valuations occur when leverage is used. One can show that when liquidity is low, leverage can become critical, in the sense that as a position is being entered there is a critical value of the leverage above which it becomes very likely that liquidation will result in bankruptcy, that is, liquidation value less than money owed to creditors.
This does not require bad luck or unusual price fluctuations – it is a mechanical consequence of using too much leverage and neglecting the impact of trading out of the position.

Mechanisms to address the problem

The impact of unwinding a position of size Q in a market with daily liquidity V and volatility σ is now quite well known from empirical studies, with some theoretical justifications. This impact turns out to be large. In particular, it is the ratio Q/V that matters and not Q/Total size of the market, which is much smaller. The establishment of a quantitative formula for expected impact makes it possible to do impact-adjusted accounting. Rather than using the mark-to-market price, which is the marginal price of an infinitesimal liquidation, we propose using the expected price under complete liquidation, depressed by the impact. This will lower the mark-to-market valuation and prevent the built up of artificially “goosed up” positions.

Functional principles and expected effects

When liquidation occurs in normal conditions, that is, at a reasonable pace that does not attempt to remove liquidity too quickly from the order book, the expected impact I due to liquidating a volume Q is to a large extent universal, independent of the asset, time period, tick size, execution style, etc. It is given by: $I(Q) = Y \sigma (Q/V)^{1/2}$ where σ is the daily volatility, V is daily share transaction volume and Y is a numerical constant of order unity. We propose to subtract this expect liquidation cost to the mark-to-market value of the position.

Standard mark-to-market accounting gives no warning that a position is overleveraged, in fact quite the opposite: since mark-to-market prices rise as a position is purchased, leverage is in fact underestimated. However, as a position is unwound the situation is reversed. The impact of unwinding causes leverage to rise, and if the initial leverage is at or above a critical value, the leverage becomes infinite and the position is bankrupt. Under mark-to-market accounting this comes as a complete surprise.

Under impact-adjusted accounting, the warning is clear. As the critical point is approached, the impact-adjusted leverage diverges, telling any sensible portfolio manager that it is time to stop buying. The method of valuation that we propose here could potentially be used both by individual risk managers as well as by regulators. Had such procedures been in place in the past, we believe many previous disasters could have been avoided.

Implementation

If one believes that $I(Q) = Y \sigma (Q/V)^{1/2}$ is a reasonable representation of the impact that an asset manager will unavoidably incur when liquidating his/her position, our procedure should be easy to implement. It is based on quantities such as volatility, trading volume or the spread, which are all relatively easy to measure or estimate. However, one should worry about other potentially destabilizing feedback loops that our impact-adjusted valuation could trigger.

For example, in a crisis situation, spreads and volatilities increase while the liquidity of the market decreases. Updating the parameters entering the impact formula (volatility, spread and available volumes) too quickly would predict a deeper discount on the asset valuation, potentially leading to further fire sales, fuelling more panic, etc. It is therefore important to estimate parameters using a slow moving average to avoid any overreaction to temporary liquidity droughts. This observation is in fact quite general: recalibrating models after every market hiccup often leads to instabilities.

2) Limiting lending to income flows rather than asset appreciation

Steve Keen

Problem addressed

Current lending ostensibly bases itself on the income of the borrower and the value of the borrower's collateral according to some metric. In practice these are both systemically pro-cyclical—as we forget a previous financial crisis, these metrics rise. This leads to more leverage which drives asset prices higher—thus instituting a positive feedback cycle between lending and asset prices which helps cause the next financial crisis. This also gives borrowers an interest in the expansion of lending metrics, since they superficially profit from rising asset prices during the expansion phase—only to suffer in the following crisis, especially when it is one as severe as the Great Depression or the current crisis.

Mechanisms to address the problem

The maximum amount that a bank can lend should be based on an inflexible metric related to the project being financed, regardless of the income of the borrower or his collateral. For housing, this would be a multiple of (say ten times) the actual or imputed yearly rental income of the property. For shares the multiple should be based on the dividend flow of the shares being purchased, rather than the value of the shares as currently applies with margin lending.

I have also previously proposed a change in the nature of share ownership to limit the extent to which finance is directed to speculative purchases (as dominates now) rather than capital formation. The concept, which I called Jubilee Shares, was that shares issued by a company are perpetual when issued, but after a specified number of sales (say seven) they become "Jubilee Shares" which will expire 50 years after that sale. The objective here is to focus sharemarket activity on new capital formation while still allowing for price discovery.

Finally I am partial to suggestions that banks lose the privilege of being limited liability companies, or that unlimited liability be extended to upper managers of banks.

Functional principles and expected effects

Both my proposals and the proposals for removing the protection of limited liability can be enforced by courts rather than managed by regulators. The expected effect is to constrain the capacity of lending to finance asset bubbles, and instead motivate bank lending to focus on capital formation.

Implementation

Implementation would involve the development of legislation and the means to enforce it, rather than the construction of a regulatory body. Breaches of these principles, as breaches of the law, would carry considerably more impact on individuals and bank companies than breaches of regulations. In particular penalties for breaches could considerably exceed the penalties that regulators can enforce, and the simplicity of the rules is intended to make proof of breaches much less costly than the current ineffectual regulatory enforcement has been.

3) Align bank remuneration with the interest of wider society, rather than with bank shareholders

Problem addressed

Bank managers are answerable to shareholders, and normally are very large shareholders themselves. It is in the interest of shareholders, because of limited liability, when given a choice between two strategies with an equal expected return, to adopt the riskier strategy. Thus shareholders, and bank managers, are given strong incentives to take on much more risk than is good for society. In practice this takes the form of bank managers of seeking to maximize the Return on Equity (RoE), rather than the risk-adjusted return on assets as a whole.

Mechanisms to address the problem

What is needed are regulations to re-align the incentives facing bank managers, and those in a position to influence the risk/return profile of the bank. This could be done in several ways. One such mechanism would be to require at least 50% of any bonus to be paid in the form of co-cos or bail-inable bonds, whose value would be sharply reduced in the event of bank failure. Another mechanism would be to withdraw some of the protection of limited liability from the same group of bank managers, perhaps by requiring them to repay some multiple of their previous remuneration in the event of a bank failure.

Functional principles and expected effects

Naturally bankers would hate this since it would hit them in their pockets. But that is the purpose of the exercise, i.e. to make bank failure so much more unattractive to bankers in influential positions, that they take additional steps to avert such failure. Indeed, we could push such changes to the point where bankers became too risk-averse. There is no doubt that some experimentation would need to be undertaken to work out exactly what the optimal remuneration structure would be in order to give bankers the 'correct' incentives for choosing the best possible risk/reward tradeoff.

Implementation

Given that bankers will hate it, the problem is purely political. Is it possible to get it through the political system?

4) Recognize the law-finance-paradox and its implications for financial regulation

Katharina Pistor

Problem addressed

Binding legal commitments are constitutive of large-scale financial markets. Yet, under conditions of uncertainty and liquidity volatility enforcing all ex ante commitments will put the system on autopilot to self-destruction. The typical solution is to relax or suspend the full force of the law by bending rules to offer liquidity where no liquidity is owed. This has two effects: First, it undermines ex ante legal commitments (thus the paradox). Second, law tends to be more elastic at the core where its survival is at stake of the system but rigid on its periphery. This raises moral hazard issues at the core while exposing the periphery to the risk of unsustainable financing practices in boom years and the full force of the law in the downturn.

Mechanisms to address the problem

The Law-Finance-Paradox cannot be resolved – it is a paradox! It raises important questions about how to govern a system that is prone to endogenous financial crashes. Preventive measures are superior to ex post remedies, as the latter privilege the institutions and practices most responsible for the destabilization of the system. The challenge is to devise a system with safety valves distributed evenly (ideally randomly) throughout the system, including on its periphery so that it cannot be easily gamed. Contracts are rationally designed to shift the risk of dealing with future uncertainty to the other party. Yet, uncertainty cannot be purged from the system; it must be shared. To accomplish this we need to alter contracting practices and rules and regulations that reinforce such practices. Examples include preliminary injunctions for adapting individual contracts linked to uncertainty or fundamental changes in liquidity; regulatory intervention to adapt entire classes of contracts (i.e. automatic interest rate adjustments in mortgages or their denomination in foreign currency); suspension of netting rules for derivatives contracts; allowing public policy concerns to override choice of law and forum clauses.

Functional principles and expected effects

Such measures will, of course, increase the costs of financing as the financial intermediaries can no longer shift the risk of financial instruments to other parties – or rather, can no longer rely that the contractual shift they envision will be upheld in the future. There will be complaints that this undermines the certainty and predictability of the law. But this is precisely the point. In a world beset by uncertainty insisting on the full force of the law vis-à-vis ones own contracting parties while banking on central bank liquidity in times of needs creates a rather unleveled playing field. Introducing the changes advocated might be done step by step in a decentralized fashion and should be easier than whole sale reforms of the financial system. While subtle, such measures will over time affect behavior and outcomes, as all parties will be forced to internalize some of the risk that is inherent to the financial system. The major concern, as in all regulatory and legal interventions. is the possibility of abuse. This cannot be fully eliminated, but it should be possible do define triggers for adapting contracts or regulatory interventions subject to fact intensive reviews that will find broad respect over time. This is not fundamentally new in the law – which has developed many solutions for dealing with uncertainty (although there are important differences between legal systems).

Implementation

We need less standardization and more innovative regulatory competition. The attempt to create a level playing field for financial intermediaries on a global scale has in fact created a highway for regulatory arbitrage. Domestic regulators are kept busy with implementing standardized rules while market actors innovate to arbitrage around them – leaving regulators largely defenseless. It would be more fruitful to encourage lawmakers, regulators and courts to develop safety valves commensurate with their own legal system and in response to the practices they confront and observe. And yes, this will sometimes look like protectionism. However, in a world that is incapable of designing transnational bankruptcy regimes for financial intermediaries or redistributing the costs of financial crisis ex post, some ex ante precaution might be necessary.

5) Mandatory Contingent Convertible Bonds

Dennis Snower

Problem addressed

Systemically relevant financial institutions (which are too big and too complex to fail) inevitably generates excessive risk, since they are able to privatize the gains and socialize large losses (since the government cannot allow them to fail, by definition).

Mechanisms to address the problem

According to my proposal, all financial institutions that are deemed to be systemically relevant by the government would be required to issue all their debts (with the exception of demand deposits) in the form of contingent convertible bonds, that is, bonds that automatically convert into equity if the institutions' capital ratios fall beneath a specified floor. To avoid "death spirals", the rate at which the conversion takes place would be specified in terms of the number of shares, rather than their current value.

Functional principles and expected effects

This measure would change the incentives of the systemically relevant financial institutions. The generation of excessive risk would increase the probability of share dilution, thereby giving the shareholders and incentive to put pressure on the managers to avoid such risk.

Implementation

Implementing this measure would require new laws, on a national and possibly other European level. It is not necessary to implement this measure internationally. If it were implemented nationally, the relevant nations would benefit. Although some financial transactions may move abroad in order to avoid the mandatory contingent convertible bonds, such movements would be in the national interest over the long run, since the relevant financial institutions would otherwise have generated excessive risk.

6) Electronic certificates will reform financial architecture

Richard Olsen

Problem addressed

Financial markets are illiquid and price action is spurious. A vibrant economic system needs liquid and efficient markets, where price discovery is smooth. Today, this is not the case.

The financial architecture has evolved around business processes that were designed under the premise that buying and selling of assets involves a physical transfer of paper documents. This has resulted in batch based processing with two-day delivery.

The dichotomy between front office, where transactions occur in milliseconds, and the back office with daily batch processes gives rise to settlement risk and additional uncertainty. This increases transaction costs and impairs market liquidity. We need to create an infrastructure that can cope with the operational requirements of liquid financial markets, where 80% and more of the transaction volume opens and closes positions in less than twenty minutes. The lack of market liquidity has impaired price discovery and has resulted in increased central bank interventions.

Mechanisms to address the problem

The financial architecture needs an efficient communication layer. We propose to build a platform for the issuance of electronic certificates based on open source peer-to-peer software and an Internet exchange. The electronic certificates are digital financial assets. The issuer of an electronic certificate guarantees that the electronic certificate is convertible into the underlying financial asset as stated on the electronic certificate. Market participants can only issue electronic certificates, if they have the appropriate financial licenses and fulfill the regulatory requirements.

An electronic certificate is 'the' financial asset in the virtual world of trading, analogous to the paper certificates of shares and bonds in the physical world. Electronic certificates are bought, sold and transferred via computer over the Internet. The issuance software maintains a ledger of the electronic certificates that have been created by the issuer and every transfer of ownership is recorded in the ledger. The computer based processing allows for instantaneous transfer of the certificates and interest payments by the second.

Buyers and sellers of electronic certificates exchange one electronic certificate for another one, for example an electronic certificate for 100 EUROs issued by Deutsche Bank is exchanged for an electronic certificate of 130 USD issued by Deutsche Bank or another bank. Electronic certificates are generic and can represent any type of asset from shares of companies, such as 10 Google shares issued by Google or by a third party, such as Citibank, or a certificate of one barrel of oil issued by for example Glencore or the government of Saudi Arabia, etc. The content of the electronic certificates, i.e. the detailed terms and conditions of the financial asset, are part of the electronic description of the certificate and are embedded in the certificate. The unambiguous specifications of the underlying asset on the certificate are a guarantee of transparency for the buyer.

Traders can trade the electronic certificates over the Internet; there will be routers with limit order books of buy and sell orders with a matching algorithm to process the trades; the transfer of electronic certificates is instantaneous and ledgers are updated in real time. The ledgers are the information source for the various reporting requirements from management to regulators.

Functional principles and expected effects

Electronic certificates are encrypted tokens that are bought and sold electronically. The purchase and sale of financial asset is simultaneous with the actual transfer of the electronic certificates. In cash societies, the sale of an asset occurs step by step by handing over cash in exchange for the good. Electronic certificates reinstate the principle of simultaneous exchange. This reduces the complexity of the financial architecture and lowers risk. The instantaneity of transfer will make electronic certificates the preferred means of transaction in an economic environment, where uncertainty is high and credit facilities are lacking; the technology will be particularly attractive for emergent economies and crisis regions.

The issuer of electronic certificates guarantees the conversion of the certificate into the underlying asset. The rating of the issuer impacts the market value of the certificate: the higher the rating of the issuer, the higher the value of the certificate and its underlying asset.

Market participants will prefer certificates issued by a highly rated issuer with low spreads and gravitate to issuers with top rating. This development will lead to a financial architecture with centralized counter-parties. A benefit of the introduction of electronic certificates is the emergence of centralized counter-parties based on performance of the issuer; only issuers with persistent top quality performance will retain their central counter-party status. Regulators are pushing the financial industry to move to centralized counter party trading; the introduction of electronic certificates will propel this development and this is a benefit.

Electronic certificates are a low-cost solution for prime brokerage: the market participant deposits his assets with the prime broker; he receives certificates in exchange and then can trade those certificates. The prime brokerage customer has full flexibility; he can at any time instantaneously exchange his certificates for those of another issuer; he is not captive of his prime broker, as was the case at the time of the collapse of Lehman. Prime brokerage is a growth industry in the financial industry; it is likely that prime brokers with a small market share will use the innovative technology to gain market share, which will propel the adoption of the technology.

The electronic certificates will also be used in the regular consumer industry for micro- and mobile payments, where the new technology offers significant efficiency increases. The new technology will get rapid adoption in the international cash transfer market due to its cost efficiency.

The system of electronic certificates works within the existing legal framework and does not require time-consuming legal changes. The platform automatically generates a digital log of all the transactions; this is a benefit in the age of transparency.

Implementation

The technology for the implementation of a platform of electronic certificates exists and does not require new technology. We propose to use open source software for the development of the platform, because this will maximize ‘trust’ in the resilience and security of the system. In the Internet, there are many examples, where for profit companies support industry standards and provide funding, because it supports their core businesses; the same will be the case for electronic certificates. The cost for the development of an electronic certificate platform is around 10 and 20 Mio USD.

Lykke Foundation based in Zürich is a sponsor of the platform.

7) A safe trading network that makes a safety net

Angelo Ranaldo

Problem addressed

To guarantee financial stability, an international regulatory authority should monitor the trading network on aggregate level. The main idea is to keep track of the evolution of the risk profile of each individual firm. This measure relies on an efficient and harmonized treatment of trading information on a global level. At fairly high frequencies, the international regulatory authority should be entitled to reconstruct the trading positions of individual firms in order to spot the buildup of systemic risks. The information chain would get through the following steps:

1. Each trade should be performed and cleared in regional counterparty clearing systems (CCP).
2. Regional CCPs should provide information to the international authority at fairly high-frequencies.
3. The international authority should collect and aggregate information in order to reconstruct the portfolio positions of each individual firm.
4. The international authority would flag the buildup of unbalanced positions, in particular the risk concentration of individual entities, regions and market segments especially in terms of counterparty risk, liquidity risk and contagion risk.

Mechanisms to address the problem

The **mechanisms** to address this problem are:

1. A mandatory use of CCPs at national and macro-regional level, i.e. all (relevant) transactions should be traded and cleared by a central counterparty.
2. An efficient and harmonized use of Information Technology (IT) to map the trading network (who trades against whom) and to keep track of the risk patterns within the network.
3. International coordination of national regulatory authorities.
4. An international mandate attributed to a dedicated regulatory authority to access the necessary information, to flag unbalanced trading positions and to fix them if these might turn into systemic risk.

Functional principles and expected effects

The main **functional principle** of this measure is an appropriate treatment of disperse information items. This should be applied on micro and macro levels. On a micro level, the trading community should be seen as a network. Relevant information on each trade should be collected accordingly. A network analysis would identify local and global patterns, influential entities and risk dynamics. The most efficient way to do this is to impose the use of CCP that would then be able to map the local trading network. Identical information sets would be replicated by each CCP in each jurisdiction. On a macro level, there should be the political will shared by the international community to exchange information. A dedicated international authority like the Financial Stability Board should have the mandate to access and aggregate micro-level information to monitor risk patterns from a macro perspective. A successful example that already exists is the Continuous Settlement System (CLS) which connects the national payment systems to clear international settlements. Finally, the international authority should be able to flag the buildup of portfolio imbalances and any potential systemic risk.

The **expected** beneficial **effects** would be:

- A combined bottom-up and top-down approach to preserve financial stability. The bottom-up collection and treatment of information would highlight the ongoing risks across local and international trading networks. The top-down perspective would

empower a centralized authority to spot emergent systemic risks and to fix them in a timely and measured manner.
- A pre-emptive (rather ex-post) resolution of systemic risks thus avoiding severe financial meltdowns and adverse effects for the real economy.
- Ad-hoc (rather than indiscriminate) interventions on a firm level.
- Minimize the welfare costs of the current regulatory frameworks such as Basel III that, for instance, it imposes capital buffers and surcharges that can turn into a higher cost of capital for non-financial firms and households.
- A consistent remedy for liquidity risk, counterparty risk and contagion risk.
- Minimize "regulatory arbitrage" since all firms representing systemic risk would be identified and regulated no matter if these are outside the traditional banking system (e.g. all entities in the shadow banking system would be treated equally).
- It would reconcile "private" and "public goods". On the private side, economic agents should still enjoy the freedom to trade according to their needs and initiatives. On the public side, individual behaviors that can produce "negative externalities" would be contained to guarantee the social welfare.

Implementation

The **implementation** should get through three main steps:

1. The creation of matched CCPs in each jurisdiction. CCPs are important as collectors of valuable information on local trading networks rather than entities imposing restrictive conditions to trade.
2. Frequent and harmonized provision of information from the local CCPs to a centralized authority. The modern IT system makes this task feasible. The political support from international policymakers of the main international financial centers is necessary.
3. The use of effective indicators to spot the backlog of financial imbalances on the micro and firm level. These indicators would be monitored on real-time and they would make possible to run stress tests at high frequencies and aggregate level. If a firm represents a significant threat for the proper functioning of the financial system, then the international authority should intervene to restore financial stability, for instance by restricting its trading positions or requiring additional collateral.

8) Put the supply of money back in public hands

Norbert Haering

Problem addressed

The problem consists in commercial banks largely uncoordinated expansion and contraction of the money supply. This is the source of unsustainable credit booms and financial crises. On the other hand, the privilege of banks to have the deposit money that they create out of nothing accepted as legal tender is very valuable. The profits they make from this privilege should be obtained by the public sector, who is also the one who has to bail out the banks, if their credit expansion goes wrong. Taking back the privilege would allow governments to reign in their deficits and debt.

Mechanisms to address the problem

Do not allow banks to create deposits without full backing by cash holdings or deposits at the central bank. The deposits of customers at the bank, which are intended for payment purposes, should remain in the ownership of the customer, rather than constituting a credit to the bank. Separate from payment accounts there should be a class of investment accounts. Money put into these accounts is loan which is intermediated by the banks and cannot be used for payments before the term of the investment expires. In order to continuously enlarge the money supply, the central bank credits the account of the government with the intended amount of new money and the government spends this money and thus brings it into circulation. A law determines, how much new money is created in this way.

Functional principles and expected effects

Banks in this system are only intermediating, not creating money. They cannot create credit bubbles any more. They can still fulfill the function of assessing creditworthiness of potential borrowers. They cannot do maturity transformation any more, but this should not be necessary. Savers will have to be lured into giving long term loans by higher interest. Idiosyncratic liquidity risk of savers can be ameliorated by a facility which allows them to borrow against their long-term credit claim for a mildly punitive interest rate.

Implementation

Scrap the laws and treaty provisions which prohibit the central bank from financing government expenditure. Once banks start lending again and there is excessive liquidity, central banks should not syphon of liquidity but rather raise the minimum reserve requirement in steps. The target is 100 percent. While the requirement is raised, the amount of money that the central bank injects by crediting the government is raised.

9) Random trading to reduce financial bubbles and systemic risks

Dirk Helbing

Problem addressed

One of the functions of financial markets is to discover the fundamental value of assets. The underlying idea is that this is reached through the "wisdom of crowds" effect. For this principle to work, decision-makers must gather information and take decisions independently from each other. However, it is known that information feedback, which is a central part of the design of stock markets, may create herding behavior and thereby undermine the wisdom of crowds effect. In particular, herding behavior occurs when many market participants suffer from information overload and orient themselves through 'financial gurus' or market trends. In other words, information feedback tends to create undesirable correlations in investment behaviors and lead to bubbles.

Instabilities in financial markets are not a bad thing per se; they may be a useful and natural feature of dynamic markets adapting to a changing world. However, excess instability based on herding is dangerous. When large bubbles burst, this can cause huge losses and bankruptcy cascades. Therefore, it would seem desirable to give regulators, such as central banks, the tools to contain instability in financial markets within a target range. Nonetheless, insights from the study of complex systems in physics, ecology and sociology suggest that top-down regulation is doomed to fail. One cause of failure that is particularly relevant to financial systems is the difficulty of predicting bubbles and instabilities due to a lack of information. This leads to a delayed response that can be counter-productive. Furthermore, increasing regulation and bureaucracy to control the markets may unintentionally hamper their self-organization, leading to disequilibria. Therefore we suggest focusing on improving the financial architecture and the underlying mechanisms.

Mechanisms to address the problem

We need mechanisms that make bubbles burst before they grow so big that they create systemic risks. These mechanisms must not require advance knowledge of what is a bubble and what is healthy economic growth (as such knowledge is not reliable). They should rather “automatically” regulate the degree of instability, i.e. control the system smoothly without requiring continuous reassessment of whether the level of instability is good or bad.

Noise in the form of random trades on financial markets is expected to fulfill such requirements. By randomly buying and selling assets, big players such as central banks could limit the benefits of pure speculation, particularly insider trading. Systemic instability due to market manipulation and irrational herding could be prevented and bubbles would burst before they are large. This mechanism can be seen as bounding pathological correlations in the system without impeding self-organization.

Functional principles and expected effects

Noise lays some kind of “fog” over a signal and thus reduces its information content. This runs contrary to the dogma of maximum transparency and the general belief that more information results in more accurate prices. In ideal markets, there is no need for noise – it would in fact be considered a source of irritation. In reality, however, stock prices may differ considerably from the fundamental value. Such deviations may come from herding effects and market manipulations based on insider information, potentially also from algorithmic trading (as recent 'flash crashes' have shown). These problems are well known in financial markets, but still not fixed.

It is therefore necessary to destroy undesirable correlations in investment behaviors. Inspired by principles from physics, adding noise through random trades may be a good solution. Such noise makes price trends less easy to predict. Therefore, speculative trend following and insider trading become more risky.

By randomly buying and selling financial assets, big players such as the central banks could generate the desired noise in financial markets. Studies show that random investments create returns that are comparable to the market performance and often greater than those of managed funds. It should therefore be a viable strategy for central banks to randomly buy and sell.

In conclusion, adding noise represents a promising new tool for avoiding large bubbles and systemic risks in financial markets, supporting their self-organization ability rather than undermining it.

Implementation

First, it is essential for the random trades to be executed by one or several big players to ensure an appropriate level of price impact. Central banks are the natural candidates for this task. However, large groups of private investors or pension funds that have an interest in prices that are more stable and closer to fundamentals could also perform such trades. These random trades are expected to lead to competitive returns at comparatively small risks.

Second, it is clear that random trades must be truly random or the market will outsmart them. Even today hundreds of speculative investors are trying to game the actions and strategies of central banks by betting on bailouts of firms, banks and whole countries. However, with a completely random procedure no outsmarting should be possible.

10) Indexes of Asset Price Inflation

Edward Fullbrook

Problem addressed

Financial bubbles

Mechanisms to address the problem

1. Asset price inflation indexes
2. Their wide publication in public media
3. They would become reference points in financial market analysis and discussion.
4. They would promote awareness that price inflation is an asset phenomenon as well as a current output one.

Functional principles and expected effects

These public reference points would deter growth of asset bubbles.

Implementation

Initially academic / research institutions could start and publicize them, to be followed by commercial news organizations.

11) Global information system for the economy and financial markets to reduce uncertainty

Richard Olsen

Problem addressed

Participants in financial markets have to take decisions on a regular basis; they rely on quality information about the state of economy and its outlook. Such an assessment is difficult, because economic activity includes complex feedback loops and interdependencies. We propose to build a global online information system for the economy and its markets. We want to take advantage of the flood of data that the connectivity of the Internet and the digitization of information flows have created. We intend to build a weather forecasting system for the economy and the financial markets that processes all available information and provides real time predictive information; its content will be developed by crowd research from teams around the world. We propose to improve the resilience of the financial architecture by improving the quality of information available to decision makers.

Mechanisms to address the problem

The information system collects and processes terabytes of price and transaction data of financial markets, but also economic, environmental and consumer data and logs of social feeds, such as Twitter.

The information system is conceived as a huge decentralized brain that uses the global connectivity of the Internet to collect and process data; the analytics will be done by research and development groups from around the world; autonomous groups will build repositories to collect data, they will filter the raw data, they will analyze the data and build models to analyze the data and its trends, they will build applications and services for different user groups, other researcher groups will specialize on combining data services from different sources and creating more comprehensive global services.

The developers and researchers will use methodologies that have been evolved in recent years and have been applied successfully to a broad range of other scientific areas from meteorology to physics and pharmaceuticals; in combination, these technologies are powerful and will guarantee that the information system will become a powerful decision support tool with unique information content.

Users will have access to this information in easy to read graphical format, very much like weather maps; the information will also be available as a real time data feed that can be input into other applications, such as risk management systems in banks and treasuries.

The bulk of the information will be available as a public service; there will also exist specialized services that are available on a subscription basis.

The global information system combines in a consistent and precise format the wealth of information that our digital society generates, but has not been compiled in a consistent and systematic way. The information system offers its users real time analysis of the full complexity of the global economy and its environment and will be a powerful decision support tool for its users. The launch of a global information system will enhance the resilience of the financial architecture, because actors in the global markets, be they individuals in governments, central banks or institutional investors, will be better informed and thus take more balance decisions. The system will reduce the likelihood of mass panic or buying manias and will make the economy and its markets more balanced and resilient.

Functional principles and expected effects

A global network of contributors from academia and other organizations will create the information content; individual contributors will generate the specialized information services. The whole content of the information system will come from a roster of contributors from around the world, similar to how Wikipedia sources its information.

The information system will be based on an open source software development environment designed for storing and analyzing terabytes of digital data. The system will include a toolbox to develop models to analyze the data and operate real time information services. The shared infrastructure will enable developers to reuse components and cross-validate the applications, models and other tools that they develop.

The information content will come from crowd-based research and development; this is a winning formula for distributed and complex problems; the global information system will thus emulate the emergent approach of the Internet itself.

The information system will be operated in the same way as many other open source projects; there will be a global platform with a set of rules of conduct that regulate the system and ensure consistency and reliability.

Today, there is an overflow of raw and unfiltered data; relevant and irrelevant information are side by side. Decision makers suffer from an overflow of information, where individuals cannot see the forest for the trees; the new information system will change this. Regulators, government officials, managers in companies, treasurers, institutional and retail investors will get access to quality real time information that was designed as an input for their decision making process. The information system will improve the quality of the decisions taken and thereby improve the resilience of the financial architecture.

The recent financial crisis was exacerbated by herding behavior; better information will make it easier for decision makers to really find out, what is happening and what is optimal for them; this will increase the heterogeneity of decisions and thus contribute to more diversity, which translates into more market stability and thus a more resilience.

Implementation

The information system will be launched as an open source project. Developers from around the world will be motivated to contribute, because the system is open and offers economies of scale. Funding for the development will be network based; we propose to offer prizes as cash payments for the most valuable contributions; there will be daily, weekly, monthly, quarterly and yearly prizes. The prize money is a merit-based scheme to reward contributors. Similar to Wikipedia or the projects of the Mozilla Foundation, there will be a core team that will operate as a hub to coordinate the whole initiative. The information system will have no a priory limitations; the ultimate goal is to make the information system truly comprehensive holistic. A sponsor of the project is Lykke Foundation in Zurich.

12) Qualified money: Money as a multi-dimensional reputation system

Dirk Helbing

Problem addressed

From climate change to financial instability, many of the most challenging global problems are social dilemma situations where short-term individual interests lead to suboptimal socio-economic outcomes. We know from game theory, however, that mechanisms based on reputation systems are suitable to overcome these problems. The purpose of a reputation system is to avoid costly transaction failures arising from mismatched expectations. Reputation systems are currently spreading on the Web and are being used to evaluate goods, service providers and news. Typical examples are Ebay or Amazon. Because good reputation also pays off economically, there is an incentive for reputation-enhancing behavior. The principles of reputation systems could also be applied to money itself, thus endowing it not just with a quantity, but also with qualities. Such "qualified money" would be multi-dimensional and hence introduce multiple adaptive parameters. These new degrees of freedom would allow a better self-regulation of the financial system.

Mechanisms to address the problem

The one-dimensionality of money makes it a uniform medium of exchange, which is convenient but also comes at a high price. One-dimensionality basically implies that there can only be ups and downs. The bubbles and crashes that financial systems have been experiencing over the last hundreds of years may be a consequence of this. For a complex dynamical system such as the financial system to work well, it is important that there are enough parameters to allow the system to adapt. Trying to reach many different, non-aligned goals with just one control variable, e.g. through taxes, is an unfeasible control problem. Currently, the financial system suffers from insufficient control parameters. But most importantly, we have the technological capacity to implement a more sophisticated, multidimensional type of money.

What would happen if we applied the principles of reputation systems to money? If each unit of money could earn a reputation depending on its origin and transaction history, units of money could be treated like separate stocks. Thus money would be related not just to a quantity, but also to various qualities. This would make money multi-dimensional, akin to feedback and exchange systems in biological, ecological and also social systems.

Functional principles and expected effects

If we had "qualified money", something like a conversion factor would apply, which would determine the value of the money. The conversion factor would depend on the qualities of the respective money units, which would be given by multiple reputation values. In this way, the conversion factors would establish adaptive parameters. For example, Euros in a certain country could gain a higher or lower reputation (and value) than in other countries. If a country suffers from an economic depression, the conversion factor would decrease, and the corresponding devaluation of money would help the country to solve its problems through cheaper exports. In other words, the international financial system would have enough degrees of freedom for self-regulation to work again.

The qualifiers could also be made dependent on the history of transactions. If money were history-dependent, then money generated in certain ways (e.g. through environmentally friendly production) would gain additional value for a customer who cares about the specific characteristic. This would create incentives to invest in quality, not just quantity. Therefore,

the downward spiral leading to “tragedies of the commons” could be overcome. There would be a competition for money of higher quality. Note that what properties enter the qualifiers could be decided by regulators in a top-down way, in a democratic way, or also in a bottom-up way, by letting potential customers choose their own quality filters. The latter would establish an implicit negotiation process between sellers and buyers, i.e. it would give customers more influence on features of products and price formation than just the decision to buy a product. In this way, customers would have a louder voice to inform producers what qualities they value and what factors they care less about. If this influences the corresponding conversion factors strongly enough, it would be an effective way of improving quality standards and sustainable production practices.

Implementation

"Qualified money" could be implemented with reasonable effort for any electronic money transaction system. For example, it could be built on the existing SWIFT and credit card transaction schemes. Qualifiers could be quantities such as the local origin of transactions, but also any other recorded feature that would be considered relevant for the reputation and value of money. Note, however, that ensuring the protection of the privacy of individuals and other sensitive data is a critical part of the implementation. For example, sensitive kinds of information would not be made publicly accessible. Both anonymization and aggregation of data will be needed.

Another important question is: who would decide the qualifiers, i.e. the reputation criteria? One could start with a top-down approach building on institutional decisions, but to successfully cope with a system of high complexity, it seems advisable to eventually enable a bottom-up (i.e. user-based) self-regulation. Then, the reputation would be decided in a decentralized way, by each decision-maker, based on his or her preferences and values. This would respect personal preferences, taking into account that certain criteria, which determine high quality for some, might represent poor quality for others. People would create their own reputation filters and share them with others, who may modify them according to their own perspective. Therefore, opening up recommender data to everyone would enable the evolution of an “information ecosystem”, in which reputation filters would steadily improve over time.