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Stabilization of Financial Markets and Institutions in Light of Behavioural and Evolutionary Economics

Introduction

The existence of similarities between the process of living organism evolution and the process of changes in financial markets and businesses was noticed a long time ago by proponents of neoliberalism[1] and the Chicago school[2] in economics. On the basis of those views it can be proposed that there also exists a significant analogy between the stability of economic systems, especially financial ones, and the stability of ecosystems. In many respects they are subject to analogical laws. Therefore, the observed rules governing ecosystems can be used to investigate the stability of financial markets and systems. At the time of the economic crisis that has been unfolding since 2008, this may be an interesting voice in a discussion on successful methods of preventing such developments in the future. In this context, the role of the state in the economy cannot be omitted in the discussion. The topics presented in this article include the concept of stabilizing economic systems structured on the basis of achievements in studying the stabilization of ecosystems and the role of the state in the economy. I purposefully attempt to investigate the influence of the state on economic processes drawing on similarities between the economic environment and the natural environment: the analogy between firms' efforts to survive and the efforts of individuals to pass on their genes and the ubiquity of free selection. We are all a part of nature and subject to its rules. It is therefore nothing strange that investment decisions are in many cases made on the basis of "animal spirits", as argued in their fantastic book by

[1] Milton Friedman, *Capitalism and Freedom*, University of Chicago Press, 1962.

[2] George J. Stigler, *The Citizen and the State: Essays on Regulation*, University of Chicago Press, 1975.

George Akerlof and Robert Shiller[3]. By arguing that the state plays a similar role in the economic system to man in nature, the interactions between a market and the state intervening in the market can be described by studying the analogies of man's influence on nature. Similarly as with man and nature, some of the effects will be favourable, but some will be very adverse. The analysis of the issues from a completely new perspective will make it possible to present a new and innovative view and may be an interesting voice in discussions between the supporters of John Maynard Keynes[4] and the followers of Milton Friedman[5].

Analogies between an evolutionary theory[6] of the firm and Charles Darwin's evolution theory call for a closer look at ecosystem stability research as an inspiration for investigations into the stabilization of economic and financial markets. Searching for evolutionarily stable strategies in the economy may help to prevent future financial crises.

Investigating any system in terms of its stability usually covers two areas:

- The internal stability of the system, consisting in its ability to maintain the same parameters despite disturbances originating from elements of the system; In other words, the system must have an evolutionarily stable strategy such that no change of the strategy will cause any population (in the case of an) or firm or industry (in the case of an economic system) to gain an advantage.
- The external stability of the system, consisting in its resistance and resilience in the case of changes in external conditions.

The role of the state should be, on the one hand, to allow businesses to find evolutionarily stable strategies and, on the other, to soften and mitigate external factors affecting the functioning of the market. Below, I propose a model of activities promoting financial institution and market stabilization based on an analogy to mechanisms governing natural ecosystem stabilization.

It seems warranted to claim that the experiences of the 2008/2009 worldwide financial crisis and the 2011 eurozone crisis put the issues of financial system stabilization at the centre of the attention of both politicians and a large community of scholars. Everybody remembers how the Great Depression of the 1930s ended. The growing social tensions brought populist dictatorial systems to power in Europe and consequently brought about the outbreak of the Second World War a few years later. Therefore, in view, on the one hand, of the consciousness of the consequences of a global financial crisis and, on the other hand, of the scale

[3] George A. Akerlof and Robert J. Shiller, *Animal Spirits: How Human Psychology Drives the Economy, and Why it Matters for Global Capitalism*, Princeton University Press, 2009.

[4] John Maynard Keynes, *The General Theory of Employment, Interest and Money*, London: Macmillan, 1936.

[5] Milton Friedman, *A Theory of the Consumption Function*, Princeton University Press, 1957. Milton Friedman, *A Monetary History of the United States 1867–1960*, Princeton University Press, 1963.

[6] Charles Darwin, *The Origin of Species*, New York: Signet Classics, 1958.

of costs needed to evade them (Paulson's bailout in the USA and the European aid schemes cost a total of U.S. $4–5 trillion), it is small wonder that the issue of financial safety and the stability of the system is treated on a par with sovereignty and the military security of the state.

1. Natural ecosystem stability

It appears reasonable to argue that in view of visible similarities between the processes of firm and market evolution and the natural processes of living organism evolution and the analogies between the functioning of the human mind (logical/mathematical intelligence and emotional intelligence[7]) and the functioning of firms or banks there should also be similarities in rules concerning the stabilization of ecosystems and financial markets. A comparison of the stability of both kinds of systems should start from presenting the key conditions that, if satisfied, ensure that ecosystems remain in equilibrium.

Ecosystems as structures show numerous similarities to market/financial systems.

Like markets/financial systems, ecosystems have the following characteristics:

- spatial limitation,
- existence of food chain connections in the system,
- constant flow of matter (money flow in the financial system),
- constant development and change,
- ability to self-regulate and be resilient to outside disturbances (system stability).

The ability of a system to function at the same range of certain variables is known as homeostasis, a term used by Walter Cannon in 1932[8]. Homeostasis is to a large extent a feedback mechanism. However, its effectiveness depends on several features of a given ecosystem. Princeton University professor Robert MacArthur[9] considers the following the most important:

- greater genera variation and wealth,
- succession-readiness of the system.

Succession in an ecosystem is a constant process resulting from changes in the system and a niche being taken over by new species (as a result of evolution in response to climatic changes or natural disasters) or conquerors. The classic succession model introduced by Frederic Clements treated an ecosystem

[7] Daniel Goleman, *Emotional Intelligence*, New York: Bantam Books, 2005.

[8] Walter Cannon, *The Wisdom of the Body*, New York: W.W. Norton & Company, 1932.

[9] Stephen D. Fretwell, *The impact of Robert MacArthur on ecology*, "Annual Review of Ecology and Systematics", 6, 1975: 1–13, retrieved from http://people.uncw.edu/emslies/ecology/impactofmacarthur.pdf

as a single integrated organism undergoing constant changes[10]. While Clements's classical theory has undergone great changes since it was proposed, it remains an important part of ecosystem stability research. The incredible similarity between this description and the features of financial markets is hard to ignore. Today, succession is described as a process of natural changes in the genera composition and population structure in a given area. There are two kinds of succession:

- primary (autogenic) succession consisting in claiming a virgin environment,
- secondary (allogenic) succession consisting in population and ecosystem response to a change in external factors.

From the point of view of financial market and economy stability, the process of allogenic succession is the most interesting. It is important that the process should occur in an organized, forecastable way, as a result of which periods of large uncertainty will be avoided. However, it is worth noting that ecosystems are usually not stable through long periods, which is the effect of short-duration climatic changes and numerous other factors that are not fully recognized (including, for instance, human activities). Mass extinctions, genus replacement, and accelerated succession follow. These, however, increase flora and fauna diversity.

UWM, Olsztyn, professor Stanisław Czachorowski[11] has shown the following in his mathematical simulations:

- The numbers and populations of various species within the ecosystem depend, proportionally, on the availability of resources;
- Inflow of external energy (e.g. biomass) increases both the number and the populations of genera;
- Genera diversity increases the stability of the system;
- Migrations among systems increase diversity;
- Low frequencies of disturbances and catastrophes increase genera diversity;
- A dominant strategy among populations under environmentally stable conditions is the strategy of a specialist, who tries to achieve an advantage and a better match through far-reaching specialization;
- Under unstable conditions, the dominant strategy is the conservative strategy of an opportunist, who puts resistance to possible changes over specialization;
- The conservative strategy is dominant in primary succession, the specialist's strategy is dominant in secondary succession.

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[10] Frederic E. Clements, *Plant Succession and Indicators*, New York: The Wilson Company, 1928.

[11] Stanisław Czachorowski, *Wpływ nieciągłości krajobrazu na liczbę i liczebność gatunków – model symulacyjny* [Landscape discontinuity effect on the number of species and their populations – a simulation model], [in:] Tadeusz Puszkar and Ludyna Puszkar (eds.) *Współczesne kierunki ekologii – ekologia behawioralna*, Lublin: Wydawnictwo Uniwersytetu Marii Curii-Skłodowskiej, 1997: 399–412, retrieved from http://www.uwm.edu.pl/czachor/publik/pdf-s/czach-s-46.pdf.

2. Stabilization of financial and economic markets and stabilization of natural ecosystems

By transferring the rules and principles that apply in nature to the world of business and finance, it is possible to build a model of procedures improving the stability of financial markets and economies based on natural laws.

When building an ecosystem-based market model, it is critical to ensure such conditions for the functioning of financial institutions and other firms that they can apply evolutionarily stable strategies. In nature, an evolutionarily stable strategy is the "Tit for Tat" (TFT) strategy proposed in game theory by the Canadian mathematician and game theorist Anatol Rapoport. It consists in undertaking collaboration with another individual and then repeating the other party's latest response. This strategy, known as delayed reciprocity, turns out to be the most effective survival strategy. However, it requires the ability to memorize the moves of the other player so that the game is a no zero-sum game, iterated, with an unpredictable ending. Enabling businesses and other entities to apply this strategy may substantially increase economic stability. The following are necessary for the successful application of TFT or related strategies:

a) Efficient and fair functioning of the legal system, prompt exercise of the law and any contract made, punishing traitors but also enabling them to return to society once they have served their penalties, expressed their repentance, and declared the will to continue to work on a fair basis. Honesty being the best strategy according to game theory, it should be ensured that it can be applied in practice without the risk that traitors might achieve unusual gains through betrayal with impunity increasing their adaptation.
b) Good access to information for all market participants. With full information, the entropy is the least, and so are the levels of uncertainty and chaos. Access to information reduces the risk of information arbitrage among market participants and thus reduces the risk of speculative bubbles.
c) Preventing the risk of instability of the financial system. Destabilization of the financial market immediately affects the stability and condition of the entire economy. As shown by the examples of the 2008 Iceland crisis[12] or the more recent 2013 Cyprus crisis, the fall of banks may lead to the collapse of a country's entire economy, which is immediately reflected in the condition of all entities in a given market, unrelated to the finance industry. Therefore, ensuring the stabilization of the finance sector is particularly important for the economic stability of a country. As a result, the management of a system risk boils down to ensuring the stability of the finance system. Such stability will be ensured if the entropy of the system does not increase. It is thus crucial

[12] Willem H. Buiter and Anne Sibert, *The Icelandic banking crisis and what to do about it: The lender of last resort theory of optimal currency areas*, CEPR Policy Insight, 26, 2008.

to develop methods of measuring relevant data that may indicate an entropy increase resulting in a system risk increase. Such methods, perfected by the Basel Committee, are found in successive recommendation (Basel I, Basel II, and Basel III[13]). The financial supervision (whether consolidated or separate) must constantly monitor both external and internal conditions affecting system entropy.

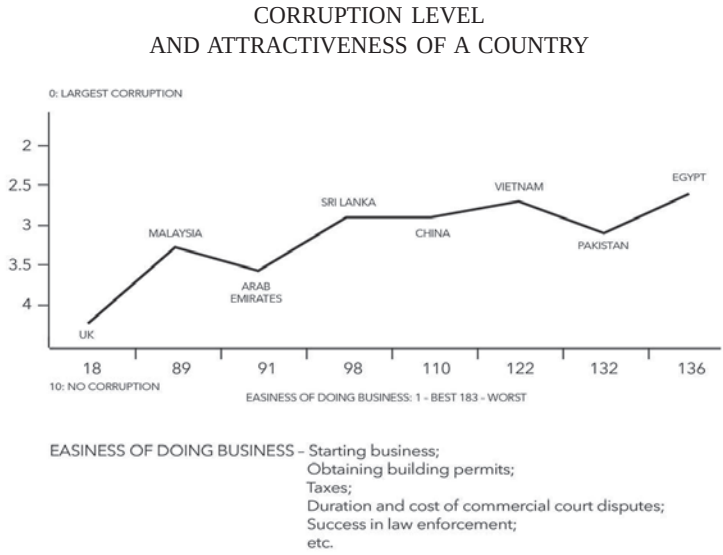
Figure 1

Correlation between law quality/transparency and the position of a country in the Global Opportunity Index (GOI) for 2011. The GOI defines the level of attractiveness for foreign direct investments

Source: Own work based on K. Savard, H. Wickramarachi, R.C. DeVol, A. Prabha, *Global Opportunity Index, Attracting Foreign Investment,* Santa Monica, California: Milken Institute, 2013, retrieved from http://www.globalopportunityindex.org/

[13] *Basel III rules text and results of the quantitative impact study issued by the Basel Committee,* 16 December 2009, retreived from http://www.bis.org/press/p101216.htm.

Figure 2
Correlation between corruption and the country's position in the World Bank's 2011 Ease of Doing Business rankings



Source: Own work based on the World Economic Forum's Global Competitiveness Report 2011–2012, Schwab (ed.) The World Bank's Doing Business 2012, and the Transparency International's 2011 report.

According to the International Monetary Fund, the following are among the main internal risk factors that may destabilize the finance sector:

Risks:
- credit risk
- liquidity risk
- interest rate risk
- exchange rate risk
- concentration risk
- profitability risk

} capital adequacy protected

- TC and IT infrastructure risk — specialist process supervision

Risks:
- management error risk
- operational risk
- legal risk
- reputation loss risk

} management and process quality control

The two kinds of risk factors are components of my own DNA model of the firm. In order to successfully apply the principles of evolution theory, I built a model that described the firm as a living organism, with actual DNA that undergoes mutations. The firm DNA consists of two strands, similarly to the true DNA (deoxyribonucleic acid), whose structure was discovered by Watson, Crick, Wilkins, and Franklin in 1953. The left strand (H = hard data) relaters to all hard data concerning the firm. These are the data that can be described and stored on information carriers. They comprise all kinds of financial information concerning the firm (including a balance sheet, an income statement, a cash flow statement, etc.), legal information about the business conducted (all contracts, rules and terms, internal procedures, etc.), organizational structure, employment terms, and all possible data that could be analysed in the course of a most thorough due-diligence examination. As this strand contains data DNA that can be subject to logical analysis, in my model this part of the firm DNA is associated with logical/mathematical intelligence (IQ). Generally, the H strand corresponds to the following spheres describing a particular firm: financials, normative documents, and technologies. The S strand (S = soft data), in turn, relates to the employees' knowledge and experience, their logical/mathematical and emotional intelligence, as well as the internal relations within the firm and the management system. Every business has its own unique DNA strands.

Regarding most of the components of these risk factors, figures have been established which allow a fairly easy assessment of potential market growth (cf., e.g., the CAMELS system in the USA or the BION system in Poland).

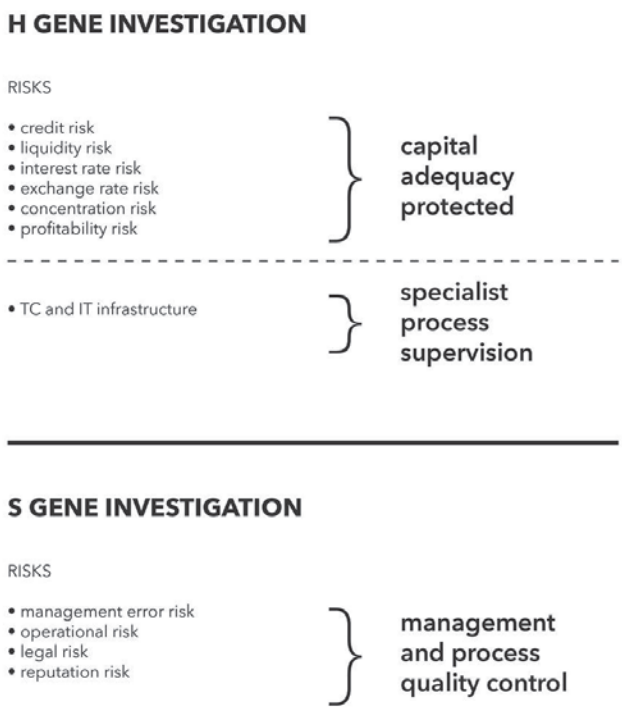
Jan Krzysztof Solarz[14] believes that the following are among the basic functions of a finance system:

- generating information about possible capital investments and allocations,
- investment monitoring,
- corporate governance enforcement,
- facilitating commerce,
- risk management and diversification,
- facilitating and helping savings.

It is obvious that if any of the above functions is substantially not fulfilled, the system's internal stability will be threatened. The role of the regulator is to create and then enforce laws preventing the attacks of mutants using strategies of betrayal and dishonesty.

[14] Jan K. Solarz, *Zarządzanie ryzykiem systemu finansowego* [Financial system risk management], Warsaw: PWN, 2008, p. 20.

Figure 3
Risks



Regardless of the issue of mutant attacks and the possible reduction of financial stability, note should be given to the aspect of epidemic and pandemic events in the financial system. It is hard not to notice analogies between the ecosystem and the economy. They occur on three levels:

a) Complications in diseases
   - in the case of one individual, every infection results in a drop in general immunity and in the likelihood of complications;
   - in the case of a financial institution we talk about credit portfolio infections. Such an infection occurs if a client has several loans and has stopped serving one of them. Even though the remaining ones are served when due, with no delays, the regulations require that a provision should be made for all the loans because it is likely that they will stop being repaid as well.

b) Epidemic events
   - a virus appearing in large human (or animal) populations spreads rapidly resulting in an epidemic;
   - 21st-century financial institutions mostly offer their products through very extensive sales networks. Consequently, any mutant attack, owing to its scale, has a mass nature resulting in an epidemic.

In nature, it is the easiest to fight those viruses that kill their carriers quickly, because that limits the speed and scale of epidemic spread. Similarly in the economy, an aggressive mutant will be noticed quite quickly, and recovery measures will be undertaken. The most dangerous mutant is one that allows the system to work longer (usually leading to speculative bubbles or financial pyramids).

c) Pandemics
   - Pandemic events have emerged with the development of globalization and travelling facilitations. Pandemic events have occurred at least five times since the beginning if the 20th century (the Spanish flu of 1918–1919 killed more than 50 million people worldwide).
   - Globalization is also responsible for crises on a global scale. This applies not only to toxic products being offered globally, but also, for instance, to currency crises.

3. External stability of the system

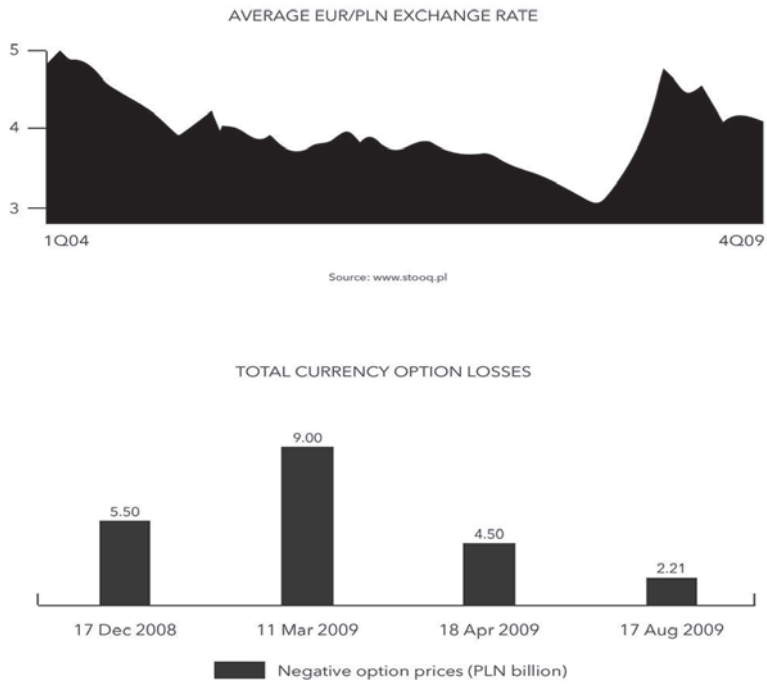
The loss of the stability of an economic and financial system as a result of external factors can be said to be a risk in the case of phenomena or events disturbing or even preventing the normal functioning of the entire financial system. From the point of view of game theory, what is important is the state's guarantee of the safe functioning of TFT strategies, which, among others, requires protecting the market from mutant attacks (by a population or a firm/financial institution that applies a parasitic, treacherous strategy that erodes the earlier evolutionarily stable strategy). This may lead to domination in the population, destroying or marginalizing local firms.

This case can be seen using the example of Hungary, where, on the one hand, most of the banking sector was allowed to become the property of foreign investors and, on the other hand, prior to the 2008 crisis, the banks could make euro- or Swiss franc-denominated mortgage loans on a large scale. Such loans were extremely popular owing to their much lower interest than in the case of Hungarian forint-denominated ones. The banks that offered these products were mutants in the economic environment. They offered foreign-currency loans to customers who earned forints, exposing them to currency risk. Additionally, without liabilities in those currencies they secured foreign funding (usually through currency swap or CIRS transactions), often with the help of their parent companies. In effect, the entire market became dependent on external funding, and the finance sphere broke away from the real economy.

Similar mutant attacks as in the case of Hungary have taken place in all Central European countries. The strategy of offering foreign-currency loans gave such huge advantages to the players that few banks, even those with local, national shareholders, could resist the temptation (Getin Bank, which I managed at the time, was a very active player in that market, too). The subsequent scale of

the destabilization of the finance sector, and thus the occurrence of the economic crisis risk, depended exclusively on the success of local financial supervisors in restricting the development of foreign-currency lending.

Figure 4
Option contract losses of Polish companies



Source: Office of the Polish Financial Supervision Authority.

Currency options hit the news in Poland in 2008, when many companies, mostly exporters, lost substantial amounts under option contracts. There were also cases, however, where there had been no reason to enter into such contracts: they were wrong investment decisions. From 2004 until the autumn of 2008 the Polish zloty continued to appreciate; the trend was good for importers and people with foreign-currency liabilities, but not for Polish exporters. As the Polish zloty strengthened, euro-denominated revenues reflected ever smaller zloty revenues. whereas the costs usually continued to be paid in the national currency. Additionally, exporters who received the amounts due to them with delays effectively received less money compared with the date of sale. To minimize their currency exchange losses, exporters gradually came to rely on currency derivatives, despite their initial reservations. With the options, they hedged against the risks of lower zloty values by accepting premium expenses (the cost of risk asymmetry). In

reality, instead of incurring the premium costs, the companies often decided to use zero-cost option structures. Consequently, for put options exporters began to issue reverse call options, as a result of which, with suitable transaction parameters, the premiums summed up and the companies effectively did not pay for entering into the transactions. As a result, together with the export income, the exporter hedged against currency rate swifts (rises or falls) because the export goods receipts balanced the option items.

The currency option crisis resulted from those companies issuing options worth several times the value of the options they purchased. That was when irrationality set in and investment risk emerged, as this transaction structure – with the weakening zloty which exposed issuers (exporters) to high losses – involved speculation rather than hedging. In 2008 companies counted on further zloty strengthening. Unfortunately, the autumn of 2008 saw a reversal in the trend, and the Polish currency began to quickly weaken. As a result, companies that had issued call options were forced to sell large quantities of currencies at previously set fixed rates, which resulted in heavy losses. Until December 2008, undertakings reported PLN 1.3 billion currency option losses to the ministry of the economy. In late 2008, the Polish Financial Supervision Authority determined that of the 99 listed companies that had been involved in option deals 35 had suffered losses. The Warsaw Exchange-listed companies that had incurred substantial derivative losses included: Police S.A., Puławy S.A., Ciech S.A., Forte S.A., DUDA S.A., Zelmer S.A., Sfinks Polska S.A., Apator S.A., and Erbud S.A. The media put the total currency option losses at PLN 40–50 billion, but they did not have accurate sources. Beginning in December 2008, the Polish Financial Supervision Authority published reports in which it presented information about the negative impact of currency derivatives, especially on the earnings of undertakings. As the zloty began to appreciate again in the second quarter of 2009, the currency option problem was gradually eliminated.

Company: Police
Industry: Chemical
Founded: 1964
Loss: PLN 124 million

The problem can be seen in detail on the example of Police S.A., one of Poland's largest chemical companies, one of the so-called Great Chemical Synthesis undertakings. Police made a debut on the Warsaw stock exchange in 2005. As a result of currency option contracts, it suffered one of the largest losses in Poland in 2008: PLN 124 million. A restructuring plan was immediately implemented, forming the basis for talks with banks about additional loans to meet the company's debts. The company's chief executive was replaced, and in 2011 the former CEO brought action for damages on the grounds that the option contracts had legal defects. However, the court found that no regulations had been violated. The Ministry of State Treasury carried out a special audit to see if companies had not entered into options to speculate on currencies. No irregularities were found as a result of the audit at the Police company.

The negative results of derivative transactions, threatening insolvency, were also recorded by Odlewnie Polskie S.A., a company doing castings from a full range of foundry materials at factories located in the town of Starachowice. From February 2009 to June 2010 the company was in bankruptcy on account of its currency option liabilities, which the court put at close to PLN 100 million. In April 2010, the company entered into an agreement with its creditors, whereby banks became its shareholders.	*Company*: Odlewnie Polskie S.A. *Industry*: Manufacturer *Founded*: 1899 *Loss*: PLN 100 million
Krosno, the manufacturer of soda-lime technical glass, is another example. In view of the huge liabilities relating to the currency option transactions entered in 2009, the earnings of the company deteriorated dramatically, and the management of the one of the oldest listed companies was forced for file for bankruptcy. Because the amount of the liabilities exceeded the company's assets, court experts concluded that it was impossible to restructure the company and it had to go into liquidation.	*Company*: Krosno Glass Works *Industry*: Glass and ceramics *Founded*: 1923 *Loss*: PLN 39 million
Katowicki Holding Węglowy S.A., the hard coal extractor, did not predict the currency option downturn and invested counting on quick profits. This move was in all probability purely speculative as only 10% of the company's output was exported.	*Company*: Katowicki Holding Węglowy *Industry*: Coal mining *Founded*: 1993 *Loss*: PLN 200 million
At Jastrzębska Spółka Węglowa, Poland's largest coking coal producer, investments in currency options were also motivated by speculation. The company lost nearly PLN 100 million. However, a spokesman for the company stressed that it was a relatively small amount that would not impact significantly on the undertaking's financial liquidity.	*Company*: Jastrzębska Spółka Węglowa *Industry*: Coal mining *Founded*: 1993 *Loss*: PLN 100 million
PKM Duda S.A. can be added to the long list of currency option mismanagement. Despite the chief executive's claim in December 2008 that the company had no currency options, in mid-2009 its losses turned out to be substantial leading to a 60% drop in share prices.	*Company*: PKM Duda *Industry*: Food *Founded*: 1990 *Loss*: PLN 80 million

The problem of option contracts also led to changes in the company managements that had made the wrong investment decisions. One example is Polna S.A., where because of the position of the largest shareholder, Zbigniew Jakubas, the then chief executive of the company did not obtain his vote of approval despite the generally good assessment of his management of the undertaking. At Pol-Mot Warfama S.A., a large part of whose option contracts were for currencies in which the company had no operations and were thus obviously speculative, the chief executive was also replaced.

The massive development of mortgage loan derivatives in the USA in 2000–2008 was a similar attack of a mutant strategy on a normal market.

It seems that reducing the risk of there being insolvent businesses is a good idea increasing the chances for an evolutionarily stable balance and the use of TFT (or similar) strategies by market players. The activities of rating agencies are one of the mechanisms preventing mutant (traitor) attacks on an economy. Unfortunately, the 2008 crisis showed clearly that the market for such agencies, dominated by three or four world giants, malfunctioned and did not fulfil its warning functions. Just a few days before the collapse of Lehman Brothers, its securities enjoyed the highest rating, AAA.

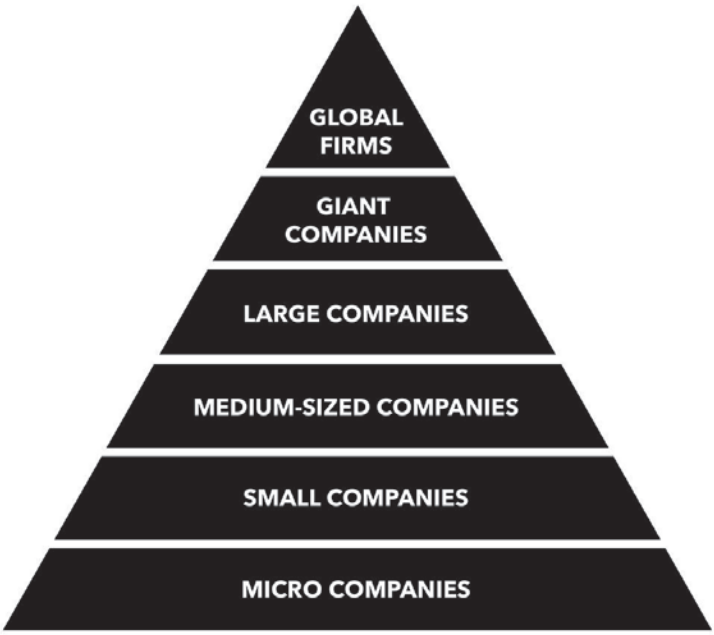
Without limiting the roles or importance of large companies such as S&P, Moody's, or Fitch, which do play an important role in providing ratings of the financial security of state or local government debt issues and which in many cases are the only entities with knowledge about and logistical means of investigating large international corporations, it has to be acknowledged that they are private entities and that it leads to possible conflicts of interests.[15] Owing to their global character and focus on investigating large and very large entities, and their costs, they remain outside the control of small, local businesses. In consequence, most of the local market cannot obtain an outside measurement of the security of debt issued. It would thus appear advisable to appoint a public rating agency obligatorily evaluating every issue above a certain level in every local market so as to increase trade security.

4. Resilience to external conditions and the capacity for smooth succession

By transferring the rules and principles applying in nature to the world of business and finance, it is possible to build a model of procedures improving the stability of financial markets and economies based on natural laws. It can be said that the stability of a market depends on the diversity and number of businesses and financial institutions in the market. The flatter the triangle shown in figure 5 is (the longer the base, the smaller the height), the greater the guarantee of a stable market. Local disturbances will be easier and faster to compensate for by other entities in the market. Where there is a large variety of businesses and no concentrations of small numbers of entities, the likelihood that in all circumstances there will be companies adapting well to the new conditions is much greater, thus increasing chances for predictable and possible succession in the market. Thus, the market will be definitely more stable.

[15] Danuta Dziawgo, *Credit rating na międzynarodowym rynku finansowym* [Credit rating in international financial markets], Warsaw: PWE, 2010.

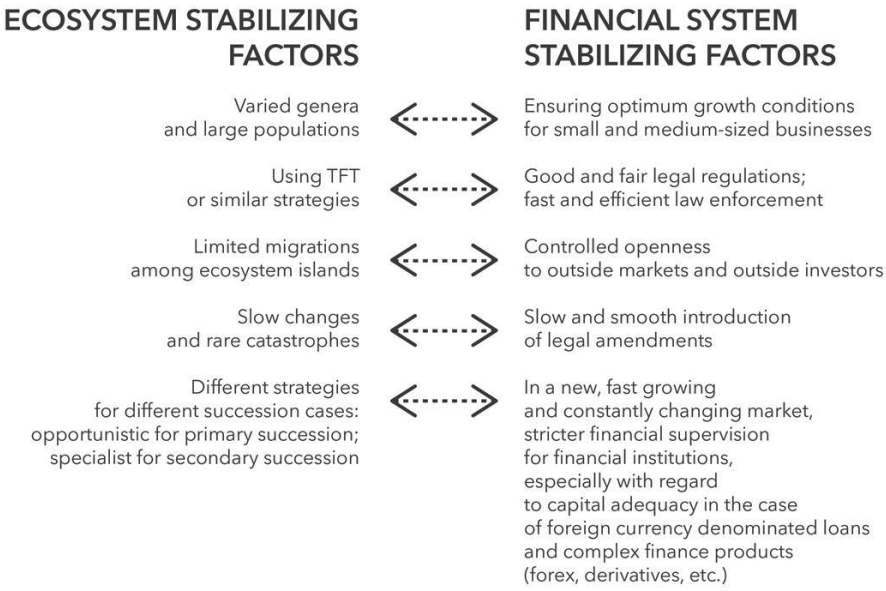
Figure 5
Company food chain



The role of the state and the regulators is, on the one hand, to maximally facilitate the formation of entities at the lower end of the business ladder presented in figure 5 and, on the other, to prevent the excessive growth of giant companies and global firms. Obviously, all adaptations and full succession require time. As a result of excessively abrupt changes, there may be too little time for market and business adjustment to the new conditions. In such cases, as in nature, catastrophic extinctions may then take place – businesses may terminate and collapse on a mass scale. It is, therefore, obvious that all major changes to the principles according to which a market functions must be properly spread over time.

According to Ronald Fisher's well known evolutionary theorem, ensuring a low dynamics of changes (both external and internal) will provide time for enough mutations, which in turn, in accordance with the theorem, enables favourable changes that increase the chances of survival. In other words, the more micro and small companies there are, the greater the chances that in the event of rapid market perturbations some of them will be able to adapt, keeping jobs and maintaining economic growth. The effect on the stabilization of financial markets is obvious. Hence, efforts to ensure that the largest possible number of small businesses are formed and that necessary (tax, legal, etc.) changes are evolutionary and not abrupt are key for market stabilization.

Figure 6
Financial market stabilization regulation model based on ecosystem stability rules



5. The role and scope of regulation in the financial system

At first sight, it seems that the natural environment is not subject to any limitations or regulations and there are no limitations to the process of evolution. That, however, is a misconception. For example, every ecosystem is limited geographically (it is an ecosystem island), and populations and entire species fight for restricted resources. When forming their mutual relations they search for evolutionarily stable strategies. Likewise in the economy, one could imagine a hundred percent free market, completely unregulated, but it would definitely not be stable and it would result in huge social tensions. Nonetheless, I do not I believe the state sector should play a larger part in the economy as in most cases the effectiveness and competitiveness of state entities is markedly lower than in the private sector. This does not exclude the necessity of regulating and controlling the rules of commerce in general, and those of banking and finance in particular. A comparison with aviation may be instructive. The state does not participate in it but manages and supervises it. It is difficult to imagine safe flying without air traffic control, but extreme liberalism praises the abandonment of all regulation and limitations and full market competition.

For this reason, the banking sector has seen the Basel I, Basel II and Basel III regulations, which are the regulator's response to new market challenges (especially

those resulting from product and technology developments and globalization). It is interesting, on the one hand, to compare the new banking regulations with laws applying to the stabilization of ecosystems and, on the other, to see what those regulations mean for bank DNA. Every important change in external environment conditions results in the need for adaptations, which after a while lead to new mutations. The new supervisory regulations concerning the banking sector and commercial banks introduced as a result of the 2008 crisis led to recommendations in 2009 that in fact required banks to increase their equity and ensure their liquidity (in line with the earlier company survival paradigm – liquidity).

Detailed assumptions on new Basel Committee proposals:

1. Increase own capitals of banks. Tier 1 funds (share capital and retained earnings) are to be the principal components. Other capital forms (Tier 2 and Tier 3) are to be gradually eliminated.

❖ ***Facilitates the use of the TFT strategy and prevents the attack of mutants using betrayal strategies***

1. Introduce additional capital requirements for international banks in view of the greater risk of their instability on account of a greater scale of operations and territorial dispersion. Additionally, a minimum standard of 30-day liquidity is introduced for such banks.

❖ ***Reduces and slows down (but does not eliminate) migrations between ecosystem islands***

1. Increase capital requirements for banks that actively engage in securitization or derivatives transactions or that invest in stocks or other securities.

❖ ***Enforces the adoption of an opportunistic strategy under primary succession***

1. Introduce a countercyclical framework for the establishment of reserves to cover operational risk. In good times, banks should build up reserves to cover losses during a downturn. Additionally, a higher solvency ratio would be required in good times, which would be reduced to a minimum level during a recession.

❖ ***Exact copy of the principles of the succession strategy choice: primary succession and large changes – opportunistic strategy (bank capital increased); secondary succession – specialist strategy (capital and liquidity requirements loosened during a slowdown)***

1. Put in place an additional capital requirement for banks showing rapid growth in lending.

❖ ***Prevents abrupt and catastrophic changes; smooth and stabilized succession***

1. Introduce the legal possibility of partly or completely restricting the payment of dividends and executive bonuses if the bank does not meet capital requirements covering potential, future risks in times of recession.

❖ ***Prevents mutant attacks***

1. Establish more restrictive rules for calculating risk in respect of incurred but not reported losses (IBNR).

❖ ***Prevents mutant attacks***

It is hard to resist the impression that most of the key regulations introduced by the Basel Committee in what is commonly referred to as Basel III are practically identical with ecosystem stabilization rules. This is good prognosis for the influence of those recommendations on the stability of the finance sector. However, when looking at bank DNA, it is difficult to avoid the impression that all the new recommendations boil down to forcing changes in the H strand, hard financial data responsible for logical/mathematical logic. It is regrettable that so far methods and regulations concerning the management of financial institutions have not been developed. Evaluations like CAMELS or BION provide some answers, but they are generally rather fragmentary in touching the problem of human capital at banks.

On the other hand, it is hard not to notice that creating lists of Systematically Important Financial Institutions (SIFI) is a major violation of the principles of natural selection (in the environment) and the free market.

The need to manage teams of executives in charge of financial institutions became apparent in the wake of the 2008 financial crisis. The widely accepted bank executive remuneration structures, which involved a very low fixed pay and huge success fees with incredible severance and contract termination benefits, promoted moral hazard games played by bankers. The reasoning was: “Accept all risk that may lead to high profits. If I’m successful, I’ll get millions of bonus pay; if the risk materializes, in the worst case I lose my job and get millions in severance pay.” In such situations nobody is interested in thinking in terms of the long-term security and stability of the bank.

The problem of wrong bank executive remuneration structures is strengthened by the shareholding structure problems of the largest banks. During the last 20–30 years, major dilution of the largest shareholdings has taken place as a result of

new issues, mergers, and acquisitions. Today, at most banks the lead shareholder usually has no more than a few per cent of the shares and can sell them on the stock market within a few days or weeks. Obviously then, the current price share is more important to the shareholders than the multi-year perspective of security and stability. Therefore, this raises a fundamental question: if neither the shareholders nor the executives care much about what the bank will be in five or seven years, who does?

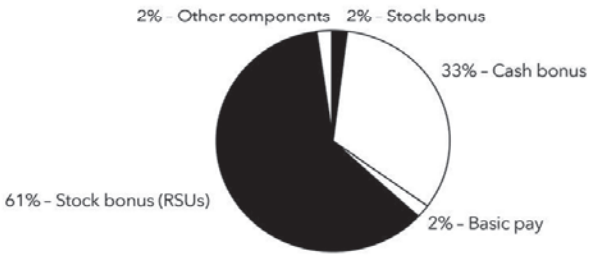
Table 1

Structures of CEO remunerations at the largest investment banks

AMOUNTS AND STRUCTURES OF CEO REMUNERATIONS
AT LARGEST WALL STREET INVESTMENT BANKS

Full name, bank	Year	Basic pay ($)	Cash bonus ($)	Other components (options, stock, other) ($)	Total ($)
LLoyd C. Blankfein **CEO Goldman Sachs**	2007 2006	600,000 600,000	26 985,474 27 243,500	42 738,878 16 233,652	70 324,352 44 077,152
James E. Cayne **CEO Bear Sterns**	2006 2005	250,000 200,000	17 070,740 12 721,154	21 028,932 15 533,246	38 349,678 28 454,400
Richard S. Fuld Jr **CEO Lehman Brothers**	2007 2006	750,000 750,000	4 250,000 6 250,000	29 382,036 11 172,645	34 382,036 18 172,645
John J. Mack **CEO JP Morgan**	2007 2006	800,000 800,000	0 0	802,458 36 729,106	1 602,458 37 529,106
Stanley E. O'Neal **CEO Merril Lynch**	2006	700,000	18 500,000	72 175,383	91 375,384
John A. Thain **CEO Merril Lynch**	2007	57,692	15 000,000	2 249,918	17 307,610

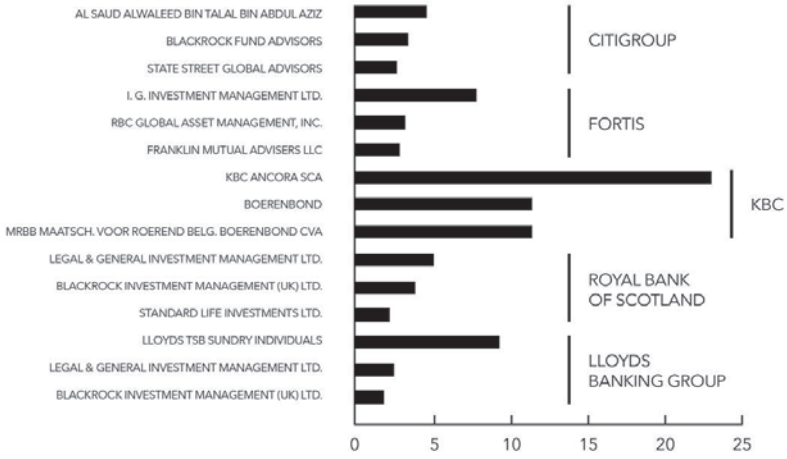
TYPICAL STRUCTURE OF SENIOR EXECUTIVE REMUNERATION
AT AMERICAN INVESTMENT BANKS



Source: Michał Mudel, *Strategia wynagrodzeń, która doprowadziła do bankructwa banki z Wall Street* [Remuneration strategy that led Wall Street banks to bankruptcy], Sedlak & Sedlak, 7 March 2009, retrieved from www.interia.pl/raport/biznes

Figure 7

Shareholder structures of selected banks and the number of days needed by the largest shareholders to sell all their shares assuming average daily stock turnovers in these securities (data from December 2007, before the outbreak of the 2008 crisis)



BANK	CITIGROUP	FORTIS	KBC	RBS	LLOYDS
Average daily stock exchange turnover as % of the entire company	1.23%	0.31%	0.42%	0.09%	0.21%
The number of days that the largest shareholder needs to sell all of its shares	3.34	10.44	54.05	56	42.43

Source: Own work based on FactSet and Bloomberg data FactSet, Bloomberg.

Final conclusions

Arguably, in order to alter the major bank boards' and shareholders' perceptions of risk, it would be good to introduce DNA changes that would enforce long-term thinking about those institutions. The first attempts to introduce such regulations have been made by European supervisors (including the one in Poland), who have set the lower limit of a fixed pay within the overall compensation packages of directors. For instance, in Poland the limit is 50%. This reduces managers' appetite for higher risk, as 50% of the package is paid regardless of current income. It is worth thinking about requiring every financial institution to have at least one lead, long-term shareholder, whose right to sell her/his/its shares would be dependent

on a supervisory consent, as in the case of acquisitions of substantial holdings. It appears that the requirement that every bank must have at least one shareholder owning 15–20% of the equity with restricted disposal rights (the holding would have to be sold in its entirety to a single buyer with at least the same credibility) would greatly change the long-term planning perspectives of the bank.

There are definitely too few efforts aimed at changing the current paradigm of bank management staff, internal standard, and shareholding structure control methods; the activities of bank internal control authorities are inadequate. The human capital of a bank is in many cases more important for its stabilization than the bank's solvency ratio or own capital. It is easy to imagine a bank that collapses though its solvency ratio is 100% or a bank with no capital at all (solvency ratio equal 0%), which still prospers and makes profits. Everything depends on the quality of the staff managing the bank. If the aim is to increase finance sector stability, research and new regulations should primarily focus on proper staff selection and appropriate motivation of that staff.

The article omits the issue of emotional intelligence, which plays a key role in the decision making process according to studies by Daniel Goleman and Daniel Khaneman and is decisive for the quality of management staff. In our increasingly variable reality, we deal with such a rate of changes that a solid fundamental analysis is impossible to perform. This results in an increase in the importance of intuitive and emotional decisions, which brings the economic environment even closer to the world of nature.

Regardless of the above, it seems reasonable to continue studies on epidemic and pandemic events in the financial sector. This article only pays attention to those phenomena marginally, but the possibility of applying epidemiological research into the speed, methods, and other aspects of virus spread to studies of the emergence of crisis situations in the financial sector appears promising.

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Summary

This article proposes the new methodology for the investigation of fluctuations in the level of financial sector and economy stability in analogy to ongoing research and experiments relating to the stability of natural ecosystems in biology. Pointing out an analogy between the natural evolutionary process and economic processes that force economies and businesses to change, I propose the methodology that adopts some rules governing the stabilization of ecosystems (such as the need for a large variety of organisms at each food chain level) for the purposes of analyses and research conducted to ensure the stabilization of the economy, especially the financial sector.

Keywords: evolutionary economics, behavioural economics, financial sector stabilization, TFT game-theory strategy