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FINANCIAL INNOVATION AND TECH-NO-LOGICAL PROGRESS

Abstract: Technological progress can be perceived as a sequence of micro revolutions, in term of speed and scope of change produced. With such characteristics, technology constantly challenges economic and societal values. Sustainability is a dominant development paradigm of contemporary world. But policy makers at national, regional as well as global level usually overlook the fact that sustainable development assumes sustainable financing. This point is of crucial importance in order to prevent mismanagement of future economic and social development. Old financial practice cannot be appropriate response to the underlying risks.

Some globally recognized financial experts argue that financial innovation could be appropriate answer. Robert J. Shiller [1], considered radical financial innovation as „the development of new institutions and methods that permit risk management to be extended far beyond its former realm, covering important new classes of risks." This quest for radical change in financial innovation came out only four years before global financial crisis exploded, just because of „too innovative" financial product known as subprime mortgages. Thus, financial innovation has two sides — bright side is creation of new tools to mitigate risk in economic system, and dark side — potential for creation more troubles in that system.

The aim of this paper is to analyze whether financial innovation, supported by rapid technological change, mitigate the existing risks in economic and social system, or simultaneously induce new risks and potential for new financial crisis.

Main methods are studies of the available relevant literature, regulation frameworks, and the best practices which could be of use in formulating some proposals which will make products and market more safe means of value creation and distribution.

Finding of this paper confirm that there are still unidentified threats connected with financial innovation process and it's unclear influence on future economic prospects of contemporary world.

Key words: *financial innovation, technological progress, information, financial markets*

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INTRODUCTION

Technological progress has seen as a main driver of economic and societal development. This factor drastically changed the shape of modern societies, and contributed their global interconnectedness. That radical change affects not only societies, but also individuals, companies, governments, institutions, etc. As Lerner and Tufano [2] noted these innovations may have broad implications for households, enabling new choices for investment and consumption, and reducing the costs of raising and deploying funds. Similarly, financial innovation enable firms to raise capital in larger amounts and at a lower cost than they could otherwise and in some cases (for instance, biotechnology start-ups) to obtaining financing that they would otherwise simply be unable to raise.

Sustainable development as a dominant developing paradigm must lean on dynamic and sound financial system capable to produce sustainable finance for future economic growth. Since finance is an inevitable input for all forms of production as well as consumption, every innovation in financial sector will have direct influence on economy and society.

This paper deals with the socio-economic interpretations of interaction between the financial innovation and technological progress. Heaving in mind that both processes have their inherent positive effects on economic and societal values, here is emphasized less visible, risk bearing side of intricate interplay between finance and technology. Traditionally, profit-maximizing entrepreneurs who spring up to commercialize new technologies were considered as a main drivers of economic growth. But Levine, Laeven, and Michalopoulos [3] argue that growth is also driven by the financial entrepreneurs who develop new ways to screen and fund the technologists. So, the flow of influence between technological progress and financial innovation can be seen as bi-directional process.

Frame and White [4] in their review paper provide a survey of the literature on financial innovation, with a special emphasize on the empirical articles. They find that descriptive aspects dominate academic research on financial innovation. The authors urge financial regulators to undertake more surveys of financial innovation and to make the survey data more available to researchers in order to foster empirical research on financial innovation and to better understand its economic and social effects.

From the regulatory point of view, Lumpkin [5] argue that regulators of financial system start from a premise that financial innovation are a natural outcome of a competitive economy. They are neither inherently good nor inherently bad. Innovation have the potential to provide for a more efficient allocation of resources and thereby a higher level of capital productivity and economic growth. Many financial innovation, Lumpkin note, have this effect and for that reason policymakers may wish to adopt a positive attitude towards innovative activities; that is, to start from a presumption of benefit until detriment is proven as opposed to the reverse construction.

One more controversy concerning financial innovation comes from different perception regarding its place of occurrence. Some authors, led by Schumpeter,

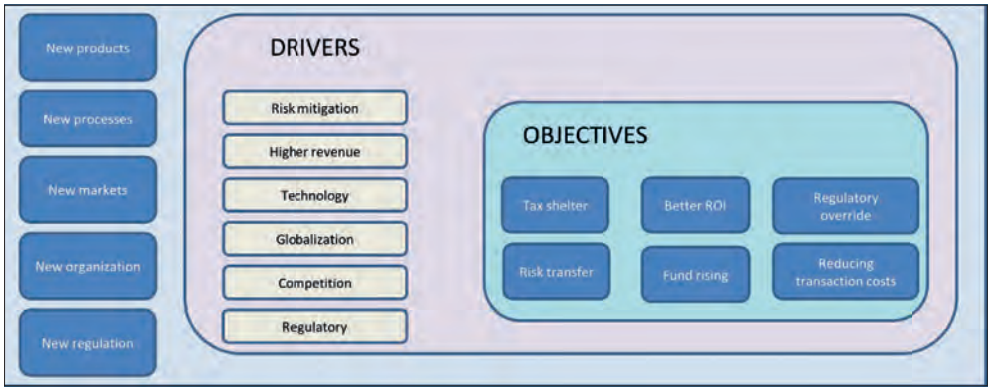
consider that the bulk of an economy's innovation was likely to occur in relatively large firms that possess significant market power (Schumpeterian hypotheses). Among other arguments, greater size of an enterprise allows it to benefit the economies of scale inherent in R&D facilities, which are necessary to yield innovations. Opposite perception comes from the Scherer and his followers who suggest that smaller firms, with (at most) only modest levels of market power, may be more likely to be rapid innovators, because of the competitive pressures that are absent in the world of monopoly.

As I noted in my earlier work [6], globalization means not only breaking barriers that lags international capital flows but also breaking ones that block transmission of financial crises. As globalization becomes more extensive, the spillover effect of the financial crisis is intensifying more than ever before. We need to rethink the hidden causes and paths of financial crises and their terrible consequences on economies and societies worldwide. Yes, the answer to this question is very close to the financial innovation and their role in creating additional systematic risk. 2008 global financial crisis raised fundamental question about the nature of financial innovation and their role in financial and economic stability on a global scale.

WHAT IS FINANCIAL INNOVATION?

According to Tufano [2] financial innovation is a process of the creation and diffusion of new financial products, services, processes, techniques and institutional forms. Viewed in this context, a financial innovation represents something new that reduces costs, reduces risks, or provides an improved product, service, instrument that better satisfies participants' demands.

In order to propose definition of financial innovation from different perspective I would say that financial innovation are socially and economically acceptable solutions to financial problems, based on creative use of financial theory and practice. Defining financial innovation this way I offer more generalized approach and value neutral definition which avoid numeration of aspects that financial innovation contribute.



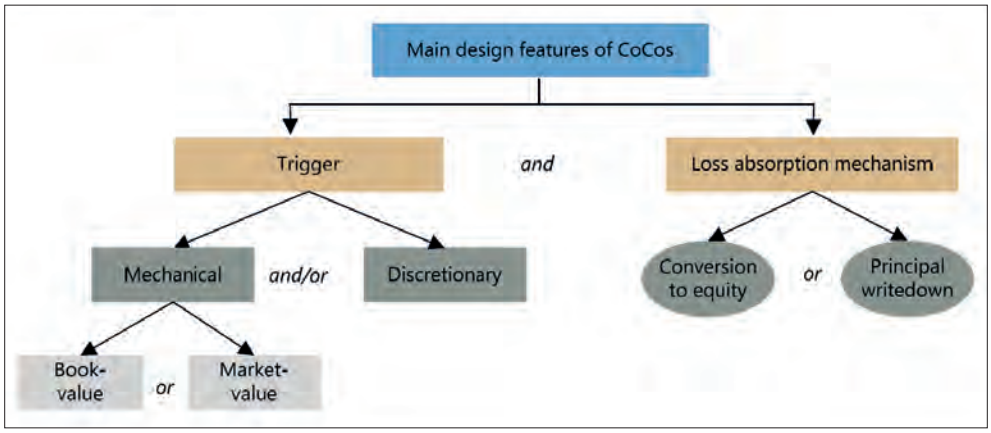
Picture 1. Classification, drivers and objectives of financial innovations [7]

The factors that encourage financial innovation are mainly connected with advances in underlying technologies, i. e. telecommunications and data processing, macroeconomic conditions, regulation, taxes and other influences.

In order to classify financial innovation we use Sanaj Banka [7] graphical presentation (Picture 1) which shows three aspects of financial innovation: classification according to functional approach, list of the main drivers of financial innovation, and the objectives one can accomplish by appropriate financial innovation.

Classification of financial innovations adopted by most researchers has a functional approach [8]. The most common classification of financial innovations includes the categories of:

1) New products. Contingent Convertible bonds (CoCos), are good example of an innovation-generated financial instrument that convert debt to equity during financial turmoil. Unlike traditional convertibles, which have predetermined con-



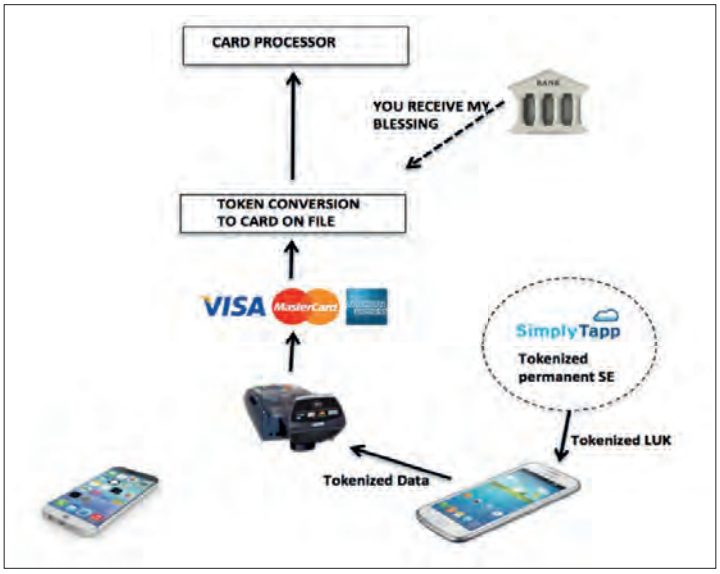
Picture 2. Structure of CoCos [9]

version date, CoCos are bonds that convert debt to equity, or are written off, after some triggering event such as a decline in a bank's capital below a threshold. Main characteristic of this newly invented credit derivative instrument is transfer of responsibility for bearing the costs of poor bank's performance from the taxpayers to the bondholders. The conversion process makes an interesting metamorphosis of a bondholder — form bondholder to a troubled-bank holder. At the very beginning, the CoCo market was relatively small, but it continue growing. Banks have issued approximately $70 billion USD worth of CoCos since 2009. CoCo's volumes have increased to grow with issuance in 2014 projected to be in the range of $75 billion to $100 billion. According to Moody's Investors Service[1] CoCo issuance peaked

[1] https://www.moodys.com/research/Moodys-Global-issuance-of-contingent-capital-instruments-drops-by-44--PR_335214, accessed on 18th January 2016, 8: 08 PM.

in 2014. Some expert expect issuance for the full year 2015 would total about $106 billion on an annualized basis, compared with USD 175 billion the previous year.

2) New processes. The highest-profile technology to hit the market is Apple Pay, which works with the iPhone 6 s. It lets shoppers store their credit card information on their iPhone and pay for goods by tapping the phone on an in-store receiver. Because of a technology called „tokenisation" experts say it is more secure than



Picture 3. Tokenization process

current card systems. With tokenisation, merchants receive data that obscures the shopper's actual credit card number, reducing the chance that hackers can steal usable data from merchants' internal systems. Because iPhones use fingerprint recognition to verify shoppers' identity, it is also nearly impossible for a thief to steal an iPhone and make a purchase (Picture 3).

3) New markets. Carbon markets are new infrastructure based on financial innovation, which helps financing reduction of greenhouse gas emission in developing countries since 2005, when the Kyoto Protocol came into effect. Emission reductions associated with projects that are used to generate financial assets known as „carbon credits" that are tradable in newly created carbon markets.

4) New organizations. Looking back to history, the transition from a sole proprietorship to a limited liability company was the silent revolution of the organizational forms of companies enabling the mortal beings — natural persons — to establish legal entities in the form of joint stock companies. This organizational innovation allowed that lifetime of such companies no longer depend on the lifetime

of their founders. Theoretically, a joint stock company can last indefinitely. Hence, in financial theory we need to model and to evaluate infinite stream of cash flows, which we call perpetuities.

5) New regulations. Many large banks suffered from deep losses of capital during the 2008 financial crisis. As catastrophic consequences confirmed later, many of them had inadequate capital levels. Such hard experience of bailing-out those who were „too big to fail" forced governments to increase level of resistance of commercial banks to external shocks as well as level of confidence in banking sector. As Pennacchi *et al*. [10] noted with the goal of avoiding such bailouts in the future, regulators have raised banks' capital requirements and reconsidered what debt-like instruments should qualify as capital. Basel III was supposed to strengthen bank capital requirements by increasing bank liquidity and decreasing bank leverage.

Next important aspect of financial innovation refers to the need for their quantification in order to measure financial development. Innovation in the manufacturing industry has focused mostly on patents, research and development expenditures (R&D), or share of research staff as indicators of innovative activity. The need for measurement of financial innovation opens up a number of practical problems. Unlike the manufacturing sector, in the financial sector patents and other copyright methods rarely exist. That is the reason why intensity of financial innovation cannot be directly measured. The indicators (the proxies) of financial innovation intensity practitioners usually use are as follows:

1) Private sector credit to Gross Domestic Product (PSC/GDP) ratio. The ratio of private sector credit (PSC) to Gross Domestic Product (GDP) is the most popular measure of financial innovation intensity. The Basel Committee on Banking Supervision in 2010 has issued a proposal to incorporate this approach into the regulatory system, by using the deviation from long-run trend of the PSC/GDP ratio (the 'credit gap') to calibrate a countercyclical capital buffer. In the first instance, this method uses the ratio of credit to GDP, thus allowing credit to grow naturally in line with overall economic activity. Trending techniques are then employed to generate a long-run mean for the ratio and the actual position is then contrasted with this mean. [11]

2) Financial R&D intensity (value added). This indicator can be calculated by collecting data on R&D expenditure in the financial intermediation industry from the Analytical Business Enterprise Research and Development database (ANBERD) of the OECD [12]. Most R&D data in financial sector are derived from retrospective surveys of the units actually carrying out or 'performing' R&D projects, and collected from enterprise surveys via the OECD/Eurostat International Survey of Resources Devoted to R&D from 32, mostly high-income, nations in the world from 1987 to 2006. This indicator are calculated by using financial R&D intensity relative to the value added in the financial intermediation sector.

3) Financial R&D intensity (cost). This indicator can be calculated the same way a as the previous one (value added), but here the intensity of the financial innovation is measured by standardizing financial R&D with total operating cost of banks. The information is drawn from OECD Banking Statistics.[2] Operating cost refers to total non-interest expenses. [12].

TECHNOLOGICAL PROGRESS AND FINANCIAL INNOVATION

Let me briefly comment some contradictory findings which are directly or indirectly connected with financial innovation in the context of technological progress. These findings provide evidence for both the innovation-growth and innovation-fragility hypotheses.

Let me start with discrepancy between theoretical and empirical research on financial innovation. Frame and White [4] find that descriptive aspects dominate academic research on financial innovation. There is still evident need for empirical research and more innovative empirical measures of financial innovation. What is contradictory in this fact is that measurement process of financial innovation is dominantly based on proxies of financial innovation intensity. Although financial innovation are achieved by innovative solutions, no innovative solutions in measuring that process in financial markets.

Apart from that gap between theoretical and empirical research, implementation of high-end theoretical innovative models and methods, have not always produced positive outcomes. On the contrary, Nobel prize (1997) theoretical financial innovation known as the Black-Scholes model for derivative pricing, caused enormous loss in US financial system just couple of years later. 1999 fall of Long Term Capital Management (LTCM) hedge fund management firm, whose board of directors were 1997 Nobel prize laureates Myron Scholes and Robert Merton initiated total loss 4.6 billion USD in six months.

Contradictory conclusions we find following even the single author considerations on financial innovation. Mishkin and Strahan say „Innovations in computer and telecommunications technologies (that) reduced both transactions costs and asymmetric information problems…" [12]. The same authors argue that „Financial intermediaries now function to unbundle risks, permitting more assets to be funded by less informed investors, thereby enhancing liquidity." [12]. Are investors, gaining ICT innovation, getting more or less informed, relative to their scope of choices? Technological progress in ICT, according to Mishkin and Strahan, reduces asymmetric information problem, which means investors are more informed and that way exposed to less risk. By broadening investment menu, investors use powerful diversification tool to reduce their investment risk, but the same time they are usually more puzzled by greater choices they need to take into consideration. From the diversification standpoint, „…the amount of risk that investors bear is reduced, as a consequence of the availability of a broader menu of assets, allowing greater diversification and risk sharing (Merton [1987], Mendoza

[2] Source: OECD Statistics 2010, OECD Banking Statistics, BankScope.

et al. [2008]). Some authors argue that financial development has made the world riskier and subject to „excessive risk taking" (Rajan, 2005) (Shin, 2009).

Financial innovation give investors new tools for diversifying portfolios and sharing risks, so it should make markets safer. But the theory that new financial products will make markets less dangerous doesn't always stand up. Consider these arguments taking into account mega process such as globalization of financial industry. Financial institutions are getting global and it size grew enormously, giving them opportunity to benefit economics of scale and scope. But growing size of the financial institutions becomes more problematic causing regulators selective law enforcement („too big to fail" principle).

Some authors [13] find more contradictory aspects of financial innovation. They find that countries where financial institutions spend more on financial innovation are better able to translate growth opportunities into GDP per capita growth. No doubt that industries that rely more on external finance and more on R&D activity grow faster in countries where financial institutions spend more on financial innovation. But such industries also experience more volatile growth in countries where financial institutions spend more on financial innovation. They also experience more volatile growth and more fragility. In countries where banks spent more on financial innovation before the crisis, they suffered greater reductions in their profits, relative to both total assets and equity.

CONCLUSION

Financial innovation have made a significant contribution to the economic development of the modern world. They are reflection of creativity, based on financial theory and practice, which offers solutions and opens up new possibilities for various financial entities. The expansion of new technologies, especially ICT, contributed to the significant growth of financial innovation, which enhanced efficiency of financial markets, enforced global flow of financial information and reduced cost of financial intermediation. The financial transactions became faster and more reliable, including lower cost associated with funds transfer.

Schumpeter's phrase „creative destruction" which acknowledges the erosion of value that established companies experience when another company introduces a radical innovation explains the role creativity play in innovation generating process. Creativity is a result of effective mixing knowledge and imagination. In our education systems we usually underestimate imagination, making huge effort only to enhance knowledge. This is one of the conclusions we seriously must take into account in reforming contemporary educational systems.

Culture of innovation in another dimension worth mentioning in the context of societal implication of innovation. If not enough innovative, a society must quickly adapt to innovations made worldwide. Not investing in *know-how*, every society, sooner or later, will ask itself *now how?*

Technological innovation can make huge contribution to unification of people (e. g. social networks) as well as their separation (digital divide). Biasness toward positive side of technological progress, make us blind to fact that enormous num-

ber of people suffer from informational poverty. According to *ICT Facts&Figures*, published by International Telecommunication Union in May 2015, globally 3.2 billion people are using the Internet by end 2015, of which 2 billion are from developing countries. However, 4 billion people from developing countries remain offline, representing 2/3 of the population residing in developing countries. Of the 940 million people living in the least developed countries, only 89 million use the Internet, corresponding to a 9.5% penetration rate.

At the personal level ICT has dramatically changed a form of our identity. Real identity becomes digital identity — a chain of binary digits. „I am who I am" doesn't work anymore. I am what the intelligence authorities think I am, based on my digital identity. All that process is conducted by sophisticated technology, which allows their user to browse through digital data recorded based on our activities and stored into digital archives. Today, we are witnesses of a slow transformation of „virtual reality" into „real virtuality". I coined syntagma „real virtuelity" to raise awareness of time people, especially children, spent with electronic devices such as TVs, computers, cell phones, etc. Use or misuse of technological innovation, especially financial innovation, is our responsibility. By concluding this paper with word responsibility, just want to recall that the roots of this word come from word response. Appropriate response to these conclusions is our future imperative.

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