Financial Instability and Financial Innovations

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Abstract: The paper aims to analyze in detail the concept of financial innovation. Thus, it is important to clarify the definition of financial innovation, to present the classification and functions of the financial innovations, to describe the link between financial innovations, the market and the agents. Therefore, all these are necessary in order to highlight the impact of specific types of financial innovations, with repercussions on economic policies related to financial innovations. In addition, their importance is correlated with financial instability involved by the financial innovations. Financial instability is an economic reality becoming more evident and more critical, having severe financial and real effects, whose processes and operating mechanisms must be understood in order to avoid or minimize the future periods of instability. Considering the contribution of financial innovation in creating this process, the paper considers their approach to be very important to address them.

Keywords: financial instability, financial innovations, financial crises, innovation policy, volatility

Introduction

Financial innovation, in times of favorable economic and financial conditions, rises the degree of uncertainty regarding the evolution of the exposures and the function of the markets in unfavorable circumstances. The past several years of rapid growth in credit derivatives and the important role of the non-bank financial institutions have taken place in a context of a relatively strong and stable economic growth, less concerned about the future level and volatility of the inflation, and characterized by low expected volatility of the asset prices. Even if a considerable part of these changes were durable, the economic science knows less about the function of the markets in conditions of stress.

1. The Definition of Financial Innovations

The sources of innovations can be analyzed from two perspectives: the demand theory of innovation and the supply theory of innovation.

According to the demand theory, the innovations are a response to the demand of business entities that want to acquire competitive advantage in their business environment (demand-driven innovations). This demand is influenced either by the internal needs of the business entity aiming at improvement in its activity or by the changes in its environment requiring the proper adjustment in its business strategy.

According to the supply theory, the innovations are firstly created by the innovation providers and then they are implemented in the business entities (the end-users of innovations). This category of new solutions is a result of a process of three phases: (1) the creativity phase, (2) the innovation phase and (3) the diffusion phase.

The main features of the financial innovations are: 1) they can be entirely new solutions or just traditional instruments in which new elements of construction have been introduced, improving their liquidity and increasing the number of their potential applications as they are better suited to the circumstances of the time; 2) they can be used as substitutes to the traditional financial instruments, improving the financial situation of the business entities using them; 3) they cannot be easily assigned to one particular segment of the financial market; 4) they can be used to hedge against the intensive volatility of the market parameters; 5) they can be used in a form of complex instruments including several simple, traditional financial instruments; 6) they can be used in a form of new financial processes or techniques or new strategies that primary use these new products [5].
Other approach to the financial innovations definition states that they can be categorized as: (1) product innovations (which include new financial instruments, contracts, techniques and markets); (2) process innovations (the process innovations are connected with improvements in the processes of securities distribution, transaction payments or assets valuation); (3) risk-shifting innovations (where there can be distinguished two sub-categories: i) the instrument innovations, where a new instrument is designed and created with in order to achieve a particular set of characteristics, so they are ex-ante innovations and ii) the post-contract innovations, where the risk characteristics is changed after the original instrument is used, so they are ex-post innovations).

A broader definition may describe financial innovations as changes in the functioning and the new solutions and developments in: (1) financial markets, (2) financial institutions, (3) financial instruments and (4) regulations connected with their activity.

According to the narrow approach, the financial innovations are defined as any new developments in financial instruments (entirely new instruments, combination of traditional instruments, modification of traditional instruments, and new application of existing instruments).

According to the broad approach, the financial innovations include any new developments in any elements of the financial system (markets, institutions, instruments and regulations).

2. Classification of the Financial Innovations

The financial innovations can be classified according to various criteria, from which the most important include: (1) sources of innovations (supply-driven innovations, demand-driven innovations), (2) factors influencing the process of creation and implementation of innovations (external factors driven innovations, internal factors driven innovations), (3) the motives of using the financial innovations (adaptive innovations, aggressive innovations, defensive innovations, protective innovations, responsive innovations), (4) the elements of the financial system where the innovations occur (financial market innovations, financial institutions innovations, financial instruments innovations, financial regulations innovations), (5) the types of innovations (product innovations, process innovations, risk-shifting innovations), (6) the effect of the financial innovation application (sustainable innovations, harmful innovations), (7) the moment of creation (ex-ante innovations, ex-post innovations) and (8) the underlying assets (debt-linked innovations, equity-linked innovations) [5].

3. Functions of the Financial Innovations

Financial innovations may be classified into three categories regarding their functions: (1) market-broadening instruments (which increase the liquidity of the financial markets, ensure access to new investment opportunities to surplus units and improve the availability of funds to deficit units), (2) risk management instruments (which enable to reallocate financial risk to those market participants who are less adverse to it or better prepared to handle with it) and (3) arbitraging and processes instruments (which give the opportunity for the market participants to benefit from differences in costs and returns between markets).

According to another classification of the financial innovations based on their functions, financial innovations are divided into five groups: (1) price-risk transferring (which provide market participants with more efficient means for dealing with price or exchange rate risk), (2) credit-risk transferring (which are used in order to reallocate the risk of default), (3) liquidity-generating (which have three different consequences: they increase the liquidity of the market, they enable deficit units to look for additional sources of funds and they allow market participants to avoid unfavorable regulations), (4) credit-generating (which increase the amount of debt funds available to the deficit units) and (5) equity-generating instruments (which provide the access to the additional sources of equity capital).

Regardless the classification of the financial innovations functions, there are two important problems that should be taken into account while analyzing the impact of the financial innovations on the financial system: the potential changes in the efficiency and stability of the financial system. The sustainable financial innovations should be beneficial in reducing the negative elements of the financial system, by decreasing level of risk, closing the information gap, lowering the transaction cost.
and minimizing the tax payments. Therefore, they should also maintain the stability of the financial system and increase its efficiency.

4. Innovation, the Market and the Agents

The theory of the dynamics of innovative industries is based on two assumptions: i) new industries are not very well known, so learning will be conducted about the strength of these innovations, ii) in these industries it is difficult for outsiders to understand and monitor managers’ actions, and therefore there is moral hazard. These assumptions explain the financial innovations waves. Moral hazard leads to endogenous crises.

Innovation waves may determine boom and bust cycles. Uncertainty, information asymmetry and learning are key features of such waves [1].

The value of the innovation is uncertain and agents progressively learn about it. With some probability, the innovation is robust, otherwise it is fragile. In the first case, default risk in the innovative sector is low, while in the second case it is high. In time, investors and managers conduct rational Bayesian learning. When aggregate default rates are low, the beliefs regarding the strength of the innovative sector improve, which leads to an increase in the size of the innovative sector and of the compensation of its managers.

If defaults are frequent, the generated pessimism leads to a decline in the size of the innovative sector. Innovative sectors may be plagued by information asymmetries. It is difficult for outsiders to understand the insiders and to monitor their actions. In the innovative sector, each manager must exert costly and unobservable effort to reduce the probability of failure of his project. For example, one manager can invest in a portfolio of CDOs. If the manager exerts effort, he scrutinizes the quality of the CDOs. Alternatively, the manager is opting for risk; therefore, he would rely on evaluations. Furthermore, managers have limited liability. This diminishes the ability to punish failure. To provide incentives for risk, investors must ensure rewards to agents in case of success. When the moral hazard problem is critical, the rewards are above the market clearing wage (the managers in the innovative sector earn rents, although they are competitive).

While shirking increases the probability of default, it is assumed that the increase in risk is stronger when the innovation is fragile, because strong industries are likely to be more robust to shirking than fragile ones. Therefore, after years of success, managers become confident that the industry is solid. They exert effort, believing that the project will be successful. Because the confidence is increasing, agency rents grow very large. Investors may find it cheaper to give up on incentives, to avoid paying very large fees. In that case, the actions switch from effort to risk-taking. This switch in the action of each manager distorts the distribution of outcomes towards more frequent failures. Because the burst in aggregate default results from the taken actions, the financial crisis is endogenous.

Because finance is intangible and complex, learning and information asymmetry are important features of this industry. Initial successes are followed by an increase in the complexity of jobs and the magnitude of rents in the finance sector.

There are two possible regimes, depending on whether the incentive compatibility condition binds or not. In the first regime, the market clearing condition determines the equilibrium compensation of the managers.

\[
M_t^* = M_t
\]

\[
E(M_t^*) = E(M_t - M_t^*)
\]

As illustrated in figure 1, in this regime the supply and demand curves on the labor market intersect above \( R_t \), so the incentive compatibility condition does not bind. In the second regime, as illustrated in figure 2, the supply and demand curves on the labor market intersect below \( R_t \). The incentive compatibility condition binds (\( M_t^* < R_t \)), and the expected managerial compensation is \( M_t = R_t \).
Since this is above $M^s_t$, managers from the innovative sector earn greater expected compensation. Although they are competitive, they earn rents, which make working in the innovative sector very attractive. The number of managers who want to work in that sector is therefore above the demand for their services:

$$G(M_t) = \int G(R_t) > \int F(S_t - M_t)$$

![Figure no. 1 Supply, demand and rents when there is no rationing](image1)

where $M^s_t$ is the expected compensation of the manager, $\int G(M^s_t)$ is the mass of managers who, given this compensation, prefer to work in the speculative sector, and $\int F(S_t - M_t)$ is the mass of investors who also choose that sector; $M^s_t$ is the market clearing expected compensation and $R^s_t$ the rent which must be left to managers to incentivize effort. When $M^s_t > R^s_t$, there is no rationing. When $M^s_t < R^s_t$, there is rationing.

5. The Impact of Financial Innovation

Financial innovation and the developments in financial markets imply higher maximum loan-to-value ratios (higher values of the fraction of the asset value that can be used as collateral) and greater financial market depth (lower values of the productivity of capital). Assuming that the initial value of the fraction of the asset value that can be used as collateral is not particularly low, figure 3(a) illustrates how these changes have made crises less likely (darker areas in the chart correspond to a higher crisis frequency). Figure 3(b) illustrates the increase of the severity of crises (darker areas correspond to a more severe crisis) [6].

A reduction of capital reduces both the likelihood and scale of crises. If the secondary market for capital is deeper, shocks can be better absorbed; therefore, the demand curve in the traditional sector is flatter.

By contrast, an increase in the fraction of the asset value that can be used as collateral increases the severity of crises. The rise in the fraction of the asset value that can be used as collateral enables intermediaries to borrow more. Therefore, investment is higher, and crises will be more severe when they occur. Greater borrowing increases the probability of crises. However, a rise in the fraction of the asset value that can be used as collateral means that intermediaries have greater access to liquidity in the next period, which means that they are less likely to go into total liquidation, making crises less likely.

Crises are most frequent for intermediate values of the fraction of the asset value that can be used as collateral; therefore, middle-income emerging market economies are the most vulnerable to systemic
instability. Countries with well-developed or underdeveloped financial sectors, that present high/low loan-to-value ratios, are less vulnerable to crises.

Maximum Loan-to-Value Ratio, Financial Market Depth and the Probability of Crisis

Figure no. 3 Financial innovation and the probability and scale of crises

6. Analyzing the Impact of Specific Types of Financial Innovations
The development of the financial sector is characterized by an expanding variety of financial products. The stock of financial products affects the production of new financial ideas as following:

\[
\tau = F(\mu, L)^{\lambda + \theta} A^\varepsilon
\]

where \( \tau \) is the quantity of financial innovations per unit time, \( \mu \) is the fraction of the labor force employed by the financial sector, \( L \) is the aggregate stock of labor (assumed to embody a fixed amount of human capital per unit of labor), \( F \) is a productivity parameter, \( \lambda \in (0,1) \) is an elasticity parameter, and \( \theta \in (0,1) \) measures the extent of spillovers from existing financial products (the idea is of a positive externality emanating from each financial innovation: financial innovators may build upon the ideas already introduced by other innovators; innovation begetting innovation corresponds to the “innovation spiral”); \( \varepsilon \in (0,1) \) measures the impact of technological innovations on the rate of financial innovation[7].

The financial sector comprises financial innovators and financial intermediaries. The financial intermediaries produce new financial products and services using labor that is diverted from the production of the final consumption good and from real research and development activities. These include different types of innovations. Type A innovations (instruments that aim to aid the innovative real activities, such as bank loans, venture capital, joint stock) and type B innovations (instruments that assist corporate growth or expansion, such as bonds) are those related to the basic role of finance as an intermediary in relation to production investment, either to initiate activities (A), or for growth, expansion and extension (B). Type C innovations (modernization of the financial services themselves, such as personal checking accounts, ATMs, E-banking) improve the performance of the financial
system. Type D innovations (profit-taking investment and risk, such as mutual funds, CDs, bonds, IPOs, junk bonds, derivatives, hedge funds) reduce the apparent risk of investment activities for clients and facilitate the profit-taking of the original investors, in the case of venture capital, and of subsequent investors. Type E innovations (instruments that are used in order to refinance obligations or mobilize assets, such as swaps, acquisitions, mergers, takeovers, futures) point the role of financial services as vehicles for mobilizing existing assets or facilitating the change of ownership of these assets. Type F innovations (questionable innovations, such as foreign exchange arbitrage, fiscal havens, off-the-record deals, pyramid schemes) are the manipulative activities practiced by financial agents that are socially undesirable even if they are sometimes legitimate.

6.1 Type A Innovations
The predominance of these innovations during the cycle may be modeled as an increase in $\beta$, the parameter characterizing the extent of spillovers of financial development on the rate of innovation. An increase in $\beta$ raises the steady state growth rate of the economy and reallocates labor from the final goods and research and development sector to the financial innovation sector.

6.2 Type C Innovations
This type of innovation is modeled as an increase in $\varepsilon$, the parameter that measures the elasticity of spillovers from research and development to financial innovation. An increase in $\varepsilon$ raises the steady state growth rate of the economy, and reallocates labor from the research and development sector to the final goods and financial innovation sectors.

6.3 Types B, D and E Innovations
Types B, D and E innovations are very effective in improving the efficiency of financial intermediation. The prevalence of these types of innovations can be modeled over other types as an increase in the productivity parameter in the dynamic equation for financial innovation, $F$. Therefore, for the same amount of human resources channeled into the financial innovation sector, more financial innovations are created per unit time, leading to a higher increase in $\tau$, and consequently $\xi$, where $\xi$ is the intermediation coefficient (which measures the efficiency by which savings can be transformed into productive investment). While the steady state growth rate of the economy and the distribution of labor across sectors remain unchanged, the efficiency of financial intermediation, per capita consumption $c^*$, and capital per worker, $k^*$, will be permanently increased.

6.4 Type F Innovations
Type F innovations do not result in additional real production or creation of new wealth. These rent-seeking activities are redistributing the existing income. In addition, they may reduce the public confidence in the financial system and the efficacy of financial intermediation. Therefore, they have the opposite effect as innovations of types B, D and E.

7. Innovation Policy
Innovation is very important for achieving economic growth and competitiveness: innovation may be a key contributor to long-term welfare. Innovation is the engine of economic growth, which is central to increasing welfare. Innovation fuels economic growth by creating new markets and reaching new productivity levels.

Innovation policy around the world is becoming more complex; this complexity is more visible in a multi-level government framework. A well-conceived innovation strategy must use a large set of tools.

But innovation is a very difficult subject for public policy: it is a pervasive and elusive subject. It is pervasive because it entails both government and private investment; because it permeates all areas of public policy, from supply-side to demand-side policies; because it requires actions at the global, European, regional, national, and local level. Innovation is also an elusive subject because it is hard to be defined and because there is no unique solution in order to benefit from the potential of innovation in a specific country: regarding the innovation policy, quality, quantity, control and speed are very important. This is why governments want innovation, but no government is sure of how to increase its full potential.
The most important problem in creating the innovation policy is that the innovation patterns change even more quickly for policy-makers, and by the time a new generation of innovation policy reaches the market, it is already obsolete. Current policies that seek to stimulate innovation are the result of what we understood about innovation since the 1960s. These are supply-side innovation policies, which look at the financing of new ventures by coupling public and private resources. Only recently the policy-makers started to take into consideration the demand side.

A greater part of the initiatives in support of innovation is based on the use of financial instruments such as loans and grants. The funding instruments (such as equity funding and the risk sharing finance facility) aim to solve the typical problem faced by some tools in support for small and medium enterprises (the large size of loans, which is unfit to serve small and medium enterprises), by credit lines set up with commercial banks that are managing the small and medium enterprises financing. Figure 4 shows the major instruments available during the different phases of the life of small and medium enterprises and the “valley of death” (from the time when a start up firm receives an initial capital contribution to when it begin generating revenues).

Businesses may face a set of different constraints that go beyond the availability of equity funds. For example: (i) the lack of an internal market limits the incentive to develop new products, due to differences in technical standards, legal fragmentation and divergent conditions for market access; (ii) the lack of clear and effective rules on technology transfer limits firms’ potential to exploit the excellence in basic research; (iii) the predominance of national interests in the innovation policy limits the size of accessible markets and the possibility for firms to engage in profitable cross border co-innovation initiatives, which would bring together the most productive and innovative companies from all cooperating member states; (iv) the lack of a comprehensive view of the innovation value chain leads policymakers to over-invest in funding instruments and under-invest in cheaper policy instruments such as demand-side policies [3].

The innovation policy should take a holistic approach; it is currently too one-sided, too supply-sided, too narrow, not efficiently multi-level, obsolete, and too slow.

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<th>Demand-side innovation policies</th>
<th>Supply-side innovation policies</th>
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<td>3.1. Public procurement</td>
<td>R&amp;D support (grants, tax incentives, public venture capital)</td>
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<tr>
<td>3.2. Regulation</td>
<td>Provision of scientific base (research centers, infrastructure, trainings, mobility programs)</td>
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<td>3.3. Support for private demand</td>
<td>Information &amp; brokerage (international technology watch, benchmarking, patent databases)</td>
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<td>3.4. Promotion of user-driven innovation</td>
<td>Networking measures (incubators, science parks, cluster support)</td>
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<td>3.5. Systemic approaches</td>
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**Conclusions**

The modern financial system is characterized by high pace of innovations that can occur in any of its elements: markets, institutions, instruments and regulations. The financial innovations from the financial system can be classified according to various criteria.

Despite the differences in the applied classifications, the theory of financial innovations is mainly focused on their effects upon the financial system.

The sustainable financial innovations are required; as they enhance the efficiency of the financial system and by this they can improve the economic growth and increase the social wealth. However, some of the financial innovations may have some negative side-effects upon the financial system, offering benefits to the single participants and simultaneously being harmful to others. Thus, the efficient usage of particular financial innovation requires an extensive knowledge about its way of functioning and a thorough analysis of its consequences.

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