“Is the progress of financial innovations a continuous spiral process?”

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Is the progress of financial innovations a continuous spiral process?

Abstract

The paper examines the progress of financial innovations over the past 30 years, beginning with how they have influenced the financial system. The article adopts a framework of classification that provides an overview of previous findings to examine the continuity of financial innovations. The authors find that the progress of financial innovations is discontinuous and is characterized by isolation and limited research studies. Finally, the authors highlight the main reasons why the previous literature in this area is limited and how financial innovations have not yet reached the point of diminishing returns.

Keywords: financial innovation, spiral effect process, survey.
JEL Classification: G00, O31, O33.

Introduction

Financial innovation is the process of the creation and diffusion of new financial products, services, processes, techniques and institutional forms. The analysis of financial innovation aims to examine the reasons why there is a need to be introduced in a market and to evaluate the economic impact of this activity (Tufano, 2002).

The variety of financial innovations shows the difficulty of classifying them. A classification according to one characteristic is not representative because most financial innovations can fall under more than one category. Therefore, the alternative classification adopted by most researchers has a functional approach (Finnerty, 2001). The most common classification of financial innovations includes the categories of: (1) new products; (2) new procedures and services; and (3) new forms of companies.

The various imperfections of financial systems urge the appearance, development and function of financial innovations in the following main sectors (Merton, 1992; Tufano, 2002; Frame & White, 2004):

1. *Regulation and taxes*. Financial innovations can be a partial solution to taxation constraints and markets' regulatory constraints.
2. *Inefficient markets and transaction costs*. Financial innovations must satisfy investors' expectations in terms of market completion, capital transfer, concentration and circulation in space and time.
3. *Risk management, asymmetry information and agency costs*. Risk exposure causes disorders but also encourages companies and intermediaries to innovate by offering their customers new products or by advising them to take advantage of new risks.
4. *Macroeconomic conditions*. Rising globalization and macroeconomic instability are phenomena that require the creation of financial innovations because companies, investors and governments are exposed to new risks (e.g., monetary policies, inflation, exchange currency risks, etc.).
5. *Research and technology*. New forms of financial products, services and processes are created because of new methods for portfolio management, new ways of making transactions and new evaluation techniques using technological and IT innovations.

The above sectors are characterized by interdependence. When this interdependence is very strong, alterations and shocks in one sector can affect, sometimes with high intensity and speed, all other linked sectors. The degree of dependence can vary in quality and time and yet interdependence is a fact. Thus, the consequences of financial innovation are important overall for the economic sector and market participants, and they regard:

1. *The markets' functional frameworks*. They include the effective management of various portfolios and their risks using financial innovations and the creation of financial instruments and the analysis of innovative products that are issued and negotiated in domestic and international financial markets.
2. *The companies' microeconomic functional frameworks*. They include the decrease in transaction costs, dealing with asymmetric information, effective systems of administration motives, the expansion of competition forms between financial institutions that issue national or international services, the development of technological progresses in payment, service and information systems and the changes in the strategy of liquidity management.
3. *The companies' and states' macroeconomic functional frameworks*. They include the financial innovations that have brought about changes in the dynamic macroeconomic analysis, in credit extension and credit quality, in the credit creation process, in monetary policy issues and in banks' funding policies.

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The previous literature on financial innovation can be divided according to several broad criteria such as their functionality and degree of change they invoke (Finnerty, 1992; Frame & White, 2004, 2009). We develop a spiral framework to examine whether the progress of financial innovations has been continuous over the past 30 years. The purpose is to examine whether there have been constant research hypotheses about the main issues of financial innovations over the past 30 years.

The structure of the remainder paper is organized as follows. Section 1 discusses the major findings of the previous literature on spiral classification frameworks. Section 2 analyzes the findings on the progress of financial innovations. The final section summarizes and concludes.

1. The spiral effect of financial innovations

The introduction of financial innovations can be considered to be an arbitrage opportunity for investors, caused by market frictions and Pareto improvements (Citanna & Cass, 1998). In such cases, innovative investors try to find profitable securities and take advantage of price deviations. This arbitrage opportunity is available only to innovative investors because of their potential to issue new securities and processes and because of their experience of handling friction costs at will. In such cases, financial innovation can continually remove items from the list of non-trading assets by introducing new instruments that render assets effectively tradable.

This phenomenon can create a wave of innovations. Market frictions and the multiplication of transactions make possible the creation of new financial products to ameliorate the market's efficiency in combination with technology. Thus, transaction volumes increase and investors and intermediaries trade in order to counterbalance their exposure to risk. This increased volume of transactions reduces margin transaction costs and thereby new financial products, services and strategies become possible that, in turn, increase the volume of transactions.

The success of such a process encourages all sectors of the financial system to continuously innovate and lead the progress of financial innovations. Since markets and market participants are characterized by interdependence, the degree of financial structure changes and macroeconomic conditions (employment, interest rates, etc.) alter.

In order to examine the above phenomenon, we consider the previous literature on financial innovations to be a part of a spiral effect process of classification. This refers to: (1) the design and nature of financial innovations; (2) the conditions of the economic environment that acts upon financial innovations and vice versa; (3) the empirical study of the diffusion models of a financial innovation and adopters' characteristics (investors, companies, consumers); and (4) the consequences of financial innovations on financial markets and economic activity. This spiral process is presented in Figure 1 below. For our analysis, we only included previous studies that involved the presentation of a research question containing persuasive arguments.

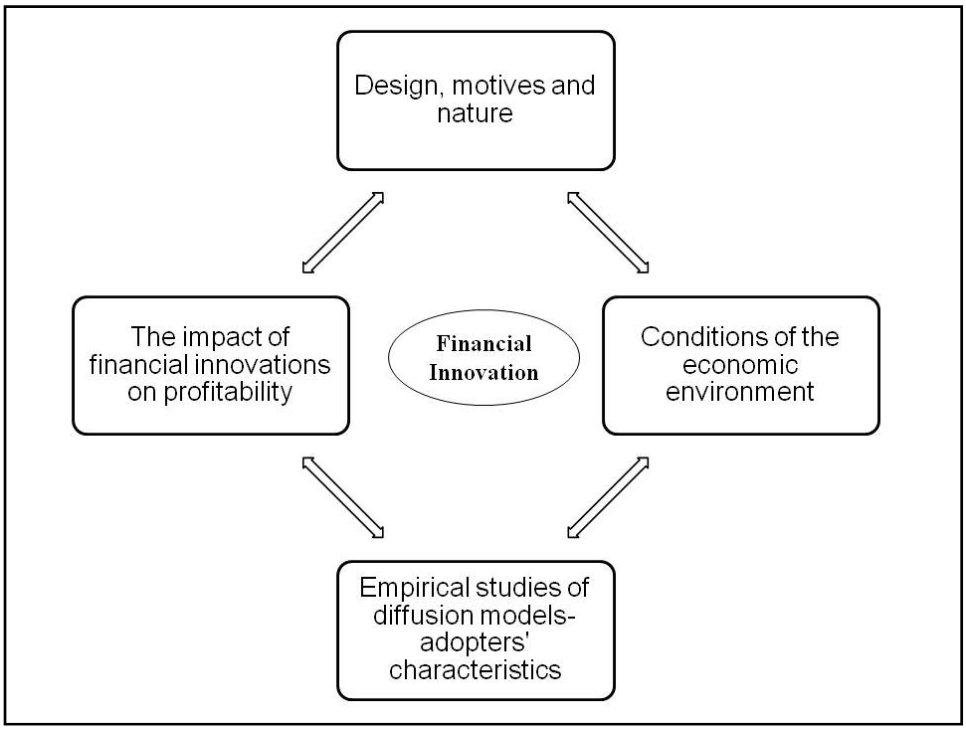

Fig. 1. The spiral process of financial innovations

The multiplication of research in one category makes possible the creation of new relevant research questions. Thus, the volume of research should increase over time and the continuity of the process can reveal the progress of financial innovations over the years. This multiplication of research can affect any economic sector.

In order to examine the momentum and the distribution of the volume of the relevant research to multiple sectors, we code the following ones: (1) the banking sector (transactions and payments, new banking products, banking technology, etc.); (2) companies and financial intermediaries (new company forms or/and company clusters that deal with similar or complementary activities, new processes, etc.); (3) the macroeconomic level (households and agents, inflation, etc.); (4) the market and securities (effectiveness, liquidity, new bonds, etc.); and (5) other cases (patterns, research, evaluation, etc.).

1.1. The design and nature of financial innovations. The design and nature of financial innovations have posed major questions to researchers, which have developed study cases for financial innovations, from both a theoretical and a practical point of view, particularly during the 1990s.

The main idea is that the demand and supply of financial innovations are functions of players, whose actions are limited by limitations such as financial intermediation, marketing costs, information aggregation and policy rules. Thus, financial innovation seems to be the natural combination of supply and demand and the players' limitations (Ross, 1989; Harris & Raviv, 1989; Duffie & Rahi, 1995). Moreover, Ireland (1995) combined two main ideas about the nature of financial innovations in an equilibrium model: (1) the process of a financial innovation is an endogenous factor and is considered to be an investing plan; and (2) the process of a financial innovation comes with an important initial cost that could complicate the relation between liquidity demand and floating interests. If the process of financial innovation includes significant but stable initial costs (because of the market's reaction to the new security), then the decision about the innovation will be taken only if bargain costs exceed certain threshold levels.

Various studies in the 1990s focused on the design and sales of new asset-backed securities and junk bonds (Madan & Soubra, 1991; McConnell & Schwartz, 1992; Boot & Thakor, 1993; Molyneux & Shamroukh, 1996; DeMarzo & Duffie, 1999), short sales constraints (Allen & Gale, 1991; Chen, 1995; Pesendorfer, 1995), asymmetric information and the design of new securities (Demange & Laroque, 1995) or investment bank motives to innovate, particularly market shares (Carrow, 1999; Bhattacharyya & Nanda, 2000; Grinblatt & Longstaff, 2000).

In some cases, the financial institution is seen as an innovator intermediary that plans profit based only on the transaction and service offer (Cuny, 1993; Hara, 1995; Ohashi, 1995). New forms of transaction services and techniques (cards, ATMs, Internet banking, etc.) have been developed in combination with technology (DeYoung, 2001, 2005). Their successes depend on the transaction rate, technological development and its effect on economies of scale and on the powerful administrative organization and practice.

In recent years, investment banks have promoted a series of complicated products (such as credit default swaps or asset-back securities), and thus financial innovations have added greater complexity to the financial sector. However, the latest global crisis in the financial markets raised fundamental questions about the nature of financial innovations and their role in financial and economic stability (Plosser, 2009). These questions mostly focus on the misrepresentations that gave impetus to the latest crisis and suggest general reforms of financial products to decrease distortion costs that relate to complexity, agency problems and credit risk (Calomiris, 2009).

Figure 2 presents the number of research studies on the design and nature of financial innovations by sector and date. It shows that there was an enormous research effort in 1990s, particularly concerning the market securities and intermediaries. However, other cases have been marginalized and the research positive effects about the design and nature of financial innovations have diminished over the years.

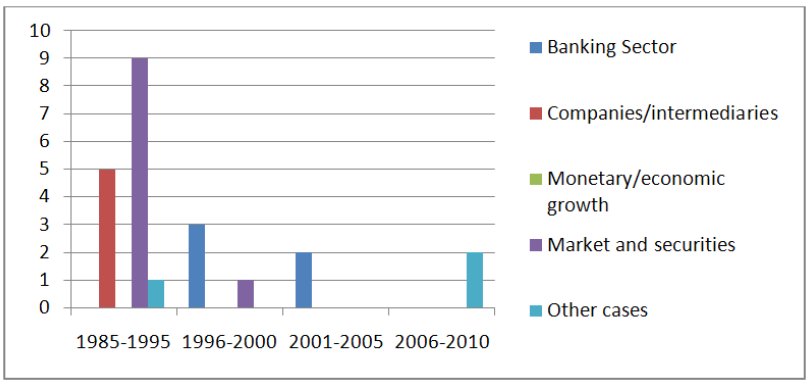

Fig. 2. The design and nature of financial innovations

1.2. The economic conditions that stimulate financial innovations. Dynamic economic conditions are one of the main factors that stimulate the creation, emergence and diffusion of financial innovations. These conditions are underlying generative mechanisms, and they can be either within the company (liquidity, management, intermediate costs, productivity, merging, etc.) or external (interest rate level, inflation, technological changes, economic activity, regulatory infrastructure, demand and supply factors of financial products) that are the momentum of the market (Silber, 1983; Van Horne, 1984; Miller, 1986; Alcorta, 1999; Bhar & Malliaris, 2011).

Overall, economic conditions create market frictions to market participants with different rates of dependency. Markets frictions can have various characteristics, dynamically transform over time, generate new costs and generate new business opportunities for market participants (DeGennaro & Robotti, 2007). Thus, market frictions motivate the creation of financial innovations because of two main arbitrage opportunities.

The first is the creation of an effective monopoly in order for the new financial innovation to be sold at a profit. The second is to cover, with the introduction of the innovation, the bigger share of the market (Tufano, 1989; Charupat & Prisman, 1997). Levine (1997) analyzed the link between financial innovations and market frictions and explains the way that the financial system affects economic growth based on a functional approach. This approach examines frictions between the development and quality of functions that the financial system provides, particularly through innovations.

By contrast, a financial patenting innovation through a certificate of innovation plays an important role in business circles and forwards financial activities. Lerner (2002, 2006) noted that the level of patents was mediocre but suddenly surged in 1998 after the State Street Decision that allowed business method patents. The author studied the activity of investment banks awarded with patent certificates and found that it was proportional to their size. However, there is little evidence to support that business method patents have had a significant effect on the R&D investments of financial institutions. At present, business method patents represent intriguing possibilities but not real measurable outcomes (Hunt, 2010).

Thus, the financial architecture of an economy is oriented towards a financial market or towards the banking sector, which is an important factor for long-term economic growth, especially for industrial activities, the banking sector and the creation of financial innovations. The oriented investment design in the market has a positive impact on technological development, a fact that agrees with the theoretical approaches that want markets to have a comparative advantage in the identification and funding of new technologies (Citanna & Schmedders, 2005; Tadesse, 2006).

Figure 3 presents the number of research studies on the economic conditions that stimulate the creation of financial innovations by sector and date. We can see that there is no joint effort to capture and link these various economic conditions in all fields of research. Market effectiveness seems to be the major reason that provokes the appearance of financial innovations over time.

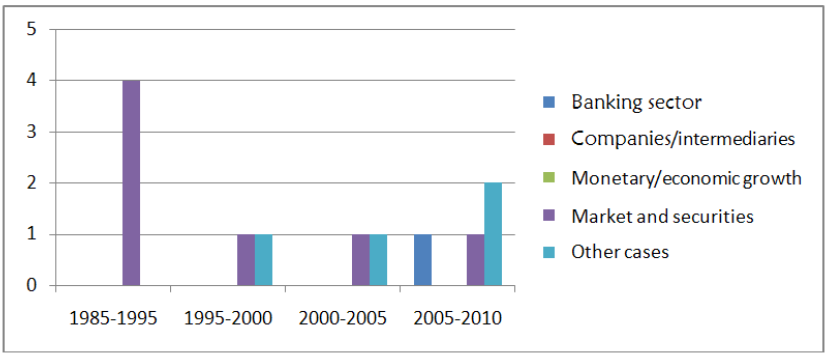

Fig. 3. Economic conditions stimulate financial innovations

1.3. The diffusion of financial innovations and adopters' characteristics. This category deals with the way and the rate that a financial innovation is adopted by the market or by consumers. Each period's dynamic adaptation (and profits) can reveal information about the innovation's value. Thus, social welfare is boosted, innovations are adopted by more companies and intermediaries have a reason to motivate such adoptions (Persons & Warther, 1997). Some existing research has concentrated on the adoption of technological innovations such as e-banking transaction products (ATMs, debit cards, credit cards, electronic bill payment services) by banks and consumers. The adoption of ATMs by banks, a competitive impulse, affects their reactions in terms of the number of accounts and the accounts' forms, which are reduced because of network externalities (Hannan & McDowell, 1987; Saloner & Shepard, 1995; Gowrisankaran & Stavins, 2004).

By contrast, the expansion of technological innovations has changed the interaction of the market's concentration in the presence of competition. Bank corporations that offer online transactions and Internet banking have lower expenses, bigger profits, bigger markets and higher customer loyalty (Sullivan, 2000; Mantel, 2000; Mantel & McHugh, 2001; Lang et al., 2003). A large share of the services of banks that offer Internet banking is positively related to their size and to the time needed for online transactions.

Consumers' characteristics can have a positive or negative impact on the adoption of electronic transaction systems. These characteristics pay for the services and products in different ways, which depends partly on the consuming tendency that helps new technology adoption and partly on the need to use services and products and on the transaction's nature (Stavins, 2001; Hayashi & Klee, 2003).

Finally, the credit available to small companies has also been studied (Frame et al., 2001; Berger et al., 2002; Akhavein et al., 2005). The results show that that the possibility of the adoption of this diffusion process is inversely proportional to the number of bank affiliates and proportional to the number of bank sectors. This shows the connection between the corporation's structure and the adoption of specific technologies.

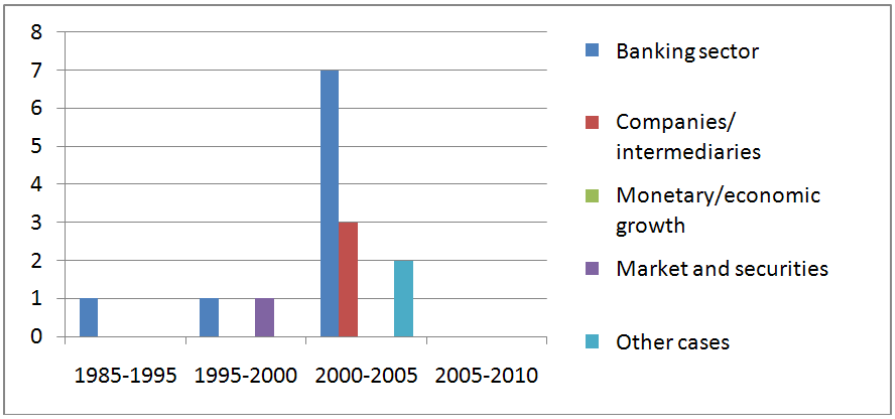

Fig. 4. The diffusion of financial innovations

Figure 4 shows that research studies on the diffusion of financial innovations have been mostly published after 2000, especially for the banking sector and financial intermediaries. The bank's products and consumer characteristics are major questions along with the rate of diffusion of new products and procedures, especially during 2000-2005.

1.4. The impact and consequences of financial innovations. The introduction of financial innovations has a major influence on the financial welfare of market participants because of arbitrary effects as well as the socioeconomic system that is adopted. Financial innovations' results, which are linked to macroeconomic levels and financial markets, have direct and/or indirect consequences on economic welfare (Elul, 1995). Therefore, the consequences of financial innovations can create a contagion effect that differentiate between market frictions and might postulate demand for more financial innovations. When a market participant adapts, then financial innovation becomes more desired by other market participants, who in turn might follow it and thus adopters will increase.

By introducing a financial innovation, the investors that are risk averse and/or those who are not informed about hedging and counterbalancing risk needs, can use the new market to counterbalance the positions they hold before the new security's introduction with a liquidity shift in the market (Dow, 1998).

The introduction of new securities changes the share ratio in the market; it reduces dividend flow and, in some cases, decreases risk premiums, driving higher turnovers for participants, particularly in endogenous markets with heterogeneous risks for revenues. Within multi-sector economies, financial innovations expand into markets via the choice of diversified portfolios and affect expected revenues (Calvetet al., 2004; Ang & Cheng, 2005).

New technology and new transaction methods ameliorate the effectiveness of the market, particular in the banking sector. Internet banking and online transactions have a great impact on banks' activities and, in general, the network adoption improves their effectiveness, especially through the increased incomes that come from transaction services' costs (DeYoung et al., 2007; Delgado et al., 2007).

Financial innovations also affect economic activity, consumption and business investment activity (Dynan et al., 2006). The introduction of financial innovations induces two basic changes in economic activity and monetary policies: changes in the business sector (i.e., the interest rate channel) and changes in monetary policy decisions because of the

total impact of the business channels. However, the volume of changes and the total impact of a financial innovation cannot be exactly defined as it is influenced by other factors such as unemployment, inflation and international risk factors.

The latest crisis raised some important issues about the value of financial innovations. Gerardi et al. (2010) developed an evaluation methodology to measure the impacts of the changes in the market of mortgage loans for households, based on the hypothesis that the higher are the expectations of the income revenue of a household, the higher the wish to consume, ceteris paribus. The authors showed that the use of the secondary market and innovative mortgage product diffusion happened much earlier (2001-2005) and disagreed that securitization was responsible for the present crisis (not the diffusion of new mortgage products but the increase in loans) because of credit criteria loosening.

Figure 5 shows that interest in the consequences of financial innovations has focused on market effectiveness, the banking sector and economic growth since 2005. Nowadays, the consequences of financial innovation are questionable when it comes to the potential advantages and disadvantages of the financial system and economic activity. However, the main question of whether financial innovations have achieved their goals remains.

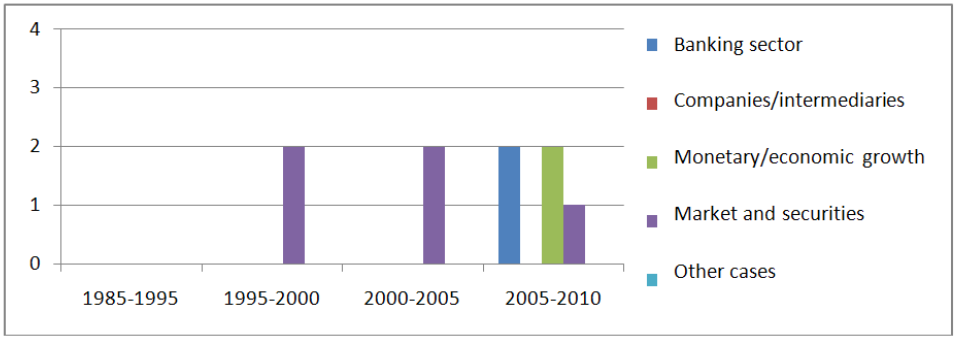

Fig. 5. The consequences of financial innovations

2. Financial innovations: a critical point of view

There has been great effort to comprehend several aspects of financial innovations in the past 30 years. The availability of financial innovations has possibly encouraged more profitable investments, with the expansion of new technologies, or the more efficient intermediation of financial trading.

However, the relevant research questions have been examined in isolation and the progress of financial innovations has not been constant. Figure 6 (or Table 1, Appendix) presents the overall results of the relevant research studies by sector.

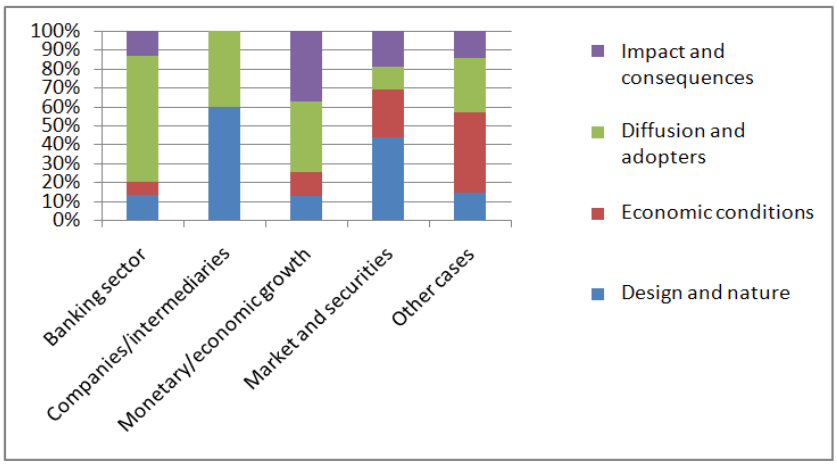

Fig. 6. Relevant % of research by classification and by sector

We calculate the *Cohen coefficient d* and the *effect size* (ES) correlation coefficient *r* (Table 2, Appendix) using the means and the standard deviations for the groups of classifications, above. High positive value of the *ES* indicates an increase in persuasion and the continuity of the process can reveal the progress of financial innovations over time, where negative value indicates decay in persuasion. The results in Table 2 show that the variability in the change observed on the progress of financial innovation makes it unlikely that a significant effect is present under all conditions. The overall analysis identifies a small effect size ($r \leq 0.3$) in all the cases.

The above results led us to the conclusion that an overall effort with regard to the various research questions has not been observed over time regarding financial innovations. A research effort correlated to a research question is carried out solely when there is a need to study the research question in a time period. Certain periods seem to be more active in individual sectors, especially when there is a boost of relative activity in the sector, when other stationary periods do make research more difficult.

Financial innovations seem to represent intriguing possibilities and not real measureable outcomes. In short, we cannot determine whether a financial innovation really adds value to the overall market. Moreover, we know little about how and why a variety of financial innovations are developed in the first place and we know even less about how they are related to one another. We also notice that the adaptation times and rates of a financial innovation are not the same for all the contributing parts and that the frictions between market participants are significantly varied. By contrast, it is important to understand further the conditions that stimulate financial innovations.

Frame and White (2004, 2009) stated some of the reasons why the previous literature is limited and, furthermore, we add some more:

1. *R&D department policies*. Empirical research on financial innovations has been related to development attempts or to company extensions and the design of new products. Thus, there is a shift away from financial research. By contrast, financial institutions rarely have an R&D budget (even if they have IT budgets). Nevertheless, the lack of financial research is wrong, strategically speaking, as industrial development gives priority to financial and resource development.
2. *Lack of empirical data*. Central banks and financial institutions collect and analyze financial, banking and macroeconomic databases. Data samples and their analytical elaborations are especially useful and help central banks perceive the challenges they face for the preservation of economic stability. These data can reveal the market's need for financial innovations for general use. However, there is a huge lack of historical data and reports because most databases are inaccessible for researchers or require a huge cost. By contrast, big organizations keep data of their activities but these are only for personal use and are not published.
3. *Industrial organization*. A major part of research about innovation originates from sectors or economic agents that relate to industrial organization and research targets (directly or indirectly), to industrial production and to the construction sector. Thus, the volume of research activity in innovation should be by companies with market power and firm size. However, R&D activities and sales data are private or unavailable, as stated previously.
4. *Patenting*. The characteristics of financial innovations vary greatly. Sometimes, certified financial innovations that have uncommon characteristics are neither patented nor advertised. As a result, empirical research on financial innovations that use patents does not appear in finance. Researches must shed light on the basic questions of the patent process, such as the possible production of additional financial innovations and the economics of financial innovations.
5. *Financial innovation seems to be an opportunist product without continuation*. Financial innovations can appear suddenly as a reaction by market participants to environmental changes in the form of opportunist products. Consequently, the new product is immediately standardized or/and does not present any interest of research. Therefore, it can quickly conclude its life circle as it has served its purpose. Sometimes, even if it presents an interesting research area, the financial innovation does not follow a precise structural and developmental course and thus it cannot be evaluated.
6. *Regulation changes.* In recent years, various regulation changes have been noticed in financial markets. With the extension of regulations (an important stimuli for change), opportunities for more financial innovations increase. However, when constraints are imposed or intensified, financial innovations tend to be defensive mechanisms that aim to restore profitability or reduce risk. They are activated because of the cost increase that results from the adherence to certain constraints. By contrast, when constraints relax, market participants introduce new investment strategies that were unattainable in the past when it came to profit and/or the probable decrease of risk. Thus, it is impossible to define a priori a clearly positive or negative relation between the regulatory framework and financial innovation.
7. *Contribution of financial innovations*. The contribution of financial innovations is difficult to measure or define. Financial innovation adds value to a company. This is reflected in the company's share value, even though this value is objective because it is based on a group of imprecise hypotheses about the innovation's usefulness. Therefore, market participants adopt financial innovations without having formed a personal opinion on them, just to be ahead of the game, to overcome current competition and to

respond to the conflict of interests that the financial innovation might cause through its introduction. In other words, a financial innovation does not always add value by making financial intermediation available to all economic agents (companies, households, intermediaries) that can effectively use it by reducing transaction costs and by making the market more attractive.

8. *Investor trust in evaluation models*. The shift in investor trust in the evaluation models of new products needs a short time period to happen and it can cause uncertainty in financial markets. This shift of trust can happen because the actual asset prices have fundamental deviations from previous predictions. The level of trust in models of a new financial product depends on the level of effectiveness of the model and on time. Thus, the effectiveness of evaluation models has to be improved in order to improve the interpretation of mutability and frictions between the market's participants.

Based on the above, we conclude that research studies on financial innovations are limited. There is very little evidence to accept that the progress of financial innovations presents a continuous spiral effect following a quantitative analysis of empirical studies. The lack of systematic research on financial innovations has led most empirical analyses to study the progress of financial innovations in isolation.

It becomes even worse if we consider the number of similar studies in other financial fields of research. This lack of systematic research is mostly true about hypotheses that focus on the structuring terms that encourage a financial innovation and mainly on frictions and on the relations that are developed and influence its diffusion. Some empirical studies have focused on innovation evaluation, on adopters' characteristics and sometimes on a cross-sectional basis or on the diffusion framework of innovations. However, we cannot be certain of the reasons for this.

Thus, the question posed is whether the progress of financial innovations has already come to the point of diminishing returns. The answer is that as long as financial innovations are created as a result of financial expansion, they will continue to be necessary in the future. Financial innovations will continue to thrive as long as capital markets continue to evolve, transform and cause uncertainty. The attention of financial institutions will constantly shift towards offering more profitable financial products in order to become more competitive.

Summary and conclusions

We study the progress of financial innovations in the past 30 years by analyzing the significant research findings as well as the limitations of this research analysis. We conclude that financial innovations are a response by market participants to many of the changes in financial, fiscal and regulatory systems around the world. They can also be the answer to the continuous search for low cost and more flexible financial instruments to restructure capital markets and address the risks posed.

We present the progress of financial innovations by adopting a spiral framework and demonstrate their significant role in all sectors of the financial system. Furthermore, we highlight the important issues presented by the previous literature, such as the lack of data and the role of financial institutions in the creation of new financial products. Our findings are important and show that the progress of financial innovations is a discontinuous process led by isolated efforts to describe the underlying issue.

Thus, the key question remains of whether financial innovation share just a temporary response to imperfections and restrictions that try to overcome difficulties and increase profits, or whether they are truly created to complete markets through new products, processes, forms and techniques. The continuous evolution of the global economic environment will remain, and the need to create innovative financial products will always exist. There is plenty of room for a more functional perspective on and analysis of the dynamic introduction of financial innovations. Therefore, future research should move in two main areas, namely how and why financial innovations are developed and endure, and their functional approaches and analyses.

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Appendix

Table 1. Relevant percentages

	Design and nature	Economic conditions	Diffusion and adopters	Impact and consequences
Banking sector	13%	6%	66%	13%
Companies/intermediaries	60%	0%	40%	0%
Monetary/economic growth	12.5%	12.5%	37.5%	37.5%
Market and securities	43.7%	25%	12.5%	18.7%
Other cases	14.2%	42.8%	28.5%	14.2%
Mean	29%	17%	37%	17%
Std. dev.	21.93%	17.03%	19.51%	13.56%

Note: The table presents the relevant percentage of researches by sector and classifications, the mean and standard deviation of the columns.

Table 2. Cohen's *d* value and ES *r* by classification

Cohen's *d* value / Effect size *r*	Design and nature	Economic conditions	Diffusion and adopters	Impact and consequences
Design and nature	-	*d* = 0.28	*d* = 0.27	*d* = 0.29
		r = 0.13	*r* = 0.135	*r* = 0.14
Economic conditions		-	*d* = 0.1	*d* = 0.015
			r = 0.012	*r* = 0.007
Diffusion and adopters			-	*d* = 0.8
				r = 0.3

Note: Table 2 presents the value of Cohen's *d* and the effect size *r* based on means and standard deviations, in terms of a comparison of percentiles. Cohen's coefficient *d* is calculated (Cohen, 1988): $d = \frac{M_1 - M_2}{\sigma_{pooled}}$, where M_i and s_i^2 are the mean and the variance of the group, respectively, and σ_{pooled} is the pooled standard deviation (Rosnow & Rosenthal, 1996): $\sigma_{pooled} = \sqrt{\left(s_1^2 + s_2^2\right)/2}$. ES coefficient (*r*) is calculated: $r = d/\sqrt{d^2 + 4}$. The levels of ES are: small effect ($r < 0.3$), medium effect ($r < 0.5$), large effect ($r < 0.8$).

Table 3. Summary tables

The table below shows the names of the authors, the year and the relevant research question that the previous literature posed, according to the spiral classification.

Panel A: The design and nature of financial innovations	
Authors (year)	The relevant research question
Miller (1986)	Generative mechanisms behind financial innovation
Tufano (1989)	Why a company innovates
Ross (1989)	The relation between the demand and supply of securities
Harris & Raviv (1989)	The design of new securities
Duffie & Rahi (1995)	The design of new securities
Ireland (1995)	The nature of financial innovation in an equilibrium monetary policy model
Molyneux & Shamroukh (1996)	The diffusion of junk bonds and note issuance facilities
Boot & Thakor (1993), DeMarzo & Duffie (1999)	The design and sales issue of asset-backed securities
Madan & Soubra (1991), Demange & Laroque (1995)	The design of financial innovations according to investors' needs
Carrow (1999), Bhattacharyya & Nanda (2000)	Investment bank motives to innovate
Cuny (1993), Hara (1995), Ohashi (1995)	Is a financial institution an innovator intermediary
McConnell & Schwartz (1992)	The case of LYON
Allen & Gale (1991), Chen (1995), Pesendorfer (1995)	The case of short sales constraints
Levine (1997)	The relation between financial innovation and economic growth
Grinblatt & Longstaff (2000)	The case of Treasury STRIPS and zero coupon bonds
DeYoung (2001 & 2005)	The case of Internet novo-banks
Calomiris (2009), Plosser (2009)	The misrepresentations of financial innovations, which is led by financial and econometrics development
Panel B: The economic conditions that stimulate the creation of financial innovations	
Authors (year)	The relevant research question
Silber (1983)	The external factors that affect the appearance of financial innovations
Van Horne (1984)	The changes in the economic environment that dictate the creation of financial innovations
Charupat & Prisman (1997)	The market frictions that induce motives for the creation of financial innovations
Alcorta (1999)	Grouping the factors that induce motives for financial innovation diffusion
Lerner (2002)	Financial patenting of innovations
Lerner (2006)	Financial patenting of innovations
Hunt (2010)	Business patenting and innovations
Citanna & Schmedders (2005)	Financial structure changes
Tadesse (2006)	Financial architecture that influence financial innovations
Panel C: The diffusion of financial innovations and adopters' characteristics	
Authors (year)	The relevant research question
Hannan & McDowell (1987)	The ATMs adopted by banks
Saloner & Shepard (1995)	The ATMs adopted by banks
Persons & Warther (1997)	The dynamic adoption of financial innovations
Sullivan (2000)	Comparison of banks that offer online transactions

Table 3 (cont.). Summary tables

Authors (year)	The relevant research question
Mantel (2000)	Diffusion of electronic transactions and debit cards
Mantel & McHugh (2001)	Innovation and competition of the specialized market in electronic transactions
Stavins (2001)	Consumers' characteristics that have a positive or negative impact on the adoption of electronic transaction systems
Frame et al. (2001)	Portfolio's impact for commercial loans under $100,000 of the large banks
Hayashi & Klee (2003)	Consumers' characteristics regarding new transaction methods
Lang et al. (2003)	Internet banking adoption
Gowrisankaran & Stavins (2004)	Network externalities for the automated clearing house electronic payments system
Berger et al. (2001)	Small business credit scoring diffusion
Akhavein et al. (2005)	Small business credit scoring diffusion
Panel D: The impact and consequences of financial innovations	
Authors (year)	The relevant research question
Dow (1998)	The yields, liquidity and costs that result from the introduction of an innovative bond in a cross market
Calvet et al. (2004)	The introduction of a financial innovation in an endogenous market with heterogeneous risks
Ang & Cheng (2005)	The case of Single Stock Futures Exchanges
Dynan et al. (2006)	Financial innovation as a stabilizing factor on economic activity
DeYoung et al. (2007)	The impact that bank webpage and online transactions have on the effectiveness of banks
Gerardi et al. (2010)	The impacts of changes in the market of mortgage loans for households