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The hidden soul of financial innovation: An agent-based modelling of home mortgage securitization and the finance-growth nexus

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ABSTRACT

This paper investigates the interaction between financial innovation and securitization. To this end, it introduces the *rate of financial innovation (RoFIN)* as an endogenous variable in an Agent-Based Model (ABM) set up and studies its interaction with the non-fixed fraction of securitized mortgage loans. *RoFIN* is able to capture financial agents' business decisions on using financial innovation tools, processes and services, such as the home mortgage securitization process. In the aftermath of the 2007–2009 financial and economic crisis it has been argued that financial innovation and securitization have increased macro/finance systemic instability via, for example, non-linear two-way spillovers between the financial system and the macroeconomy. The ABM model proposed enables the capture of these dynamics. High values of *RoFIN* (i.e. exceeding the threshold of 50%) make financial innovation become harmful for the economic system, leading to a switch from a virtuous to an unvirtuous business cycle. When *RoFIN* reaches 90%, the numerical simulations come close to the macro/finance dynamics observed before and during the financial crisis. Given its potential role in triggering financial and economic instability, *RoFIN* is of interest for financial regulation and supervision. How this endogenous variable may be influenced by means of operational variables under the control of policymakers remains a subject for future research.

1. Introduction

The need to understand the finance-growth nexus and the role of financial innovation within it, in particular with regard to the process of endogenous money/credit creation, has led to this research paper. The modern financial system is complex, globalized and highly technologically advanced, characterized by financial innovation and speculation (Bezemer, 2012; Nguyen, 2014). Econometric papers such as those by Amore et al. (2013) or Beck et al. (2016) show that there exists a strong connection between finance and technological innovation. Studies focusing on understanding the U.S. subprime mortgage crisis, such as those of Mian and Sufi (2009), Keys et al. (2010) and Dell'Ariccia et al. (2012), have found evidence of the linkage between the securitization process and lax lending standards. Mallick and Sousa (2013) show how changes in financial distress conditions can explain output fluctuations. Others have clearly highlighted the existence of the finance-growth nexus (e.g. Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; King and Levine, 1993; Levine, 2005; Greenwood et al., 2010; Creel et al., 2015) and demonstrated that financial innovation combined with deregulation has on one hand fostered a rapid development of the financial system, but on the other has increased financial instability and complexity over time (e.g. Brunnermeier and Sannikov, 2014; Grydaki and Bezemer, 2013; Bezemer, 2012; Dosi et al., 2013; Palley, 2011). This has contributed to a shift from the OTH (Originate-To-Hold)[1] model to the OTD (Originate-To-Distribute)[2] model (Berndt and Gupta, 2009; Bord and Santos, 2012; Scannella, 2011). The latter, characterized by the use of financial innovation instruments and trading strategies to promote credit risk transfer, triggers the creation of multi-leveraging phenomena within the financial sector. In principle, the OTD model helps to improve the diversification of risk. According to Allen and Carletti (2006), this is true only if the demand for liquidity is uniform. Otherwise, when there are idiosyncratic liquidity risk and hedging behaviours, credit risk transfer (and multi-leveraging) can become harmful to the economy. However, the empirical studies conducted to explain and understand the last financial crisis and the nexus between finance and growth mostly identify financial innovation with the securitization process, when in fact the concept of financial innovation is much more extensive.

There are few theoretical and empirical studies specifically focused

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[1] The Originate-To-Hold (OTH) model is based on traditional bank business - collecting savings to make loans.

[2] The Originate-To-Distribute (OTD) model is the newly established financial system architecture. The OTD model makes it possible to split some activities in the value chain of mortgage and loan supply. Each financial agent can transfer risk forward to other financial agents along the chain.

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on the broader concept of financial innovation (e.g. see Rousseau (1998), Levine (1997, 2005), Klein and Olivei (2008) and Lerner and Tufano (2011)). However, these studies define and model financial innovation in a way that overlaps with the concept of innovation used in the manufacturing sector. They focus their attention on a more generic and not very well identified concept of financial innovation, analysing its impact on financial depth and its resulting effects on economic growth. Therefore, the role of financial innovation still remains unclear and not well modelled.

The paper contributes to the ongoing discussion in the literature on financial innovation. In particular, it applies the concepts of 'disruptive innovation' (Christensen and Raynor, 2003) and 'diffusion and adoption of innovation' (Sinkey, 1992; Rogers, 2003).[3] Therefore, from this perspective, the paper defines financial innovation as the interaction between securitization and the more specific concept of the *rate of financial innovation*. This concept captures the level of development of financial tools, processes and services, given the financial operators' business decisions on how to make use of them (in terms of operational business decisions[4]). Is there any role played by financial innovation (securitization times the rate of financial innovation) in affecting endogenous money/credit creation? If there is, how does it impact on the finance-growth nexus?

It would appear that the link between securitization and the rate of financial innovation has yet to be investigated in the literature. The interesting paper of Leaven et al. (2015) investigates for the first time the coevolution of the interaction between finance and technology and introduces the concept of financial innovation as the 'rate of financial system improvements' in the Schumpeterian economic growth model. However, the authors are focused on analysing how the interaction between finance and technology affects the financial system screening process to fund entrepreneurs. They do not model the role of the financial system in diversifying risk and they do not provide any discussion on how exceeding certain levels of diversification (i.e. the rate of financial system improvements) can lead to asset mispricing and increasing systemic instability, which were the conditions at the heart of the last global financial crisis.

Additionally, this research assumes the existence of two temporally opposite cycles; namely, the *virtuous* and *unvirtuous* cycles. The *virtuous cycle* characterized the post-world war II period, an era of rapid progress (the golden age). Until the 1970s/80s, the economy had modest inflation rates, low unemployment rates, and rapid economic growth. In the *virtuous cycle* the presence of a developed structure of financial institutions channels high levels of savings into the productive sector, spurs investments for innovation projects in the economy and fosters a high level of economic growth. However, the technological revolution in the 1970s/80s promoted the creation of an "IT network economy", making the financial system a complex environment. The will of the financial and economic operators to diversify risk by complex financial integration of the economy was accompanied by an increasing level of indebtedness in the economy and the risk of associated emerging externalities, marking the passage from a period of prudential attitude, when debt use was careful, to a period of prosperity, when the debt exposure of all the agents operating in the economic system grew rapidly (Minsky, 1986). Therefore, the alternative perspective seems to entail an *unvirtuous cycle,* in which the growth-finance relationship is reversed into the finance-growth nexus. Part of the wealth created in the business cycle is captured and, thanks to the presence of sophisticated financial innovation tools, it is not allocated to the productive sector, but diverted into speculative channels for the financial operators' self-seeking profit interests. This bad cycle has supported the reinforcement of monopolistic financial positions (financial power concentration), which had already started in the *virtuous cycle* as a natural consequence (externality) of the development from a period of prudential attitude to a period of prosperity (Minsky, 1986). It has resulted in a financial market and political power in the hands of the financial sector. This strengthens the possibility that increasingly aggressive 'boom and bust cycles' are created over time, with wider gaps with respect to potential GDP, and a reduction in the length of time between the occurrence of one boom-bust and another.[5] The increasing level of volatility created in the business cycle makes the economy more fragile, raising the possibility of turning easily from simple financial/real shock to severe economic crises. As a consequence, business and innovation investments slow down, and the level of growth declines until, in the worst case scenario, there is a recession and negative growth (as was observed after the 2007–2009 financial crisis). Regulatory loopholes emerge, and current regulation becomes inadequate. Thus, a crisis forces re-regulation and a switch to a virtuous cycle for a certain period. However, when the financial capitalists exert new pressures for liberalization (as the length of time since the last crisis increases), the virtuous cycle gradually tends to turn bad again, as the political influence of financial capitalists and regulation laxity increases, until the next crisis erupts. Hence, more regulatory tightening will be applied, and so on. A 'regulatory dialectic' (Kane, 1977) seems to underpin the passage from one cycle to another.

Regarding the choice of methodology, this study takes into account the fact that after the global financial crisis a wide debate in the literature has questioned the reliability of the dominant paradigm in macroeconomics. Several studies have revealed the inadequacy of the mainstream macroeconomic models and the difficulties these models have encountered in proposing adequate policy solutions (e.g. see Colander et al. (2008), Kirman (2010), Keen (2011), Bezemer (2011) and Romer, forthcoming). However, it is interesting to observe that, although in the literature there is a wide debate on, and relevant evidence for, the non-neutral and non-exogenous role of the financial system within the economy, the leading monetary policy analysis approach is still founded on the general equilibrium models (based on the General Equilibrium Theory - (Walras, 1874, 1877)), and the resulting complex DSGE (Dynamic Stochastic General Equilibrium) models[6] developed are still widely used by monetary authorities and governments to decide policy strategies and actions. These models and related assumptions (e.g. representative independent agents, full rationality and full information, perfect markets, etc.), provide impressive mathematical toolkits, but present artefact elements with no clear link to reality (Verspagen, 2004), distorting the correct interpretation of phenomena such as the 2007–2009 financial crisis, and constraining the identification of the problem and its solution (Tovar, 2009). In particular, for these models the banking sector and credit creation and debt are a marginal exogenous problem that can only create temporary shocks which cannot affect the long-run macroeconomic dynamics. Moreover, the more sophisticated form of these models, represented by the DSGE models, do not produce appreciable results on capturing emergent phenomena and in modelling financial system behaviour.

Since the crisis, mainstream macroeconomists have tried to compensate for the lack of realism in their models by introducing a more detailed theoretical specification of the micro-economic foundations; in

[3] Innovation can be disruptive; in particular, when there is a rapid diffusion and adoption of it. A widespread adoption – the relative speed with which an innovation is adopted by the agents of the system - exploits 'networks effects', encouraging underpricing of risks in order to gain 'first mover' advantage and increase profits (Mullineux, 2010).

[4] Operational business decisions are a collection of business rules which help to automate operational choices, such as the number of mortgages to send to the securitization process.

[5] ... as some of the literature has also highlighted (e.g. Koo, 2014).

[6] The DSGE models, developed by a new generation of economists such as E.S. Phelps, R. Lucas, N. G. Mankiw and others, are micro-founded general equilibrium representative agent models, able to capture non-linear dynamics. They bring together the neoclassical (Real Business Cycles) and the New Keynesian models.