2. Literature Synthesis, Theoretical Background and Research Focus

Another treatise on systemic risk is a risky venture for any author. There are simply so many of them. However, despite the amount of research undertaken in the area of systemic risk in the financial sector (e.g., Battiston et al., 2012; Billio et al., 2012; Blyth, 2010; Sornette, 2009; Gorton & Metrick, 2009; Huang et al., 2009a; Hellwig, 2008; Schwarcz, 2008; Taleb, 2007a; etc.), a holistic and, especially, a complexity/systems theories driven and logic-based perspective can be very fruitful for contributing to how to be better equipped for assessing and managing systemic risks more effectively in the future (Klimek et al., 2015; Thurner et al., 2010); a critical perspective on systemic and extreme risks in financial systems and quantitative risk models that lie within banks’ scope. To start with, it ought to be acknowledged that systems theoretic notions are beginning to provide new insights on risk and resilience of banks (e.g., Battiston et al., 2016; Bonabeau, 2007: 64)\(^{30}\). Therefore, we immerse ourselves in reviewing notions of system, financial systems and complexity before the spotlight is turned to risk, systemic risk and risk modeling in the financial sector.

2.1. Complexity and Modern Financial Systems

There are many definitions of the fundamental term “system” (cf. e.g. Stacey, 2010: 122f. for an overview). Schwaninger (2011: 753) gives two examples: “A portion of the world sufficiently well-defined to be the subject of study; something characterized by a structure, for example, a social system (Anatol Rapoport). A system is a family of relationships between its members acting as a whole (In-

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\(^{30}\) For example, Bonabeau (2007: 64) stresses that it is the context of complex systems where systemic risks arise. Literature has not yet sufficiently examined this relationship between complexity and systemic risks. Thus, it is picked up in this dissertation (Chapter 6).
ternational Society for the Systems Sciences).”

What is crucial to know about the concept of system is that it is a formal concept, which designates the form of many, in practice very different objects and phenomena. In particular, it applies not only to ‘classical objects’ (financial system vs. ecosystem vs. a car as a system, etc.), but also many other different things such as problems are termed systems (Gomez & Probst, 1997: 14f.; Ulrich & Probst, 1990: 109; Beer, 1959: 24 and see Weaver, 1948 in Chapter 6). The demarcation between a system and its environment is highlighted by specifying a boundary of the system (Klir, 1991: 10f., 30).

The following Figure 1, adapted from Schwaninger (2005: 31), depicts the system as a whole with elements, subsystems, relationships and environment.

Banks are systems and they are embedded in (larger) financial systems (see also 6.3.). According to Cecchetti (2008: 2), a financial system is constituted of five parts, each of which plays a fundamental role in a country’s economy. Those parts are money, financial instruments, financial markets (comprising credit, capital, and money markets), financial institutions, and central banks. Gurusamy (2008: 3) defines a financial system similarly as a set of “interconnected financial institutions, markets, instruments, services, practices, and transactions”; cf. also Schinasi (2004: 6) and the simple toy models of the financial and real economy in Thurner & Poledna (2013: 2) and Rossi (2011: 70). Notwithstanding these and

31 It can be left open whether systems exist in the real world (Flood & Carson, 1993: 250). There exist several definitions of systems science. For example, Klir (1991: 6) defines it as “a science whose domain of inquiry consists of those properties of systems and associated problems that emanate from the general notion of systemhood”. For more details, see Chapter 6.

32 “We have also come to realize that no problem ever exists in complete isolation. Every problem interacts with other problems and is therefore part of a set of interrelated problems, a system of problems.” (Ackoff, 1974: 21).

33 This distinction is absolute in the theoretical construct of a closed system, i.e. where no relationships are found or made between elements of a system and things external to it (Flood & Carson, 1993: 8). Conversely, an open system exchanges material, information, and/or energy with its environment across a boundary (ibid.).

34 Simply put, money functions as a medium of exchange; a unit of account; a store of value; and, perhaps, a standard of deferred payment. Financial instruments are used to transfer resources from savers to investors and to transfer risk to those “who are best equipped to bear it” (Cecchetti, 2008: 2). Stocks, mortgages, and insurance policies are examples of financial instruments. The third part of a financial system, financial markets, allows participants to buy and sell financial instruments quickly and cheaply (ibid.). The New York Stock Exchange (NYSE) is an example of a financial market. Fourth, financial institutions (or banks, for short) provide a myriad of services, including access to the financial markets and collection of information about prospective borrowers to ensure that they are creditworthy etc. (ibid.). Finally, central banks like the ECB or the Fed manage a state’s or a confederation’s currency, money supply, and interest rates and monitor and stabilize the economy (ibid.).