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Keywords

usa, banking, crisis, 08, preponderant, 2007, causes, ERA2015

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The Preponderant Causes of the USA Banking Crisis 2007-08

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Abstract

Scientific research on the banking crisis 2007-08 has answered many important questions according to generally accepted methodological standards. However, there remains at least one outstanding question that has not been answered with methodological accuracy: What caused the severe USA banking crisis 2007-08? To address this question the paper uses a counterfactual definition of ‘cause,’ distinguishes between separable and non-separable causes, and employs a well-posed methodology for the causation analysis of singular events. In addition, first causes and preponderant causes are distinguished. The main result of this paper is that the preponderant causes of the banking crisis 2007-08 were securitization and ignorance.

Key words

USA banking crisis 2007-2008, counterfactual approach, preponderant causes, securitization, ignorance

JEL: B.41, G10

1. Introduction

Financial instability happens when shocks to the financial system distort the information flows in such a way that the financial sector finds increasingly difficult to perform the task of channelling funds to productive investment opportunities. Those shocks make the adverse selection and moral hazard problems worse, and thereby, lending tends to dry-up. It is generally agreed that a financial crisis is an extreme case of financial instability.¹

Although the first major crisis of the twenty first century is usually referred to as the ‘financial crisis 2007-2008,’ it should be clear that the expression ‘banking crisis 2007-2008’ is a better term. Distinguishing banking crises from the broader category of financial crises is not a mere terminological quibble. It is methodologically improper to identify the group of financial crises F with the collection of banking crises A because every banking crisis is a financial crisis, but the converse is not true. Consequently, we can study the characteristics of A most effectively if they are not merged with the characteristics of other financial crises such as currency crashes and sovereign debt defaults.

As Reinhart and Rogoff (2008a), (2008b) have documented, financial crisis are often linked to economic growth, capital inflows and financial innovation. Reinhart and Rogoff (2008a) provide a panoramic view of eight centuries of financial crises “dating from England’s fourteenth-century default to the current United States sub-prime financial crisis.” These authors deal with five types of financial crises (banking crises, currency crashes, inflation outbursts, domestic default, and external default) and use quantitative thresholds and events to date crisis episodes.

Inspection of the annotated appendix in (Reinhart and Rogoff, 2008a, esp. pp.75-88) shows that it is important to realize that not all financial crises are banking crises. Likewise, Calomiris (2009) signalizes that it is methodologically improper to mix banking crises with other financial crises indiscriminately: “Banking crises must be distinguished from the broader category of ‘financial crises’.” (Calomiris 2009, p. 5)

The assertion that the collection of banking crises A is a proper subset of the set of financial crises F presupposes a definition of the term ‘banking crisis’ allowing us to decide whether a crisis can be considered as an element of A or not. Any crisis where the shock provoking financial instability directly affects the banking sector (regulated, unregulated or a combination of the two) in a fundamental way is called a *banking crisis*. Banking crises can manifest themselves by either panics conducive to a sudden stop of the credit market or waves of bank insolvency. Calomiris (2009) has shown that sometimes the two aspects (panic and insolvency) occur concurrently, but at other times they do not coincide. This means that the collection of banking crises A consists

¹ This broad definition of financial crisis was introduced by Mishkin (1999) to analyse the 1997-1999 financial crises in Mexico and east Asia.

of two subsets A_1 (banking panics) and A_2 (banking insolvencies) with non-empty intersection and neither A_1 is a proper subset of A_2 nor A_2 is a proper subset of A_1 .

While each banking crisis no doubt is distinct, comparative historical analysis shows that the antecedents and aftermaths of banking crises –in both rich economies and emerging markets– have similar patterns in housing and equity prices, unemployment, and government revenues and debt. Reinhart and Rogoff (2009c). All banking crises have an onset, an outbreak and a culmination. Severe banking crises end with pervasive Knightian uncertainty and sudden stops.

The first severe banking crisis of the twenty first century started on June 20, 2007 when two highly leveraged Bear Sterns-managed hedge funds collapsed due to their investment in sub-prime asset-backed securities (this event spread the news that AAA-rated securities were not safe), exploded out of control on September 15, 2008 with the fall of Lehman Brothers, and culminated with a sudden freeze in the market for short-term, secured borrowing in October 2008.

There are several points of general agreement about the USA banking crisis 2007-08, including the following six. First and most obvious, the culmination of the banking crisis was a singular event – in that it was a dated and non-replicable phenomenon occurring at a particular location. Greenspan (2008). Second, the crisis displayed multiple causative factors. Diamond and Rajan (2009). Third, the crisis was stupefyingly complex. Brunnermeir (2009). Fourth, the financial system was devoured by its own creations; in particular, innovations in the field of structured finance allowed trillions of dollars of risky assets to be transformed into financial products that were far riskier than originally advertised. Coval et al. (2009). Fifth, the crisis was triggered by the burst of the USA real estate bubble and was magnified by the extreme concentration of risk in a highly leveraged financial sector. Caballero et al. (2008). And sixth, the rules governing the banking system encouraged risky practices.

The last point deserves a special comment. Banks do not operate in a vacuum. Their activities take place within a milieu that includes, but it is not limited to, the political environment and the microeconomic rules of the banking game, such as the rules that govern the operations of each bank (prudential supervisory rules, protective rules, etc.). According to Curie (2006, 2010), the set of microeconomic rules of the banking game is a key explanatory factor of banking stability (instability). This point is also forcibly made by Calomiris (2009). In his review of the history of banking crises, (Calomiris, 2009, p. 4) shows that “When the political equilibrium governing the rules of the banking game changed for the better (worse) in a particular country, previously unstable (stable) banking systems became stable (unstable).”

Beyond those points of general agreement, there are many questions that will be debated by academics, policymakers, and lawmakers for decades. One of the outstanding questions is what caused the USA banking crisis 2007-08.

To examine the causes of the financial crisis, the USA Congress created a bipartisan panel of ten members led by Phil Angelides, known as the *Financial Crisis Inquiry Commission*. The Commission interviewed hundreds of witnesses and collected additional evidence from a variety of sources, including case study investigations of financial firms such as the American International Group, Bear Stearns, Citigroup, Fannie Mae, Goldman Sachs, Lehman Brothers, and Moody's.

In January 2011, the Commission issued the first official report² on the causes of the 2008 financial meltdown. Three compelling points can be made in relation to the FCIR: (a) the FCIR was virtually ignored by the academic community, probably due to the lack of analytical rigor and suspicion of political bias; (b) the collection of possible causes mentioned in the FCIR is all-embracing; and (c) there was no unique set of possible causes.

As can be found in the FCIR, it was not possible for the Commission to reach a bipartisan agreement on the causes of the USA banking crisis. According to the majority's conclusions, the fundamental causes of the crisis are the following eight: (1) Widespread failures in financial regulation and supervision; (2) Dramatic failures of corporate governance and risk management at many systemically important financial institutions; (3) Combination of excessive borrowing, risky investments, and lack of transparency; (4) Government ill prepared and inconsistent; (5) Systemic breakdown in accountability and ethics; (6) Collapsing of mortgage-lending standards and mortgage securitization; (7) Over-the-counter derivatives; and (8) Failures of credit rating agencies. (FCIR, 2011, esp. pp. xv-xxviii).

Some members of the Commission found areas of substantial disagreement with the majority's conclusions and presented dissent views. (FCIR, 2011, pp. 413-450). For example, in one of the dissenting statements there is an explicit list of ten essential causes of the crisis: I. Credit bubble; II. Housing bubble; III. Nontraditional mortgages; IV. Credit ratings and securitizations; V. Financial institutions concentrated correlated risk; VI. Leverage and liquidity risk; VII. Risk of contagion; VIII. Common shock; IX. Financial shock and panic; and X. Financial crisis causes economic crisis. (FCIR, 2011, pp. 413-439).

From the methodological viewpoint, the biggest problem with the conclusions of the Financial Crisis Inquiry Report lies in the fact that they are not derived from a clearly formulated analytical framework. In particular, the report in question (a) has no explicit definition of 'cause'; (b) does not distinguish between separable and non-

² The title of the report is *The Financial Crisis Inquiry Report (FCIR)*.

separable causes; and (c) has no explicit methodology for causation analysis. Furthermore, it is not inconceivable that there may have been biases in the conclusions of both Democrats and Republicans arising from the fact that this is a politically motivated document.³

Leaving aside political stances, it should be emphasized that a narrative approach to causality is fruitful as a first approximation but not as a second, for one fundamental methodological reason. There must be an analytical framework in which to *evaluate* the claim that one or more factors are the causes of a particular economic event.

To shed light on the answer on what were the causes of the USA banking crisis 2007-08, the paper uses a counterfactual definition of ‘cause,’ distinguishes between separable and non-separable causes, and employs a well-posed methodology for the causation analysis of singular events. In addition, first causes and preponderant causes are distinguished. The main result in this paper is that the preponderant causes of the banking crisis 2007-08 were securitization and ignorance.

The organization of the paper is as follows. Section 2 succinctly describes the banking crisis in order to obtain a source of raw material to isolate plausible causative factors. Section 3 sketches the counterfactual methodology for causality analysis. Section 4 compiles a list of plausible causative factors underlying the financial meltdown and discusses their separability. Section 5 uses the counterfactual methodology to structure a proof of causality in the context of the USA banking crisis 2007-08. Section 6 concludes.

2. Crisis intertwined phases

Not surprisingly, the banking crisis 2007-08 has originated an explosion of articles. In fact, there exists a large theoretical and empirical literature on this banking crisis that enables a sound understanding of the complex dynamic process that led to a catastrophic collapse in October 2008.

The dynamic process boils down to an explosive sequence of nine intertwined phases: ① Low interest rate environment; ② Housing bubble; ③ Sub-prime market boom; ④ Formidable credit expansion; ⑤ Ignorance; ⑥ Massive retention of toxic assets; ⑦ Housing bubble collapse and systemic risk; ⑧ Complex environment; and ⑨ Runs on the shadow banking system and fire sales.

As a preparatory step to identify plausible causative factors, we start with a generally accepted narrative of the crisis. We sketch only the most basic outline. More detailed accounts are contained in the references in Table 6 (see appendix).

³ The Democrat members blamed the bankers and called for tougher regulation, while the minority reports from the Republicans signaled the credit bubble the Federal Reserve allowed to grow.

① Low interest rate environment

The first phase of the sequence is given by the extended period of low interest rates starting in the year 2000, approximately. It is generally agreed that there were two concurrent factors conducive to this low interest rate environment. After the Internet bubble and burst: (a) the Federal Reserve feared a deflationary period and adopted a lax interest rate policy; and (b) excess world savings looked for safe debt investments and the USA experienced large and sustained capital flows from foreigners. These global imbalances led to the USA financial intermediaries to manufacture debt claims out of all types of financial products.

The United States was not by any means the only country with low interest rates during the first quinquennium of the 2000s. Then, why the collapse first manifested itself in the USA? “Probably because the US innovated by securitizing sub-prime loans, thus drawing more marginal-credit-quality buyers into the market!” (Diamond and Rajan, 2009, p. 606).

② Housing bubble

The second phase of the sequence is the USA housing bubble where home prices tripled between the mid-1990s and 2006. During the 2000s the USA mortgage market shifted to a *modus operandis* in which mortgage brokers originated loans and then sold them to financial firms that securitized them (‘originate-to-distribute’ model). Quite obviously, brokers did not bear the ultimate costs of default and had no clear incentive to screen applicants carefully. Low interest rates, easy access to mortgage loans, abundant refinancing opportunities, and securitization of sub-prime loans were the immediate determinants of the housing bubble.

③ Sub-prime market boom

Borrowers in the sub-prime mortgage market differ from their prime counterparts in several aspects, including risk, collateral, and credit histories. Indeed, sub-prime borrowers are riskier, possess less collateral, and have shorter or worse credit histories than their prime counterparts. Generally speaking, sub-prime mortgages were short-term hybrids with a prepayment penalty. These mortgages were allocated to borrowers with the lowest credit scores and highest loan-to-value ratios.

The sub-prime mortgage market grew substantially between 2003 and 2005. In dollar terms, the share of non-prime mortgages (i.e. the aggregate of sub-prime and near-prime mortgages) as a proportion of the total USA mortgage market grew from 10% in 2003 to 32% in 2005. (Mayer et al, 2009, p. 28).

The empirical evidence supports the view that low short-term interest rates softened lending standards for companies, householders, and consumers. In particular, the sub-prime market boom of 2001-2006 was fuelled by a decrease in lending standards, as

measured by a decline in loan denial rates and an increase in loan-to-income ratios. This softening was amplified by high securitization activity, weak supervision of bank capital and too low for too long interest rates.

④ Formidable credit expansion

Financial innovation led to a formidable credit expansion that helped feed the boom in the housing market. In fact, the real estate boom and the corresponding leverage were accompanied by an extraordinary credit expansion revolving around securitization in residential and commercial mortgages, corporate loans and credit cards.

The high demand for AAA securities by foreigners and money market funds magnified the re-securitization activity. In particular, the now-notorious CDOs, for *Collateralized Debt Obligations*, were designed to satisfy the high demand for AAA securities. Misleading ratings of these securities by the rating agencies further exacerbated the manufacturing of AAA tranches of CDOs.

⑤ Ignorance

Conventional wisdom disregards *ignorance* – in the sense of lack of understanding about the nature of complex financial products and the risk associated with them – as a destabilizing factor. This is probably due to the tacit presumption that ‘transparency’ is ubiquitous in the contemporary economy and, consequently, ignorance cannot prevail.

Notwithstanding, there is evidence that ignorance played an important role in the banking crisis 2007-08. As complex products multiplied from CDOs to CDOs of CDOs (or CDOs²), it became harder and harder for investors to understand what the quality of the underlying assets had to do with their value. The empirical evidence points strongly toward a conclusion that even sophisticated investors did not take into account the possibility of sharp declines in housing prices (neglect of tail risk) but also did not have credible models for pricing re-securitized debt, particularly CDOs.

The former Prime Minister of the United Kingdom, Gordon Brown, is devastatingly unambiguous:

We were to find that almost all the banks would have too little capital to cope with a mispricing of the American mortgage market. The entire world failed to fully understand the new financial instruments. But so, it transpires, had those who devised, bought, and sold them. (...)
(Brown, 2010, p. 21)

⑥ Massive retention of toxic assets

Capital flows into the USA were non-speculative and in search for safety. In manufacturing (perceived) safe assets, the financial intermediaries took on more leverage, sourced assets such as sub-prime loans that carried higher risks, and retained toxic assets.

There are at least three plausible reasons for the massive retention of toxic assets by financial intermediaries (banks, for short). First, the retention was due to the fact that banks accumulated massive risks counting on government rescue – the ‘too-big-to-fail’ argument. Second, inappropriately designed arrangements for traders encouraged them to take risks unknown to the top executives – the ‘moral hazard’ argument. Finally, a third reason was the reluctance of large pools of investors to take any risk, which led to the concentration of risk in banks. Faced with high demand for riskless debt, banks diversified their portfolios by buying and selling risky loans. This diversification provoked the so-called ‘diversification myth’: banks bought risky loans to support the issuance of (perceived) riskless debt, increased the systematic risk of their portfolios, and became interconnected by sharing each other’s risks.

⑦ Housing bubble collapse and systemic risk

The housing bubble burst in July 2007 and vastly increased systemic risk in the financial system. Decline in interest rates, easier access to mortgage loans, appreciation of property values, and growth in refinancing opportunities are individually benign market conditions, but jointly pernicious when synchronized. This synchronization combined with the indivisibility of residential real estate (that prevents home owners from deleveraging when home values decline and homeowner equity deteriorates) results in the so-called ‘refinancing ratchet effect’:

Once property values decline, a wave of defaults becomes unavoidable because mortgage lenders have no mechanism such as a margin call to compel homeowners to add more equity to maintain their leverage ratio, nor can homeowners reduce their leverage in incremental steps by selling a portion of their homes and using the proceeds to reduce their debt.”
(Khandani et al., 2009, p. 2).

The refinancing ratchet effect gave rise to significant systemic risk in an otherwise geographically and temporarily diverse pool of mortgages.

⑧ Complex environment

At least two different types of complexity were present during the banking crisis 2007-08. First, structured finance created complicated and confusing products. The intricacies of these financial products are best illustrated by the CDOs. These esoteric financial products were created by investment banks to offload risk. In broad outline, the CDOs were created by pooling together portfolios of mortgages and then

separating them into different tranches (different classes of securities) with prioritized claims on the collateral. The process of pooling and tranching produced some securities that were riskier than the average asset in the collateral pool and some that were safer. The safest tranche was the senior tranche and the riskiest the junior tranche, usually referred to as ‘toxic waste.’ The senior tranches were constructed to receive AAA rating.⁴

Second, there was complexity emerging from the evaluation of the financial situation of counterparties (who owes what to whom). We can think of the financial sector as a complex network of linkages. A node in this network is a bank. Banks are frequently evaluating the financial situation of their counterparties. This network functions smoothly in normal times. Even though banks do not know the financial exposures of the other banks with certainty the auditing problem is tractable in normal times. However, when a sizable shock happens – e.g. a large liquidity shock – in parts of the network, the number of nodes to be scrutinized by each bank rises because the shock may have impacted the bank’s counterparties. The auditing problem becomes increasingly difficult to solve and, consequently, uncertainty pervades the network. Faced with this uncertainty, the banks hoard liquidity.

© Runs on the shadow banking system and fire sales

The term ‘shadow banking system’ refers to a section of the financial sector in which some financial institutions carried out activities similar to those of a traditional bank, but were unregulated. Investment banks financed some of their activities with repurchase agreements, or “repos.” Repo contracts are short-term loans collateralized by longer-term securities. For example, an investment bank borrows funds from a hedge fund by selling collateral today and promising to repurchase it tomorrow. Overnight financing required investment banks to roll over a substantial proportion of their funding on a daily basis.

The fall in house prices induced a fall in the prices of securitized sub-prime mortgages and the disclosure that highly leveraged investment banks were holding securitized sub-prime mortgages shocked the financial markets. This, in turn, led to a deterioration of the conditions in collateralized markets. For example, haircuts increased and became increasingly difficult to borrow against low-quality collateral.

What developed in the late 2007 and into 2008 was a run on the shadow banking system. The most visible of these runs was the collapse of the investment bank Bear Stearns. In March 2008, there was a run on Bear by its clients. These ‘depositors’ pull out their funds to enjoy a first-mover advantage (those who withdraw their money early get their full amount while those who move late might not). On March 12, 2008,

⁴ For a clear explanation of the market for CDOs and the economic motivation for CDO issuance see Benmelech and Dlugosz (2009a). A description of the credit rating crisis 2007-08 can be found in Benmelech and Dlugosz (2009b).

Bear was unable to secure funding on the repo market. The Federal Reserve bailed out Bear Stearns through an arranged merger with J.P. Morgan.

Substantial liquidity interventions from the Federal Reserve, for example lending to banks against risky collateral, stabilized the financial sector through the first three quarters of 2008. In the wake of the Lehman Brothers default on 15th September, 2008, the financial system cracked. This event revealed that the safe debt created by financial engineering was not truly safe.

Institutions that sold Credit Default Swaps (CDSs) such as the American International Group (AIG) run into trouble.⁵ On 16th September, 2008, the Federal Reserve organized a bailout of AIG (\$85 billion) in exchange for an 80% equity stake. Finally, banks' balance sheets contracted due to massive losses on assets and withdrawals of short-term financing. This prompted banks to liquidate assets in fire sales.

In October 2008 Knightian uncertainty was pervasive and the financial market conditions deteriorated precipitously. There was a freeze of the credit markets. Specifically, banks stopped lending; the issuance of corporate bonds, commercial paper, and a wide variety of other financial products largely ceased; and credit-financed economic activity was brought to a standstill.

The preceding sketch of the various phases of the banking crisis provides a number of factors that *prima facie* should be taken into account as a starting point of causation research. Before going into the identification of plausible causative factors, it is pertinent to specify a general methodology for counterfactual causation analysis that will be used later on.

3. Counterfactual methodology

The idea that causality is central to economics is at least as old as Adam Smith's (1776) foundational work. Indeed, the full title of Smith's book, *An Inquiry into the Nature and Causes of the Wealth of Nations*, signals that one of the most important tasks of economics is the search for explanations involving causal connections. For example, the importance of causal analysis to address specific policy problems is undeniable.

The most explicit recognition of the importance of causality in economics was made by Alfred Marshall in his *Principles of Economics*. Marshall's notion of cause-and-effect relation revolves around the idea of *ceteris paribus* change:

It is sometimes said that the laws of economics are

⁵ Many buyers of CDOs tried to protect themselves by purchasing *Credit Default Swaps (CDSs)*. The CDSs engendered a mirage. Worldly wisdom captured the relevance of these insurance contracts as follows: buying CDSs was like buying insurance for the Titanic from someone on the Titanic.

“hypothetical.” Of course, like every other science, it undertakes to study the effects which will be produced by certain causes, not absolutely, but subject to the condition that *other things are equal*, and the causes are able to work out their effects undisturbed. Almost every scientific doctrine, when carefully and formally stated, will be found to contain some proviso to the effect that other things are equal: the action of the causes in question is supposed to be isolated; certain effects are attributed to them, but only *on the hypothesis* that no cause is permitted to enter except those distinctly allowed for.

(Marshall 1966, p. 30) [*Italics in original*]

3.1. Dominant approaches to causality: structural and experimentalist

The most influential methodologies to causation in economics are the structural (or econometric) approach (Heckman, 2008) and the experimental (or atheoretic) approach, the latter based on statistical causality (Holland, 1986). Somewhat roughly, econometric causality is based on structural equations models (which rely on the specification of systems of equations representing behavioural relationships between variables and parameters) and the method of controlled variation.⁶ Statistical causality is an alternative approach to econometric causality based on the Rubin causal model (Holland, 1986).

Both econometric causality and statistical causality often take advantage of the presence of instrumental variables. These variables are excluded from some equations and included in others, so that they are correlated with some outcomes only through the effect on other variables. However, whereas econometric causality focuses on ‘causes of effects,’ statistical causality focuses on the ‘effects of causes’ (Holland, 1986, p. 945).

Discussing the myriad of technical issues associated with these two leading approaches to causality in economics requires significant space, and we will not undertake this task in the present paper. There are two reasons for overlooking the technicalities inherent to the major approaches: first, the difference between the structural and the experimentalist approaches has recently been clarified by Keane (2010); and second, neither of them will be used in the rest of the paper.

3.2. Two kinds of causation

Any analysis of causality should start by bringing into sharp focus the type of causation to be examined. Essentially, there are two kinds of causation. First, the

⁶ This method goes back to Marshall (1966, p. 30) who repeatedly used the method of controlled variation in his *ceteris paribus* clauses.

analysis may refer to instances of the same phenomenon. The causal analysis of a reproducible phenomenon is called *general* causation. Typical economic examples of this kind of causality include: the effects of a firm's input on its output, the effect of education on earnings, and the effects of employment training programs on subsequent labour market histories. Both the structural approach and the experimentalist approach have been extensively used to deal with problems that fall within the category of general causation.

The second kind of causation analysis focuses on a dated and non-replicable phenomenon occurring at a particular location such as the financial crisis 1930-33 in the United States. Causation of the second kind is said to be *singular*. In this case, facts do not permit the type of replicability that is present in much scientific enquiry. Counterfactual reasoning is typically used to explore singular causality. A counterfactual argument requires the analyst to posit: "What would have happened if ... had happened (or not had happened)."

3.3. Hicksian approach to causality

One particular approach dealing with singular causation is due to Hicks (1979). In rough outline, the counterfactual approach to causality involves three steps⁷: first, formulation of a counterfactual definition of 'cause'; second, given a collection of plausible causative factors, distinction between separable and non-separable causes; and finally, causality tests.

When there are several causative factors, it is necessary to distinguish 'separable' from 'non-separable' causes. If C is one of the causes of the effect E, then C can be a cause of E by itself. In this case, C is called a *separable* cause. But there may also be non-separable causes of E. It is said that a factor F is a *non-separable* cause of E if either the existence of F presupposes that C must be present or F is brought about by one or more separable causes.

3.3.1. Strong causation (single cause)

Consider two events, C and E that occurred at times T and T*, respectively, where T and T* are not necessarily moments of time (they can be periods of time). According to Hicks (1979, p. 12), to assert that C caused E presupposes that both C and E existed and involves positing that

If C had not have happened, E would *not* have happened. (1)

To test this basic definition, one must construct the hypothetical situation 'C did not exist' (or briefly, 'not-C'). The reason is easily seen. We know that C did happen, but

⁷ From now on, the expressions 'Hicksian approach to causality' and 'counterfactual approach to causality' will be used interchangeably.

we do not know what would have happened if C had not happened. In turn, the not-C situation requires a model or theory of the way C and E are connected. The model should provide reasons for thinking that events in reality may have been connected in the way they have been hypothesized.

If we represent the expression ‘E would *not* have happened’ by the symbol \ominus , that is,

$$\ominus \equiv \text{E would } \textit{not} \text{ have happened,} \quad (2)$$

the foregoing definition of cause can be slightly reformulated as follows:

$$\text{‘C caused E’ if ‘not-C produces } \ominus \text{.’} \quad (3)$$

This definition is only valid when C is the *sole* cause of E (strong causation), that is, when there is no other potential cause which is admitted to be a cause of E (Hicks, 1979, p. 13).

The simple logic of single cause analysis can be condensed as follows:

Not-C		Conclusion
Produces \ominus	implies	C caused E
Produces \oplus	implies	C did not cause E,

where

$$\oplus \equiv \text{‘E would have happened,’} \quad (4)$$

Suppose that the event E represents the USA banking crisis 2007-08 and ask: What caused E? One can always answer this question specifying a cause that is so general as to be useless. For instance, we can claim that ‘capitalism’ was the cause of the banking crisis 2007-08. The sheer number and variety of elements characterizing ‘capitalism’ makes the claim both trite and trivial. The ‘cause’ just mentioned reminds us what Hayek (1967) suggested many years ago. The complexity of the economy makes it possible for the economist to seek only the most prominent causative factors at work prior to the occurrence of E.

3.3.2. *Weak causation (multiple causes)*

It should be clear that if there are several potential causes (say, the separable factors C_1, C_2, C_3 , etc.) which may be operating to produce the effect E, the preceding definition requires further refinement. The reason is clear. If C_1 is not *the* but simply *a* cause of E (but so is C_2, C_3 , and so on), then the statement that the non-occurrence of C_1 implies the non-occurrence of E may not be valid.

We now consider the simplest case of weak causation (two separable factors C_1 and C_2). It is said that C_1 and C_2 are causes of E if one of the following two situations happens:

- (1) The effect E does not occur when either C_1 is absent or C_2 is absent or both C_1 and C_2 are absent
- (2) The effect E occurs if either cause is present, but it does not occur when both C_1 and C_2 are absent

The first situation can be symbolically represented as follows.

Situation 1

not- C_1 and C_2 is present, *ceteris paribus*, produces \ominus ;
 not- C_2 and C_1 is present, *ceteris paribus*, produces \ominus ;
 not- C_{12} *ceteris paribus* produces \ominus ,

where the symbolism not- C_{12} denotes a theoretical construction in which both C_1 and C_2 are absent. In this case, it is said that C_1 and C_2 are *additive causes* (Hicks, 1979, p. 15). The present situation can be visualized with the help of Table 1.

TABLE 1 HERE

Table 1

Additive causes

The not- C_1 construction is a model that allows the evaluation of the logical connection between the statement “ C_1 absent and C_2 present, *ceteris paribus*” and the mutually exclusive outcomes “ \ominus (non-occurrence of E)” and “ \oplus (occurrence of E).” According to the first column of this table, if the statement “ C_1 absent and C_2 present, *ceteris paribus*” is inserted into the model the effect E does not occur. A similar interpretation can be given to the not- C_2 and not- C_{12} constructions. For example, the last column of this table asserts that within the model “ C_1 absent and C_2 absent, *ceteris paribus*” implies the non-occurrence of E. All in all, this table asserts that the effect E will not happen unless both causes are present.

Not- C_1	Not- C_2	Not- C_{12}
\ominus	\ominus	\ominus

Situation 2 captures the possibility that additivity breaks down. In symbols,

Situation 2

not- C_1 and C_2 is present, *ceteris paribus*, produces \oplus ;

not- C_2 and C_1 is present, *ceteris paribus*, produces \oplus ; and

not- C_{12} *ceteris paribus* produces \ominus

This is the case of *overlapping causes* (Hicks, 1979, p. 15). Table 2 shows symbolically the essence of overlapping causes.

TABLE 2 HERE

Table 2

Overlapping causes

The interpretation of the symbolisms not- C_1 , not- C_2 and not- C_{12} is the same as in Table 1. The first and second columns of this table assert that the absence of only one factor (C_1 or C_2) is not enough to prevent the occurrence of the effect E. The message conveyed by this table is that the effect E will occur unless both C_1 and C_2 are absent.

Not- C_1	Not- C_2	Not- C_{12}
\oplus	\oplus	\ominus

3.3.3. Limitations

There can be little doubt that the counterfactual approach is a coherent methodology to organize thinking about singular causation. Its principal message is that theoretical economics is a key tool for hunting the causes of singular events that cannot be replicated. But praise does not imply perfection. Like most methodologies this approach has weaknesses. Undertaking an evaluation of the Hicksian approach to causality would take us too far afield. However, one example where the methodology is inconclusive immediately suggests itself. Suppose that two well-specified models M_a and M_b are suitable to accommodate the not-C construction. Suppose, in addition, that model M_a produces \ominus but model M_b produces \oplus . In this hypothetical situation, Hicks' account of causation turns out to be inconclusive. We are left, in principle, with an indeterminate outcome.

4. Identifying causative factors

For concreteness, the freeze in the credit markets that occurred in October 2008 is identified here with the effect E in the causal relationship ‘C caused E.’ It is generally agreed that E was caused by a combination of factors. For example, Archaya and Richardson (2009a) state that “There is almost universal agreement that the fundamental cause of the crisis was the combination of a credit boom and a housing bubble.” The narrative of the USA banking crisis sketched in Section 2 provides a source of raw material for the identification of the most prominent factors underlying the credit boom and the housing bubble that provoked E.

4.1. *Listing plausible causative factors*

Table 3 shows a list of nine plausible causative factors. This table omits complicating factors such as the refinancing ratchet effect, the rating agencies, and the CDSs because their role in the banking crisis was contingent on the presence of one or more of the items enumerated in Table 3. For example, it is evident that the CDSs delayed the occurrence of the financial collapse and constituted an important magnifying factor of wealth destruction but they cannot be held responsible for the financial crisis. The biggest problem was the fragility of the securities with bad loans in them, not the CDSs.

TABLE 3 HERE

Table 3

Factors underlying the credit boom and the housing bubble

This table reports what appear to be the most important factors conducive to the credit boom and the housing bubble emerging from comprehensive academic research. Each of them suggests itself as a seemingly worthy candidate to be a cause of the USA banking crisis 2007-08.

Plausible Causative Factor	Name
F ₁	Loose monetary policy
F ₂	Global saving glut
F ₃	Poor supervision
F ₄	Sub-prime market boom
F ₅	High securitization activity
F ₆	Re-securitization
F ₇	Ignorance
F ₈	Excessive risk-taking
F ₉	Too-big-to-fail

4.2. *Sifting causative factors*

It is generally agreed that the origins of the crisis can be traced to two plausible causative factors F_1 (loose monetary policy) and F_2 (global saving glut). Lax monetary policy after the burst of the internet bubble combined with the high demand for safe securities, especially from Asian central banks, constituted enabling conditions for the banking crisis 2007-08.

Furthermore, there is no doubt that poor supervision (causative factor F_3 in Table 3) substantially contributed to worsening the opacity of the financial system. However, it would be hard to argue that this factor in *isolation* provoked the financial catastrophe. Supervision cannot restore transparency if the existing financial regulation is obsolete. For example, the ‘shadow banking’ system was beyond the control of the U.S. Securities and Exchange Commission.

Dell’Ariccia et al. (2008) brings into sharp focus the sub-prime mortgage market boom (causative factor F_4 in Table 3) and developed an appreciative model to show that one of the origins of the USA banking crisis 2007-08 was the abnormal size of this market. Specifically, these authors establish a link between the credit bubble and the deterioration of the lending standards in the sub-prime market. The model of Dell’Ariccia et al. (2008) confirms that with sound lending standards the USA sub-prime mortgage market would have remained relatively small.

Allen and Carletti (2010) argue that loose monetary policy, particularly in the USA, and global imbalances created a bubble in real estate prices in the USA and other developed countries such as Spain and Ireland. These authors also argue that many other factors such as high securitization activity (causative factor F_5 in Table 3) exacerbated the effects of F_1 and F_2 .

Re-securitization refers to the process of pooling and tranching a whole set of, for example, mortgages to spread risk differentially implemented by the investment banks. The archetypal example of F_6 (re-securitization) is the creation of CDOs. The root problem with F_6 was the lack of incentives to monitor the quality of the underlying loans. It should be clear that F_6 cannot exist without securitization because re-securitization presupposes securitization. Therefore, F_6 cannot be separated from F_5 .

An efficient financial system presupposes that (a) people have easy access to all relevant information; (b) the availability of information automatically implies a clear understanding of the possibilities and limitations of the products in question; and (c) all risks are recognized *ex-ante*. For lack of a better term, we call this presumption *postulate of full comprehension*. For example, according to this postulate economic agents are perfectly aware of the existence of worst states of the world associated with

complex financial products such as the CDOs and they do not ignore the probability of occurrence of the worst states.

If (for whatever reason) some risks associated with financial products are ignored, the factor F_7 (ignorance) is present. Gennaioli et al. (2011a) assume that investors and intermediaries did not satisfy the postulate of full comprehension during the unfolding of the banking crisis 2007-08 because they *neglected* tail risks.⁸ They argue that, with the neglected risk assumption, new financial products provide false substitutes for truly safe bonds and the financial system is fragile. Specifically, Gennaioli et al. (2011a) state that, “A small piece of news that brings to investors’ minds the previously unattended risks catches them by surprise, causes them to drastically revise their valuations of new securities, and to sell them in the market.”

As to the second last plausible causative factor F_8 (excessive risk-taking), there is evidence that low interest rates induce imprudent risk-taking (Taylor, 2009); (Maddaloni and Peydro, 2011). This suggests that F_8 was brought about by F_1 (loose monetary policy) and F_2 (global saving glut), and therefore, F_8 cannot be considered as a separable cause of E.

On the last causative factor F_9 (too-big-to-fail), it is not inconceivable that the ‘too-big-to-fail’ phenomenon may have encouraged large and complex financial institutions to take on too much risk. However, few economists would argue that the expectation that taxpayers would end up footing the bill of bank loss was one of the separable causes of the financial debacle at the end of 2008. It does not appear to be solid evidence that F_9 played a key role in engendering the banking crisis.

The foregoing discussion enables us to confine attention to the six factors shown in table 4.

TABLE 4 HERE

5. Causality analysis of the banking crisis 2007-08

The counterfactual approach to causality outlined in Section 3 provides a simple framework which can be applied to identify the preponderant causes of the USA banking crisis 2007-08. It should be emphasized that the following causality analysis takes for granted the existence of a set of microeconomic rules for the banking game compatible with banking fragility. This presupposition is based on a key lesson of the history of banking crises identified by Curie (2006) and Calomiris (2009).

According to the counterfactual approach, the proof that S_1 (loose monetary policy), S_2 (global saving glut), S_3 (poor supervision), S_4 (sub-prime market), S_5 (high

⁸ If investors and intermediaries ignore tail risks, it is said that the assumption of *neglected risk* is met.

securitization activity), and S_6 (ignorance) are separable causes of E would require at least one theoretical construction capturing these key factors. In reviewing the literature on the banking crisis 2007-08, we have not uncovered any work that incorporates all these six factors into a single model. It is likely that a model explicitly involving such a large number of factors would be intractable or ambiguous.

Table 4

Separable factors of the banking crisis 2007-08

The identification of separable causative factors is a pre-condition to implement the counterfactual approach to causality. The elimination from Table 3 of F_6 (re-securitization), F_8 (excessive risk-taking), and F_9 (too-big-to-fail) is based on logic connections, empirical evidence, and lack of evidence, respectively. This leads to six separable factors, denoted by S_1, S_2, \dots, S_6 , that were present during the credit boom and the housing bubble.

Separable Causative Factor	Name
S_1	Loose monetary policy
S_2	Global saving glut
S_3	Poor supervision
S_4	Sub-prime market
S_5	High securitization activity
S_6	Ignorance

5.1. First causes and preponderant causes

Faced with this stumbling block, we posit a hierarchical classification of the causative factors. The *first causes* of E are those separable causative factors that establish a platform for the unfolding of the banking crisis. Archaya and Richardson (2009b), and Rajan (2010) suggest that loose monetary policy, global imbalances, poor supervision, and the sub-prime market were the first causes of E. The collection of these causative factors can be thought of as a ‘crisis environment’ necessary –but not sufficient– for E to occur. To guarantee the occurrence of E, there has to be supplementary and powerfully operative factors. We call these high-powered factors which have to be embedded in the crisis environment to provoke the freeze of the credit markets, the *preponderant causes* of E.

Few economists would deny that securitization and ignorance were powerfully operative factors at work prior to the occurrence of E. However, to argue that there are reasons to believe that S_5 and S_6 constituted important separable factors in the context of the banking crisis is not the same as showing that they were, in fact, the preponderant causes of the crisis.

5.2. Structure of the proof

Using the counterfactual approach to causation, it will be shown that C_1 (securitization) and C_2 (ignorance) were the preponderant causes of the crisis and these separable causes were additive.⁹ To this end, it is necessary to find one or more economic models such that the following conditions are satisfied:

- ① C_1 is absent while C_2 is present *ceteris paribus* imply E does not happen;
- ② C_2 is absent while C_1 is present *ceteris paribus* imply E does not happen; and
- ③ both C_1 and C_2 are absent *ceteris paribus* imply E does not happen,

where the *ceteris paribus* clause includes the first causes of E.

Gennaioli et al. (2011b) have developed a model of shadow banking that brings into sharp focus the implications of risk allocation through securitization. The risky loans generated by the financial intermediaries are subject both to idiosyncratic risk and to systematic risk. Outside investors are only interested in riskless debt. Securitization enables the diversification of idiosyncratic risk, promotes the expansion of the banks' balance sheets, and increases the links among them. In their model, a high level of investor wealth triggered a chain reaction: expanded securitization, growing leverage, growing assets of the intermediate sector, lower interest rates, and increased bank risk-taking.

The novel result of the shadow banking model is that the elimination of intermediary-specific idiosyncratic risks by securitization to underpin the issuance of (perceived) riskless debt raises the exposure of these intermediaries to the tail aggregate risks. Or, to put it differently, the model of shadow banking predicts the 'diversification myth.' This result is valid under either the rational expectations assumption or the 'neglected risk' assumption.

It should be clear that the rational expectations assumption implies that the postulate of full comprehension is valid. It should also be clear that the failure to recognize risks ex-ante implies ignorance. What may not be as obvious is that under rational expectations the shadow banking system is very stable, but the neglected risk assumption renders the shadow banking system extremely fragile. The source of instability is the neglect of aggregate risk (Gennaioli et al., 2011b).

⁹ The change in notation from S_5 and S_6 to C_1 and C_2 , respectively, is just to facilitate contact with Section 3.

5.3. *Proof of additive causality*

Using the shadow banking model as a theoretical construction to test for causality, it is not difficult to prove that C_1 and C_2 are additive causes of the credit market freeze. As mentioned previously, the proof of causation with two separable factors requires the logical analysis of three distinct cases.

Proof of Case ①. In the absence of securitization, the shadow banking system is stable even under the neglected risk assumption. The reason is obvious. If there is no securitization activity, bank interdependence cannot grow.

Proof of Case ②. When securitization exists and all market participants hold rational expectations, the shadow banking system is stable, and therefore, the banking crisis cannot happen.

Proof of Case ③. A trivial prediction of the shadow banking model is that a banking crisis cannot occur in the absence of both securitization and ignorance. This completes the proof.

Table 5 provides a schematic view of the causality proof. It is easily seen that the collection of the first causes together with the preponderant causes constitutes a *minimal* sufficient condition for E to occur. This set consists of six separable causative factors (see Table 4) and is ‘minimal’ in the sense that it does not contain redundant conditions.

TABLE 5 HERE

6. Summary and concluding remarks

The Financial Crisis Inquiry Commission was created by both the USA Congress and the President to answer the question: What caused the USA banking crisis 2007-08? The Commission interviewed more than 700 witnesses, held 19 days of public hearings, examined millions of pages of documents, and published a 545-page report. (FCIR, 2011). Using a narrative approach the report established that the crisis had many causes and identified them.

Both the majority’s report and the dissenting statements are an account of events without a clear methodological framework. Any identification of causes in this fashion, even as a suggestive rather than a substantial result, must meet some minimum methodological requirements to underpin its validity. Unfortunately, FCIR (2011) does not define the meaning of ‘cause.’ It also does not make use of any methodology for causation analysis applicable to single non-replicable events. There are no tests to indicate if the identified factors were, in fact, separable causes of the banking crisis.

Table 5

Schematic view of the causality proof

The proof that securitization and ignorance were the preponderant causes of the USA financial crisis 2007-08 is based in the Gennaioli-Shleifer-Vishny model of shadow banking. The last row in Table 5 shows that inserting into this model the assumptions corresponding to each case implies that the credit market freeze does not occur. Or, to put it differently, the crisis does not happen unless both C_1 and C_2 are present.

Cases Causes	Case ①	Case ②	Case ③
C_1 (Securitization)	Absent	Present	Absent
C_2 (Ignorance)	Present	Absent	Absent
E (Credit Market Freeze)	\ominus	\ominus	\ominus

To structure our exploration of the causes of the financial crisis 2007-08, we started with a condensed narrative of the crisis. That allowed us to identify nine plausible causative factors (see Table 3). Three factors, namely: re-securitization, excessive risk-taking, and too-big-to-fail were discarded for different reasons (logical connection with securitization, empirical link with loose monetary policy, and lack of solid evidence, respectively). As a result, we arrived at a list of six separable causative factors shown in Table 4.

The counterfactual approach to causality uses theoretical economics in a fundamental way. To implement the causality tests, we need at least one theoretical construction connecting all six causative factors. Regrettably, there is no formal model explicitly capturing such large number of factors. However, there is persuasive evidence that loose monetary policy, global saving glut, poor supervision, and the sub-prime market were necessary conditions for the banking crisis to occur. It is for this reason that we consider them as the first causes of the banking crisis.

The set of first causes constitutes the ‘crisis environment.’ To guarantee that the freeze of the credit markets happens, there must be supplementary and powerfully operative factors at work in addition to the first causes, such as high securitization activity and ignorance. We call these additional factors the preponderant causes of the banking crisis.

Evidently, we know that the freeze of the credit markets did happen in October 2008 and that both C_1 (securitization) and C_2 (ignorance) were present; we do not know, in the same way, what would have happened if both C_1 and C_2 did not happen. The counterfactual approach to causality enables us to answer this question with the help of economic models. Using the path-breaking model of shadow banking developed by Gennaioli et al. (2011b), together with the counterfactual approach to causality, we have shown that securitization and ignorance were the preponderant causes of the USA banking crisis 2007-08.

As a final remark in this paper, we should mention the relationship between necessary and sufficient conditions for the USA banking crisis 2007-08 to occur. As mentioned before, the set of first causes is a set of necessary conditions for E to occur. When we embed the preponderant causes into the crisis environment, we generate a set of six causative factors that constitutes a minimal sufficient condition for E to occur.

Appendix

The purpose of this appendix is to present in tabular form the anatomy of the USA banking crisis 2007-08 together with a small sample of academic references extracted from the massive literature associated with this crisis.

TABLE 6 HERE

Table 6**Anatomy of the USA banking crisis 2007-08 and key references**

This table provides the anatomy of the banking crisis and indicates some of the key references associated with each of the nine intertwined phases of the USA banking crisis 2007-08.

Crisis intertwined phases	Central facts	Sample of key references
① Low interest rate environment	After the Internet bubble and burst, the Federal Reserve adopted a lax interest rate policy, and the USA experience large capital inflows from foreign central banks and governments seeking for safe investments.	(Brunnermeier, 2009); (Caballero et al., 2008); (Caballero and Krishnamurthy, 2009); (Diamond and Rajan, 2009); (Taylor, 2009)
② Housing bubble	A housing bubble inflates in the mid-2000s. The USA home prices tripled between the mid-1990s and 2006.	Case (2008); (Mayer et al. 2009).
③ Sub-prime market boom	Lending to risky borrowers grew rapidly in the 2000s. Deteriorating lending standards in the mortgage market contributed to the expansion of the sub-prime market. The number of sub-prime mortgages nearly doubled between 2003 and 2005. Non-prime lending levelled off in 2006.	(Dell’Ariccia et al., 2008); (Mayer et al., 2009); (Maddaloni and Peydro, 2011)
④ Formidable credit expansion	The housing bubble was accompanied by a major credit expansion not only in the residential mortgage area but also in commercial mortgages and credit card finance. The insatiable demand for AAA securities magnified the re-securitization activity. Leading rating companies reinforced the hyperactive process of re-securitization through misleading ratings of these securities.	(Benmelech and Dlugosz, 2009b); (Coval et al. 2009); (Mian and Sufi 2009).
⑤ Ignorance	Complex bundles of obligations that was thought to spread risk efficiently, made the resulting financial products extremely non-transparent. Market participants, including the rating agencies, did not understand the risks of the mortgage-related securities. The difficulty of understanding the riskiness of financial products such as CDOs was due to the intricacies of the financial engineering process.	(Brown, 2010); (Coval et al., 2009); (Gennaioli et al. 2011a); (Gerardi et al., 2008); (Jarrow et al., 2007).
⑥ Massive retention of toxic assets	Re-securitization resulted in a massive retention of toxic assets by financial intermediaries. There are three possible explanations for such retention: ‘too-big-to-fail,’ ‘moral hazard,’ and ‘diversification myth.’	(Brown, 2010); (Gennaioli et al. 2011b); (Rajan, 2010); (Shleifer and Vishny, 2010a).

Table 6 –Continued

Crisis intertwined phases	Central facts	Sample of key references
<p>⑦ Housing bubble collapse and systemic risk</p>	<p>The triggering event of the banking crisis was the crash in the housing bubble. Non-prime lending drop drastically in the first half of 2007. The USA home prices fell spectacularly by about 30% in 2007-2009. As the housing bubble collapsed, sub-prime mortgages began to default. The 2007 dramatic fall in non-prime originations was accompanied by a sharp rise in delinquencies rates and vastly increased systemic risk. The impact of these defaults was greatly magnified by the ‘refinancing ratchet effect,’ and the complex bundling of obligations, e.g. CDOs.</p>	<p>(Mayer et al., 2009) (Khandani et al., 2009)</p>
<p>⑧ Complex environment</p> <p>Complex financial products</p> <p>Complex auditing problem</p>	<p>Complexity stemmed from complicated financial products and the difficulty in assessing counterparty risk.</p> <p>The slicing and dicing through repeated securitization of the original package of mortgages originated very complex securities difficult to value.</p> <p>When a sizable shock to the financial system happens, the number of counterparties to be audited rises. The problem becomes too complex for the banks to figure out.</p>	<p>(Benmelech and Dlugosz, 2009a); (Buchhiet, 2008)</p> <p>(Caballero and Simsek, 2009a)</p>
<p>⑨ Runs on the shadow banking system and fire sales</p>	<p>A run on the shadow banking system developed in the late 2007 and into 2008. After the bankruptcy of Lehman Brothers investment bank in September 2008, disturbing events rolled out in quick succession (particularly, bad news about the value of mortgage-backed securities used as collateral in the repo contracts). As the value of mortgage-back securities fell and uncertainty about their future increased, many forms of short-term financing such as repos dried up.</p> <p>Collateralized lending was the most common mechanism that precipitated forced sales of assets.</p>	<p>(Adrian and Shin, 2010); (Brunnermeier, 2009); (Gorton and Metrick, 2009, 2010)</p> <p>(Caballero and Simsek, 2009a) (Shleifer and Vishny, 2010b, 2010c)</p>

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