Why are there financial crises? Recent developments in theory

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Abstract

In financial crises, a period of overheated credit markets turns into a credit crunch accompanied by a systemic break-down in the financial intermediary sector. Without a deep understanding of their roots, designing policies to decrease the probability of suffering from them, or to avoid the worst consequences is like flying blind. In this paper, we survey how the theory of financial crises has recently developed. We focus on the answers these theories provide to four fundamental questions. What makes the booming phase fragile and what are the incentives and frictions leading to that fragility? What triggers the crisis? Why is the downturn persistent? Should policy intervene and, if yes, how?

1 Introduction

Financial crises are widely described as a period of overheated credit markets, which abruptly turns to a credit crunch accompanied by a systemic breakdown in the financial intermediary sector. During the boom phase there is abundant available credit at small spreads even to risky firms and households, and fast growth in investment and output. In the bust phase the same risky entrepreneurs and households are squeezed, credit is expensive if there is any, asset prices and output growth collapses.

Clearly, it is critical for both policy makers and academics to understand the mechanisms that cause financial crises. Without a deep understanding of their roots, designing policies to decrease the probability of suffering them, or to avoid the worst consequences is like flying blind.

Before the Global Financial Crisis, there was a perception that in the post-war world, such boom bust patterns were characteristic of emerging markets only. Accordingly, empirical and theoretical research alike focused mostly on the emerging market crises of the 1980s and 1990s highlighting the role of capital account liberalization, surge in capital inflows and sudden stops, real-exchange rates and evolution of terms of trade.

However, the Global Financial Crisis in 2008, and, to some extent, the European Debt Crisis in 2010 have dramatically exposed similar vulnerabilities in a group of advanced economies. This has in turn led to a shift in focus on the potential and existing problems of financial intermediation even where it is the most developed.

In this paper, we survey the development of financial crises theory as a result of that shift in attention.

We choose the seminal papers of Kiyotaki & Moore (1997) and Bernanke et al. (1999) as our starting point. These works had a fundamental impact on our thinking, by providing a plausible mechanism on how relatively small adverse shocks can be amplified through asset prices when collateralized credit is present, leading to persistent downturns. Starting from there we take a bird's eye view of the main directions the literature has developed since then. We focus exclusively on papers which contribute new theoretical insights to our understanding of the potential mechanisms behind these episodes.

As we show, most proposed mechanisms can be viewed as a combination of answers to some or all of four fundamental questions. First, what makes the booming phase fragile and what are the incentives and frictions leading to that fragility? Second, what triggers the overheated market to turn to a credit crunch? Third, why is the downturn persistent? And, consequently, should policy intervene and, if yes, how?

In what follows, we will discuss the main developments in theory through the suggested answers to these questions. To set the stage, Section 2 provides a brief summary of the recent empirical literature highlighting the most robust empirical facts characterizing these episodes. Then, as the main part, in Section 3 we group and summarize papers based on their main insights. Instead of aiming for a comprehensive list, we select the papers which we feel, quite subjectively, as the most likely to change the direction of the future discussion. We put special emphasis on more recent publications. In Section 4, we discuss the differences of the policy implications of various theories. Finally, we conclude.

2 Stylized facts in financial crises

Financial crises are rare events. In order to separate the general features from the particularities of each episode, during the last decades there has been an increasing effort to build

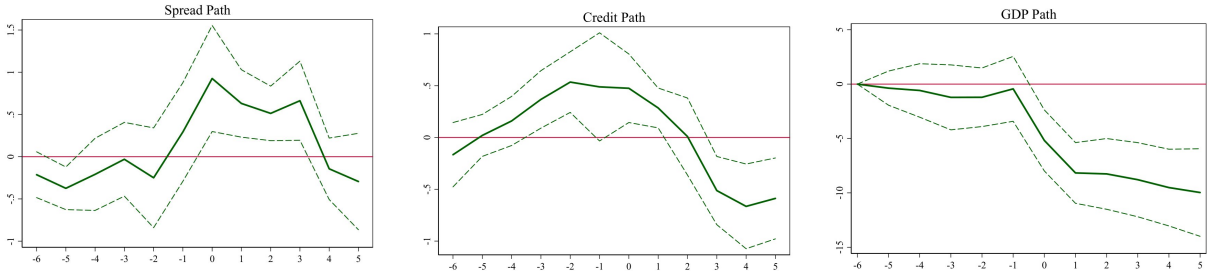

Figure 1: This is Figure 1 in Krishnamurthy & Muir (2024) showing the mean path of credit spread, bank credit and GDP across a sample of 40 financial crises. Units for credit spread are in standard deviations from trend for given country, and in % deviation from trend for GDP.

large, increasingly comprehensive data sets.

The first wave of this empirical work focused on financial crises in emerging markets of the 1980s and 1990s (e.g. Kaminsky & Reinhart, 1999; Borio & Lowe, 2002). Since the Global Financial Crisis, the attention shifted to advanced economies and extending the scope back to the pre-war periods (e.g. Schularick & Taylor, 2012; Jordà et al., 2015). Even more recently, there has been an increasing attention on the role of asset prices and the sectoral decomposition of credit besides traditional macroeconomic variables (e.g. Baron & Xiong, 2017; Greenwood et al., 2022; Müller & Verner, 2023; Krishnamurthy & Muir, 2024). We refer the interested reader to Sufi & Taylor (2022) and Frydman & Xu (2023) for recent surveys of this literature.

For our purposes, it is sufficient to focus on the stylized facts of Figure 1 borrowed from Krishnamurthy & Muir (2024). The figure plots the mean path of credit spread, bank loans and GDP around 40 international financial crises. The episodes are identified by systemic problems in the banking sector. Credit spreads are measured as the difference between the normalized average yield of corporate and sovereign bonds in a given country in a given period, relative to the corresponding yield on UK government debt.

Looking at the pre-crisis dates on the three panels, it is apparent that financial crises tend to be preceded by a period of increased quantity of credit issued at low spreads and higher than average GDP growth. This is the pre-crisis period characterized by an overheated credit market.

When the crisis is triggered, spreads jump showing a sharp negative update of assessed credit quality, which corresponds to a collapse of credit quantity and GDP growth. Importantly, the post-crises period is characterized by a persistent recession. Credit and GDP growth remains under the trend for even 5 years after the crisis.

Krishnamurthy & Muir (2024) also emphasize the considerable heterogeneity across episodes which Figure 1 masks. The left panel of Figure 2 shows their scatter plot of the

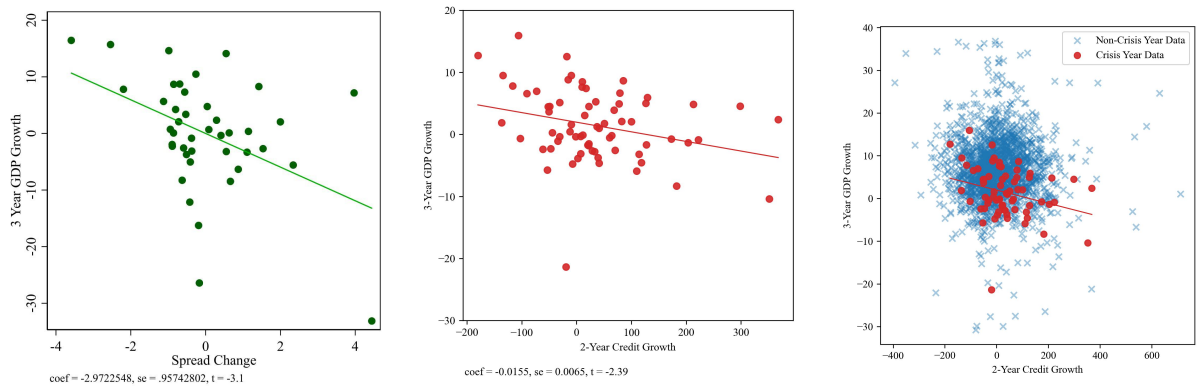

Figure 2: The left panel is part of Figure 2 in Krishnamurthy & Muir (2024) showing spread changes against future 3-year GDP growth around financial crisis dates. The middle panel shows 2-year credit growth before crisis dates against 3-year GDP growth after. The right panel adds the non-crisis dates (blue cross).

three year GDP growth rate against the spread change for the 40 financial crises episodes. While there is a significant negative relationship, clearly, there are many episodes where the GDP collapse was not presaged by a jump in the credit spread.

The middle and right panels of Figure 2 represent a similar observation with respect to credit growth. The scatter plots show the 3-year GDP growth after crisis episodes against the 2-year credit growth before using the data and the crisis dates from Jordà et al. (2015).[1] Panel (c) adds observations for non-crisis dates. While the presence of a credit boom increases the probability of a crisis, clearly, it is neither sufficient nor necessary for one.

Krishnamurthy & Muir (2024) argues that these stylized facts lend themselves to an "FZ"-view of financial crisis. That is, the crisis is severe when the product $\mathcal{F}_{i,t} \times z_t$ is large where z_t is the shock hitting the financial sector with a fragility $\mathcal{F}_{i,t}$. Their results point to the direction that the extent of the pre-crisis growth in credit and the increase in credit spreads are good proxies to measure the fragility of the financial sector, and the size of the shock, respectively.

In the rest of this survey, we discuss how various theories of financial crisis can shed more light on such mechanism. Namely, how does fragility, $\mathcal{F}_{i,t}$, build up in the financial sector? Why are periods with large fragility associated with an overheated credit market? What can be a trigger, z_t which turns the booming credit market to a credit crunch? What makes the

[1] We exclude years for WWI and WWII. GDP growth is computed as the cumulative percentage change of real GDP per capita in the 3 years following a given period t. It is demeaned by the sample growth rate in GDP for country i. Credit growth is the percentage change of total loans in the 2 years preceding a given period t. It is demeaned by the sample growth rate and normalized by the standard deviation of credit growth for country i.

resulting recession deep and persistent? In what sense are any of the stages inefficient and, hence, require government intervention? If they do, should the intervention be preemptive, or ex-post?

3 Theories of financial crises

In this section, we focus on the main distortions which can help us to conceptualize the mechanisms of financial crises.

Building on the early insights of Kiyotaki & Moore (1997) and Bernanke et al. (1999), there has been a growing literature exploring in more detail the role of financial constraints in the intermediary sector in amplifying the size and persistence of initial adverse financial shocks to the economy leading to deep and long recessions.

An important literature focuses on the normative side of such economies focusing on the question of how pecuniary externalities might justify the need for policy intervention. It was recognized early that these externalities might help to understand why there is over-borrowing in credit markets in the boom phase, leading to excessive deleveraging in the crisis. More recent literature highlights that the pecuniary externality might arise on the side of financial intermediaries instead of firms. It also argues that these externalities are conceptually distinct from fire sales, and that they can lead not only to over-borrowing, but to excessive risk-taking as well.

There has also been a growing interest in the role of demand externalities in the persistence of recessions following financial crisis. Demand externalities assume complete markets but nominally rigid prices and also lead to over-borrowing in the boom phase.

Then we turn to the role of belief distortions. We show that speculation due to dispersion in beliefs can simultaneously explain increased leverage and inflated asset prices in the boom phase and the abrupt crash in the bust phase as the most optimistic investors lose their capital. Consequently, their influence on the wealth weighted average belief also decreases. In contrast, models with diagnostic expectations are particularly useful to explain the low level of spreads in the boom phase, because the average investors' overreaction to recent news results in over-optimism. Then, disappointing shocks lead to a hike in spreads and a collapse.

There is also a stream of papers arguing that the abrupt change of overheated credit markets to a credit crunch is due to lenders' rational decision to change the way they learn about the fundamentals of the economy, and, consequently, tighten their lending standards. Therefore, the crisis corresponds to a sudden revelation of information instead of a sudden change of beliefs. We can see this as a rationalization of the "Minsky-moment". In

these models, fragility and the probability of the crash is related. When fundamentals are sufficiently weak it becomes rational for investors to change their lending standards.

The last stream of papers we discuss in this section conceptualizes the occurrence of the crisis as a shift across multiple equilibria. This shift is interpreted as a bank run. In these models the economy is fragile if it is the region of multiplicity. However, beyond that there is no direct connection between fundamentals and the probability of the crisis. In that region, fundamentals are consistent both with a crisis and with no crisis.

3.1 Constrained intermediaries: amplification and persistence

The Global Financial Crisis renewed attention on amplification affects through financial institutions balance sheets (e.g., Gertler & Kiyotaki, 2010; Gertler & Karadi, 2011; He & Krishnamurthy, 2012; Brunnermeier & Sannikov, 2014; Di Tella, 2017).

A subset of these papers developed a continuous-time formalization (e.g. He & Krishnamurthy, 2012; Brunnermeier & Sannikov, 2014) which contributed to a better understanding of certain facades of financial crises as the non-linear effect of shocks and the origins of endogenous risk.[2] In He & Krishnamurthy (2012) only specialists have access to a high return technology. Households would like to invest through the intermediaries managed by the specialist, but a moral hazard problem imply a skin-in-the game constraint: households can delegate their moneys only up to a given fraction of specialists' own wealth. Hence, when specialists are subject to losses, the constraint might become more binding, leading to less delegated capital, further losses of capital for specialists, lower price or the risky asset, reinforcing the deterioration of intermediaries balance sheets. That is, the agency problem creates a concentration of aggregate risk on the intermediaries' balance-sheet.

Note however that just as in the classic versions of Kiyotaki & Moore (1997) and Bernanke et al. (1999), these models do not separate the balance sheet of high-productivity agents (representing non-financial firms) and that of financial intermediatiaries (representing banks). The intermediation friction is captured in a minimal form, reduced to a financial constraint limiting the high-productvity agent's activity. The ambition of Gertler & Kiyotaki (2010) and Gertler & Karadi (2011) is to model an explicit banking sector as the source of financial acceleration to understand better how intermediation breaks down, or by extension on how policy instruments aiming to improve the health of banks can help

In particular, Gertler & Kiyotaki (2010) assumes bankers who can abscond with an exogenous fraction of their assets. Hence, they will be able to take deposits, and expand their assets, only to the extent that their value is not too high compared to their own

[2]See Kondor & Vayanos (2019) for a minimalist continuous-time model where standard risk-sharing and wealth effects lead to similar amplification and risk patterns to the Brunnermeier & Sannikov (2014) economy.

equity which determines the continuation value of banking. That is, while in Kiyotaki & Moore (1997), the future value of firms' assets limits how much they can borrow, resulting in financial acceleration through the balance sheet of non-financial firms, in Gertler & Kiyotaki (2010), the equity of the bank puts an endogenous limit on how much deposit they can collect, resulting in financial acceleration through the balance sheet of banks.

In this version, the trigger of a financial crisis is a decline in capital quality deteriorating the net worth of banks. This leads to a drop in their demand for assets, and a subsequent drop in the value of assets, amplifying the deterioration of net worth, especially when banks' leverage is high. Given banks' leverage constraint, their reduced net worth limits lending in the subsequent periods constraining, investment and growth rate of output leading to long and persistent recessions.

3.2 Pecuniary externalities: the reason for regulation

Since the seminal work of Stiglitz (1982), Geanakoplos & Polemarchakis (1985), and Greenwald & Stiglitz (1986) it is well understood that when markets are incomplete, pecuniary externalities might distort agents' decisions in the market equilibrium.

Two major types of such externalities are often connected to financial crises: the collateral externality and the distributive externality.

The collateral externality arises when firms or intermediaries face financial constraints which tighten when the price of capital is depressed. As firms do not internalize that the price effect of their decisions might tighten the constraint for other agents, their individual choices might not be socially optimal. The typical picture is that the capital price in the crisis period is too low from the planner's point of view, which is consistent with socially excessive borrowing in the ex-ante period. The most prominent example is when firms' debt is limited by the future value of their capital (e.g. Kiyotaki & Moore, 1997; Bianchi, 2011).

The distributive externality, in contrast, can be consistent both with socially too high or too low capital price in the crisis period. The critical observation is that incomplete markets might hinder the ability of capital markets to equalize the marginal rate of substitution of different group of agents across dates and states. For instance, it might be the case that high productivity agents are forced to sell capital to low productivity agents at a price which is in between their marginal valuation of capital. Then, if the planner can modify allocations in the ex-ante period to raise the transaction price in the crisis period, this would transfer resources towards the high productivity agent raising social welfare. However, in economies where the high productivity agent buys capital in the crisis period the direction of the externality is reversed.

Dávila & Korinek (2018) systematically analyze the effect of collateral or distributive externalities to welfare.[3] Importantly, they point out that even if we observe fire sales and financial amplification in the crisis state it does not imply that limiting credit in the boom phase would have increased welfare. In fact, through a series of examples, they demonstrate that fire sales and financial amplification can arise in a constrained efficient economy.

Lorenzoni (2008) is a well-known example to highlight that the distributive externality can lead to inefficient credit booms.[4] The basic idea is as follows. There are high productivity entrepreneurs borrowing from low productivity consumers and choosing their level of investment in the ex-ante period. The investment produces high output by the final period if the capital is adequately maintained. Namely, in the interim period, a maintenance cost has to be paid proportionally to the level of capital. If the entrepreneur does not have enough cash for maintenance, she has to sell her existing capital to consumers to cover the maintenance of the remaining stock. If contracting is subject to financial constraints, this will be the case after sufficiently adverse shocks in the interim period. As consumers have a decreasing marginal product of capital, the more entrepreneurs sell, the lower the price. As each agent takes prices as given, entrepreneurs do not internalize that if they were to invest less ex-ante, they would liquidate less in the bad state, which would increase the interim price of capital. As entrepreneurs are the sellers in the interim period, higher price is a transfer from consumers to entrepreneurs. Because entrepreneur's marginal product is larger, this transfer would increase total consumption. Therefore, there is inefficiently high investment and borrowing in the ex-ante period.

He & Kondor (2016) show, in a model where entrepreneurs' main choice is how much liquidity to hold to safeguard against maintenance shocks of capital and prepare for idiosyncratic new investment opportunities, that the distributive externality often changes sign over the cycle. Namely, it simultaneously leads to over-investment in capital in the boom phase and to underinvestment in the recession phase compared to second best.

[3]There is a small group of papers focusing on the interaction of the collateral and distributive externalities. An early example is Gromb & Vayanos (2002) where arbitrageurs trade between segmented markets but their activity is limited by a price sensitive collateral constraint. They do not internalize that the price effect of higher risk taking both redistributes utility across the segmented markets, and affect the risk-taking ability of other arbitrageurs. Depending on the relative direction and size of these forces, arbitrageurs might take on too much or too little risk.

More recently, in Lanteri & Rampini (2023) constrained and unconstrained firms trade old and new capital creating an economy where the the collateral and the distributive externalities have opposite sign. Lanteri & Rampini (2023) provide a proof that in the stationary equilibrium, the distributive externality must be larger leading to inefficiently high price for the old capital.

[4]See also Shleifer & Vishny (1992), Allen & Gale (1994) for early work pointing out mechanisms related to the distributive externality. There is also a long tradition of related mechanisms in international finance (Caballero & Krishnamurthy, 2001, 2003; Bocola & Lorenzoni, 2020) and in banking (Allen & Gale, 2004, 2005; Farhi et al., 2009).

There is also a growing literature aiming to understand better why financial institutions not share their risk exposure with the rest of the economy to a larger extent. As it was pointed out early by Krishnamurthy (2003), if agents can insure against aggregate shocks, the amplification through the collateral constraint and the collateral externality disappear. Di Tella (2017) makes a similar point with respect to continuous-time balance-sheet recession models (e.g. He & Krishnamurthy, 2012; Brunnermeier & Sannikov, 2014). If short-term contracts on aggregate risk are available, the concentration of aggregate risk on intermediaries' balance sheet, and the implied balance-sheet amplification channel, can be avoided.[5] In a follow-up paper, Di Tella (2019) provides a more detailed welfare and policy assessment for these type of models. Di Tella (2019) specify the moral hazard problem of He & Krishnamurthy (2012) in terms of hidden trade. The intermediary can secretly sell part of the managed capital on the market. This is important, because it implies that the moral hazard problem is more severe when asset prices are higher. In that framework, he shows that even if households and intermediaries can enter into general long-term contracts, a pecuniary externality arises. The planner prefers lower asset prices to alleviate the incentive problem, leading to a less tight equity constraint and lower risk-concentration on intermediaries' balance sheet, even if this leads to less investment.

Bocola & Lorenzoni (2023) argue that, through macro-spillovers, the distributive externality might also be responsible for firms' excessive risk-taking in the booming period even when the space for risk-sharing contracts is complete. The argument is as follows. Suppose that in the ex-ante period high productivity entrepreneurs invest in capital. In the absence of risk-sharing, a sufficiently adverse capital quality shock in the interim period, through a binding borrowing constraint, lowers entrepreneurs' investment. As a result, potentially for many periods going forward, capital accumulation is slower. The resulting lower net worth of entrepreneurs implies a contraction in economic activity and in a lower wage path. This is the macro-spillover. What if consumers and entrepreneurs can enter into risk-sharing contracts to alleviate the adverse consequences of the capital-quality shock? Naturally, consumers will ask for a high price to provide such insurance as they have to pay-out exactly when their own wealth is low. Moreover, the main result in Bocola & Lorenzoni (2023) is that this price is too high from a second-best perspective. The reason is that consumers do not internalize that paying out more to entrepreneurs when the shock hits, easing entrepreneurs' collateral constraint, would lead to faster capital accumulation and, consequently, higher wages in subsequent periods. As a result, production is under-hedged in the decentralized equilibrium

[5]Krishnamurthy (2003) raises the possibility that limited commitment on the household side to provide this insurance is the friction which restores amplification, while Di Tella (2017) points to shocks to idiosyncratic uncertainty.

and the credit boom is too risky.

Similarly, Asriyan (2020) also argues that the inefficiently high equilibrium price of insuring against aggregate shocks is responsible for the overly risky production in the boom phase. However, Asriyan (2020) traces back this distortion to the information rents of insurance sellers due to their monopoly power. As rents wash-out from the planner's objective, lower rents implying more hedging would improve welfare.

3.3 The aggregate demand externality: prolonged recessions due to nominal rigidities

In an economy where aggregate demand affects output and there are nominal rigidities, a recession can be prolonged by an illiquidity trap. (Eggertsson & Krugman, 2012; Schmitt-Grohé & Uribe, 2016; Korinek & Simsek, 2016; Farhi & Werning, 2016; Guerrieri & Lorenzoni, 2017)

In Korinek & Simsek (2016), impatient households borrow from the patient ones in the ex-ante period. Then, a financial shock hits which is represented as a binding borrowing limit in the interim period. This requires heavily indebted households to deleverage; decrease their consumption and increase their savings to service this debt. In a frictionless economy, interest rates would drop, limiting saving and increasing consumption of unconstrained households which would limit the reduction in aggregate demand. However, if interest rates are subject to the zero lower bound, that might not be achievable. In this version, aggregate demand affects output, because of the combination of oligopolistic competition and sticky prices on the supply side. Because of the latter, firms cannot lower prices as a response to the smaller aggregate demand. Hence, they respond by producing less, leading to a sharp drop in output.

Similarly to models with distributive externalities, the implied resulting allocation in these models is constrained inefficient, implying over-borrowing in the pre-crisis period. The heart of the argument is that in the interim period, constrained borrowers have a larger propensity to consume than unconstrained lenders. As policies which constrain borrowing in the pre-crisis period imply a transfer from lenders to borrowers in the interim period, they also raise aggregate demand. Larger aggregate demand implies larger output, potentially increasing welfare to all. The externality arises, because borrowers in the pre-crisis period do not internalize that over-borrowing ex-ante implies a lower aggregate output ex-post. Note the contrast to models with distributive externalities which usually require incomplete markets and flexible prices; here markets are complete, but some prices cannot adjust.

3.4 Dispersed beliefs: speculative bets between borrowers and lenders

When investors do not share a common prior, they act according to their belief without learning from other's actions resulting in a form of overconfidence. Geanakoplos (2010) and, in a more canonical framework, Martin & Papadimitriou (2022) point out that heterogeneous priors naturally lead to exaggerated boom and bust patterns where investors are overly leveraged in the boom. The idea is that it is natural that the most optimistic agents borrow from the most pessimistic ones and invest in the risky asset leading to an overly optimistic marginal buyer. Hence, in the boom, asset prices are high, and the marginal buyer has high leverage. When a bad shock hits, the most optimistic buyers suffer capital losses disproportionally. As a result, less optimistic buyers have to take their place, depressing asset prices further, aggravating the losses of the original buyers.[6]

While Dávila & Walther (2023) exogenously separate agents into lenders and borrowers, they consider a richer space of potential heterogeneity in beliefs. In particular, they focus on the differential impact of lenders' and borrowers' belief distortions to the equilibrium leverage in the economy and, consequently, to policy implications. Intuitively, if borrowers are relatively more optimistic, they expect to repay more often, decreasing equilibrium leverage. While if creditors are more optimistic, they are willing to lend at a lower interest rate. Therefore, equilibrium leverage increases. Both scenarios tend to increase market prices and investment leading to a boom. However, the desirability and the effect of a stricter leverage constraint critically depends on the nature of the distortion. We will return to this in section 4.

3.5 Distorted beliefs: excessive optimism and the overheated credit markets

There is an increasing group of papers arguing that it is hard to rationalize the small credit spreads on risky debt in pre-crisis periods without evoking overoptimistic beliefs. Bordalo et al. (2018) introduce the notion of diagnostic expectations; the idea that a typical investor overweighs those future states which are the most similar to the current state. In practice, this leads to overoptimism in good times leading to too much debt sold at too low spreads. Recently, a series of papers (Gertler et al., 2020b; Maxted, 2023; Krishnamurthy & Li, 2024) find that incorporating diagnostic expectations into a model with a standard financial

[6]Simsek (2013) points out that not every type of heterogeneity inflates asset prices and raises leverage if collateral constraints are also present. See also Simsek (2021) for an excellent survey of the role of heterogeneous beliefs across various areas of macroeconomics.

accelerator mechanism can simultaneously capture the small spreads and increased leverage in the overheated boom phase and the persistently repressed investment and slow growth in the subsequent downturn.

Maxted (2023) incorporates diagnostic expectations into the continuous-time model of He & Krishnamurthy (2019) where the moral hazard problem of financial intermediaries leads to balance-sheet amplification. Maxted (2023) highlights that the interaction of diagnostic expectations with constrained financial intermediation implies opposite short-term and long-term effects. In the short-term, initial good shocks are extrapolated by diagnostic expectations leading to overoptimism. However, too much credit to bad quality projects eventually erodes the equity of financial intermediaries constraining their issuance of debt. He also emphasizes that in the recession period diagnostic expectations might lead to faster recovery. The reason is that by extrapolating bad shocks, it limits banks' investment in quantity, increasing its marginal return. The increased return can lead to faster internal accumulation of net worth.

Investors in Greenwood et al. (2024) also exhibit extrapolative beliefs, but of a different type. Greenwood et al. (2024) assume that investors mistakenly believe that firms' default intensity is described by a latent 2-state Markov process. Hence, when investors do not observe a default for a long period, their belief converges to the lower state, while observing a default makes beliefs jump toward the higher state. In contrast, equity holders of firms are rational and decide to default accordingly as in Demarzo & He (2021). Just as in Maxted (2023), overoptimism has opposite short-term and long-term effects in this framework. Initially, overoptimistic expectations delay the default of firms facing adverse shocks, because refinancing is cheap. However, exploiting overheated credit markets, they also issue more debt, which eventually leads to more default.

Note that, as Maxted (2023) points out, diagnostic expectations do not add a new source of uncertainty, only alter how existing shocks affect the economy. This leads to a more parsimonious model and potentially simpler solution. This contrasts with extrapolative expectations in Greenwood et al. (2024) where beliefs can improve when fundamentals do not. That is, their specification adds an independent state-variable: investors' belief on default intensity. Consequently, in this model there are more degrees of freedom to match stylized facts. Greenwood et al. (2024) argues that this significantly helps to fit the data.

3.6 Endogenous Information: lax lending standards and the rationalization of the Minsky-moment

There is a growing group of papers arguing that information choices of lenders and borrowers are crucial determinants on the characteristics of both the credit boom and the subsequent downturn. (Gorton & Ordoñez, 2014, 2019; Moreira & Savov, 2017; Asriyan et al., 2022; Farboodi & Kondor, 2022, 2023; Fishman et al., 2024) In these papers there is a "Minsky-moment" when lenders, rationally, change how they learn leading to a sudden revelation of information on the quality of credit issued during the boom-phase. This revelation triggers the credit crunch.

In Gorton & Ordoñez (2014) capital of uncertain quality serves as collateral for borrowing. Lenders can decide to pay a fixed cost to learn about the quality of collateral. As long as they decide not to do so, each unit of capital can be used as collateral resulting in extensive lending and high consumption: a credit boom. At the same time, as long as there is no learning information depreciates, and the perceived quality of the collateral slowly decreases. The authors introduce an aggregate shock which affects the perceived quality of the collateral. If the preceding boom has been long, the perceived quality due to the shock might drop sufficiently to make agents pay the cost of learning. In this case only, the aggregate shock triggers the crisis. After the resolution of uncertainty, only good quality capital is accepted as a collateral implying less lending: a credit crunch. The longer the boom, the deeper the crisis. Still, in this model, ignorance is bliss. Learning generally harms welfare as it reduces the stock of capital which lenders accept as collateral. Therefore, as Gorton & Ordoñez (2014) emphasize, the planner might prefer to keep the economy in ignorance to maintain higher current output even at the cost of a potential larger crisis in case of an aggregate shock.

Farboodi & Kondor (2023) argue that booming periods are special not because lenders do not learn at all, but because in these periods they learn differently. In the model, lenders distinguish good from bad borrowers based on signals they choose to obtain. In particular, they can choose between two information structures. The first represents lax lending standards, giving favorable signals about all good borrowers but also some bad borrowers. The second represents tight lending standards, giving adverse signals about all bad borrowers but also some good borrowers. The authors show that lenders optimally choose lax lending standards, if and only if the pool of borrowers is of relatively good quality. They also show that as long as lending standards are lax, the average quality worsens. In the resulting economy, credit market and production fundamentals generate cycles even in the absence of shocks. Lax lending fosters investment but also leads to a gradual deterioration of loan qual-

ity during the boom, which ultimately triggers lenders to tighten their lending standards, turning the credit boom to a credit crunch. While tight lending standards do slow down the economy in the short term, they also improve fundamentals in the long-term. Hence, in contrast to Gorton & Ordoñez (2014), the constrained planner typically would implement an economy with alternating periods of tight and lax standards. Still, as atomistic investors fail to internalize that their choice of lending standards affects the quality of the current and future lending pool, the decentralized equilibrium often features inefficiently long booms and inefficiently deep recessions.

Asriyan et al. (2022) instead emphasizes that the price of collateral can have a crucial impact on how much lenders learn about the quality of the borrower. In particular, if lenders have the choice of securing lending by collateral or, instead, to lend only to projects which are screened by a costly technology, they will choose the former when the value of collateral is high. This is usually the case in booms. Just as in Gorton & Ordoñez (2014), these periods with no screening result in the depletion of the stock of information. Hence, when the price of the collateral drops and lenders switch to screening, the problem of small stock of acceptable collateral is aggravated by the low stock of accumulated information leading to painful recessions.

3.7 Multiple equilibria: bank runs and roll-over crises

Another way to conceptualize the abrupt turning point of booms to credit crunch is to build a theory of multiple equilibria where the system can switch from a normal state to a crunch equilibrium. That switching point would correspond to a financial panic, a bank run or a roll-over crisis (akin to Cole & Kehoe (2000)) in the real world. A group of papers follow this route (see Angeloni & Faia, 2013; Martin et al., 2014; Gertler & Kiyotaki, 2015; Boissay et al., 2016; Gertler et al., 2020b,a; Schmitt-Grohé & Uribe, 2020; Amador & Bianchi, 2024).

Gertler & Kiyotaki (2015) incorporate the possibility of multiple equilibria in a dynamic endowment economy while Gertler et al. (2020b) and Gertler et al. (2020a) extend this work to a model of production. Importantly, in these models the run equilibrium exists only when fundamentals are weak. In particular, they assume risk-neutral bank managers choosing their leverage endogenously subject to a moral hazard constraint. Namely, the possibility to abscond with a fraction of their assets if their continuation value is too low, imposes an endogenous constraint on how much banks can borrow from depositors. Also, banks go bankrupt if their net worth, the gross return on assets net the cost of deposits falls below zero. Banks' net worth depends on the equilibrium price of capital, raising the possibility of multiple equilibria. In the bad equilibrium banks default and liquidate their capital to

low productivity households. This is an equilibrium if the resulting return on assets is not sufficient to pay back existing depositors. Each depositor is worried about this scenario and does not roll-over its debt if she expects it to play out. In contrast, there is also a good equilibrium if gross return on assets is larger than the cost of paying back depositors given the equilibrium price with no defaulting banks. Hence, whether a bad equilibrium exists depends on how low the liquidation price is. It is lower when the productivity of capital is low, that is when fundamentals are weak. It is also lower when banks' leverage is large, hence they liquidate large quantities when in default. Note that here each debtor is motivated to run in the bad equilibrium independently of whether other debtors do. Also, there is no strict distinction between insolvency and illiquidity. In the bad equilibrium all banks are insolvent and illiquid, while in the good equilibrium all are solvent and liquid.

Amador & Bianchi (2024) defines a self-fulfilling roll-over crisis differently. In their economy, banks default strategically whenever the punishment of being excluded from the market is smaller than the benefit of not paying back their debt. This introduces an endogenous upper limit on the leverage each bank can take. However, due to a sunspot, potential depositors might decide not to lend to a given bank. This is a run. As the leveraged return on banks' capital is larger than the non-leveraged return, the run might be self-fulfilling. This is the case, if a bank earning the non-leveraged return will not pay-back its creditors (but one with the leveraged return would). Now suppose that banks are subject to heterogeneous productivity shocks. Banks with the worst shocks would default even without a run. These are fundamentally insolvent. Banks with the most favorable shocks would not default even with a run. These are fundamentally safe. All banks in between will default if and only if there is a run. Amador & Bianchi (2024) also proposes that the natural buyers of defaulting banks' assets are the non-defaulting banks. This observation has important policy consequences as we explain in the next section.

4 Why should the policy maker care?

In the previous section, we have overviewed various potential mechanisms behind financial crises. Understanding the various frictions and distortions which can lead to the dysfunction of credit markets is important. However, for the policy maker, the distinction across these possibilities becomes crucial only if the implied policy responses differ. In this section, we focus on the main differences in policy implications.

4.1 Ex-ante regulation: the leverage constraint

As we have discussed in section 2, the general picture is that financial crises are preceded by a period of overheated credit markets. Hence, it is not surprising that most theories of financial crisis associate the pre-crisis period with over-borrowing, implying that limiting credit ex-ante would lead to a less severe downturn when the crisis hits. However, there are various caveats to this general picture.

First, for a case for constraining credit in the boom phase, the policy maker needs to establish that there is over-borrowing in a second-best welfare sense. As sections 3.2-3.3 on pecuniary and demand externalities demonstrate, this is far from obvious. For instance, even if the policy maker correctly foresees that credit growth in the boom phase implies financial acceleration and fire-sales in the crisis period, constraining it still might decrease welfare if financial markets are sufficiently complete (Dávila & Korinek, 2018). On the other hand, even when financial markets are complete, agents might still over-borrow in the presence of nominal rigidities (Farhi & Werning, 2016) or take on too much risk in the presence of macro-spillovers (Bocola & Lorenzoni, 2023).

Second, as Figure 2 highlights, a large fraction of credit booms do not lead to a financial crisis. Constraining credit in such "good" booms is sacrificing consumption growth. The way the policymaker should think about this trade-off depends crucially on the type of theory she uses as her conceptual framework.

In models with multiple equilibria this trade-off is explicit. Depending on the equilibrium that materializes, a given set of fundamentals might or might not lead to a financial crisis. Then, the optimal tightness of the constraint is a quantitative question, depending on the assessed frequency of a bad equilibrium realization. Gertler et al. (2020a) calibrates a sunspot type of shock to replicate the empirical frequency of runs. Quantifying the cost of counter-cyclical capital requirements in the case in which there is no run, and its benefits when there is, they conclude that the latter outweighs the formal.

In contrast, in models where the crisis happens because of an endogenous shift in information regime (e.g. Gorton & Ordoñez, 2014, 2019; Asriyan et al., 2022; Farboodi & Kondor, 2022, 2023), the difference between bad booms and good booms boils down to fundamentals.

For instance, in good booms of Gorton & Ordoñez (2019) sufficiently fast productivity growth of new projects implies low default rates, hence capital with average quality is sufficient to collateralize credit for those new projects. They argue that a distance-to-default type of measure might distinguish between the good and the bad booms.

Instead, in Farboodi & Kondor (2023) both good booms, where lending standards switch in line with the constrained planner's problem, and bad booms, where lending standards are implied by the decentralized equilibrium, are followed by a downturn. However, in

the decentralized equilibrium booms are inefficiently long, and the subsequent downturn is inefficiently deep because private incentives for lax lending standards differ from their social counterpart. This is why in this economy regulating lenders to tighten lending standards when the quality of their loan book is too low would improve welfare.

Third, different distortions might require different ex-ante policies. For instance, Bocola & Lorenzoni (2023) emphasizes that a general constraint on borrowing in booms might be sub-optimal, if, as in their model, the main symptom of fragility is excessive risk-taking as opposed to excessive borrowing. They show that the planner should specifically limit borrowing against the states where the collateral constraint will bind the most when the crisis hits. This not only limits risk-taking in general but reduces financial amplification in case of a crisis. Such a policy can be implemented by risk-weighted constraint on the issuance of debt.

Turning to distorted beliefs, Maxted (2023) warns that when overoptimistic expectations drive asset prices in the boom period, the health of balance sheet of intermediaries evaluated at those prices might be misleading on the real fragility of the economy. This is so, because in these periods, financial institutions tend to invest in overvalued assets and lend at overly low spreads. If expectations are diagnostic, a series of bad shocks leads to a sharp change in asset prices, and, consequently, an abrupt deterioration of the balance sheet.

In contrast, Dávila & Walther (2023) argues that even if the policy maker's beliefs are correct whether she should tighten leverage constraints in a boom with overoptimistic agents, depends on exactly which side of the credit market exhibit overoptimism. In particular, stricter leverage constraints improve welfare when lenders are getting more overoptimistic. However, when the irrational exuberance is on the borrowers' side, the constrained planner often would like to encourage leverage instead of constraining it.

4.2 Ex-post regulation: bailouts and stimuli

In the crisis period, almost by definition, some agents are constrained in their consumption, investment and/or borrowing. Hence, if the planner can ease those constraints ex-post, it tends to increase welfare. However, again, depending on the underlying distortion, there are crucial details to consider.

First, tracing back a crisis episode to a particular distortion can help to pin down the most efficient direction of intervention. For instance, in case of a recession due to demand externalities, a dollar in the hand of the agent with high propensity to consume is more useful in boosting demand. In contrast, Geanakoplos (2010) points out that when the extensive collapse of asset prices is due to speculation with heterogeneous beliefs, easing the constraint

of more optimistic agents helps asset prices to recover faster.

Amador & Bianchi (2024) emphasizes that in their economy where a fraction of banks might default either because they are fundamentally insolvent or because of a run, deciding on the beneficial ex-post intervention can be more subtle. In particular, to proxy for QE type of policies, they consider the effect of a policy maker purchasing capital to raise depressed asset prices when the crisis hits. Recall from Section 3.7 that in this economy, whenever some banks default, the non-defaulting banks are the natural buyers of the liquidated assets. Then, the effect of the proposed policy is opposite depending on whether the crisis is driven by a run. This is because raising the capital price is a transfer from buyers to sellers. When the crisis is due to a run, the bank who survives tends to sell assets in order to raise enough cash to cover deposits. When the crisis is due to fundamentals, the surviving banks are healthy and buy assets from the fundamentally insolvent ones. Raising capital prices by asset purchases is a welfare improving policy only in the earlier case when it helps fundamentally solvent banks to liquidate less. In the latter case, it decreases the welfare of solvent banks and helps some insolvent banks to survive which reduces welfare.

Second, unless ex-post policies are fully unexpected, they interact with ex-ante incentives. The basic idea that ex-post bailouts imply too much ex-ante risk-taking through moral hazard is well-known. However, careful modeling can help with the nuances.

Bianchi (2016) focuses on the efficiency of a bail-out policy in a quantitative model with a collateral constraint and an equity constraint. In this model, the main pecuniary externality stems from the fact that firms' hiring policy raises the wages for the other firms dragging down profits and limiting investments when the equity constraint binds. He argues that ex-post bail-outs can improve welfare if they are used only in systematic financial crises. In this case, the moral hazard problem is small because individual decisions have little effect on the aggregate state of the economy. Hence, the ex-post benefits dominate the ex-ante costs.

In a similar spirit, Jeanne & Korinek (2020) considers a standard model with collateral externalities which lead to financial amplification ex-post and over-borrowing ex-ante. They consider the choice and interaction of the ex-ante policy of restricting leverage and the ex-post policy of providing liquidity. They emphasize two lessons beyond the usual considerations of moral hazard. First, ex-post liquidity provision limits the need for liquidity constraints, but it does not completely eliminate it as long as providing liquidity is costly. Second, if an unregulated shadow banking sector exists, restricting leverage in the regulated sector artificially increases the role of the former. Hence, it is optimal to commit to less generous liquidity provision with a combination of less strict leverage constraints to limit this effect.

5 Conclusion

While financial crises are rare, their power of disruption has placed them to the forefront of academic research and policy discussions alike. With the benefit of hindsight, researchers have identified several common traits.

In this survey we highlighted recent developments on the theoretical side of this literature. We grouped and summarized papers based on their main insights. We focused on a selective list, which, quite subjectively, we feel to have the potential to have the greatest influence on the discussion.

However, it is clear that this field of research has a moving target. As economies develop, the regulatory system changes, and global interactions strengthen, it is quite possible that the root of the next global financial crisis will be somewhere where we are not yet looking. This is why the development of new, creative and forward-looking theoretical work, identifying potential vulnerabilities and understanding their policy implications is of first-order importance for the future stability of the world economy.

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