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TOWARDS A MODEL ON JUNK BOND CONTAGION

FRANCESCO BELLANDI *
LUDOVICO BELLANDI **
SIMONE BOCCALETTI ***
CLAUDIO CHIACCHIERINI ****

Abstract

Understanding contagion mechanisms is important to identify key factors that may have predictive information value or confirmatory information value for market trading. After reviewing the current literature on financial contagion, this article focuses on specific characteristics of junk bonds that are particularly sensitive to contagion situations. Next, it proposes a new framework to disentangle factors that may act as predictive and proactive and those that may represent confirming information and reactive effects. It then discusses some historical situations as evidence of how such factors may have manifested themselves in practice. Finally, it concludes by discussing the use of the proposed framework, and what directions it can offer for new developments by other scholars.

* Head of Technical Accounting, Multinational company London.
** Student MSc Finance and Private Equity, London School of Economics
*** Researcher, Department of Economics, Management and Statistics, DEMS, University of Milano-Bicocca
**** Full Professor of Management, University of Milano-Bicocca

Verso un modello di contagio dei Junk Bond – Sintesi

La comprensione dei meccanismi di contagio è importante per identificare i fattori chiave che possono avere un valore informativo predittivo o di conferma per il trading di mercato. Dopo aver passato in rassegna l'attuale letteratura sul contagio finanziario, questo articolo si concentra sulle caratteristiche specifiche dei junk bond che sono particolarmente rilevanti nelle situazioni di contagio. Si propone poi un nuovo schema di riferimento per distinguere i fattori che possono agire come predittivi e proattivi da quelli che possono rappresentare informazioni di conferma ed effetti reattivi. Vengono poi discusse alcune situazioni storiche che dimostrano come tali fattori possano essersi manifestati nella pratica. Infine, si conclude discutendo l'uso dello schema proposto e le direzioni che può offrire per nuovi sviluppi di ricerca.

Parole chiave: *Contagio; Obbligazioni ad alto rendimento; Obbligazioni spazzatura; Spillover.*

Codici JEL: G01; G10; G12.

Keywords: Contagion; High-yield bonds; Junk bonds; Spillover.

1. Introduction

The phenomenon of a financial contagion is generally defined as a chain reaction that adversely affects certain financial markets, defined on a geographical and/or financial instrument basis. Specifically, credit contagion is a situation where a company's default triggers the default of other entities. The term 'spillover' refers to situations where different countries have respective economies affected by events that would otherwise appear to be unrelated. The more trade or financial links there are between these economies, the more likely spillovers are to occur. Thus, spillover conditions may exacerbate the ripple effect of a possible contagion.

A particular research field in this area is the role that junk bonds may play in a contagion situation. Junk bonds, also known as high-yield bonds, are bonds issued by companies with a low credit rating and therefore a high default risk. Of course, high risk calls for high returns. In fact, junk bonds by definition have a high promised return. However, at the crux of the junk bond dilemma is that the 'promised' interest rates or yield to maturity are the total payment *if* the borrower *does* not default. High promised rates attract investors. Old memories from the times of Michael Milken of Drexel Burnham Lambert remind us that, by factoring in the default rate, the 'expected' (i.e., by taking into account the possibility of a default) and 'actual' rates of return end up being much lower. By their nature, junk bonds may have a strong role in contagion.

The level of exchanges in junk bonds is often used as an indicator of the market sentiment towards risk based on the perceived economy outlook. Significant junk bonds sell-offs signal prudence by investors, insofar as lenders may be anticipating an economy downturn. A deterioration in the general economy, even when triggered by external factors such as oil prices or war events, would generally be expected to push down prices of high-yield bonds through a restriction of credit facilities offered by banks and financial institutions, and a consequent increase in default rates and, eventually, corporate

bankruptcies.

Understanding contagion mechanisms is important to identify key factors that may have predictive or confirmatory information value for market trading, which is relevant for both market participants and regulators (Rigobon, 2016).

This paper first reviews the current literature of financial contagion in general. It then focuses on specific characteristics of junk bonds that are particularly sensitive to contagion situations. Next, it proposes a new framework to disentangle factors that in a junk bond contagion may play out as predictive information value and proactive effects, and elements that may represent confirming information value and reactive effects. It then discusses some historical situations as evidence of how such factors may have manifested themselves in practice. Finally, the paper concludes on the use of the proposed framework, and what directions it can offer for new developments by other scholars.

2. Literature review on financial contagion and spillovers

Academic research has theorised different mechanisms that drive financial contagion and spillovers, which apply in general not solely, or not necessarily to, junk bonds. Generally speaking, our proposed framework contributes to the following literature by highlighting the effect of junk bonds on investors in the context of both in economic expansion and negative economic outlook, to have a broader view of the phenomena and to better understand the implications of the expected valuation of this type of bond from the investors' perspective.

As a general macroeconomic approach, spillovers would first arise from trade connections between countries, where the economic situation of one country would affect another through reciprocal imports and exports (Gerlach *et al.*, 1996). Likewise, economic policies, namely monetary policies through interest rates, would affect investment in, and financial flows to, oth-

er countries, working as a possible channel for shocks (Basu, 1998; Corsetti *et al.*, 2005). Pavlova *et al.* (2007) analyse the effect of asset prices in this context. Some contributions (Goldstein *et al.*, 2000; Kaminsky *et al.*, 2002) isolate the effects of financial connections from the real variables mentioned in the previous school of thoughts. Inefficiencies in the banking sector and international equity markets would facilitate the propagation of shocks from one country to another. Specifically, we contribute to this literature by directly considering the interplay between the acceleration of defaults triggered by adverse shocks and the repackaging of bonds into CDOs in determining a liquidity effect which might trigger fire sales of junk bonds, thereby magnifying and propagating shocks across economies.

Some streams of research may be considered subsets or specialisations of this financial view. According to the correlated-information view (including Kiyotaki *et al.,* 2002, Kaminsky *et al.,* 2003), contagion would arise from the transfer of adverse information from a more-liquid or more-reactive market to another market. Some contributions move consistently with this framework to analyse the mechanisms by which market participants mimic the behaviour of others. Bikhchandani *et al.* (1992) and Banerjee (1992) reckon that contagion arises from information cascades or sequential decision making, that is, emulation of behaviour that others have had before, so that a crowd of similar reactions is formed.

The theory of liquidity-induced contagion (Allen *et al.,* 2000, Brunnermeier *et al.*, 2009) sees such a phenomenon as the result of investors moving out of a market where they have suffered losses in search of funding, eventually triggering an overall market liquidity crisis. Calvo (1998) explains that the necessity to pay margins makes leveraged investors sell assets at low prices, which in turn makes their prices to fall. Kaminsky *et al.* (2000) analyse the propagation role of commercial banks in calling loans and asking repayment of other form of debt. Basu (1998) points out that investors replicate sell-offs from countries that share the same characteristics as a crisis country.

In relation to information content, some contributions focus more specifi-

cally on information asymmetries. Calvo *et al.* (2000) observe that replicating behaviour is an economically rational choice when the marginal cost of obtaining information exceeds its marginal benefit. Kodres *et al.* (2002) theorise that contagion may result from misinterpretation by uninformed investors of rebalancing of portfolios made by informed investors, maybe due to private information. By not fully understanding the reason for the rebalancing, these uninformed investors may attribute it to factors of their country and adjust their positions as well in a chain reaction. This leads to the paradox that more liquid markets may be hit stronger by contagion. As a matter of fact, our framework highlights the role of information transmission in the explanation of financial contagion, and provides a general scheme in which sources of risk and their effects are interconnected.

Another stream of contributions focuses on the problem of asset commonality in the banking sector, specifically referring to the problem of asset sales in magnifying contagion in the financial system. Indeed, asset commonality, that is broadly defined as common exposures between banks' portfolios (Dissem, 2019), or, in other words, the presence of overlapping portfolios between banks, may be a source of systematic risk (Allen *et al.*, 2012; Caccioli *et al.*, 2014; Poledna *et al.*, 2021; Kosenko and Michelson, 2022). Indeed, in some circumstances, common asset holdings, and, especially the multiple bank-lending relationships, may reduce monitoring costs (Carletti *et al.*, 2007), and contagion might occur because of devaluation of common assets (Poledna *et al.*, 2021).

Another perspective is the risk-premium contagion mechanism (Vayanos, 2004, Acharya *et al.*, 2005, Longstaff, 2008), with emphasises the temporal dimension of contagion, i.e., an increased risk premium in a market would subsequently follow from earlier shocks elsewhere. Longstaff (2010) finds that the 2007 subprime crisis better justifies the liquidity-induced and risk-premium theories of contagion. We also discuss our proposed framework in the light of past recessions to analyze how it can integrate the existing literature in past economic downturns, with also a forward-looking perspective.

Some strands of research apply to specific contexts. Gerlach *et al.* (1996) highlight that competitive devaluations arise from rational decisions to reduce imports and increase exports through devaluation of foreign exchange rate. According to Shleifer *et al.* (1997), in situations of fund withdrawals, arbitrageurs may decide to shift positions in their portfolio to avoid being hit by future withdrawals. Other studies mix different inputs. Kaminsky *et al.* (2003) find that contagion with international repercussions occurs when three factors are present: a drastic reversal of capital flows, unanticipated announcements to the market, and a leveraged common creditor that spreads the contagion. Our approach is to propose a framework that could be used not only in the case of junk bonds, but, with specific variations, used to understand contagion phenomena with different characteristics.

3. Relevant characteristics of junk bonds in financial contagion

3.1. Characteristics of junk bonds

High-yield (or junk) bonds are corporate bonds with high interest rate reflecting a high risk of default and a rating below investment grade. Conventionally, junk bonds have a rating of BB+ or lower (Standard & Poor's), or Ba1 or lower (Moody's), or BB+ (Fitch), or BB high (DBRS). Issuers typically are characterized with high leverage, or in financial difficulties in paying interests or principals, often start-ups or entities with speculative financial plans, or insufficient collateral. In comparison to other bonds, in addition to their high risk of default, high-yield bonds are subject to higher economic risk following the so-called 'flight to quality', i.e., sell-offs by investors in excess of demand, to buy safer securities. They also have higher liquidity risk due to a lower possibility to be sold at a desired price when needed. High-yield bonds may have more extensive covenants, or sometimes allow for the skipping of an interest payment, or provide for payments-in-kind (PIK) or call provisions

that may expose the holders to the inability to reinvest at a similar interest rate (SEC, 2022).

3.2. Relationship between government bonds and corporate bonds

It is also important to look at the relationship between government bonds and high yield bonds. The probability of default of a corporate bond can be derived from the credit spread (or default premium) of its yield over the yield of a comparable risk-free bond (which can be assumed to be a comparable government bonds, e.g., the U.S. Treasury bonds). The average probability of default could be defined as the difference between the price of the bond and the price of a comparable risk-free bond, all divided by the difference between the future cash flows of the PV bond using the risk-free rate and the expected recovery rate times the face value. The numerator is the difference between the present value of the corporate bond's future cash flows at its yield rate and the present value of the comparable risk-free bond at the risk-free rate. The higher the yield of a bond, the lower its price, therefore market participants will pay a corporate bond less than a comparable risk-free bond because of the higher probability of default. Ignoring the effect of liquidity, the numerator is the expected credit loss of the corporate bond. In the denominator, the expected recovery rate is defined as a the market value of the bond a few days after a default in percentage of its nominal value. The denominator is the so called loss given default, i.e., the amount that will not be recovered if the bond defaults. So, by inverting the formula, the probability of default is equal to the bond's face value times the loss given default times the probability of default. Obviously, the worse is the credit rating of the bond, the higher the probability of default (Hull, 2021).

Analysts also compute probabilities of default from historical data (called real-world or physical probabilities of default, as opposed to risk-neutral probabilities of default based on risk-free rates as described above), such as from

tables of default rates by credit rating published by financial rating agencies. Typically, probabilities of default derived from bond prices are higher than risk-neutral probabilities of default, particularly in crisis situations. There are two main explanations for this phenomenon. First, the so-called 'flight to quality' means that during a crisis investors sell off riskier bonds, which pushes down their prices, hence increasing the spread. Second, there is evidence of a systematic risk of bonds that trigger credit contagion, in the sense that they tend to default in the same periods, ignited for example by adverse macroeconomic factors in one year or by the default of certain bonds infecting others (Hull, 2021).

In a dynamic perspective, while the higher yield of junk bonds is the reason why investors may want to buy them, for the reasons explained above, the soaring in spread over government bonds is an indicator of increasing default risk in junk bonds and possible contagion situations, as also illustrated below in a historical context. In a context where the government bonds yields themselves are affected by inflation and interest rate expectations, high-yield bonds must offer new issues at higher interest rates to remain competitive in an inflationary situation and detract from safer-asset investments, a fact which in turn increases market volatility.

3.3 . Relationship between equity and corporate bonds

A third method of estimating the probability of default of a bond is the model based on share prices developed by Merton (1974). This model is grounded on the view of equity as a put option on a company's net assets with a strike price set as the repayment amount of the debt. So, the value of risky bonds is the value of safe bonds minus the value of shareholders' option to default (the put). If the firm defaults, shareholders are in effect exercising the put. This approach illuminates on certain connections between corporate bonds and equity, as well as implications on the contagion topic. First, in this

view, probabilities of default are not articulated around the credit ratings of bonds issued by rating agencies, which may not be continuously updated, but around the information on bond risk that is implicit in the equity prices. Second, if the beta of a company is zero, there would be no relation between possible default and the general economy, and value of risky bonds would be the same as risk-free bonds (ignoring lower marketability). On the contrary, when a company's net assets are strong, the value of the put option representing the option to default is close to zero, but when a large shock to the economy makes net assets fall, the value of that implicit put rises, which confirms the systematic risk of bonds seen above. What is worst is that the standard deviation of the put increases drastically too. This translates into more sensitivity of the put option to additional shocks and therefore unexpected increase in the risk of default of high-yield bonds. This clearly shows a contagion between the equity and the bond markets.

4. Recent regulatory developments

It is also important to note that the regulatory system has evolved in response to contagion situations. In the UK, in line with international developments, the Financial Services (Banking Reform) Act 2013, and the Financial Services and Markets Act 2000 Order 2014 introduced measures on ring-fencing of core activities (i.e., deposits from retail and small business customers in the UK or in the European Economic Area) from other activities in a banking group, such as investment banking. These laws introduced the concept of 'sufficient separation' between Ring-Fenced Bodies (RFB) and other activities in a banking group. This essentially means that an RFB must manage exposures to other members of the banking group by (i) applying the same standards as those used with to third parties, (ii) adopt a governance and management structure that ensures independent decision-making, (iii) be sufficiently capitalised and have enough liquidity, and survive to the default of

other group members (Britton *et al.*, 2016). This is important because these measures should also reduce the risk of contagion of bank ring-fenced bodies, as well as spillover to other activities and markets. In particular, the requirement that ring-fenced bodies should not be financially dependent on other members of the banking group is consistent with several of the contagion theories mentioned above.

Stress testing requirements constitute another important development. These types of stress tests simultaneously simulate an adverse scenario on several banks, with the main purpose of determining the likely system-wide impact of a shock for the banking sector, as well as its amplification to the broader financial system and the economy at large. There is a close mirroring between the typical scenarios that are tested and the possible contagion situations that are used by regulators for macroprudential policy (Constancio. 2015). For example, households would find difficult to repay mortgages and unsecured loans if unemployment rates increase. If risk on loan increases, banks may need to increase their level of capital to comply with regulatory capital requirements. On the other hand, repercussions on financial market prices and the increase in the cost of bank funding would reduce banks net interest income generated by banks' lending and deposit-taking activities. Behavioural responses of banks are also critical in this context. For example, a reduction of lending to limit the adverse effects of a shock may exacerbate an economy recession and so increase the risk of bank losses even more. Substituting wholesale funding with retail deposits may trigger higher interest rates in the deposits market which would depress bank profitability even more. It is interesting to note that some of the historical scenarios used in stress-testing exercises include notorious contagion situations, often spreading from bond, equity, and currency markets. For example, they include the 1994 unexpected increase in the US interest rate that depressed bond portfolios and then spilled over to the US equity market, or the 1994 unexpected devaluation of the Mexican peso that triggered divestments of peso-denominated investments and then spread across Asia and Latin America (Den *et al.*, 2016).

5. The role of junk bonds in contagion

It is generally held that credit markets provide equity markets with signals about up- and down-turns. As shown, the literature review reveals a fragmented picture of theories. The research question of this paper is whether it is possible to build a more integrated framework where those theories interact to explain the economic phenomenon of junk bonds and contagion. In this paper, we propose a conceptual and theoretical approach to elaborate on existing literature, based on the characteristics of high-yield bonds. We consider the role of junk bonds in two types of symmetric factors, specifically differentiating between two distinct phasis of the economic cycle. First, we consider the effect of junk bonds in context that would mainly play out in an economy expansion context. Subsequently, and more importantly, we analyse another series of factors that reflect downturn situations. Generally speaking, this paper classifies these two categories as predictive information value, proactive effects, confirming information value and reactive effects (**Exhibit 1**).

Exhibit 1: Proposed Framework of the Role of Junk Bonds in Financial Contagion

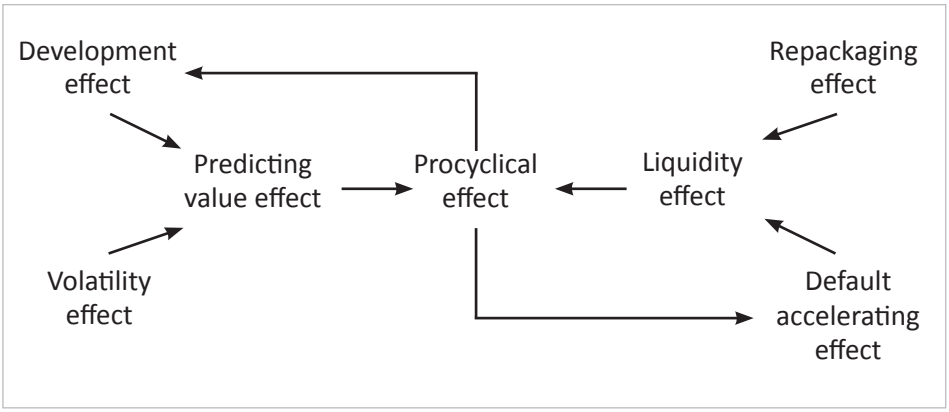

Exhibit 1 is the graphical representation of our proposed framework. The left-hand side, that is, the *cycle* between Procyclical Effect, Development Effect, Volatility Effect and the Predicting Value Effect, shows a success sequence, i.e., positive economic consequences related to junk bond diffusions.

- *Development effect.* Historically, the market has extensively used junk bonds to finance high-growth companies, often start-ups that were could not access the ordinary credit market, as well as M&A activities, especially leveraged buyouts (Hurduseu *at al.*, 2015; DePamphilis, 2010; Yago, 1991). Therefore, junk bonds play a role in financing economic growth.
- *Volatility effect*. Junk bonds have higher volatility, which reflects the uncertainty of an issuer's financial performance. The more junk bonds are employed in leveraged activities, the more the effect of volatility is amplified.

Notably, this high volatility may be deemed to have predictive value. Indeed, analysts may interpret its movements as change in market sentiment, a risk indicator of change in risk appetite of investors. For example, falling prices could signal that a market downturn may be expected, whereas rising prices might tell that the economy is improving (*Predicting value effect*). Through the combination of the factors mentioned above, junk bonds may propagate an economic seasonal, cyclical, or temporary effect even more by accelerating positive or negative prospects of the economy (*Procyclical Effect).*

Indeed, as junk bonds prices rise because of financing growing activity of the economy using junk bonds (development effect), investors factor such growth in their forecasts (predictive value effect), and this is amplified by the volatility of the instrument (volatility effect) as success stories and companies' good financial performance make their high yield bonds even more attractive. This ignites a self-fulfilling prophecy (procyclical effect) until unforeseen shocks occur.

The right-hand side, that is, the cycle between Procyclical Effect, Repackaging Effect, Default Accelerating Effect and Liquidity Effect, reflect negative economic consequences in a contagion situation.

- *Repackaging effect***.** Junk bonds are often repackaged into collateralised debt obligations (CDOs). Repackaging gives opacity of what a resulting financial instrument really contains, its risk and its fair value. In addition, the creation of tranches in CDOs may artificially raise the credit rating of senior tranches above the threshold that an institutional investor may consider acceptable.
- *Default accelerating effect*. Because junk bonds have a higher risk of default in the first place, an economic downturn may increase their risk of default and risk premiums even more through the mechanisms discussed earlier in this paper.

Specifically, the needs of funds to meet interest payments and principal repayment obligations may trigger sell-offs of junk bonds in situations of downturn (*Liquidity Effect).*

The model channels explain that the higher risk created by repackaging (repackaging effect) and the chain of defaults of junk bonds once a shock has occurred (default accelerating effect) lead to a flight to quality that triggers a liquidity crisis (liquidity effect). This detonates a self-fulfilled prophecy (procyclical effect) of negative economic outlook and even recession.

This model offers a comprehensive picture of the impact of junk bonds on financial contagion, explicitly examining the particular channels and mechanisms that can amplify financial turmoil and affect economic activity. Specifically, this proposed framework is intended to guide not only financial analysts and practitioner, but also policymakers to understand the channels underlying financial contagions in order to act promptly with the right interventions. As a matter of fact, some of the underlying channels have manifested in different occasions, as described in the next section.

6. Discussion

As an example of *development effect*, in the 1970s and 1980s junk bonds played an important role in financing development stage and high-grow companies, as well as a source of financing for takeovers and leveraged buyouts (Hurduseu *at al.*, 2015; DePamphilis, 2010; Yago, 1991).

As an instance of *predicting value effect*, in 2013 investors showed a renewing interest in high-yield bonds because of a favourable outlook of the economy, while the opposite occurred in 2015-2016 in conjunction with economic uncertainty (Corporate Finance Institute, 2022). Choudhry (2001) shows that the yield spread on high-yield bonds boosted in 1991-1992 when the US recovered from the 1990 recession, while it settled down in 1992-1995 in line with a more stable economic growth, and increased again in 1998 during Asian currency crisis and Russian bond technical default.

The collapse of Lehman Brothers is an example of the *repackaging effect*, when high-yield bonds were repackaged into collateralised debt obligations backed by assets with low merit of credit, like the subprime mortgages (The Daily Telegraph, 2011).

Repackaging is also linked to the *default accelerating effect*, for example when the higher volatility of those instruments multiplied the effect of default during the 2008-2009 recession. As another example, the high level of default rates of high-yield bond reflected the 1990-1991 recession, with rates as high as beyond 9% against an average of 3%-3.5% in the 1980s and 1990s. In the US, over the period 1972-2002, the default rate of junk bonds showed an increasing pattern at the start of recessions and arrived at its peak at or immediately after the recession (Altman *et al.*, 2003). One notable crisis incident that is often considered as a benchmark when assessing contagion situations is the market spread between the US Federal Funds rate and US high yield B/CCC bonds before and after the collapse of Lehman Brothers in 2008.

A sell-off in junk bonds consequent to a deteriorating general economy may result in a liquidity crisis in the bond market, as events in 2015-2017

show. As an example of *liquidity effect*, in 2015 the Third Avenue Value Focused Credit Fund had to liquidate some of its funds to get enough cash needed to meet its redemption obligations (Wall Street Journal, 2015). In August 1998 high exposure in junk bonds was a major factor in determining the default of Russia domestic bond market and the bankruptcy of the hedge fund Long Term Capital Management (LTMC). Because of the liquidity needed to adjust margins, investors and leveraged hedge funds engaged in sell-offs that spread to other emerging markets (Kaminsky *et al.*, 2003). A recent situation of *liquidity effect* and adverse *procyclical effect*, even if not confined to high-yield bonds, is the recent UK 'mini budget' decision to fix the energy cost around £ 2,500 per year, which the Government committed to cover by issuing gilts. The financing of this was unclear and not understood by the market, so it determined an inflationary reaction, a plunge in the pound exchange rate, which reached the lowest level against the USD ever, and a huge increase in interest rates. The latter also increased pension obligations of pension funds. Pension funds and other institutional investors had to sell bonds to raise money to adjust their plan assets and margin requirements. The problem was that they were selling bond when prices were falling, so their prices fell even more, making the yield of bonds rise even more. The rise in interest rates also triggered an increase a rise in mortgage loan rates. All of this led the Bank of England to intervene.

7. Conclusion

Academic contributions have produced several theories of financial contagion, as well as analysis of specific occurrences involving high-yield bonds. Although each stream of research has highlighted specific events and circumstances that can trigger a contagion, no theory fully explains the phenomenon in different contexts. After reviewing the esisting literature, as well as the relationship between government bonds and high-yield bonds, and equities and

high-yield bonds, this paper has attempted to build an initial framework that may apply contagion theories to high-yield bonds and bring together the existing schools of thoughts. Each building block of this model is not intended to be applicable in every situation, conversely some of the components of the model would be expected to be applicable depending on a specific situation. Finally, the proposed approach is an initial conceptual model, meant to encourage other scholars to translate it into a quantitative model. The model is dynamic, as its building blocks mimic possible sequences in market, which were also realized on different occasion and specific to the business cycle situation. In particular, different quantitative methods could be used to apply the proposed framework, but particular attention must be paid to the analysis of the interconnected mechanisms which are of utmost importance for identifying and preventing financial contagion.

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