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Effect of rollover risk on default risk: Evidence from bank financing

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ABSTRACT

We study the effect of rollover risk on the risk of default using a comprehensive database of U.S. industrial firms during 1986–2013. Dependence on bank financing is the key driver of the impact of rollover risk on default risk. Default risk and rollover risk present a significant positive relation in firms dependent on bank financing. In contrast, rollover risk is uncorrelated with default probability in the case of firms that do not rely on bank financing. Our measure of rollover risk is the amount of long-term debt maturing in one year, weighted by total assets. In the case of a firm that depends on bank financing, an increase of one standard deviation in this measure leads to a significant increase of 3.2% in its default probability within one year. Other drivers affecting the interaction between rollover risk and default risk are whether a firm suffers from declining profitability and has poor credit. Additionally, rollover risk's impact on default probability is stronger during periods when credit market conditions are tighter.

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1. Introduction

Rollover (refinancing) risk arises when a firm's debt is close to maturity but the firm wants to refinance it. During the financial crisis of 2007–2009, rollover risk exacerbated default risk because liquidity deteriorated in debt markets. This lack of liquidity negatively affected the main channel used by firms needing to refinance their maturing debt. He and Xiong (2012) theorize that this interaction between rollover risk and default risk, where rollover risk sharpens conflicts of interest between shareholders and debt holders because shareholders have to bear refinancing costs, making equity holders declare the firm insolvent earlier, thus increasing the default probability.

Empirical evidence about the effect of rollover risk over default risk is in its early stages.¹ This paper empirically examines rollover risk using a comprehensive dataset of industrial firms in the U.S. market from 1986 to 2013. We thus provide new evidence on this issue by exploring whether a firm's financing structure drives this risk. Our key

finding is that rollover risk increases the default probability of firms that depend on bank financing. This increase is greater if they suffer from declining profitability and poor credit quality. Moreover, crises in credit market boost the effect.² In contrast, we do not find significant evidence of this rollover risk effect (RRE) for firms that do not rely on bank financing. The risk is not significant, even when such firms have weak fundamentals or credit markets are in crisis.

Our sample contains all publicly traded industrial firms in the U.S. market from 1986 to 2013. We employ a panel data regression. We measure default risk using the expected default frequency based on the Merton's (1974) model. Our measure of rollover risk is the amount of the firm's long-term debt outstanding at the end of year $t - 1$, due for repayment in year t , weighted by total assets. This measure is attractive because it is usually uncorrelated with the firm's current risk characteristics. Therefore, we avoid possible endogeneity problems that could arise with other commonly used proxies for rollover risk (e.g., proportion of short-term debt in total debt; see Harford, Klasa, & Maxwell, 2014).

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¹ To the best of our knowledge, only two published articles (Gopalan, Song, & Yerramilli, 2014; Valenzuela, 2016) document that firms that experience large increases in rollover risk are likely to suffer a strong deterioration in their credit quality. The work of Chen, Xu, and Yang (2012) and Hu (2010) also relates to this topic.

² The literature argues that firms that depend on bank financing are different from firms that enjoy wider financing choices, because bank-dependent firms tend to face more difficulties with long-term borrowing, have lower debt capacity, and suffer greater liquidity risk (e.g., Mian & Santos, 2011). In turn, we hypothesize that the impact of rollover risk on increasing default risk is stronger for bank-dependent firms than for non-bank-dependent firms. This is the central hypothesis in this paper and it is illustrated thoroughly in Section 2.2.

Our evidence suggests that rollover risk is significant for bank-dependent (BD) firms, because such firms suffer from significant increases in default rates when rollover risk increases, even after we control for a comprehensive list of default risk factors, firm fixed effects, and year fixed effects. However, rollover risk is not significant in the case of firms that do not depend on bank financing, suggesting that the source of financing (banks or other sources) is the factor determining the impact of rollover risk.

Rollover risk is not only statistically significant but also economically substantial. For a BD firm, a one standard deviation increase in the rollover risk measure leads to a significant 3.2% increase in the default probability during the next year.

To gain more insight about the effect of rollover risk on the default probability, we examine several factors that could influence this effect. We find that, for BD firms, RRE is particularly stronger among those with declining profitability and poor credit quality. Moreover, tighter credit markets amplify the effect. In contrast, the RRE for non-BD firms is not significant, even under these amplification forces, suggesting that a firm's dependence on bank financing plays a dominant role in driving the impact of rollover risk on default.

For BD firms, a one standard deviation increase in the rollover risk measure *increases* the default probability by 7.6% when firms also experience declining profitability, but *decreases* it by 2.7% when firms become profitable. The default probability *increases* from 3.5% to 5.2% when firms suffer from poor credit. In contrast, the default probability *decreases* from 2.8% to 11.1% when firms enjoy good credit. During periods of stress in credit markets, the default probability increases from 6.4% to 14.4%. However, under normal market circumstances, the default probability increases by only 1%.

We present several robustness tests. First, in the baseline analysis, we classify a firm as BD when it has no ratings (Chava & Purnanandam, 2011). We realize that this bank dependence identification strategy is open to criticism. For example, a firm could not be rated because it chose to not ask for a rating, irrespective of whether it relies on financing from banks or from other sources. Therefore, we adopt an alternative identification scheme by examining a firm's actual dependence on bank loans relative to its total assets. Second, we use the ratio of debt maturing in more than three years to total debt as an alternative measure of rollover risk. Third, we use stock returns volatility as an alternative default risk measure and repeat the baseline regressions. Overall, the results from these robustness tests largely support our baseline findings.

This study adds to the literature in several ways. First, we contribute to the literature on both debt maturity and credit risk by empirically validating the theoretical prediction that rollover risk arising from a firm's debt maturity structure increases the firm's overall credit risk (e.g., He & Xiong, 2012; Morris & Shin, 2009).

Second, we complement empirical studies on the RRE by showing that the level of dependence on bank financing largely drives the rollover risk channel, in which BD firms experience a significant increase in default probability because of their exposure to rollover risk. Moreover, our findings suggest that, if BD firms can properly manage their debt maturity structure, this strategy could help mitigate the likelihood of bankruptcy.

Furthermore, we find that rated firms do not suffer additional default risk arising from rolling over debt. This result is inconsistent with the findings of Gopalan et al. (2014). One possible explanation for this disagreement could be that we assess default risk based on Merton's (1974) model, which provides a continuous, absolute measure of default risk that changes over the course of the credit cycle, reflecting changes in the level of default risk. However, Gopalan et al. use credit ratings as a proxy for default risk, which can only reflect relative rankings of credit risk across firms at each time (see the discussion by Hovakimian, Kayhan, & Titman, 2012).

Finally yet importantly, this article also contributes to the bank dependence literature by highlighting adverse consequences of relying

on bank financing (e.g., Chava & Purnanandam, 2011). Our evidence suggests that bank dependence exposes firms to higher default risk because of the additional impact of rollover risk.

The remainder of this article proceeds as follows: We present related literature and our hypotheses in Section 2. Section 3 describes the main variables and the data. Section 4 discusses the empirical results. Section 5 documents robustness tests. Section 6 concludes with a discussion of the results and suggestions for further research.

2. Literature review and hypothesis development

This section outlines both theoretical and empirical research into the effect of rollover risk on default risk and discusses the potential impact of reliance on bank financing.

2.1. RRE on default risk

2.1.1. Theoretical background

Recent studies propose theoretical models in which rollover (refinancing) risk increases default risk. Morris and Shin (2009) incorporate insights from the bank-run literature (Diamond & Dybvig, 1983) into a stylized model and examine the interaction, showing that a negative fundamental shock can increase the probability of short-term debt holders deciding not to refinance, which then increases the bank's default probability. He and Xiong (2012) apply Myers's (1977) notions to Leland and Toft's (1996) model and find that, when debt market liquidity deteriorates, firms face rollover losses if they issue new bonds to replace maturing bonds. To avoid default, equity holders must bear rollover losses. The intrinsic conflict of interest between debt and equity holders could force equity holders to choose a higher fundamental firm value as a default barrier. In the presence of refinancing risk, a firm has a lower probability of survival. Forte and Peña (2011) also investigate the long-run effects of refinancing and find that debt refinancing increases default risk and induces systematic rating downgrades, unless some minimum level of firm value growth occurs. Deviations from this growth path imply asymmetric results: Lower firm value growth generates downgrades and higher firm value growth generates upgrades. However, downgrades tend to be greater in absolute terms.

A key implication of these theoretical contributions is that the amount of firm debt that matures in the short term increases the firm's overall default probability, beyond traditional default risk factors, causing the RRE we define herein.

2.1.2. Empirical evidence

Recent empirical evidence indicates the existence of an RRE. Gopalan et al. (2014) find that firms with greater exposure to rollover risk have poorer credit ratings. The RRE is also stronger among firms with speculative-grade ratings and declining profitability, as well as during economic recessions. According to Chen et al. (2012), a bigger drop in the maturity of debt led to larger increases in credit spreads during the 2007–2009 crisis. This maturity effect on credit spreads is more pronounced for firms with high leverage or high systematic risk. Valenzuela (2016) finds that debt market illiquidity increases firms' corporate bond spreads through rollover risk in the international context. Our first hypothesis follows directly from these theoretical predictions and empirical evidence.

H1. Firms with high exposure to rollover risk suffer higher default risk than firms without such exposure.

Empirical studies that use particular proxies for default risk usually study a restricted sample that does not cover all firms. For example, they use credit ratings, corporate bond spreads, or credit default swap spreads, limiting samples to large or less risky firms. We argue though

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