Oil Prices and Banking Instability: A Jump-Diffusion Model of Bank Capital Structure

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Executive summary

Over the past two decades, an increasing level of bank leveraging has occurred, which was one of the main causes behind the financial market meltdown of the years 2008-9. This trend in the banking industry was accompanied by another trend in the real estate sector, where the subprime mortgage crisis originated. For example, the home price-to-rent ratio began to increase rapidly in 2001 (Finicelli 2007), and American households accrued debt at an unprecedented level (Hudson 2006). Interestingly, 90% of this increase in debt since the 1990s consisted of mortgage loans, which roughly constituted 50% of total bank loans in general. This increase in mortgage loans was caused by the low interest rate, which stimulated home buyer borrowing capabilities. In addition, leveraging increased due to the expanding role of financial intermediaries, which acted in the middle and hedged risk by outsourcing loans. Risk was transferred through the securitization of risky loans, banks increased their risk-taking behaviors and neglected sufficiently screening borrowers' risk. To account for this we develop a measure of bank overleveraging and examine banks' past leveraging experiences to determine how the excessive leverage contributed to their failures and to the instability of the overall banking sector.

To turn this issue into an empirical question, this paper presents a model of bank capital structure, which easily lends itself to capture and measure the mechanism driving a wedge between the optimal or sustainable leverage of a bank, as measured by the Stein model (2012) and actual debt. We apply this method to test whether various oil-related, politically related, and regulation-related events have magnified the excess debt observable in the balance sheets of banks. Our focus includes banks in oil-producing countries and Western countries. Though the work builds on the Stein (2012) model we add a jump-diffusion component that captures the jump size and intensity of oil prices and political instability predictors. The optimal debt is derived and then estimated for a sample of six banks in three countries using Markov Chain Monte Carlo, for the time span from 2006-2016.

This paper contributes to recent academic research on the topic of overleveraging and the effects of large oil and political instability shocks on asset prices, financial markets, and the balance sheets of banks. We show that those shocks might be destabilizing rather than mean reverting. In our paper, we are dealing with the oil market and the volatility of oil prices in terms of a jump-diffusion process that not only helps one understand and stylize how the commodity market is affected, but also how the stability of the banking system is impacted.

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Our findings show that most of the banks in this context had a high optimal debt around 2008, overlapping with the oil price shock. In addition, most of the predictors, namely oil prices and political instability factors proxied by terrorism, corruption, and military expenses, regularly appeared in volatility and jump intensity factors. This is in line with the assumption that they serve as significant risk drivers for businesses and the macroeconomy. The oil price had a negative effect on drift and jump intensity for four banks in the U.S. and the U.K., while exhibitingted a different drift effect for the oil-exporting country such as for example Bahrain.

The optimal debt ratio estimation presented in this paper is an important measure that can help banks detecting a sustainable debt level above which it becomes risky to leverage. This is a key financial metric in that it allows banks to avoid instability and/or risk of insolvency when they take this metric seriously. However, banks do not accurately assess optimal debt, and in most cases, when the optimal debt moves down, excess leverage increases for a given level of actual leverage.
We add to the previously referenced academic studies the role of rapid changes of oil prices and political stability, and their impact on the stability of the banking system. We use the oil price change as an example of a rare but large event, and model it as the jump-diffusion process with its impact on banks' portfolios, their asset prices, and balance sheets. Here, too, the banks' vulnerability and exposure to insolvency risk can become an important threat to macroeconomic stability and performance.
Given our results fromof the jump-diffusion component built into the Stein model of optimal bank debt, we can spell out some policy implications. The main one for all countries is to reduce overall risky debt, and develop an optimal debt structure which needs to be followed in order to avoid the risk of financial instability and default. The first challenge in designing an effective policy is to make optimal debt a fixed ratio based on the net worth of a financial corporation, which should be a regulatory one. High risk implies high return, therefore, decreasing the risk by providing secured lending will be a challenging task. One has observed that a risky portfolio that is driven by commodity prices, such as oil prices, props up the lending to dangerous levels. We have tried to distinguish between optimal and actual leveraging of financial institutions.
We could observe that what has been called optimal debt is even rising with the oil price spikes, and so is the actual level of debt. A further policy challenge is to introduce and strengthen risk weighted capital buffers and the use of collaterals that can quickly turn into liquidity. Collaterals are a powerful tool for achieving stability, despite the repossession cost they impose on the banks. Policymakers should impose higher collaterals on riskier borrowers, and also for financial institutions exposed to such shocks as oil price shocks. In addition, monetary policy that increases the interest rate will prompt a greater collateral, closer to optimal leverage level, which affects borrower's investments' opportunities and risks, hence its effect on the bank's portfolio risk and choice. Thus, policymakers should also be aware that the value of collaterals are also endogenously determined, for example based on the level and volatility of the oil price.
Keywords: overleveraging, banking instability, banking sector, real economy, oil prices, oil shocks, MCMC, jump-diffusion, and jump risk.