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The effects of financial distress: Evidence from US GDP growth

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ABSTRACT

This study provides a dynamic characterization of the link between financial distress risk and the real economy. Using a large dataset of firm-level observations, new ex-ante measures of financial distress are developed at the sector level and used to examine growth trends in the US economy. More specifically, we develop a comprehensive set-up for predicting ex-ante financial distress risk, then examine the effects of ex-ante financial distress risk on GDP growth. Our results show that over the period of 1970–2012, ex-ante financial distress risk contracts GDP growth by up to 9 per cent. The results also reveal greater contractions in exports and investment. The results remain unchanged when internal and external instruments are used to address endogeneity issues.

1. Introduction

In the aftermath of the global financial crisis, economic models that incorporate financial conditions in business cycles have become more important to academics and policy makers. In the macroeconomic literature, credit market conditions gained greater prominence in the modelling of economic fluctuations, while financial debt featured more heavily in the analytics. See, for example, [Allen et al. \(2012\)](#); [Baele et al. \(2013\)](#); [Christensen and Dib \(2008\)](#); [Gilchrist and Ortiz \(2009\)](#). Further, the role of financial features including debt, credit and collaterals as determinants of macroeconomic outcomes have also gained increased scrutiny (see [Pagan and Robinson \(2014\)](#)).

On the microeconomic aspect of the financial literature, most studies have focused on analysing the ability of investors or managers to acquire credit or finance and the role that this plays in investment behaviour/decisions (see [Kiyotaki and Moore \(1997\)](#); [Liu et al. \(2010\)](#)). A related area of interest is the modelling of financial distress or bankruptcy at the micro-unit or firm-level. The development of these models has historically followed the path of methodological improvements and variable selection, with most extensions largely focused on the evaluation of alternative models' predictive abilities for financial distress.

Currently, the main research interest is the examination of the manner in which financial crises impact on macroeconomic outcomes. [Pagan and Robinson \(2014\)](#) provide a timely overview of such recent works and evaluate the ability of the proposed models to generate recessions of the

duration and severity as observed in the recent past. Their own analysis examines the implications of collateral and credit availability on the real economy. They show that the extent to which business cycle is affected is less than what the literature on financial/real interactions suggests.

The link between financial frictions and macroeconomic outcomes has been the subject of many research studies. However, the literature on this particular topic is relatively young and many important dimensions of the effects of firm-level financial distress on the real economy remain unexplored. Our study aims to address this gap and we achieve this aim in two steps. First, we extend the literature on financial distress risk models by developing an ex-ante financial distress indicator at sector level; and second, we provide a dynamic link between ex-ante financial distress and growth in gross domestic product (GDP) using information from US firm-level data. We develop an ex-ante financial distress (FD) indicator based on FD conceptualisations in [Altman \(1984\)](#) and examine its interaction with the real economy. As failure to meet financial obligations might not imply bankruptcy ([Barnes, 1990](#)) and the definition of financial distress, which is independent of its outcome is important ([Altman, 1984](#)). The use of an ex-ante-based definition of financial distress likelihood (FDL) helps in achieving the primary objective of relating FDL to growth in GDP.

In this paper, we employ several ex-ante financial distress definitions. Following [Pindado et al. \(2008\)](#), we first define financial distress to depict a condition in which a firm's market value falls for two consecutive years and its financial (accrued) expenses are greater than its earnings before interest and taxes, depreciation and amortization (EBITDA) for

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two consecutive years. The second definition follows [Asquith et al. \(1994\)](#) who state that financial distress occurs when a firm's reported interest expense (accrued expense) is greater than its EBITDA for any two consecutive years. We further extend this definition such that a firm is financially distressed for any three consecutive years when EBITDA is less than the accrued expense.

In contrast to previous work, we define ex-ante financial distress at the sector level using the information generated from the firm-level observations. We first identify financial distress in a sector using the proportion of distressed firms in that sector in any particular year. Secondly, the cumulative distribution of firms that are financially distressed is used to identify financial distress among sectors. Both financial and non-financial firms are studied and we control for the influence of the financial sector on the models. These sectors include agriculture-forestry-fishing, mining, construction, manufacturing, transportation-utility-communication, wholesale trade, retail trade, finance-insurance-real estate, services, and public administration (government).

To capture the dynamic nature of the data, we predict distress one or more years prior to its observation. This introduces dynamism in the predictive criterion of financial distress and aligns with the approach of [Pindado et al. \(2008\)](#) and [Hernandez Tinoco and Wilson \(2013\)](#) who both employ one year lag in their studies.

Our paper proposes a model that employs a panel specification of both binary and continuous dependent variables. Our estimation methodology employs the conditional mixed process model of [Roodman \(2011\)](#) which generates efficient and consistent estimates in a recursive simultaneous system. The system of equations estimation approach is meant to resolve possible simultaneity bias among variables and provides a solution to endogeneity among variables of interest. Given the complexity of the nature of endogeneity between finance and growth, we also use alternative IV models which invariably incorporate lagged variables, external or synthetic instruments.

Our results show that financial distress is strongly related to the growth of US GDP and of its investments and exports components. In particular, ex-ante financial distress is found to induce a fall in exports by 14 per cent and a fall in investment by 11 per cent. Overall, the results further show that financial distress causes a 9 per cent contraction in the GDP growth. The results reveal the importance of firms and their investment decisions on macroeconomic outcomes. They also highlight the importance of financial distress prediction models in understanding mainstream macro-economic outcomes. The results support macro-finance studies where the importance of the financial sector and/or financial features in macroeconomic outcomes are revealed. This is particularly important in recent times where the interaction of finance and macroeconomic features has become useful in business cycle studies.

The rest of the paper is organised as follows. Section 2 presents the literature review on financial distress as well as the theoretical and empirical relationship between financial conditions and the macro-economy. Section 3 discusses the methodological approaches. Section 4 presents the results and Section 5 concludes.

2. Literature review

In the first subsection, we briefly review the financial distress literature and the second subsection provides an overview of theoretical and empirical relationships between finance and the economy.

2.1. An overview of financial distress models

Financial solvency, the efficiency of operation, and access to capital markets are fundamental requirements for good performance in any business unit. Over the past 6 decades, many businesses have grown, but also faltered due to both internal and external factors. The economic/financial literature is rich with bankruptcy/financial distress prediction models, which seek to help us understand the phenomenon we call financial distress. The importance of these competing models can be

evaluated by their prediction ability of bankruptcy or financial distress. With the ability to predict insolvency among firms, the accounting ratios and market variables have become useful in unveiling competence and performance among firms.

The prediction of bankruptcy has maintained a pivotal position in credit risk identification and assessment. After the introduction of Z-score model ([Altman, 1968](#)) plus its variant; ZETA model ([Altman et al., 1977](#)) that relies on discriminant analytical method, other methodological improvements such as the conditional logistic model ([Ohlson, 1980](#)) and the probit model ([Zmijewski, 1984](#)) have evolved over time. The criticism of the discriminant analytical method is its reliance on the assumption of multivariate normality while the logistic and probit models are static in nature.

With regards to methodological improvement, [Jones and Hensher \(2004\)](#) introduce an advanced discrete choice model referred to as the mixed logit model. When compared to the standard logit model or probit model, the mixed logit model has been superior for model fits and out-of-sample forecasts. In recent years, the use of panel logit models such as in [Pindado et al. \(2008\)](#) and hazard models ([Shumway, 2001](#)) among others are present in the literature. These have the advantage of incorporating the dynamics of firms in the prediction of business failure as the characteristics of firms change over time. These models have generated consistent and efficient out of sample forecast. Particularly, the argument by [Shumway \(2001\)](#) is that the static models cannot appropriately forecast bankruptcy. In the identification of failing firms, he introduces a model that uses market driven variables and argues that the model has better out of sample forecasts.

The selection of variables that distinguish future solvent firms from distressed firms is also a major determinant of a successful distress prediction model. Conventional predictors include accounting-based ratios computed from a firm's accounting statements. [Grice Jr and Dugan \(2003\)](#) re-examine the performance of original accounting-based models when applied to periods other than the period studied by pioneer authors and show that these models are sensitive to time.

Predictors using stock indices are also common (examples include [Agarwal and Taffler \(2008\)](#) [Hillegeist et al. \(2004\)](#)), and these market-based models rely on the [Black and Myron \(1973\)](#) and [Merton \(1974\)](#) option pricing models. Here, the value of equity can be viewed as a call option on the market value of the assets of the firm. The criticism of this type of model is that stock price volatility may not be an accurate proxy of the expected implied price variance.

For listed firms, [Hernandez Tinoco and Wilson \(2013\)](#) reveal the importance of a combined model that harbours accounting, market and macroeconomic variables in financial distress risk predictions. However, both accounting-based models and market-based models have remained equally important in predicting financial distress and bankruptcy.

2.2. Finance and the macro economy: theory and evidence

The interplay of the financial and real sectors in the economy has always been of great concern to policymakers and researchers alike. After the last global financial crises, models that incorporate the importance of financial conditions in business cycle have taken on greater importance in policy and academic discussions.¹ Financial features pertaining to debt and credit are increasingly being investigated as key channels and the financial/real interactions are being studied in models with financial frictions.

The credit channel ([Kiyotaki and Moore, 1997](#)) and the financial accelerator ([Bernanke and Gertler, 1989](#); [Bernanke et al., 1999](#); [Carlstrom and Fuerst, 1997](#)) are the ways used in introducing financial factors into macroeconomic models. In the former, financial frictions occur because of collateral constraints, which affect the quantity of loan. The financial sector intermediates between lenders and borrowers and by

¹ Some studies on finance-growth nexus can be found in [Obstfeld \(2009\)](#); [Law and Singh \(2014\)](#); [Menyah et al. \(2014\)](#) and [Trew \(2014\)](#). [Inekwe \(2015\)](#) shows that financial distress affects employment.

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