Journal of Financial Stability 8 (2012) 219–235

Contents lists available at SciVerse ScienceDirect

Journal of Financial Stability

journal homepage: www.elsevier.com/locate/jfstabil

Macroeconomic fluctuations and corporate financial fragility

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ARTICLE INFO

Article history:
Received 29 October 2010
Received in revised form
28 December 2011
Accepted 28 February 2012
Available online 16 March 2012

JEL classification:
G33
E32
D21
C41

Keywords:
Financial fragility
Macroeconomic shocks
Corporate bankruptcies
Multi-period Logit model
Stress testing
Second round effects

ABSTRACT

Using a large sample of accounting data for non-financial companies in France, this paper studies the interactions between macroeconomic shocks and companies' financial fragility. We consider links in both directions, namely whether firms' bankruptcies are affected by macroeconomic variables, and whether bankruptcies determine the business cycle. We estimate forecasting equations for firms' bankruptcy using Shumway's (2001) approach and study the joint dynamics of bankruptcies and macroeconomic variables within an exogenous VAR type model estimated at the sector level. We find evidence of reciprocal links between the bankruptcy rate and the output gap and highlight significant "second round effects" of shocks to the output gap on bankruptcies. We show how taking into account the dynamic transmission of macroeconomic shocks matters in stress testing exercises.

1. Introduction

The financial crisis that emerged in the summer of 2007, characterized by the most severe recession in the post-war period and a historical level of business bankruptcies in many countries, has highlighted the need to identify the link between bankruptcies and macroeconomic developments in a dynamic perspective. This is important for the proper implementation of "stress tests" of credit risk that are designed to assess the resilience of the financial sector, notably banks' loan portfolios, to exceptional but plausible macroeconomic shocks. In contrast to the way stress tests are usually carried out, with a one-way impact of the macroeconomic environment on the financial sector, we highlight the need to take account of "second round" effects, namely the reverse impact of bankruptcies on the macroeconomy. To this end, we estimate a 2-equation VAR type model linking the output gap and the bankruptcy rate, also using detailed information on the financial situation of individual firms.

We illustrate our methodology in the case of France and show that second round effects do matter. Fig. 1, where we report the number of corporate bankruptcies in France and a simple measure of the output gap (in inverted scale), provides *prima facie* evidence of the link between the two variables: in the wake of the crisis, in 2010, bankruptcies reached levels that were equivalent to those in the 1992–1993 period.[1] However, taking a longer perspective, one can observe different cases: either bankruptcies led the output gap as in the early 1990s and in 2001–2002, or the output gap led bankruptcies as in the late 1990s, or the two were independent as in 1993–1994, when the increase in the number of bankruptcies outpaced that of the output gap. This was also the case in 2003–2007: more bankruptcies occurred in spite of the upward phase of the business cycle. The Banque de France (2009) stressed in particular that the higher level of business creations during the 2003–2007 period – itself correlated with the business cycle – may explain

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[1] The output gap is computed as the residual of a regression of the logarithm of real GDP on an intercept and a time trend.

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doi:10.1016/j.jfs.2012.02.002

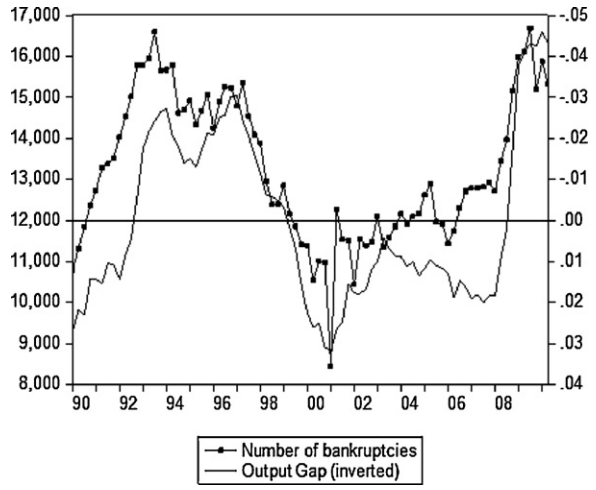

Fig. 1. Number of bankruptcies and the output gap in France (1990–2010). Source: Banque de France.

the increase in the number of bankruptcies. This calls for a more detailed analysis of the dynamic link between business bankruptcies and the business cycle.

There is agreement in the financial economics literature regarding the existence of a link between bankruptcies and the business cycle. This topic has already been extensively investigated and it is now acknowledged that some interaction exists. This led the Basel Committee on Banking Supervision to recommend in 2004 a regulatory framework (commonly known as Basel II) to, *inter alia*, take account of the adverse effect of the macro-economy on banks' loan portfolios, particularly in the implementation of stress tests. More recently, the Basel III framework introduced capital buffers that increase the cost of credit in the upturn, but reduce it during the downturn, highlighting the effect of capital losses on the supply of credit, hence on the business cycle. However, there is no agreement on the channels by which bankruptcies and the business cycle interact, nor on how to measure the link.

Regarding the channels of interaction, the business cycle affects the environment of firms, and hence may explain, with a lag, the changes in bankruptcies over time, in addition to firm-specific variables like financial ratios. On the other hand, bankruptcies may affect the business cycle, marginally through lost capacities of production, and more significantly through credit rationing as shocks to credit supply have often been shown to be leading indicators of the business cycle (Bernanke and Gertler, 1989; Lown and Morgan, 2006). In addition, banks may limit credit supply because they become more risk averse when they observe more bankruptcies or because larger losses constrain their ability to expand assets.

As far as measurement is concerned, the approaches followed in many studies are usually partial, as they focus on one-way interactions between bankruptcies and the business cycle. As mentioned above, our study contributes to this literature by focusing on the French case, providing evidence of two-way interactions, as well as showing how taking account of the dynamic transmission of macroeconomic shocks matters in stress testing exercises.

This paper attempts to merge two strands of the quantitative economic literature regarding how the macroeconomic environment affects financial fragility, and conversely how financial fragility affects the business cycle. We also consider evidence that points to two-way interactions between business bankruptcies and the macroeconomy.

The first strand in the literature is the growing number of quantitative papers focusing on the impact of macroeconomic conditions on the bankruptcy of firms. The different contributions can be distinguished either according to the types of data used, or the method implemented, with overlaps between the two types of papers. *First, regarding data*, macroeconomic indicators have been introduced into the estimation of credit risk models for portfolio management, but we should distinguish between models that use financial market data and models that use accounting data. In the first case, we are mainly looking at large quoted companies. See Allen and Saunders (2004) for a survey of these papers.[2] In the latter case, we consider a larger set of non-financial companies. *Second, regarding the methods used*, we should distinguish between (i) a large number of papers starting from Altman's (1968) seminal paper based on discriminant analysis that predict business failures but without introducing macroeconomic variables, (ii) papers introducing macroeconomic variables using the multiperiod Logit model advocated by Allison (1982) and Shumway (2001), (iii) duration models and (iv) other econometric methods. Regarding the first group of papers, we should mention Altman and Saunders (1998), Benito et al. (2004), Bernhardsen (2001) and Bunn and Redwood (2003). Regarding the second group of papers, we refer to the methodology initiated by Allison (1982) and most notably applied by Shumway (2001), who use a particular Logit model in order to measure the dynamic relationship between macroeconomic variables and bankruptcies. In our case, we have access to a large sample of non-financial French firms (an average of 80,000 firms per year) which are observed over a sufficiently long period and make it possible to take into account the progressive deterioration of their financial conditions in predicting business failures, unlike the first generation Logit or Probit models, which only provide a static analysis, period by period, based on a cross-section of accounting ratios, hence without macroeconomic variables. Applications of this method include Chava and Jarrow (2004) and Campbell et al. (2008). In the latter paper, the macroeconomic environment is introduced through financial market variables. In addition, Beck et al. (1998) and Glennon and Nigro (2005) use dummy variables to capture the effects of the business cycle. Hillegeist et al. (2004) introduce the aggregate failure rate of US firms as a proxy for the growth rate of GDP. Nam et al. (2008) study defaults of Korean quoted companies and introduce exchange rate volatility as a macroeconomic variable. Jacobson et al. (2005) use Shumway's (2001) approach to model the default risk of Swedish companies. The third group of papers use duration models, for example Carling et al. (2007), Duffie et al. (2007), Bonfim (2009), Bhattacharjee et al. (2009) and Koopman et al. (2009). But despite the main advantages outlined above, the use of duration models remains limited due to left-censoring problems. Indeed, when the observation period is short, most firms in the dataset were created before the observation period, implying that firms' time at risk may be much greater than the observation period. The fourth group of papers, from the point of view of methodology, use a variety of econometric techniques to estimate bankruptcies, also taking into account macroeconomic variables: Hamerle et al. (2004) estimate a random effect Logit model of bankruptcies for German companies; Bonfim (2009) uses a random effect Probit model for Portuguese firms and Qu (2008) uses a fixed-effect LSDV model. Pederzoli and Torricelli (2005) estimate a state-dependent static Probit model of default, distinguishing between expansion

[2] Credit risk models based on financial market information and designed for the pricing of a portfolio of corporate bond fall into two categories: "structural" models derived from the financial literature (Merton, 1974; Black and Cox, 1976; Hull and White, 2004), "reduced form" models (Jarrow and Turnbull, 1992, 1995; Duffie et al., 1996). However, a limitation of these papers is that they concentrate on a subset of non-financial companies, namely quoted companies or those with access to financial markets.