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How does the stock market respond to changes in bank lending standards?

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HIGHLIGHTS

- The stock market impact of bank credit supply shocks is studied.
- Industry stock returns fall significantly in response to tightening bank credit supply.
- Stock returns fall relatively more in more financially dependent industries.

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ABSTRACT

I investigate the industry-level responses of U.S. stock returns to unanticipated changes in bank lending standards, exploiting cross-industry variation in the levels of dependence on external finance. I document that, on average, cumulative stock returns fall significantly by 1.36 percentage points two years after an unexpected one-standard-deviation tightening in lending standards. Moreover, moving from an industry at the 10th percentile of financial dependence to one at the 90th percentile adds between 1.24 and 2.19 additional percentage points to this effect.

1. Introduction

I investigate the industry-level responses of US stock returns to unanticipated changes in bank lending standards, exploiting cross-industry variation in the levels of dependence on external finance. I show that cumulative stock returns fall significantly after an adverse shock to lending standards, and I provide evidence that links the estimated impulse responses in a systematic fashion to financial dependence. On average, an unexpected one-standard-deviation tightening in lending standards is associated with a fall in cumulative industry returns of 1.36 percentage points two years after impact. Moving from an industry at the 10th percentile of financial dependence to one at the 90th percentile adds between 1.24 and 2.19 additional percentage points to this effect.

The starting point of my analysis is an indicator of shifts in the effective supply of bank credit proposed by Bassett et al. (2014). This indicator captures exogenous changes in bank lending standards based on bank-level responses to the Federal Reserve's Senior Loan Officer Opinion Survey on Bank Lending Practices, adjusted by removing bank-specific and macroeconomic factors that can simultaneously affect credit demand. I embed this indicator in a factor-augmented vector autoregression (FAVAR) to trace the dynamic effects of bank credit supply shocks on returns for 24 Fama-French industry portfolios (see Fama and French, 1997). In a second stage, the estimated impulse responses are regressed on a measure of financial dependence proposed by Rajan and Zingales (1998). I focus on financial dependence because existing evidence shows that a bank credit crunch leads to a decline in corporate investment and output that is particularly severe for firms operating in industries highly dependent on external finance (see, e.g., Kroszner et al., 2007; Duchin et al., 2010). The foregone investment opportunities might reduce the net present value of expected future cash flows, which provides a rationale for the stock market's reaction to bank credit supply shocks.

This paper is related to a large literature on the impact of changes in bank lending; see, e.g., Kashyap et al. (1993), Peek et al. (2003), Lown and Morgan (2006), and Bassett et al. (2014). Moreover, it belongs to a growing literature that examines the

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reaction of stock returns to macroeconomic shocks at the disaggregated level. For example, Gorodnichenko and Weber (2016) show that after monetary policy announcements, the conditional volatility of stock returns rises more for firms that change their producer prices less frequently. I contribute to this literature by documenting that stock returns respond heterogeneously to bank credit supply shocks. In a seminal paper, Slovin et al. (1993) conduct an event study on relationship banking which shows that a US bank's impending insolvency has a negative effect on client firm share prices (see also Kang and Stulz, 2000; Dahiya et al., 2003; Ongena et al., 2003). I add to this third strand by highlighting the importance of financial dependence in the differential reaction of stock returns to bank credit supply shocks.

2. Methodology

I proceed in two stages. First, I estimate impulse responses of industry stock returns to changes in bank lending standards using a FAVAR approach introduced by Bernanke et al. (2005). The FAVAR lends itself particularly well to this exercise, as it allows me to jointly model the dynamics of macroeconomic variables and industry returns, and to simultaneously estimate the impulse responses of all variables at the disaggregated level. Moreover, as Bernanke et al. (2005) and Boivin et al. (2009) argue, this framework exploits a larger information set than standard VARs, which should improve the identification of credit supply shocks. In the second stage, I estimate the relationship between the intensity of the estimated impulse responses and measures of financial dependence.

Let $\boldsymbol{X}_t$ denote a $N \times 1$ vector of (standardized) industry returns observed at $t = 1, 2, \ldots, T$. Conforming to arbitrage pricing theory, $\boldsymbol{X}_t$ is assumed to admit an approximate factor model (see Chamberlain and Rothschild, 1983; Bai and Ng, 2002; Stock and Watson, 2002a):

$$\boldsymbol{X}_t = \boldsymbol{\Lambda}\boldsymbol{F}_t + \boldsymbol{Z}_t, \quad (1)$$

where $\boldsymbol{F}_t$ is a $M \times 1$ vector of systematic risk factors, $\boldsymbol{\Lambda}$ is an $N \times M$ matrix of factor loadings that capture industry-specific exposure to common risk, and $\boldsymbol{Z}_t$ is a $N \times 1$ vector of idiosyncratic components. $\boldsymbol{F}_t$ are mutually orthogonal and uncorrelated with $\boldsymbol{Z}_t$. The idiosyncratic components $\boldsymbol{Z}_t$ are stationary with zero mean, and they may exhibit weak cross-sectional and serial correlation.

$\boldsymbol{F}_t$ is partitioned into a $K \times 1$ vector of observable macroeconomic variables $\boldsymbol{G}_t$ and a $R \times 1$ vector of latent factors $\boldsymbol{H}_t$ that capture unobserved drivers of co-movement in industry returns ($M = K + R$). In accordance with Bassett et al. (2014), $\boldsymbol{G}_t$ includes: adjusted changes in bank lending standards; the log-difference of real GDP; the log-difference of the GDP deflator; the log-difference of banks' core lending capacity – the sum of core loans outstanding and the corresponding unused commitments; the "GZ spread" – a composite index of non-financial corporate bond spreads proposed by Gilchrist and Zakrajsek (2012); and the effective federal funds rate. The joint dynamics of $\boldsymbol{F}_t = [\boldsymbol{G}_t', \boldsymbol{H}_t']'$ follow a VAR(p):

$$\boldsymbol{F}_t = \boldsymbol{C} + \boldsymbol{\Phi}(L)\boldsymbol{F}_{t-1} + \boldsymbol{\nu}_t, \quad (2)$$

where $\boldsymbol{\Phi}(L)$ is a lag polynomial of finite order p. The $M \times 1$ error term $\boldsymbol{\nu}_t$ is i.i.d. with mean zero.

The model is estimated following a two-step principal component (PC) approach as described in Bernanke et al. (2005). In the first step, I adopt an iterative procedure proposed by Boivin et al. (2009) to obtain consistent PC estimates of the latent factors $\boldsymbol{H}_t$ that recover dimensions of the common dynamics in industry returns not captured by $\boldsymbol{G}_t$, i.e., the latter are removed from the overall factor space. In the second step, I compute the OLS estimates of the VAR in Eq. (2) for the joint dynamics of $\boldsymbol{G}_t$ and the estimate of $\boldsymbol{H}_t$.

Following Bassett et al. (2014), the shocks are orthogonalized using a Cholesky decomposition of the reduced form error covariance matrix. The identifying assumption implies that changes in the unanticipated component of bank lending standards can have an immediate impact (within a quarter) on output, inflation, lending capacity, credit spreads, monetary policy, and the stock market.

3. Results

I use quarterly US macroeconomic data obtained from the St. Louis Fed and the Bassett et al. (2014) indicator from the Stock and Watson (2012) dataset from 1992Q2 to 2010Q4. The time span is determined by the period for which the Bassett et al. (2014) indicator is available. Call Report data on banks' core loans and unused commitments come from the Enhanced Financial Accounts.[1] Value-weighted returns on NYSE, AMEX, and NASDAQ stocks sorted into one of 38 industry portfolios are retrieved from the Fama-French Data Library.[2] I couple the latter with sectoral measures of financial dependence from Rajan and Zingales (1998) and Larrain (2015). Using those 24 industries for which an appropriate match is available, I estimate a factor model with $R = 4$ factors, selected using the IC_{p1} and IC_{p2} information criteria proposed by Bai and Ng (2002).[3] The FAVAR is estimated using two lags, indicated by the Akaike information criterion.

Fig. 1 depicts the responses of the macroeconomic variables to an unexpected one-standard-deviation tightening in adjusted bank lending standards. The responses are plotted with 90% confidence bands. The bank credit supply shock has significant macroeconomic effects that are in line with Bassett et al. (2014). Specifically, the shock is associated with a contraction in real GDP of about 0.75 percentage points two years after impact. Banks' core lending capacity decreases by nearly 4 percentage points within three years after the shock. Furthermore, a surprise tightening in lending standards is followed by a significant jump in the GZ spread, and the federal funds rate falls by about 50 basis points two years after impact.

Fig. 2 depicts the accumulated impulse responses of industry returns to the same credit supply shock. Cumulative stock returns fall significantly following the shock for almost all industry portfolios. On average, cumulative returns drop by 1.36 percentage points two years after impact. However, there is substantial heterogeneity in the responses across industrial sectors. Cumulative returns in the Electrical Machinery industry fall by 2.95 percentage points two years after the shock, while the effect is essentially indistinguishable from zero for the Chemicals, Food, Rubber and Plastic, and Tobacco industries. The effects typically remain significant for about four to eight quarters, while they persist beyond the two year horizon in the case of, for example, Nonmetalic Mineral Products, Petroleum and Coal Products, Telecommunications, and Transportation Equipment.

I adopt a regression-based approach to investigate the sources of heterogeneity in impulse responses (see also Dedola and Lippi, 2005; Boivin et al., 2009; Buch et al., 2014). First, I construct three summary measures of the estimated impulse responses proposed by Dedola and Lippi (2005): the response two years after the shock;

[1] See http://www.federalreserve.gov/apps/fof/efa/enhanced-financial-accounts.htm.

[2] See http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.

[3] The factor space estimated from the panel with 24 industry portfolios is very similar to the one estimated with all 38 industry portfolios; the trace R^2 statistic is 0.85 (see Stock and Watson, 2002b). After removing the observable variables from the factor space, the first 10 factors explain a cumulative 61%, 69%, 75%, 79%, 82%, 84%, 86%, 88%, 90%, and 91% of the return variance on average across all variables, respectively.