Journal of Banking & Finance 39 (2014) 14–28

Contents lists available at ScienceDirect

Journal of Banking & Finance

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

An intertemporal capital asset pricing model with bank credit growth as a state variable

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ARTICLE INFO

Article history:
Received 2 June 2011
Accepted 17 October 2013
Available online 26 October 2013

JEL classification:
C10
C13
G12
G21

Keywords:
Asset pricing models
Horse races
Predictability
Bank credit
Business cycle
Labor income

ABSTRACT

An ICAPM which includes bank credit growth as a state variable explains 94% of the cross-sectional variation in the average returns on the 25 Fama–French portfolios. We find compelling evidence that bank credit growth is priced in the cross-section of expected stock returns, even after controlling for well-documented asset pricing factors. These results are robust to the inclusion of industry portfolios in the set of test assets. They are also robust to the addition of firm characteristics and lagged instruments in the factor model. Bank credit growth is important because of its ability to predict business cycle variables as well as future labor income growth. These findings underscore the relevance of bank credit growth in stock pricing.

1. Introduction

A growing financial economics literature highlights the importance of bank credit in promoting future economic growth (Levine and Zervos, 1998; Beck and Levine, 2004; Levine, 2006; Beck et al., 2008). Levine and Zervos (1998) find that developed financial systems measured by the level of bank credit, as well as market liquidity, predict future economic growth. King and Levine (1993) and Levine and Zervos (1998) construct and test an endogenous growth model in which developed banking systems spur economic growth through the innovation channel. Indeed, banks provide a unique range of services, such as assessing, monitoring and providing funding for productive entrepreneurs, which are critical contributors to innovation and productivity growth, and hence promote broader economic growth.

Moreover, as noted by Levine (2006), banks alleviate informational asymmetries and therefore facilitate transactions, which in turn leads to future economic growth. This is particularly true for small firms which face external financing constraints (Beck et al., 2008). Well-developed banking systems ease these frictions, thus contributing to the expansion of small business and, accordingly, future economic growth. In addition, Levine and Zervos (1998) and Beck and Levine (2004) show that banking developments influence economic growth, even after controlling for various political and economic factors. Beck et al. (2007) also find that higher levels of bank credit to the private sector reduce income inequality by boosting the lowest labor incomes.

These previous studies demonstrate that bank credit growth predicts future economic growth. This paper also finds that bank credit growth is a strong predictor of labor income growth. This result is consistent with the recent findings of Lynch and Tan (2011) which show that labor income growth is procyclical. In fact, labor income growth tends to be higher during expansions than during recessions. As higher (lower) bank credit growth predicts periods of strong (weak) economic growth during which labor income growth increases (decreases), it is not surprising to find that bank credit growth also helps in predicting labor income growth.

The fact that bank credit growth predicts labor income growth suggests that bank credit growth should be a state variable in

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http://dx.doi.org/10.1016/j.jbankfin.2013.10.008

Campbell's (1996) intertemporal capital asset pricing model (ICAPM). Indeed, Campbell (1996) demonstrates that any variable that predicts future labor income growth or stock returns is a candidate risk factor in asset pricing models. In the empirical tests, we find strong evidence that bank credit growth is a priced factor in the cross-section of expected stock returns, even after controlling for well-documented risk variables such as the Fama–French factors and liquidity risk. These findings are robust to different specification tests, including the misspecification robust t-test proposed by Kan and Robotti (2009) and Kan et al. (forthcoming). Adding industry portfolios to the set of test assets does not alter the main conclusion of the paper that bank credit growth is relevant in the pricing of stock returns in the United States.

While bank credit growth's impact on economic growth is well documented, our paper is among the few studies that examines the impact of bank credit growth on stock returns. An exception is Gorton and He (2008) who develop a model in which the strategic interaction between banks leads to bank credit cycles, which in turn bring about macroeconomic fluctuations.[1] They also argue that since bank credit cycles determine business cycle conditions, they should be a priced factor in an asset pricing model of stock returns. As a proxy for bank credit cycles, Gorton and He (2008) construct an aggregate Performance Difference Index (*PDI*)[2] and find that the coefficient on the *PDI* is significant in the time-series regressions of 10 size portfolios. They thus conclude that bank credit cycles are priced.

Our work differs from Gorton and He (2008) in two ways. First, as a proxy for bank credit cycles, we use bank credit growth instead of the *PDI*.[3] The advantage of bank credit growth over the *PDI* is that it can be computed with high frequency data and for a long sample period, while the *PDI* can only be computed at a quarterly frequency for a short sample period. Second, this paper investigates whether bank credit growth explains the cross-section of expected returns, whereas Gorton and He (2008) rely on a simple time-series analysis and do not perform any formal tests of model adequacy.

Our study also complements the large existing literature which conducts empirical tests of asset pricing models. Petkova (2006) shows that an ICAPM that includes market excess returns and innovations in the variables that predict future returns performs better than the Fama and French (1993) model in explaining the average returns on the 25 Fama–French portfolios. However, Kan and Robotti (2009) and Kan et al. (forthcoming) find that, under the assumption of potentially misspecified models, Petkova's (2006) model and the Fama–French model do not produce significantly different goodness-of-fit measures at conventional levels. This paper contributes to the existing literature by demonstrating that the ICAPM that includes bank credit growth outperforms the Fama–French model, even when the Kan et al. (forthcoming) test of equality of cross-sectional R^2s is implemented.

The rest of the paper is organized as follows. Section 1 presents Campbell's (1996) ICAPM framework and introduces the two-pass methodology under potentially misspecified models. It also presents the GMM methodology under the same assumption. Section 2 reports the empirical results of the ICAPM that includes bank credit growth. Section 3 provides tests for robustness. Section 4 concludes.

2. Theoretical framework and econometric methodology

2.1. Campbell's (1996) ICAPM framework

Campbell's (1996) asset pricing formula implies that the expected excess returns on assets are determined by their covariances with (i) market excess returns and (ii) the innovations in state variables that forecast income growth or future asset returns. Formally, expected excess returns on assets are governed by the following linear relation:

$$E(r) = V_m\lambda_m + \sum_{s=1}^{S} V_s\lambda_s \tag{1}$$

where $E(r)$ is an N-dimensional vector containing the expected excess returns on assets, V_m and V_s are N-dimensional vectors consisting of the covariances of asset returns with the market excess returns and with the innovations in state variable "s," respectively. λ_m and λ_s are the price of risk for the excess market return and the sth state variable, respectively. Let $K = S + 1$, $V_K = [V_m, V_1, \ldots, V_S]$ and $\lambda_K = [\lambda_m, \lambda_1, \ldots, \lambda_S]'$ such that we can rewrite Eq. (1) as follows:

$$E(r) = V_K\lambda_K \tag{2}$$

For ease of comparison with the previous literature, it is convenient to express Eq. (2) in terms of betas, such that:

$$E(r) = \beta_K\phi_K \tag{3}$$

where $\phi_K = [\phi_m, \phi_1, \ldots, \phi_S]'$ is a vector containing risk premia, and $\beta_K = [\beta_m, \beta_1, \ldots, \beta_S]$ is the $N \times K$ matrix of betas, which are the coefficients from the following equation:

$$r_t = \alpha + \beta_m r_{mt} + \sum_{s=1}^{S}\beta_s\varepsilon_{st} + e_t, \quad t = 1, \ldots, T \tag{4}$$

r_t is an N-dimensional vector including the excess returns on assets at time t, r_{mt} is the market excess return at time t, ε_{st} is the observation of state variable "s" at time t, α is an $N \times 1$ vector of constants, and e_t is an $N \times 1$ vector containing the residual return from multivariate regression (4) at time t. Let $f_t = [r_{mt}, \varepsilon_{1t}, \ldots, \varepsilon_{St}]'$ such that we can rewrite Eq. (4) as follows:

$$r_t = \alpha + \beta_K f_t + e_t, \quad t = 1, \ldots, T \tag{5}$$

In this study, Eq. (2) is more relevant than Eq. (3) for two reasons: (i) Campbell's (1996) ICAPM implies Eq. (2) and (ii) in the context of model selection, Eq. (2) is more appropriate than Eq. (3), especially when the betas are estimated via multivariate regression (5). Indeed, Kan et al. (2009, p. 17) demonstrate that "finding a significant t-ratio on a factor risk premium need not imply that inclusion of that factor will add to the cross-sectional explanatory power of a model…the corresponding implications do hold if the explanatory variables are simple regression betas or covariances with the factors."

2.2. Time-series predictability: A vector autoregressive approach

As in Campbell (1996), this paper uses a vector autoregressive (VAR) approach to construct the innovations in state variables. Formally, we assume that:

$$z_t = \sum_{l=1}^{L} A_l z_{t-l} + \eta_t \tag{6}$$

[1] Many papers show that bank credit policy is not determined by business cycle fluctuations, but is driven endogenously by the strategic interaction between banks (Asea and Blomberg, 1998; Lown et al., 2000; Lown and Morgan, 2001; Dell'Ariccia and Marquez, 2006).

[2] The rationale for using the *PDI* is that large differences between bank performances prompt bankers to engage in higher quality loans, which results in more costly information and a smaller amount of loans. The fact that banks tend to raise and drop credit standards simultaneously leads to bank credit cycles.

[3] Gorton and He (2008) define bank credit cycles as "swings between high and low credit allocations". Bank credit growth increases in periods of high credit allocation and decreases in periods of credit crunches. Therefore, it is a direct measure of bank credit cycles.