J. Int. Financ. Markets Inst. Money xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of International Financial Markets, Institutions & Money

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

Predicting risk premium under changes in the conditional distribution of stock returns ☆

João Sousa [a,*], Ricardo M. Sousa [b,c]

[a] European Central Bank, Sonnemannstrasse 22, 60314 Frankfurt am Main, Germany
[b] University of Minho, Department of Economics and Economic Policies Research Unit (NIPE), Campus of Gualtar, 4710-057 Braga, Portugal
[c] London School of Economics and Political Science, LSE Alumni Association, Houghton Street, London WC2 2AE, United Kingdom

ARTICLE INFO

Article history:
Received 1 July 2016
Accepted 12 September 2017
Available online xxxx

JEL classification:
E21
G11
E44

Keywords:
Stock returns
Conditional distribution
Quantile regression

ABSTRACT

The goal of this paper is to assess time-variation in asset returns while considering the whole conditional distribution. We use a quantile regression framework and quarterly data for the U.S., and show that the probabilistic distribution of expectations about future stock returns changes in response to variation in commonly used explanatory variables. Moreover, our results support the idea that lower quantiles are less stable than upper quantiles, thus, suggesting that asset pricing models are particularly accurate in capturing the expectations that less risk-averse agents have about future returns.

1. Introduction

Fluctuations in risk are important to explain consumption and investment behaviour and, therefore, business cycle patterns. Similarly, periods of booms and busts in asset prices are generally associated with variation in expectations that agents have about future risk premium. By analyzing these movements, it may be possible to detect earlier manifestations of asset misalignments and take corrective measures. Therefore, understanding the determinants of risk, elusive a goal as it may be, is crucial for policies aiming at macro-financial stability.

While the empirical finance literature has shown that expected excess returns on assets tend to be counter-cyclical[1] and numerous economically motivated variables capture time-variation in risk premium,[2] another line of investigation has considered that the mean and variance are not necessarily sufficient for risk averse investors to base their portfolio decisions on. Other characteristics of the distribution of returns such as skewness (Kraus and Litzenberger, 1976; Harvey and Siddique, 2000) or even kurtosis or higher moments (Scott and Horvath, 1980) of stock returns should also matter.

☆ Sousa acknowledges that this work was carried out within the funding with COMPETE reference nº POCI-01-0145-FEDER-006683, with the FCT/MEC's (Fundação para a Ciência e Tecnologia, I.P.) financial support through national funding and by the European Regional Development Fund (ERDF) through the Operational Programme on "Competitiveness and Internationalization - COMPETE 2020" under the PT2020 Partnership Agreement.

* Corresponding author.
E-mail addresses: joao.sousa@ecb.int (J. Sousa), rjsousa@eeg.uminho.pt, rjsousa@alumni.lse.ac.uk (R.M. Sousa).

[1] See Fama (1970, 1991, 1998), Fama and French (1996), Campbell and Cochrane (1999) and Duffee (2005).

[2] See, for instance, Lettau and Ludvigson (2001), Lustig and Van Nieuwerburgh (2005), Parker and Julliard (2005), Yogo (2006), Piazzesi et al. (2007), Campbell and Diebold (2009) and Sousa (2010, 2015a).

https://doi.org/10.1016/j.intfin.2017.09.002
1042-4431/

In this paper, we look at the evolution of the distribution of risk premium over time and, as a by-product, at the issue of deviations of an asset from its "fundamental value", i.e. the one provided by a specific asset pricing model. These deviations can be indicative of under or over valuation of the asset and can signal important mispricing in the market. However, a major difficulty arises when determining what a "large" deviation from fundamentals is due to the lack of a clear criterion.

In this context, our paper retakes a technique that has been widely used in economics and empirical finance.[3] More specifically, we use quantile regressions to estimate the probability distribution of asset returns and to investigate the extent to which changes in expectations about risk premium help detecting periods of "abnormal" returns. The main advantage of this econometric framework is that it allows us to condition the whole distribution of asset returns on a set of explanatory variables, that is, we can estimate not only the median but also any quantile of the distribution of asset returns. In addition, extreme events characterizing the tails of the distribution of asset returns and situations of large outliers can be identified and predicted without resorting on "ad hoc" definitions (Koenker and Hallock, 2001). Thus, quantile regressions, as ways of characterizing and predicting the distribution of returns, can be valuable for asset pricing and a benchmark for detecting asset price misalignments, providing an analysis that is more robust than the ordinary least squares (OLS) regression that focuses only on the mean.

We start with an agnostic approach, trying to link asset returns with a series of explanatory variables in a way that is not fully grounded on equilibrium models derived from theory. In a second stage, we analyze the results of a large set of asset pricing models.

Using data for the US, we show that the probabilistic distribution of stock returns is time-varying. Moreover, we find that several macroeconomic and financial variables help explaining such variation. The results of the forecasting regressions are consistent with theoretical predictions and so monitoring these factors can help assessing attitudes towards risk. In particular, we find evidence that credit growth and long-term consumption growth predict a fall in future stock returns, which suggests more appetite for risk-taking.

With regard to the results based on asset pricing models, we conclude that there are various models that are useful in explaining time-variation in the probability distribution of returns. We show that lower quantiles tend to be less stable than upper quantiles. If the lower quantiles can be attributed to agents that are more prone towards risk while the upper quantiles depend on those that are more averse to risk, our findings highlight that asset pricing models are particularly accurate in capturing the expectations that less risk-averse agents have about future returns.

By linking the conditional return distribution to different pricing factors, our methodology suggests that some predictors are better at picking up episodes of extremely high (low) stock returns and not just mean returns. Thus, it can help policymakers in designing macroprudential policies based on a battery of early warning indicators. It can also enhance our understanding of the drivers of the tails of the distribution of risk premium.

The research presented in this paper is indebted to the works that have focused on forecasting either the mean or the volatility of stock returns and, more specifically, to those that have either provided novel frameworks (Diebold and Yilmaz, 2009; Rua and Nunes, 2009) or highlighted the potential mis-specification associated with standard approaches (Baillie and DeGennaro, 1990; González-Rivera, 1998; González-Rivera, 2013; Almeida and Garcia, 2012, 2013; González-Rivera and Jiménez-Martín, 2012). It is also built on the literature that showed that accounting for the nonlinearity of the behaviour of stock markets, the uncertainty about the model governing asset prices or the distribution characterizing stock returns can help improving predictability (Baillie, 1993; Jawadi, 2009; Jawadi et al., 2009; Almeida et al., 2013; Sousa and Sousa, 2017). In particular, we rely on several asset pricing models as starting frameworks to address this specific issue. Then, we use quantile regressions to investigate whether these models are able to forecast time-variation in the distribution of asset returns.

The rest of the paper is organized as follows. Section 2 introduces the econometric framework and presents the data. Section 3 discusses the empirical results. Section 4 concludes with the main findings and policy implications.

2. Econometric framework and data

2.1. Conditional distribution of asset returns and quantile regressions

The distribution of the returns can be characterized by its different quantiles. In Machado and Sousa (2006), this technique was first applied to the level of stock prices with the aim of assessing misalignments. Moreover, while the more usual approach of the empirical finance literature uses the standard ordinary least squares (OLS) estimation and looks at stock returns rather than the level of stock prices, in this paper, we consider quantile regressions. A main advantage of this technique is that it allows relating the quantiles that summarize the distribution of asset returns with explanatory variables that convey information about risk premium. In fact, quantile regressions make it possible to construct probability intervals and

[3] For example, Taylor (1999) considers quantile regressions in the context of value at risk. Leon Li and Miu (2010) provide a bankruptcy prediction model with dynamic accounting-ratio-based and market-based information. Conley and Galenson (1998) explore wealth accumulation in several U.S. cities. Gosling et al. (2000) study the income and wealth distribution in the UK, while Bassett and Chen (2001) characterize mutual fund investment styles. Machado and Sousa (2005) assess the impact of macroeconomic fundamentals on the distribution of asset prices. Leon Li and Yen (2011) analyse the dynamic covariance risk in global stock markets, Lee and Leon Li (2012) assess the linkages between diversification and risk-adjusted performance and Leon Li and Wu (2014) evaluate the relationship among analysts' forecast dispersion and stock returns.

Please cite this article in press as: Sousa, J., Sousa, R.M. Predicting risk premium under changes in the conditional distribution of stock returns. J. Int. Financ. Markets Inst. Money (2017), https://doi.org/10.1016/j.intfin.2017.09.002