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Portfolio management using realized covariances: Evidence from Brazil

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Abstract

It is often argued that intraday returns can be used to construct covariance estimates that are more accurate than those based on daily returns. However, it is still unclear whether high frequency data provide more precise covariance estimates in markets more contaminated from microstructure noise such as higher bid-ask spreads and lower liquidity. We address this question by investigating the benefits of using high frequency data in the Brazilian equities market to construct optimal minimum variance portfolios. We implement alternative realized covariance estimators based on intraday returns sampled at alternative frequencies and obtain their dynamic versions using a multivariate GARCH framework. Our evidence based on a high-dimensional data set suggests that realized covariance estimators performed significantly better from an economic point of view in comparison to standard estimators based on low-frequency (close-to-close) data as they delivered less risky portfolios.

JEL classification: C58; G11

Keywords: BEKK specification; Bootstrap test; Liquidity; Tick by tick data; Turnover

Resumo

Argumenta-se frequentemente que retornos intradiários podem ser usados para construir estimativas de covariâncias mais precisas em relação àquelas obtidas com retornos diários. No entanto, ainda não está claro se os dados de alta freqüência fornecem estimativas de covariância mais precisas em mercados mais contaminados pelo ruído da microestrutura, como maiores spreads entre ofertas de compra e venda e baixa liquidez. Abordamos essa questão investigando os benefícios do uso de dados de alta freqüência no mercado de ações brasileiro através da construção de portfólios ótimos de variância mínima. Implementamos diversos estimadores de covariâncias realizadas com base em retornos intradiários amostrados em diferentes frequências e obtemos suas versões dinâmicas usando uma estrutura GARCH multivariada. Nossa evidência baseada em um conjunto de dados de alta dimensão sugere que os estimadores de covariâncias realizadas obtiveram um desempenho significativamente melhor do ponto de vista econômico em

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comparação com os estimadores baseados em dados de baixa freqüência (baseados em dados de fechamento) uma vez que geraram portfólios menos arriscados.

Palavras-chave: Especificação BEKK; Bootstrap; Liquidez; Dados negócio a negócio; Turnover

1. Introduction

Modeling the covariation among financial time series is a fundamental task to numerous applications including derivative pricing, risk management and portfolio allocation. In this context, the search for a framework that allows a more precise estimate of the covariance matrix of financial assets returns has led to the analysis of high-frequency intraday data. The so-called realized covariance estimation initially proposed by Andersen et al. (2003) and Barndorff-Nielsen and Shephard (2004) has emerged as a viable candidate for more accurate covariance estimation. The use of intraday observations should improve estimation accuracy, however, data sampled at higher frequencies are affected by microstructure noise, which could cast doubts on the usefulness of high frequency data.

A large body of literature aims at investigating the advantages, from an economic standpoint, of using realized covariance estimators as opposed to traditional estimators based on low-frequency data. For instance, Bollerslev and Zhang (2003) demonstrate how high-frequency data may be more effectively measuring and modeling the systematic risks in factor pricing models. Fleming et al. (2003), Bandi et al. (2008), de Pooter et al. (2008), Bannouh et al. (2009), Liu (2009), Chiriac and Voev (2011), Hautsch et al. (2013), and Jin and Maheu (2013) employ alternative realized covariance estimators and conclude that the use of high-frequency data can improve the performance of mean-variance portfolios. Altogether, the empirical evidence suggests that realized covariance estimators improve volatility timing. This results in a better performance of optimal portfolios in terms of risk and/or portfolio turnover.

Even though the literature on realized volatility measures has been rapidly increasing, the empirical evidence available so far is mainly focused on developed markets (specially US), with limited attention to the applicability and potential gains from using these estimators in emerging markets. An obvious reason for this gap in the literature is the unavailability of high frequency data for these markets. This situation, however, has been changing as researchers now have more access to data from emerging markets and started addressing the benefits of using intraday information in volatility modeling. This raises the question of whether or not high frequency data also leads to more accurate estimates of the (co)variation among asset returns in less developed markets. One can argue that the increased microstructure noise coming from higher bid-ask spreads and lower liquidity in these markets might neutralize part of the gains from using high frequency data. The limited empirical evidence suggest that the use of intraday data is also beneficial in emerging markets. For instance, Bildik (2001) studies the intraday patterns of the volatility in the Istanbul stock exchange, while Kayahan et al. (2002) find that realized volatility outperforms a GARCH model in modeling the volatility of that market. Carvalho et al. (2006) and Wink Junior and Pereira (2011) construct realized volatility measures for the Brazilian equities market. The authors corroborate the evidence that realized measures provide better fit for the volatility dynamics.

One common point in the existing empirical evidence on the use of high-frequency data in emerging markets is that the authors consider only univariate realized measures, with no account on the study of multivariate realized estimators. This seems to be gap in the literature since many practical problems such as portfolio selection depends intrinsically on measuring the covariation among many assets. We fill this gap by implementing alternative realized covariance estimators in the Brazilian equities market, and check its usefulness in building optimal minimum variance portfolios. Our empirical strategy proceeds as follows. First, we use tick data of the 30 mostly traded stocks in the São Paulo stock exchange (BM&FBovespa) to build five alternative realized covariance estimators similar to those considered in de Pooter et al. (2008) and Liu (2009) and based on aggregating 5-min, 15-min, 30-min, 60-min, 90-min, and 120-min intraday returns. These estimators include not only intraday data but also the overnight volatility (Martens, 2002; Hansen and Lunde, 2005). Additionally, we also implement the realized covariance estimator proposed in Barndorff-Nielsen et al. (2011), which is the first to simultaneously address market microstructure effects and asynchronous price observations. Second, we consider a parsimonious multivariate GARCH specification to obtain a conditional dynamic version of each of the realized covariance estimators. Third, we use both unconditional and conditional