Asset pricing with conditional illiquidity*

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Abstract

The paper proposes a dynamic model of asset pricing with conditional illiquidity. The empirical analysis is developed for the 10 Fama-French industry portfolios and proposes several findings: (i) the Fama-French five factors model with the conditional illiquidity of the market is tested; (ii) the estimation of the conditional parameters for each industry portfolio; (iii) the conditional level of illiquidity for each industry portfolio and for the market portfolio; (iv) the spillover effects among the conditional illiquidity of each industry portfolio and the market portfolio; (v) the forecasts during some periods of crisis.

JEL Classification: G0,G1,G12

Keywords: asset pricing, illiquidity, robust regressions, Bayesian vector autoregressive.

*The author would like to thank Rong Chen, Richard Roll as well as several participants of the conferences and seminars organized by the GARP New York and Chicago Chapters, the University of Alberta, the Luxembourg School of Finance, The Wharton School at the University of Pennsylvania, the Allied Social Science Association, the Chicago Board Options Exchange, The Paris EUROPLACE International Financial Forum, The U.S. Department of the Treasury, the Office of Financial Stability (OFS), the Office of Financial Research (OFR), the International Organization of Securities Commissions (OICV-IOSCO), the Center for Financial Statistics and Risk Management at Rutgers University, its advisors and the staff members. The author also acknowledges several consultants, advisers, hedge/private equity and family funds as well as banks located in Chicago, New York, Washington, Philadelphia, London, Hong Kong and Switzerland for comments received.

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1. Introduction

The recent market events such as The Coronavirus crash and the liquidity crunch of 2007-2008 (Brunnermeier 2009), highlight the need to measure and model liquidity risk that arises from the simultaneous drying up of liquidity across assets and can lead to the freezing up of the markets. In the case of liquidity crises, liquidity risk becomes a concern and the pricing of assets is particularly questioned. After a certain threshold, the dry up of liquidity causes more severe market declines than would occur in normal circumstances (Brunnermeier and Pedersen, 2009), jeopardizing the markets stability.

The question whether liquidity affect stock returns is a central topic in the finance literature. Liquidity is considered as a major determinant of stock returns and many authors argue that liquidity has first order implications on stock returns. Amihud and Mendelson (1986) were the first to examine the relationship between liquidity and asset prices, and how this is interlinked with investors holding period and found that market-observed expected return is an increasing and concave function of the spread and investors trading more often would prefer to hold assets with lower transaction costs.

This paper proposes a dynamic model of asset pricing able to compensate a premium for a security when the market return is low or better for a security that has a high return when the market is conditionally illiquid (Acharya and Pedersen 2005). The empirical analysis is developed for the 10 Fama-French industry portfolios and proposes a dynamic framework of the Fama-French five factors model augmented with a factor able to depict the conditional illiquidity of the market. The estimation results rely on the Diagonal BEKK(1,1) specification (Baba et al. 1985), with a multivariate *t-student* distribution and an unknown parameter, for quantifying the degrees of freedom.

A large amount of papers focuses on investigating the factors that affect stock returns. Brennan et al. (1998) study the relationship between the illiquidity premium and returns while measuring the alternative liquidity proxy that measures price impact and market depth. Amihud (2000) and Jones (2000) document the presence of a time-series relation between their measures of market liquidity and expected market returns. Jones (2001) finds evidence that the expected returns are the same when the spread is large. Chordia et al. (2000) find a significant cross-sectional relation between stock returns and the variability of liquidity, where liquidity is proxied by measures of trading activity such as volume and turnover. The authors report an unexpected result that stocks with more volatile liquidity have lower expected returns. Kumar and Misra (2019) suggest that liquidity forms part of the systematic and idiosyncratic risk.

The remainder of the paper is organized as follows: Section 2 elaborates the dynamic model of asset pricing with conditional illiquidity. The section 3 presents the data and summary statistics. Section 4 examines the econometric methodology for estimating the asset pricing model. Section 5 is devoted to the discussion of the empirical results. Section 6 concludes.

2. The Model

The Fama French (FF 2015) five factors model is designed to capture several implications of the return on security or portfolio i and the benchmark interest rate $(R_{F,t})$. Therefore, the Fama-French five factors model can be written as a function of the excess return on the value weighted market portfolio $(R_{M,t})$; the return on a diversified portfolio of small stocks minus the return on a diversified portfolio of big stocks (SMB); the difference between the returns on diversified portfolios of high and low B/M stocks (HML); the difference between the returns on diversified portfolios of stocks with robust and weak profitability (RMW); the returns on diversified portfolios of the stocks of low and high investment firms, which we call conservative and aggressive (CMA).

As such,

$$R_{i,t} - R_{F,t} = a_i + b_i \cdot (R_{M,t} - R_{F,t}) + s_i \cdot SMB_t + h_i \cdot HML_t + r_i \cdot RMW_t + c_i \cdot CMA_t + e_{i,t} \quad (1)$$

where, $e_{i,t}$ is a zero-mean residual component. Treating the parameters b_i, s_i, h_i, r_i, c_i as true values rather than estimates, able to depict all variation in expected returns, the model implies that the quantity a_i is zero for all securities and portfolios i.

The proposed framework augments the Fama-French five factors model with a term able to compensate a premium for a security when the market return is low or better for a security that has a high return when the market is conditionally illiquid (Acharya and Pedersen 2005) and further it is dynamic. Therefore, the model can be written in the following way:

$$R_{i,t} - R_{F,t} = a_{i,t} + b_{i,t} \cdot (R_{M,t} - R_{F,t}) + s_{i,t} \cdot SMB_t + h_{i,t} \cdot HML_t + \quad (2)$$

$$+ r_{i,t} \cdot RMW_t + c_{i,t} \cdot CMA_t + \delta_{i,t} \cdot ILL\_MKT_t + e_{i,t}$$

where, the quantity ILL_MKT depicts the conditional level of illiquidity for the market portfolio and $\delta_{i,t}$ represents the dynamic sensitivity of the excess security or portfolio i return with respect to the conditional level of illiquidity for the market portfolio and the quantity ILL_MKT is computed as a function of the first order serial conditional covariance of the observed market returns and it is based on the information set at time $t-2$. As such,

$$ILL\_MKT_t = -Cov\left(R_{M,t}\,,\, R_{M,t-1} \,|\, F_{t-2}\right). \quad (3)$$

The quantities $a_{i,t}$, $b_{i,t}$, $s_{i,t}$, $h_{i,t}$, $r_{i,t}$, $c_{i,t}$ are respectively the *time-varying* sensitivities of the excess security or portfolio i return with respect to the excess market portfolio, the SMB, the HML, the RMW and the CMA portfolios.

3. Data and descriptive statistics

The empirical analysis considers the U.S. data downloaded from Kenneth French's website, based on daily returns for the 10 Fama-French value weighted U.S. industry portfolios, with the aim to study the relationship between each industry portfolio and the market portfolio, that is the value weighted return for all CRSP firms incorporated in the U.S. and listed on the NYSE, AMEX and NASDAQ stock exchanges. Table 1 reports the descriptive statistics for the 10 Fama-French industry portfolios and the 5 Fama-French factors, considering the period from July 1st, 1963 to November 30th, 2020.

[Please insert Table 1 around here]

The average return across industry portfolios is above 0.39, with the business equipment industry (HITEC) reaching a level of 0.52 and healthcare, medical equipment and drugs industry (HLTH) providing an average of 0.51. The median return across industry portfolios is above 0.030, with the industry portfolio called OTHER reaching a level of 0.080. The standard deviation is equal to 1.425 for HITEC industry portfolio and declines to 0.884 for the portfolio UTILS. The level of the kurtosis increases from 12.357 for HITEC industry portfolio, reaching a level of 21.043 for the manufacturing industry (MANUF), to 29.657 for the portfolio UTILS.

The average return of the market portfolio adjusted for the benchmark interest rate is equal to 0.027; whereas, the average return increases to 0.013 for the HML portfolio. The standard deviation decreases from 1.015 for the market portfolio to 0.366 for CMA portfolio. The kurtosis increases from 13.111 for RMW portfolio to 23 for SMB portfolio. The Jarque-Bera tests show how the factors MKR_RF, SMB, HML, CMA, RMW are not normally distributed.

4. The Econometric methodology

This section proposes the econometric methodology that describes the dynamic model of asset pricing with conditional illiquidity. The framework is applied to the 10 Fama-French industry portfolios and consider the estimation of the conditional illiquidity for the market portfolio in the following way:

$$R_{M,t} = \mu_0 + \xi_{1,t} \tag{4}$$

$$R_{M,t-1} = \mu_1 + \xi_{2,t-1} \tag{5}$$

where, μ_0 and $\mu_1$are the constants of the mean equations related to the market return at time t and $t-1$; whereas, the conditional variances and the first order serial conditional covariance for the observed variations of the market returns, provided the information set F at time $t-1$ and $t-2$, are based on a Diagonal BEKK(1,1) specification (Baba et al. 1985) with a multivariate *t-student* distribution and an unknown parameter, for quantifying the degrees of freedom. As such,

$$E\left[\xi_{1,t}^2 \,|\, F_{t-1}\right] = N(1,1) + C(1,1)^2 \cdot \xi_{1,t-1}^2 + D(1,1)^2 \cdot \sigma_{1,t-1}^2 \tag{6}$$

$$E\left[\xi_{2,t-1}^2 \,|\, F_{t-2}\right] = N(2,2) + C(2,2)^2 \cdot \xi_{2,t-2}^2 + D(2,2)^2 \cdot \sigma_{2,t-2}^2 \tag{7}$$

$$E\left[\xi_{1,t} \cdot \xi_{2,t-1} \,|\, F_{t-2}\right] = C(1,1) \cdot C(2,2) \cdot \xi_{1,t-1} \cdot \xi_{2,t-2} + D(1,1) \cdot D(2,2) \cdot cov_{12,t-2} \tag{8}$$

The quantities $N(1,1)$ and $N(2,2)$ are the diagonal coefficients that depict the long term components of the conditional variances; $C(1,1)$ and $C(2,2)$ are the diagonal coefficients that depict the influence of the squared residuals at time $t-1$ and $t-2$; whereas, $D(1,1)$ and $D(2,2)$ are the diagonal coefficients that depict the persistence of the conditional variances at time $t-1$ and $t-2$.

Therefore, the conditional illiquidity of the market portfolio can be computed in the following way:

$$ILL\_MKT_t = -E\left[\xi_{1,t} \cdot \xi_{2,t-1} \,|\, F_{t-2}\right]. \tag{9}$$

The dynamic framework of asset pricing includes the conditional illiquidity of the market portfolio and for each industry portfolio the following quantities can be evaluated:

$$R_{i,t} - R_{F,t} = \alpha_0 + \varepsilon_{0,t} \tag{10}$$

$$CMA_t = \alpha_1 + \varepsilon_{1,t} \tag{11}$$

$$HML_t = \alpha_2 + \varepsilon_{2,t} \tag{12}$$

$$R_{M,t} - R_{F,t} = \alpha_3 + \varepsilon_{3,t} \tag{13}$$

$$RMW_t = \alpha_4 + \varepsilon_{4,t} \tag{14}$$

$$SMB_t = \alpha_5 + \varepsilon_{5,t} \tag{15}$$

$$ILL\_MKT_t = \alpha_6 + \varepsilon_{6,t} \tag{16}$$

where, $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$and α_6 are respectively the constants of the mean equations related to the excess portfolio return, to the conservative minus aggressive portfolio, to the diversified portfolios of high and low B/M stocks (HML),to the excess market return, to the diversified portfolios of stocks with robust and weak profitability (RMW), to small stocks minus the diversified portfolio of big stocks (SMB), to the conditional illiquidity of the market portfolio. The conditional variances and covariances are estimated using a Diagonal BEKK(1,1) specification, with a multivariate *t-student* distribution and an unknown parameter, for quantifying the degrees of freedom. As such,

$$\sigma_{1,t}^2 = M\left(1,1\right) + A\left(1,1\right)^2 \cdot \varepsilon_{1,t-1}^2 + B\left(1,1\right)^2 .\sigma_{1,t-1}^2 \tag{17}$$

$$\sigma_{2,t}^2 = M\left(2,2\right) + A\left(2,2\right)^2 \cdot \varepsilon_{2,t-1}^2 + B\left(2,2\right)^2 .\sigma_{2,t-1}^2 \tag{18}$$

$$\sigma_{3,t}^2 = M\left(3,3\right) + A\left(3,3\right)^2 \cdot \varepsilon_{3,t-1}^2 + B\left(3,3\right)^2 .\sigma_{3,t-1}^2 \tag{19}$$

$$\sigma_{4,t}^2 = M\left(4,4\right) + A\left(4,4\right)^2 \cdot \varepsilon_{4,t-1}^2 + B\left(4,4\right)^2 .\sigma_{4,t-1}^2 \tag{20}$$

$$\sigma_{5,t}^2 = M\left(5,5\right) + A\left(5,5\right)^2 \cdot \varepsilon_{5,t-1}^2 + B\left(5,5\right)^2 .\sigma_{5,t-1}^2 \tag{21}$$

$$\sigma_{6,t}^2 = M\left(6,6\right) + A\left(6,6\right)^2 \cdot \varepsilon_{6,t-1}^2 + B\left(6,6\right)^2 .\sigma_{6,t-1}^2 \tag{22}$$

$$\sigma_{7,t}^2 = M\left(7,7\right) + A\left(7,7\right)^2 \cdot \varepsilon_{7,t-1}^2 + B\left(7,7\right)^2 .\sigma_{7,t-1}^2. \tag{23}$$

The quantities $M\left(1,1\right)$,$M\left(2,2\right)$, $M\left(3,3\right)$, $M\left(4,4\right)$, $M\left(5,5\right)$, $M\left(6,6\right)$ and $M\left(7,7\right)$ are the diagonal coefficients that depict the long term components of the conditional variances; $A\left(1,1\right)$, $A\left(2,2\right)$, $A\left(3,3\right)$, $A\left(4,4\right)$, $A\left(5,5\right)$, $A\left(6,6\right)$ and $A\left(7,7\right)$are the diagonal coefficients that depict the influence of the squared residuals at time $t-1$; whereas, $B\left(1,1\right)$, $B\left(2,2\right)$, $B\left(3,3\right)$, $B\left(4,4\right)$, $B\left(5,5\right)$, $B\left(6,6\right)$ and $B\left(7,7\right)$ are the diagonal coefficients that depict the persistence of the conditional variances at time $t-1$. Accordingly, the conditional covariances that allow to determine the time-varying coefficients can be computed in the following way:

$$cov_{12,t} = M(1,2) + A(1,1) \cdot A(2,2) \cdot \varepsilon_{1,t-1} \cdot \varepsilon_{2,t-1} + B(1,1) \cdot B(2,2) \cdot cov_{12,t-1} \tag{24}$$

$$cov_{13,t} = M(1,3) + A(1,1) \cdot A(3,3) \cdot \varepsilon_{1,t-1} \cdot \varepsilon_{3,t-1} + B(1,1) \cdot B(3,3) \cdot cov_{13,t-1} \tag{25}$$

$$cov_{14,t} = M(1,4) + A(1,1) \cdot A(4,4) \cdot \varepsilon_{1,t-1} \cdot \varepsilon_{4,t-1} + B(1,1) \cdot B(4,4) \cdot cov_{14,t-1} \tag{26}$$

$$cov_{15,t} = M(1,5) + A(1,1) \cdot A(5,5) \cdot \varepsilon_{1,t-1} \cdot \varepsilon_{5,t-1} + B(1,1) \cdot B(5,5) \cdot cov_{15,t-1} \tag{27}$$

$$cov_{16,t} = M(1,6) + A(1,1) \cdot A(6,6) \cdot \varepsilon_{1,t-1} \cdot \varepsilon_{6,t-1} + B(1,1) \cdot B(6,6) \cdot cov_{16,t-1} \tag{28}$$

$$cov_{17,t} = M(1,7) + A(1,1) \cdot A(7,7) \cdot \varepsilon_{1,t-1} \cdot \varepsilon_{7,t-1} + B(1,1) \cdot B(7,7) \cdot cov_{17,t-1}. \tag{29}$$

Therefore, the time varying coefficients $b_{i,t}$, $s_{i,t}$, $h_{i,t}$, $r_{i,t}$, $c_{i,t}$ and $\delta_{i,t}$ can be computed in the following way:

$$c_{i,t} = \frac{cov_{12,t}}{\sigma^2_{2,t}} \tag{30}$$

$$h_{i,t} = \frac{cov_{13,t}}{\sigma^2_{3,t}} \tag{31}$$

$$b_{i,t} = \frac{cov_{14,t}}{\sigma^2_{4,t}} \tag{32}$$

$$r_{i,t} = \frac{cov_{15,t}}{\sigma^2_{5,t}} \tag{33}$$

$$s_{i,t} = \frac{cov_{16,t}}{\sigma^2_{6,t}} \tag{34}$$

$$\delta_{i,t} = \frac{cov_{17,t}}{\sigma^2_{7,t}}. \tag{35}$$

5. Empirical Results

This section discusses the estimates and the empirical results of the econometric methodology proposed in Section 4 for computing the time-varying coefficients of the proposed asset pricing model. Table 2 reports the estimates of the coefficients that determine the conditional illiquidity for the 10 Fama-French Industry portfolios and for the market portfolio, computed as the value-weight return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ.

[Please Insert Table 2 around here]

The quantities $C(1,1)$ and $C(2,2)$ that depict the influence of the squared residuals are at least equal to 0.181 for the industry portfolios, whereas they are equal to 0.217 and 0.254 for the market portfolio. $D(1,1)$ and $D(2,2)$ that depict the persistence of the conditional variances are at least equal to 0.963 for the industry portfolios and are equal to 0.975 and 0.966 for the market portfolio.

The recent financial crisis shows several spikes of the conditional illiquidity across industry portfolios, reacting in response to unexpected market and world events. The conditional illiquidity for the market portfolio reaches a level of 0.559; whereas for the energy industry reaches a level of 1.626.

[Please Insert Figure 1 around here]

Figure 1 shows how the bursting of the United States housing bubble, culminating with the bankruptcy of Lehman Brothers on September 15, 2008, as well as the lack of investor confidence in bank solvency and declines in credit availability rapidly spread into a global economic shock, reporting several bank and business failures, reflecting these conditions with the spikes of the indicators of conditional illiquidìty across industry portfolios. The household wealth felt around $ 14 trillion USD, resulting in a decline of the consumption and a decline of the business investment. In the fourth quarter of 2008, the quarter-over-quarter decline in real GDP in the U.S. was 8.4%, with a progressive level of unemployment increasing along the time and a decrease of the average number of hours per work week. In the aftermath of each spike the conditional illiquidity returns to more normal levels, fluctuating around the value of zero.

Another example of spikes of the conditional illiquidity, although less severe, is followed by the European sovereign debt crisis, which began with a deficit of the Greek economy in late 2009, and the 2008–2011 Icelandic financial crisis, which involved the bank failure of the major banks in Iceland. During this period, the financial assistance of the European Central Bank (ECB) or the International Monetary Fund (IMF) were extremely important for several eurozone member states. The conditional illiquidity for the market portfolio is equal to 0.070, whereas for OTHER industry reaches a level of 0.198.

The circumstances that determine the spikes of the conditional illiquidity are also relevant during the period referred to as The Coronavirus crash, that began on February 20th, 2020 and ended on April 7th, 2020. Panel 2.2 reports a level of conditional illiquidity for the market portfolio that is equal to 5.646 with the conditional illiquidity of HITEC industry that is equal to 6.162 and for OTHER industry equals to 6.868.

5.1 The Fama-French five factors model adjusted for the conditional illiquidity

This subsection discusses the results of the robust and quantile regressions that relate the excess portfolio i return with the Fama-French five factors and the conditional illiquidity that is statistically significant across almost all industry portfolios. For eight out of ten industry portfolios, the coefficient related to the conditional illiquidity is negative and statistically significant. Therefore, a higher level of the conditional illiquidity is related to a lower level of the excess portfolio i return. Basically, the framework compensates with a premium the investors that allocate sources on certain industry portfolios characterized by conditional illiquidity, decreasing the excess portfolio i return. The quantity conditional illiquidity is also statistically significant if augmented to the 3 Fama-French factors model. For six out of ten industry portfolios, the coefficient that depict the influence of the conditional illiquidity is negative and statistically significant. The same results are also evident if the estimation only considers the augmented Capital Asset Pricing Model (CAPM), with the conditional illiquidity of the market portfolio.

The quantile regressions corroborate the findings, with the coefficient that depict the conditional illiquidity negative and statistically significant. The quantile regressions are computed at the 1st percentile and rely on the Markov Chain Marginal Bootstrap (MCMB) method developed by Kocherginsky et al. (2005). The MCMB-A method distinguishes itself from the usual bootstrap since it involves solving only one-dimensional equations for parameters of any dimension and produces a Markov chain rather than a (conditionally) independent sequence.

Therefore, the method alleviates computational burdens often associated with bootstrap in high-dimensional problems and can be applied for solving the quantile regressions. The sparsity estimation rely on the Chamberlain bandwidth and the number of bootstrap replications is equal to 10,000.

5.2 The dynamic conditional coefficients and the spillover effect

The estimation results for the dynamic augmented Fama-French five factors model are reported in Table 5. Across industry portfolios, the coefficients that depict the persistence of the variance components are statistically significant and above the level of 0.986; whereas, the coefficient that depict the persistence of the variance and related to the conditional illiquidity increases from 0.519 for OTHER industry portfolio to 0.541 for UTILS industry portfolio. The values that depict the degrees of freedom for the multivariate *t-statistic* are statistically significant and increase from 8.840 for ENRGY industry portfolio to 9.192 for MANUF industry portfolio.

[Please Insert Table 5 around here]

The estimation results lead to the determination of the dynamic coefficient for the illiquidity measure that is persistent along the time. The average value of the coefficient is equal to -0.038 with a standard deviation equals to 1.792 and a level of skewness equals to -0.213. Figure 2 also shows the dynamic medians across industry portfolios for the five Fama-French factors. The average value for the coefficient related to the factor RMW is equal to 0.033 with a standard deviation equals to 0.916; whereas for the factor CMA, the average value is equal to -0.573 and the standard deviation equals to 0.844.

[Please Insert Figure 2 around here]

The conditional levels of illiquidity for the industry portfolios and for the market portfolio allow to determine the spillover effects among industries, relying on a Bayesian vector autoregressive with 2 lags and Normal-Wishart priors. The estimation results of the methodology show how the conditional illiquidity of the industries is influenced by the lags of the conditional illiquidity.

[Please Insert Table 6 around here]

For example, in Table 6 the lags of conditional illiquidity for HITEC industry, HLTH industry, MANUF industry, OTHER industry, SHOPS industry are statistically significant for explaining the conditional illiquidity of DURBL industry. Further, the conditional illiquidity for the market portfolio is positive and statistically significant at the first lag and negative as well as statistically significant at the second lag for explaning the conditional illiquidity of the industry portfolios. Therefore, an increase of the first lag of the conditional illiquidity for the market portfolio increases the conditional illiquidity of all industry portfolios; whereas, an increase of the second lag of conditional illiquidity for the market portfolio decreases the conditional illiquidity of all industry portfolios.

The conditional level of illiquidity for DURBL industry portfolio, for ENRGY portfolio, for MANUF portfolio, for NODUR portfolio, for OTHER industry portfolio and for SHOPS industry portfolio is statistically significant for explaining the conditional illiquidity of the market portfolio.

[Please Insert Figure 3 around here]

Figure 3 reports the generalized impulse response functions able to depict the responses of the conditional illiquidity for the market portfolio to shocks of the conditional illiquidity for the industry portfolios, considering n. 10 periods. The graphs show a monotonic decrease of the responses particularly related to shocks of conditional illiquidity for DURBL and ENRGY industry portfolios, declining to around zero within n. 10 periods; whereas the response of the conditional illiquidity for the market portfolio to shocks of the conditional illiquidity for others industry portfolios needs more periods of time for reaching the level of zero.

[Please insert Table 7 around here]

The one step ahead forecasts of the Baysian vector autoregressive are computed on three different sub-periods: the financial crisis, the European sovereign debt crisis, the Coronavirus crash (Table 7). The number of observations included for the forecasts related to the financial crisis period are equal to 429. The root mean square error ranges from 0.173, for the conditional illiquidity related to the industry NODUR, to 0.686 for the conditional illiquidity related to OTHER industry portfolio. Instead, the level of the mean absolute error ranges from 0.097, for the conditional illiquidity related to the industry NODUR, to 0.348 for the conditional illiquidity related to OTHER industry portfolio.

The number of observations for the one step ahead forecast related to the European sovereign debt crisis increases to 1070. The root mean square error ranges from 0.083, for the conditional illiquidity related to the industry HLTH, to 0.194 for the conditional illiquidity related to OTHER industry portfolio. Instead, the level of the mean absolute error ranges from 0.050, for the conditional illiquidity related to the industry HLTH, to 0.135 for the conditional illiquidity related to ENRGY industry portfolio.

6. Conclusions

After a certain threshold, the dry up of liquidity causes more severe market declines than would occur in normal circumstances (Brunnermeier and Pedersen, 2009), jeopardizing the markets stability and questioning the way in which the assets are priced. Therefore, the need to rely on an asset pricing model able to compensate for the illiquidity of the market is crucial.

This paper extends the academic debate for pricing assets during periods of market illiquidity and proposes a dynamic augmented version of the Fama-French five factors model, able to accommodate the conditional illiquidity of the market. The empirical analysis is developed for the 10 Fama-French industry portfolios, where the estimation of the conditional coefficients is derived for each industry portfolio and it is based on a Diagonal BEKK(1,1) specification, with a multivariate *t-student* distribution and an unknown parameter, for quantifying the degrees of freedom.

The conditional level of illiquidity is derived for each industry portfolio and for the market portfolio and the spillover effects among the conditional illiquidity of each industry portfolio and the market portfolio are computed, via a Bayesian vector autoregressive (BVAR) with two lags and Normal-Wishart priors. The metrics of accuracy for the one-step ahead forecasts show the reliability of the BVAR for predicting the conditional levels of illiquidity for each industry portfolio and for the market portfolio.

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Table 1.
Descriptive statistics

The table reports the descriptive statistics (mean, median, max., min., standard deviation, skewness, kurtosis) for the 10 industry portfolios and for the 5 Fama-French factors, downloaded from Kenneth French's website. Therefore, **MKT_RF** is the excess return on the market, value-weight return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ minus the one-month Treasury bill rate (from Ibbotson Associates); **SMB** (Small Minus Big) is the average return on the nine small stock portfolios minus the average return on the nine big stock portfolios; **HML** (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios; **RMW** (Robust Minus Weak) is the average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios; **CMA** (Conservative Minus Aggressive) is the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios. The descriptive statistics are related to the period from July 1st, 1963 to November 30th, 2020. The table also reports the Jarque-Bera tests.

Panel 1.1: The 10 Industry Portfolios

	DURBL	ENRGY	HITEC	HLTH	MANUF	NODUR	OTHER	SHOPS	TELCM	UTILS
Mean	0.046	0.044	0.052	0.051	0.046	0.049	0.045	0.050	0.042	0.039
Median	0.030	0.050	0.070	0.060	0.070	0.070	0.080	0.070	0.030	0.050
Maximum	15.030	19.330	16.040	11.100	10.830	10.240	12.240	10.990	14.470	14.430
Minimum	-18.350	-19.730	-19.980	-17.890	-20.010	-17.030	-15.250	-16.750	-16.690	-12.860
Std. Dev.	1.372	1.382	1.425	1.084	1.068	0.886	1.170	1.066	1.101	0.884
Skewness	-0.262	-0.261	-0.026	-0.383	-0.673	-0.645	-0.313	-0.319	-0.088	-0.009
Kurtosis	13.432	21.401	12.357	13.854	21.043	22.263	18.742	14.228	16.721	29.657
Jarque-Bera	65707.62	204095.3	52729.91	71305.73	197157.1	224480.6	149482.4	76172.45	113402.0	427943.7
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sum	658.390	638.490	744.410	740.670	668.360	713.930	644.300	731.790	606.830	564.040
Sum Sq. Dev.	27211.82	27622.60	29361.39	16993.34	16480.11	11353.71	19781.06	16412.80	17511.83	11299.30
Observations	14454	14454	14454	14454	14454	14454	14454	14454	14454	14454

Panel 1.2: The 5 Fama-French factors

	MKT_RF	SMB	HML	CMA	RMW
Mean	0.027	0.007	0.013	0.012	0.012
Median	0.050	0.020	0.010	0.010	0.010
Maximum	11.350	6.080	6.750	2.530	4.490
Minimum	-17.440	-11.170	-4.880	-5.940	-3.020
Std. Dev.	1.015	0.532	0.545	0.366	0.374
Skewness	-0.556	-0.800	0.336	-0.363	0.305
Kurtosis	19.723	23.000	15.712	13.685	13.111
Jarque-Bera	169176.4	242431.4	97598.87	69080.56	61790.66
Probability	0.000	0.000	0.000	0.000	0.000
Sum	391.360	104.080	189.600	179.600	182.130
Sum Sq. Dev.	14886.81	4083.546	4300.649	1933.713	2026.744
Observations	14454	14454	14454	14454	14454

Table 2.
The Conditional Illiquidity

The table reports the estimates of the coefficients that determine the conditional illiquidity for the 10 Fama-French Industry portfolios and for the market, computed as value-weight return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ. Panel 2.2 reports the descriptive statistics of the conditional illiquidity considering the following sub-periods: (i) The financial crisis (Q3 2007 – Q1 2009); (ii) The European Sovereign Debt crisis (Q3-2009 until Q4-2013); (iii) the 2020 stock market crash or Coronavirus crash (February 20th, 2020 – April 7th, 2020). The statistics are based on the period from July 1st, 1963 to November 30th, 2020.

Panel 2.1: The estimation results

	MKT	**DURBL**	**ENRGY**	**HITEC**	**HLTH**	**MANUF**	**NODUR**	**OTHER**	**SHOPS**	**TELCM**	**UTILS**
μ_0	0.056 (0.006)	0.050 (0.008)	0.057 (0.007)	0.072 (0.009)	0.074 (0.007)	0.073 (0.006)	0.066 (0.005)	0.078 (0.006)	0.070 (0.007)	0.041 (0.006)	0.045 (0.004)
μ_1	0.063 (0.006)	0.054 (0.008)	0.060 (0.007)	0.079 (0.009)	0.079 (0.007)	0.079 (0.006)	0.070 (0.005)	0.087 (0.006)	0.074 (0.007)	0.043 (0.006)	0.046 (0.004)
$N(1,1)$	0.004 (0.001)	0.008 (0.002)	0.002 (0.001)	0.010 (0.002)	0.007 (0.001)	0.005 (0.001)	0.004 (0.001)	0.005 (0.001)	0.007 (0.001)	0.005 (0.001)	0.001 (0.000)
$N(2,2)$	0.005 (0.001)	0.011 (0.002)	0.003 (0.001)	0.012 (0.002)	0.008 (0.002)	0.007 (0.001)	0.005 (0.001)	0.007 (0.001)	0.008 (0.001)	0.007 (0.002)	0.001 (0.000)
$C(1,1)$	0.217 (0.009)	0.181 (0.009)	0.189 (0.008)	0.195 (0.009)	0.203 (0.009)	0.211 (0.009)	0.206 (0.009)	0.217 (0.009)	0.204 (0.009)	0.183 (0.009)	0.216 (0.008)
$C(2,2)$	0.254 (0.011)	0.208 (0.011)	0.219 (0.011)	0.220 (0.011)	0.236 (0.011)	0.247 (0.011)	0.251 (0.012)	0.264 (0.012)	0.238 (0.011)	0.227 (0.014)	0.277 (0.013)
$D(1,1)$	0.975 (0.002)	0.981 (0.002)	0.982 (0.002)	0.978 (0.002)	0.976 (0.002)	0.975 (0.002)	0.976 (0.002)	0.974 (0.002)	0.976 (0.002)	0.981 (0.002)	0.977 (0.002)
$D(2,2)$	0.966 (0.003)	0.975 (0.003)	0.976 (0.002)	0.972 (0.003)	0.969 (0.003)	0.967 (0.003)	0.966 (0.003)	0.963 (0.003)	0.968 (0.003)	0.971 (0.004)	0.964 (0.003)
t	7.371 (0.338)	8.493 (0.430)	7.800 (0.361)	8.799 (0.455)	7.789 (0.355)	8.181 (0.418)	7.381 (0.322)	7.058 (0.297)	8.314 (0.408)	6.689 (0.266)	6.038 (0.217)

Panel 2.2: The descriptive statistics

	Date	MKT	DURBL	ENRGY	HITEC	HLTH	MANUF	NODUR	OTHER	SHOPS	TELCM	UTILS
Mean	**July 2007 – March 15th, 2009**	0.559	-0.030	1.626	0.567	0.289	0.514	0.264	0.570	0.252	0.442	0.723
	October 1st,2009 – December 31st, 2013	0.070	-0.075	0.038	0.026	0.042	0.042	0.042	0.198	0.051	0.038	0.042
	February 20th, 2020 – April 7th, 2020	5.646	1.458	3.607	6.162	3.372	4.300	3.525	6.868	3.940	3.739	4.402
Median	**July 2007 – March 15th, 2009**	0.271	0.068	0.567	0.216	0.127	0.287	0.143	0.249	0.154	0.206	0.185
	October 1st,2009 – December 31st, 2013	0.013	-0.073	0.017	0.004	0.006	0.003	0.008	0.050	0.007	-0.002	0.003
	February 20th, 2020 – April 7th, 2020	4.025	1.195	0.660	4.159	2.570	3.572	2.280	5.301	2.771	2.946	1.375
Std. Dev.	**July 2007 – March 15th, 2009**	0.744	0.767	2.643	0.822	0.563	0.756	0.385	1.389	0.462	0.699	1.587
	October 1st,2009 – December 31st, 2013	0.325	0.335	0.281	0.238	0.218	0.315	0.218	0.607	0.266	0.252	0.286
	February 20th, 2020 – April 7th, 2020	5.843	2.385	5.667	6.133	3.199	4.686	3.805	7.372	4.076	3.679	5.324
Skewness	**July 2007 – March 15th, 2009**	1.931	-2.177	2.218	1.470	1.326	1.890	1.375	1.395	2.335	1.836	2.212
	October 1st,2009 – December 31st, 2013	6.456	4.801	2.423	4.996	5.988	4.892	6.082	5.732	6.573	5.929	5.805
	February 20th, 2020 – April 7th, 2020	0.155	0.491	0.084	0.092	0.103	0.306	0.371	0.245	0.123	0.045	0.717

Table 3.

5 Fama-French factors adjusted for the conditional illiquidity

The table reports the estimation results for the 10 Fama-French industry portfolios as a function of MKT_RF, SMB, HML, CMA, RMW and conditional illiquidity of the market. The statistics are based on the period from July 1st, 1963 to November 30th, 2020. The standard errors are reported in the brackets.

Panel 3.1: DURBL, ENRGY, HITEC

	DURBL			ENRGY			HITEC		
MKT_RF	1.134	1.165	1.201	0.969	1.015	1.064	1.194	1.159	1.100
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)
SMB		0.103	0.155		-0.111	-0.045		0.025	-0.031
		(0.010)	(0.010)		(0.011)	(0.011)		(0.008)	(0.008)
HML		0.267	0.194		0.412	0.285		-0.518	-0.397
		(0.009)	(0.011)		(0.011)	(0.013)		(0.008)	(0.009)
CMA			0.259			0.434			-0.532
			(0.017)			(0.020)			(0.014)
RMW			0.228			0.328			-0.300
			(0.014)			(0.016)			(0.012)
Illiquidity	-0.012	-0.050	-0.059	-0.066	-0.063	-0.060	0.008	-0.028	-0.029
	(0.010)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.009)	(0.008)	(0.008)
Monday	0.064	0.056	0.044	0.002	-0.017	-0.028	0.069	0.081	0.099
	(0.012)	(0.012)	(0.011)	(0.014)	(0.013)	(0.013)	(0.011)	(0.010)	(0.009)
Tuesday	0.011	0.003	-0.005	0.007	-0.007	-0.014	0.027	0.033	0.042
	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.010)	(0.009)	(0.009)
Wednesday (x10)	-0.002	-0.090	-0.131	-0.033	-0.073	-0.114	0.345	0.279	0.323
	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.010)	(0.009)	(0.009)
Thursday	-0.019	-0.027	-0.032	0.012	0.014	0.008	-0.003	-0.005	0.002
	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.010)	(0.009)	(0.009)
Friday	-0.036	-0.051	-0.057	0.029	0.031	0.025	-0.021	-0.018	-0.012
	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.010)	(0.009)	(0.009)
Adj-Rw^2	79.75%	80.99%	81.24%	68.03%	70.56%	71.33%	83.98%	87.55%	88.82%

Panel 3.2: HLTH, MANUF, NODUR

	HLTH			MANUF			NODUR		
MKT_RF	0.927	0.885	0.905	1.023	1.033	1.060	0.765	0.759	0.797
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
SMB		-0.103	-0.077		0.071	0.121		-0.107	-0.039
		(0.007)	(0.008)		(0.004)	(0.004)		(0.006)	(0.006)
HML		-0.342	-0.390		0.079	0.042		-0.034	-0.092
		(0.007)	(0.008)		(0.004)	(0.005)		(0.006)	(0.007)
CMA			0.199			0.194			0.315
			(0.013)			(0.007)			(0.010)
RMW			0.114			0.253			0.391
			(0.011)			(0.006)			(0.009)
Illiquidity	0.031	-0.010	-0.009	-0.014	-0.017	-0.036	0.017	0.010	-0.023
	(0.008)	(0.007)	(0.007)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Monday	0.013	0.016	0.011	0.022	0.022	0.010	0.024	0.019	-0.002
	(0.009)	(0.009)	(0.009)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Tuesday	0.039	0.041	0.037	0.017	0.018	0.008	0.029	0.028	0.018
	(0.009)	(0.009)	(0.009)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Wednesday	0.369	0.376	0.376	0.056	0.025	0.015	0.297	0.312	0.268
(x10)	(0.009)	(0.009)	(0.009)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Thursday	0.030	0.030	0.027	0.018	0.014	0.008	0.031	0.035	0.027
	(0.009)	(0.009)	(0.009)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Friday	0.020	0.028	0.024	0.023	0.017	0.013	0.031	0.041	0.035
	(0.009)	(0.009)	(0.009)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Adj-Rw^2	79.68%	82.53%	82.57%	94.13%	94.24%	94.63%	82.06%	82.40%	83.40%

Panel 3.3: OTHER, SHOPS, TELCM, UTILS

	OTHER			SHOPS			TELCM			UTILS		
MKT_RF	1.014	1.084	1.069	0.945	0.931	0.946	0.839	0.853	0.867	0.534	0.575	0.595
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.003)	(0.004)
SMB		0.161	0.143		0.037	0.059		-0.181	-0.196		-0.053	-0.025
		(0.004)	(0.004)		(0.006)	(0.007)		(0.009)	(0.009)		(0.007)	(0.007)
HML		0.346	0.438		-0.167	-0.184		0.202	0.122		0.298	0.243
		(0.004)	(0.005)		(0.006)	(0.007)		(0.008)	(0.009)		(0.007)	(0.008)
CMA			-0.234			0.099			0.222			0.184
			(0.007)			(0.011)			(0.015)			(0.012)
RMW			-0.046			0.146			-0.119			0.122
			(0.006)			(0.009)			(0.013)			(0.010)
Illiquidity	-0.082	-0.028	-0.025	0.022	0.008	0.002	-0.018	0.001	-0.003	0.098	0.090	0.095
	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.009)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
Monday	-0.017	-0.019	-0.017	0.000	0.007	0.000	0.007	-0.008	-0.006	0.035	0.022	0.017
	(0.006)	(0.005)	(0.005)	(0.008)	(0.008)	(0.007)	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
Tuesday	0.005	0.000	0.002	0.021	0.023	0.018	0.010	0.005	0.008	0.030	0.019	0.015
	(0.005)	(0.005)	(0.005)	(0.008)	(0.007)	(0.007)	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
Wednesday (x10)	0.134	0.136	0.147	0.260	0.242	0.022	-0.215	-0.017	-0.166	0.055	0.007	0.071
	(0.005)	(0.005)	(0.005)	(0.008)	(0.007)	(0.007)	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
Thursday	0.018	0.016	0.020	0.043	0.040	0.038	0.010	0.022	0.020	0.029	0.031	0.027
	(0.005)	(0.005)	(0.005)	(0.008)	(0.007)	(0.007)	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
Friday	0.028	0.010	0.017	0.022	0.022	0.019	0.030	0.043	0.038	0.057	0.056	0.053
	(0.006)	(0.005)	(0.005)	(0.008)	(0.008)	(0.007)	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
Adj-Rw^2	92.34%	94.73%	95.10%	85.68%	86.51%	86.52%	72.71%	74.71%	75.42%	60.92%	65.52%	65.48%

Table 4.
Quantile regressions

The table reports the estimation results for the 10 Fama-French industry portfolios as a function of MKT_RF, SMB, HML, CMA, RMW and conditional illiquidity of the market. The quantile regressions are computed at the 1st percentile and rely on the MCMB-A bootstrap method, where the sparsity estimation is Chamberlain as a bandwidth method and Gumbel is the quantile method based on Epanechnikov kernel. The number of bootstrap replications is equal to 10000. The statistics are based on the period from July 1st, 1963 to November 30th, 2020. The standard errors are reported in the brackets.

Panel 4.1: DURBL, ENRGY, HITEC

	DURBL			ENRGY			HITEC		
MKT_RF	0.991	1.053	1.080	0.930	0.955	1.116	1.290	1.186	1.065
	(0.023)	(0.023)	(0.027)	(0.049)	(0.046)	(0.042)	(0.041)	(0.039)	(0.026)
SMB		0.110	0.230		-0.073	0.211		0.216	-0.007
		(0.070)	(0.066)		(0.095)	(0.097)		(0.054)	(0.044)
HML		0.324	0.206		0.439	0.218		-0.700	-0.446
		(0.072)	(0.070)		(0.072)	(0.105)		(0.045)	(0.053)
CMA			0.208			0.640			-0.488
			(0.115)			(0.169)			(0.081)
RMW			0.164			0.503			-0.562
			(0.089)			(0.103)			(0.075)
Illiquidity	-0.399	-0.410	-0.395	-0.559	-0.405	-0.482	-0.070	0.017	-0.001
	(0.062)	(0.059)	(0.065)	(0.123)	(0.127)	(0.111)	(0.050)	(0.064)	(0.038)
Monday	-1.853	-1.680	-1.700	-2.696	-2.533	-2.513	-1.979	-1.636	-1.360
	(0.080)	(0.084)	(0.083)	(0.183)	(0.136)	(0.193)	(0.156)	(0.126)	(0.087)
Tuesday	-2.106	-2.058	-2.016	-2.460	-2.384	-2.366	-2.009	-1.696	-1.462
	(0.127)	(0.118)	(0.126)	(0.119)	(0.128)	(0.112)	(0.065)	(0.118)	(0.074)
Wednesday	-1.946	-1.873	-1.856	-2.852	-2.656	-2.523	-2.017	-1.700	-1.442
	(0.059)	(0.063)	(0.070)	(0.149)	(0.120)	(0.121)	(0.185)	(0.114)	(0.117)
Thursday	-1.965	-1.964	-1.829	-2.709	-2.573	-2.519	-1.780	-1.578	-1.386
	(0.157)	(0.141)	(0.117)	(0.153)	(0.136)	(0.128)	(0.115)	(0.079)	(0.055)
Friday	-1.908	-1.880	-1.945	-2.359	-2.264	-2.195	-1.954	-1.580	-1.441
	(0.179)	(0.187)	(0.171)	(0.159)	(0.153)	(0.160)	(0.132)	(0.089)	(0.071)
Adj-Rw^2	51.14%	52.94%	53.30%	36.03%	38.30%	40.56%	51.65%	59.47%	64.81%

Panel 4.2: HLTH, MANUF, NODUR

	HLTH			MANUF			NODUR		
MKT_RF	0.821	0.783	0.936	0.963	0.953	1.061	0.690	0.693	0.825
	(0.041)	(0.032)	(0.032)	(0.022)	(0.028)	(0.019)	(0.035)	(0.032)	(0.021)
SMB		-0.179	0.007		0.048	0.187		-0.110	0.036
		(0.069)	(0.041)		(0.046)	(0.035)		(0.059)	(0.046)
HML		-0.258	-0.616		0.100	-0.018		0.106	-0.126
		(0.059)	(0.062)		(0.038)	(0.030)		(0.055)	(0.038)
CMA			0.678			0.327			0.456
			(0.107)			(0.050)			(0.064)
RMW			0.422			0.410			0.582
			(0.077)			(0.034)			(0.046)
Illiquidity	-0.156	-0.053	-0.097	-0.078	-0.121	-0.098	-0.146	-0.136	-0.132
	(0.094)	(0.056)	(0.055)	(0.052)	(0.056)	(0.039)	(0.033)	(0.083)	(0.044)
Monday	-1.730	-1.692	-1.562	-0.968	-0.917	-0.902	-1.217	-1.228	-1.142
	(0.096)	(0.095)	(0.094)	(0.074)	(0.091)	(0.076)	(0.074)	(0.079)	(0.054)
Tuesday	-1.752	-1.613	-1.570	-0.992	-0.975	-0.823	-1.267	-1.307	-1.129
	(0.120)	(0.137)	(0.099)	(0.089)	(0.081)	(0.045)	(0.097)	(0.074)	(0.064)
Wednesday	-1.802	-1.682	-1.599	-0.937	-0.890	-0.811	-1.345	-1.380	-1.213
(x10)	(0.141)	(0.155)	(0.110)	(0.055)	(0.065)	(0.050)	(0.068)	(0.074)	(0.051)
Thursday	-1.839	-1.780	-1.704	-1.107	-1.042	-0.867	-1.324	-1.313	-1.178
	(0.144)	(0.125)	(0.075)	(0.087)	(0.089)	(0.042)	(0.089)	(0.092)	(0.090)
Friday	-1.686	-1.687	-1.568	-0.898	-0.881	-0.796	-1.223	-1.225	-1.093
	(0.174)	(0.106)	(0.100)	(0.045)	(0.060)	(0.045)	(0.112)	(0.110)	(0.068)
Adj-Rw^2	40.49%	42.46%	46.36%	68.06%	68.63%	72.87%	47.18%	47.68%	57.13%

Panel 4.3: OTHER, SHOPS, TELCM, UTILS

	OTHER			SHOPS			TELCM			UTILS		
MKT_RF	1.083	1.109	1.100	0.871	0.857	0.941	0.937	0.952	0.919	0.645	0.641	0.778
	(0.020)	(0.017)	(0.019)	(0.033)	(0.038)	(0.027)	(0.018)	(0.028)	(0.026)	(0.026)	(0.028)	(0.027)
SMB		0.115	0.123		0.031	0.181		-0.085	-0.212		-0.137	-0.033
		(0.043)	(0.047)		(0.075)	(0.042)		(0.075)	(0.070)		(0.062)	(0.062)
HML		0.512	0.545		-0.040	-0.222		0.142	0.045		0.309	-0.004
		(0.021)	(0.030)		(0.065)	(0.055)		(0.054)	(0.057)		(0.049)	(0.057)
CMA			-0.110			0.218			0.251			0.717
			(0.061)			(0.085)			(0.095)			(0.110)
RMW			0.050			0.385			-0.362			0.287
			(0.038)			(0.064)			(0.071)			(0.080)
Illiquidity	-0.260	-0.047	-0.084	-0.065	-0.048	-0.088	-0.111	-0.146	-0.102	-0.440	-0.469	-0.351
	(0.084)	(0.054)	(0.048)	(0.075)	(0.076)	(0.057)	(0.023)	(0.079)	(0.107)	(0.092)	(0.078)	(0.076)
Monday	-1.290	-1.064	-1.039	-1.284	-1.299	-1.441	-1.785	-1.700	-1.676	-1.711	-1.609	-1.560
	(0.075)	(0.054)	(0.057)	(0.134)	(0.127)	(0.105)	(0.155)	(0.172)	(0.164)	(0.081)	(0.109)	(0.111)
Tuesday	-1.176	-0.820	-0.804	-1.319	-1.355	-1.319	-1.581	-1.645	-1.595	-1.906	-2.042	-1.893
	(0.073)	(0.038)	(0.041)	(0.102)	(0.098)	(0.094)	(0.089)	(0.093)	(0.082)	(0.145)	(0.105)	(0.100)
Wednesday (x10)	-1.143	-0.854	-0.841	-1.341	-1.351	-1.308	-1.897	-1.806	-1.810	-1.761	-1.801	-1.693
	(0.054)	(0.040)	(0.047)	(0.099)	(0.105)	(0.094)	(0.086)	(0.110)	(0.099)	(0.131)	(0.170)	(0.098)
Thursday	-1.242	-0.949	-0.910	-1.574	-1.569	-1.480	-1.552	-1.557	-1.613	-1.866	-1.729	-1.719
	(0.085)	(0.060)	(0.067)	(0.116)	(0.122)	(0.114)	(0.126)	(0.127)	(0.103)	(0.135)	(0.112)	(0.137)
Friday	-0.970	-0.813	-0.802	-1.393	-1.406	-1.218	-1.344	-1.382	-1.372	-1.773	-1.649	-1.674
	(0.069)	(0.040)	(0.045)	(0.092)	(0.099)	(0.079)	(0.090)	(0.079)	(0.080)	(0.085)	(0.152)	(0.008)
Adj-Rw^2	67.74%	75.88%	75.99%	50.98%	51.03%	53.58%	48.13%	48.55%	49.87%	34.20%	36.29%	40.77%

Table 5.
The Dynamic Conditional Coefficients

The table reports the estimation results of the coefficients that determine the dynamic conditional coefficients related to the 10 Fama-French industry portfolios. The significance levels at 1%, 5% and 10% are respectively represented in the following way: ***, **, *.

Panel 5.1: DURBL, ENRGY, HITEC, HLTH, MANUF

	DURBL	ENRGY	HITEC	HLTH	MANUF
α_0	0.051***	0.056***	0.061***	0.065***	0.059***
α_1	0.039***	0.037***	0.039***	0.040***	0.039***
α_2	0.024***	0.022***	0.023***	0.022***	0.022***
α_3	0.006*	0.007**	0.006**	0.005*	0.006**
α_4	0.003*	0.005**	0.004*	0.003*	0.004*
α_5	0.010***	0.010***	0.009***	0.010***	0.011***
α_6	-0.026***	-0.026***	-0.026***	-0.026***	-0.026***
$M(1,1)$ x1000	0.921***	0.376***	0.163***	0.656***	0.155***
$M(2,2)$ x1000	0.235***	0.270***	0.287***	0.311***	0.059***
$M(3,3)$ x1000	0.455***	0.500***	0.432***	0.488***	0.490***
$M(4,4)$ x1000	0.181***	0.197***	0.199***	0.179***	0.199***
$M(5,5)$ x1000	0.146***	0.152***	0.165***	0.162***	0.150***
$M(6,6)$ x1000	0.127***	0.122***	0.132***	0.131***	0.128***
$M(7,7)$ x1000	0.195***	0.194***	0.190***	0.194***	0.190***
$A(1,1)$	0.160***	0.168***	0.158***	0.164***	0.171***
$A(2,2)$	0.167***	0.173***	0.166***	0.170***	0.169***
$A(3,3)$	0.163***	0.167***	0.165***	0.163***	0.164***
$A(4,4)$	0.165***	0.168***	0.166***	0.164***	0.163***
$A(5,5)$	0.150***	0.154***	0.151***	0.150***	0.150***
$A(6,6)$	0.147***	0.151***	0.149***	0.147***	0.147***
$A(7,7)$	0.994***	0.992***	0.988***	0.986***	0.982***
$B(1,1)$	0.987***	0.986***	0.988***	0.986***	0.986***
$B(2,2)$	0.986***	0.985***	0.986***	0.985***	0.986***
$B(3,3)$	0.986***	0.986***	0.986***	0.986***	0.986***
$B(4,4)$	0.986***	0.986***	0.986***	0.986***	0.986***
$B(5,5)$	0.989***	0.988***	0.988***	0.989***	0.989***
$B(6,6)$	0.989***	0.989***	0.989***	0.989***	0.989***
$B(7,7)$	0.521***	0.522***	0.527***	0.525***	0.529***
t	8.974***	8.840***	9.034***	9.028***	9.192***

Panel 5.2: NODUR, OTHER, SHOPS, TELCM, UTILS

	NODUR	OTHER	SHOPS	TELCM	UTILS
α_0	0.059***	0.063***	0.062***	0.047***	0.046***
α_1	0.038***	0.040***	0.038***	0.038***	0.039***
α_2	0.020***	0.019***	0.022***	0.022***	0.021***
α_3	0.005*	0.009**	0.004	0.004	0.004
α_4	0.005*	0.007***	0.003	0.003	0.004
α_5	0.011***	0.010***	0.012***	0.011***	0.012***
α_6	-0.026***	-0.026***	-0.026***	-0.026***	-0.026***
$M(1,1)$ x1000	0.315***	0.149***	0.519***	1.054***	0.386***
$M(2,2)$ x1000	0.112***	0.004***	0.144***	0.187***	0.192***
$M(3,3)$ x1000	0.433***	0.340***	0.507***	0.496***	0.529***
$M(4,4)$ x1000	0.200***	0.161***	0.192***	0.170***	0.154***
$M(5,5)$ x1000	0.155***	0.160***	0.160***	0.164***	0.157***
$M(6,6)$ x1000	0.128***	0.134***	0.126***	0.128***	0.137***
$M(7,7)$ x1000	0.188***	0.199***	0.192***	0.194***	0.189***
$A(1,1)$	0.160***	0.169***	0.166***	0.159***	0.189***
$A(2,2)$	0.164***	0.169***	0.170***	0.169***	0.184***
$A(3,3)$	0.164***	0.168***	0.166***	0.162***	0.168***
$A(4,4)$	0.164***	0.169***	0.164***	0.165***	0.168***
$A(5,5)$	0.149***	0.151***	0.148***	0.150***	0.149***
$A(6,6)$	0.147***	0.150***	0.148***	0.148***	0.148***
$A(7,7)$	0.973***	0.990***	0.979***	0.993***	0.970***
$B(1,1)$	0.987***	0.986***	0.986***	0.987***	0.983***
$B(2,2)$	0.987***	0.986***	0.986***	0.986***	0.984***
$B(3,3)$	0.986***	0.986***	0.986***	0.986***	0.985***
$B(4,4)$	0.986***	0.986***	0.986***	0.986***	0.986***
$B(5,5)$	0.989***	0.988***	0.989***	0.989***	0.989***
$B(6,6)$	0.989***	0.989***	0.989***	0.989***	0.989***
$B(7,7)$	0.540***	0.519***	0.533***	0.523***	0.541***
t	9.183***	9.092***	9.151***	8.895***	8.864***

Table 6.
The Bayesian Vector Autoregressive: The spillover effect

The table reports the estimation results of the Bayesian Vector Autoregressive (BVAR) with 2 lags and Normal Wishart priors among the conditional illiquidity of the 10 Fama-French industry portfolios and the conditional illiquidity for the market. The brackets contain the t-statistics.

	ILL_DURBL	ILL_ENRGY	ILL_HITEC	ILL_HLTH	ILL_MANUF	ILL_NODUR	ILL_OTHER	ILL_SHOPS	ILL_TELCM	ILL_UTILS	ILL_MKT
ILL_DURBL(-1)	0.892272	-0.060310	-0.087517	-0.034298	-0.059113	-0.093396	-0.023939	-0.064400	-0.037289	-0.165839	-0.076315
	[73.0683]	[-3.47096]	[-5.62537]	[-3.45314]	[-4.69934]	[-9.98265]	[-1.25922]	[-6.14924]	[-3.51818]	[-11.8525]	[-6.26559]
ILL_DURBL(-2)	0.011463	-0.000814	0.052497	0.019735	0.013802	0.071537	-0.037470	0.046017	-0.000559	0.115452	0.036882
	[1.30289]	[-0.06504]	[4.68360]	[2.75790]	[1.52291]	[10.6130]	[-2.73566]	[6.09882]	[-0.07325]	[11.4529]	[4.20293]
ILL_ENRGY(-1)	-0.030097	0.769536	0.005786	-0.044722	-0.038541	-0.015689	-0.086246	-0.014891	-0.037135	-0.051291	-0.040589
	[-2.24754]	[40.3875]	[0.33916]	[-4.10610]	[-2.79404]	[-1.52919]	[-4.13701]	[-1.29664]	[-3.19511]	[-3.34289]	[-3.03888]
ILL_ENRGY(-2)	-0.001598	0.184860	-0.014504	0.046602	0.033247	0.006840	0.064617	0.008446	0.029730	0.077846	0.031038
	[-0.09020]	[7.33394]	[-0.64267]	[3.23433]	[1.82194]	[0.50397]	[2.34299]	[0.55596]	[1.93364]	[3.83526]	[1.75661]
ILL_HITEC(-1)	-0.047089	-0.036918	0.853596	-0.047388	-0.020517	-0.006914	-0.078349	-0.022510	-0.022588	-0.113590	-0.024649
	[-1.77223]	[-0.97647]	[25.2161]	[-2.19270]	[-0.74963]	[-0.33963]	[-1.89404]	[-0.98782]	[-0.97948]	[-3.73106]	[-0.93008]
ILL_HITEC(-2)	0.061857	0.047556	0.064222	0.050981	0.031850	0.008913	0.076684	0.030729	0.025948	0.108975	0.021777
	[2.55082]	[1.37824]	[2.07874]	[2.58475]	[1.27506]	[0.47975]	[2.03120]	[1.47758]	[1.23283]	[3.92203]	[0.90035]
ILL_HLTH(-1)	-0.042780	-0.074771	0.074740	0.871344	-0.003947	0.026342	-0.140385	0.007023	-0.015581	-0.082818	0.003248
	[-3.28414]	[-4.03406]	[4.50363]	[82.2405]	[-0.29417]	[2.63945]	[-6.92241]	[0.62861]	[-1.37816]	[-5.54880]	[0.25001]
ILL_HLTH(-2)	0.062548	0.074078	-0.054604	0.083732	0.021297	-0.002726	0.173405	0.013702	0.026167	0.095351	0.014513
	[3.19121]	[2.65617]	[-2.18670]	[5.25223]	[1.05484]	[-0.18153]	[5.68273]	[0.81514]	[1.53818]	[4.24580]	[0.74236]
ILL_MANUF(-1)	-0.147283	-0.586588	-0.427657	-0.251115	0.468726	-0.328591	-0.417167	-0.272859	-0.386371	-0.672706	-0.423055
	[-9.06074]	[-25.3614]	[-20.6506]	[-18.9932]	[27.9933]	[-26.3849]	[-16.4846]	[-19.5728]	[-27.3859]	[-36.1186]	[-26.0933]
ILL_MANUF(-2)	0.137377	0.542343	0.411415	0.230741	0.448648	0.318173	0.415613	0.259749	0.372670	0.657134	0.407588
	[12.0929]	[33.5519]	[28.4264]	[24.9721]	[38.3393]	[36.5566]	[23.4996]	[26.6607]	[37.7964]	[50.4850]	[35.9713]
ILL_NODUR(-1)	-0.047446	0.097520	0.110476	0.113954	0.102895	0.812543	0.434725	0.096325	-0.075713	0.149149	0.155302
	[-0.91070]	[1.31552]	[1.66446]	[2.68917]	[1.91732]	[20.3568]	[5.35978]	[2.15585]	[-1.67440]	[2.49855]	[2.98863]

(continue)

ILL_NODUR(-2)	0.132802	-0.069811	-0.087061	-0.089163	-0.070506	0.100695	-0.346009	-0.034816	0.076742	-0.178411	-0.117275
	[10.8926]	[-4.02422]	[-5.60503]	[-8.99139]	[-5.61405]	[10.7801]	[-18.2293]	[-3.32972]	[7.25227]	[-12.7715]	[-9.64394]
ILL_OTHER(-1)	0.040839	0.194632	0.092435	0.035298	0.020931	0.027302	0.783663	0.028719	0.103329	0.029587	0.061385
	[4.61903]	[15.4709]	[8.20610]	[4.90838]	[2.29822]	[4.03047]	[56.9321]	[3.78747]	[13.4650]	[2.92056]	[6.96072]
ILL_OTHER(-2)	-0.039584	-0.201937	-0.097553	-0.051302	-0.048839	-0.041505	0.124091	-0.031920	-0.114815	-0.073923	-0.080813
	[-2.95738]	[-10.6031]	[-5.72080]	[-4.71240]	[-3.54225]	[-4.04744]	[5.95508]	[-2.78070]	[-9.88327]	[-4.82020]	[-6.05332]
ILL_SHOPS(-1)	0.089635	0.040100	0.071913	-0.017479	0.126383	0.077911	0.159487	0.946923	0.007610	0.042797	0.086477
	[5.06666]	[1.59298]	[3.19066]	[-1.21472]	[6.93513]	[5.74819]	[5.79060]	[62.4110]	[0.49561]	[2.11128]	[4.90079]
ILL_SHOPS(-2)	-0.131459	-0.054200	-0.090492	0.012902	-0.134152	-0.089392	-0.212176	-0.030381	-0.027187	-0.042355	-0.114702
	[-4.99635]	[-1.44776]	[-2.69961]	[0.60288]	[-4.94975]	[-4.43456]	[-5.17985]	[-1.34638]	[-1.19050]	[-1.40495]	[-4.37076]
ILL_TELCM(-1)	-0.036052	-0.061422	0.057092	-0.030200	-0.007996	-0.087718	0.050953	0.055437	0.742299	-0.234956	-0.015856
	[-1.48226]	[-1.77479]	[1.84246]	[-1.52658]	[-0.31915]	[-4.70732]	[1.34562]	[2.65769]	[35.1632]	[-8.43100]	[-0.65358]
ILL_TELCM(-2)	0.010315	0.047965	-0.069261	0.040017	0.008507	0.095481	-0.044901	-0.039842	0.201188	0.248263	0.019097
	[0.79142]	[2.58632]	[-4.17100]	[3.77474]	[0.63359]	[9.56160]	[-2.21276]	[-3.56425]	[17.7845]	[16.6239]	[1.46900]
ILL_UTILS(-1)	0.017756	-0.067994	0.014084	-0.024017	-0.029780	0.088305	-0.170434	-0.029076	0.040051	0.899256	-0.019754
	[0.90957]	[-2.44785]	[0.56631]	[-1.51255]	[-1.48091]	[5.90415]	[-5.60786]	[-1.73667]	[2.36382]	[40.2033]	[-1.01449]
ILL_UTILS(-2)	0.017311	0.048186	-0.012944	0.004250	-0.000527	-0.108325	0.119791	0.010583	-0.060093	-0.043018	-0.005450
	[1.06497]	[2.08340]	[-0.62506]	[0.32142]	[-0.03145]	[-8.69835]	[4.73369]	[0.75915]	[-4.25947]	[-2.30972]	[-0.33614]
ILL_MKT(-1)	0.106074	0.437774	0.328177	0.396096	0.477918	0.410575	0.763032	0.360650	0.394944	1.142079	1.342085
	[9.29404]	[26.9572]	[22.5700]	[42.6689]	[40.6511]	[46.9545]	[42.9433]	[36.8456]	[39.8697]	[87.3345]	[117.895]
ILL_MKT(-2)	-0.122936	-0.321739	-0.234417	-0.351466	-0.400123	-0.334102	-0.649939	-0.349098	-0.310429	-0.983266	-0.306818
	[-2.36316]	[-4.34657]	[-3.53697]	[-8.30639]	[-7.46674]	[-8.38266]	[-8.02497]	[-7.82466]	[-6.87525]	[-16.4960]	[-5.91310]
C	-0.005504	-0.005723	-0.004294	-0.005650	-0.005682	-0.004213	-0.005724	-0.004632	-0.003266	-0.006703	-0.004011
	[-4.51586]	[-3.30012]	[-2.76523]	[-5.69983]	[-4.52576]	[-4.51197]	[-3.01668]	[-4.43177]	[-3.08761]	[-4.80015]	[-3.29966]
R-squared	0.844840	0.948204	0.938195	0.940814	0.925329	0.929302	0.923558	0.941909	0.929955	0.930294	0.946419
Adj. R-squared	0.844604	0.948125	0.938101	0.940723	0.925215	0.929194	0.923441	0.941820	0.929848	0.930188	0.946338

Table 7.
The forecasts: Metrics of accuracy

The table reports the metrics of accuracy (RMSE, MAE, MAPE, Theil inequality coefficient) related to the forecasts of the BVAR methodology with 2 lags and Normal-Wishart priors. The metrics of accuracy are related to the following sub-periods: (i) The financial crisis (Q3 2007 – Q1 2009); (ii) The European Sovereign Debt crisis (Q3-2009 until Q4-2013); (iii) the 2020 stock market crash or Coronavirus crash (February 20th, 2020 – April 7th, 2020).

Panel 7.1: The financial crisis

Variable	Inc. obs.	RMSE	MAE	MAPE	Theil
ILLIQUIDITY_MKT	429	0.323939	0.172530	82.38351	0.179950
ILLIQUIDITY_DURBL	429	0.339944	0.199442	327.7425	0.234012
ILLIQUIDITY_ENRGY	429	0.573274	0.293768	58307.08	0.093277
ILLIQUIDITY_HITEC	429	0.263430	0.145744	90.43326	0.134405
ILLIQUIDITY_HLTH	429	0.183171	0.093856	149.7630	0.148023
ILLIQUIDITY_MANUF	429	0.308453	0.175675	142.6962	0.174055
ILLIQUIDITY_NODUR	429	0.173396	0.096664	66.81919	0.192995
ILLIQUIDITY_OTHER	429	0.685968	0.347976	147.1665	0.242150
ILLIQUIDITY_SHOPS	429	0.213749	0.123853	128.7848	0.212821
ILLIQUIDITY_TELCM	429	0.282112	0.155216	90.74403	0.176035
ILLIQUIDITY_UTILS	429	0.356271	0.182181	193.8616	0.103342

Panel 7.2: The European sovereign debt crisis

Variable	Inc. obs.	RMSE	MAE	MAPE	Theil
ILLIQUIDITY_MKT	1070	0.129609	0.087375	364.1668	0.209455
ILLIQUIDITY_DURBL	1070	0.173587	0.114557	893.8697	0.291602
ILLIQUIDITY_ENRGY	1070	0.180682	0.135170	986.1486	0.333525
ILLIQUIDITY_HITEC	1070	0.117909	0.083031	432.9085	0.273000
ILLIQUIDITY_HLTH	1070	0.083357	0.050139	367.4005	0.211782
ILLIQUIDITY_MANUF	1070	0.145202	0.093987	396.0616	0.257440
ILLIQUIDITY_NODUR	1070	0.096641	0.067268	1070.569	0.249432
ILLIQUIDITY_OTHER	1070	0.194146	0.110474	225.5414	0.158740
ILLIQUIDITY_SHOPS	1070	0.097150	0.059537	640.1869	0.195116
ILLIQUIDITY_TELCM	1070	0.108282	0.083973	409.2584	0.228836
ILLIQUIDITY_UTILS	1070	0.151690	0.096686	317.9567	0.308411

Panel 7.3: The Coronavirus crash

Variable	Inc. obs.	RMSE	MAE	MAPE	Theil
ILLIQUIDITY_MKT	34	2.752553	1.781431	151.3366	0.192901
ILLIQUIDITY_DURBL	34	2.119729	1.382895	604.3222	0.456778
ILLIQUIDITY_ENRGY	34	3.458581	2.241296	211.6654	0.288860
ILLIQUIDITY_HITEC	34	2.722473	1.895132	130.3331	0.179935
ILLIQUIDITY_HLTH	34	1.573921	1.130759	239.5876	0.197769
ILLIQUIDITY_MANUF	34	2.705127	1.706822	291.6385	0.244963
ILLIQUIDITY_NODUR	34	2.256333	1.588185	366.8177	0.267838
ILLIQUIDITY_OTHER	34	3.075972	1.877031	124.9802	0.163561
ILLIQUIDITY_SHOPS	34	2.173264	1.505752	277.1083	0.226508
ILLIQUIDITY_TELCM	34	1.737918	1.285819	156.3417	0.193934
ILLIQUIDITY_UTILS	34	3.829980	2.477539	1405.591	0.353826

Figure 1.
The Dynamic Conditional Illiquidity

The figure shows the dynamic of the conditional illiquidity for the 10 Fama-French industry portfolios and for the market, computed as value-weight return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ. The period of consideration is from July 1st, 1963 to November 30th, 2020.

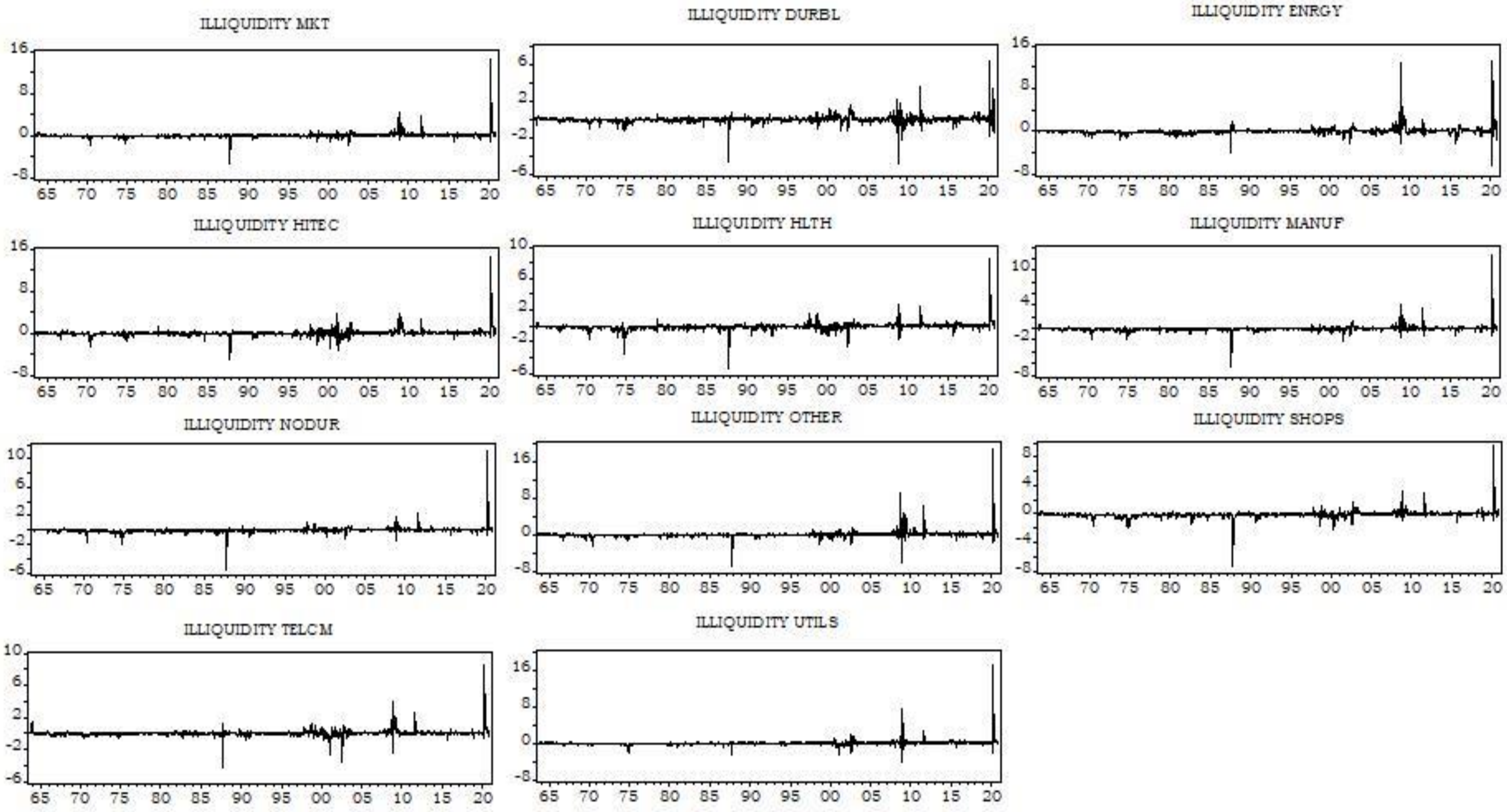

Figure 2.

The Dynamic medians across industry portfolios for the factors

The figure shows the dynamic medians of the betas across industry portfolios for the following factors: MKT, SMB, HML, CMA, RMW, Conditional Illiquidity. The figure is related to the period July 1st, 1963 - November 30th, 2020.

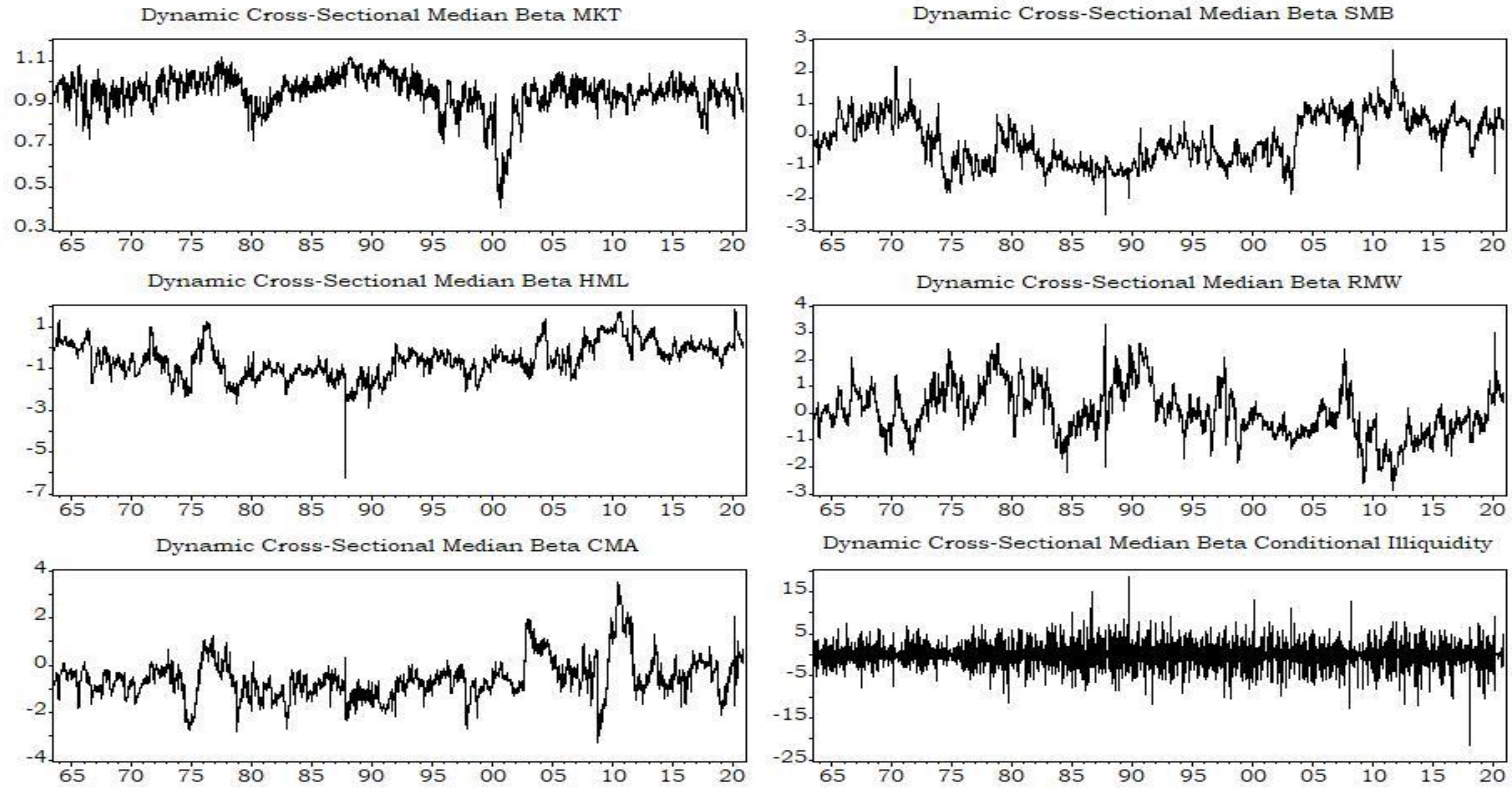

Figure 3.
Generalized Impulse Response Functions

The figure shows the generalized impulse response functions of the conditional illiquidity for the market to the shocks of the conditional illiquidity for the industry portfolios, considering n.10 periods.