Discussion of *Nowhere to Run, Nowhere to Hide: Asset Diversification in a Flat World*

Paper by John COTTER, Stuart GABRIEL and Richard ROLL

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9th Tau Finance Conference

December 2018

The paper in a nutshell

Main question of the paper:

Is the potential for diversification greater or lower now than 25 years ago?

This paper investigates the trends in diversification for:

- three classes of assets (equity, debt, real estate),
- 23 different countries...
- gathering 40 equity indices.

Main Findings:

- Much lower potential for diversification in 2012 than in 1986 (negative trend).
- Driven notably by internet diffusion and communication.

Methodology

- A (global) factor model for returns:

$$R_{i,t} = \alpha_i + \beta_i^\top F_t + \varepsilon_{i,t} \, .$$

- Residual variance is idiosyncratic, and given α_i, β_i:

$$\mathbb{V}\left(R_{i,t}\right) = \beta_i^\top \Sigma \beta_i + \sigma_i^2 \, .$$

- Measure of diversification potential (Roll & Pukthuanthong 2009):

$$\mathcal{D}_i = \frac{\sigma_i^2}{\mathbb{V}\left(R_{i,t}\right)} = 1 - \mathcal{R}_i^2 \, .$$

Rationale of the measure:

$\mathcal{R}_i^2$ is an indicator of integration such that $\mathcal{R}_i^2 = \mathcal{R}_j^2 = 1$ implies that markets i and j are **perfectly integrated** (spanned by the same global factors).

In practice

- Sample a year of daily data,
- Estimate PCAs and keep the first 16 ones F_t,
- Regress all returns on F_t: $R_{i,t} = \alpha_i + \beta_i^\top F_t + \varepsilon_{i,t}$.
- Compute R-squares: $\widehat{\mathcal{R}}_i^2 = 1 - \sum_t \widehat{\varepsilon_{i,t}^2} / \sum_t (R_{i,t} - \overline{R}_i)^2$.
- Average R-squares: $\overline{\mathcal{R}}^2 = \sum_i \widehat{\mathcal{R}}_i^2$.
- Repeat for every year (possibly averaging on subpopulations).

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General impressions

My impressions

- Very interesting paper and results, I learned a lot.
- A lot of different analyses benefiting from a large cross-section of assets and countries

I discuss below:

- The performance of the econometric method and inference,
- The treatment of fixed income securities,
- The economic mechanism at play.

Naive question

- If using stock index is problematic, why not using individual stock data?
- Modeling of large scale (dynamic) variance-covariance matrices is allowed by big data methods (see e.g. Ledoit & Wolf 2012).
- Is the problem data availability?

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Methodology: $\mathcal{R}^2$ dispersion

Main question

How is the dispersion across $\mathcal{R}^2$ affecting the measure?

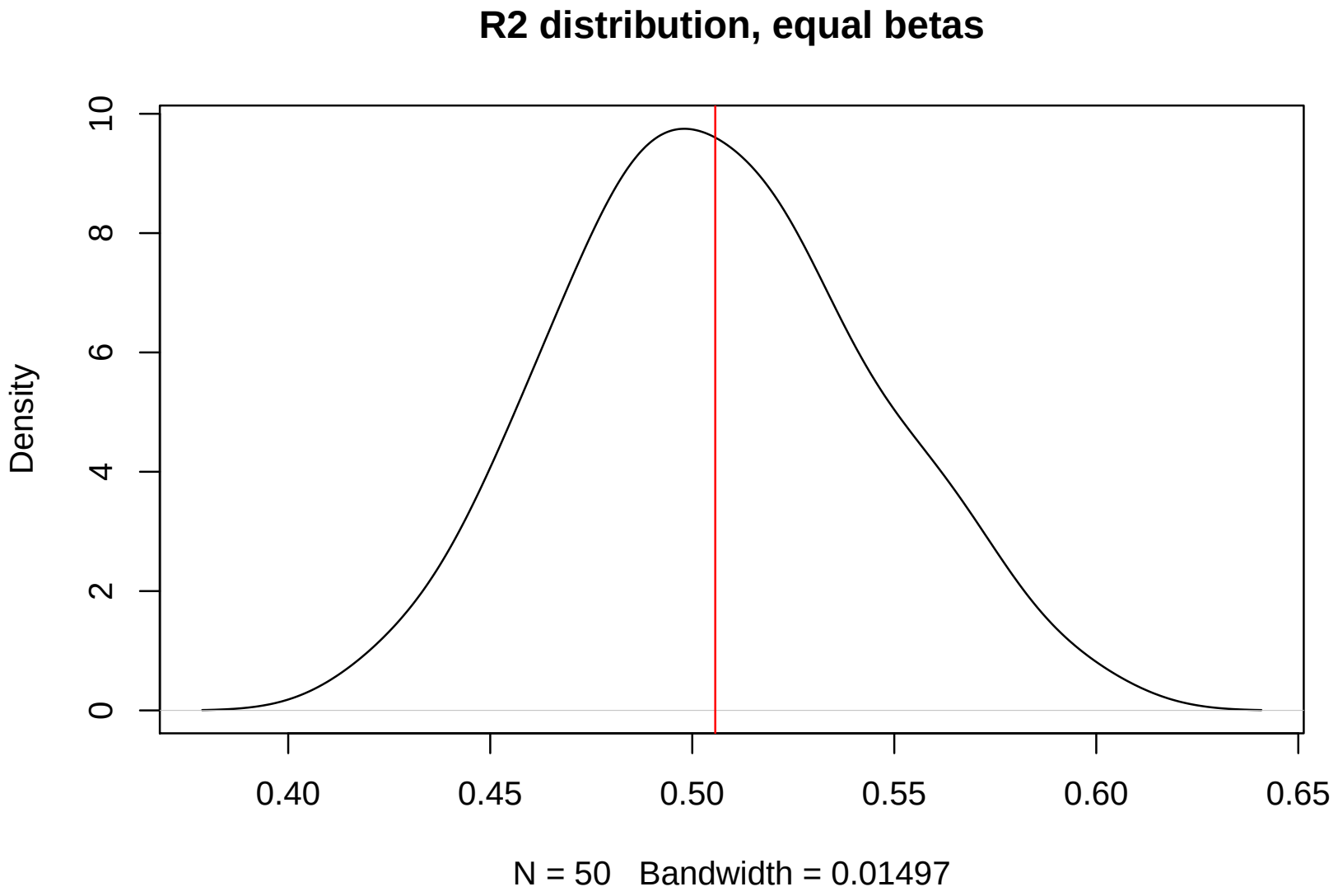
- Let us consider a 1-factor model, and set σ_i identical in the cross-section.
- The theoretical R-squared is $\mathcal{R}_i^2 = \frac{\beta_i^2 \Sigma}{\beta_i^2 \Sigma + \sigma^2}$.
- The variance in the cross-section represents the cross-sectional difference in exposures β_i to the global factor F_t.
- These differences in (sign) exposure matter!
- Because of short-selling constraints, two stocks may depend on the same factor with opposite signs which allows to construct a portfolio insensitive to this factor.

  $\Longrightarrow$ More benefits.

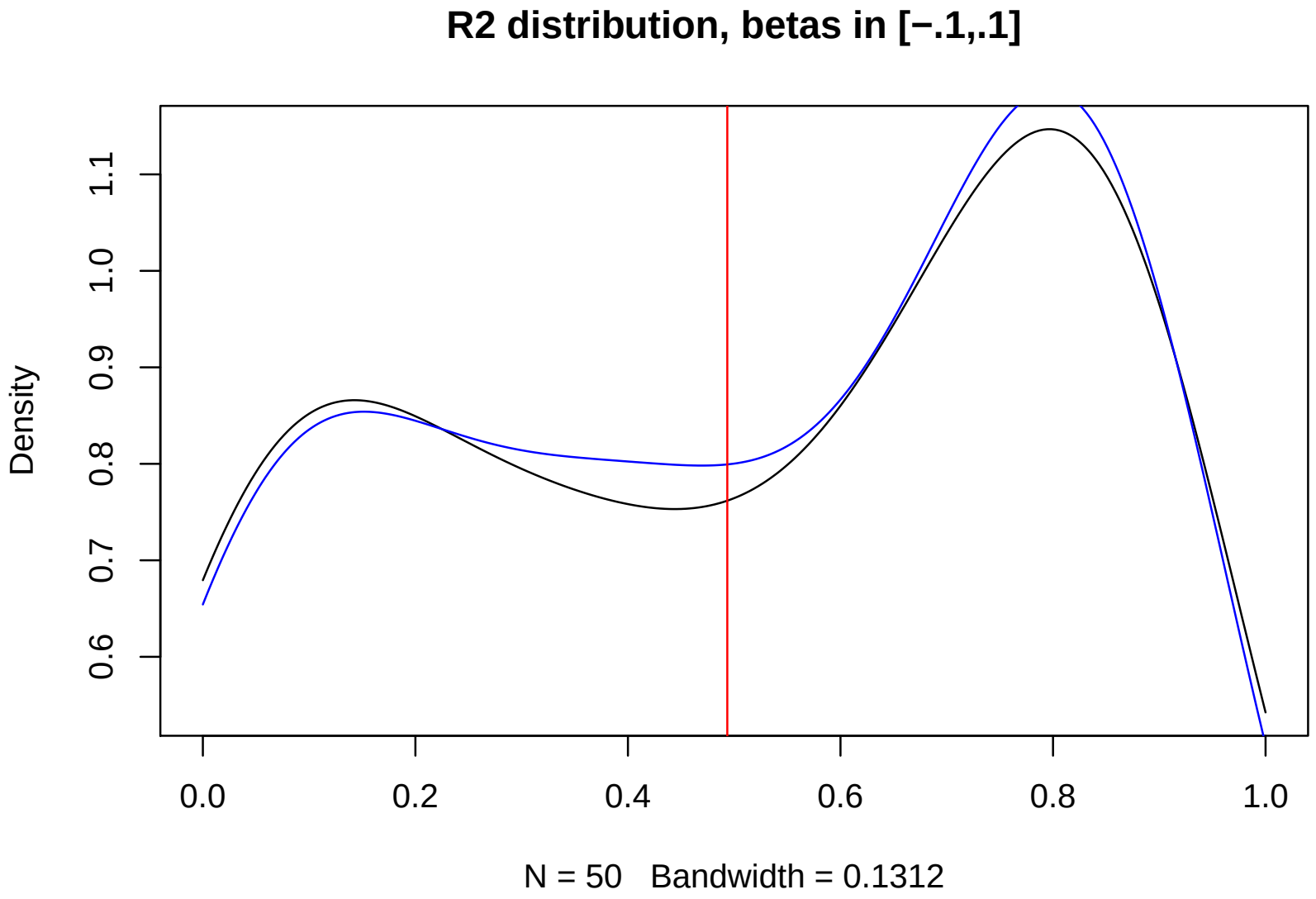
Simulation experiment

- 50 returns in the cross-section,
- 252 dates,
- one factor $F_t = \sqrt{h_t}\eta_t$, conditionally Gaussian, variance normalized to 1.
- Gaussian idiosyncratic shocks ε_t with $\sigma = .1$.

$\beta_i = .1$


R2 distribution, equal betas
Density
0
2
4
6
8
10
0.40
0.45
0.50
0.55
0.60
0.65
N = 50 Bandwidth = 0.01497

$\beta_i \in (-.1, .1)$ (blue = true)



Cross-sectional dispersion

- In the two cases you have the same average.
- But these worlds are not the same at all.
- Can the cross-sectional differences in $\mathcal{R}^2$ tell us something about integration?

Global v.s. Local factors

Main question

How do you know PCA factors are "global" instead of "local"?

- PCA will naturally pick the factors that explain most of the cross-section.
- It means that it can favor factors that explain only clusters of the data.
- I wouldn't be surprised if you have equity, fixed income, and real estate distinct factors.
- But also **geographic factors**!

  $\Longrightarrow$ It is important to check the loadings spitted out of the PCA!

Simulation experiment

- 50 returns in the cross-section,
- 252 dates,
- Two factors $F_t = \sqrt{h_t}\eta_t$, conditionally Gaussian, variance normalized to 1.
- Gaussian idiosyncratic shocks ε_t with $\sigma = .1$.
- Half of the returns depend on the **global** factor :

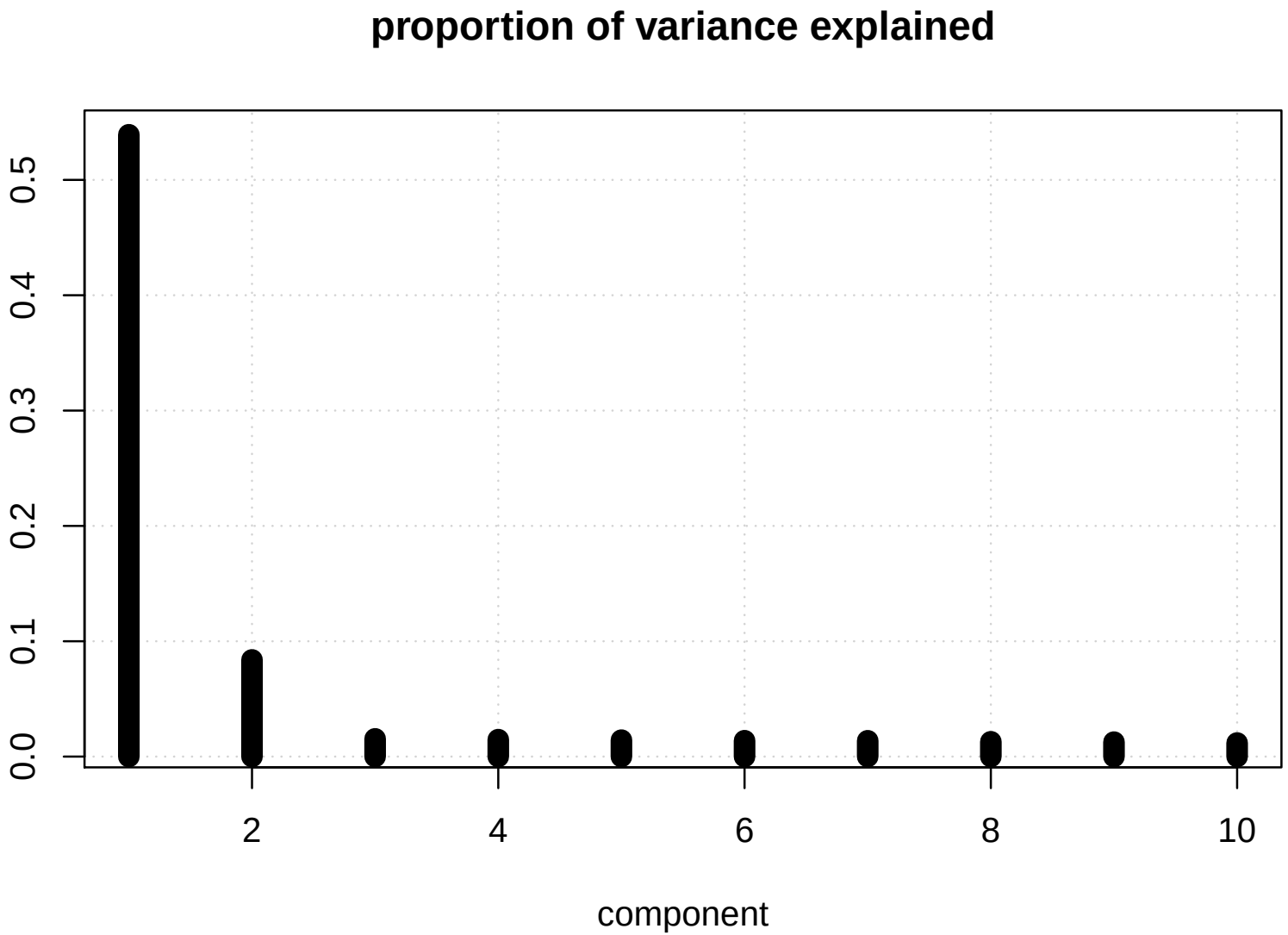
$$R_{i,t} = \beta_i F_{g,t} + \varepsilon_{i,t} \, .$$

- Half of the returns depend on the global and the **local** factor:

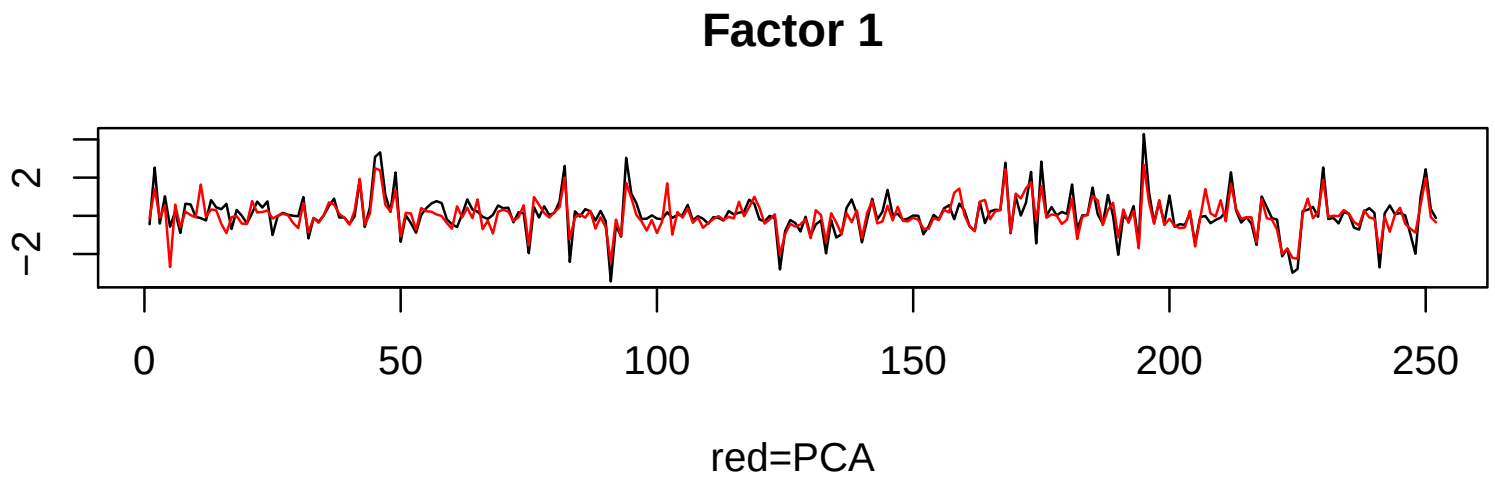
$$R_{j,t} = \beta_{g,j} F_{g,t} + \beta_{\ell,j} F_{\ell,t} + \varepsilon_{i,t} \, .$$

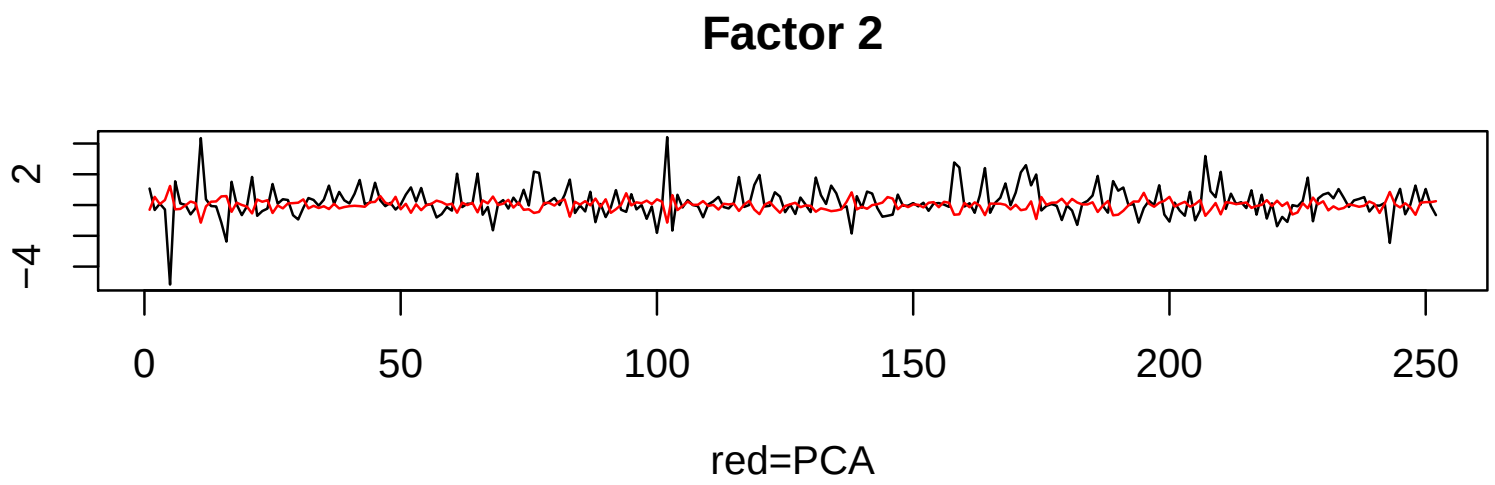
- The econometrician does **not know** the number of factors.

Recovering the factors (1/2)

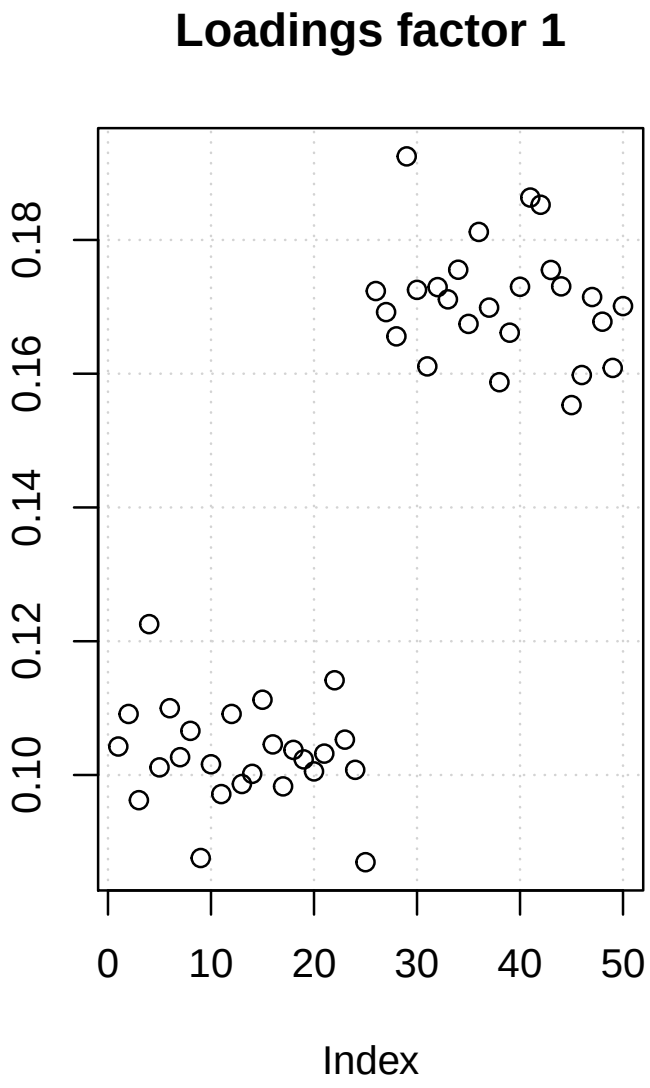


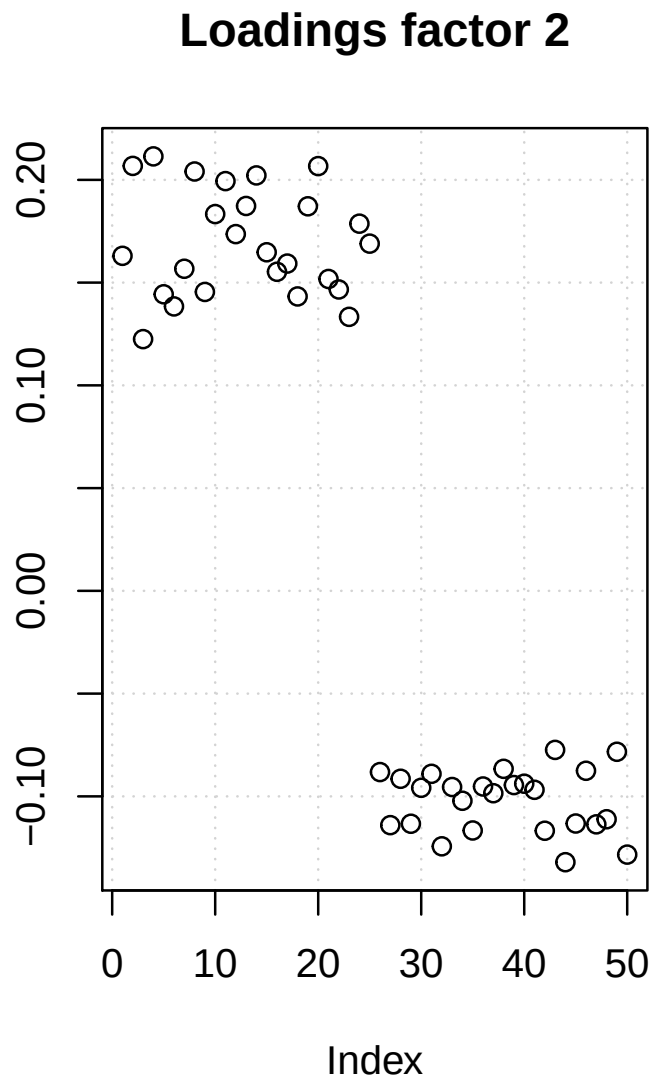
Recovering the factors (2/2)





A deeper analysis





Factor selection

Main question:

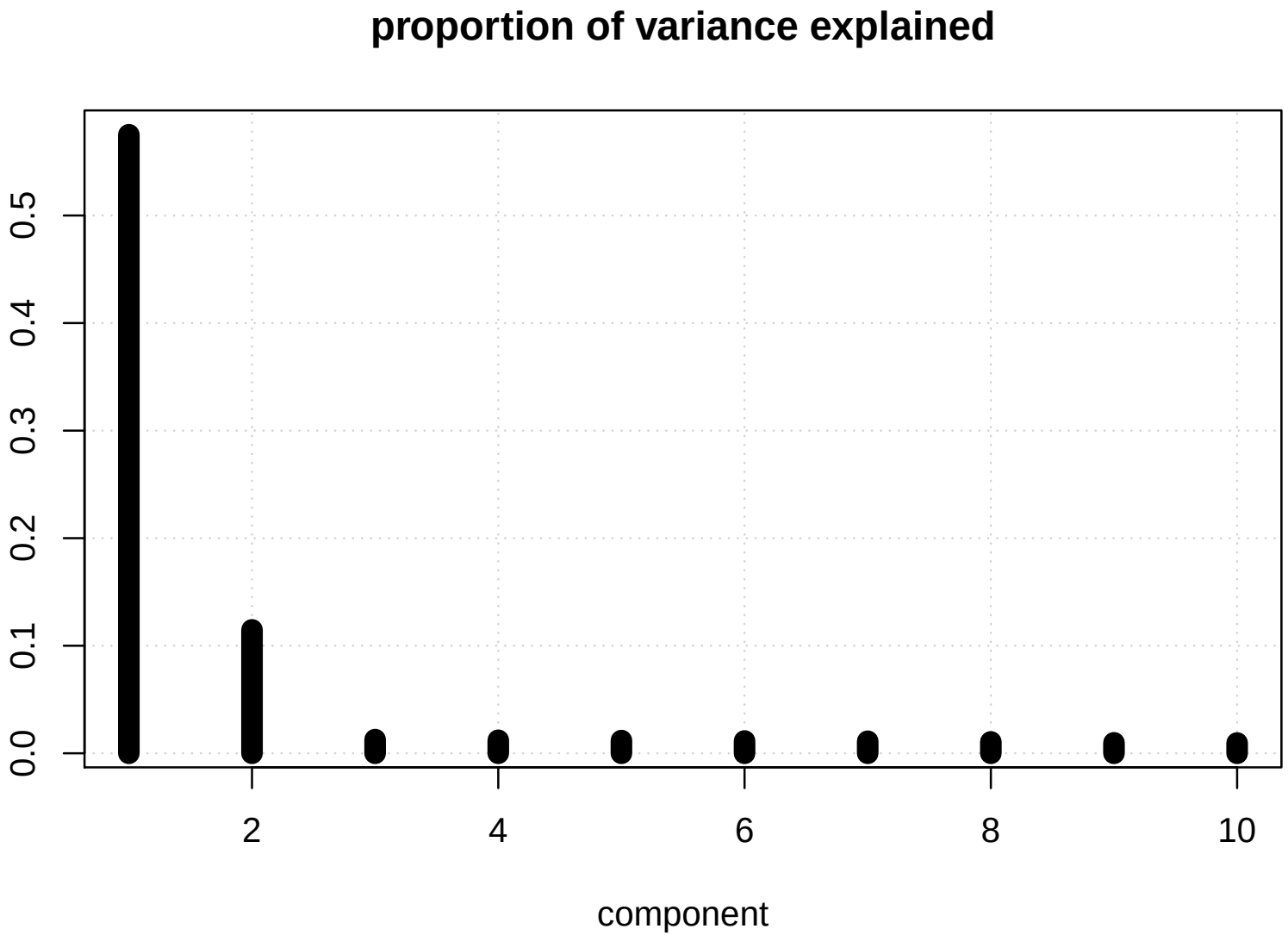
How many PCAs should you include and how should you select them?

- The authors pick 16 PCAs. why?
- Are these PCA local or global factors?
- There is a literature in inference and picking the number of PCAs in an approximate factor model: Bai & Ng (2013), **Moench, Ng & Potter (2013)**, Onatski (2009-2015), etc.
- This could help you robustify the analysis with respect to the number of factors.

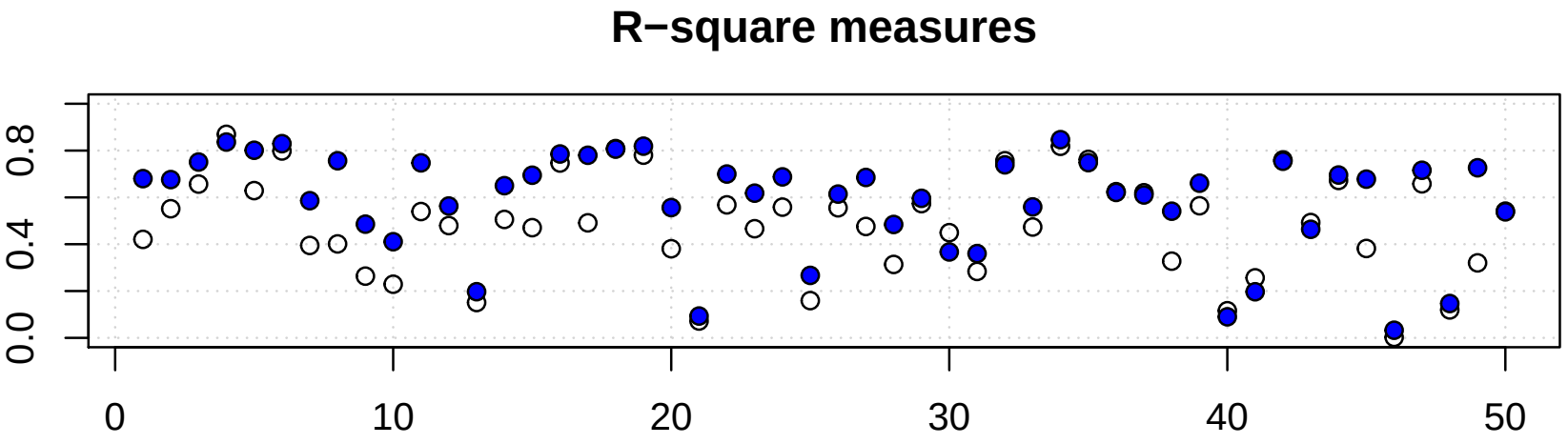
Simulation experiment

- 50 returns in the cross-section,
- 252 dates,
- Two factors $F_t = \sqrt{h_t}\eta_t$, conditionally Gaussian, variance normalized to 1.
- Gaussian idiosyncratic shocks ε_t with $\sigma = .1$.
- All returns depend on all factors.
- All betas are drawn from $\mathcal{U}(0, .2)$.
- The econometrician does **not know** the number of factors.

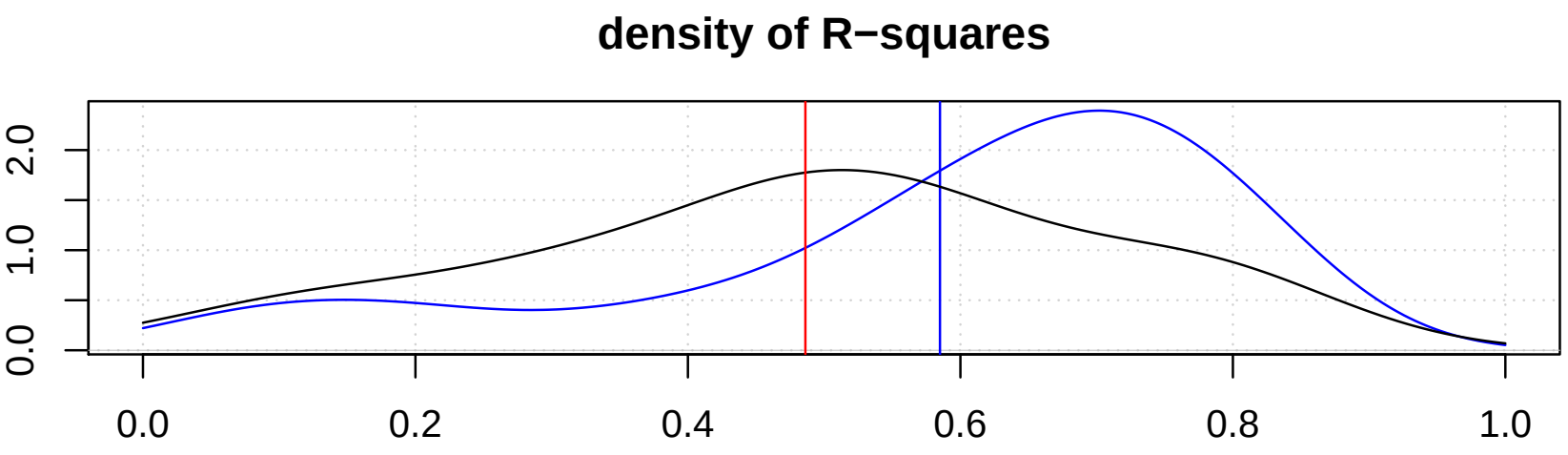
Variance explained



Keeping one factor only

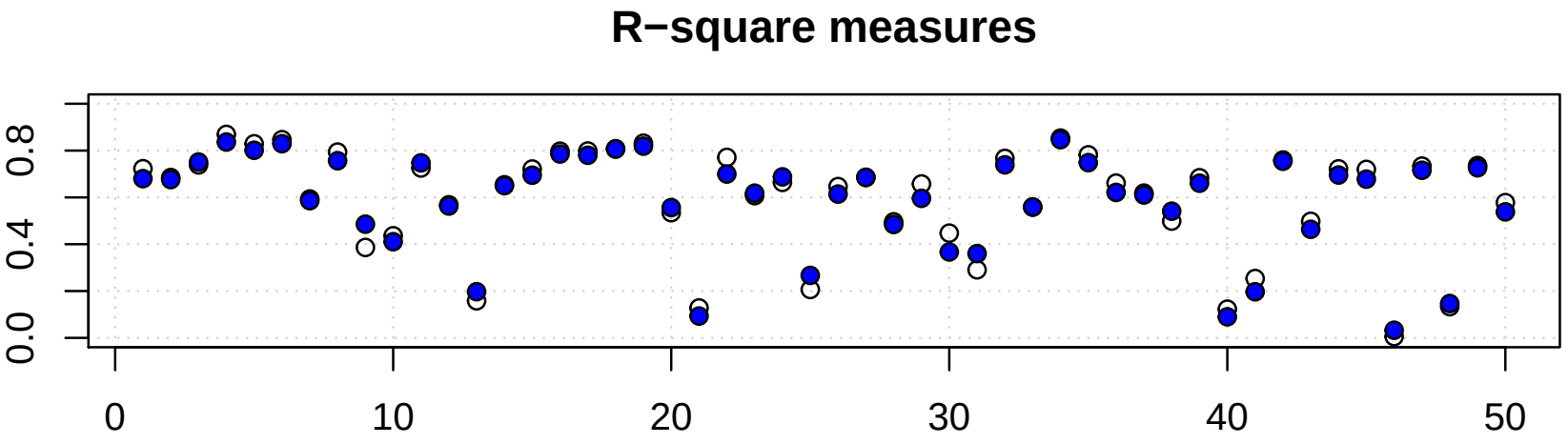


blue = true, black = 1fac

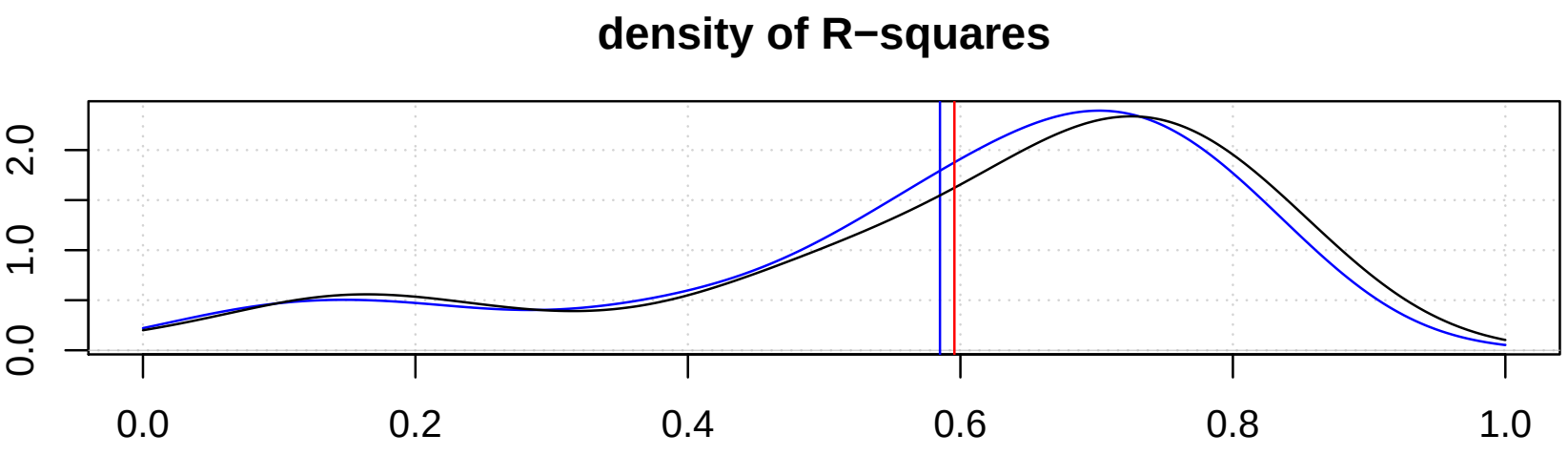


blue = true

Keeping two factors

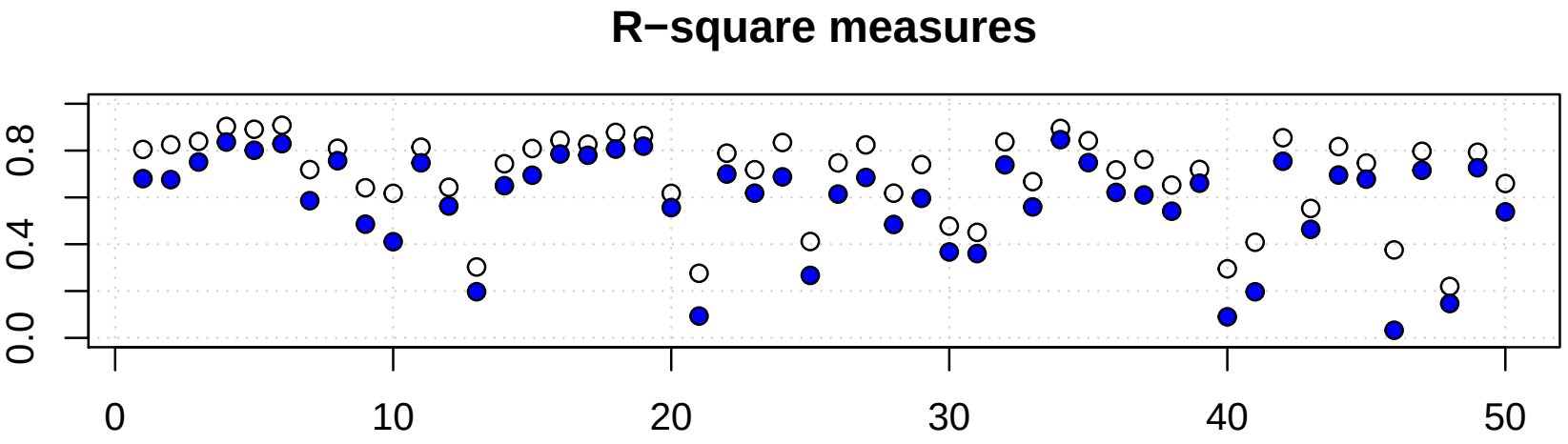


blue = true, black = 2fac

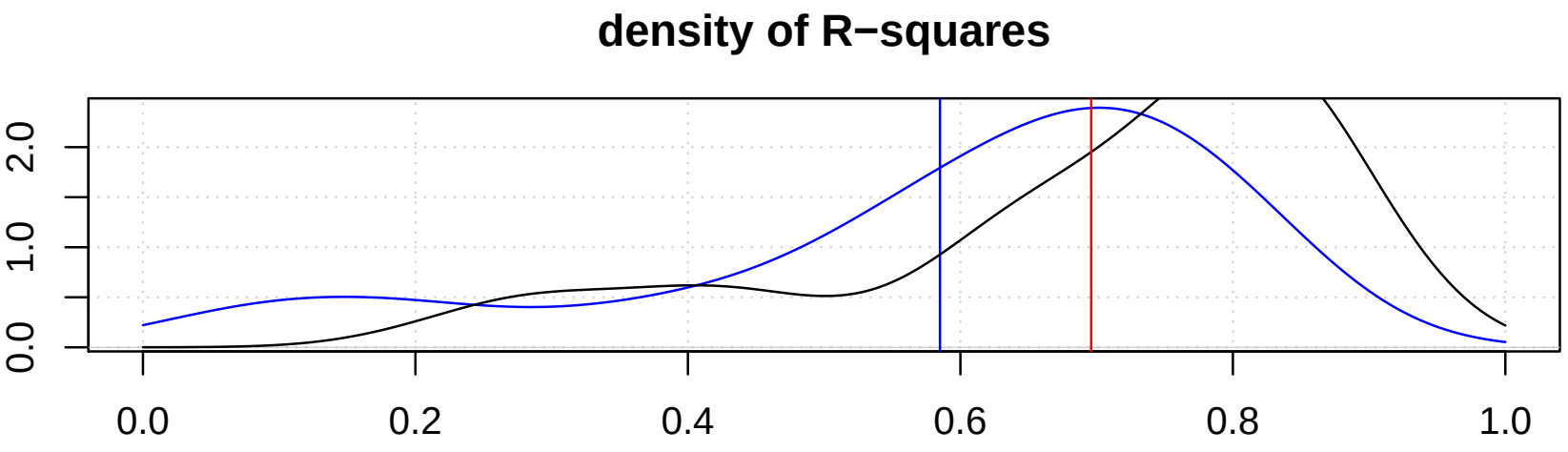


blue = true

Keeping ten factors



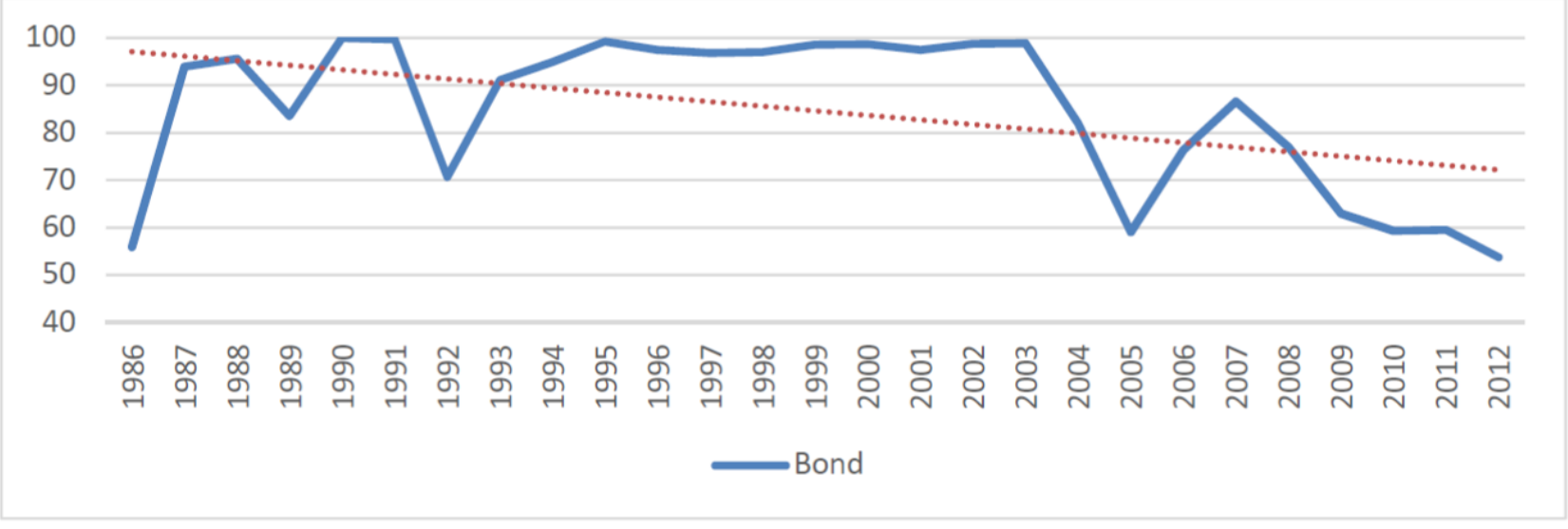
blue = true, black = 10fac



blue = true

Performance and finite distance inference

- Because there is embedded estimation and approximate factor structure, there is a lot of **parameter uncertainty**.
- Can the authors present confidence bands around their estimates of $\mathcal{R}^2$ and trends?



Treatment of bonds in the data

- On of the novelties of the paper is to include a wider class of assets such as fixed income.
- I did not quite get how the authors are treating bond data:
  - 5y constant maturity bond yield?
  - closest to 5y maturity traded bond?
  - log-change of 5y constant maturity bond yield?
  - excess returns on the 5y bond yield for a certain holding period?
- The first or last are probably the most sensible things to do.
- The first will give you an approximation of 1y sovereign yields, the return of a buy-and-hold position on a sovereign bond.
- The last will give you a ex-ante unknown return comparable to those of stocks, and I suggest a 1y holding period.
- Another possibility is to use a level factor.

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Regression results

- One result is that the variable *Secular trends in the use of telecommunications and related technology* is significant for explaining the downward trends in diversification opportunities.
- "*a 1 percent increase in global internet diffusion is associated with a 1.7 percent decline in diversification potential*".

Main Question

What is the economic story behind this? How does more communication translate into more "asset connectedness"? Is it a systemic risk story?

Thank you! תּוֹדָה רַבָּה