Forecasting U.S. recessions with a large number of predictors

Shuting Chen

MACSS Project Proposal
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Introduction - Motivation of the project

- **Predicting recessions using probit models**
  - Estrella and Mishkin (1998) predict the recession indicator y_t with a static probit model
  - Kauppi and Saikkonen (2008) propose the dynamic autoregressive specification
    - Improve the forecasting performance by including lags of π_t, the usual probit latent variable
    - Only use interest rate spread as the driving predictor
    - Use the same variables for different forecasting horizons
- **Using a large panel of predictors**
  - Stock and Watson (2002) forecast real-valued economic activities with a large set of predictors
  - Chen, Iqbal, and Li (2011) demonstrate that including principal components improves dynamic probit models for predicting recessions

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Introduction - Purpose of the project

- Extend Kauppi and Saikkonen's (2008) dynamic autoregressive probit model by
  - replacing the interest rate spread with a few factors or predictors selected from a large panel of predictors
  - augmenting nonlinearity with factors selected from a pool set of predictors and their squares
- Ideal contributions:
  - Identify most informative predictors/factors
  - Understand whether the selected predictors/factors are horizon specific

Models

- **How to predict the probability of recessions occurring at time t?**
  - y_t - recession indicator, having a Bernoulli distribution with conditional probability p_t
  - Using probit model: $\Phi(\pi_t) = p_t$
  - Model specification:

$$\pi_t = \omega + y_{t-1}\alpha + \pi_{t-1}\delta + f'_{t-1}\beta$$

  - How to determine f_{t-1}?
    - Option 1: factors extracted from a large set of predictors by principal component analysis
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Estimation and forecasting

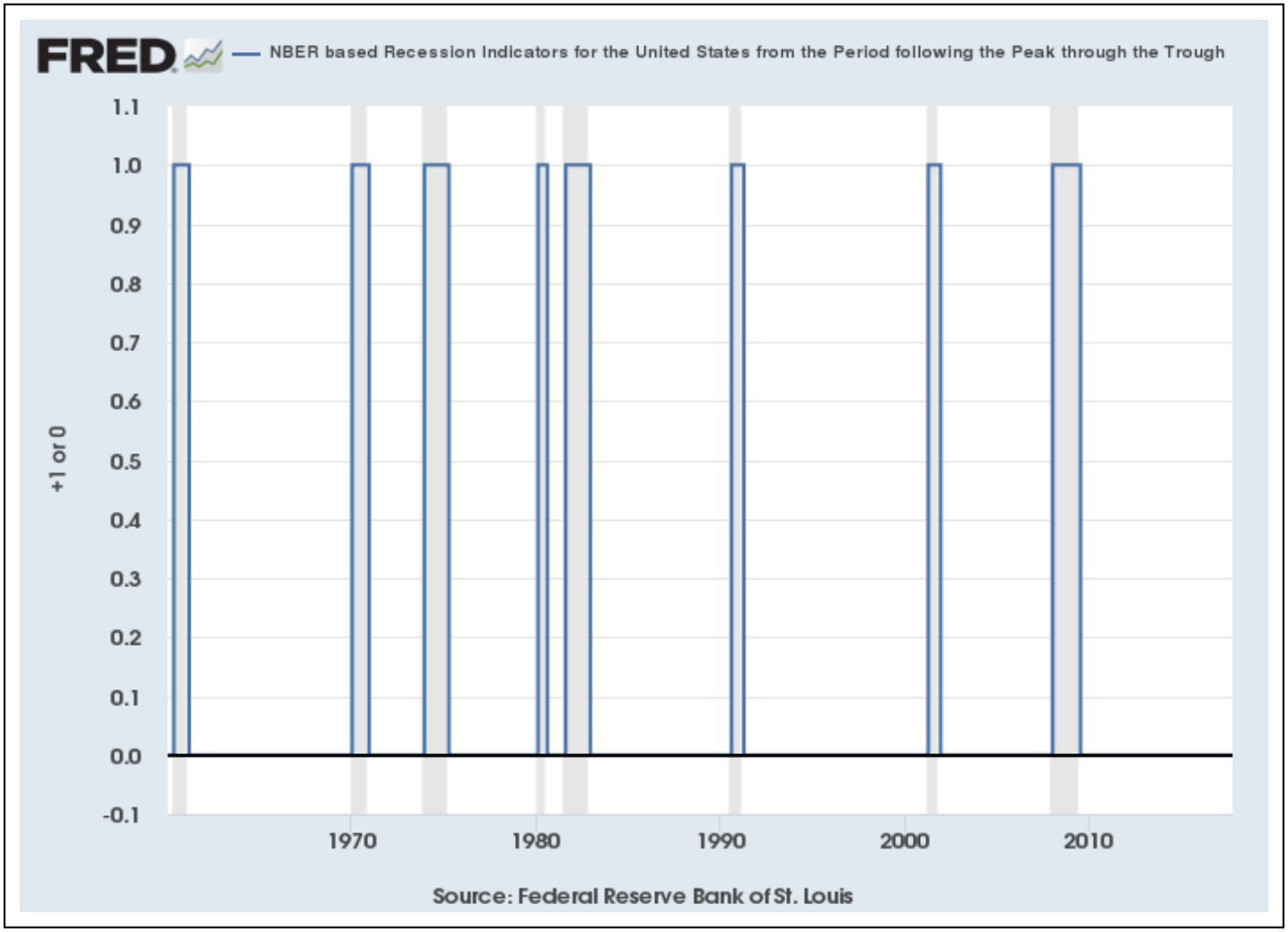
- Estimate parameters, $\theta = \left(\omega, \alpha, \delta, \beta', \pi_0\right)'$ in the specification of π_t, by maximum likelihood estimation
- Forecasting procedures
  - Forecasting horizons: h = 3, 6, 12 months ahead
  - Direct approach vs iterative approach
    - Iterative approach: need to consider every possible path of y_t through the $h-1$ months
    - Potential drawbacks

Data description

Use data from two different sources

- U.S. business cycle expansion and contraction dates announced by NBER
  - The first month following a peak month defines the first recession month
  - The last month of a trough defines the last recession month
- Monthly frequency macroeconomic series from FRED-MD
  - disposed by McCracken and Ng with the data desk at the Federal Reserve Bank of St. Louis
  - including 123 variables over 1960:M1 to 2017:M10
  - covering macroeconomic and financial series such as real activity indicators, interest rate indices and price indices

Data Figure - U.S. Business Cycle Dates by NBER



Data Table - Interest and exchange rates

Table 1: Summary Statistics for 10 Predictors
Classified as Interest and Exchange Rates

Fred	Description	Mean	S. D.
FEDFUNDS	Effective Federal Funds Rate	5.1085	3.6843
CP3Mx	3-Month AA Financial Commercial Paper Rate	5.2132	3.4627
TB3MS	3-Month Treasury Bill	4.6322	3.1724
TB6MS	6-Month Treasury Bill	4.7704	3.1582
GS1	1-Year Treasury Rate	5.1491	3.3706
GS5	5-Year Treasury Rate	5.8484	3.0684
GS10	10-Year Treasury Rate	6.1815	2.8436
AAAFFM	Moody's Aaa Corporate Bond Minus FEDFUNDS	2.0696	1.9733
BAAFFM	Moody's Baa Corporate Bond Minus FEDFUNDS	3.0836	2.0758
TB3SMFFM	3-Month Treasury C Minus FEDFUNDS	-0.4764	0.7146