1. Classify a model from a journal

(i) https://www.aeaweb.org/articles?id=10.1257/aer.20131193

(ii) Jurado, Kyle, Sydney C. Ludvigson, and Serena Ng. 2015. "Measuring Uncertainty." American Economic Review, 105 (3): 1177-1216.

(iii) Write down the mathematical or statistical model

(a) Uncertainty: common variation in the unforecastable components of macroeconomic indicators.

$$U_{jt}^{y}(h) = \sqrt{E[(y_{jt+h} - E[y_{jt+h}|I_t])^2|I_t]},$$

where y_{jt+h} is h-period ahead uncertainty, $U_{jt}^{y}(h)$ is the conditional volatility of the purely unforecastable component of the future value of the sereis, and the expectation is taken with respect to information I_t available to economic agents at time t.

(b) Macroeconomic uncertainty: aggregating individual uncertainty.

$$U_{t}^{y}(h) = E_w[U_{jt}^{y}(h)].$$

(c) Set of factor augmented regression.
This will replace the conditional expectation in i by a forecast.

$$y_{jt+1} = \phi_j^y(L)y_{jt} + \gamma_j^F(L)\hat{F}_t + \gamma_j^W(L)W_t + v_{jt+1}^y,$$

where $v_{jt+1}^y = \sigma_{jt+1}^y \epsilon_{jt+1}^y$ with $\epsilon_{jt+1}^y \sim^{iid} N(0,1)$ and

$$log(\sigma_{jt+1}^y)^2 = \alpha_j^y + \beta_j^y log(\sigma_{jt}^y)^2 + \gamma_j^y \eta_{jt+1}, \quad \eta_{jt+1} \sim^{iid} N(0,1)$$

$\hat{F}_t$ is introduced in the following factor structure and W_t consists of squares of the first component of $\hat{F}_t$ and factors in X_{it}^2 collected into the $N_G \times 1$ vectors $\hat{G}_t$ and X_{it}will be introduced in the following factor structure.

(d) Dynamic Factor Structure
$\mathbb{X}_t = (X_{1t},...,X_{Nt})'$ denote the predictor available for analysis and assume X_{it} has a following approximate factor structure

$$X_{it} = \Lambda_i^{F'} F_t + e_{it}^X$$

,where 12 forecasting factors F_t is chosen for the combined datasets $X^m$and X^f where each are 132 moslty macro economic time series variables and 147 financial time series variables respectively. The factors in the forecasting equation are estiamted by the method of static principal components (PCA).

(e) Vector Autoregression (VAR) model

$$X_t = \sum_{i=1}^{p} A_i X_{t-i} + e_t, \quad E(e_t e_t') = \Omega$$

where $p = 12$ and 11 macro variables X=(log(IP),log(employment),log(real consumption),log(PCE deflato

(iv) List which variables are exogenous and endogenous
In this article, since it focuses on predictor and dynamics relying on its past activity, there are all endogenous.

(v) Classify the model as static vs dynamic, linear vs nonlinear, deterministic vs stochastic

(a) Uncertainty: Deterministic static nonlinear model

(b) Macroeconomic uncertainty: Deterministic static linear model

(c) Set of factor augmented regression: Stochastic Dyamic nonlinear model

(d) Factor Structure: Stochastic Dynmaic linear model

(e) VAR model: Stochastic Dynamic Linear model

(vi) List a vriable or feature that you think the model is missing that might be valuable
Possible to make macro variables and financial variables separate to do analysis. By relying on financial variable that has more frequent time window, I think researchers can try to calculate real time uncertainty in daily basis or in realtime.

2. Make your own model

(i) Write down a model of whether someone decides to get married
Here, we will use logistic regression model. Probability of getting married,

$$p = pr[y = 1|x] = F(x'\beta)$$
$$(By\, logit\, model) = \frac{exp(x'\beta)}{1 + exp(x'\beta)}$$

where $F(x'\beta)$ is the cdf of the logistic distribution. The predicted probabilities are limited between 0 and 1.

(ii) Explanatory variables are as follows (explanation on the right side):

$$x' = \begin{pmatrix} \text{age.husband} \\ \text{age.wife} \\ \text{age.first.dating*dating.duration} \\ \text{income.husband} \\ \text{income.wife} \\ \text{wealth.parent.husband} \\ \text{wealth.parent.wife} \\ \text{education.husband} \\ \text{education.wife} \\ \text{number of shared habits} \end{pmatrix}' =$$

(iii) How could you do a preliminary test whether your factors are significant in real life?

Jurado et al create an alternative measure of uncertainty based on the common volatility of forecast misses in a large number of economic series. Unlike other measures, their measure of uncertainty captures whether the economy has become more or less forecastable, rather than more or less volatile. Jurado et al argue that this notion of uncertainty is a better prodxy because predictability,

not dispersion, matters for economic decision making. Jurado et al find that their measure differs substantially from other commonly used measures of uncertainty - uncertainty epsiodes are much less frequent, but more persistent, than other measures imply.

Jurado et al derive uncertainty measures from common variation in the unforecastable components of macroeconomic indicators.

Is uncertainty another potential driver of growth and cycles?

Interested in econometric studies on measuring uncertainty and its effects on the economy, starting with the seminal paper by Bloom. A common denominator of most of the contributions in the literature is the fact that a measure of uncertainty is estimated in a preliminary step and then used as if it were an observable data series in the subsequent econometric analysis of its impact on macroeconomic variables.

- ▷ Bloom - VIX
- ▷ Basu and Bundick - VXO
- ▷ Bachmann - The disagreement in business expectations
- ▷ Jurado - An average of the volatilities of the residuals of a set of factor augmented regressions
- ▷ Jo and Sikkel - the common factor in the forecast errors resulting from the use of SPF forecasts for a few variables
- ▷ Baker, Bloom - index based on newspapers coverage
- ▷ Gilchrist - a sequence of estimated time fixed effects capturing common shocks to firm specific idosyncratic volatilities.

They all then include their preferred uncertainty measure, together with a small set of macroeconomic variables, in a VAR model and compute the responses of the macro variables to the uncertainty shock. While such an approach has the merit of bringing to the fore the effects that uncertainty can have on the macroeconomy, the fact that the uncertainty measure is not fully embedded in the econometric model at the estimation stage inevitably complicates the task of making statistical inference on its effects.

JLN Approach,

individual measures of uncertainty are built for each variable, using an augmented factor model for each variable assuming that uncertainty does not affect the conditional mean. In the second step, the aggregate uncertainty measure of uncertainty is formed as an average of the individual estiamtes obatined in the first step. In the third step, the uncertainty estimate is treated as data and inserted into a separate small VAR to compute its effects on the macroeconomy. This approach rules out an assessment of the uncertainty around uncertainty in conducting inference on uncertainty's macroeconomic effects.

... Aiming to overcome these shortcomings, a new branch of the literature has emerged, which proposes to measure uncertainty only after removing the forecastable component of the series. In this line, the work of JLN provides estimates of uncertainty using a data-rich environment, which comprises 132 macro-series and 147 financial series with a monthly frequency, ranging from 1960 to 2011. They approach uncertainty as the average across the conditional stochastic volatilities of the

estimated forecasting error in a dynamic factor model. Being the 132 macro series the forecasted objects, they use the first twelve principal components of the 279 series as forecasting variables, together with their squares, their lags (and lags of the forecasted variables) and other external information7 . They use forecast horizons of 1, 3 and 12 moths in their final estimations.

The first point is important because given the notion of uncertainty, which is inherently related to unexpected variations of the series, it is very appealing first to discard the pureforecastable component of the variables before computing any uncertainty measure. In the context of a dynamic factor model, the forecastable variation is understood as the common variation of the series. This first step is closely related to the proposals of JLN and Gilchrist et al. (2014).