Final Project

Time Varying Linear Regression on Price of Apartment in Korea

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1. Motivation

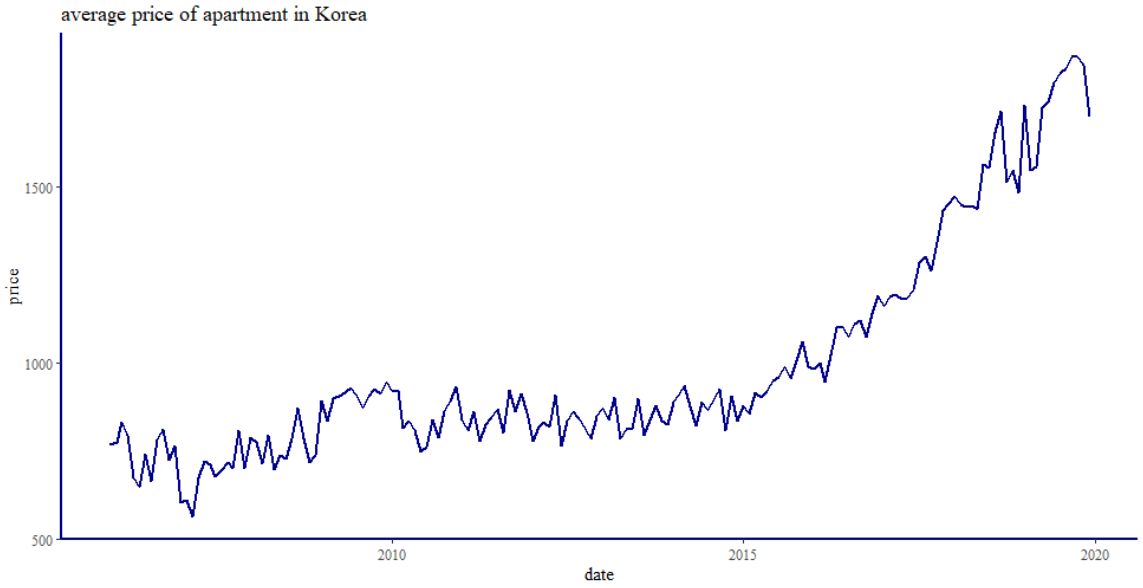
Paint a picture for you and me on the days when we were young

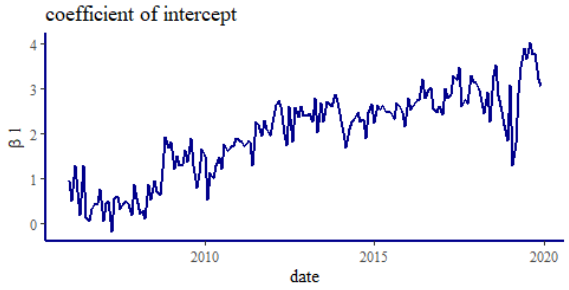
Forecasting price of apartment

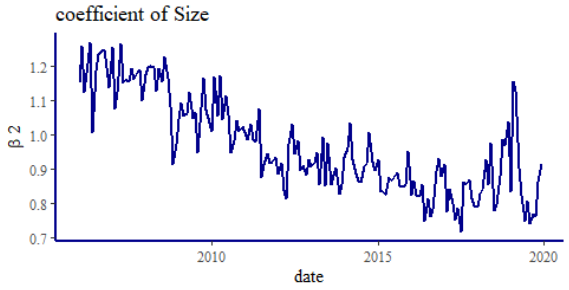
- Personal interest
- Increasing trend in average housing price
- Goal: Predicting accurate housing price of future time point.

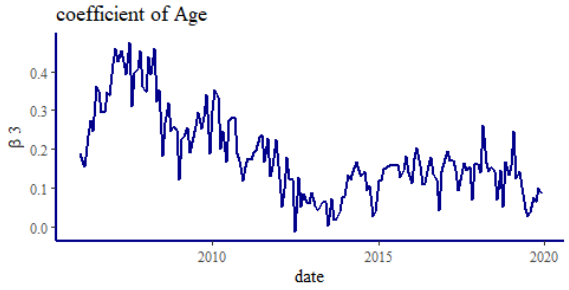
Changing Relationship

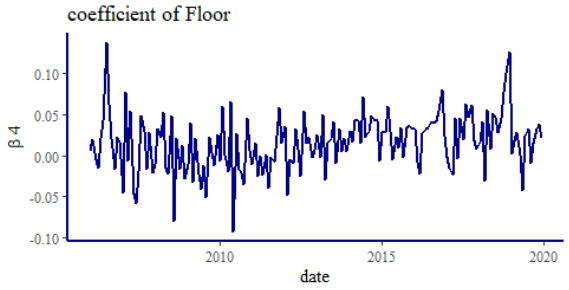
- People's preference
- Economic or social circumstance











2. Model

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Model structure

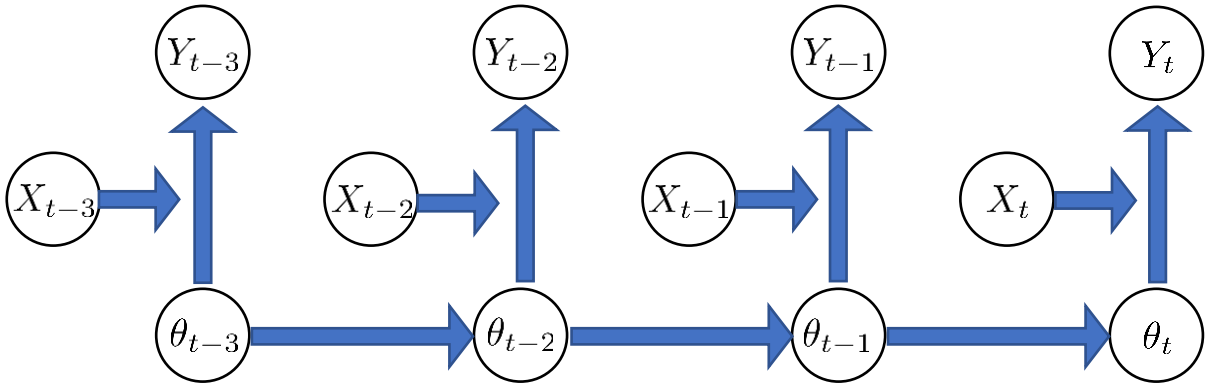
$$Y_t = X_t\beta_t + \epsilon_t \quad where\ \epsilon_t \sim N(0, \nu_t I_{O_t})$$

$$\beta_t = F\theta_t$$

$$\theta_t = G\theta_{t-1} + w_t \quad where\ w_t \sim N(0, \frac{\nu_t}{s_{t-1}} W)$$

Description	Dimension
Y_t: Log(price) vector	$O_t \times 1$
X_t: Predictor variable matrix	$O_t \times q$
β_t: current regression coefficents	$q \times 1$
θ_t: vector of coefficients p-1$\sim$ t	$pq \times 1$
G: VAR(p) coefficient matrix of θ	$pq \times pq$
F: Matrix select current β	$q \times pq$

Graphical model



3. Assessment

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Model comparison

$$\theta_t = \theta \qquad \text{(static)}$$
$$\theta_t = \theta_{t-1} + w_t \qquad \text{(random walk - time varying)}$$
$$\theta_t = G\theta_{t-1} + w_t \qquad \text{(VAR(1) model)}$$

Criterion

- Model quality

$$\text{AIC} = \text{-2deviance} + 2\text{q}$$

- Prediction performance

$$\text{MSE} = \sum_{h=1}^{3}(Y_{t+h} - X_{t+h}m_{t+h})^2/O_{t+h}$$

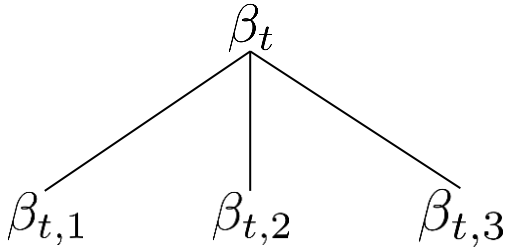
$$\text{Coverage} = Pr(Y_{t+h} \in (L_{t+h}, U_{t+h}))$$

Future topic

- Dynamic Latent factor model

$$\text{Macroeconomic factors}$$

- Hierarchical Dynamic linear model



Q&A