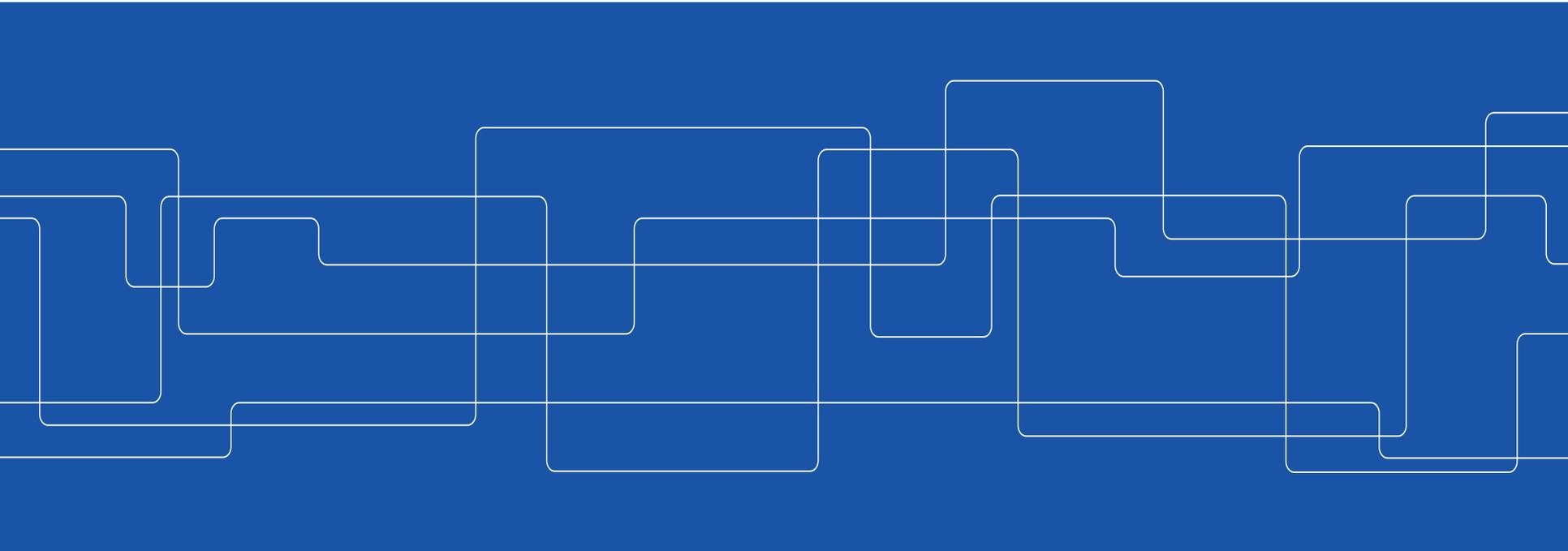




Energy Statistics & Forecasting

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Econometric Modeling

The Non-Econometrician's Lament"

Sir Dennis Robertson (1955)

- As soon as I could safely toddle
- My parents handed me a Model.
- My brisk and energetic pater
- Provided the accelerator.
- My mother, with her kindly gumption,
- The function guiding my consumption;
- And every week I had from her
- A lovely new parameter,
- With lots of little leads and lags
- In pretty parabolic bags.
- With optimistic expectations
- I started on my explorations,
- And swore to move without a swerve
- Along my sinusoidal curve.
- Alas! I knew how it would end:
- I've mixed the cycle and the trend,
- And fear that, growing daily skinnier,
- I have at length become non-linear.
- I wander glumly round the house
- As though I were exogenous,
- And hardly capable of feeling
- The difference between floor and ceiling.
- I scarcely now, a pallid ghost,
- Can tell ex-ante from ex-post:
- My thoughts are sadly inelastic,
- My acts incurably stochastic

STEPS IN DEVELOPING AN ECONOMETRIC MODEL

Develop a priori model

A priori analysis involves the use of judgment

A priori Analysis is the first stage towards developing an econometric model

Select data

Analyse data

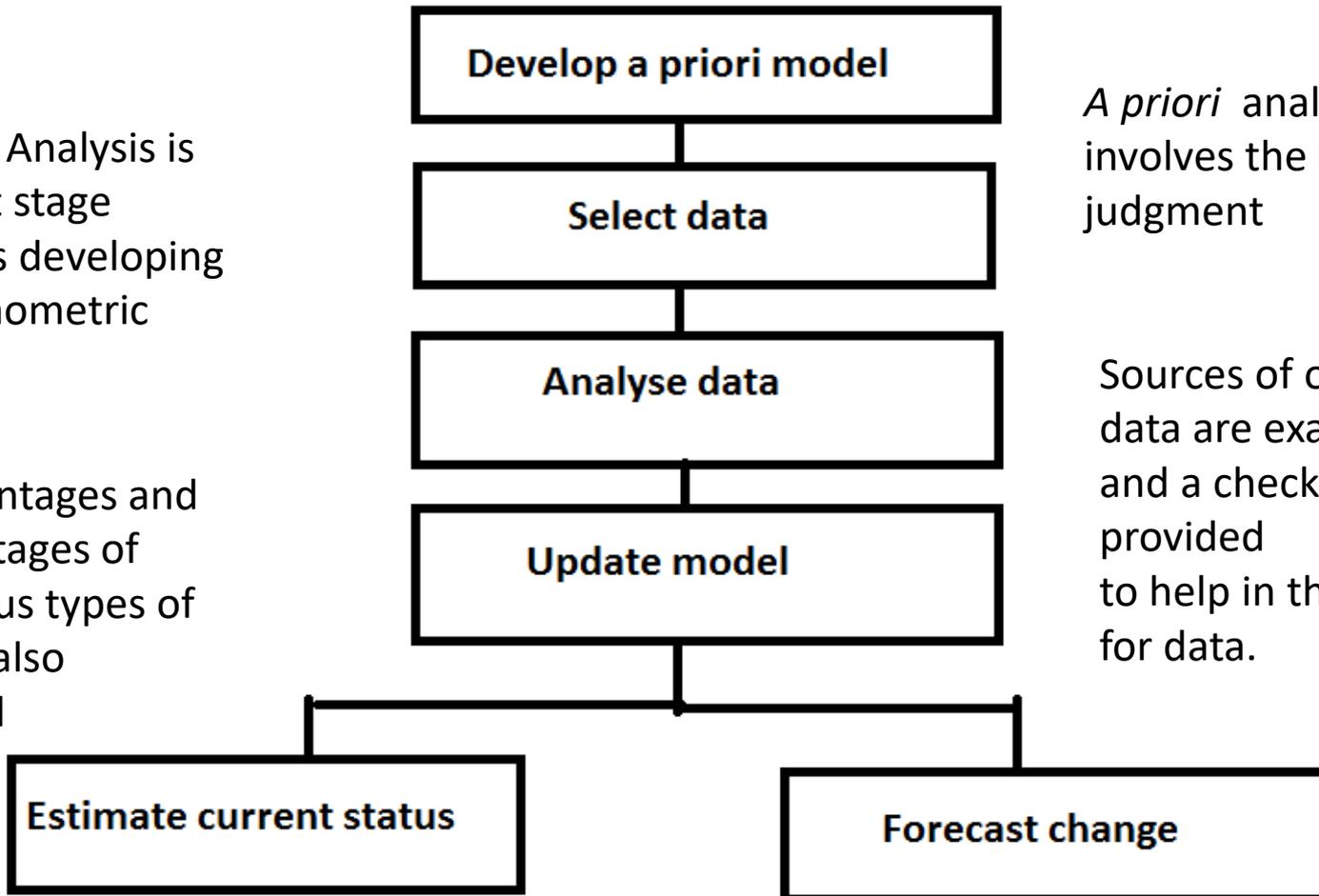
Sources of objective data are examined, and a checklist is provided to help in the search for data.

Update model

The advantages and disadvantages of the various types of data are also discussed

Estimate current status

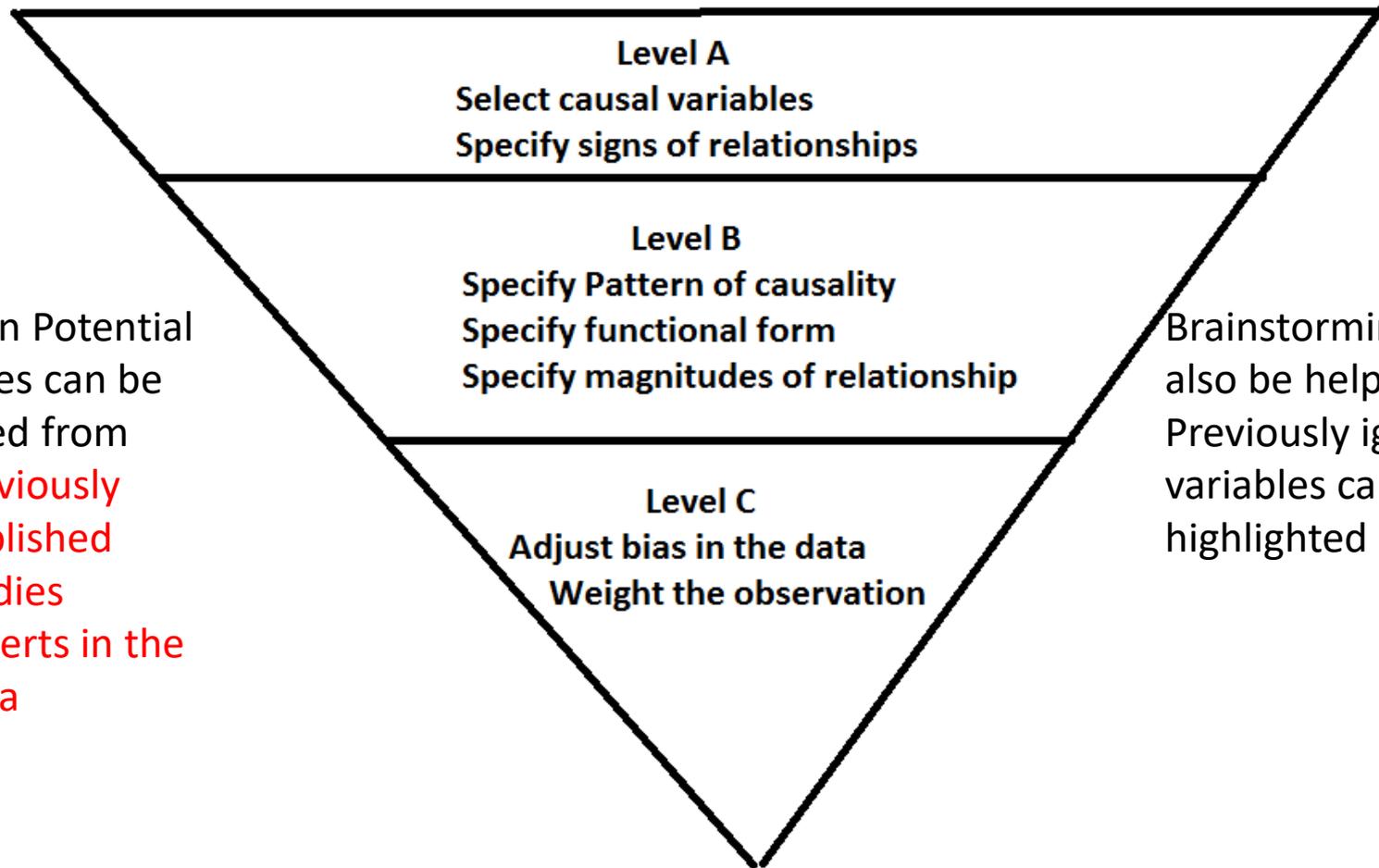
Forecast change



Conditions favoring the use of econometric models

- Three basic conditions favor the use of econometric methods.
- **ONE** and **OBVIOUS** : Good information is needed on causal relationships.
- “Good information” can come from subjective sources or from the analysis of objective data.
- **SECOND**, may be **less OBVIOUS** - condition favoring econometric methods : econometric methods are appropriate for large changes (or large differences) in the causal variables.
- For small changes, there is little reason to use econometric methods.
- **THIRD**, or set of conditions, is that the direction of changes in the causal variables can be accurately predicted, and that reasonable estimates can be made of the magnitudes of these changes.

A priori analysis in econometric methods



Ideas on Potential Variables can be obtained from

1. Previously published studies
2. Experts in the Area

Brainstorming can also be helpful. Previously ignored variables can be highlighted

Rating of the variables

- Is there a strong causal relationship (i.e., do changes in the causal variable cause substantial changes in the dependent variable)?
- Can the relationship be estimated accurately?
- Will the causal variable show a substantial amount of change in the forecast period?
- Can the changes occurring in the forecast period be forecast with fair accuracy?

Checklist for selecting variables

	Yes	No
• Is a strong causal relationship expected?	----	-----
• Can the causal relationship be estimated accurately?	-----	-----
• Will the causal variable change substantially?	-----	-----
• Can the change in the causal variable be forecasted accurately?	-----	-----

Direction of relationship

- The a priori information should be strong enough so that the analyst can state the sign of the relationship.
- Given a change in the causal variable, what will be the direction of change in the dependent variable?
- If this is not possible, then this causal variable should not be used.
- Causal chains provide an apparently useful way to decompose problems.
- Although the number of equations increases, the overall system is easy to understand.
- The results from the first equation are used as inputs to the second equation; the results from the second equation are entered into the third equation.

“Simultaneous causality”

- Simultaneous causality occurs when a causal variable, say X , causes a change in Y , and the change in Y , in turn, causes a change in X .
- For example, as the price of automobiles is lowered, sales increase; the increase in sales then permits economies of scale that allow for further decreases in price.
- simultaneous causality is represented by simultaneous equations

Functional Form

- The selection of a functional form', that is, the way the dependent variable relates to the causal variables, is of little importance for small changes.
- For large changes, however, this can become an important decision.
- Linear or Non Linear Model
- If the problem can be decomposed into equivalent statements that are "linear in the parameters" Avoid Non Linear Models

Advantages of Functional Form

- It can be made linear in its parameters.
- Use a standard regression program after taking natural logs (ln) of both sides of the equation:
- $\ln Y = \ln(a) + b_1 \ln X + b_2 \ln X^2 + b_3 \ln X$
- Often referred to as the log-log model.
- A reasonable way to represent much human behavior.
- Constant elasticities are assumed;
- A 1% change in X will lead to a given percentage change in Y, which is equal to b.
- It lends itself easily to a priori analysis because the researcher does not have to worry about units of measurement when specifying relationships.
- It often makes more efficient use of the data because it may correct for heteroscedasticity".
- In simple terms, if the errors in predicting Y are proportional to the magnitude of the X's (big errors are found when X is large), the log-log transformation will reduce the effect of these large errors.

a priori specification of magnitudes

- Information on causality is strong,
- Large changes are involved, and
- Little information is available from objective data
- When these conditions do not hold, a priori specification of magnitude is expected to be of little value
- Unity weight if no specific a priori information is available – assign equal weights

Step wise regression vs a priori model

- ONE option: skip the a priori analysis and go directly to the data.
- Why do they ignore all that good advice about a priori analysis??
- Two Reasons : Technology and Publication standard
- Reduced the cost of exploratory research by using computers
- Stepwise regression procedures allow one to search through many possible predictor variables in order to find the "best" model.
- By contrast a priori analysis is slow and subjective
- Publication practices by academic journals may also inhibit a priori analysis

Objective Data

- Objective data may be limited.
- The data may not be accurate.
- The observations may not be independent of one another. (For time series this is called autocorrelation)
- The factors may not vary. To assess relationships, it is necessary that both the dependent and the causal factors vary. The more variation there is, the easier it will be to measure the relationship.
- The causal factors should vary independently of one another. Correlation among the independent variables, called multi-collinearity, makes it difficult to determine which of the causal factors should get the credit for changes in the dependent variable.
- Multi-collinearity introduces uncertainty into the estimates of relationships.
- The measurement process may have affected the results. This is typical for data collected in organizations; the measures may become goals and cause people to act differently.

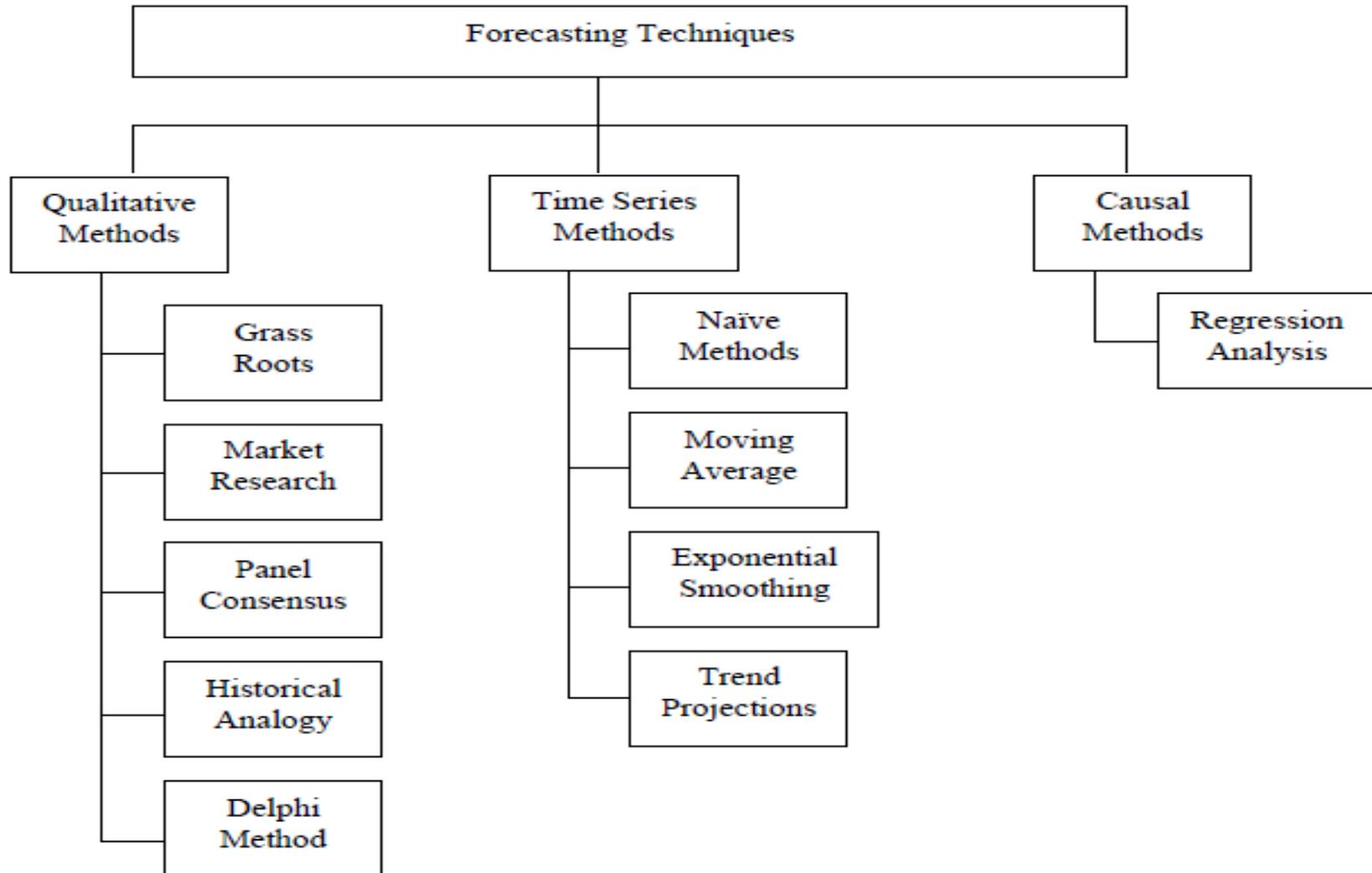
A priori analyses of the data

- Cleaning of the data
- Efforts should be made to deal with outliers, for example, and this should be done before using these data to estimate values for the forecasting model.
- The data for a given conceptual variable may incorporate variation due to other variables. For example, income estimates for a country may be unduly influenced by exchange rates or by the black market and thus may provide poor estimates of "ability to purchase."
- If you suspect such biases in the data, you can consider two strategies to compensate for them.
- One is to find alternative indicators for the same conceptual variable, and then to average these in the hope of washing out the variation due to irrelevant factors (e.g., different estimates of ability to buy should be obtained).
- The second strategy is to adjust the observations. Whether such an adjustment is useful is speculative.

Measurement errors and their consequences

- Errors can occur in either the dependent variable or the causal variables
- Presence of measurement error in the dependent variable leads to uncertainty in the estimates of the relationships
- One solution is to gain additional information on the dependent variable by finding additional observations
- When the size of the measurement error varies over the range of the independent variables (heteroscedasticity), it may be possible to obtain a more efficient estimate by the use of a transformation.
- This is a risky strategy, however, for the transformation changes the statement about the type of relationship; the relationship should be decided on the basis of the a priori analysis, not on the basis of what will provide the most reliable estimate
- Measurement error in the causal variables will increase uncertainty and lead to bias in the estimates of the coefficients

Classification of Forecasting Techniques





Thank You