Apply Statistics and Econometrics in Financial Research

Obj. of Study & Hypotheses Testing

From framework – objectives of study are needed to clarify, then, in research methodology the hypotheses testing are stated, including testing methods.

Section 1	Section 2	Section 3	Section 4	Section 5
	Lit. Rev. Framework	Methodology - Data	Results - Data - Prelim.	
Obj 1. 2.	Hypotheses 1. 2	H_0: Testing 1. 2.	H_0: Testing 1. 2.	Conclusion 1. 2.

Data Collection

Definitions of Variables

- Conceptualize vs Operationalize

Sample Selection Criteria

Source of Data

Consistency of Data

Types of Variables

Nominal Level

Ordinal Level

Interval Level

Ratio Level

Measurement Problem

Ordinal Level vs Interval Level

Describing Data or Sample

Univariate Statistical Analysis

- Frequency Table, Graph, Chart
- Mean, Median, Mode
- Max, Min, Range, Variance, SD., CV.
- Skewness, Kurtosis

Subsample Analysis

By dividing sample based on some certain criterion, subsample analyses can lead to a more clear understanding of the sample group.

Apply Statistics & Econometrics Methods

1. Objectives of Study & Hypotheses Testing
2. Hypotheses Testing
   - Univariate and Bivariate Hypothesis Testing using Basic Statistics
   - Multivariate Hypothesis Testing using Econometrics

Hypotheses Testing

Univariate & Bivariate Hypotheses Testing
- Parametric Tests
- Nonparametric Tests

Multivariate Hypotheses Testing using Econometric Technique
- Individual Test – t-test
- Overall Test – F-test – Restricted vs Unrestricted Test
- Dummy Variables Test
- Specific Test

Univariate & Bivariate Hypotheses Testing

Parametric Tests

Univariate Hypothesis Test

One-sample t-test

Bivariate Hypothesis Test

Two-sample Test
- Independent Sample t-test
- Dependent (Paired) t-test

One-way Analysis of Variance (ANOVA)

Pearson's Correlation Test

Univariate & Bivariate Hypotheses Testing

Independent Variable	Level of Measurement	Dependent Variables	Level of Measurement	Statistical Testing
-	-	Return	Interval or Ratio	One-Sample t-test
Dividend Paid 2 Groups	Nominal Independent	Return	Interval or Ratio	Independent-Sample t-test
Before-After 2 Groups	Nominal Dependent	Return	Interval or Ratio	Dependent Paired t-test
Firm Size >2 Groups	Nominal	Return	Interval or Ratio	One-way ANOVA
Risk	Interval or Ratio	Return	Interval or Ratio	Pearson's Correlation

Univariate & Bivariate Hypotheses Testing – Nonnormal or Small Sample

Nonparametric Tests

More appropriated for nonnormal distribution data or small sample case.

Nominal Data – Frequency

- Contingency Table Analysis – Chi-squared Test

Ordinal Data – Rank

Dependent Samples

- Sign Test & Wilcoxon Signed Rank Test

Independent Samples

- Wilcoxon Mann-Whitney Rank-Sum Test
- Kruskal-Wallis Test

Univariate & Bivariate Hypotheses Testing – Nonnormal or Small Sample

Independent Variable	Level of Measurement	Dependent Variables	Level of Measurement	Statistical Testing
-	-	Rating, Ranking	Ordinal to Ratio	Sign & Rank Test
Dividend Paid 2 Groups	Nominal Independent	Liquidity Ratio, Return	Interval to Ratio	Wilcoxon Test
Before-After 2 Groups	Nominal Dependent	Liquidity Ratio, Return	Interval to Ratio	Sign & Rank Test
Firm Size >2 Groups	Nominal	Liquidity Ratio, Return	Interval to Ratio	Kruskal-Wallis Test
Dividend Paid, Firm Size	Nominal	Firm Size, Industry	Nominal	Chi-square test
Rating, Ranking	Ordinal	Rating, Ranking	Ordinal	Spearman's Correlation

Multivariate Hypothesis Testing using Econometric Technique

1. Traditional Linear Regression Model
   - Overall Test – F-test
   - Individual Test – t-test
   - Test for Equality Restriction
     - Restricted Regression Test – F-test
   - Test for Stability (Structural Break)
   - Dummy Variable Technique.
2. Microeconometrics Models
3. Time Series Models

Hypothesis Testing

Basic Tests

e.g. Determinants of firms' performances

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + u_i$$

1. Select the Most Appropriated Model

Overall Test (or F-test) $H_0: \beta_2 = \beta_3 = \beta_4 = 0$

Violation of OLS Assumption

includes Multicollinearity, Autocorrelation, Heteroscasticity, Model Specification, Endogeneity problem – Robustness of the Tests.

2. Test Significant Impact of Each Variable

Individual Test $H_0: \beta_i = 0$

Hypothesis Testing

Specific Test on Certain Condition

e.g. Equality of influences of interest rate and inflation rate

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + u_i$$

Test for Equality Restriction

$$H_0 : \beta_3 = \beta_4 \ \ or \ \ (\beta_3 - \beta_4) = 0$$

e.g. Economy of Scale $Y_i = \beta_1 X_{2i}^{\beta_2} X_{3i}^{\beta_3} e^{u_i}$

$$\ln Y_i = \ln \beta_1 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + u_i$$

Test for Equality Restriction

$$H_0 : \beta_2 + \beta_3 = 1$$

Hypothesis Testing
Test for Stability

Chow Test

Whole Period $Y_t = \lambda_0 + \lambda_1 X_{1t} + \lambda_2 X_{2t} + u_t$ for $t = 1, 2, \ldots, n_1 + n_2$

Before Crisis $Y_t = \alpha_0 + \alpha_1 X_{1t} + \alpha_2 X_{2t} + u_{1t}$ for $t = 1, 2, \ldots, n_1$

After Crisis $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + u_{2t}$ for $t = n_1+1, n_1+2, \ldots, n_1+n_2$

Hypothesis

$H_0 :$ $\alpha_0 = \beta_0 = \lambda_0$

and $\alpha_1 = \beta_1 = \lambda_1$

and $\alpha_2 = \beta_2 = \lambda_2$

$H_a :$ Otherwise

$$F = \frac{(S_1 - S_2 - S_3)/k}{(S_2 + S_3)/(n_1 + n_2 - 2k)}$$

Hypothesis Testing
Test for Stability

Dummy Variables Technique

Model with Intercept and Slope Dummy Variable

$$Y_t = \beta_0 + \gamma_0 D_t + \beta_1 X_{1t} + \gamma_1 D_t X_{1t} + \beta_2 X_{2t} + \gamma_2 D_t X_{2t} + u_t$$

where: $D_t = 0$ before crisis

$= 1$ after crisis.

This model can be interpreted as:

Before Crisis: $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + u_t$

After Crisis: $Y_t = (\beta_0 + \gamma_0) + (\beta_1 + \gamma_1) X_{1t} + (\beta_2 + \gamma_2) X_{2t} + u_t$

Dummy Variable Alternative to Chow Test

Chow Test

Whole Period $Y_t = \lambda_0 + \lambda_1 X_{1t} + \lambda_2 X_{2t} + u_t$ for $t = 1, 2, \ldots, n_1 + n_2$

Before Crisis $Y_t = \alpha_0 + \alpha_1 X_{1t} + \alpha_2 X_{2t} + u_{1t}$ for $t = 1, 2, \ldots, n_1$

After Crisis $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + u_{2t}$ for $t = n_1+1, n_1+2, \ldots, n_1+n_2$

Dummy Variable Technique

Whole Period $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + u_t$

Before Crisis $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + u_t$

After Crisis $Y_t = (\beta_0 + \gamma_0) + (\beta_1 + \gamma_1) X_{1t} + (\beta_2 + \gamma_2) X_{2t} + u_t$

Dummy variable can be used as Chow Test.

Restricted F-test $H_0 : \gamma_0 = \gamma_1 = \gamma_2 = 0$

Dummy Variable Technique

Dummy variable can also be used to test whether specific event has significant impact.

e.g. Whether earning announcement has impact on stock price

Whether the protest has impact on the stock market

$$Y_t = \beta_0 + \gamma_0 D_t + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + u_t$$

where: $D_t = 0$ for normal period

$= 1$ for event period

Individual Test $H_0 : \gamma_0 = 0$

Dummy Variable Technique

Weekend Effect and Reverse Weekend Effect on Thai Stock Market

RQ: Whether there exists evidences of weekend and reverse weekend effect and impacts of firm size on the weekend effect and the reverse weekend effect.

Objectives:

- To examine the evidence of weekend effect and reverse weekend effect in Thailand.
- To examine the degree to which the reverse weekend effect are related to firm size.

Weekend Effect

Definition

Weekend Effect -- Different Return on Monday

Reverse weekend effect -- Different Return on Friday

1st Obj. Hypothesis Testing

H_{0i}: Excess Return Each Day = 0

Where i = 1 for Monday, 2 Tuesday, 3 Wednesday, 4 Thursday, and 5 Friday

These hypotheses can be tested by using One-sample t-test for each day.

If reject H_0, it means that there exists excess return on each day, otherwise no excess return.

Dummy variables regression model:

$$R_t = \alpha + \beta_2 d_{2t} + \beta_3 d_{3t} + \beta_4 d_{4t} + \beta_5 d_{5t} + \varepsilon_t$$

If t-test of β_i ***(i=2, 3,…,5)*** is rejected, it means that there exists excess return on each day. If not, there is no excess return on that day.

2nd Obj. Hypothesis Testing

H_0: Different firm size has different return

$$\mu_1 = \mu_2 = \ldots = \mu_5$$

These hypotheses can be tested by using One-way Analysis of Variance (ANOVA) for each day.

If reject H_0, it means that firm size has significant effect on weekend effect. If not, there is no firm size effect.