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```r
# 安装并加载必要的包

if (!require("POE5Rdata")) {

    install.packages("POE5Rdata")

}

if (!require("ggplot2")) {

    install.packages("ggplot2")

}

library(POE5Rdata)

library(ggplot2)


# 加载 capm5 数据集

data("capm5")


# 查看数据结构

head(capm5)


# 计算每个公司的风险溢价(即股票回报减去无风险利率)

# 计算市场风险溢价(即市场回报减去无风险利率)

capm5$ge_excess <- capm5$ge - capm5$riskfree

capm5$ibm_excess <- capm5$ibm - capm5$riskfree

capm5$ford_excess <- capm5$ford - capm5$riskfree

capm5$msft_excess <- capm5$msft - capm5$riskfree

capm5$dis_excess <- capm5$dis - capm5$riskfree
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capm5$xom_excess <- capm5$xom - capm5$riskfree

capm5$mkt_excess <- capm5$mkt - capm5$riskfree


# 创建公司列表

companies <- c("ge", "ibm", "ford", "msft", "dis", "xom")

results <- data.frame(Company = companies, Alpha = numeric(6), Beta = numeric(6),

                      Alpha_pvalue = numeric(6), Alpha_significant =

character(6))


# 为每个公司估计 CAPM 模型

for (i in 1:length(companies)) {

    company <- companies[i]

    formula <- as.formula(paste0(company, "_excess ~ mkt_excess"))

    model <- lm(formula, data = capm5)


    # 获取模型摘要

    model_summary <- summary(model)


    # 存储结果

    results$Alpha[i] <- coef(model)[1]

    results$Beta[i] <- coef(model)[2]

    results$Alpha_pvalue[i] <- model_summary$coefficients[1,4]    # Alpha 的 p 值


    # 判断 Alpha 是否显著 (在 5%的显著性水平下)
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    results$Alpha_significant[i] <- ifelse(model_summary$coefficients[1,4] < 0.05, "是
", "否")


    # 打印模型摘要

    cat("\n", "CAPM Model for", toupper(company), "\n")

    print(model_summary)

}


# 打印整体结果

print(results)


# 找出最具进攻性和最具防御性的公司

most_aggressive <- results$Company[which.max(results$Beta)]

most_defensive <- results$Company[which.min(results$Beta)]


cat("\nMost aggressive company:", toupper(most_aggressive), "with beta =",
max(results$Beta))

cat("\nMost defensive company:", toupper(most_defensive), "with beta =",
min(results$Beta))


# 解决 c 小题：评估各公司的截距参数 alpha 是否显著不为零

cat("\n\n 解决 c 小题：评估各公司的截距参数 alpha 是否显著不为零\n")

cat("金融理论认为 alpha(截距)应该为零。根据我们的估计结果：\n")


for (i in 1:length(companies)) {
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    cat(toupper(results$Company[i]), "的 alpha =", round(results$Alpha[i], 4),

        ", p 值  =", round(results$Alpha_pvalue[i], 4),

        ", 在 5%显著性水平下是否显著不为零:", results$Alpha_significant[i], "\n")

}


# 总结 alpha 是否为零的结论

significant_alphas <- sum(results$Alpha_significant == "是")

if (significant_alphas > 0) {

    cat("\n 结论：有", significant_alphas, "个公司的 alpha 显著不为零，",

        "这与金融理论预期不符。这可能表明市场在样本期间存在某些异常或
CAPM 模型的局限性。\n")

} else {

    cat("\n 结论：所有公司的 alpha 都不显著不为零，这与金融理论预期相符。
\n")

}


# 为 Microsoft 股票绘制回归线和数据散点图

msft_model <- lm(msft_excess ~ mkt_excess, data = capm5)


# 确保 ggplot2 已加载

library(ggplot2)


ggplot(capm5, aes(x = mkt_excess, y = msft_excess)) +

    geom_point(alpha = 0.5) +

    geom_smooth(method = "lm", se = TRUE, color = "blue") +
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      labs(title = "CAPM Model for Microsoft",

           x = "Market Excess Return",

           y = "Microsoft Excess Return",

           subtitle = paste("Beta =", round(coef(msft_model)[2], 4),

                            ", Alpha =", round(coef(msft_model)[1], 4))) +

      theme_minimal()

# d. 在假設 alpha = 0 的條件下估計 beta

capm_no_alpha <- lapply(names(excess_returns), function(firm) {

    lm(excess_returns[[firm]] ~ market_excess + 0) # +0 強制截距為 0

})


# 顯示新的 beta 值

beta_no_alpha <- sapply(capm_no_alpha, function(model) coef(model)[1])

print(beta_no_alpha)
```