Using A Bayesian Approach in Management Research: Why it Makes Sense and How to Do It

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Research Question

How do strategic actions affect performance in the long run?

Data

Performance

- Quarterly Market Returns (%)

Strategic Actions

- Selling Units
- Buying Units
- Financial Restructuring
- Organizational Restructuring
- New Product Introduction
- New Market Entry
- Key Personnel Changes
- Strategic Alliances
- Layoffs
- Hiring

Frequentist Regression

Random sample from population

Get a point estimate with a confidence interval

Based on averages

If there were infinitely repeated random samples drawn, the model would yield a point estimate that falls within the confidence interval 95% of the time

However, no point estimate would be any more likely than any other

Bayesian Regression

Analysis is based on observed data

Posterior distribution shows how the probability of an outcome is distributed

Results for individual observations (firms, etc.) can be generated

Endogeneity is modeled

Prior information and updating are modeled

OLS Pooled Regression

Performance Effect = Market Returns

Coefficient	estimate	std.error	t-statistic	p.value	
(Intercept)	0.043	0.003	13.221	0.000	
SellUnits	0.003	0.004	0.603	0.547	
BuyUnits	-0.002	0.003	-0.805	0.421	
Frestruct	**0.014**	0.004	3.996	0.000	←
Restruct	**0.016**	0.006	2.610	0.009	←
Nproduct	0.000	0.001	-0.266	0.790	
Nmarket	-0.003	0.009	-0.288	0.773	
Personnel	**-0.004**	0.001	-3.083	0.002	←
Alliances	0.000	0.004	0.091	0.928	
Layoffs	-0.003	0.007	-0.373	0.709	
Hiring	0.011	0.016	0.654	0.513	

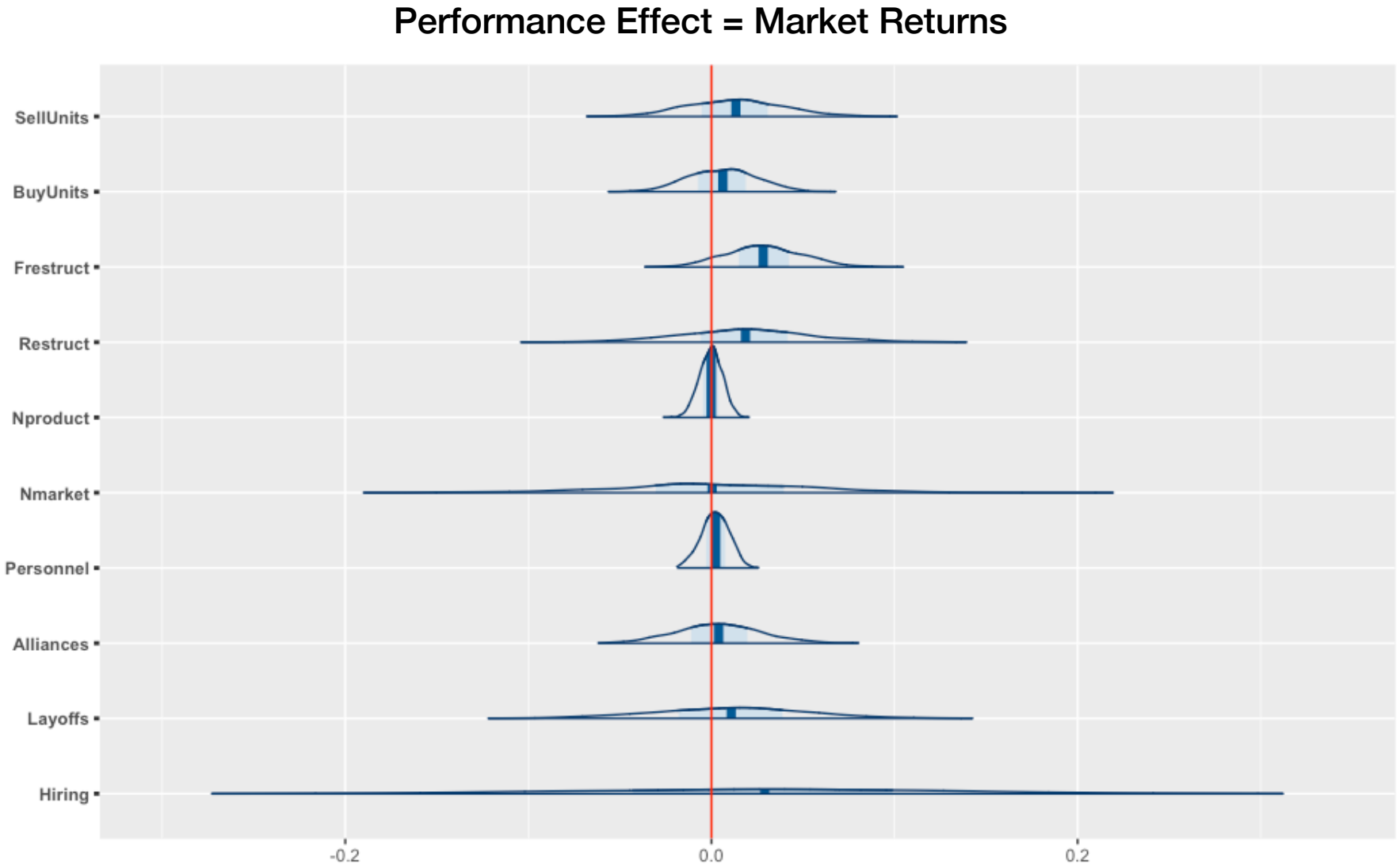
$$R^2 = .007$$

Pooled Regression Model

$$y_{it} = \beta_0 + \sum_{k=1}^{K} \beta_k x_{kit} + \varepsilon_{it}$$

We assume that the impact of X on Y is identical for all firms in the sample.

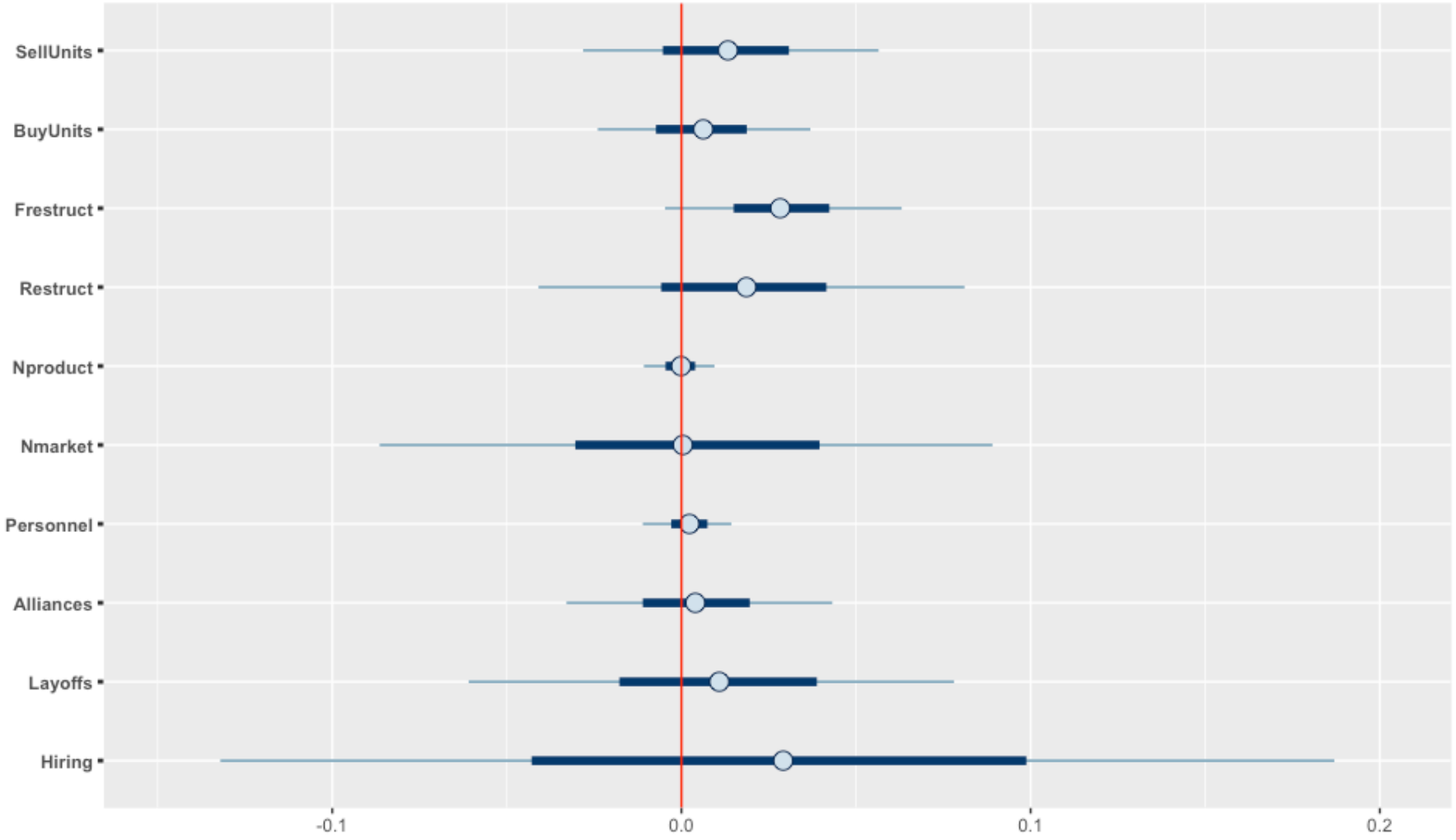
Bayesian Regression - Posterior Distribution – All Firms



0.2 = 20%

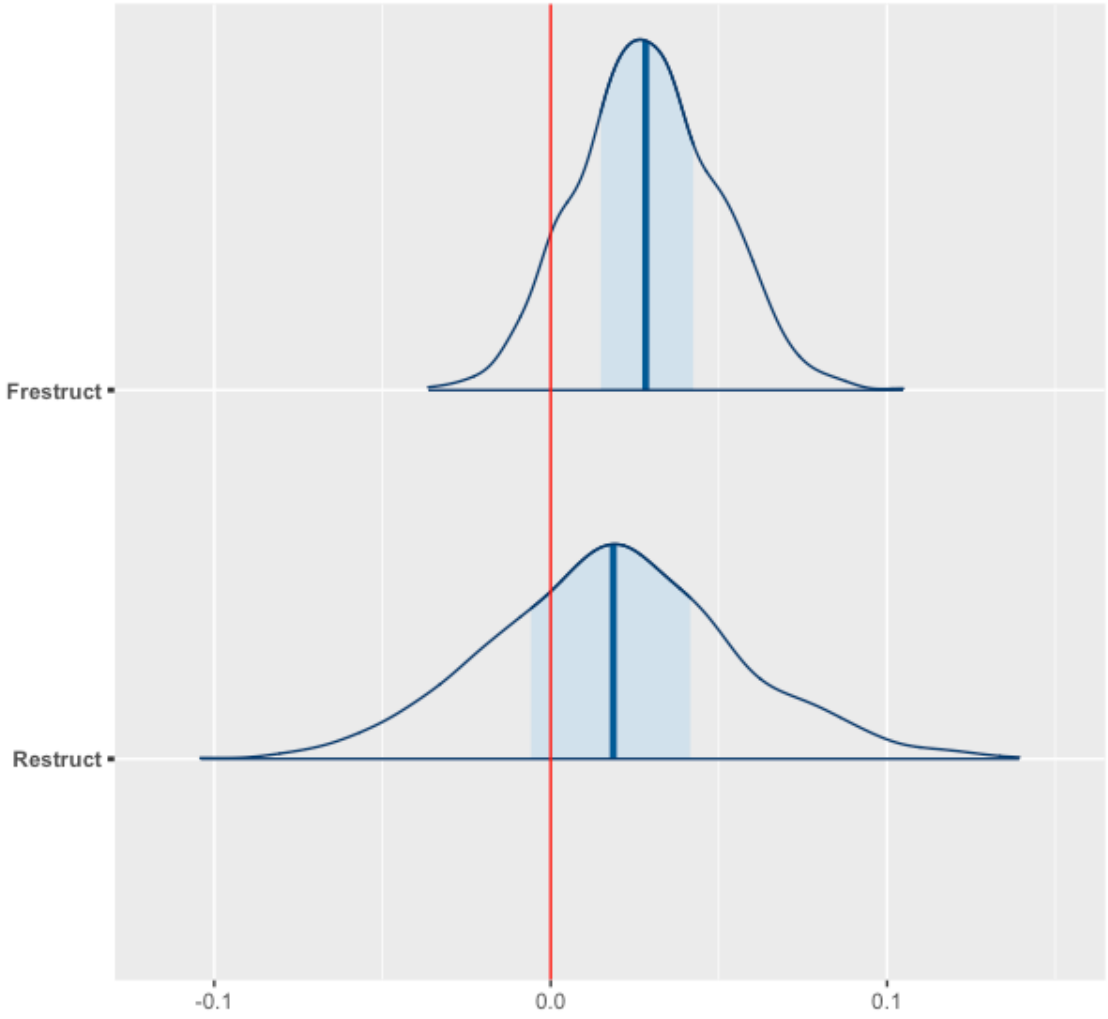
Bayesian Regression – Interval Estimates – All Firms

Performance Effect = Market Returns



0.1 = 10%

Posterior Distribution - Frestruct and Restruct



There is a 92% chance (.92 probability) that Frestruct will have a positive impact on Returns

There is a 70% chance (.70 probability) that Restruct will have a positive impact on Returns

Hierarchical Linear Model

$$y_{it} = \beta_{0i} + \sum_{k=1}^{K} \beta_{ki} x_{kit} + \varepsilon_{it}$$

$$\beta_{ki} \sim N(\overline{\beta}, \Sigma)$$

We allow the impact of X on Y to differ by firm and assume that all firms are related through a common (hierarchical) distribution

Code Snippet

```r
library(bayesm)

## Import Data
XX = read.csv("ltsadata.csv",header = TRUE)

## Format Data
regdata = NULL

for(i in 1:nfirm){
  firm = firms[i]
  xmat = XX[which(XX$Ind.Firm==firm),]
  y = xmat$Return
  X = as.matrix(xmat[,7:ncol(xmat)])
  X = cbind(1,X)
  regdata[[i]] = list(y=y,X=X)
}

## Create Model Opjects
Data = list(regdata = regdata, Z = Z)
Mcmc = list(R = 100000, keep=100, nprint=1000)

## Run Model Estimation Routine
out = rhierLinearModel(Data=Data,Mcmc=Mcmc)
```

Conclusion

A Bayesian analysis can yield results for a pooled sample and/or for individual observations (e.g. firms, industries, CEOs, etc.)

The main output is the posterior distribution

There are not arbitrary cutoffs or thresholds—the reader is allowed to determine what constitutes convincing evidence

Remember, the reader is looking at actual probabilities given the observed data