Using Causal Path Analysis to Test & Validate Strategic Hypotheses

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Agenda

I) The Role of Survey Validity in Strategic Planning

II) A General Method for Synthesizing Soft Voices & Hard Numbers

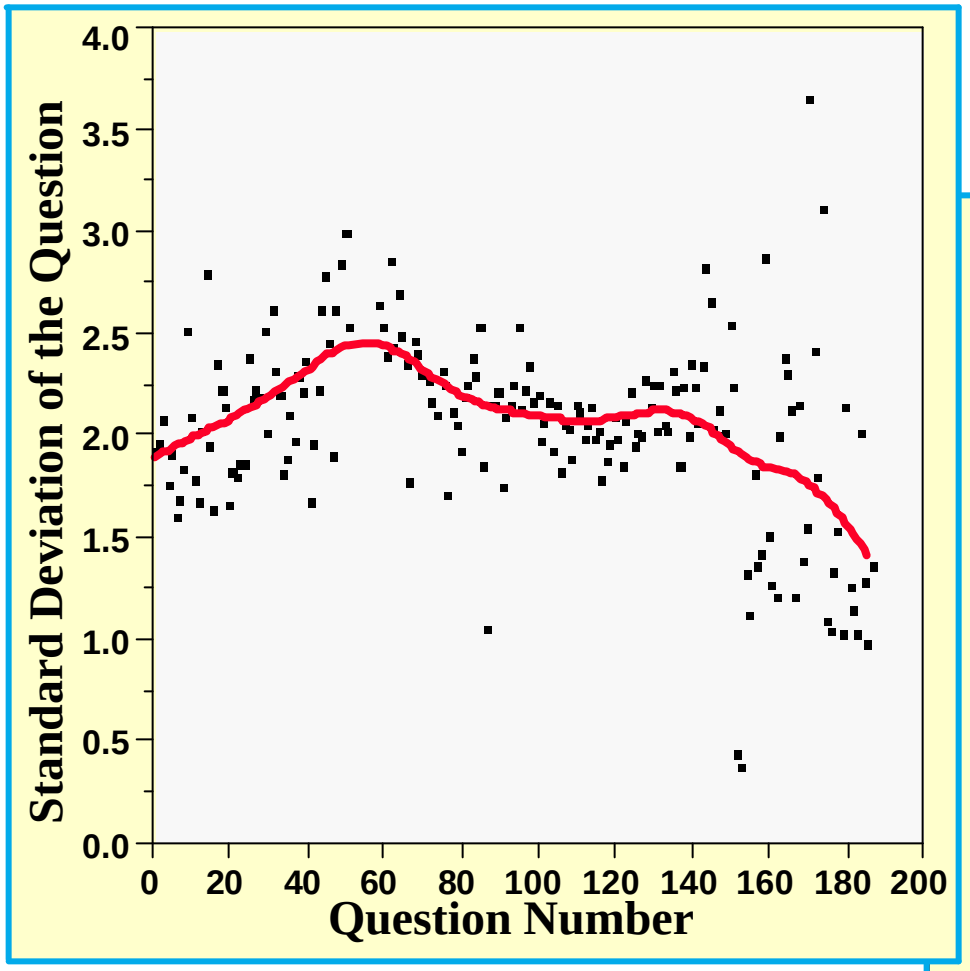
III) Causal Path Analysis -- Strengths & Weaknesses of 3 Methods

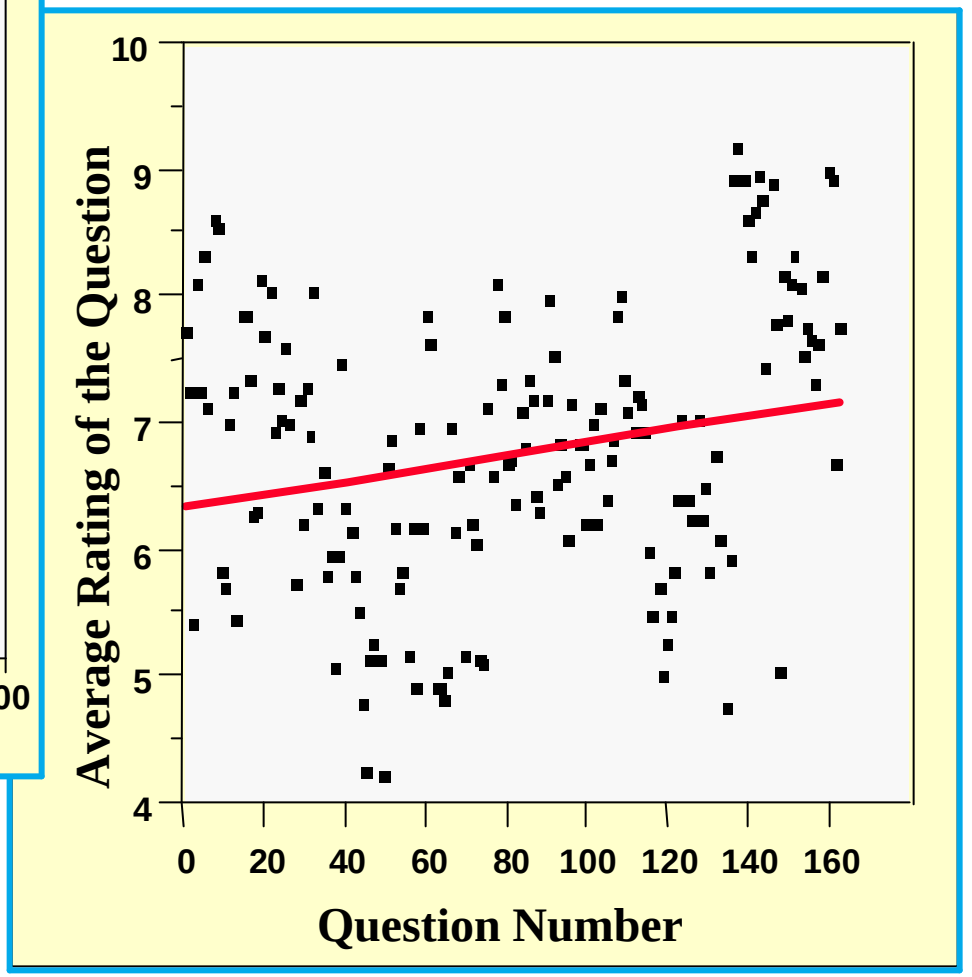
IV) Case Profiles: Examples of the Rigorous Quantitative Approach

Section I

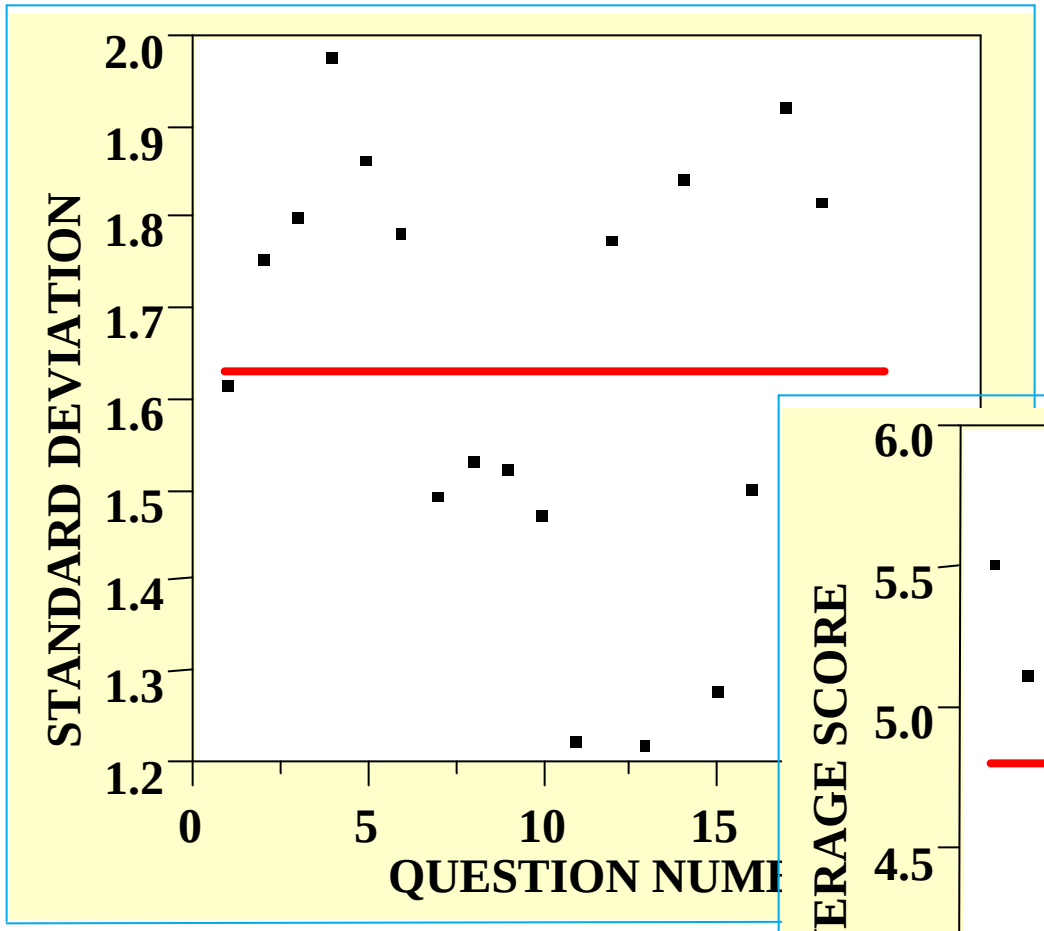
The Role of Survey Validity in Strategic Planning

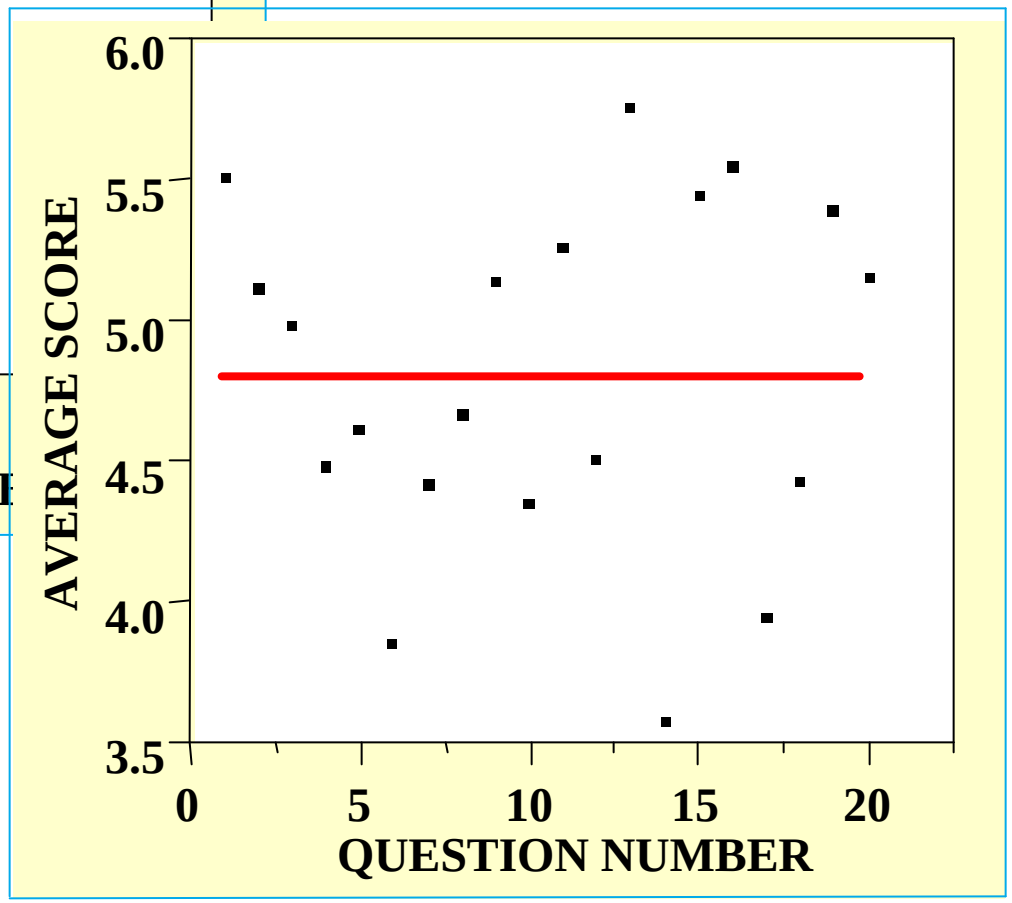
Proof of Poor Validity - Standard Deviations & Means are Inconstant



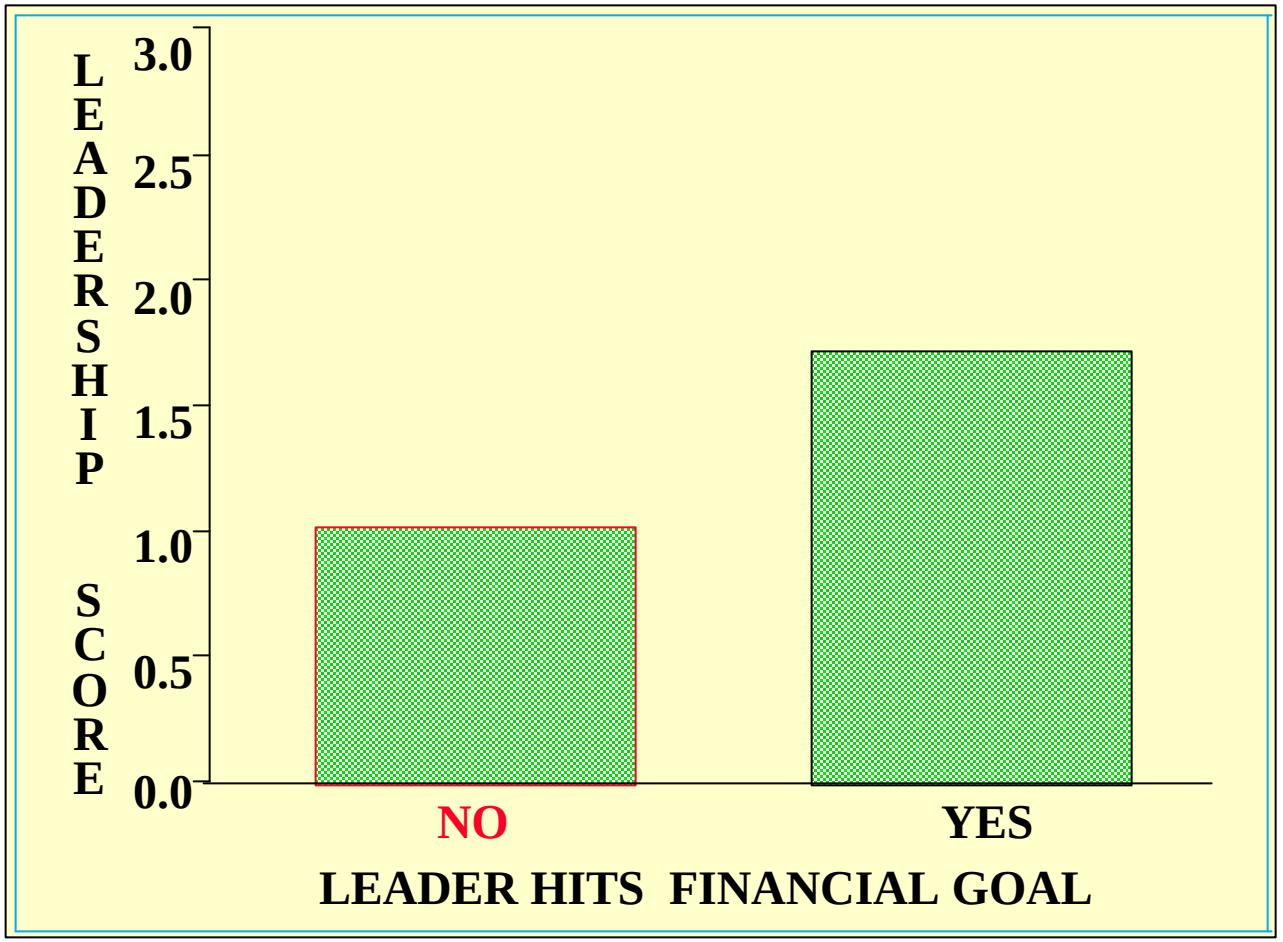


Validity - Standard Deviations and Means are Flat Throughout the Survey



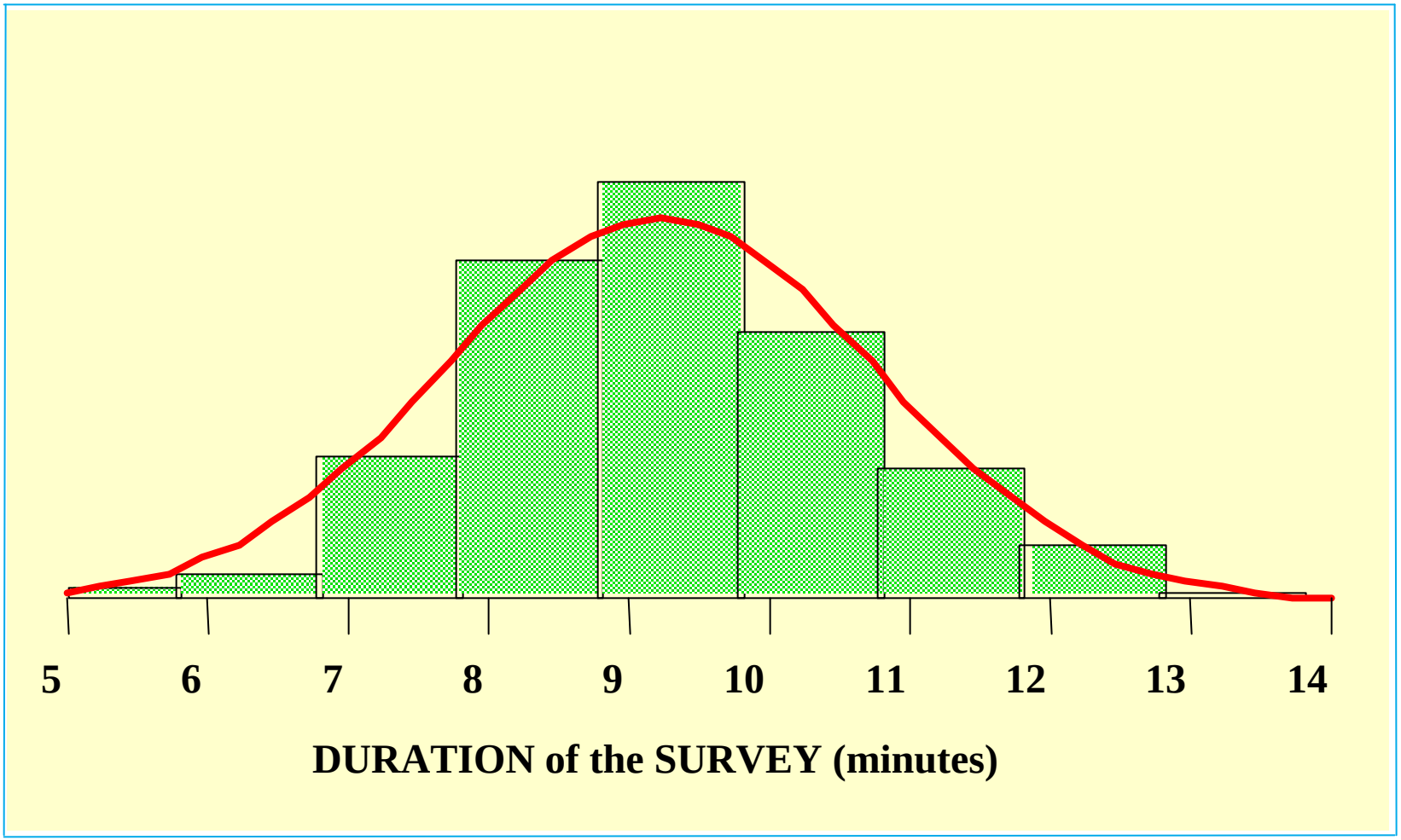


Validity - Leadership Assessment Scores Predict Financial Performance

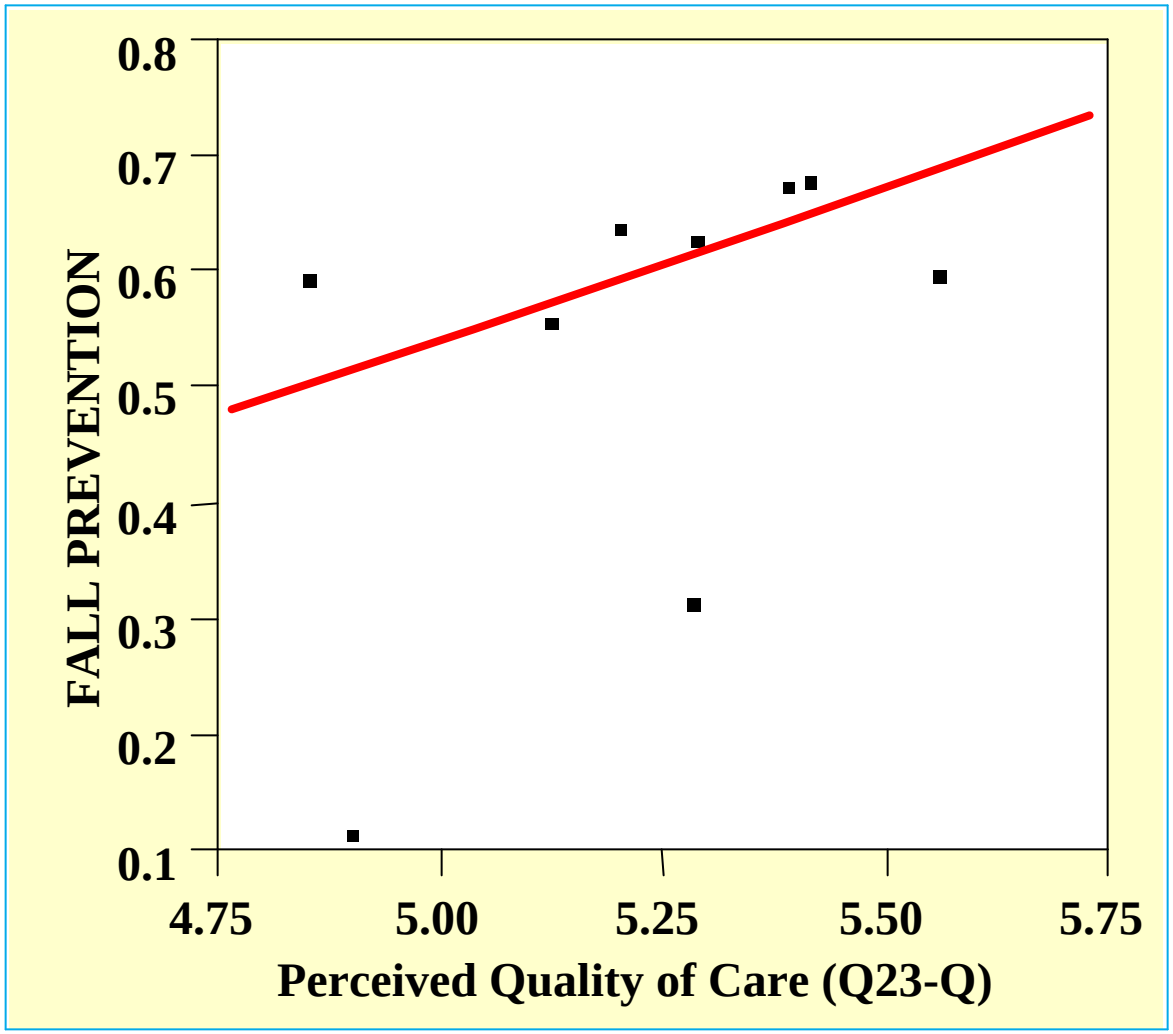


The Diamond Diagnostic gives significantly higher Leadership scores to executives who subsequently come within 10% of their financial target.

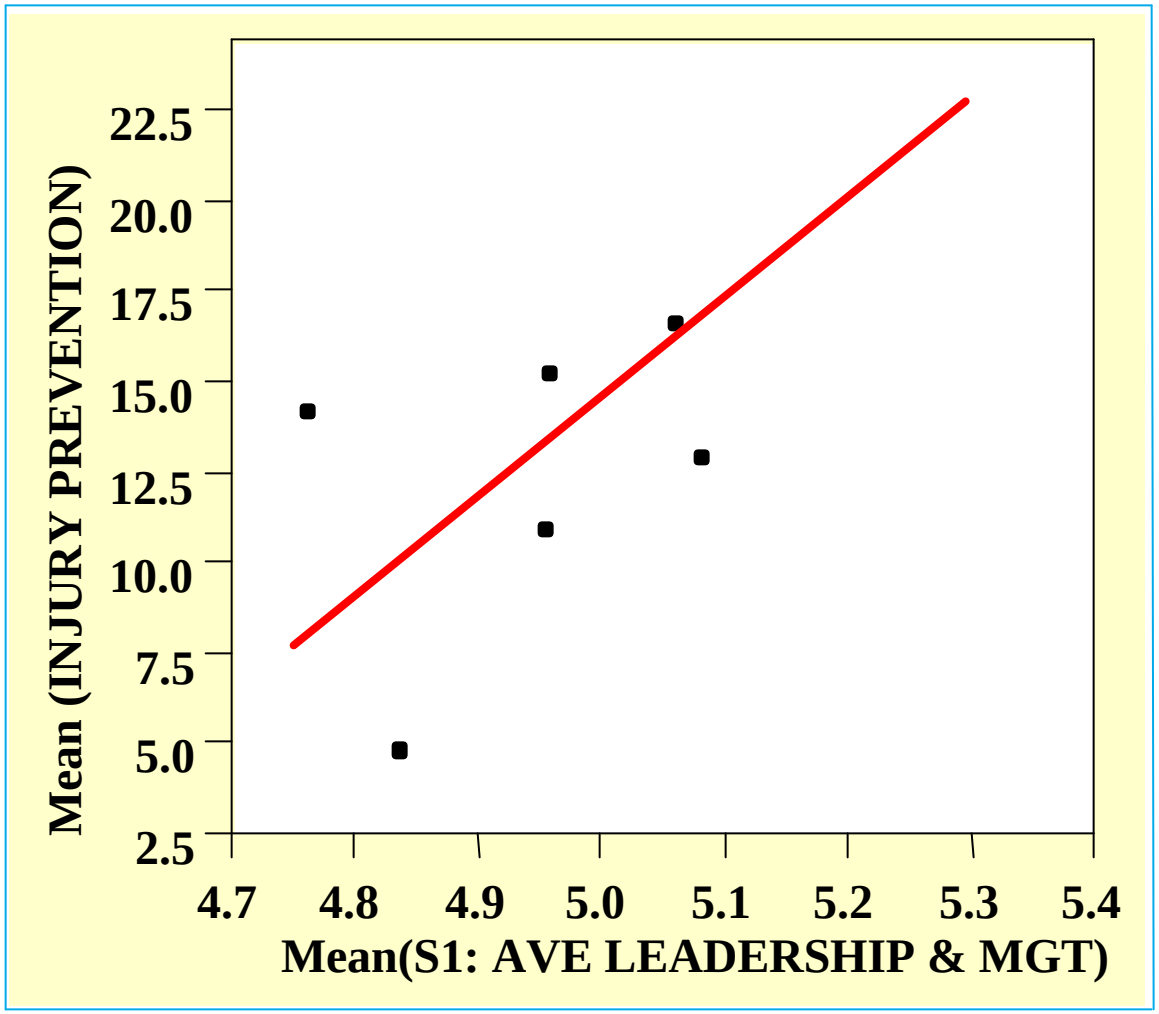
Validity - Data are Distributed Normally in the Dataset



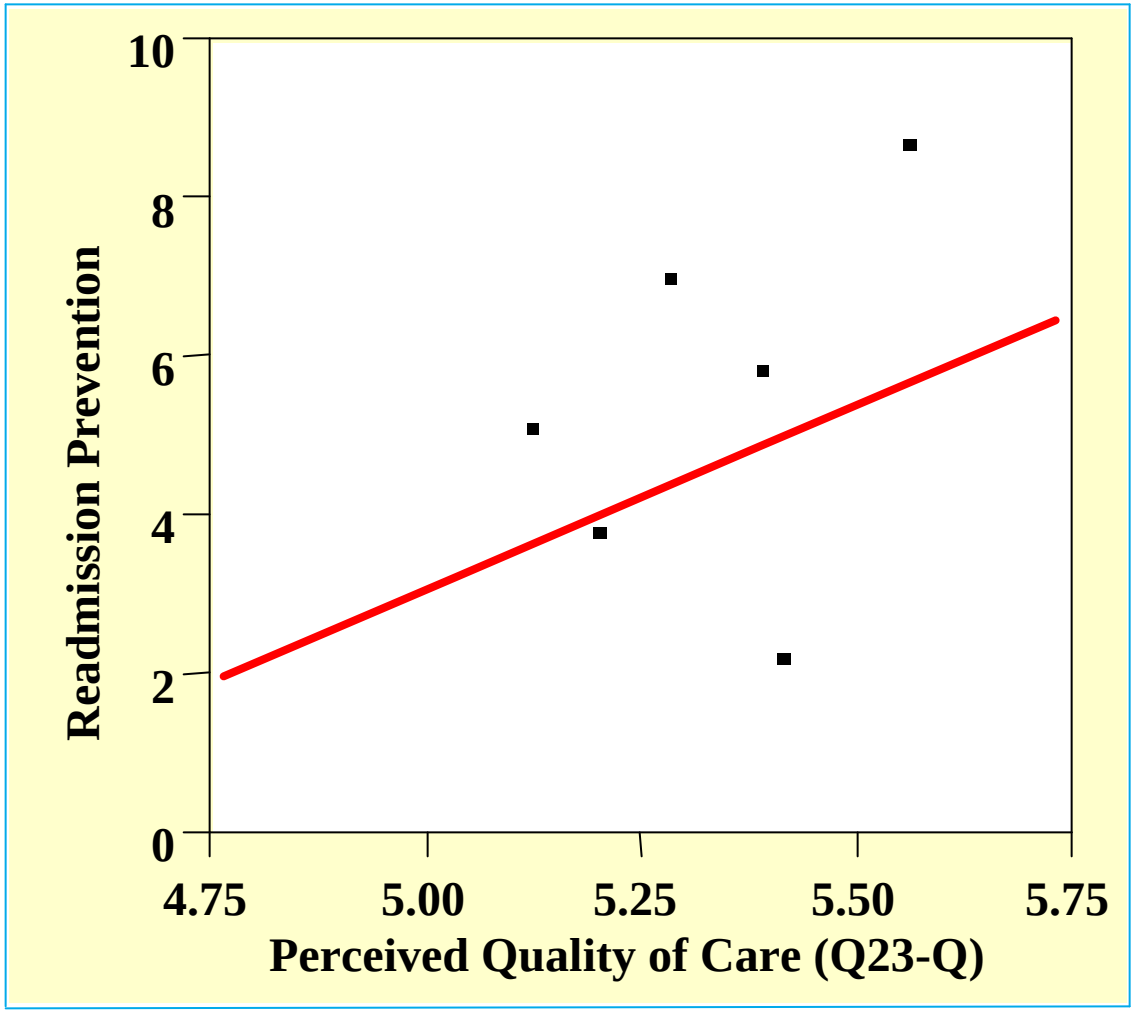
Validity - Perceived Quality Predicts Prevention of Hospital Patient Falls



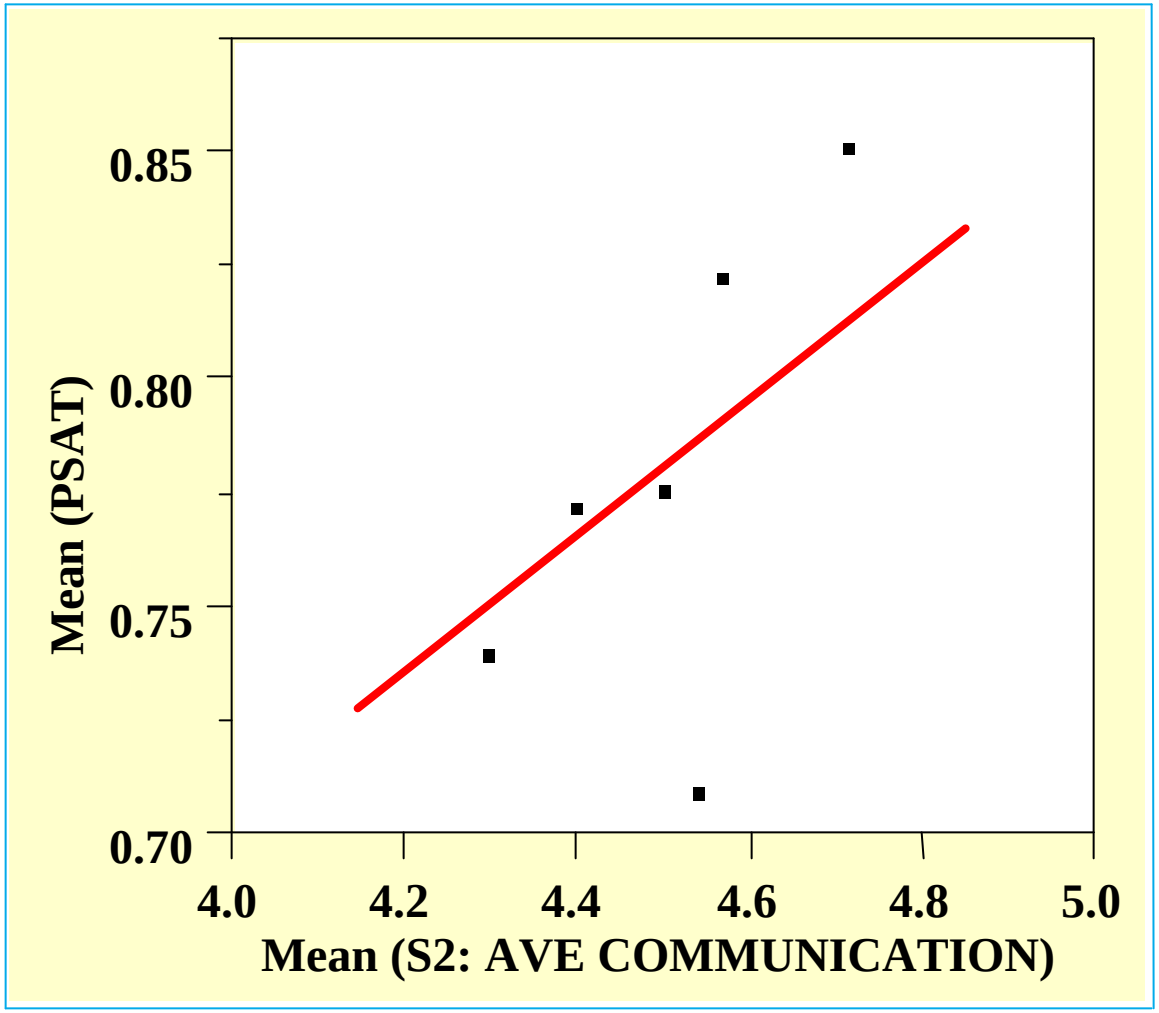
Validity - Leadership Predicts Prevention of Hospital Employee Injuries



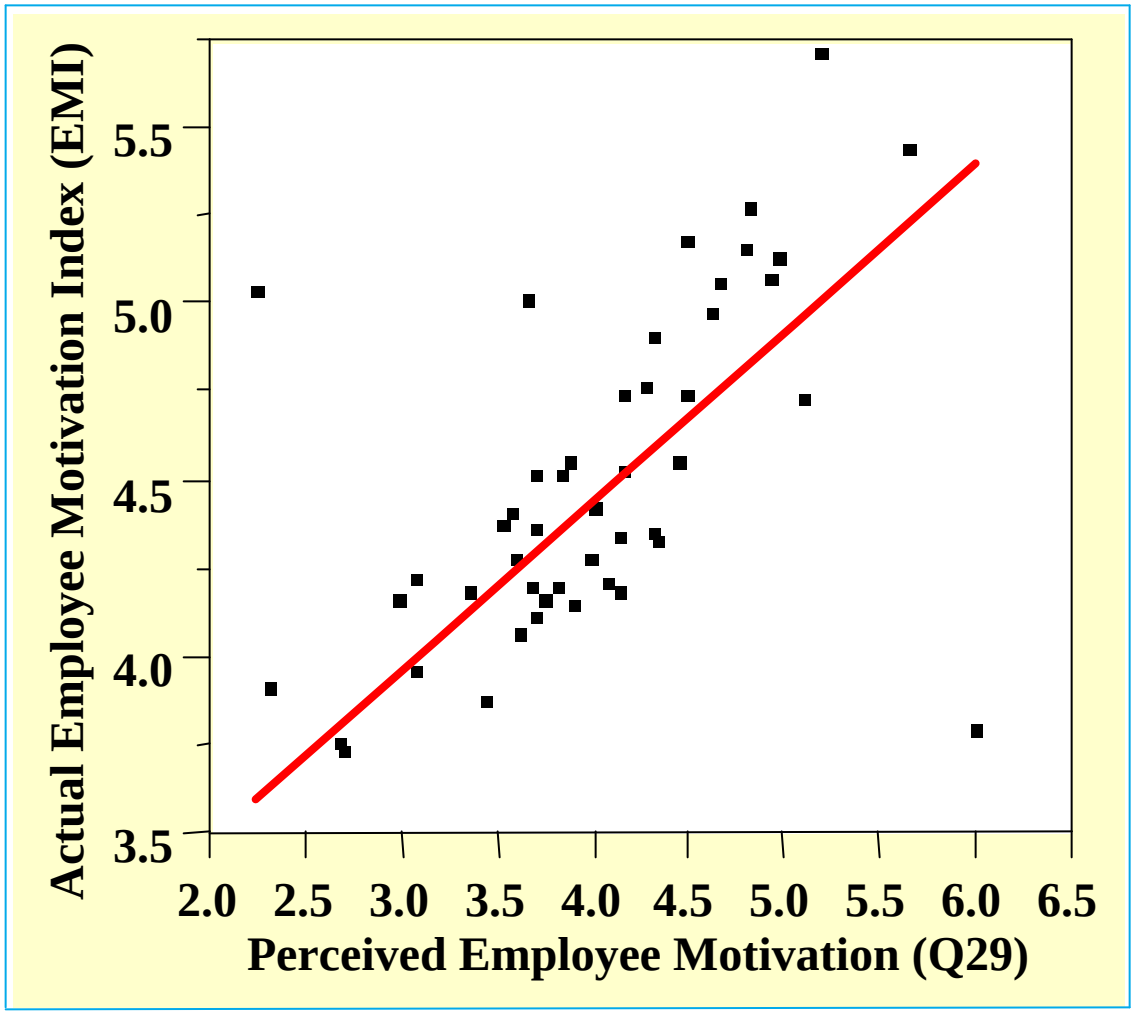
Validity - Quality Predicts Prevention of Post-treatment Readmission



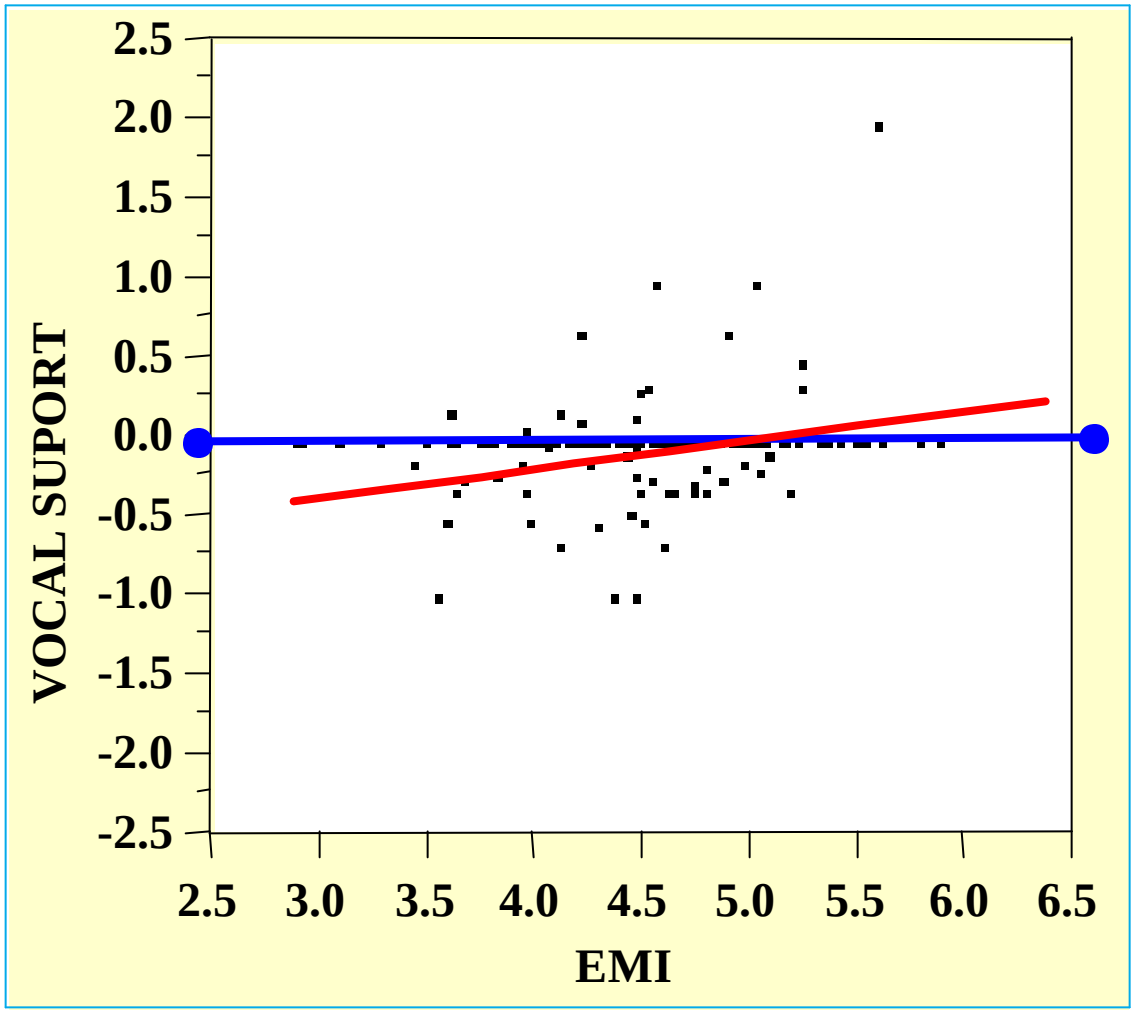
Validity - Communication Predicts Hospital Patient Satisfaction



Validity - Estimated Employee Motivation Tracks Actual Motivation

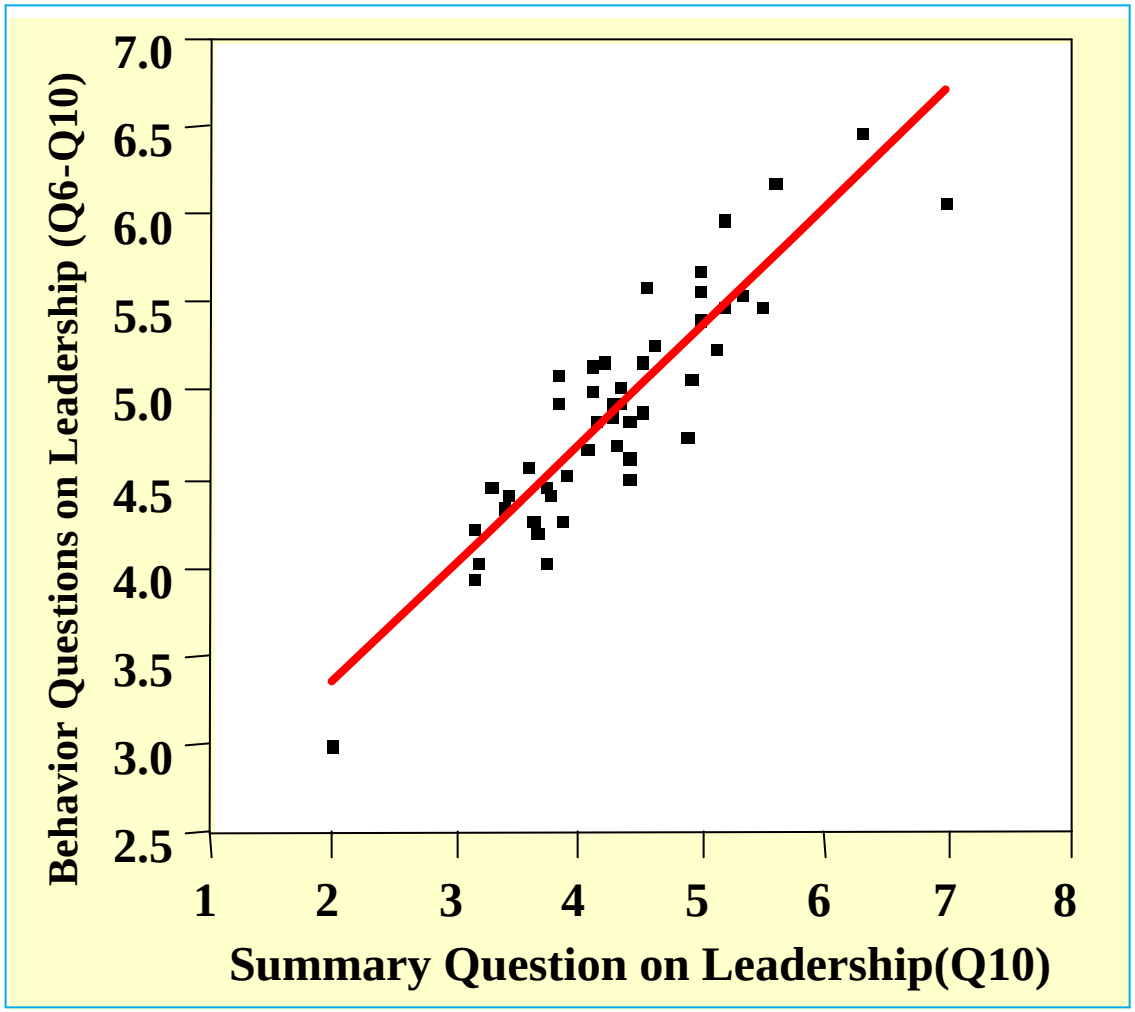


Validity - Written Comments & Quantitative Ratings Agree



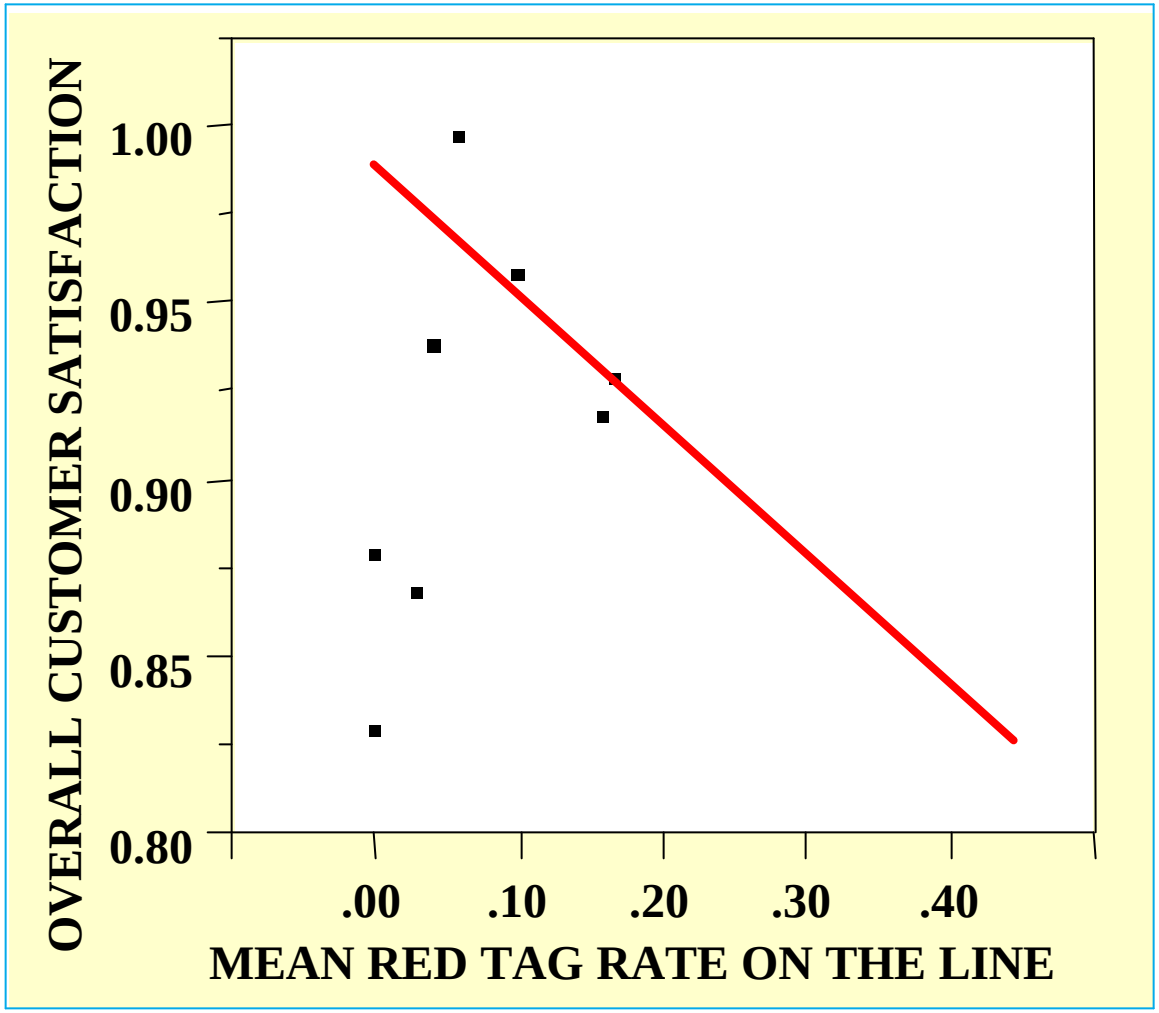
Employees with a high Employee Motivation Index write survey comments that are more positive.

Validity - Summary Questions Confirm Behavior Questions

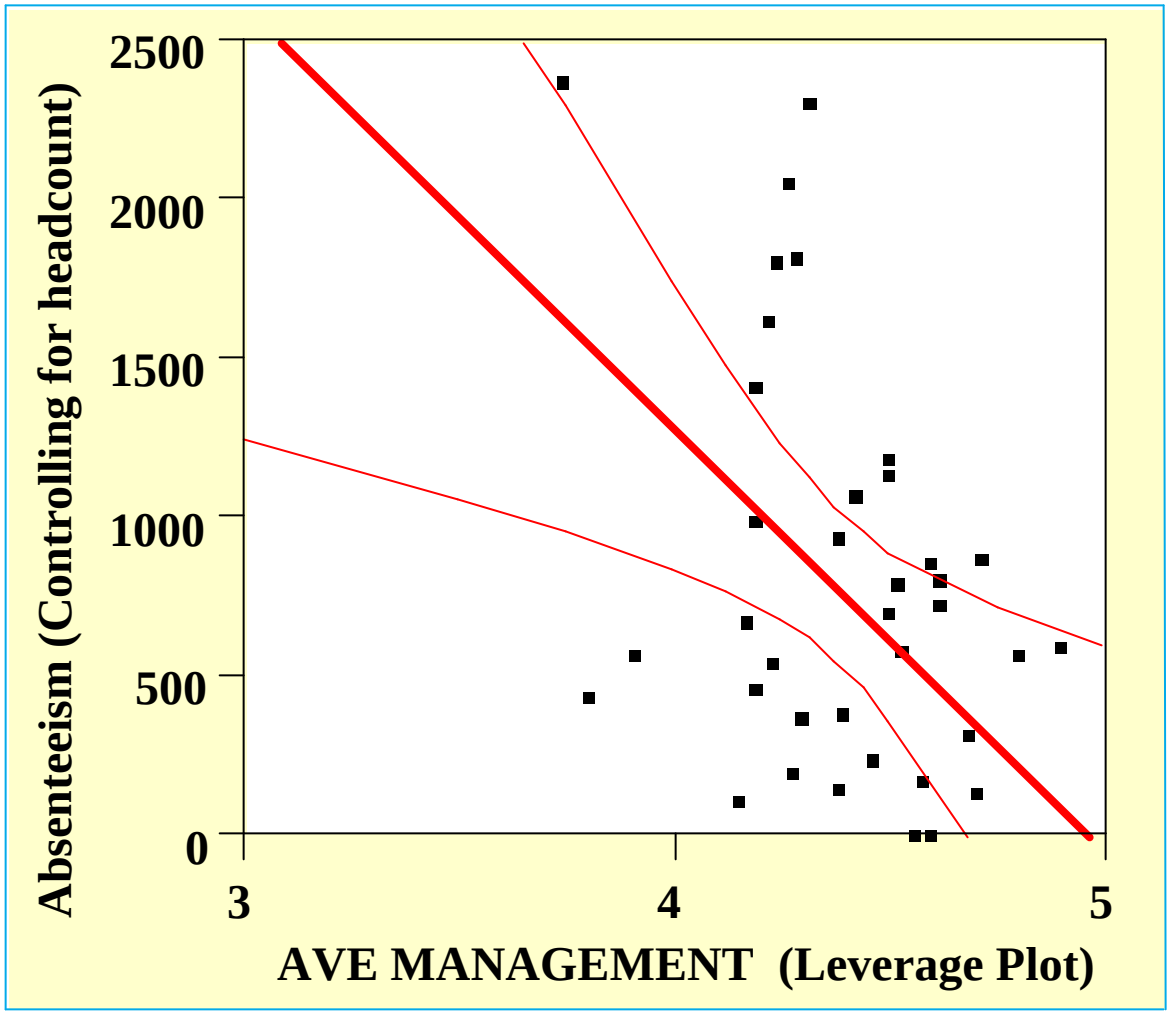


The high correlation proves that the survey asked the right questions in each of the topic areas.

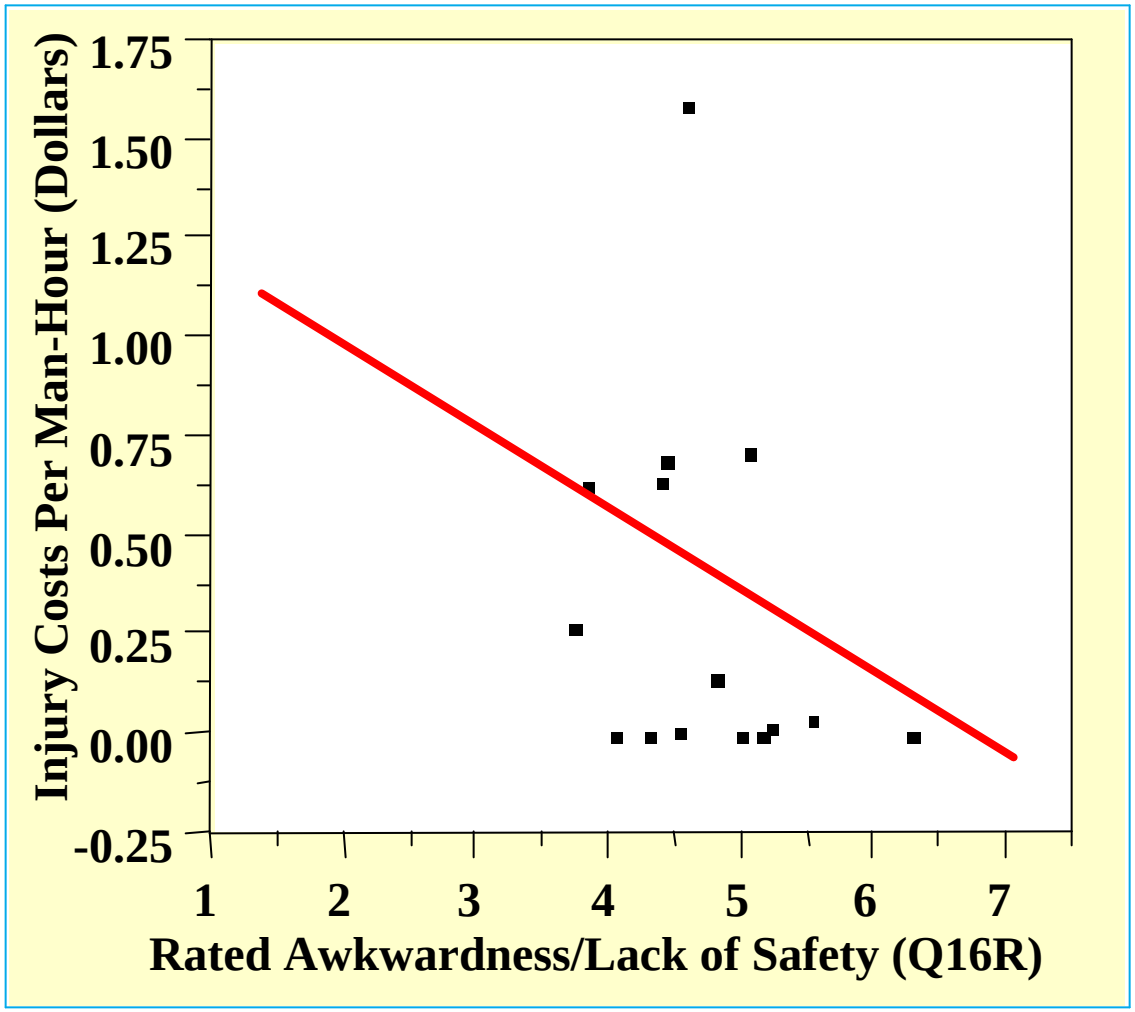
Validity - Truck Defect Rate Predicts Customer Satisfaction



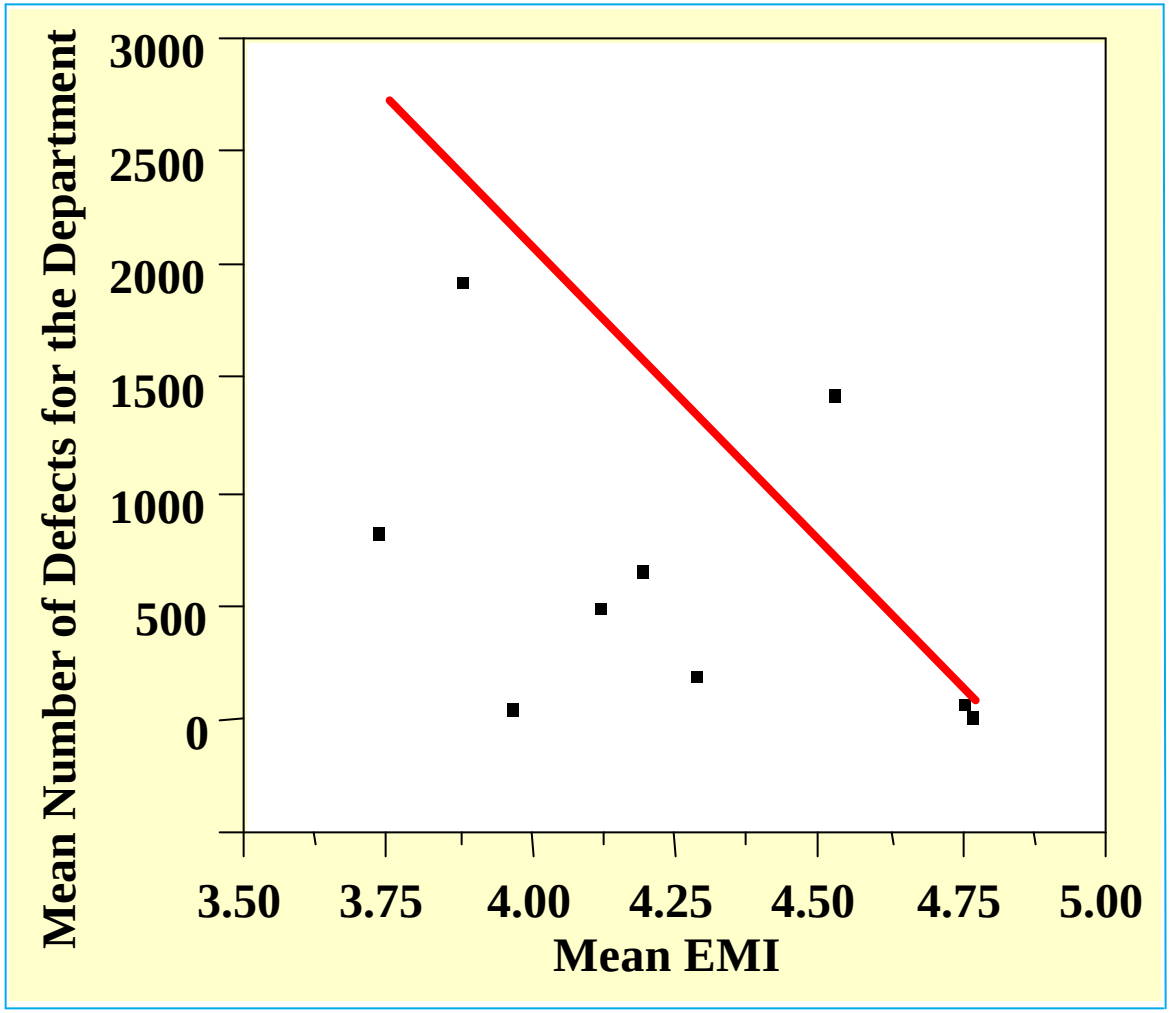
Validity - Good Management Predicts Low Factory Absenteeism



Validity - Less Awkward Jobs Have Lower Accident Costs



Validity - High Motivation Index Scores Predict **Low Defect Rate**



Poor survey data will give you poor predictions every time.

Section II

A General Method for Synthesizing Soft Voices & Hard Numbers

A Straightforward Process

1) Solicit voice of the customer and/or the employee with a focused survey
    a) Use qualitative & quantitative methods
    b) Preserve anonymity & confidentiality
    c) Include an indexing variable (e.g., SU, or job, or region)
2) Compile quantitative data into a quantitative database
    a) One row for each respondent, 1 column for each question
    b) Include the chosen indexing variable
    c) Import hard performance metrics on profit, turnover, defect rate, etc.
3) Code qualitative data and enter into a qualitative database
    a) Use double blind procedures wherever possible
    b) Limit number of categories in each constructed variable
    c) One row for each interviewee
    d) Include the chosen indexing variable
    e) If each level of the indexing variable has more than 1 row, then make a transitional database that concatenates or counts or gives a ratio, so that each level has no more than 1 row
4) Merge qualitative & quantitative databases for statistical analysis

Section III

Causal Path Analysis;
Strengths & Weaknesses of 3 Methods

Method 1: Comprehensive Inter-Correlations

"Managers can help validate hypothesized cause-and-effect relationships by measuring the correlation between two or more measures."

Kaplan & Norton, The Balanced Scorecard, 1996 pg. 254

	WORK CONDITIONS	TEAMWORK	COMMUNICATION	LEADERSHIP & MGT	LEADER FOCUSED	BLAME FOCUSED	TEAM FOCUSED	SKILL FOCUSED	TOOL FOCUSED
SALES	POS	NEG		NEG		NEG		NEG	
GROSS PROFIT	POS			POS		NEG	POS	POS	
NET INCOME			NEG						
G/P PER TOTAL EXPENSE DOLLAR	POS	POS							
G/P PER EE	POS								
NET INCOME PER EE		POS	NEG	NEG			POS	NEG	
G/P PER COMP DOLLAR	NEG		POS			NEG		POS	
NET INCOME PER COMP DOLLAR	POS	POS				POS			POS
STAFF RETENTION %	NEG		POS		NEG	POS		NEG	
STAFF GROWTH %	NEG		POS			POS	POS		POS

One simple zero-order correlation

Benefits & Disadvantages- Inter-correlations

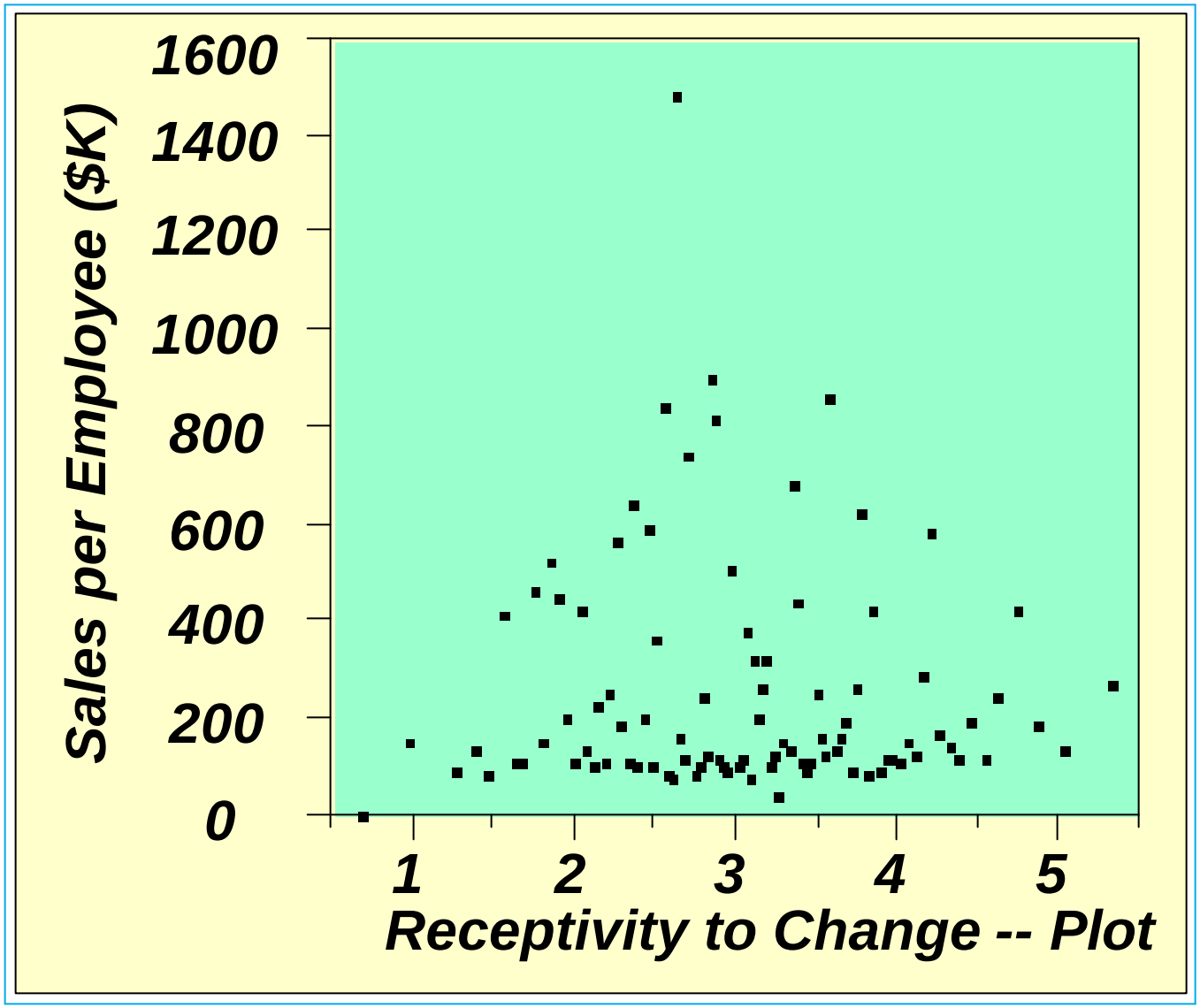
Benefits:

- Ease of computation
- High clarity during rollout

Disadvantages:

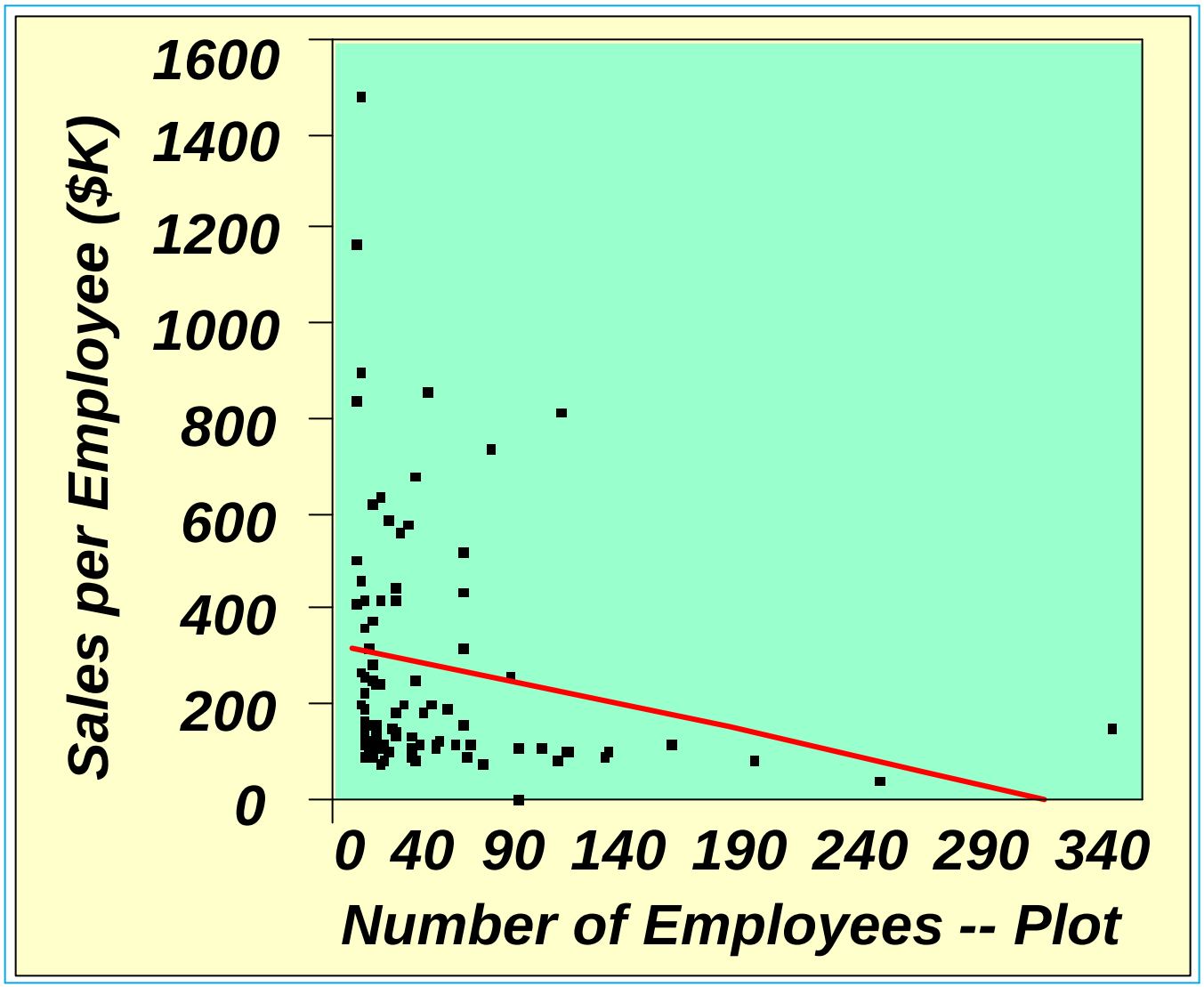
- Possible errors due to spurious correlation
- Possible omissions due to masked effects

Simple Plots May Mask Actual Associations



No correlation appears between Sales per Employee & Receptivity to Change...

Simple Plots May Show Spurious Correlations

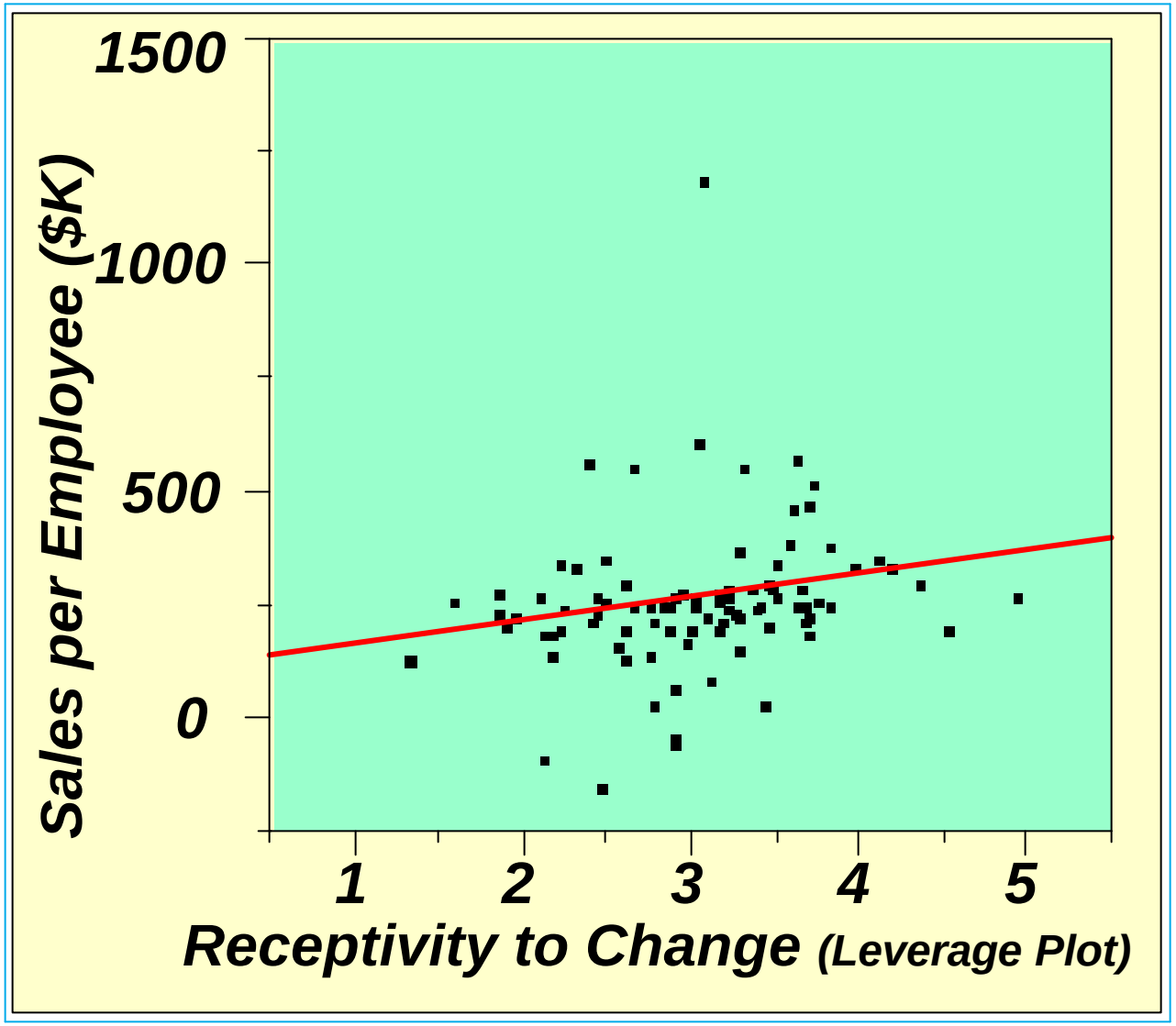


and Sales per Employee appears to drop as Number of Employees rises. However...

Leverage Plots show Association Controlling for Confounding Variables

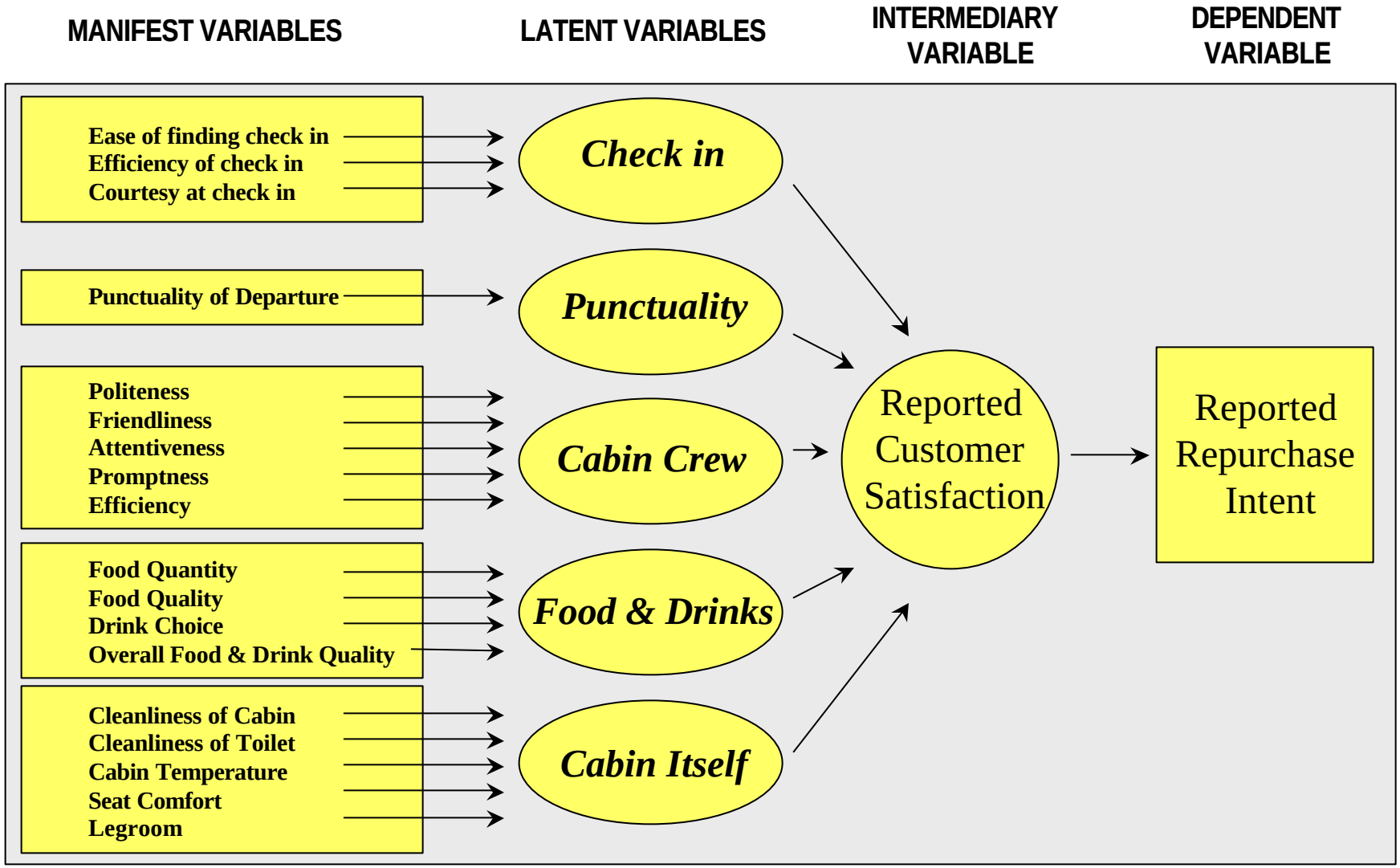
HOWEVER...

Receptivity to Change **DOES** emerge as a consistent driver for Sales per Employee, but only when we control for all available demographic covariates (viz.: Region, Number of Employees, Company Age & Company Type.) In the full partialled analysis only Company Type & Receptivity to Change are significant drivers.



All prescription drugs in the US are tested with this type of statistical analysis.

Method 2: Path Analysis for Causal Modeling (used at Sears)



"Exploring the complex dynamics will likely require simulation and cost modeling." K& N HBR '92, p. 79. See also Fortune, 10/13/97: Bringing Sears into the New World p. 183-184: " Now we know that if a store increases its employee satisfaction score by five measuring units this quarter, the following quarter its customer satisfaction scores will go up by two units. And if a store increases its customer satisfaction by two units, its revenue growth the following quarter will beat our stores' national average by 0.5%" p. 184. Customer Satisfaction Model for Cathay Pacific Airline, Business Class; adapted from Customer Orientation & Market Action, M. Johnson, p. 122

Benefits & Disadvantages- causal Modeling with PLS

Benefits:

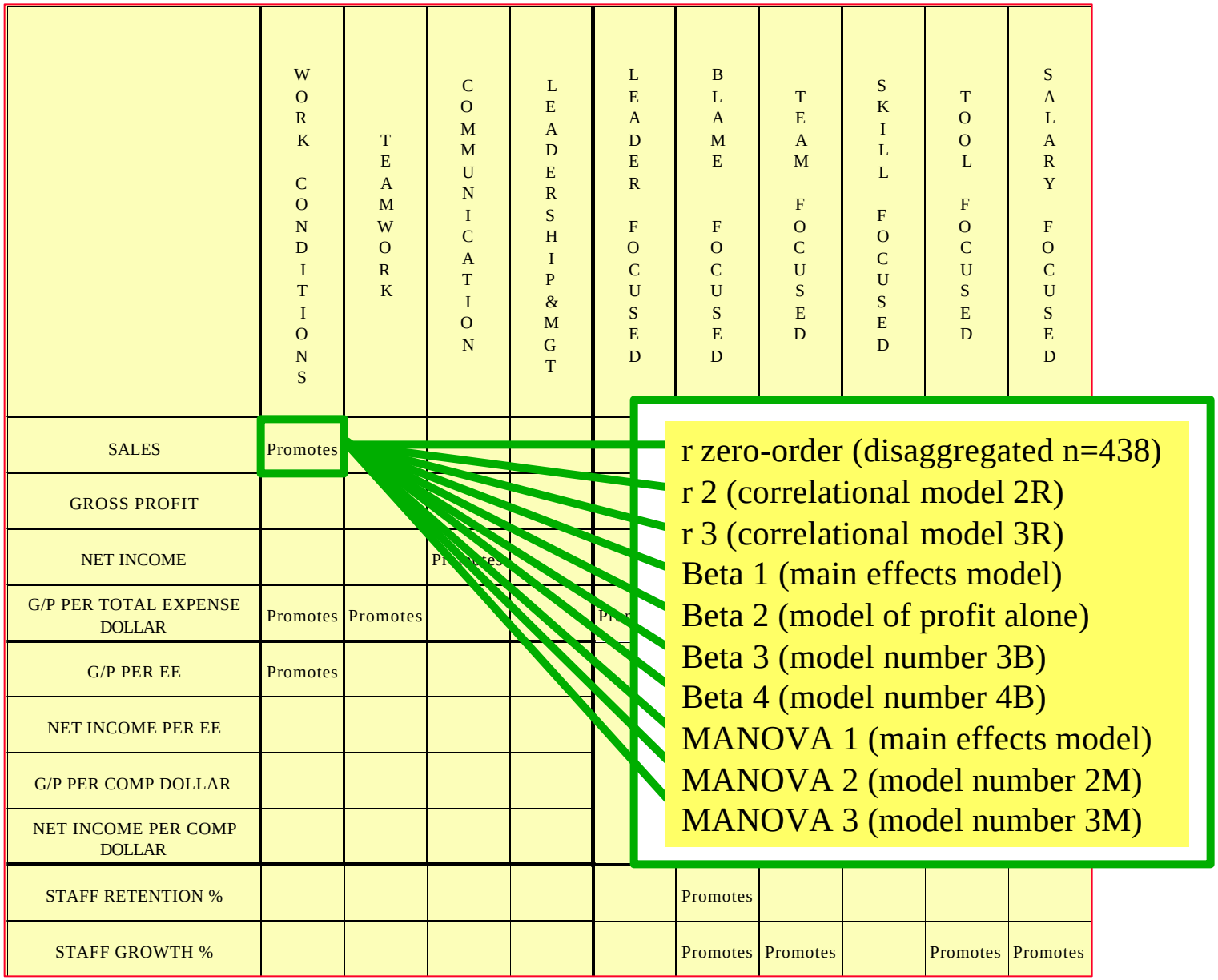
Models can accommodate complexity even with a few Latent Variables (LVs) (H, '88, p. 221)
Can run well even with small datasets of non-normal distributions (FT&Z '82, p. 405)
Can be used well even in datasets where multicollinearity is high (P&R, '95, p. 184 ff.)
Does not require ratio scales with an absolute zero and even intervals (P&R, '95, p. 191)

Disadvantages:

Results are model-specific: Excluding a link or Manifest Variable (MV) can ruin all predictions*
Comparative testing of alternate models is not straightforward (G '94, p. 124)
Magnitude of linkage is usually underestimated (WRW&D, '84, p. 740)
Valence of linkages is unstable (WRW&D, '84, p. 741)
MVs must be standardized, but standardization makes coefficients unstable (C&C, '83, p. 366)
Direction of MV-LV arrow is theory-determined but can effect results (F&C, '94, p. 75)
Predictive power may be very low even in good models (J, '98, e.g., 123)
Results very unstable where many non-essential factors have small impacts (H&A, '94 p. 589)
Conventional significance tests are approximate and/or problematic (H '88, p. 222 ff.)
LVs are necessarily independent, so their scores and interrelations may be unrepresentative

* "In cases in which the causal relations are uncertain, the method [path analysis] can be used to find the *logical consequences* of any particular hypothesis in regard *to them* ." (W, 1921, p. 557)

Method 3: Hierarchical Modeling (used at Disney)



	WORK CONDITIONS	TEAMWORK	COMMUNICATION	LEADERSHIP&MGT	LEADER FOCUSED	BLAME FOCUSED	TEAM FOCUSED	SKILL FOCUSED	TOOL FOCUSED	SALARY FOCUSED
SALES	Promotes									
GROSS PROFIT										
NET INCOME			Pr[illegible]							
G/P PER TOTAL EXPENSE DOLLAR	Promotes	Promotes			Pr[illegible]					
G/P PER EE	Promotes									
NET INCOME PER EE										
G/P PER COMP DOLLAR										
NET INCOME PER COMP DOLLAR										
STAFF RETENTION %						Promotes				
STAFF GROWTH %						Promotes	Promotes		Promotes	Promotes

r zero-order (disaggregated n=438)
r 2 (correlational model 2R)
r 3 (correlational model 3R)
Beta 1 (main effects model)
Beta 2 (model of profit alone)
Beta 3 (model number 3B)
Beta 4 (model number 4B)
MANOVA 1 (main effects model)
MANOVA 2 (model number 2M)
MANOVA 3 (model number 3M)

Benefits & Disadvantages- Hierarchical Modeling

Benefits:

- Results hold *regardless* of statistical model used
- Good clarity during rollout
- Predictions are conservative (low Type I Error)
- Results are highly-defensible

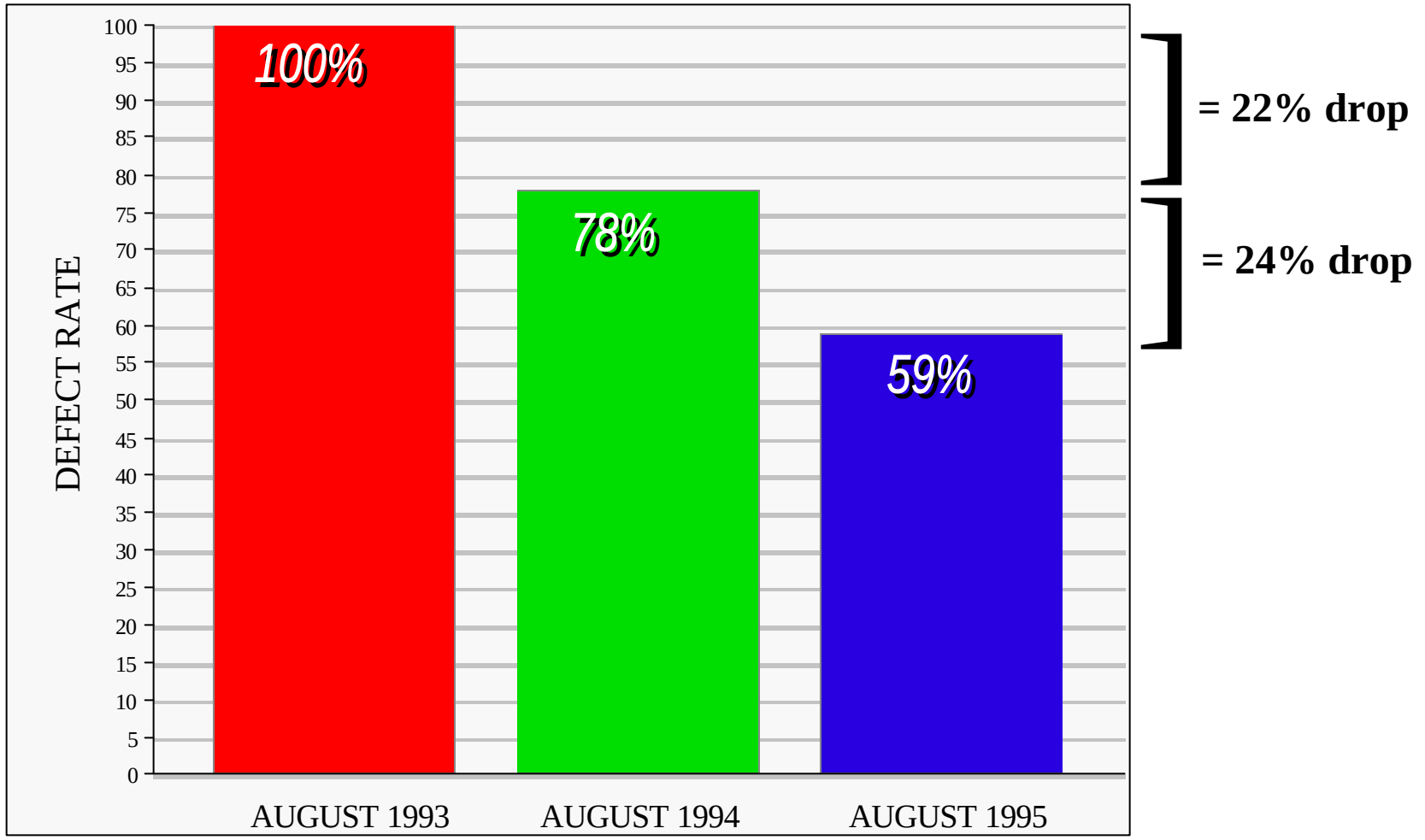
Disadvantages:

- Computational rules are required to tally results

Section IV

Case Profiles: Examples of the Rigorous Quantitative Approach

Quantitative Analysis of Linkages Lowers Defect Rate at GTE



An analysis of linkages in '93 showed that Leadership drove Quality in this division of GTE. Programs to improve Leadership were implemented over the next two years, and a customized employee survey documented their effectiveness: Leadership rose each year. As predicted, when Leadership rose so did Quality: Defect Rate dropped by 22% in 1994 and by an additional 24% in 1995.

Quantitative Analysis of Linkages Increases Revenue at XYZ

In a recent engagement, EMPA designed a customized annual survey for a the 20K employees of XYZ. The linkage analysis predicted that increasing what the employee survey identified as Career Focused Workstyle would boost financial productivity *regardless* of the metric used. After the survey, XYZ rolled out a set of programs to help boost Career Focused Workstyle at a cost of about $60K. EMPA's next annual survey tracked the change in the corporate culture as workstyle increased by 5%.

Multivariate statistical analysis also proved that this 5% increase in Career Focused Workstyle generated $3.3M in new revenue for the company.

Quantitative Analysis of Linkages Improves Quality at INS

Workforce: 20,000 employees in 350 Ports-of-Entry across the nation at our borders
Problem & Scope: No objective QC for 500,000,000 INS Inspections per year
Intervention: Quality Checks of inspected & approved travelers before entry to the US
Method: A Multiphase-multistage Proportional Stratified Random Sample
Construct Validity: Quality Checks show no bias for Gender, Age, or Citizenship
Predictive Validity: Good Communication predicts low Defect Rate in Inspections
Content Validity: High Commitment yields high Thoroughness in the Quality Check
Business Utility: Catch Rates vary at the POEs, so strategic interventions are possible

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