1-1-1983

A New Approach to Variance Analysis

Michael van Breda
Southern Methodist University

Follow this and additional works at: https://scholar.smu.edu/business_workingpapers

Part of the Business Commons

This document is brought to you for free and open access by the Cox School of Business at SMU Scholar. It has been accepted for inclusion in Historical Working Papers by an authorized administrator of SMU Scholar. For more information, please visit http://digitalrepository.smu.edu.
A NEW APPROACH TO VARIANCE ANALYSIS

Working Paper 83-808*

by

Michael F. van Breda

First draft July 1983

Michael F. van Breda
Associate Professor of Accounting
Edwin L. Cox School of Business
Southern Methodist University
Dallas, Texas 75275

*This paper represents a draft of work in progress by the author and is being sent to you for information and review. Responsibility for the contents rests solely with the author. This working paper may not be reproduced or distributed without the written consent of the author. Please address all correspondence to Michael F. van Breda.
Every standard cost variance can be associated with a conceptually identical index. Restating variances in terms of equivalent indices facilitates comparisons across products enabling critical areas to be pinpointed. Additional advantages are the insights that index analysis yields into management's response to price changes and the improvement that results from these insights in performance evaluation.
A NEW APPROACH TO VARIANCE ANALYSIS

Accountants typically use variances to express, and to analyze, changes in costs; economists, on the other hand, use indices for the same purpose. This paper demonstrates that the underlying methodology is identical and that for every variance there is a corresponding index and vice-versa. These indices may be calculated directly very easily and offer three benefits to management.

**They make comparisons of changes of costs and especially of changes in unit costs possible across products and across inputs within the company and with other companies in the economy.**

**They give insight into the nature of the variances themselves since they reveal very clearly the weighting systems that are in use in the calculation of variances.**

**They are a useful addition to the analysis of management's behavior and they are of value, therefore, in evaluating performance.**

To which should be added that one can bring the experience of economists in analyzing indices together with the experience of accountants in analyzing variances.

The first part of this paper provides a numerical example of a production system in which mix variances are calculated. The second shows how mix indices may be calculated directly and how one might convert these indices to variances and back, and then discusses an immediate advantage of having these indices at one's disposal. The third section discusses the weighting systems being used in calculating indices in the context of variance analysis. The fourth section demonstrates how one might calculate some alternative indices and discusses the insights these give one. A brief conclusion follows.
I. MIX VARIANCES

INTRODUCTION

Consider, by way of example, a manufacturer distilling perfume from three raw materials. Exhibit I shows the unit prices paid for these materials this year and the prices that were budgeted to be paid for these materials at the start of the year. Also found in that exhibit is the quantity of each raw material used to produce 75,000 ounces of distillate and the percentage each input formed of the total, i.e., the nature of the mix. Above the actual figures appear the comparative budget figures.

The exhibit reveals that the price of the first material fell by $0.50 or by 8.3 percent while the prices of the other two materials rose by 20 percent and 10 percent, respectively. Management's response was to increase the use of the first material relative to the others. The actual blend increased the overall yield from 75 percent to 80 percent reducing the use of materials from a total of 100,000 ounces to 93,750 ounces.

The exhibit shows that the actual costs were $703 above the budgeted costs of $420,000 -- a rise of 0.17 percent. A completely conventional variance analysis where the $703 is split into a favorable price variance of $1,172, an unfavorable mix variance of $28,125, and a favorable yield variance of $26,250, follows.

These variances may be given a fairly simple -- although, as will be seen, a slightly misleading -- interpretation. Prices fell on average saving the company $1,172. The relative prices shifted in such a way that management was obliged to shift to a less favorable mix costing the company $28,125; however, this new blend, while less favorable in terms of its mix, yielded more distillate proportionately and so saved the company $26,250.
II. MIX INDICES

INDEX ANALYSIS

The analysis of variance just completed is repeated in percentage or index terms in Exhibit II where all the necessary formulae are displayed too. (The body of this article limits itself to results as far as possible. The details of all calculations may be found in the exhibits.) The formulae in Exhibit II demonstrate that to arrive at an index one essentially divides one cost by the other rather than subtracting one cost from the other. This process is further simplified by the use of weights so that one uses weighted average unit costs in the analysis.

For example, to calculate the price index one divides the actual average unit cost of $4.4875 by $4.50 which is the average unit cost that would have been incurred if the actual mix had been used but prices had remained steady. The corresponding price variance subtracts the two unit costs yielding a difference of ($0.125) and multiplies this by the actual number of ounces used or 93,750. The result is the ($1,172) found in Exhibit I.

The mix index is found similarly. The weights now in use in the numerator and denominator are the standard prices. The denominator is the standard average unit cost of $4.20 and the numerator is the $4.50 described in the previous paragraph. If instead of dividing these two average costs they are subtracted one from the other and the result multiplied by the actual total usage the mix variance of $28,125 found in Exhibit I results.

The interpretation of the indices in Exhibit II is as straightforward as their calculation although, as with the variances, the interpretation is phrased, at this point, in slightly misleading terms. Prices are shown to have fallen on average 0.28 percent, i.e., 100 less 99.72 percent. Management responded by rearranging the mix of inputs. The new mix, without taking
changes in the yield into account, caused costs to rise 7.14 percent; however, this was offset by a decline of 6.25 percent in costs owing to improved yield. The product of these three indices i.e., $0.9972 \times 1.0714 \times 0.9375$ results in an overall rise in costs of 0.17 percent or an index of 1.0017.

CONVERSIONS

Converting price variances to price indices and back again is not difficult as Exhibit III demonstrates. Take the price variance by way of example. The amount of 93,750 is the total raw material input actually used to produce 75,000 ounces of distillate. The $4.4875 is this year's average unit cost. The 0.9972 is the associated price index that was calculated in Exhibit II. The product is the price variance as it appeared in Exhibit I.

This conversion may be reversed. The mix index, for instance, is the sum of this year's actual usage of 93,750 ounces multiplied by the standard average unit cost of $4.20 and the mix variance of $28,125 from Exhibit I divided by the actual usage multiplied by the standard average unit cost. The resulting index of 1.0714 may be verified in Exhibit II.

SOME ADVANTAGES

There are several immediate advantages to either calculating indices directly or converting variances to indices by the methods just outlined. The first is that indices, while no more difficult than variances to calculate, lend themselves to comparative statements. For example, one can compare the cost reduction of 6.25 percent due to the increased yield with similar percentages in other perfumeries.

A similar argument is often made about accounting net income figures versus return on investment. And quite frankly, indices simply formalize common
practice anyway since most people speak in terms of percentages rather than dollar numbers.

The second advantage of estimating indices is that they give one insights into the nature of variances. These insights result from the fact that with every variance may be associated a conceptually identical index. Indices emphasize the weights used in their calculation but these weights are implicit in the variances too. A study of index weights can provide insights into variances therefore. This conceptual link between indices and variances is explored more fully in the following section.

A third advantage is that the combination of variance and index analysis enables management to draw on both the work of economists and of accountants. This is especially valuable in the area of price changes where price indices are used far more frequently than price variances. For example, an internal price index may be compared with the government's price indices for similar materials -- or an internal wage index with the economy wide change in average wages.

III. WEIGHTING INDICES

WEIGHTING PRICE INDICES

All price indices involve a basket of goods. Most typically this is a set of items that an average family might have purchased some years back. Each month or year, this basket is repriced. The cost of the basket when it was originally constructed is set at a level of 100. The current cost of that basket is calibrated accordingly. An alternative seldom used by economists is to construct a new basket of goods each year and then to work backwards. In other words, one would base the index on the set of items that an average
family purchased this year. The current cost of this basket is established and compared with the cost of a similar basket in previous years.

The first method creates what is known as a Laspeyres Index, the second creates a Paasche Index. The disadvantage of the Laspeyres Index is that people's tastes change. Items that were in the basket ten years ago might not even be made today. Also, the proportion in which goods find their way into baskets shifts. Fewer middle-income families own homes today; more rent houses. Everyone buys less gasoline. The obvious way out is to update the basket each year, i.e., to use a Paasche Index, but that is a more costly procedure. So the Laspeyres tends to be favored by economists.

As noted in the previous paragraph, every price variance can be associated with a price index. An examination of the price indices in Exhibit II reveals quite clearly that the weights being used to arrive at an average unit cost both in the numerator and the denominator are those of the actual mix of raw materials. The basket, or blend, is today's. In other words, the price index that the accountant implicitly calculates is a Paasche index. Stated otherwise, when it was asserted that the index analysis revealed a decline of prices of 0.28 percent, the assertion was based on the actual blend of material management used.

The price index may now be interpreted more precisely. A Paasche index, as calculated here, is really a residual index. It shows the fall in average unit cost after management changed the blend. The following section demonstrates that average unit costs "actually" rose in this period. The Paasche index reflects a fall only because management was able to shift to materials that were less affected by rises in price.

In summary, it is useful to calculate the Paasche index because it reveals the effects of management's efforts to cope with changes in price. On
the other hand, the Paasche price index gives one little or no information about the rise or fall in prices with which management had to cope in the first place. For that one needs the Laspeyres price index developed in Section IV of this paper.

WEIGHTING MIX INDICES

An analysis similar to the one just undertaken for the price index can be done for the mix index. The weights used in the mix index are prices rather than quantities. The particular index established in Exhibit II used standard prices and by analogy with price indices may be labelled a Laspeyres mix index.

A more precise interpretation of this index may now be given. If prices had not differed from those budgeted, and if the yield had not improved, then the change in mix from that budgeted to that actually used would have caused costs to rise by 7.14 percent. Of course, the only reason why this new mix was adopted was because it led to a higher yield offsetting the effect of the unfavorable cost effects of a change in the blend.

It is interesting to note briefly at this point how the traditional variance or index analysis leads one logically to work backwards from the actual costs of $420,703 to the budget of $420,000. If prices had not changed, the actual quantities used would have cost $420,703 divided by the price index of 0.9972 or $421,875. If the yield had not improved, the cost would have risen to $450,000 or $421,875 divided by the yield index of 0.9375. Finally, if the mix had not changed, the cost would have been the original budgeted cost of $420,000 or $450,000 divided by the mix index of 1.0714.
IV. ALTERNATIVE INDICES

LASPEYRES PRICE VARIANCES

Exhibit IV reveals how a price index might be calculated using the original blend. The unit costs, actual in the numerator and standard in the denominator, are multiplied by the actual material weights or equivalently, by the proportion each material forms in the actual total of 93,750 ounces that were used. All these figures are freely available from the normal analysis of variance so that this Laspeyres index can be calculated as easily as the Paasche index.

As noted on several occasions, with each index is an associated variance. Exhibit V shows how one might calculate the Laspeyres price variance. The only change from the Paasche variance is that the differences in unit costs are multiplied by the standard quantities rather than the actual quantities. As with the index, the necessary figures are freely available.

The price index calculated in this way shows a rise in average unit costs of 2.02 percent. This translates into a dollar variance of $8,500. This was the rise in costs that management faced if it did not respond. The Paasche index calculated earlier shows that management did respond by changing the mix and in so doing actually turned the rise in average unit costs of 2.02 percent into a decline of 0.28 percent.

The two forms of the price index between them provide an illuminating analysis of management’s initial situation and their subsequent response. The Laspeyres index shows the size of the problem; the Paasche indicates the outcome from management’s response to the problem; and the difference between the two, the effect of management’s response.

Of course, for a full understanding of changes in costs one must examine the mix and yield variances as well as the price variance. In particular, it
is also useful on occasion to look at the Paasche mix indices which are associated with the Laspeyres price indices.

**PAASCHE MIX INDICES**

To calculate the Paasche mix index, one weights the actual and standard mixes by the actual unit costs rather than the standard unit costs. The result, as shown in Exhibit IV, is a mix index of 1.0473 indicating that, at actual unit costs, the change in mix caused a rise in costs of 4.73 percent.

As before, the Paasche mix index can be converted to a Paasche mix variance. Alternatively, the variance may be calculated directly. Exhibit V demonstrates how this might be done. All figures are freely available from the standard variance analysis so that it is quite straightforward to arrive at the figure of $20,250.

It is interesting now to contrast this alternative analysis with the more traditional variance analysis. As noted earlier, the traditional analysis leads logically backwards. The Paasche index, by contrast, leads forwards from the budget of $420,000 to the actual costs of $420,703. If prices had risen but no further action had been taken prices would have risen 2.02 percent from $420,000 to $428,500. If the mix had been changed but no yield benefit had been felt the costs would have risen a further 4.73 percent from $428,500 to $448,750. The improved yield reduced this last by 6.25 percent to $420,703.

**V. CONCLUSION**

To draw all the foregoing together, this article has suggested that index analysis is an overlooked tool with all sorts of potentially rich applications for analyzing the effects of cost changes. In particular, the variance
analysis familiar to accountants is identical to the index analysis familiar to economists.

The benefits of converting variances to indices are three. First, it enables the accountant to draw on all the insights into the behavior of indices that economists have generated over the years. Second, it enables management to compare the effects of price changes within the firm with those outside the firm. Third, the different percentage changes, instead of variances, enable one to identify very simply where the largest price effects are occurring across the firm.

The proposal is simple. All the figures used in the proposed analysis are freely available from the conventional variance analysis. Given the potential benefits the relative cost of the few additional lines of programming it would take to implement the proposal would appear to be minimal.
## EXHIBIT I

Conventional Variance Analysis

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Prices (SP₁)</td>
<td>$6.00</td>
<td>$3.50</td>
<td>$2.50</td>
<td></td>
</tr>
<tr>
<td>Standard Quantities (SQ₁) required for 75,000 ounces</td>
<td>40,000</td>
<td>30,000</td>
<td>30,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Standard Mix Proportions (SM₁)</td>
<td>0.40</td>
<td>0.30</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Standard Cost of Materials</td>
<td>$240,000</td>
<td>$105,000</td>
<td>$75,000</td>
<td>$420,000</td>
</tr>
<tr>
<td>Actual Prices (AP₁)</td>
<td>$5.50</td>
<td>$4.20</td>
<td>$2.75</td>
<td></td>
</tr>
<tr>
<td>Actual Quantities Used (AQ₁)</td>
<td>46,875</td>
<td>23,475.5</td>
<td>23,437.5</td>
<td>93,750</td>
</tr>
<tr>
<td>Actual Mix Proportions (AM₁)</td>
<td>0.50</td>
<td>0.25</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Actual Cost of Materials</td>
<td>$257,812</td>
<td>$98,438</td>
<td>$64,453</td>
<td>$420,703</td>
</tr>
</tbody>
</table>

Price Variance = \[ \sum (AP₁ - SP₁) \cdot AQ₁ \]
= \[(5.50 - 6.00)(46,875) + (4.20 - 3.50)(23,437.5) + (2.75 - 2.50)(23,437.5)\]
= $1,172 \text{ F}

Mix Variance = \[ \sum (AQ₁ - SQ₁)(SP₁ - SP) \]
= \[(46,875 - 40,000)(6.00 - 4.20) + (23,437.5 - 30,000)(3.50 - 4.20) + (23,437.5 - 30,000)(2.50 - 4.20)\]
= $28,125 \text{ U}

Yield Variance = \[ \sum (SP₁)(AQ₁ - SQ₁) \]
= \[(4.20)(93,750 - 100,000)\]
= $26,250 \text{ F}

Total Variance = (Price + Mix + Yield Variances)
= $703 \text{ U}

\[ \sum \text{SP₁}(\sum \text{SQ₁}) / (\sum \text{SQ₁}) \]

F = Favorable \hspace{1cm} U = Unfavorable
EXHIBIT II

Index Analysis

Price Index: \[
\frac{\sum (AP_i)(AQ_i)}{\sum (SP_i)(AQ_i)}
\]
\[
= \frac{\sum (AP_i)(AM_i)}{\sum (SP_i)(AM_i)}
\]
\[
= \frac{5.50 \times 0.5 + 4.20 \times 0.25 + 2.75 \times 0.25}{6.00 \times 0.5 + 3.50 \times 0.25 + 2.50 \times 0.25}
\]
\[
= \frac{4.4875}{4.50}
\]
\[
= 0.9972
\]

Mix Index: \[
\frac{\sum (AM_i)(SP_i)}{\sum (SM_i)(SP_i)}
\]
\[
= \frac{0.5 \times 6.00 + 0.25 \times 3.50 + 0.25 \times 2.50}{0.4 \times 6.00 + 0.30 \times 3.50 + 0.30 \times 2.50}
\]
\[
= \frac{4.50}{4.20}
\]
\[
= 1.0714
\]

Yield Index: \[
\frac{\sum AQ_i}{\sum SQ_i}
\]
\[
= 93,750 / 100,000
\]
\[
= 0.9375
\]

Overall Costs \[
= \frac{420,703}{420,000}
\]
\[
= 0.9972 \times 1.0714 \times 0.9375
\]
\[
= 1.0017
\]
### EXHIBIT III

**Indices to Variances**

<table>
<thead>
<tr>
<th>Term</th>
<th>Equation</th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price Variance</strong></td>
<td>$\sum(AQ_t)(AP)[1 - (\text{Price Index})^{-1}]$</td>
<td>$(93,750)($4.4875)[1 - 0.9972^{-1}]$</td>
<td>$($1,172)$</td>
</tr>
<tr>
<td><strong>Mix Variance</strong></td>
<td>$\sum(AQ_t)(SP)[\text{Mix Index} - 1]$</td>
<td>$(93,750)($4.20)[1.0714 - 1]$</td>
<td>$($28,125)$</td>
</tr>
<tr>
<td><strong>Yield Variance</strong></td>
<td>$\sum(AQ_t)(SP)[1 - (\text{Yield Index})^{-1}]$</td>
<td>$(93,750)($4.20)[1 - 0.9375^{-1}]$</td>
<td>$($26,250)$</td>
</tr>
<tr>
<td><strong>Price Index</strong></td>
<td>$\sum(AQ_t)(\overline{AP})[\sum(AQ_t)(\overline{AP}) - \text{Price Variance}]^{-1}$</td>
<td>$(93,750)($4.4875)[93,750 \times $4.4875 + 1,172]^{-1}$</td>
<td>0.9972</td>
</tr>
<tr>
<td><strong>Mix Index</strong></td>
<td>$[\sum(AQ_t)(\overline{SP}) + \text{Mix Variance}][\sum(AQ_t)(\overline{SP})]^{-1}$</td>
<td>$[(93,750)($4.20) + $28,125][(93,750)($4.20)]^{-1}$</td>
<td>1.0714</td>
</tr>
<tr>
<td><strong>Yield Index</strong></td>
<td>$[\sum(AQ_t)(\overline{SP})][\sum(AQ_t)(\overline{SP}) - \text{Yield Variance}]^{-1}$</td>
<td>$(93,750)($4.20)[(93,750)($4.20) + $26,250]^{-1}$</td>
<td>0.9375</td>
</tr>
</tbody>
</table>
EXHIBIT IV

Alternative Index Analysis

Price Index: \[
\frac{\sum (AP_i)(SM_i)}{\sum (SP_i)(SM_i)}
\]

\[
= \frac{5.50 \times 0.4 + 4.20 \times 0.3 + 2.75 \times 0.3}{6.00 \times 0.4 + 3.50 \times 0.3 + 2.50 \times 0.3}
\]

\[
= \frac{4.285}{4.20}
\]

\[
= 1.0202
\]

Mix Index: \[
\frac{\sum (AM_i)(AP_i)}{\sum (SM_i)(AP_i)}
\]

\[
= \frac{0.50 \times 5.50 + 0.25 \times 4.20 + 0.25 \times 2.75}{0.40 \times 5.50 + 0.30 \times 4.20 + 0.30 \times 2.75}
\]

\[
= \frac{4.4875}{4.285}
\]

\[
= 1.0473
\]

Yield Index: \[
\frac{\sum AQ_i}{\sum SQ_i}
\]

\[
= \frac{93,750}{100,000}
\]

\[
= 0.9375
\]

Overall Costs: \[
= \frac{420,703}{420,000}
\]

\[
= 1.0202 \times 1.0473 \times 0.9375
\]

\[
= 1.0017
\]
Exhibit V
Alternative Variance Analysis

(i) Price Variance = \sum (AP_i -SP_i)SQ_i
= (\$5.50-6.00)(40,000) + (\$4.20-3.50)(30,000) +
(\$2.75-2.50)(30,000)
= $8,500

(ii) Mix Variance = \sum (AQ_i - (SQ_i))(AP_i - \overline{AP})
= (46,875-40,000)(\$5.50-4.4875) + (23,437.5-30,000)(\$4.20-4.4875) +
(23,437.5-30,000)(\$2.75-4.4875)
= 20,250

(iii) Yield Variance = (\overline{AP})(\sum AQ_i - \sum SQ_i)
= (\$4.4875)(93,750-100,000)
= (\$28,047)

\overline{AP} = \sum (AP_i)(AQ_i)/\sum (AQ_i)
The following papers are currently available in the Edwin L. Cox School of Business Working Paper Series.

79-100 "Microdata File Merging Through Large-Scale Network Technology," by Richard S. Barr and J. Scott Turner

79-101 "Perceived Environmental Uncertainty: An Individual or Environmental Attribute," by Peter Lorenzi, Henry P. Sims, Jr., and John W. Slocum, Jr.


80-100 "Implementing the Portfolio (SBU) Concept," by Richard A. Bettis and William K. Hall

80-101 "Assessing Organizational Change Approaches: Towards a Comparative Typology," by Don Hellriegel and John W. Slocum, Jr.

80-102 "Constructing a Theory of Accounting—An Axiomatic Approach," by Marvin L. Carlson and James W. Lamb

80-103 "Mentors & Managers," by Michael E. McGill

80-104 "Budgeting Capital for R&D: An Application of Option Pricing," by John W. Kensinger

80-200 "Financial Terms of Sale and Control of Marketing Channel Conflict," by Michael Levy and Dwight Grant


80-301 "Controlling the Performance of People in Organizations," by Steven Kerr and John W. Slocum, Jr.

80-400 "The Effects of Racial Composition on Neighborhood Succession," by Kerry D. Vandell


80-801 "Comparison of the EEOCC Four-Fifths Rule and A One, Two or Three σ Binomial Criterion," by Marion Gross Sobol and Paul Ellard

80-900 "Bank Portfolio Management: The Role of Financial Futures," by Dwight M. Grant and George Hempel
"Hedging Uncertain Foreign Exchange Positions," by Mark R. Eaker and Dwight M. Grant


"Sources of Performance Differences in Related and Unrelated Diversified Firms," by Richard A. Bettis

"The Information Needs of Business With Special Application to Managerial Decision Making," by Paul Gray

"Diversification Strategy, Accounting Determined Risk, and Accounting Determined Return," by Richard A. Bettis and William K. Hall

"Toward Analytically Precise Definitions of Market Value and Highest and Best Use," by Kerry D. Vandell

"Person-Situation Interaction: An Exploration of Competing Models of Fit," by William F. Joyce, John W. Slocum, Jr., and Mary Ann Von Glinow

"Correlates of Climate Discrepancy," by William F. Joyce and John Slocum

"Alternative Perspectives on Neighborhood Decline," by Arthur P. Solomon and Kerry D. Vandell

"Project Abandonment as a Put Option: Dealing with the Capital Investment Decision and Operating Risk Using Option Pricing Theory," by John W. Kensinger

"The Interrelationships Between Banking Returns and Risks," by George H. Hempel

"The Environment For Funds Management Decisions In Coming Years," by George H. Hempel

"A Test of Gouldner's Norm of Reciprocity in a Commercial Marketing Research Setting," by Roger Kerin, Thomas Barry, and Alan Dubinsky

"Solution Strategies and Algorithm Behavior in Large-Scale Network Codes," by Richard S. Barr

"The SMU Decision Room Project," by Paul Gray, Julius Aronofsky, Nancy W. Berry, Olaf Helmer, Gerald R. Kane, and Thomas E. Perkins

"Cash Discounts to Retail Customers: An Alternative to Credit Card Performance," by Michael Levy and Charles Ingene


<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>81-501</td>
<td>&quot;Job Redesign: Improving the Quality of Working Life,&quot;</td>
<td>John W. Slocum, Jr.</td>
</tr>
<tr>
<td>81-600</td>
<td>&quot;Managerial Uncertainty and Performance,&quot;</td>
<td>H. Kirk Downey and John W. Slocum, Jr.</td>
</tr>
<tr>
<td>81-601</td>
<td>&quot;Compensating Balance, Rationality, and Optimality,&quot;</td>
<td>Chun H. Lam and Kenneth J. Boudreaux</td>
</tr>
<tr>
<td>81-800</td>
<td>&quot;The Chinese-U.S. Symposium On Systems Analysis,&quot;</td>
<td>Paul Gray and Burton V. Dean</td>
</tr>
<tr>
<td>81-900</td>
<td>&quot;Forecasting Industrial Bond Rating Changes: A Multivariate Model,&quot;</td>
<td>John W. Peavy, III</td>
</tr>
<tr>
<td>81-110</td>
<td>&quot;Improving Gap Management as a Technique for Reducing Interest Rate Risk,&quot;</td>
<td>Donald G. Simonson and George H. Hempel</td>
</tr>
<tr>
<td>81-112</td>
<td>&quot;The Significance of Price-Earnings Ratios on Portfolio Returns,&quot;</td>
<td>John W. Peavy, III and David A. Goodman</td>
</tr>
<tr>
<td>81-113</td>
<td>&quot;Further Evaluation of Financing Costs for Multinational Subsidiaries,&quot;</td>
<td>Catherine J. Bruno and Mark R. Eaker</td>
</tr>
<tr>
<td>81-114</td>
<td>&quot;Seven Key Rules for Successful Stock Market Speculation,&quot;</td>
<td>David Goodman</td>
</tr>
<tr>
<td>81-115</td>
<td>&quot;The Price-Earnings Relative as an Indicator of Investment Returns,&quot;</td>
<td>David Goodman and John W. Peavy, III</td>
</tr>
<tr>
<td>81-117</td>
<td>&quot;Sequential Information Dissemination and Relative Market Efficiency,&quot;</td>
<td>Christopher B. Barry and Robert H. Jennings</td>
</tr>
<tr>
<td>81-118</td>
<td>&quot;Modeling Earnings Behavior,&quot;</td>
<td>Michael F. van Breda</td>
</tr>
<tr>
<td>81-120</td>
<td>&quot;The Price-Earnings Relatives - A New Twist to the Low-Multiple Strategy,&quot;</td>
<td>David A. Goodman and John W. Peavy, III</td>
</tr>
<tr>
<td>82-100</td>
<td>&quot;Risk Considerations in Modeling Corporate Strategy,&quot;</td>
<td>Richard A. Bettis</td>
</tr>
</tbody>
</table>


82-103 "A Typology of Small Businesses: Hypothesis and Preliminary Study," by Neil C. Churchill and Virginia L. Lewis

82-104 "Imperfect Information, Uncertainty, and Credit Rationing: A Comment and Extension," by Kerry D. Vandell

82-200 "Equilibrium in a Futures Market," by Jerome Baesel and Dwight Grant

82-201 "A Market Index Futures Contract and Portfolio Selection," by Dwight Grant

82-202 "Selecting Optimal Portfolios with a Futures Market in a Stock Index," by Dwight Grant

82-203 "Market Index Futures Contracts: Some Thoughts on Delivery Dates," by Dwight Grant

82-204 "Optimal Sequential Futures Trading," by Jerome Baesel and Dwight Grant

82-300 "The Hypothesized Effects of Ability in the Turnover Process," by Ellen F. Jackofsky and Lawrence H. Peters

82-301 "Teaching a Financial Planning Language as the Principal Computer Language for MBA's," by Thomas E. Perkins and Paul Gray

82-302 "Put Budgeting Back Into Capital Budgeting," by Michael F. van Breda

82-400 "Information Dissemination and Portfolio Choice," by Robert H. Jennings and Christopher B. Barry

82-401 "Reality Shock: The Link Between Socialization and Organizational Commitment," by Roger A. Dean

82-402 "Reporting on the Annual Report," by Gail E. Farrelly and Gail B. Wright


82-601 "Optimal Land Use Planning," by Richard B. Peiser

82-602 "Variance and Indices," by Michael F. van Breda

82-603 "The Pricing of Small Business Loans," by Jonathan A. Scott

82-604 "Collateral Requirements and Small Business Loans," by Jonathan A. Scott

82-605 "Validation Strategies for Multiple Regression Analysis: A Tutorial," by Marion G. Sobol
82-700 "Credit Rationing and the Small Business Community," by Jonathan A. Scott

82-701 "Bank Structure and Small Business Loan Markets," by William C. Dunkelberg and Jonathan A. Scott

82-800 "Transportation Evaluation in Community Design: An Extension with Equilibrium Route Assignment," by Richard B. Peiser

82-801 "An Expanded Commercial Paper Rating Scale: Classification of Industrial Issuers," by John W. Peavy, III and S. Michael Edgar

82-802 "Inflation, Risk, and Corporate Profitability: Effects on Common Stock Returns," by David A. Goodman and John W. Peavy, III

82-803 "Turnover and Job Performance: An Integrated Process Model," by Ellen F. Jackofsky


82-806 "Analytical Review Developments in Practice: Misconceptions, Potential Applications, and Field Experience," by Wanda Wallace

82-807 "Using Financial Planning Languages for Simulation," by Paul Gray

82-808 "A Look at How Managers' Minds Work," by John W. Slocum, Jr. and Don Hellriegel

82-900 "The Impact of Price Earnings Ratios on Portfolio Returns," by John W. Peavy, III and David A. Goodman

82-901 "Replicating Electric Utility Short-Term Credit Ratings," by John W. Peavy, III and S. Michael Edgar

82-902 "Job Turnover Versus Company Turnover: Reassessment of the March and Simon Participation Model," by Ellen F. Jackofsky and Lawrence H. Peters

82-903 "Investment Management by Multiple Managers: An Agency-Theoretic Explanation," by Christopher B. Barry and Laura T. Starks

82-904 "The Senior Marketing Officer - An Academic Perspective," by James T. Rothe

82-905 "The Impact of Cable Television on Subscriber and Nonsubscriber Behavior," by James T. Rothe, Michael G. Harvey, and George C. Michael

82-110 "Reasons for Quitting: A Comparison of Part-Time and Full-Time Employees," by James R. Salter, Lawrence H. Peters, and Ellen F. Jackofsky

82-111 "Integrating Financial Portfolio Analysis with Product Portfolio Models," by Vijay Mahajan and Jerry Wind
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>82-112</td>
<td>&quot;A Non-Uniform Influence Innovation Diffusion Model of New Product Acceptance,&quot;</td>
<td>Christopher J. Easingwood, Vijay Mahajan, and Eitan Muller</td>
</tr>
<tr>
<td>82-113</td>
<td>&quot;The Acceptability of Regression Analysis as Evidence in a Courtroom - Implications for the Auditor,&quot;</td>
<td>Wanda A. Wallace</td>
</tr>
<tr>
<td>82-114</td>
<td>&quot;A Further Inquiry Into the Market Value and Earnings' Yield Anomalies,&quot;</td>
<td>John W. Peavy, III and David A. Goodman</td>
</tr>
<tr>
<td>82-120</td>
<td>&quot;Compensating Balances, Deficiency Fees and Lines of Credit: An Operational Model,&quot;</td>
<td>Chun H. Lam and Kenneth J. Boudreaux</td>
</tr>
<tr>
<td>82-121</td>
<td>&quot;Toward a Formal Model of Optimal Seller Behavior in the Real Estate Transactions Process,&quot;</td>
<td>Kerry Vandell</td>
</tr>
<tr>
<td>82-123</td>
<td>&quot;Compensating Balances, Deficiency Fees and Lines of Credit,&quot;</td>
<td>Chun H. Lam and Kenneth J. Boudreaux</td>
</tr>
<tr>
<td>83-100</td>
<td>&quot;Teaching Software System Design: An Experiential Approach,&quot;</td>
<td>Thomas E. Perkins</td>
</tr>
<tr>
<td>83-102</td>
<td>&quot;An Interactive Approach to Pension Fund Asset Management,&quot;</td>
<td>David A. Goodman and John W. Peavy, III</td>
</tr>
<tr>
<td>83-105</td>
<td>&quot;Robust Regression: Method and Applications,&quot;</td>
<td>Vijay Mahajan, Subhash Sharma, and Jerry Wind</td>
</tr>
<tr>
<td>83-106</td>
<td>&quot;An Approach to Repeat-Purchase Diffusion Analysis,&quot;</td>
<td>Vijay Mahajan, Subhash Sharma, and Jerry Wind</td>
</tr>
<tr>
<td>83-200</td>
<td>&quot;A Life Stage Analysis of Small Business Strategies and Performance,&quot;</td>
<td>Rajeswararao Chaganti, Radharao Chaganti, and Vijay Mahajan</td>
</tr>
<tr>
<td>83-201</td>
<td>&quot;Reality Shock: When A New Employee's Expectations Don't Match Reality,&quot;</td>
<td>Roger A. Dean and John P. Wanous</td>
</tr>
<tr>
<td>83-202</td>
<td>&quot;The Effects of Realistic Job Previews on Hiring Bank Tellers,&quot;</td>
<td>Roger A. Dean and John P. Wanous</td>
</tr>
<tr>
<td>83-204</td>
<td>&quot;Differential Information and the Small Firm Effect,&quot;</td>
<td>Christopher B. Barry and Stephen J. Brown</td>
</tr>
</tbody>
</table>
83-300 "Constrained Classification: The Use of a Priori Information in Cluster Analysis," by Wayne S. DeSarbo and Vijay Mahajan


83-400 "Small Businesses, the Economy, and High Interest Rates: Impacts and Actions Taken in Response," by Neil C. Churchill and Virginia L. Lewis


83-500 "A Closer Look at Stock-For-Debt Swaps," by John W. Peavy III and Jonathan A. Scott

83-501 "Small Business Evaluates its Relationship with Commercial Banks," by William C. Dunkelberg and Jonathan A. Scott


83-503 "Differential Information and the Small Firm Effect," by Christopher B. Barry and Stephen J. Brown

83-504 "Accounting Paradigms and Short-Term Decisions: A Preliminary Study," by Michael van Breda


83-506 "Initial Observations from the Decision Room Project," by Paul Gray


83-800  "Multiple Key Informants' Perceptions of Business Environments," by William L. Cron and John W. Slocum, Jr.


83-803  "Business Synergy and Profitability," by Vijay Mahajan and Yoram Wind

83-804  "Advertising, Pricing and Stability in Oligopolistic Markets for New Products," by Chaim Fershtman, Vijay Mahajan, and Eitan Muller

83-805  "How Have The Professional Standards Influenced Practice?," by Wanda A. Wallace

83-806  "What Attributes of an Internal Auditing Department Significantly Increase the Probability of External Auditors Relying on the Internal Audit Department?," by Wanda A. Wallace

83-807  "Building Bridges in Rotary," by Michael F. van Breda

83-808  "A New Approach to Variance Analysis," by Michael F. van Breda