"Fair" Allocations of Salaries and Taxes

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Judges were asked to "fairly" allocate salaries to hypothetical faculty members on the basis of their merit ratings. Individual merit ratings, total budgets to be distributed, and distributions of merit ratings for the entire group were manipulated. In another set of studies, judges were asked to "fairly" assign income taxes to hypothetical persons given their salaries. Individual salaries, amounts of revenue to generate, and distributions of salaries for the group were varied. A theory of relative equity is presented that successfully accounts for both sets of results. It is hypothesized that an equitable state is one in which the relative position of a stimulus (e.g., merit or salary) in the distribution of stimuli matches the relative position of the response (e.g., salary or tax) in the distribution of responses. The relative position of a stimulus or response is defined as its range-frequency value based on the range-frequency compromise.

The relative position of a stimulus in its distribution is assumed to be given by Parducci's (1968, 1974, 1982) range-frequency compromise. In range-frequency theory, the relative position of a stimulus is defined as the weighted average of two relative standings: the rank of the stimulus in its distribution and the position of the stimulus relative to the stimulus endpoints. When the endpoints are fixed, the theory can be written as

\[ R_{ik} = wF_k(s_i) + (1 - w) \frac{S_i - S_o}{S_m - S_o}, \]

where \( R_{ik} \) is the relative position of stimulus \( i \) in context \( k \); \( F_k(s_i) \) is the rank of stimulus \( i \) in context \( k \); \( w \) is the weight of the percentage rank \( 0 < w < 1 \); \( s_i \) is the subjective value of the stimulus; \( s_0 \) and \( s_m \) are the minimum and maximum subjective values, respectively. If \( w \) is zero, the relative position is linearly related to the subjective value of the stimulus (range principle). If \( w \) is one, the relative standing is linearly related to percentile (frequency principle).

Mellers (1982) proposed that judgments of "fair" salaries can be fit as follows:

\[ s_{ik} = \bar{s}_{ik} + A[R_{ik} - \bar{R}_{ik}], \]

where \( s_{ik} \) is the predicted salary given to faculty member \( i \) with a total budget of size \( j \) to be allocated in context \( k \); \( \bar{s}_{ik} \) is the average salary; \( A \) is a multiplier; \( R_{ik} \) is the relative position of person \( i \)'s merit from Equation 1 (Note: \( s_i \) denotes the subjective value of a merit rating of level \( i \)); \( \bar{R}_{ik} \) is the average relative position in context \( k \).

When the value of \( A \) in Equation 2 is zero, the theory implies that each faculty member will receive the average salary. When \( A \) is greater than zero, salaries will deviate from equality and depend, in part, on the relative position of a person's merit (in deviation score form). The larger the value of \( A \), the more salaries will depend on merit. Thus, \( A \) represents the weight of the tendency to deviate from equality on the basis of merit.

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1 Quotation marks will be used to distinguish judgments of equity from either normative or descriptive theories of fairness.
Alternative Theories of Equity

Some theories of equity employ different versions of Aristotle's concept of proportionality: The situation is assumed to be equitable when outcomes are proportional to inputs (Adams, 1965; Walster, Walster, & Berscheid, 1978). One such theory is the relative ratio model (Anderson, 1976). For the allocation task of Mellers (1982), the relative ratio model can be written as follows:

\[ S_{jk} = \frac{M_i}{\Sigma M} S\$, \]  

where \( S_{jk} \) is the predicted salary for person \( i \) in context \( k \) with an amount to distribute; \( j \); \( M_i \) is the merit rating for person \( i \); \( \Sigma M \) is the sum of the merit ratings in the group; \( S\$ \) is the sum of the salaries (or the total amount to be distributed). Common salaries from different contexts should be related by a constant of proportionality, because variations in contexts are assumed to influence only \( \Sigma M \) and \( S\$ \).

The relative ratio model can be thought of as a special case of relative equity theory where the relative standing of a stimulus is defined as that value of the stimulus divided by the sum of the stimuli in the distribution, that is, \( S/\Sigma S = M/\Sigma M \). If \( w = 0 \), \( s_o = 0 \), \( s_m = 1 \) in Equation 1, the linear theory is a special case of relative equity theory with a slope of \( A \) and intercept of \( (S - AS) \). Harris (1983) has proposed another version of the linear theory, referred to as the weighted sums model, with a different slope and intercept. According to these theories, common salaries from different contexts should be related by a linear transformation.

Mellers (1982) found evidence against both ratio models and linear models of equity. Ratios of judged salaries were not independent of the amount to distribute, the number of people in the group, or the distribution of merit ratings, in violation of the Aristotelian ratio rules. Furthermore, common salaries in different contexts were nonlinearly related, in violation of the linear models.

The general form of relative equity theory asserts that salaries from different contexts may be nonlinearly related to each other, and the particular relation can be predicted from the merit distributions in the different contexts. Thus, it is possible to reject the Aristotelian ratio model or the linear model in favor of the more general theory. Mellers (1982) concluded that "fair" allocation judgments could be well described by the general form of relative equity theory.

Overview

The present article extends the experiment of Mellers (1982, Experiment 3) to accomplish three goals. First, "fair" cost allocations (taxes) will be investigated and compared to "fair" reward allocations (salaries) to determine whether the same theory of "fairness" accounts for both tasks. In the salary allocation tasks, subjects are given the merit ratings of hypothetical faculty members and are asked to assign "fair" salaries. In the tax allocation tasks, subjects are given the salaries of hypothetical persons and are asked to assign "fair" income taxes. Both high and low salaries are used to find out how "fair" cost allocations depend on the magnitude of the salaries.

The second goal is to examine whether conditions that place less emphasis on immediate comparisons reduce the effects of the context. It may be that "fair" allocations differ when there are no budget or revenue constraints. When the budget is fixed, the salary given to one person necessarily depends on the salaries given to other people, because salaries must sum to a fixed budget. However, when the budget is not specified, the salary can, in principle, be independent of other salaries, and therefore comparison with experimental stimuli need not occur. Contextual effects due to variations in the experimental stimulus distribution might consequently disappear. Thus, "fair" salaries with and without budget constraints will be examined. Similarly, "fair" taxes with and without a specified amount of revenue to generate will also be investigated.

The third goal is to investigate the parameters in models for salary and tax allocations. For example, what influences the value of \( w \) in Equation 1? Although it was once thought that \( w \) was fairly constant across different contexts and rating scales, Parducci (1982) has recently found an exception to this finding. In particular, he has shown that when subjects make category ratings of the same stimuli in different distributions, \( w \) increases with the number of stimulus levels presented and decreases with the number of categories in the rating scale. The present experiment permits a virtually unlimited number of categories because subjects can assign salaries or taxes to the nearest cent. In conditions with larger budgets, there may be less of a need to deprive some

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\[ S_{jk} = aM_i + b, \]

where \( a \) and \( b \) are the slope and intercept, respectively. If \( w = 0 \), \( s_o = 0 \), and \( s_m = 1 \) in Equation 1, the linear theory is a special case of relative equity theory with a slope of \( A \) and intercept of \( (S - AS) \).

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\[ \text{Figure 1. Illustration of stimulus distributions used in Experiment 1 and 2. (Longer lines represent common stimuli [merit ratings or salaries]; shorter dashes are the contextual stimuli. For Experiment 1, the endpoints represent 0.5 and 3.5. For Experiment 2, the endpoints represent $15,000 and$45,000 in Parts 1 and 3 and $30,000 and$60,000 in Part 2. Pos skew = positively skewed distribution; Neg skew = negatively skewed distribution.)} \]
What influences the value of \( A \)? It is commonplace in our society to provide a minimum living allowance even for those who contribute very little. On the other hand, those who contribute a great deal should be rewarded with financial incentives. In the salary allocation tasks, smaller values of \( A \) tend to make salaries more equal; larger values of \( A \) create bigger differences between salaries. Thus, values of \( A \) will presumably reflect some compromise between these tendencies.

"Fair" tax allocations pose a related problem. Taxes are usually not collected from the very poor even though they have some income and use common resources. However, there is also concern that if those with higher salaries are overtaxed, they will reduce their inputs or contributions. Values of \( A \) in the tax allocation tasks may reflect a balance between these two positions.

Experiment 1: Salary Allocations

In Experiment 1, judges were given the merit ratings of hypothetical faculty members in an academic department. Their task was to assign salaries that were as "fair" as possible on the basis of merit. In Part 1, instructions required that the salaries sum to a fixed budget. Both the budget and the distribution of merit ratings were manipulated, as in Mellers (1982). Mellers (1982) used positively and negatively skewed merit distributions. Part 1 of the present experiment uses bimodal and unimodal distributions to investigate an additional hypothesis that will be discussed later. In Part 2, the budget was unspecified; salaries could sum to any total.

Method

Instructions. In Parts 1 and 2, judges were told that each faculty member had been given a merit rating by an evaluation committee in the department. This rating was a composite index of impact, recognition, research, teaching, and service. In addition, judges were told that the poverty level for a family of four was $8,000. The amounts of $16,000, $24,000, and $32,000 were specified as low, medium, and high standards of living for a family of four, respectively. Descriptions of the merit ratings were the same as those given by Mellers (1982, Experiment 3, Version 2).

Design. In Part 1, six conditions were constructed from a 2 (Merit Distribution) \( \times \) 3 (Budget) factorial design. Seven merit ratings were common to each of the conditions: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, and 3.5. Six additional contextual stimuli were included in each merit distribution as follows: Bimodal context = 0.6, 0.7, 0.8, 3.2, 3.3, and 3.4; unimodal context = 1.7, 1.8, 1.9, 2.1, 2.2, and 2.3. The three levels of the fixed budget were $130,000, $260,000, and $520,000 (with an average of $10,000, $20,000, and $40,000).
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Figure 3. Mean salaries for subjects who did not follow the Aristotelian ratio model in Part 1, Experiment 1, plotted as a function of the common merit ratings with a separate curve for each merit distribution and a separate panel for each amount to distribute. (Upper panels show the bimodal and unimodal merit distributions. Lower panels show positively and negatively skewed merit distributions from Mellers, 1982. Brackets represent ± 1 SE. Pos = positively skewed context; Neg = negatively skewed context.)

In Part 1, three different groups of subjects (with 29 or 30 judges in each) were given different merit distributions. Each received only one distribution.

Results

Part 1: Salary allocations with fixed budgets. If subjects follow the Aristotelian ratio rule, salaries should be proportional to merit and should appear as in Figure 2. Upper panels show predictions for the unimodal and bimodal merit distributions; these predictions are identical. Lower panels show predictions for positively and negatively skewed merit distributions and will be discussed later. Only 10% of the subjects had data consistent with the upper panels of Figure 2. Mellers (1982, Experiment 3) found that only 4% of her subjects who received the positively and negatively skewed distributions followed the ratio rule.

The data for the remaining 90% of the subjects are shown in the upper panels of Figure 3, plotted as in Figure 2. The lower panels present data from Mellers (1982, Experiment 3) and will be discussed later. The data are averaged over first and second tasks because the effects of order were negligible.

"Fair" salaries depend not only on a faculty member's merit rating and the size of the budget but also on the distribution of merit. The curves are steeper in regions of greater density where ranks change more rapidly, as predicted by the relative equity
theory. In the unimodal contexts, the slopes are steepest in the center; in the bimodal contexts, the slopes are steepest at the ends.

Notice that a faculty member with a merit rating of 3.0 receives a lower salary in the bimodal context than in the unimodal context. But a faculty member with a merit rating of 1.0 receives a higher salary in the bimodal context than in the unimodal context. The interaction between context and merit is significant, \( F(6, 738) = 21.92. \) Furthermore, the curves show the same trends for all three budgets; effects of the context do not appear to depend on the amount to distribute.

**Part 2: Salary allocations with unspecified budgets.** Figure 4 shows mean salaries, plotted as in Figure 3, for those conditions with unspecified budgets. The interaction between merit rating and context is significant in the unspecified budget conditions, \( F(12, 504) = 3.30. \) Once again, the slopes are generally steeper in regions of greater density. The curve from the positively skewed context is concave downward relative to that for the negatively skewed context. The curve for the uniform distribution falls between the curves for the two skewed distributions.

Previous results from Mellers (1982, Experiment 3) are presented in the lower panels of Figure 3 for comparison with Figure 4. Those data were obtained in an experiment done 4 years before the present study. Subjects were University of California, Berkeley, undergraduates who received credit in a psychology course for participating. Subjects allocated “fair” salaries among faculty members in merit distributions that were either positively skewed or negatively skewed with a fixed amount to distribute. Notice that the general shape of the positively and negatively skewed curves relative to each other is similar in Figures 3 and 4.

In summary, it appears that the effects of the context on “fair” salary allocations do not appear to depend on whether or not a budget is specified. When the budget is unspecified, one might expect subjects to use outside-the-laboratory information about the sizes of salaries and how salaries covary with merit; however, Figure 4 shows that even if subjects did so, they did not give it sufficient weight to reduce the effects of the merit distributions within the experiment.

**Comparisons of theories.** Mellers (1982) found that her data were inconsistent with the Aristotelian ratio rules (compare lower panels of Figure 2 with lower panels of Figure 3). However, the data are consistent with a subjective version of the Aristotelian model which can be written as follows:

\[
S_{jk} = J_j \left( \frac{m_i}{\Sigma m} \right) \Sigma S,
\]

where \( S_{jk} \) is the predicted salary given to person \( i \) in context \( k \) with amount to distribute, \( J_j \); \( m_i \) is the subjective value of the \( i \)th merit rating; \( J_j \) is a monotonically transformed to bilinearity and will satisfy

Equation 5. However, the data from the bimodal and unimodal contexts (upper panels of Figure 3) show crossover interactions. These crossovers are an ordinal violation of the subjective Aristotelian model (Equation 5), and they also create difficulties for subjective versions of the linear theory.

Relative equity theory (Equations 1 and 2) was simultaneously fit to the data in Parts 1 and 2. Mean responses to both common and contextual stimuli were used in the model fitting. In addition, the data from Mellers (1982, Experiment 3) were used in the analyses. Thus, there was a total of 15 different conditions with 13 responses in each condition.

Relative equity theory was fit to the data by means of computer programs that utilized Chandler's (1969) STEPIT subroutine and minimized the total loss function, \( L \), where \( L = \Sigma L_{jk} \) and

\[
L_{jk} = \frac{\Sigma (S_j - \bar{S}_j)^2}{\Sigma (\bar{S}_i - \bar{S})^2},
\]

where \( \bar{S}_i \) is the observed mean for person \( i \) in the \( jk \) condition; \( \bar{S}_j \) is the prediction; \( \bar{S} \) is the grand mean in the \( jk \) condition. Thus, sums of squared errors were minimized relative to sums of deviations around the mean in each condition. This function was used so that conditions with larger variance would not have a disproportionate effect on the minimization.

The theory required the estimation of 18 parameters. The weight of the frequency component, \( w \), was assumed to be constant across all 15 conditions. Values of \( w \) were allowed to vary.

\footnotetext{All tests are significant at the .01 level.}
with budget size and merit distribution. Subjective values of merit (\(s_i\) in Equation 1) were assumed to be equal in Parts 1 and 2 and were approximated as a cubic polynomial function of merit. Because the subjective values associated with 0.5 and 3.5 (\(s_0\) and \(s_m\)) were arbitrarily fixed to 0 and 1, the function could be written 

\[
[(x_i - 0.5) + a(x_i^2 - 0.5^2) + b(x_i^3 - 0.5^3)] / [(3.5 - 0.5) + a(3.5^2 - 0.5^2) + b(3.5^3 - 0.5^3)],
\]

where \(a\) and \(b\) are estimated parameters and \(x_i\) is the a priori merit rating given to the judges. Notice that there are only two estimated parameters for this polynomial because the slope and intercept are fixed.

Data and predictions are shown for Parts 1 and 2 in Figures 5 and 6, respectively. The average value of the loss function in each condition (\(L/15\)) was less than one percent (0.91%) of the variance in the mean judgments. Figures 5 and 6 show that the residuals do not appear to be systematic.

The estimated value of \(w\) was .44. Parameters for the cubic function, \(a\) and \(b\), were -0.246 and 0.098. These values formed a concave upward psychophysical function for merit. Estimated values of \(A\) are shown in the left of Figure 7. Notice that values of \(A\) depend largely on the size of the budget but also vary with contexts. If the context had had no effect on values of \(A\), the curves in Figure 7 would be horizontal lines.

If it is assumed that salaries are monotonically related to merit and can not be negative, values of \(A\) can, in principle, range from 0 to \(1/R\), where \(\$\) is the average salary in each condition and \(R\) is the mean range-frequency value. According to relative equity theory, the predicted salary for the lowest merit person is \(\$\) when \(A\) is zero. That predicted salary decreases as \(A\) increases, and when \(A\) is equal to \(\$/R\), the predicted salary for the lowest merit person is 0. In the present experiment, values of \(A\) range from 31% to 46% of \(\$/R\). Thus, predicted salaries for the lowest merit person range from 34% to 69% of the average salary in each condition. These predictions appear generally consistent with the data (Figures 5 and 6).

In summary, relative equity theory appears to give a good account of the data for subjects shown in Figures 3 and 4, if it is assumed that \(w\) is constant across all conditions and \(A\) is free to vary with budget size and merit distribution. Relative equity theory can account for both the qualitative and the quantitative aspects of “fair” salary allocations (Figures 5 and 6).

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*For example, if \(A = 0.4\$/R\), then according to relative equity theory, the predicted salary for the lowest merit faculty member is \(s_i = \$ + 0.4\$ / R(0 - R)\). In this case, \(s_i = .6\$.**
Experiment 2: Tax Allocations

In Experiment 2, judges were asked to assign taxes as “fairly” as possible on the basis of yearly salaries. In Part 1, judges assigned “fair” taxes to salaries that ranged from $15,000 to $45,000 with a fixed amount of revenue to generate. Part 2 investigated how “fair” taxes depended on higher salaries ranging from $30,000 to $60,000 when there was a fixed amount of revenue to generate. Part 3 examined “fair” taxes when the taxes could sum to any total.

Method

Instructions and procedure. Judges were given the salaries of 13 hypothetical persons and were asked to assign income taxes as “fairly” as possible. Each subject was given instructions and a response sheet with 13 salaries and a specific dollar amount to generate in total taxes. In Parts 1 and 2, when each subject finished, the experimenter checked whether the taxes summed to the correct amount of revenue. If not, judges were asked to continue working until the total was correct. Then subjects were given a second distribution of salaries. In Part 3, the amount of revenue to generate was unspecified; taxes could sum to any total. Each subject was given two distributions of salaries.

Design. In Part 1, eight low salary conditions were constructed from a 4 (Salary Distribution) × 2 (Percent of Total Salary Needed) factorial design. Seven salaries were common to each of the eight low salary conditions: $15,000, $20,000, $25,000, $30,000, $35,000, $40,000, and $45,000. Six contextual salaries were included in each salary distribution as follows: Positively skewed context = $16,000, $17,000, $18,000, $19,000, $22,000, and $24,000; negatively skewed context = $37,000, $38,000, $41,000, $42,000, $43,000, and $44,000; bimodal context = $16,000, $17,000, $18,000, $42,000, $43,000, and $44,000; unimodal context = $27,000, $28,000, $29,000, $31,000, $32,000, $33,000. The stimulus distributions are shown in Figure 1.

The amount of revenue needed was either 10% or 30% of the sum of the 13 salaries. In the 10% conditions, the amounts are $39,000, $39,000, $32,500, and $45,500 in the bimodal, unimodal, positively skewed, and negatively skewed distributions, respectively. In the 30% conditions, the amounts are $117,000, $117,000, $97,500, and $136,500, respectively.

In Part 2, four high salary conditions formed a 2 (Salary Distribution) × 2 (Percent of Total Salary Needed) factorial design. The seven salaries common to each high salary condition were shifted up by $15,000 compared to the low salary conditions in Part 1: $30,000, $35,000, $40,000, $45,000, $50,000, $55,000, and $60,000. The six additional contextual stimuli were spaced according to the positively and negatively skewed contexts, but were also $15,000 higher than their counterparts in the low salary conditions.

The amount of revenue needed was either 10% or 30% of the total salary. For the 10% conditions, the amounts to generate were $52,000 and $65,000 in the positively and negatively skewed conditions, respectively. For the 30% conditions, the amounts were $156,000 and $195,000 for the positively and negatively skewed distributions, respectively.

In Part 3, two conditions were constructed from two salary distributions. Seven salaries were common to both conditions: $15,000, $20,000, $25,000, $30,000, $35,000, $40,000, and $45,000. The six contextual salaries were as follows: Positively skewed context = $16,000, $17,000, $18,000, $19,000, $22,000, and $24,000; negatively skewed context = $37,000, $38,000, $41,000, $42,000, $43,000, and $44,000.

Participants. In Part 1, there were four different groups of subjects with between 41 and 43 judges in each. Two groups received the bimodal
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Figure 8. Predicted taxes for the Aristotelian model, plotted as a function of salaries. (All four contexts yield the same predicted curve. Upper panel shows predictions when 10% of the total salary was needed for taxes; lower panel shows predictions when subjects generated 30% of the total salary in taxes.

Figure 9. Mean taxes for subjects in Part 1, Experiment 2, who did not follow the Aristotelian ratio model. (Responses are plotted as a function of common salaries with a separate curve for each salary distribution and a separate panel for each percentage of the total salary to generate in taxes. Brackets represent ± 1 SE. Pos = positive skew; Neg = negative skew.)

and unimodal distributions; the other two groups received the positively and negatively skewed distributions. Each group (within a pair of stimulus distributions) was asked to generate an amount which was either 10% or 30% of the total salary to generate. Order of presentation of stimulus distributions was counterbalanced across subjects.

In Part 2, there were two different groups of subjects with between 43 and 48 judges in each. Both groups of subjects received the positively and negatively skewed salary distributions, but each group received a different percent of the total salary to generate (10% or 30%).

In Part 3, 42 subjects received both the positively and negatively skewed salary distributions.

Results

Part 1: Tax allocations with lower salaries. For tax allocations, the Aristotelian model implies a flat tax strategy. If subjects used a flat percentage strategy, then taxes should be proportional to salaries. According to the ratio model, the results should appear as in Figure 8. Predicted taxes, plotted as a function of salaries, should be the same in all four contexts because the percent of total salary to be generated in revenue was manipulated rather than a fixed amount of revenue.

Figure 10. Mean taxes for Part 2, Experiment 2, plotted as in Figure 9. (Brackets represent ± 1 SD. Contextual effects for higher salaries are similar to those obtained with lower salaries. Pos = positive skew; Neg = negative skew.)
Thirty percent of the subjects had data consistent with the ratio model. Mean "fair" taxes for the remaining 70% of the subjects are shown in Figure 9. Once again, the slopes of the curves are steeper in regions of greater density. "Fair" taxes for a person with a salary of $30,000 are higher in the positively skewed context than in the negatively skewed context. Furthermore, "fair" taxes for a person with a salary of $20,000 are higher in the bimodal than the unimodal context. However, "fair" taxes for a person with a salary of $40,000 are higher in the unimodal than the bimodal context. Effects of the salary distribution appear to show the same trends for both levels of the percent of total salary needed. Furthermore, those trends resemble the ones found for "fair" salary allocations (Figures 3 and 4).

Part 2: Tax allocations with higher salaries. Thirty-six percent of the subjects used a flat tax strategy, in accordance with the ratio model. Data for the remaining 64% of the subjects are shown in Figure 10, plotted as in Figure 9. Large and similar effects of the skewing are obtained when the mean tax rate is fixed at 10% (on the left) and 30% (on the right).

By comparing the results of Figure 9 with those of Figure 10, it is possible to ask if judges use a different strategy for high and low salaries when the percent of total salary to generate is held constant. The shape of the curves in Figure 10 resembles those in the lower panels of Figure 9. Thus, even when salaries are shifted up $15,000, the effects of the context are large and resemble those that occur with lower salaries.

Part 3: Tax allocations with unspecified revenues. Fourteen percent of the subjects (compared with the 30% and 36% in Parts 1 and 2) used a flat tax strategy. For these subjects, the percent of salaries assigned to taxes ranged from 1% to 31%, and the average value was 8.3%. Mean taxes for the other 86% of the subjects are shown in Figure 11. The average percent of salaries assigned to taxes was 16% and 17% in the positively and negatively skewed conditions, respectively.

Subject variability is greater in the unspecified revenue conditions than in the fixed revenue conditions. However, the Context X Salary interaction is again significant, $F(6, 210) = 9.41$. More important, the relation of the curves to each other is similar for fixed and unspecified revenue conditions. The positively skewed curve is concave downward relative to the negatively skewed curve.

Percent of salary assigned to taxes. It is interesting to examine what percentage of salaries was assigned to taxes for each of the common salaries. Figure 12 plots the percent of salary assigned to taxes for data from Parts 1 and 3. If subjects had used a flat tax strategy, their data would appear as horizontal lines at 10% and 30% for the lower and upper curves, respectively. In some conditions, judges assigned not only higher taxes to higher salaries, but higher taxes are also a higher percentage of the salaries. This form of taxation is usually referred to as progressive taxation. However, in the two positively skewed conditions with fixed amounts of revenue needed, progressive taxation becomes flat percentage taxation between $25,000 and $45,000. In the negatively skewed condition with 30% of the total salary to generate in taxes, flat percentage taxation seemed to occur between

![Figure 11](image.png)

*Figure 11. Mean taxes for common salaries in Part 3, Experiment 2, plotted as in Figure 10. (Brackets represent ± 1/2 SD. Pos = positive skew; Neg = negative skew.)*

![Figure 12](image.png)

*Figure 12. Mean percent of salary assigned to taxes plotted as a function of common salaries. (Solid points represent the positively skewed conditions [Pos]; open points are negatively skewed contexts [Neg]. Both the upper and lower pairs of curves are from Part 1, Experiment 2 with fixed revenues. The lower two curves are from conditions in which 10% of the total salary was assigned to taxes; upper curves are from conditions in which 30% of the total salary was assigned to taxes. Curves in the center are from the unspecified revenue tasks. The dashed line is based on 1983 U.S. federal taxes [1983 US Fed] and appears remarkably similar to taxes in the unspecified revenue conditions.)*
$15,000 and $35,000 and became progressive taxation only with the highest salaries.

The dashed line shows the percent of salaries in taxes required for U.S. Federal income taxes for the same year in which the data were collected. U.S. taxes are shown assuming that all income was taxable and filing status was "married, filing jointly." It is interesting to compare this curve with curves from the unspecified revenue conditions; judges in the unspecified revenue conditions tended to assign a lower percentage of salary to taxes than those of the U.S. Federal government, with the exception of the lower salaries. Perhaps these judges believed that "fair" income taxes should be lower for those with higher salaries.

**Fit of the relative equity theory.** For tax allocations, relative equity theory can be written as follows:

\[ T_{jk} = \bar{T}_{jk} + A[R_k - \bar{R}_k], \]

(7)

where \( T_{jk} \) is the predicted tax allocation for a person with salary \( i \) in context \( k \) with a percent of total salary to generate in taxes; \( j \); \( \bar{T}_{jk} \) is the average tax in the \( jk \) condition; \( A \) is the weight of the tendency to make adjustments from equal taxes on the basis of incomes; \( R_k \) is the relative position of a person's salary in the distribution of salaries, as defined in the Equation 1; (Note: In this case, \( s_i \) in Equation 1 refers to the subjective value of salary rather than merit); \( \bar{R}_k \) is the average relative position in context \( k \).

Relative equity theory was simultaneously fit to the data in Parts 1 and 3; Part 2 was fit separately because the stimuli were shifted up by $15,000. Mean judgments for both common and contextual stimuli were included in the analyses. There were 10 conditions in Parts 1 and 3, and 4 conditions in Part 2, with 13 responses in each condition.

Relative equity theory required 13 parameters for Parts 1 and 3, and 7 parameters for Part 2. In both cases, the assumptions about \( w \) and \( A \) made for salary allocations were also made for tax allocations. Subjective salary, \( s_i \), was approximated as a cubic polynomial function of salary. The endpoints were arbitrarily fixed to 0.0 and 1.0. Thus, the function was similar to that written for Experiment 1, except 0.5 was replaced with either 15,000 for Parts 1 and 3 or 30,000 for Part 2, and 3.5 was replaced with 45,000 for Parts 1 and 3 or 60,000 for Part 2.

Data and predictions are shown for Parts 1, 2, and 3 in Figures 13, 14, and 15. In Parts 1 and 3, the average lack of fit (L/10) was less than one percent (0.28%) of the variance in the mean judgments. In Part 2, the residuals (L/4) also comprised an average of less than half of one percent of the variance in each condition (0.49%). Inspection of Figures 13, 14, and 15 show that deviations from the theory are not systematic.

In Parts 1 and 3, the estimated value of \( w \) was .38; in Part 2, it was .45. The psychophysical functions for both salary ranges were both concave upward. Values of \( A \) for Part 2 were $4,826 and $15,799 for the positively skewed conditions with 10% and 30% of the total salary to generate in taxes, respectively. Estimated values of \( A \) were $5,122 and $14,461 for the negatively skewed conditions. Values of \( A \) for Parts 1 and 3 are shown in the left of Figure 7. The parameters depend both on the amount of revenue to generate and on the context. Differences between contexts are more pronounced when subjects generate 30% of the total salary than when they generate 10%.

Values of \( A \) in the tax allocation tasks can range from 0 to \( \bar{T}/\bar{R} \), where \( \bar{T} \) is the average tax in each condition and \( \bar{R} \) is the mean range-frequency value. When \( A = 0 \), taxes are equal for all salaries; when \( A = \bar{T}/\bar{R} \), the tax for the person with the lowest salary is 0. Thus, as \( A \) increases, taxes for the lowest salary person decrease.
The conditions with unspecified budgets (and amounts of revenue to generate) seem analogous to magnitude estimation procedures without standards and moduli, because subjects are allowed to use any numbers they see fit to describe their judgments. Mellers (1983) compared the effects of the stimulus distribution for magnitude estimations with and without designated standards and moduli and found that the effects of the stimulus distribution were similar for both types of tasks. Furthermore, contextual effects for both types of tasks were in the direction predicted by range-frequency theory.

3. Relative equity theory gave a good account of the data when \( w \), the weight of the frequency component, which measures the sensitivity to the form of the frequency distribution of contextual values, was held constant across stimulus distributions and budgets (or amounts of revenue to generate). For the salary allocations, the estimated value of \( w \) was .44. For tax allocations, \( w \) was .38 in Parts 1 and 3, and .45 in Part 2. These estimated values of \( w \) are similar to those found in previous research (e.g., Parducci & Perrett [1971] and Birnbaum [1974]).

It is unclear why Parducci (1982) found that \( w \) varies with the number of stimulus levels and number of categories, for the present results suggest that \( w \) remains constant across conditions. There were several differences between the two experiments. For example, Parducci (1982) manipulated the frequency of presentation of the stimuli rather than the spacing between the stimuli, as in the present studies. In addition, Parducci (1982) presented the stimuli sequentially; the present experiment used a simultaneous presentation.

Values of \( A \), which reflect the influence of relative merit (or relative income), appear to depend on both the stimulus distribution and the size of the budget (or the amount of revenue to generate). It is difficult to infer a functional relation between values of \( A \) and these two variables (see Figure 7), although certain trends appear evident.

Values of \( A \) reflect the size of the predicted salary for the lowest merit faculty member and the amount of taxation for the lowest salary person. In the salary allocation tasks, the minimum living allowance for the lowest merit person ranges from 54% to 69% of the average salary in each condition. In the tax allocation tasks, predicted taxes for the lowest salary person range from 26% to 46% of the average tax in each condition. Figures 13, 14, and 15 show that these predictions are generally consistent with the data.

Discussion

The results appear consistent with the following principles:

1. Relative equity theory describes both “fair” salary allocations and “fair” tax allocations. “Fair” salaries are a linear function of the relative standing of an individual’s merit in the distribution of merits. “Fair” taxes are linearly related to the relative position of a person’s salary in the distribution of salaries. For the majority of subjects, range-frequency theory describes the relative position of a stimulus in its distribution.

2. Effects of the stimulus distribution appear similar for “fair” salaries with or without specified budgets and for “fair” taxes with or without specified amounts of revenue to generate. When the task is less constrained, one might expect judges to use information from outside the laboratory to assign salaries and taxes. Even if judges used this information, it did not appear to reduce the effect of the context due to the stimulus distribution. Thus, the present data extend previous results by demonstrating similar effects of the stimulus distribution with or without specified budgets or amounts of revenue to generate.

The conditions with unspecified budgets (and amounts of revenue to generate) seem analogous to magnitude estimation procedures without standards and moduli, because subjects are allowed to use any numbers they see fit to describe their judgments. Mellers (1983) compared the effects of the stimulus distribution for magnitude estimations with and without designated standards and moduli and found that the effects of the stimulus distribution were similar for both types of tasks. Furthermore, contextual effects for both types of tasks were in the direction predicted by range-frequency theory.

3. Relative equity theory gave a good account of the data when \( w \), the weight of the frequency component, which measures the sensitivity to the form of the frequency distribution of contextual values, was held constant across stimulus distributions and budgets (or amounts of revenue to generate). For the salary allocations, the estimated value of \( w \) was .44. For tax allocations, \( w \) was .38 in Parts 1 and 3, and .45 in Part 2. These estimated values of \( w \) are similar to those found in previous research (e.g., Parducci & Perrett [1971] and Birnbaum [1974]).

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In conclusion, the present results extend previous work and demonstrate that judgments of “fair” tax allocations resemble those for “fair” salary allocations. Relative equity theory can describe both types of judgments and is general enough to accommodate different allocation strategies. Equity occurs when the relative position of the stimulus in the distribution of stimuli matches the relative position of the response in the distribution of responses. For the great majority of subjects, the relative standing of a stimulus or response in its distribution is well described by range-frequency theory.

References


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