What Is a Fair Salary?

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Abstract

Pay satisfaction and pay fairness are of vital concern to employees, employers, and hence the entire economic structure. Although the importance of fairness to compensation decisions is widely acknowledged, the research examining how fairness perception relates to components of pay is relatively scarce. Here, I model a dyadic employer-employee interaction as a two-person game in which an *allocator* (an employer) divides a monetary amount (a workplace net profit) between herself and a recipient (an employee). Assuming self-interested players, I propose a level-of-aspiration model, according to which players' pay satisfaction is proportional to their *actual* payoffs *relative* to their *aspired* payoffs. Solving for the points of equality between the players' levels of pay satisfaction, yields two "harmony" points, depending on the assumption made about the recipient's aspirations. Assuming that the recipient aspires for 50% of the total amount, the predicted harmony allocation is $(\frac{2}{3}, \frac{1}{3})$ for the allocator and recipient, respectively. On the other hand, assuming that the recipient aspires to receive the same amount as the allocator, the predicted harmony allocation is (φ, 1-φ), where φ≈0.62 is the famous Golden Ratio.

For a dyadic employer-employee interaction, the above solution prescribes that a fair salary is any percentage of the net profit between ≈33% to ≈38%, with strong preference for the upper limit, which in addition to yielding higher pay and pay satisfaction, is also aesthetically pleasing. Tests using field data on attitudinal pay fairness, actual pay data, and allocation behavior in experimental ultimatum bargaining, lend strong support to the proposed model.

Keywords: Pay satisfaction, Pay fairness, Salary, Aspiration level, Distributive justice, Resource allocation, Ultimatum game.

1. Introduction

Job satisfaction and pay satisfaction are of vital concern to the individual employee, the individual employer, and, in turn, the entire economic structure (Shapiro, 1976; Porter et al., 1974; Heneman & Schwab, 1985; Wallace & Fay, 1988, Williams et al., 2006; Hartmanna & Slapnicˇar, 2012). Job satisfaction is related to employee motivation and performance (Ostroff, 1992), employee absenteeism and turnover rates (Hackett & Guion, 1985; Griffeth, Hom, & Gaertner, 2000), organizational citizenship behavior (Organ & Ryan, 1995), and more. Pay satisfaction, which I discuss in the present paper, is a much narrower construct than job satisfaction. However, it is also an important variable, linked to significant organizational outcomes. As examples, empirical evidence suggests that dissatisfaction with pay and work conditions may lead to decreased job satisfaction (Lumi et al., 1998), decreased motivation and performance (Lumi et al., 1998; Ostroff, 1992), increased absenteeism and turnover rates (Hackett & Guion, 1985, Griffeth, Hom, & Gaertner, 2000; Vandenberghe & Tremblay, 2008), more pay-related grievances and lawsuits (Cable & Judge, 1994; Gerhart & Milkovich, 1990), attitudes favoring militancy and willingness to vote for going on strikes (Feuille & Blandin, 1976; Donnenwerth & Cox, 1978; Ng, 1991), and psycho-social problems (Butterworth et al., 2011).

Pay satisfaction is intimately related to the concept of *perceived pay fairness*. Although the perception of fairness is important to all human resource decisions and processes (Cohen-Charash & Spector, 2001; Jawahar, 2007; Thurston & McNall, 2010; Jawahar & Stone, 2011), it is particularly important to compensation decisions. Research suggests that perceived compensation fairness, the procedures used to make compensation-related decisions, and the manner in which compensation-related information is communicated play an integral role in shaping reactions to critical elements of the compensation system (Milkovich and Newman, 2008; Nelson et al., 2008; Jawahar & Stone, 2011).

Despite the obvious relationship between pay satisfaction and pay fairness, the literatures on pay satisfaction and compensation have evolved independently (Williams et al., 2006). Moreover, even though most researchers would readily acknowledge that fairness is important to compensation decisions, the research examining the relationship between pay satisfaction and perceived pay fairness is relatively scarce (Jawahar & Stone, 2011).

Two major theoretical frameworks—equity theory (Adams, 1965) and discrepancy theory (Lawler, 1971, 1981)—have been proposed to explain the relationship between pay satisfaction and perceived fairness in the workplace. Both theories posit that perceptions of fairness and equity in payment are central to explaining employee pay satisfaction or dissatisfaction (Ruiz-Palomino et al., 2013). Equity theory assumes employees seek to maintain an equitable ratio between the inputs they bring to the relationship and the outcomes they receive from it (Adams, 1965). In business, however, equity theory introduces the concept of social comparison, whereby employees evaluate their own input/output ratios based on their comparison with the input/outcome ratios of other employees (Carrell & Dittrich, 1978; Dittrich & Carell, 1979). Discrepancy theory (Lawler, 1971, Lawler & Porter, 1967) posits that the levels of satisfaction, including pay satisfaction, are negatively correlated with the discrepancy between the actual and expected job satisfaction.

Several empirical studies have investigated the main factors that influence the level of employees' pay satisfaction. In a study based on data from two similar companies engaged in the manufacture of aircraft components and systems for the government and private industry, Shapiro (1976) was able to delineate four important antecedents of pay satisfaction: (1) actual pay—how much actual money the individual receives; (2) social comparisons—how the individual's pay compares with his or her perceptions of what others receive; (3) scale of living—satisfactory pay must cover a worker's basic needs; and (4) wage history—how much the individual was paid in the past. Shapiro and Wahba (1978) found that actual pay, social comparison, wage history, status, performance, and job difficulty are the best predictors of pay satisfaction. A more recent study on the antecedents and consequences of pay-level satisfaction (Williams et al., 2006) reported results from a meta-analysis of 28 correlates of pay-level satisfaction, involving 240 samples from 203 studies conducted over 35 years. The main findings of the analysis indicate that the strongest predictor of pay satisfaction is the discrepancy between perceived amount of pay that should be received, and the perceived amount of pay received. Another comprehensive study found that the three types of psychological determinants that contribute most to predicting pay satisfaction are equity considerations, actual pay, and living standards (Berkowitz et al., 1987).

Notwithstanding the importance of both equity and discrepancy theories as theoretical frameworks, and their success in generating interesting predictions concerning pay fairness, their predictions remain on the quantitative and correlational level. For example, equity theory will predict that an employee pay satisfaction will be positively correlated her perceived personal input/output ratio, and with his or her perceived input/output ratio, relative to the perceived input/output ratio of other players. For the same situation, discrepancy theory will predict that the employee's pay satisfaction will be positively correlated with the discrepancy between his or her actual pay and aspired pay. For the case of one employer and one employee the present paper goes one step further, by proposing a normative formal model for predicting the exact amount of pay, out of a net profit, which would guarantee that both parties perceive it as fair.

The rest of the paper is organized as follows: In section 2 I describe the model and utilize it to derive quantitative predictions of what constitutes a fair pay in a simple dyadic employer-employee situation. In section 3 I test the model's predictions using previous field data on perception of salary farness (section 3.1), new field data on actual salaries in twenty developed and developing countries (section 3.2), experimental data on ultimatum bargaining reported in two large-scale, cross-cultural studies (section 3.3), and a new experiment on ultimatum bargaining with varying recipients' punishment power. Section 4 concludes.

2. The proposed model

The proposed model could be viewed as a conceptualization, in strategic formal terms, of ideas drawn from both equity and discrepancy theories. In addition, despite different formalization, the proposed model, although interactive, resembles classical studies on aspiration levels in individual choice behavior (Hilgard et al., 1940; Lewin et al., 1944; Siegel, 1957; Simon, 1959), as well as more recent theories of level of aspiration in individual decision-making under risk (e.g., Lopes, 1987; Lopes, 1995; Lopes & Oden, 1999; Rieger, 2010).

In the context of allocation of profits between employers and employees, the present study asks, "What is a fair salary?" I model a dyadic employer-employee interaction by a "minimal," two-person game in which an *allocator* (e.g., an employer) must allocate a monetary amount (e.g., a workplace net profit) between himself or herself and a recipient (e.g., an employee). Assuming rational, self-interested players, the model posits that the players' payoff satisfaction levels are proportional to their *actual* payoffs, *relative* to the payoffs to which they *aspired*. In formal terms, the level of satisfaction (LS_i) of an individual i who is allocated x_i monetary units when he or she had aspired to receive A_i monetary units is assumed to be a function of x_i/A_i, or $LS_i = F(x_i/A_i)$, where F(.) is an increasing function with its argument. For the “minimal” dyadic interaction described above, assume the allocator keeps x_a units out of S monetary units, and transfers $x_r = S - x_a$ to the recipient. The levels of pay satisfaction of the two players, as prescribed by the model, will be $LS_a = F_a(x_a/A_a)$ and $LS_r = F_r(x_r/A_r) = F_r((S - x_a)/A_r)$, for the allocator and recipient, respectively, where A_a and A_r are the maximal payoffs to which the allocator and the recipient aspire, respectively. For simplicity, we assume linear relationships, such that $LS_a = x_a/A_a$ and $LS_r = x_r/A_j$.

The two players will be equally satisfied with their payoffs if $LS_a = LS_r$, or:

$$\frac{x_a}{A_a} = \frac{x_r}{A_r} = \frac{(S-x_a)}{A_r} \qquad \ldots\ldots (1)$$

Yielding

$$x_a = \frac{A_a}{A_a+A_r} S \qquad \ldots\ldots (2)$$

And

$$x_r = S - \frac{A_a}{A_a+A_r} S = \frac{A_r}{A_a+A_r} S \qquad \ldots\ldots (3)$$

Determining (x_a, x_r), which guarantees a fair allocation—in the sense of equal levels of satisfaction—requires the assessment, or measurement of the players’ maximal aspirations. In the absence of any constraints on the allocator’s decision, a rational allocator’s maximal aspired payoff is the entire sum ($i.e., A_a$ = S). Hypothesizing about the recipient’s maximal aspired payoff is trickier. We consider two plausible possibilities: (1) the recipient might aspire to receive half of the net profit; (2) he or she might aspire to receive a sum that equals the sum the allocator keeps for himself or herself. Although at first sight, the two conjectures seem identical, they are not.

Under the first assumption, we have A_a = S and $A_r = \frac{1}{2}$ S. Substitution in equation 2 yields:

$$x_a = \frac{A_a}{A_a + A_r} \text{S} = \frac{S}{S + \frac{1}{2}\text{S}} \text{S} = \frac{2}{3} \text{S} \qquad \ldots\ldots (4)$$

And

$$x_r = \text{S} - \frac{2}{3} \text{S} = \frac{1}{3} \text{S} \qquad \ldots\ldots (5)$$

On the other hand, under the second assumption, we have A_a = S and A_r = x_a. Substitution in equations 2 yields:

$$x_a = \frac{S}{S + x_a} \text{S} \qquad \ldots\ldots (6)$$

Solving for x_a we get:

$$x_a^2 + \text{S}\, x_a - S^2 = 0 \qquad \ldots\ldots (7)$$

Which solves for:

$$x_a = \frac{-S \pm \sqrt[2]{S^2 + 4S^2}}{2} = (\frac{-1 \pm \sqrt[2]{5}}{2}) \text{S} \qquad \ldots\ldots (8)$$

For positive x_a values, we get:

$$x_a = \frac{\sqrt[2]{5} - 1}{2} \text{S} = \varphi \text{ S} \approx 0.62 \text{ S} \qquad \ldots\ldots (9)$$

Where φ is the famous Golden Ratio (see, e.g., Livio, 2002; Posamentier & Lehmann, 2007). The corresponding portion for the recipient is:

x_r = (1- φ) S ≈ 0.38 S. …… (10)

In summary, the proposed model predicts that if the recipient aspires to receive 50% of the total amount, having him or her receive *one third* of the total amount achieves the point of equal levels of payoff satisfaction. On the other hand, if the recipient aspires to be treated equally (i.e., $A_r = x_a$), having him or her receive a portion of *1- φ ≈ 0.38* of the total amount achieves the point of equal levels of payoff satisfaction. We refer to these points as *harmony points*. Because rational allocators will not allocate more to recipients than they allocate to themselves, the difference between the predicted harmony points falls within the ±5% error range. In accounting for empirical reports of pay satisfaction, and in the absence of any information about the fairness principle to which individuals adhere, the model predicts a mean allocation for the recipient in the range between ≈ 0.33 and ≈ 0.38 of the entire amount.

The solution prescribing a Golden Ratio division is quite striking, given the appearances of this algebraic number in many fields of science and the arts. I will say more on the appearances of the Golden Ratio in the concluding section. Note that none of the model's predictions of what constitutes fair allocations is a stable outcome. In the absence of binding rules (e.g., a minimum wage) or sanctions for allocating unfairly, rational allocators will strive to maximize their personal payoffs. In game theoretical terms, the points of harmony, predicted by the model, are not in equilibrium. For a point of harmony to be stable, it must be supported by an external mechanism, such as an efficient institutional or social sanctioning mechanism (see, e.g., Fehr & Fischbacher, 2004; Samid & Suleiman, 2008; O'Gorman et al. 2009).

The importance of efficient sanctions for achieving fairness harmony is demonstrated in sections 3.4 and 4.4, in which the derived solution is used for predicting allocators' behavior in experimental bargaining games.

3. Comparison with empirical findings

I tested the model under the rationality assumption, prescribing that the levels of payoffs to which the allocator and the recipient aspire, are A_a = S and $A_r = \frac{1}{2}S$, or x_a. The following subsections detail tests of the model's predictions, using data from two field studies and from a class of experimental studies on ultimatum bargaining.

(3.1) Study 1: Perceptions of pay fairness by executives and secretaries

In a classical questionnaire-based field study, Zedek and Cain Smith (1968) investigated the pay satisfaction of male junior executives (Group I), and of female secretaries in the maintenance department (Group II) and in the executive department (Group III) in a large academic institution in the United State. For determining the upper and lower thresholds of the perceived equitable payment, the "just meaningful difference" (jmd) of payment (analogous to the jnd in psychophysical measurement), and the points of subjective equity (PSE), the study used an adaptation of the Method of Limits (Woodworth & Schlosberg, 1954). The main results of the study are depicted in Table 1. Calculation of the average perceived fair salary by the executives group and the secretaries group yields $\frac{1}{2}$ (7008+ 8832) ≈ \$7920 for the executives and $\frac{1}{2}$ (3676+ 4050) ≈ \$3813 for the secretaries. Given the type of relationship between executives and secretaries, viewing the executives as "employers" and the secretaries as "employees" makes sense. Calculating the secretaries' perceived fair pay, relative to the total pay, gives $\frac{\$3813}{(\$3813+\$7920)}$ ≈ 0.33, which is identical to the lower limit of the predicted range of fair pay.

Table 1

Mean perceived fair salaries by executives and secretaries

(Source: Zedek & Cain Smith, 1977)

Perceived Mean Salary Ranges (in $)			
Group	< Fair	Equitable (PSE ± jmd)	> Fair
Junior executives	7008.00	7008.00 - 8832.00	8832.00
Secretaries	3578.58	3576.58 - 4050.00	4050.00
Group II	3278.58	3278.58 - 3870.00	3870.00
Group III	3722.73	3722.73 - 4115.45	4115.45

(3.2) Study 2: Actual salaries of senior and junior employee

In a new study I looked at *actual* mean salaries of senior and junior employee in two high-tech professions and two non-high-tech professions, from 10 "developed" countries with high gross national income (GNI) and 10 "developing" countries with low GNI, representing different cultures around the world. The high-tech professions were computer programmer and electrical engineer, and the two non-high-tech (hereafter "low-tech") professions were accountant and schoolteacher. The developed countries were the United States, England, Canada, Israel, Spain, New Zealand, Australia, Italy, Austria, and Japan, and the developing countries were Pakistan, Jordan, Lebanon, Oman, India, Bahrain, Egypt, Saudi Arabia, Brazil, and Thailand. Table 2 depicts the average salaries and the ratios of juniors' salaries to the total salaries (junior salary/(junior salary + senior salary)), by levels of country development (developed vs. developing), and profession type (high-tech vs. low-tech). Table 3 depicts the mean ratios (and standard deviations) for the tested categories, across the sampled countries (see also Figure 1). As can be seen from the tables and the figure, for developed countries, the average ratios of the juniors' salaries to the total salaries are almost the same for the high- and low-tech professions (≈0.37), and are only slightly below the Golden Ratio prediction of ≈0.38. On the other hand, for the low-tech professions, the mean ratio of the juniors' salaries is about 28% lower than the mean ratio of the seniors' salaries, with both ratios falling below the predicted 0.33-0.38 fairness range.

Notably, Egypt is an outlier among the developing countries, with a ratio of 0.19 for low-tech professions (which equals the mean ratio of developing countries), but with a more than fair ratio of 0.46 for the high-tech professions. Dropping Egypt from the sample yields means of 0.24 and 0.19 for the high- and low-tech professions, respectively, with a difference of 21% between the two. To compare the actual ratios in the various categories with the Golden Ratio prediction (≈ 0.38), I used a two one-sided test (TOST). A rule of thumb for testing equivalence using TOST is to set a confidence level at ±10%. For the developed countries, the equivalence between the observed and predicted proportions was statistically significant, $t(19) = -2.65$, $p < .01$and $t(19) = -1.95$, $p < .05$, for the high- and low-tech professions, respectively. For developing countries, the statistical tests of equivalence were non-significant, $t(19) = 2.71$ and $t(19) = 11.67$, for the high- and low-tech professions, respectively.

Table 2: Ratios of the junior salaries to the total salaries, by country development and profession level

Country	Technology					
	High-tech			Non-high-tech		
Developed	Junior ($)	Senior ($)	$\frac{Junior\ Salary}{total\ salary}$	Junior ($)	Senior ($)	$\frac{Junior\ Salary}{total\ salary}$
Italy	1887	2038	0.48	1986	2170	0.48
Canada	5898.5	6742	0.47	3969	4888	0.45
Japan	1924.5	2263	0.46	1789	2444	0.41
Austria	1463	1837	0.44	1705	2129	0.44
Astralia	4519	7017	0.39	3970	5757	0.41
New Zealand	3164	4794	0.40	2725	4273	0.39
England	2600	6400	0.29	2375	4975	0.33
USA	4275	14250	0.23	3000	5625	0.35
Israel	3347	6445	0.34	1475	4834	0.24
Spain	1268	4048	0.24	1336	7037	0.16
Mean ratio			**0.37**	**Mean ratio**		**0.37**
Developing	Junior Salary ($)	Senior Salary ($)	$\frac{Junior\ Salary}{total\ salary}$	Junior Salary ($)	Senior Salary ($)	$\frac{Junior\ Salary}{total\ salary}$
Egypt	1322	1546	0.46	707	2950	0.19
Thailand	569	1784	0.24	825	2208	0.28
Lebanon	900	2470	0.26	389	1287	0.23
Brazil	1361	3388	0.29	860	3449	0.20
Oman	1103	3760	0.24	583	2000	0.22
Saudi Arabia	1321.5	3089	0.33	155	1132	0.12
Jordan	621	1997	0.24	133	770	0.15
Bahrain	1122	4366	0.21	1506	7007	0.18
India	2278	11619	0.16	750	3489	0.18
Pakistan	322	1365	0.19	133	770	0.15
Mean Ratio			**0.26**	**Mean Ratio**		**0.19**

Table 3

Mean ratios (and SDs) by levels of development and profession

Development level	Technology level	
	High	Low
Developed	0.37 (0.09)	0.37 (0.10)
Developing	0.26 (0.09)	0.19 (0.05)

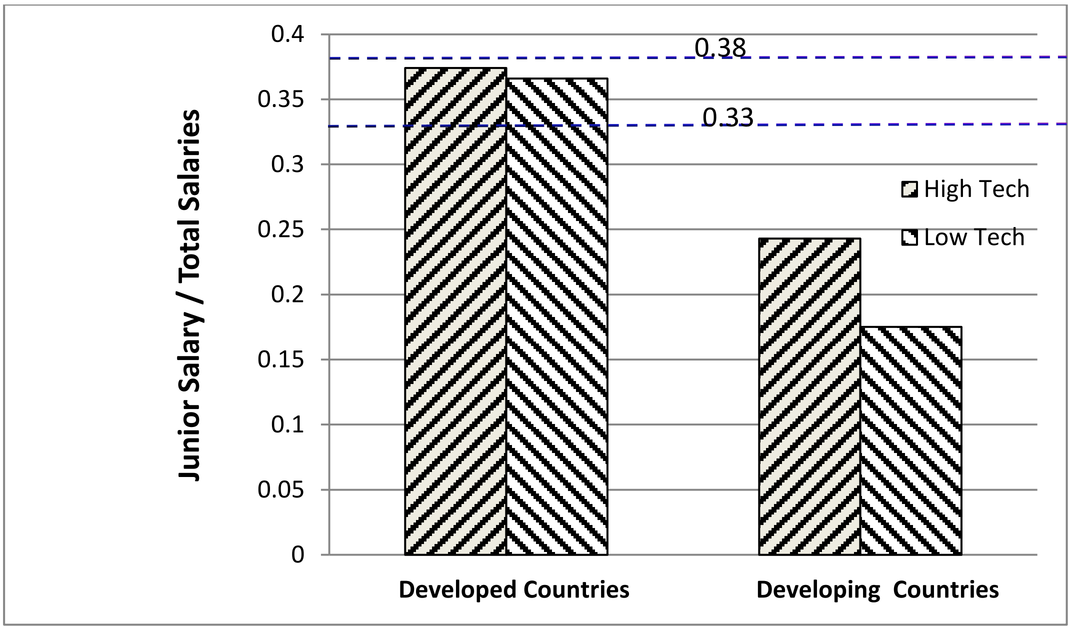

Figure 1: Mean ratios of junior salaries by country development and profession type

(3.3) Study 3: Allocation decisions in ultimatum experiments

As noted in section 2, for a point of harmony to be stable, it must be supported by an efficient external mechanism, such as an institutional or social sanctioning mechanism. In experimental economics, there is ample evidence demonstrating the effectiveness of sanctions, whether by a second party, third party, or an institution, in enhancing cooperation and fairness in resource allocation games (e.g., Boyd &

Richerson, 1992; Fehr, & Gächter, 2002; Fehr & Fischbacher, 2004; Henrich, et al. 2005; Samid & Suleiman, 2008; O'Gorman et al., 2009; Servátka, 2009; Baldassarria & Grossman, 2011).

The ultimatum game structure renders it suitable for investigating the effect of punishment on allocators' behavior in a dyadic economic interaction like the one discussed in the present study. In the ultimatum game (Güth, Schmittberger & Schwartze, 1982; Camerer & Thaler, 1995), one player, designated as the allocator, receives an amount of monetary units and must decide how much to keep for herself and how much to transfer to another player (the recipient). The recipient replies either by accepting the proposed allocation, in which case both players receive their shares, or by rejecting the proposal, in which case the two players receive nothing. Thus, whereas the allocator has complete entitlement to make an allocation decision, the recipient can inflict a harsh, although costly, punishment on an unfair allocator.

Game theory predicts that a rational allocator, who believes that the recipient is also a rational player, should offer the smallest amount possible, since the recipient, being rational, will accept any positive offer. In contrast the proposed model predicts an offer in the range 0.33-0.38 of the entire amount, with preference for the upper limit; i.e., the Golden Ratio division. Experimental findings of numerous ultimatum game studies show that the mean offers are about 0.4 of the entire amount, and that offers of 0.2 or less of the entire amount are rejected with high probability (Camerer & Thaler, 1995; Suleiman, 1996; Camerer, 2003).

I tested the model's predictions using two large data sets on the ultimatum game: (1) a meta-analysis on 75 ultimatum game experiments conducted in 26 countries with different cultural backgrounds (Oosterbeek, Sloof, & Van de Kuilen, 2004); (2) a large cross-cultural study conducted in 15 small-scale societies, including three groups of foragers, six groups of slash-and-burn horticulturalists, four groups of nomadic herders, and two groups of small-scale agriculturalists (Henrich et al., 2005). For the two tested studies, the frequencies of offers are depicted in Figure 2. The figure shows that the two distributions are well-behaved and quite similar to each other.

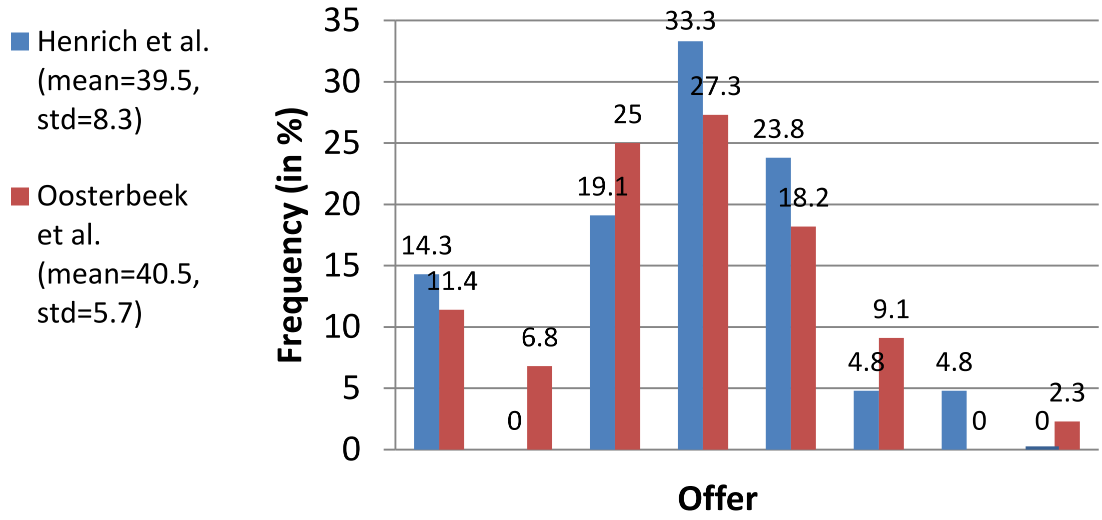

Figure 2: Distributions of offers in two large-scale ultimatum studies

The reported mean offers are ≈ 0.40 and 0.41, for the Oosterbeek et al. and the Henrich et al. studies, respectively; both close to the Golden prediction of ≈0.38. A TOST validates this conjecture. For the Oosterbeek et al. study, the analysis yielded significant results for the upper and lower bounds of the equivalence range (upper bound=42.016, p<0.0001; lower bound=34.377, *p*= 0.0425; overall significance=0.0425). For the Henrich et al. study, the results were also significant (upper bound=42.016, p= 0.012; lower bound=34.377, *p*=0.0255; overall significance= 0.0255). Similar tests for the adequacies for the $(\frac{2}{3}, \frac{1}{3})$ harmony point and for an equality model (perscribing an equal split), yielded insignificant results.

(3.4) Study 4: Learning to be fair

Although the data of the two multi-cultural studies, as well as numerous other ultimatum studies, strongly support the model's Golden Ratio prediction, a proper investigation of the effectiveness of punishment in ultimatum bargaining requires testing the allocators' offers and different levels of punishment effectiveness. To accomplish this I ran an experiment using a *repeated* δ-ultimatum game (Suleiman, 1996), with trial-to-trial feedback. In the δ-ultimatum game, acceptance of an offer of [x, S-x] entails its implementation, whereas its rejection results in an allocation of [δ x, δ (S-x)], where δ is a "reduction factor" known to both players ($0 \leq \delta \leq 1$). Varying the reduction factor, results in different recipients' punishment efficacy. For $\delta = 0$, the game reduces to the standard ultimatum game, in which the recipient has maximal punishment power, while for $\delta = 0$ the game reduces to the dictator game (…) in which the recipient is powerless.

Design

The experimental design included two factors: A "punishment" factor (two levels: high vs. low), crossed, in a between-subjects design, with a "priming" factor (priming vs. no priming). To manipulate the punishment level, half of the subjects participated in a standard ultimatum game (strong-punishment condition), while the other half participated in a game with $\delta = 0.8$ (weak-punishment condition). In the priming condition, in each trial the higher values that they could demand for themselves (10, 9, 8, 7, 6) were explicitly displayed on the allocators computer screens, who were instructed that they can demand for themselves "10, 9, 8, 7, 6 or any other value from the entire amount of 10 NIS". Under the no-priming condition, no priming information suggesting specific optional demands was displayed.

Procedure

Subjects were invited to the laboratory in groups of eight. On arrival, each subject was admitted separately, seated in a soundproof booth, and given detailed written instructions about the experiment. Special efforts were made to prevent subjects from meeting or even seeing each other before the experiment. Following the arrival of the eighth participant, the computerized experiment started. First, the experimenter made sure that all participants completely understood the game. Then the eight participants were randomly paired into two four dyads, and in each dyad one participant was randomly ascribed the role of allocator, and the other the role of recipient. Subjects played in their designated roles for the entire duration of the experiment. On each trial of the game, allocators and recipients were matched in a round robin procedure, such that each allocator played equal number of rounds with each recipient. In each round the allocators were requested to divide a sum of 10 NIS (about &2.75) between themselves and their recipients. The entire game consisted of forty eight trials, with a between-trial-to-trial feedback regarding the decisions of the players and their respective gains. When the experiment ended, five trials were selected randomly and participant were paid the sum of their earnings in the selected trials, in additions to 10 NIS show-up bonus. Participants were informed, via their computer screens, about their earnings. They were requested to wait patiently for the experimenter, who then paid each one in his or her booth, and released him or her from the laboratory. Care was taken that participants be sent out one at a time, thus preventing them from meeting after the experiment.

Subjects

One hundred and twenty eight subjects, students from the University of Haifa participated in the experiment. Four sessions were run under each condition, with eight subjects participating in each session (a total of 32 subjects in each condition).

Hypothesis

We hypothesized that given the option to learn from experience, allocators playing under the strong-punishment condition (δ=0) will learn to propose fair offers of about 0.38 of the total amount, whereas allocators playing under the low-punishment condition, will demonstrate a greedier behavior, and will lower their offers well below the predicted fairness allocation. We also hypothesized that under the two punishment condition, the priming of high optional demands will encourage greediness, causing allocators to lower their offers.

Results

For the four experimental conditions, Table 4 depicts the means (and standard deviations) of the allocators' offers, together with and recipients' acceptance rates. As shown in the table, under the two priming conditions, the mean offers made under the strong-punishment condition were 2 to -2.9 times higher than the mean offers made under the week-punishment condition. A two-factor analysis of variance on the allocators offers revealed a significant effect for the punishment condition $F(3, 60) = 85.27$, $p < 0.0001$). No significant effects were detected for the priming condition ($F < 1$), and for the interaction between the punishment and priming conditions ($F(3,60) = 2.95$, $p < 0.09$). Figure 2 depicts the mean allocators' mean offers as functions of trial-block (6 trials in each block). The figure shows that starting from the first trial-block, the mean offers under the strong-punishment, no-priming condition, were impressively close to the model's prediction of ≈ 38%.

Table 4

Means (and standard deviations) of the allocators' offers and recipients' acceptance rates

Priming Condition	**Punishment Condition**	
	Strong ($\delta = 0$)	Weak ($\delta = 0.8$)
No-Priming	0.39 (0.09) 73%	0.19 (0.13) 44%
Priming	0.44 (0.06) 73%	0.15 (0.13) 46%
Across Priming Conditions	0.41(0.08) 73%	0.17 (0.13) 45%

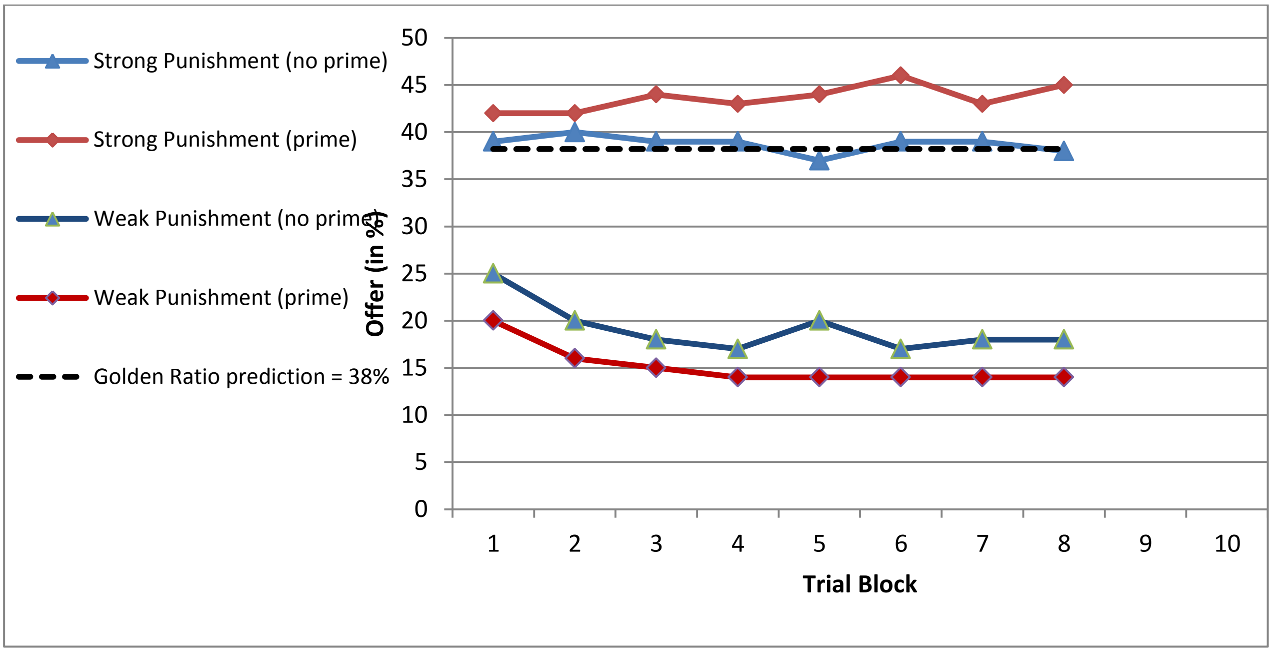

Figure 2: Allocators' offers (in % of the total amount) by trial-block under the four experimental conditions

Moreover, although non-significant, the figure shows that priming high optional demands, caused allocators to decrease their offers *only* under weak-punishment, while under strong-punishment, priming high demands resulted in allocators *increasing* their offers, rather than decreasing them. It is possible that when the punishment for making greedy demands was high, making such demands salient made the allocators more awareness of the high risk in choosing them.

4. Summary and concluding remarks

Under assumptions of rationality and linearity of level of satisfaction functions, the present paper proposed a formal model, based on aspiration levels considerations and utilized it to predict the amount of fair allocation in a dyadic economic interaction, which models an employer-employee interaction. Depending on the assumption made about the recipient's aspiration, the model yields two numerical solutions, termed "harmony" points, at which the levels of pay satisfaction of the two interacting parties are equal. Under the assumption that the employee aspires to receive 50% of the total net profit, the predicted "harmony" pay for the employee is *one third* of the total amount. On the other hand, assuming the employee aspires to be treated equally, that is, to receive the same amount of the net profit as the employer, the predicted harmony pay is $1-\varphi \approx 0.38$ of the total amount, where $\varphi \approx 0.62$ is the Golden Ratio.

In deriving the "harmony" points we assumed that that a rational allocator, would aspire for the entire amount. However, it is more realistic to assume that rational allocators, who cannot assume that the recipient are rational, might expect that positive but low offers are likely to be rejected (Hoffman et al., 1994; Harrison & McCabe, 1996). Relaxing the model, by assuming that allocators might aspire for any amount between the entire amount, S, and (1- α) S, where $0 \leq \alpha \leq 0.5$, is a "security factor" (Lopes, 1987), reveals that under plausible assumptions about the allocators' aspiration levels, the resulting solutions are only 2%-3% higher than the solutions derived under the complete rationality assumption (see appendix A).

The model's predictions successfully accounted for the perception of salary farness reported by a field study (Zedek & Cain Smith, 1968), for fairness in actual salaries in developed countries, for the allocation decisions in ultimatum bargaining reported in two large-scale, cross-cultural studies (Oosterbeek et al., 2004; Henrich et al., 2005), and in a new experiment on ultimatum bargaining with different (high/low) levels of punishment power.

As Study 4 demonstrates, on the behavioral level, a point of harmony in resource allocation will not emerge and stabilize unless supported by an effective punishment. A similar result was reported in a study by Nikoforakis and Normann (2008) on the effect of punishment on contribution to public goods reported. The authors varied the effectiveness of punishment, by changing the factor by which punishment reduces the punished player's income. Their findings indicate that contributions increased monotonically with punishment effectiveness. High effectiveness led to near complete cooperation, whereas below a certain threshold, punishment did not prevent the decay of cooperation.

Further development of the proposed model requires accounting for non-linearity in the individual's perception of outcome fairness, reflected, among other things, in more sensitivity to underpayment than overpayment (Adams, 1963; Greenberg, 1988). Another generalization of the model would be to account for perceptions and behaviors in multi-person resource-allocation interactions. Moreover, the present analysis leaves out several individual and organizational, non-pay-related factors, such as the employee "voice," that is, the opportunity to present an opinion in the decision-making process (e.g., Lind et al., 1990; Tyler & Lind, 1992), and the employee level of engagement (e.g., Saks, 2006; Bakker & Demerouti, 2008; Shuck et al. 2011). Further theoretical and experimental effort is needed for incorporating these factors in the model.

The Golden Ratio as a point of harmony

The appearance of the Golden Ratio as a point of harmony between the player's pay satisfaction levels adds to several appearances of this algebraic number in the social sciences, including in human aesthetics (Green, 1995; Pittard et al., 2007), ethical judgment (Lefebvre, 1985), market behavior (Nikolic et al., 2011), and brain functioning (Weiss & Weiss, 2003; Roopun et al., 2008). A review of the role the Golden Ratio plays in all fields of science and the arts is beyond the scope of this paper. A short list includes biology (e.g., Klar, 2002), chemistry (e.g., Shechtman et al., 1984), physics (e.g., Coldea et al., 2010; Suleiman, 2013), brain science (e.g., Weiss & Weiss, 2003; Conte et al., 2009; Roopun et al., 2008), and aesthetics and the arts (Pittard et al., 2007; Hammel & Vaughan, 1995; Livio, 2002; Olsen, 2006). It is argued that the role of the Golden Ratio in human cognition and behavior has deep evolutionary roots, in earlier times in the evolution of our universe, even before the evolution of life. Aside from contributing to the demystification and secularization of the Golden Ratio, such a perspective could generate some interesting testable hypotheses. For example, one might hypothesize that humans' psychophysiological responses to receiving fair offers in a resource allocation game would be similar to the responses aroused by visual or auditory stimuli with Golden Ratio symmetries. In fact, Chapman et al. (2009) had recently confirmed a comparabe hypothesis. In a study published in *Science*, the authors demonstrated that photographs of disgusting contaminants, and receiving unfair offers, evoked similar activation of the muscle region of the face characteristic of an oral-nasal rejection response.

Going back to the opening question—“What is a fair salary?”—the present paper suggests that it is any percentage out of the entire resource, in the range of 33% to 38%, but with high preference for the upper limit, because it yields higher employee pay-satisfaction (while being more aesthetically pleasing).

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Appendix A

In deriving the "harmony" points in section 2, we assumed that a rational allocator would aspire for the entire amount. We relax the model by assuming that allocators might aspire to receive any amount between the entire amount, S, and (1- α) S, where $0 \leq \alpha \leq 0.5$. Under the assumption that the recipient aspires to receive $\frac{1}{2}S$, Eq. 1 becomes:

$$\frac{x_a}{(1-\alpha)\,S} = \frac{(S-x_a)}{0.5\,S} \qquad \ldots\ldots (1a)$$

Solving for $\frac{x_a}{S}$ we get:

$$\frac{x_a}{S} = \frac{1-\alpha}{(1.5-\alpha)} \qquad \text{….. (2a)}$$

And:

$$\frac{x_r}{S} = 1 - \frac{1-\alpha}{(1.5-\alpha)} = \frac{0.5}{(1.5-\alpha)} \qquad \text{….. (3a)}$$

Similarly, assuming that the recipient aspires to be treated equally ($A_r = x_a$), we have:

$$\frac{x_a}{(1-\alpha)\,S} = \frac{(S - x_a)}{x_a} \qquad \text{….. (4a)}$$

Solving for x= $\frac{x_a}{S}$ yields:

$$x^2 + (1-\alpha)\,x - (1-\alpha) = 0 \qquad \text{…. (5a)}$$

Which solves for:

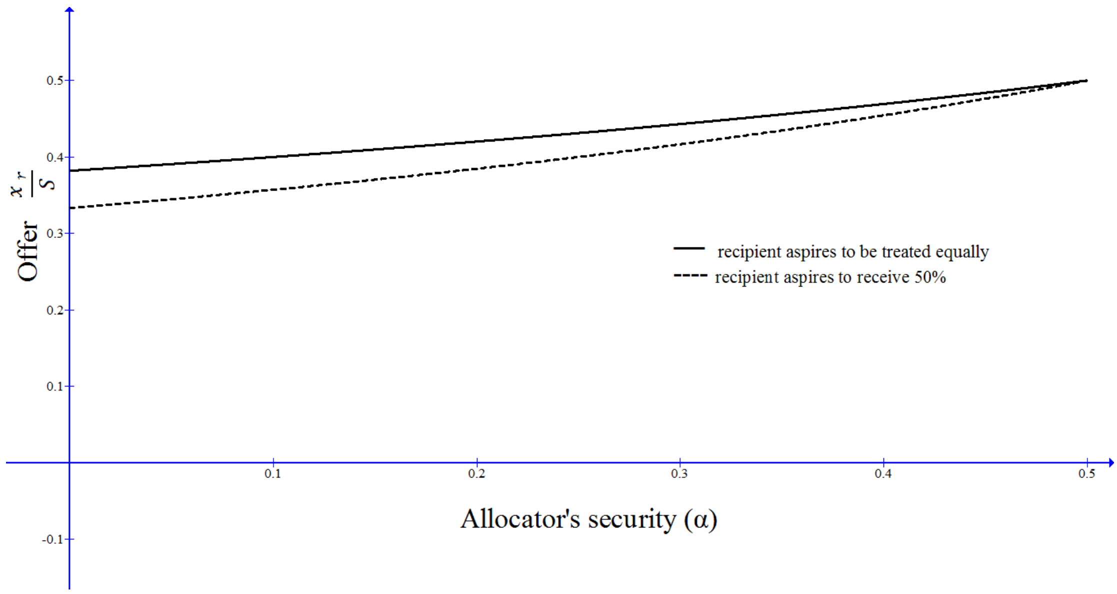
$$\frac{x_a}{S} = \frac{\sqrt[2]{(1-\alpha)^2 + 4\,(1-\alpha)} - (1-\alpha)}{2} \qquad \text{….. (6a)}$$

And

$$\frac{x_r}{S} = 1 - \frac{\sqrt[2]{(1-\alpha)^2 + 4\,(1-\alpha)} - (1-\alpha)}{2} = \frac{3 + \alpha + \sqrt[2]{(1-\alpha)^2 + 4\,(1-\alpha)}}{2} \qquad \text{…… (7a)}$$

For the solutions in equations 2a and 7a, the relative offers ($\frac{x_r}{S}$) as functions of α in the range α = 0 - 0.5 are depicted in Figure 1a.

As expected, the figure shows that two functions increase monotonically with α.



Assuming that allocators would aspire for any amount in the range (S, $\frac{3}{4}$ S), the predicted mean offers could be calculated by integrating the functions in 2a and 7a over the specified range. Under the assumption $A_r = \frac{1}{2}$ S, from Eq. 2a we have:

$$\frac{x_r}{S} = \frac{1}{0.25}\int_0^{0.25}\frac{0.5}{(1.5-\alpha)}\,d\alpha = -\,2\ln(3-2\alpha)\,]_0^{0.25} \approx 0.37 \qquad \text{….. (8a)}$$

While under the assumption $A_r = x_a$, using Eq. 7a we get:

$$\frac{x_r}{S} = \frac{1}{0.25}\int_0^{0.25}\left(\frac{3+\alpha+\sqrt[2]{(1-\alpha)^2+4\,(1-\alpha)}}{2}\right)d\alpha$$

$$=2\,[3\,\alpha - \frac{\alpha^2}{2} - \frac{1}{2}\left(\frac{\alpha}{2} - \frac{3}{2}\right)\sqrt[2]{\alpha^2 - 6\alpha + 5} + 2\ln\left(3-\alpha-\sqrt[2]{\alpha^2 - 6\alpha + 5}\right)]_0^{0.25} \approx 0.40 \qquad \text{…. (9a)}$$

As could be verified, these predictions are only slightly higher (less than 2-3%) than the comparable predictions obtained under the complete rationality assumption.

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