Chapter 15

WAGE DIFFERENTIALS IN EXPERIMENTAL EFFICIENCY WAGE MARKETS[1]

ERNST FEHR and SIMON GÄCHTER
University of Zurich

1. Wage Differentials: Experiments Help to Test Explanations

In recent years, many econometric studies have confirmed the existence of inter-industry wage differentials. Even after controlling for a large number of job- and worker-related characteristics, and demographic variables, large and statistically significant industry wage differences remain. Moreover, these differences exist for union as well as for non-union workers and seem to be remarkably similar (i) across countries with different labor market institutions, (ii) across occupations, and (iii) across time. Two particularly interesting facts are that (a) high profit industries tend to pay high wages and (b) if one occupation in an industry is highly paid, all other occupations in that industry also tend to be paid high wages (Dickens and Katz, 1987; Katz and Summers, 1989).

Even though the empirical fact of wage differentials is largely undisputed, the *explanation* of it is not. Some writers (e.g., Thaler, 1989; Thaler's article also provides a summary of the most important findings) have assigned these differentials even the status of an "anomaly." Put differently, some economists see the fact of inter-industry wage differentials to be at odds with neoclassical labor market theory. Basically, there are two rival explanations. One tries to reconcile the facts with neoclassical labor market theory by claiming that the observed wages compensate for *unobserved* abilities and/or working conditions (Murphy and Topel, 1990). An alternative approach rejects the neoclassical view and invokes an efficiency wage explanation (e.g., Krueger and Summers, 1987, 1988).

With field data, it has so far been impossible to sharply discriminate between rival explanations. Unambiguous measurement of job rents requires reliable information about reservation wages, working conditions and skill levels. While these variables can in general only be crudely approximated with field data they can be controlled in the laboratory. Here we report on experimental tests of two leading efficiency wage theories, which have been invoked as an explanation of observed wage differentials, namely the Fair Wage-Effort version and the Shirking version of efficiency wages. In these experiments, the test methodology has been to implement an environment (i) that allows for the emergence of efficiency wages and (ii) that gives competitive forces the best shot.

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2. The Fair Wage-Effort Version of Efficiency Wage Theory

This version of Efficiency Wage Theory goes back to Akerlof (1982, 1984) and in particular to Akerlof and Yellen (1990). The basic hypothesis in this model is that if wages fall short of a fair reference wage, a rise in wages will raise workers' effort. As a consequence, firms have an incentive to pay wages that are close to workers' fair reference wage. Two kinds of social comparison processes may affect the level of the fair reference wage and, hence, the wage-effort relation: (i) If workers' perception of what constitutes a fair wage level is positively correlated with firms' profit opportunities, high profit firms are forced to pay a higher wage to elicit a *given* level of effort. Moreover, if higher profit opportunities are associated with a higher marginal product of effort, firms with high profit opportunities have an incentive to elicit higher effort levels. Both reasons may be responsible for the observed positive correlation between profits and wages in the field data. (ii) Fair reference wages may also be influenced by what other workers in closely related occupations earn. In the following we describe an experiment by Fehr, Gächter, and Kirchsteiger (1996) in which point (i) and its implication for persistent wage differentials was investigated.

2.1. Experimental Design

In the experiment, subjects acted in the roles of firms and workers, respectively. The design consisted of three elements: (a) *a competitive bid market* with an excess supply of workers to create a lot of competitive pressure; this market institution has well-known features of convergence to the competitive equilibrium (see Plott, 1989), (b) *firms which differ according to the profitability of an employed worker* to be able to test point (i) above, (c) *incomplete contracts*, that is, workers have some discretion in exerting work effort; this is regarded to be an essential characteristics of naturally occurring labor relations and a precondition for reciprocity to become effective. The experiment consisted of 16 trading days in each of which a three-stage game was played. Table 1 summarizes the design. An important design feature concerns the information about payoffs and the anonymity of trading partners. Payoff functions of firms and workers were common knowledge. Individual firms and individual workers could develop no reputation across periods because all interactions were fully anonymous.

2.2. Results

At the *third stage* firms actually rewarded or punished despite this being costly for the firm, which is evidence for firm's reciprocity (for a definition of reciprocity see, e.g., Rabin, 1993). At the *second stage* workers show a highly significantly positive wage-effort relation even if one controls for firms' redemption values. Put differently, the higher wages are, the higher are the effort levels put forward, despite their increasing costliness. At the *first stage* firms pay wages that are positively correlated with their profit opportunities (i.e., their redemption value).

Table 1
The Fair Wage-Effort Efficiency Wage Theory: The design of Fehr, Gächter, and Kirchsteiger (1996)

A. Sequence of events during a trading day

Stage 1	1. Each firm (which differ in their assigned redemption values q (= profitability of an employed worker)) simultaneously posts a binding wage offer $w \in [f, q]$. f is a fixed cost for the worker of accepting an offer.
	2. Workers observe all wages and choose among the available offers in a randomly determined order. There are more workers than jobs (= firms) to create competition.
Stage 2	3. Workers who accept an offer are informed about the redemption value q of their firm and choose an effort level e. They incur effort costs $c(e)$ with $c(e^{\min}) = 0$, $c'(e) > 0$ and $c''(e) > 0$.
Stage 3	4. Firms are informed about the effort choice of their worker and can punish ($p < 1$) or reward ($p > 1$) their worker at some cost $k(p)$; $k(p = 1) = 0$; $k'(p < 1) < 0$; $k'(p > 1) > 0$.

B. Payoffs

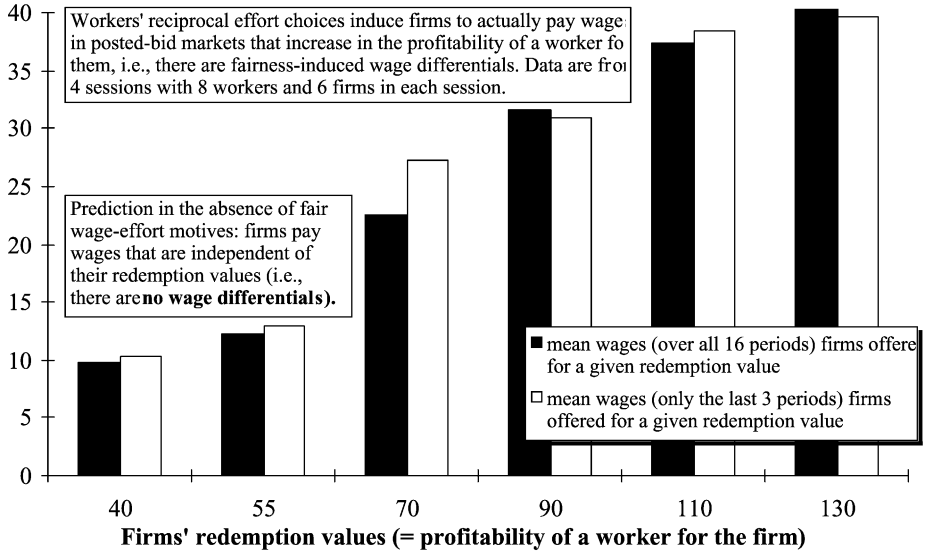
Firms	$\pi = (q - w)^* e - k(p)$
Workers	$u = [w - c(e) - f]^* p$

C. Main predictions

In the absence of fairness motives (*null hypothesis*)	*In the presence of fairness motives*
No systematic wage and job rent differentials because workers' effort choices are *not* affected by wages and firms' profit opportunities	Firms with higher profit opportunities pay higher wages and higher job rents because workers' effort choices are affected by wages and firms' profit opportunities

Figure 1 demonstrates that the null hypothesis of no wage differentials has to be rejected in favor of the fair wage-effort hypothesis that wages are positively related to profit opportunities. The black bars show the average wages over all 16 periods per redemption value (profit opportunity). The white bars are evidence for the temporal stability of observed wage differentials. They depict the average wages in the last three periods. Notice that they are almost identical to the averages over all periods.

In the empirical literature there is no doubt that wage differentials exist. However, an important open question is whether the observed differentials are *compensating* wage differentials. Notice that in this experiment unobserved abilities and other worker heterogeneities – which are invoked as explanations for observed field data (see Murphy and Topel, 1990) – are excluded by design. Therefore, a relevant question is whether the observed wages contain a pure rent element as argued by, e.g., Krueger and Summers (1988). It turns out that firms pay positive job rents at *all* redemption values. Yet,



Source: Fehr, Gächter, and Kirchsteiger (1996).

Figure 1. Intertemporally stable wage differentials in the Fair Wage-Effort Model: Firms' wage payments increase in the redemption value because workers' effort levels depend positively on the rent share.

there are also large job rent differentials. Firms with higher profit opportunities pay significantly higher job rents. The picture with job rents mimics Figure 1.

3. The Shirking Version of Efficiency Wage Theory

This version of Efficiency Wage Theory has been developed by Shapiro and Stiglitz (1984), Bowles (1985), Fehr (1986), MacLeod and Malcomson (1989), and others. The shirking version is essentially a theory of involuntary unemployment that arises because of a *moral hazard* problem. In these models, firms pay incentive compatible efficiency wages to prevent workers from shirking. Fehr, Kirchsteiger, and Riedl (1996) have developed a simplified version of the shirking model and subjected it to an experimental test.

3.1. Design

Their design is summarized in Table 2.

Despite its simplicity the efficiency wage model of Fehr, Kirchsteiger and Riedl contains many testable predictions. Among them are the following: (i) wages are incentive compatible, i.e., they satisfy the so-called "no-shirking condition" (ii) employed workers receive a job rent and the firms with the lowest redemption values make no job offer

Table 2
The shirking version of Efficiency Wage Theory: The design of Fehr, Kirchsteiger, and Riedl (1996)

A. Sequence of events during a trading day

Stage 1	1. Firms (which differ in their assigned *redemption values* q (= profitability of an employed worker)) simultaneously post employment contracts $[w, \hat{e}, p]$, where w is the wage, $\hat{e}$ is the *desired* effort and p is a penalty in case the worker is caught shirking ($e < \hat{e}$). p is bounded from above.
	2. Workers observe all contracts and choose among the available offers in a randomly determined order. There are more workers than jobs to create competition among workers.
Stage 2	3. Workers who accept an offer choose an effort level e and incur effort costs $c(e)$ with $c(e^{\min}) = 0$, $c'(e) > 0$ and $c''(e) > 0$.
	4. A random mechanism determines whether the actual effort e is verifiable. In case the worker has shirked, she has to pay the penalty p to the firm.

B. Payoffs

Firms	$\pi = q^*\hat{e} - w$ if the worker does not shirk ($e = \hat{e}$) $\pi = q^*e - w[+p]$ if the worker shirks [and gets caught]
Workers	$u = w - c(\hat{e})$ if the worker does not shirk ($e = \hat{e}$) $u = w - c(e)[-p]$ if the worker shirks [and gets caught]

C. Main predictions

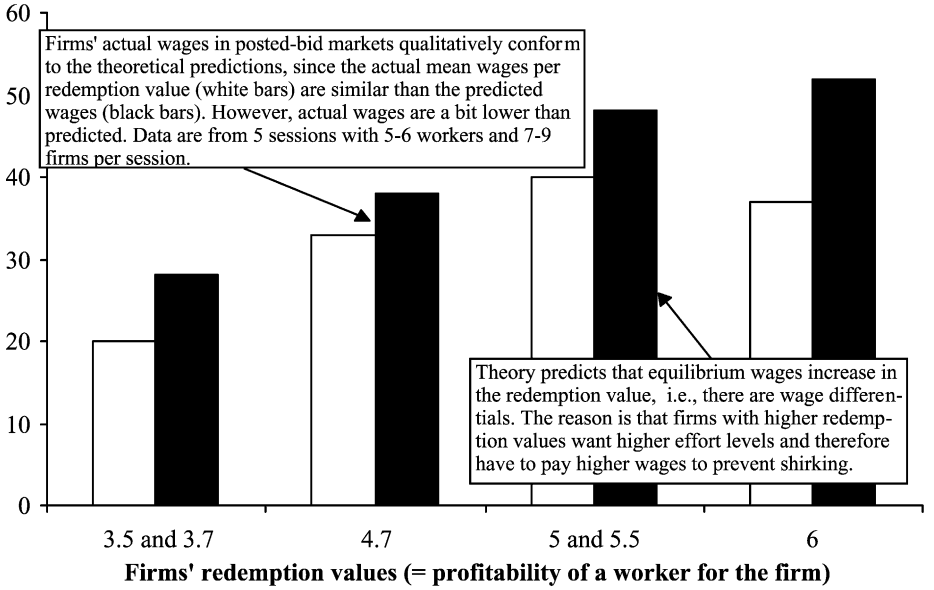
The equilibrium wage w^* and equilibrium job rents are increasing in the redemption value q. The reason is that firms with higher redemption values demand higher effort levels and therefore have to pay higher wages to prevent shirking.

which leads to endogenous involuntary unemployment, (iii) firms choose the maximal punishment possible, (iv) the desired effort level is positively correlated with a firm's redemption value, (v) there are non-compensating wage differentials, that is, the higher a firm's redemption value, the higher is the optimal wage that is paid by the firm.

3.2. Results

All five predictions are qualitatively borne out by the data. For the purpose of this paper, the most important result is related to (v), which predicts redemption value-dependent wage differentials.

This figure contains the actual average wage (white bars) and the theoretical prediction for each redemption value. As Figure 2 shows, the actual data match the predictions qualitatively quite well. Quantitatively, wages are a little bit too low compared to the theoretical prediction. With regard to job rents the picture is very similar. Job rents are increasing in the redemption value and somewhat lower than predicted. A regression



Source: Fehr, Kirchsteiger, and Riedl (1996).

Figure 2. Wage differentials in the Shirking-Model: Theoretically predicted (black bars) and actual wages (white bars).

analysis confirms that the observed positive relationship between wages (job rents) and redemption values is indeed highly significant.

4. Summary

This chapter reports on two experiments that were designed to test whether efficiency wage theories receive support in the laboratory. The idea is that theories which have no explanatory power even under the controlled circumstances of the laboratory, will not apply to the much more complicated field. The investigated efficiency wage theories – the fair wage-effort hypothesis and the shirking version – are often invoked to explain certain labor market phenomena, as involuntary unemployment and (non-compensating) wage differentials. Both variants of efficiency wage theories considered here "survived" the laboratory tests and may, therefore, be considered as possible explanations for field observations. In this sense, the reported experimental results can be viewed as complementary to field work in this area.

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