

# Lecture Note: Efficiency wages, Neoclassical and Non-Neoclassical Evidence

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## 1 INTRODUCTION

There have been a number of notable efforts to test efficiency wage models in the Shapiro-Stiglitz vein. These include:

1. Krueger (1991, QJE) “Ownership, Agency and Wages: A Study of the Fast-Food Industry.”
2. Cappelli and Chauvin (1991, QJE): “An Interplant Test of the Efficiency Wage Hypothesis.”
3. Holzer, Katz and Krueger (1991, QJE): “Job Queues and Wages.”

I will discuss each of these papers briefly. Why did these all appear in the QJE? Chicago economists don’t believe in efficiency wages.

But in this literature, there is a persistent sense that the neoclassical story is somehow missing the mark, even if it seems to fit the facts. There is an intuition that norms and fairness are an important part of the effort equation. Akerlof’s 1982 (QJE) paper on Gift Exchange is the first to articulate this formally. The 1986 AER article by Kahneman, Knetsch, and Thaler presents startling evidence that perceptions of fairness have little to do with opportunity cost – which is exactly the point where the neoclassical and the gift exchange views part ways.

Economists have been so troubled by the suspicion that the neoclassical models are wrong, they’ve actually taken to asking business managers what they think. Three papers/books that do this are:

1. Blinder (AER, 1991), Blinder and Choi (QJE, 1990).
2. Campbell and Kamlani, QJE 1997.
3. Bewley, 2000, Harvard University Press (an entire book of survey evidence from a theorist!)

All of these authors appear less convinced of the neoclassical view after talking to non-economists about it.

Most recently, a combination of theory and laboratory work has begun to structure an alternative view of fairness and cooperation.

## 2 NEOCLASSICAL EVIDENCE

### 2.1 KRUEGER, 1991: "OWNERSHIP, AGENCY AND WAGES: A STUDY OF THE FAST-FOOD INDUSTRY."

- Q: How do you go about testing efficiency wage theory? Many empirical angles are possible:
  - Shirking and wages
  - Monitoring and wages
  - Existence of involuntary unemployment
  - Worker flows and shirking behavior
  - Survey evidence on employer motivations
- Krueger 1991 explores the notion that monitoring and wages are substitutes.
- Franchising in the fast food industry:
  - Identical products
  - Different ownership structures
  - Franchising: Closer monitoring, few agency problems
  - Company stores: Greater agency problems
- See evidence in Table I that supervision less adequate in company jobs.
- Q: What would efficiency wage model predict for wages across these two settings?
- Aside: Greenberger and Steinberg (1986) cited by Krueger found that 62% of first time workers in Orange county did at least one of the following in first 9 months of employment:
  - Gave away goods

- Falsely claimed to be sick
  - Stole
  - Damaged property
  - Worked while intoxicated
- Shirking could be even more important in managerial jobs where there is more opportunity to exercise discretion.
  - Perhaps for line jobs, shirking is easier to detect and less costly in terms of foregone output.
  - Note: Bonding model would predict back-loaded compensation (i.e., Lazear contracts). Hence, the Present Value of contracts would be the same at both types of jobs. See Krueger Figure I.

### 2.1.1 FINDINGS

- The Present Value of wage differences at company-owned versus franchise stores is \$1,250 for assistant managers, \$75 for full-time workers.
- Company owned restaurants more likely to start part-time workers above the minimum wage.
- Company owned restaurants also more likely to give free meals, paid vacation, paid sick leave, paid holidays, and health insurance.
- An alternative interpretation: Agency problems – “expense preference.” Maybe managers make their own lives easier by paying higher wages at the expense of the company. This has the same empirical implications as efficiency wages except for what? It’s not efficient.

### 2.2 CAPPELLI & CHAUVIN: AN INTERPLANT TEST OF THE EFFICIENCY WAGE HYPOTHESIS

- Krueger tested implication that  $\frac{\partial \hat{w}}{\partial q} < 0$ , i.e., better monitoring technology  $\Rightarrow$  lower wages set by firm.

- Another implication we'd like to test:  $\frac{\partial e}{\partial w} > 0$  ? Do workers shirk less if they are paid more?
- This question has identification problem: Higher wages could be the cause or the result of higher productivity.
- The test here: Internal wages at a large manufacturing company, 1982:
  - All workers in United Auto Workers, which standardizes work and wages across plants. Same labor agreement for all.
  - All production workers in identically specified jobs within categories.
  - Personnel policies on shirking and discipline virtually identical across plants and centrally adjudicated by unions.
  - Wages set by company-wide collective bargaining. Hence, cannot be affected by plant level productivity.
  - Wages can however cause differences in productivity across plants.
  - Premiums 0-100 percent above local wages. Note: may not be efficient “efficiency wages” but should still impact shirking.
  - Shirking measure: Rate of dismissal across plants for disciplinary reasons.
- These results sign that the wage-effort elasticity is positive. They do not tell us:
  - Magnitude of wage-effort elasticity
  - Whether firms actually take this into account when setting wages. Variation we see here is due to firm *not* having control of its wage policies
  - What share of variation in observed wages this explains – if any.
- Yet, this is about as good as it gets
- [Also see Ichino and Riphahn working paper on “Employment Protection and Worker Effort.” This paper is an odd type of ‘experiment’ because workers are effectively ‘investing’

in good behavior in the hopes of securing a flow of quasi-rents in the near future. So, this does not tell us what shirking would be in the absence of employment protection. But it again suggests that effort is a choice variable affected by rents at jobs.]

## 2.3 EFFICIENCY WAGES: HOLZER, KATZ AND KRUEGER

### 2.3.1 MOTIVATION

- Evidence in Krueger and Summers (1988) – not discussed in class – suggests the existence of *ex post* rents in certain jobs: lower turnover, longer tenure in high wage ‘premium’ jobs.
- Evidence on *ex ante* rents would potentially be more convincing. Do we see applicants behaving as if some jobs offer rents?
- Idea: Use binding minimum wages as source of rents. Do applicants queue for these jobs?
- Problem: This approach may be less than compelling. Employers may offset some or all of the minimum wage impact with cuts in benefits and/or non-pecuniary aspects of work (e.g., safety, working conditions).
- But if wages and benefits are *imperfect substitutes*, many efficiency wage models suggest that employers will not fully offset mandated wage increases with cuts in other forms of compensation. In this case, employment rents will *increase* where minimum wages bind.

### 2.3.2 SETUP

- Consider the following basic competitive wage model:
- The worker’s value of compensation is:

$$u(w, b) = w + v(b), \tag{1}$$

where:

- $w$  is the wage paid.
- $b$  is the firm’s expenditures on non-wage compensation.

–  $v(\cdot)$  is increasing, concave with  $v'(0) > 1$  (i.e., the first dollar of benefits more valuable than wages).

- In the absence of minimum wages, firms choose:  $w^*, b^*$  such that  $v'(b^*) = 1$  and  $w^* + b^*$  is the market clearing compensation level (i.e., worker's marginal productivity).

### 2.3.3 INTRODUCTION OF A BINDING MINIMUM WAGE IN A BASIC COMPETITIVE MODEL

- Assume the government imposes a binding minimum wage such that  $w_m > w^*$ .
- If firms increased wages without reducing benefits we would have  $w = w_m + v(b^*)$ , which would attract too many applicants. Queues form.
- So firms will choose benefits  $b^{**} < b^*$  until the market clears.
- This implies that  $v(b^{**}) > 1$ .
- Note the inefficiency. Employees would gladly trade a \$ in wages for a \$ dollar in benefits, but they are unable to do so.  $\Rightarrow$  Minimum wage unambiguously reduces welfare.

### 2.3.4 INTRODUCTION OF A BINDING MINIMUM WAGE IN A MODEL WITH COSTLY TURNOVER

#### Competitive case

- The firm has a quit rate of  $Q(w + v(b))$  where  $Q' < 0, Q'' > 0$ . Turnover is declining in wages at a decreasing rate.
- Firms' net cost of turnover is  $T$ .
- Firms will therefore choose  $w$  to minimize the cost per efficiency unit of labor:

$$\min_{w,b} c = w + b + TQ(w + v(b)). \quad (2)$$

and the FOCs are:

$$\begin{aligned} \frac{\partial c}{\partial w} &= 1 + TQ'(w + v(b^*)) = 0, \\ \frac{\partial c}{\partial b} &= 1 + TQ'(w + v(b^*)) \cdot v'(b^*). \end{aligned}$$

- Simplifying:

$$TQ'(w^* + \nu(b^*)) = -1 \quad (3)$$

$$v'(b^*) = \frac{-1}{TQ'(w^* + \nu(b^*))} = 1 \quad (4)$$

- Substituting (3) into (4) gives

$$v'(b^*) = 1.$$

At the unconstrained optimum, a \$1 increase in either wages or benefits reduces turnover costs by \$1.

### Adding binding minimum wage

- Now consider imposition of  $w_m > w^*$ .
- The firm will still want to choose  $b$  to satisfy 4, i.e.,

$$v'(b^{**})TQ'(w_m + \nu(b^{**})) = -1. \quad (5)$$

- In other words, it is still equating the marginal costs of non-wage benefits with the marginal gains in efficiency units of labor.
- Notice if the firm fully offsets the minimum wage such that  $b_m = b^* - (w_m - w^*)$ , then this gives

$$TQ'(w_m + b_m) = -1,$$

and

$$v'(b_m) > 1, \quad (6)$$

which means that 5 *would not* be satisfied.

- If the firm had chosen  $b_m$ , it would find that the next \$1 in benefits would more than pay for itself with a reduction in turnover.
- Hence, to satisfy 5, it must be the case that  $b^* > b^{**} > b_m$ , which implies that:

$$\text{ABS } |TQ'(w^* + \nu(b^{**}))| < 1,$$

$$v'(b^{**}) > 1.$$

- In other words, the firm does *not fully offset* minimum wage increases with one-for-one benefit reductions. If it did, the next dollar in benefits would have reduced turnover costs by more than a dollar.
- These implies that worker utility in minimum wage jobs has unambiguously increased. Wages rise, benefits fall, but the total attractiveness of the job is higher:

$$w_m + v(b^{**}) > w^* + v(b^*).$$

- What is happening here is the following:
  - Wages are forced to rise by some amount by the binding minimum.
  - Fully offsetting the ensuing rents would be inefficient because this would induce too much costly turnover.
  - The reason is that the benefits and wages are imperfect substitutes. The first dollar of benefits costs the firm less than workers value it. If the benefits function were not concave with  $v'(0) > 1$ , this result would not hold.

### 2.3.5 IMPLICATIONS

- Workers earn rents at binding minimum wage jobs  $\Rightarrow$  Queues of applicants.
- Other possible reasons why minimum wages induce rents in the labor market:
  - Fairness/equity. Employers are constrained by fairness from ‘taking back’ the entire wage increase with benefit reductions.
  - Non-negativity constraints on benefits.
  - Non-excludability. Cannot reduce benefits to minimum wage workers without harming other workers too, e.g., shutting off the heat.
- Assume that job offer odds are equal to one over the application rate  $p$ .
- Applicants will want to equate expected utility across jobs  $i, j$ , so  $p_i[w_i + v(b_i)] = p_j[w_j + v(b_j)]$

- So, jobs paying rents will attract longer queues.
- Note that if a job is paying *compensating differentials*, this would not necessarily be true.
- Caveat: If high wage jobs also attract many unqualified applicants, this would also give rise to queues in the absence of efficiency wage considerations.
- But it's not clear why this queuing would cluster at minimum wage jobs.
- Another caveat: Let's say firms did fully offset minimum wage hikes with benefits cuts. Workers might not realize this, and so still queue for minimum wage jobs in incorrect expectation that they'll receive rents.

### 2.3.6 RESULTS ON MINIMUM WAGES

- Table I
  - More applicants at minimum wage jobs than jobs slightly above or below.
  - Characteristics of applicants at minimum and subminimum jobs are similar.
  - Firms paying subminimum are smaller.
- Table II
  - Regression estimates of minimum wage differential are large and significant (about 25%).
  - Robust to inclusion of geographic, firm size and industry dummies.
  - Would have been great to do this across jobs within companies.

### 2.3.7 ARE INDUSTRY AND/OR UNION PREMIA ALSO RENTS?

- Let  $A$  equal  $\ln$  applicants per job. We'd like to estimate

$$A = W\alpha_w + X\alpha_x + \epsilon_A,$$

where

$$W = A\beta_A + Z\beta_Z + X\beta_X + \epsilon_W,$$

and

$$\text{plim } Z'\epsilon_A = 0.$$

In this system of equations,  $\alpha_w$  is the elasticity of applications with respect to the wage, and  $Z$  is a vector of (valid) instruments.

- Since  $W$  and  $A$  are simultaneously determined in this system, we want to instrument  $W$  with  $Z$ .
- Table III
  - Surprisingly weak evidence that industry wage premia are rents.
  - Minimum wage dummy remains robust.
- Figure I:
  - Relationship between wage premia and apps appears quite visible.
  - Notice the Mining industry. What’s going on here? Possibly a compensating differential.
- Table IV
  - Use union and firm size dummies along with industry dummies as wage instruments.
  - Firm size fails the over-ID test, suggesting that it’s not a good instrument.
  - Using industry and union as instruments while including firm size in the applications equation gives weak results.
- “A larger proportion of the interindustry wage structure than previously believed may be attributable to compensating wage differentials for non-wage conditions of work.”

### 2.3.8 CONCLUSIONS

- Some evidence of rents in labor market.
- Interindustry wage structure looks more or less robust depending on the approach used (Krueger/Summers vs. HKK).
- Is HKK a high power test of rents? No. But works surprisingly well.

## 3 THEORY AND EVIDENCE ON NORMS, RECIPROCITY AND EFFORT

### 3.1 FEHR AND GACHTER, 2002, “DO INCENTIVE CONTRACTS UNDERMINE VOLUNTARY COOPERATION

Once you begin to suspect that “fairness” regulates labor market contracts, you are theoretically at sea. Economists know a great deal about opportunity costs as a normative concept and little about other possible regulators of behavior. Therefore, norms are going to be hard to “test” in observational setting – it’s not exactly clear what to look for. This is why a laboratory experiments so useful: can specify what types of incentives are to be used (standard economic incentives, and non-incentive-comptabile alternatives) and see how these contracts perform in:

1. Eliciting effort
2. Generating profits.

Fehr and Gächter’s smart and subtle paper (2002, AER forthcoming) performs some tests.

#### 3.1.1 THE SETUP.

Two types of contracts: Incentive and Trust. In both contracts:

1. The buyer’s offer labor contracts – Specifying a price and a quality
2. Sellers accept or refuse contracts. No other negotiations are possible.
3. These are one shot deals transacted anonymously. There is no possibility of developing an individual reputation.

4. After agreement, the seller ‘produces’ by generating output at some quality level. In practice, this just means selecting a quality level to deliver.
5. The buyer’s gain: rising in quality and declining in price
6. The seller’s gain: only a function of price, not of quality
7. There is always an excess supply of sellers (more sellers than buyers); sellers do not have power to hold up buyers for a contract
8. In the Trust Treatment, there is no opportunity for punishment if the seller ‘shirks’ by producing less than the agreed quality.
9. In the Incentive Treatment, buyer can penalize seller if seller is detected shirking. Shirking is detected  $1/3^{rd}$  of time.

### 3.1.2 TRUST TREATMENT (TT)

Buyer offers a contract  $\{p, \hat{q}\}$  where  $p$  is the price and  $\hat{q}$  is the desired quality level. In this treatment,  $\hat{q}$  is never enforceable. Buyer’s profit is

$$\pi = \left\{ \begin{array}{ll} vq - p & \text{If contract accepted} \\ 0 & \text{If no contract} \end{array} \right\},$$

with  $v = 100$ ,  $0 \leq p \leq 100$ , and  $q \in \{.1, .2, \dots, 1\}$ .  $q$  is delivered quality.

Seller’s payoff is

$$u = \left\{ \begin{array}{ll} p - c(q) & \text{If contract accepted} \\ 0 & \text{If no contract} \end{array} \right\}.$$

where the cost of quality is

$q$	.1	.2	.3	.4	.5	.6	.7	.8	.9	1
$c(q)$	0	1	2	4	6	8	10	12	15	18

In this treatment, there is no subgame perfect incentive to provide any level of quality exceeding  $q = 0.1$ . Given this, there is no reason to offer a price exceeding  $p = 1$  (or potentially  $p = 0$ ). So, the incentive compatible equilibrium of this game is  $\{1, .1\}$ .

This is not socially efficient. Given that the marginal cost of  $q$  to the seller less is always less than its marginal value to the buyer, efficiency requires that  $q = 1$ .

### 3.1.3 INCENTIVE TREATMENT (IT)

The basic difference between TT and IT is that in IT, the seller can be punished if caught shirking. Shirking is detected with probability  $s = 1/3$ , and the shirker is fined the amount  $f \in [0, 13]$ , specified in the contract, which is now stipulated as  $\{p, \hat{q}, f\}$ . Hence, the payoffs become:

$$\pi = \begin{cases} vq - p & \text{if contract accepted and } q \geq \hat{q} \\ vq - p + sf & \text{if contract accepted and } q < \hat{q} \\ 0 & \text{if no contract} \end{cases},$$

and similarly for the buyer

$$u = \begin{cases} p - c(q) & \text{if contract accepted and } q \geq \hat{q} \\ p - c(q) - sf & \text{if contract accepted and } q < \hat{q} \\ 0 & \text{if no contract} \end{cases}.$$

A selfish seller will accept the contract if the participation constraint is met

$$p \geq c(q^*),$$

where  $q^*$  is the quality level that maximizes the seller's payoff. The seller will provide quality  $\hat{q}$  if the No Shirking Constraint (NSC) is satisfied:

$$c(\hat{q}) \leq sf$$

Assuming linearity of buyer utility, the highest quality level that can be enforced (using  $f = 13$ ) is  $c(\hat{q}^*) = 4.33$ , which corresponds to  $\hat{q}^* = .4$ . The price associated would be 5 (or 4 depending on the assumption about what an indifferent seller does). So, the highest power incentive compatible contract is simply  $\{p = 5, \hat{q} = .4, f = 13\}$ .

Notice that this contract is inefficient for the same reasons as above. But it would be predicted to outperform TT given that it is enforceable.

### 3.1.4 THE BONUS TREATMENT (BT)

A concern is that fines  $f$  designed to elicit high quality levels may be perceived as hostile per se. More generally, explicit incentives may be viewed as a sign of distrust – and if that is viewed as unkind, it may generate an adverse response. So, re-frame the issue: Bonus Treatment (BT) instead of IT:

- In the IT, a seller pays a fine  $f$  if caught shirking.
- In the BT, a buyer pays the seller a bonus if he is detected not shirking. That is, in  $2/3^{rd}$  of cases where  $q \geq \hat{q}$ , the seller pays  $b \in [0, 13]$ , which is stipulated in the contract  $\{p_0, \hat{q}, b\}$ .
- Hence, these contracts are isomorphic with  $p = p_0 + b$ .

Note that they F/G do not use value laden language in the experiment framing. In the IT, the fine is called “A potential price deduction.” In the BT, it’s called a “potential supplementary price.”

### 3.1.5 A TINY BEHAVIORAL MODEL

F&G discuss ‘reciprocal’ and ‘inequity averse’ sellers. These concepts probably have similar predictions but different behavioral mechanisms. Reciprocal sellers play tit-for-tat strategies. Hence, two reciprocal players who meet will outperform two purely selfish players. But the behavior is still arguably selfish. Inequity averse sellers get direct disutility from outcomes that do not benefit both sides equally.

A simple inequity averse utility function might look like:

$$U_i(x) = x_i - \alpha_i \max\{x_j - x_i, 0\} - \beta_i \max\{x_i - x_j, 0\},$$

with  $\alpha_i \geq \beta_i$  and  $0 \leq \beta_i \leq 1$ . In this formulation,  $i$  places negative weight on any deviation from an ‘equitable’ outcome for either party. But  $\alpha_i \geq \beta_i$  means that  $i$  weakly prefers inequity favoring herself. Assuming  $\alpha = \beta = 0.5$ , seller utility is maximized when

$$\pi = 100q - p = p - c(q) = u,$$

(assuming  $p$  is high enough to support an equilibrium with both players benefiting).

Notice that

$$\partial q / \partial p = 2 / (100 + c'(q)) > 0.$$

Higher offered prices yield higher quality from inequity averse players. Hence, if you were a selfish buyer facing inequity averse players, you might rationally offer a price above  $p^{\min} = 5$ . Denote the ‘payoff equalizing’ quality level as  $q^e$ .

This model is developed further in the paper, but it turns out not to be too relevant. Why? Even where sellers are offered non-incentive compatible contracts in the IT, they still perform like selfish players in general. Moreover, when the IT payoffs are re-framed as a “bonus treatment” instead of a “punishment treatment” later in the study, sellers behave much less selfishly in the IT with punishment treatment. This suggests that something about framing – threats are perceived as slights even if not carried out – rather than inequity aversion is a better explanation for off-equilibrium-path behavior in both treatments. In other words, sellers don’t act as if they are inequity averse when faced with incentive contracts.

### 3.1.6 RESULTS

The results here are quite rich. It’s a credit to the authors that they are as good as extracting deductions from experiments as at designing them.

1. In the TT, buyers offer on average higher prices and demand higher quality than in the IT.
2. The average fine in the IT is close to the maximum of 13 (and the median is 13).  
See Table 2  
See Figure 2
3. Quality and voluntary cooperation are lower in the IT than the TT. This is because
  - A fraction of sellers shirks in the IT even when the NSC is met! (risk loving?)
  - Voluntary cooperation ( $q - q^* > 0$ ) vanishes almost completely in the IT. Almost no one performs beyond the minimum.
    - **In 62 percent of NIC (non-incentive compatible) IT contracts, sellers deliver the minimum quality.**
    - **In 69 percent of TT contracts, they deliver above minimum.**
  - If the NSC is violated, sellers generally select the minimum quality
  - In the TT, voluntary cooperation responds strongly to the price level. In the IT, there is no gradient.

See Table 3.

See Figure 3.

4. Total surplus is on average higher in TT than IT, whether comparing to IC or NIC incentive contracts.
5. But the profit for buyers is highest for incentive compatible IT contracts, second highest for TT-contracts, and lowest for NIC incentive contracts.

See Table 6.

6. It appears that the reduction of voluntary cooperation in the IT was not caused by low price offers. Rather, low price offers were a response to a lack of sellers' voluntary cooperation in the IT. Even in the 1st period – where sellers did make offers well above  $p^{\min}$ , the vast majority of buyers still provided only  $q^*$ .

See Figure 4.

See Figure 5A, 5B

7. When the problem was re-framed using the Bonus Treatment (BT), cooperation was much higher than in the IT (though still lower than the TT), and there was a significant quality-price gradient.

See Figure 6.

### 3.2 CONCLUSIONS

In my assessment, the efficiency wage literature speaks positively about the intellectual health of the Economics profession. Although economists might have concluded ‘problem solved’ after Shapiro-Stiglitz was published (and some did), apparently many other economists suffered from a troubled conscience. The problem was sufficiently important – and the proposed solution sufficiently unsatisfactory – that they kept pushing. Akerlof was early – of course. But twenty plus years after publication of Akerlof’s Gift Exchange article, experimental economists are providing rigorous evidence potentially supporting what Akerlof intuited as an alternative explanation for Shapiro-Stiglitz. A healthy tendency in labor economics in particular has been the close interaction between theory and facts, and this has served both disciplines well. I

suspect that a considerable amount of empirical work in labor economics over the next decade will explore how norms shape labor market interactions, and this will change our conception of 'efficient' labor contracts.

Image removed due to copyright considerations. Please see the following:

Krueger, Alan B. Tables 1, 2, 3, 4, Figures 1A, 1B. In "Ownership, Agency and Wages: An Examination of Franchising in the Fast Food Industry." *Quarterly Journal of Economics* 106, no. 1 (1991).

Cappelli, Peter, and Keith Chauvin. Tables 1, 2, 4, 6, Figures 3, 4, 5a, 5b, 6. In "An Interplant Test of the Efficiency Wage Hypothesis." *Quarterly Journal of Economics* 106, no. 3 (1991).

Holzer, Harry, Lawrence F. Katz, and Alan B. Krueger. Tables 1, 2, 3, 4, Figure 1. In "Job Queues and Wages." *Quarterly Journal of Economics* 106, no. 3 (1991).

Kahneman, Daniel, Jack L. Knetsch, and Richard Thaler. "Fairness as a Constraint on Profit-Seeking: Entitlements in the Market." *American Economic Review* 76, no. 4 (1986): 728-41.