LAW ENFORCEMENT PERFORMANCE STANDARDS AND WAGES:

A TEST OF THE EFFICIENCY WAGE HYPOTHESIS

By

WILLIAM LINDSAY

A dissertation submitted in partial fulfillment of
the requirements for the degree of

Doctor of Philosophy

WASHINGTON STATE UNIVERSITY
School of Economic Sciences

DECEMBER 2009

To the Faculty of Washington State University:

The members of the Committee appointed to examine the dissertation of WILLIAM LINDSAY find it satisfactory and recommend that it be accepted.

Frederick S. Inaba, Ph.D., Chair

Raymond G. Batina, Ph.D.

William S. Hallagan, Ph.D.

Mark A. Konty, Ph.D.

ACKNOWLEDGMENT

I wish to thank my committee chair Fred Inaba for the tremendous amount time he has spent working with me on this project, and for holding to high performance standards for completion. Before I began I talked to Mark Konty about the idea I had. He was encouraging, and even searched the literature for me to see if it had already been done. That gave me the motivation to begin. Many thanks to Hal, I have regularly called Hal with questions at all hours and he has always done his best to offer advice, even after being worn out I know, with his newborn, Joseph. Many thanks to George, his help in teaching me to how to improve my finances in the stock market has enabled me to pursue this endeavor that has spanned both millenniums. I also want to thank Bill Hallagan, Ray Batina for serving on the committee, and the instructors of all the classes that I have taken to complete the degree. Thanks to my friends that I met at WSU, most notably Tomas, Tom, Hal, Mick, Jeff, and Dan. Their friendship made my time at Washington State University enjoyable.

LAW ENFORCEMENT PERFORMANCE STANDARDS AND WAGES:
A TEST OF THE EFFICIENCY WAGE HYPOTHESIS

Abstract

by William Lindsay, Ph.D.
Washington State University
December 2009

Chair: Frederick S. Inaba

This study finds evidence that police officers are offered a wage premium over their alternate employment wage, offering support of an efficiency wage paid in this industry. It finds that law enforcement agency performance standards and wages are positively correlated, and provides insight in how the efficiency wage operates. Empirical evidence is found for both selection and incentive effects (adverse selection and shirking).

This study also finds evidence of the following: 1) The presence of a union in a law enforcement agency is associated with not only higher minimum wages of police officers and higher promotion wages, but higher performance standards of new hires as well. Unions are associated with more screening of applicants and more rejections of officers during their probationary period, both of which serve as entry barriers into the profession; 2) Officers must be compensated for the additional risk they take for working in high crime areas and the study is able to quantify the amount; 3) State public-official corruption is associated with the promotion wage premium of officers. This raises the

question of attempted bribery of law enforcement management by corrupt public officials.

This study is unable to find evidence of a negative correlation between the racial composition of the police force, and hiring performance standards. This suggests no relationship between performance standards and race.

TABLE OF CONTENTS

LIST OF TABLES

Dedication

This dissertation is dedicated to my parents Lola and Bill, my sisters Sunny and Piper, my friends, and the rangers in the National Park Service.

CHAPTER 1
INTRODUCTION

STATEMENT OF THE PROBLEM

Recessions and unemployment tend to go hand in hand. Classical economic theory implies that when the labor market is out of equilibrium and there is unemployment, wages will adjust downward so that the unemployment will be eliminated. Keynes believed that wages are sticky on the downside preventing the labor market from clearing. If workers were unwilling to take a pay cut even in the face of unemployment, it could take a long time for the labor market to adjust to equilibrium. Efficiency-wage models offer another explanation for persistent involuntary unemployment and disequilibrium in the labor market (see Katz 1986). The most important assumption of the efficiency wage hypothesis is that the productivity of a firm's workers increase as their wage is increased (Malclomson 1981). If this is true, then the wage that minimizes total labor costs can exceed the classical equilibrium wage that clears the labor market, and profit maximizing firms would be reluctant to cut wages, because to do so may actually lower productivity and increase labor costs. This may create wage stickiness in the labor market (Solow, 1979). Yellen (1984) explains how the efficiency wage hypothesis can explain cyclical fluctuations in unemployment.

This research tests the efficiency wage hypothesis. There are two goals: First, the study will use data from a cross section of nearly 3000 law enforcement agencies to determine if the wage offered to police officers is an efficiency wage; Second, if an efficiency wage exists, to determine if there is a positive relationship between the standards of performance set by the police department in hiring and promotion, and the real wage of police officers. Put another way, do police departments (PDs) that have high performance standards pay higher wages? If a police department wants to have high-performing officers it can pursue this in two ways. It can either increase the performance standards of existing officers or increase the performance standards of new hires. The theoretical model in this paper shows that increasing the performance standards (by either method) will increase the expected performance but will require an increase in the wage offered. If the police department increases the performance standards for promotion, and increases the wage, the expected increase in performance will be seen from existing officers. This is the incentive effect. If the police department increases the performance standards of hiring, along with an increase in the hiring wage, the increase in performance will be from new workers. This is the selection effect.

This investigation contains a model of selection and a model of incentives, and each model will be tested in the empirical section. In this way the research is able to separate out the effect of selection and incentives. The incentive model is one primarily of effort although there is some effect of ability as the current pool of officers has a range of abilities. The selection model is one primarily of abilities although it also includes the effect of effort on the pool of potential officers. In short, both models contain the effects of ability and effort but the selection model is thought to be more of ability than the incentive model and the incentive model is thought to be more of effort than the selection model.

SUMMARY OF THE RESULTS

This study finds empirical evidence of police departments offering a wage premium to officers, even though police departments are not profit-maximizing firms, offering evidence of an efficiency wage in this industry. It finds that police department performance standards and wages are positively correlated and provides a theoretical argument that hiring / promoting performance standards are correlated with expected performance, thus giving empirical support for the efficiency wage hypothesis that performance and wages are positively correlated. The study also provides insight in how the efficiency wage operates, as there are several competing efficiency-wage models. Empirical evidence is found for both the selection and incentive effects (adverse selection and shirking). A police department can influence the performance of its officers by changing the standards of hiring / promotion and the wage offered. The mechanism of operation is through both selection and incentives.

The study also finds evidence of a positive association between officer unions and officer wages, and between officer unions and entry barriers into the profession. In addition, the study finds evidence of an association between the level of public official corruption and the promotion wage premium.

Chapter 2 describes a review of the literature. Chapter 3 provides a theoretical model. Chapter 4 describes the data. Chapter 5 provides evidence for the theoretical model and Chapter 6 explains the results and provides conclusion.

CHAPTER 2
LITERATURE REVIEW

The efficiency wage hypothesis was originally applied to developing countries where there might be a connection between wages and nutrition and health (Leibenstein, 1957). The hypothesis was then applied to developed countries where wages directly affect worker productivity but for different reasons. The models generally describe an optimal wage, higher than the market-clearing wage, which maximize profits. The assumption of these models is that a higher wage has some additional benefit to the employer despite an increase in the cost. As a consequence of the higher wage there is a market surplus of labor or involuntary unemployment. The unemployment will exist as long as an efficiency wage is paid. Efficiency-wage models then can be used to help explain a labor market in equilibrium with unemployment; in fact it may necessitate unemployment in equilibrium (Shapiro and Stiglitz 1984). Yellen (1984) and Katz (1986) provide surveys of the main categories of the efficiency-wage models: a) The shirking model; b) The labor turnover model; c) Adverse selection; and d) Sociological models. Each is described below.

2.1 OVERVIEW OF THEORETCIAL MODELS

The decision making of the firm can be described as follows (see Solow 1979, Stiglitz 1976): The effort of a worker, *e*, is a function of the wage rate, *w*. The higher the wage the more effort the employee gives:

$$\mathbf{e = e(w)} \quad \text{where} \quad \mathbf{e' > 0}$$

If the efficiency or productivity of a firm is represented by e which is a function of the wage rate w and the number of employees L, the output of the firm q, where labor is the only factor of production can be represented by:

$$q = Q(e(w)L)$$

The profit maximizing problem of the firm is:

$$\text{Max} \quad P\,Q(e(w)L) - wL$$

The first order conditions for profit maximization are:

$$P\,Q'(e(w)L)\,e(w) - w = 0 \quad \text{and}$$

$$P\,Q'(e(w)L)\,L\,e'(w) - L = 0$$

By substitution: $we'(w)/e(w) = 1$

The elasticity of efficiency with respect to the wage is equal to one. The efficiency wage is the wage w* that provides a solution for this equation. The efficiency wage w* is the wage that minimizes labor costs and depends only upon the function e (w) and is not affected by the labor market. The efficiency wage w* will be greater than or equal to the market-clearing wage. If w* was less than the market-clearing wage, there would be a shortage of workers that would drive the wage upward. At the efficiency wage the marginal cost of an increase in the wage rate is exactly equal to the marginal benefit of the increase in the effort of a worker.

There are several broad categories of efficiency-wage models to explain why effort may be a function of the wage rate, or why it may be profit maximizing for a firm to set a wage above the market-clearing wage. Each category is discussed below.

2.1.1 Shirking Models

Shirking models (see Shapiro and Stiglitz 1984, Bowles 1985, Calvo 1979, 1985, Eaton and White 1981) assume that workers (all assumed to be identical) obtain some utility from shirking; firms pay their workers a higher wage than a market-clearing wage to provide an incentive to work rather than to shirk. The higher wage increases the economic cost or penalty of being fired so that workers are less likely to shirk and risk losing their jobs. In other words, one does not want to be fired from a well-paying job. If all workers were only paid market-clearing wages, there would be full employment. There would be little incentive not to shirk since a worker caught shirking and subsequently fired would easily be able to find another job at the same wage. If workers were paid a wage above the market-clearing wage, it would create a surplus of workers (unemployment) and an incentive to not shirk (loss of the high-paying wage). In addition, it would not be as easy to find another job (because of the unemployment). As unemployment **u**, increases, it raises the cost or penalty of being fired and induces more effort on the part of workers at any given wage. Workers are more likely to shirk or exert less effort when the wages of other firms or other industries $\boldsymbol{w_a}$, is higher. The effort function can be represented as follows:

$$\mathbf{e} = \mathbf{e}\,(\mathbf{w}, \mathbf{u}, \boldsymbol{w_a})$$

where $\frac{\delta \mathrm{e}}{\delta \mathrm{u}} > 0$ and $\frac{\delta \mathrm{e}}{\delta \mathrm{w}} > 0$ and $\frac{\delta \mathrm{e}}{\delta w_a} < 0$

Some firms are able to monitor workers' efforts easily or with less cost. In these firms the probability of detection would be higher since shirking is easier to spot. Therefore the incentive to shirk would be lower for workers in those firms and the firms would not need to raise the wage as much as firms that were unable to monitor workers' efforts as easily. In the Eaton and White paper, monitoring is necessary to have workers supply non-zero effort but monitoring is costly. One result of their model is a labor market that does not clear, and they discuss the possibility that discrimination can arise because employers can exhibit prejudices at no cost to the firm.

When all firms (assumed to be identical) raise their wages, the demand for labor decreases, resulting in unemployment. In the Stiglitz and Shapiro paper, the equilibrium unemployment rate is endogenous. The wage and the unemployment rate are determined simultaneously. The wage is determined where the aggregate demand for labor curve intersects the aggregate no-shirking constraint- the wage a worker must be paid not to shirk at each employment (or unemployment) level. Their model also provides and explanation as to why wages adjust slowly to aggregate shocks.

2.1.2 Labor-Turnover Models

In labor-turnover models of the efficiency wage, (see Salop 1979, Stiglitz 1974, 1985) workers are more reluctant to quit their jobs as the relative wage increases. Here there is an economic incentive for workers (assumed to be identical) to stay at the current job rather than transferring to another firm at a lower wage. Firms may find it maximizes profit by paying a wage that is in excess of the market-clearing wage because that wage lowers the cost of turnover and training. The models predict a wage in excess of the market-clearing wage with involuntary unemployment for firms or industries that have high hiring and training costs. The models can also explain differences in wage distributions within an industry for similar workers. The Stiglitz model results in equilibrium with involuntary unemployment and provides a rationale for either nominal or real wage rigidity.

2.1.3 Sociological Models.

In sociological models of the efficiency wage, a worker's effort is influenced by the work norms of the workers around him or her. Akerlof (1982) presents a gift- exchange model where employers pay workers a gift of a higher wage in return for a gift of effort above the minimum required. Akerlof and Yellen (1990) introduce the fair-wage effect hypothesis where workers have a conception of a fair wage and "proportionately withdraw effort as their actual wage falls short of their fair wage".

2.1.4 Adverse- Selection Models.

In adverse-selection models of the efficiency wage (Weiss 1980, Stiglitz 1976, Malcolmson 1981), workers are not homogeneous in their abilities as in the other models. If higher ability workers have higher reservation wages that they will accept, then the higher wages will attract higher ability workers or a pool of higher ability applicants. A higher ability worker can produce more than the average worker but he/she must be paid more than the average worker to be hired or retained. Firms that offer a wage above the market-clearing wage can minimize labor costs in terms of efficiency units because a worker hired randomly out of the pool of applicants will have a higher expected ability.

2.1.5 Empirical Review of Efficiency-Wage Models

There is little inter-industry empirical evidence of efficiency wages. This may be due to the difficulty of measuring productivity or effort and the difficulty to separate out the effects of selection vs. incentives, or to measure the effects of human capital. Most empirical evidence of efficiency wages draws on persistent wage differentials among different industries for workers with similar characteristics.

Tzu-Ling Huang et al. (1998) use manufacturing data in 18 industries from 1968 to 1991 in the U.S. to test the efficiency-wage hypothesis. The authors compare industry productivity differences with wages finding evidence that wages above the norm raise worker productivity. Specifically, they find that wages 10% above the market wage increases output between 2% to 6% and that a 10% increase in the unemployment rate is associated with a 1% increase in output. Although these results are consistent with efficiency-wage theory, most of the productivity effect (88%) can be tied to observable human capital differences (i.e. observable differences in labor endowments) while only 12% can be associated with the higher wage premium. The effect of unemployment on productivity is quite small but statistically significant and is consistent with the efficiency-wage hypothesis. The results of the study may have been subject to simultaneity bias.

Capelli and Chauvin (1981) test employee discipline rates as a measure of performance against wage premiums across plants within the same firm. By using only one firm they are able to control for many of the exogenous factors such as standards for firing/discipline as these would be consistent among plants. They measure the wage premium as the difference in pay at each plant less the prevailing wages in the local Standard Metropolitan Statistical area (SMSA). They find no evidence of selection effects so the results are entirely due to incentive effects and thereby measure the effect of wages on effort (shirking). They find that wage premiums are associated with lower levels of discipline providing evidence for the efficiency-wage hypothesis and specifically due to incentive effects.

Campbell and Kamlani (1997) take a survey of 184 firms to examine wage rigidity. They find that the greatest deterrents to wage cuts are adverse selection or quits, and the effect of wages on effort. The concern of firms is that reduction in wages would result in the most productive workers leaving with a reduction of effort by those remaining.

Kreuger and Summers (1988) suggest that some type of efficiency-wage theory is responsible for industry wage differentials. They examine differences in wages for equally skilled workers across industries and find that workers in high-wage industries receive non-competitive rents that persist over time.

2.2 POLICE OFFICER PERFORMANCE AND WAGES

There have been no studies of which that I am aware that test the relationship between police officer performance and wages, or police performance standards and wages. The "police services" industry exhibits characteristics, however, that may make it more likely to have an important wage: productivity relationship, such as high turnover costs (Salop

1979, Stiglitz 1985), high supervision costs (Eaton and White 1983), and high costs to workers for shirking (Shapiro and Stiglitz).

2.3 POLICE OFFICER PERFORMANCE AND RACE

Lott (2000) finds that affirmative action policies have increased the hiring of minority and women police officers, and that this has caused crime rates to rise. Using a panel data set with two- stage least squares (2SLS), he finds positive correlations between the hiring of minority officers, particularly blacks, and an increase in crime. "Nineteen of the twenty crime regressions imply that increasing the percentage share of minorities in a department increases crime, and the relationship is statistically significant for three quarters of the estimate". His reasoning is that the increase in crime is a result of a lowering of standards of newly-hired officers, including both minority and non-minority officers, so that more minority officers can be recruited. Gender does not appear to be an important factor in the equations. He also finds that when adding consent decrees for affirmative action to the regressions, it has an impact on crime rates independent of the racial composition of the PD. This may be from a change in the behavior of existing officers because of altering the incentives in the promotion process.

2.4 POLICE OFFICER CORRUPTION AND WAGES

Police corruption is extremely common in less-developed countries and is certainly not unheard of in the United States. Some studies have cited insufficient wages for the errant behavior. In the shirking model the wage rate would vary inversely with corrupt behavior (higher wage produces less corruption), as higher-salaried police would have more to lose from employment termination. A wage that is below workers' reservation wage would only attract dishonest people. If a police officer could collect $10,000 in bribes during the year without any chance of being detected, then the dishonest policeman would be willing to work for $10,000 less than his reservation wage. In the adverse selection model, which allows for heterogeneous workers, higher ability workers could be those that are more honest workers. Those workers would have higher reservation wages.

Becker and Stigler (1974) write that the way to improve the quality of law enforcement is to "raise the salaries of enforcers above what they could get elsewhere by an amount that is inversely related to the probability of detection and directly related to the size of the bribes and other benefits from malfeasance". They are able to calculate the salary that the police officer must be paid to avoid the temptation of malfeasance. It is:

$$\mathbf{V_w = V_V + \frac{(1-P)\,B}{P}}$$

Where: $\mathbf{V_w}$ is equal to the present value of the lifetime salary of the police officer

$\mathbf{V_v}$ is equal to the present value of the lifetime salary available elsewhere

P is the probability of detection of taking a bribe and being fired

B is the amount of the bribe

In this expression, the present value of the amount that the officer must receive in wages to avoid corruption is equal to the present value of what he could earn outside of law enforcement (his next best occupation), plus some constant multiplied by the amount he can earn taking bribes. The constant depends upon the probability of being detected. When the probability of being detected decreases, that constant increases, and a higher wage must be paid to keep the officer honest, and vice versa. If the bribe increases, the present value of the police officer's wage would need to increase by the amount of the bribe multiplied by that same constant, $\frac{1-P}{p}$.

Van Rijckeghem and Weder (1997) find a negative correlation between wages of civil-service workers in developing countries and corruption, that is, the higher the wage the less corruption. They suggest that corruption could be diminished in developing countries by raising the wages of civil-service workers, and, by extrapolation, a relative wage of three to seven times the manufacturing wage would almost eradicate corruption.

2.5 POLICE OFFICER PERFORMANCE AND EDUCATION

Sanderson (1977) showed college-educated officers tend to have higher job performance than non college-educated officers. The paper compared educational levels with job performance among 150 officers in the Los Angeles Police Department over a period of ten years. The study found that college education had a positive effect on their performance. Higher college levels were correlated with less disciplinary history arising from legitimate citizen complaints, less absenteeism from sickness and injuries on duty, less involuntary termination, and higher advancement. Finnigan (1976) examined the effect of higher education on the performance of Baltimore police personnel. After controlling for age, race, military service, and IQ, college-educated personnel out performed non college educated personnel on every evaluation item by the Baltimore

Police Department. He also found that those with a high IQ had a tendency to be rated higher.

However, not all research has shown that college-educated officers perform better to non college educated officers. In contrast, Kedia (1986) found from a study of 150 police officers in Monroe, Louisiana, that job performance evaluations of college-educated officers were no better than officers who did not have any college education.

All of these studies involve one police agency. In preparing this research, no studies could be found which compared minimum educational standards between police agencies.

CHAPTER 3
THEORETICAL MODEL

3.1 INTRODUCTION

Guasch and Weiss (1981) state that a common practice of firms is to offer a wage then testing applicants to ensure a minimum level of performance. "Tests typically include a trial hiring period during which the applicants' performance is carefully monitored…..". The decision of the law enforcement agency is to choose performance standards for hiring and promoting officers, and a wage that will provide the incentives to meet those standards. This section contains two models: one for the selection of new officers, another for the selection of officers to be promoted. Although both models include the effects of ability and effort, the second model (incentive) is thought to be more related to effort than ability while the first model (selection) is thought to be more related to ability. This chapter provides a theoretical model of selection and incentives of police officer compensation.

3.2 POLICE OFFICER PERFORMANCE

Law enforcement agencies (hereafter referred to as police departments or PDs) have a standard level of performance, *x*, that is expected from officers for hiring and promoting. Let x_1, x_2 denote the performance standards for hiring and promotion, respectively. The PD cannot observe directly the ability or effort, but it can observe some measure of the officer's performance *X* which depends positively on ability and effort. The officer is hired if $X \geq x_1$ or promoted if $X \geq x_2$. Unobservable officer ability can be either high

θ^H or low θ^L. Unobservable officer's effort can be either high, e=1 or low (shirk), e=0. Type t officer's performance, X^t, is stochastic, observable, and depends on both ability and effort:

$$X^t = \begin{cases} \theta^t + 1 \;\; with \;\; probability \;\; p_e \\ \theta^t \quad\quad with \;\; probability \; 1 - p_e \end{cases} \quad \text{where } \; p_1 > p_0 .$$

3.3 OFFICER UTILITY

The officer's utility function is given by u=w-e, where w denotes the officer's wage. Let P_e^t denote the probability that a type t (ability t) officer who expends effort *e* is hired (specifically successfully completes the officer training and probation program). Similarly, $1 - P_e^t$ denotes the probability that a type t officer with effort *e* is rejected. Thus we have: $P_e^t = prob\{X^t \geq x_1\}$. The expected utility of a type t officer who expends effort *e* is as follows:

$$U_e^t = P_e^t w_1 + (1 - P_e^t) w_a - e$$

Here w_1 and w_a denote the basic police officer wage and the wage in alternative employment, respectively. The alternate wage of the high-ability officer will be denoted as w_a^H, and for the low-ability officer, w_a^L. An assumption is made that the PD knows the alternate wages of both officers. For future reference we denote w_2 as the wage an officer receives if he/she is promoted.

3.4 A MODEL OF SELECTION

The police department does not know what ability an applicant has but they can and do administer a battery of tests and set standards designed to find out. They may set physical standards, medical standards, psychological standards, educational standards, and many departments even administer polygraph tests. There is some asymmetry of information because the applicant already knows his/her background, academic ability, medical history, physical ability, reasoning ability, etc. He/she may not know what his/her ability will be as an officer but has some idea what his/her skills and abilities are, and has an idea what he/she can earn from alternate employment or self employment. Much testing of applicants is done before a new employee is hired to determine the applicant's potential. If the applicant does not meet the standard he/she is rejected. After an applicant is hired, the PD puts the cadet through an academy for training, then field training with a probationary period. The entire training period may be up to a year long in some departments. Most PDs do not have their own academies. During the following probationary/selection period, officers are monitored carefully and their performance is evaluated regularly. The PD will reject any officer whose performance is observed to be below the standard, x_1.

Case 1: Perfect performance separation between H and L-type officers.

Consider the case where the performance between high (H) and low (L) ability officers can be perfectly separated: $\theta^L < \theta^L + 1 < \theta^H < \theta^H + 1$. This case occurs when the performance differential between H and L officers is sufficiently wide. Now suppose the police department (PD) sets the hiring standard such that $\theta^L + 1 < x_1 < \theta^H$. In this case no L-type officer will be able to meet the hiring standard, even if he/she works hard, e=1. Moreover, any H-type officer will be able to meet the performance standard with certainty, even when he/she shirks, e=0. Clearly then, no L-type will be hired by the PD and all the H-types that are hired will maximize expected utility by shirking. Moreover, the PD will only need to set its basic wage such that $w_1 = w_a^H$, and there is no need to use an incentive wage. An assumption is made that the labor constraint is not binding. The PD may not want to implement such a policy since it minimizes the expected performance of the officers as follows: $\overline{X} = p_0(\theta_H + 1) + (1 - p_0)\theta_H = \theta_H + p_0$.

Now suppose that the PD wants to implement the policy of hiring only H-type officers while providing them with the incentive to work hard, rather than shirk. To do this the PD will want to set the hire performance standard such that: $\theta^H < x_1 < \theta^H + 1$.

Now $P_e^H = p_e$ so that the officer's expected utility is:

$$U_e^H = \begin{cases} p_0\, w_1 + (1 - p_0) w_a^H & if\ e = 0 \\ p_1\, w_1 + (1 - p_1) w_a^H - 1 & if\ e = 1 \end{cases}$$

The officer will prefer to work hard rather than shirk only if $U_1^H \geq U_0^H$ which implies:

(1) $\boldsymbol{(p_1 - p_0)\,(w_1 - w_a^H) \geq 1}$

This inequality says that in order to provide the H-type officer with the incentive to work hard in order to be hired, the PD must provide a wage premium, (w_1- w_a^H), such that the expected wage premium compensates for the disutility of having to expend the extra effort. Notice that the wage premium provides the L-type officer with the incentive to work hard, but because the hire/fire standard is set sufficiently high, the L-type officers will be completely screened out. The PD may prefer this policy over the previous one, because this policy promotes a higher expected performance:

$$\overline{X} = p_1(\theta_H + 1) + (1 - p_1)\theta_H = \theta_H + p_1$$

Case 2: Imperfect performance separation between H and L-type officers.

Consider the case where performance between H and L-type officers can only be imperfectly separated as follows: $\theta^L < \theta^H < \theta^L + 1$. Now suppose the PD sets the hire/fire performance standard such that $\theta^L < x_1 < \theta^H < \theta^L + 1$. The H-type officer will always be assured of satisfying the standard even if he/she shirks. Hence the H-type officers will always be hired and will choose to shirk. The probability that an L-type officer does not get rejected, given the effort *e*, is $P_e^L = p_e$, otherwise the officer is rejected. But in this case, the L-type officer will want to work hard only if $U_1^L \geq U_0^L$ which implies: $(p_1 - p_0)(w_1 - w_a^L) \geq 1$. Thus, the basic wage w_1 must include an incentive premium in order to attract L-type officers who are willing to work hard in order to get hired and it must be at least equal to $\mathrm{w_a^H}$ to attract the H-type officers. The PD will set the wage: $w_1 = w_a^H$ if $w_a^H > \mathrm{w_a^L} + \frac{1}{\mathrm{p_1 - p_0}}$, otherwise it can set the wage to $\mathrm{w_a^L} + \frac{1}{\mathrm{p_1 - p_0}}$. With this policy, the PD will hire all H-type officers, even though they prefer to shirk, and to hire the proportion p_1 of hard-working L-type officers. The expected performance under this policy is:

$$\begin{aligned}\overline{X} &= \lambda p_0(\theta^H + 1) + (1-\lambda)p_1(\theta^L + 1) + \lambda(1-p_0)\theta^H + (1-\lambda)(1-p_1)\theta^L \\ &= \lambda\theta^H + (1-\lambda)\theta^L + \lambda p_0 + (1-\lambda)p_1\end{aligned}$$

where λ and (1- λ) are the proportions of H-type and L-type officers, respectively.

Now suppose that the PD wants to implement the policy of hiring both types of officers while providing them with the incentive to work hard, rather than shirk. To do this the PD will want to set the hire performance standard such that $\theta^L < \theta^H < x_1 < \theta^L + 1 < \theta^H + 1$ In this case, the L-type officer will want to work hard only if $U_1^L \geq U_0^L$ which implies $(p_1 - p_0)(w_1 - w_a^L) \geq 1$. The H-type officer will want to work hard only if $U_1^H \geq U_0^H$ which implies $(p_1 - p_0)(w_1 - w_a^H) \geq 1$. Thus, the basic wage w_1 must include an incentive premium in order to attract both High and Low type applicants who are willing to work hard. Therefore $w_1 = w_a^H + \frac{1}{p_1 - p_0}$ and must be $\geq w_a^L + \frac{1}{p_1 - p_0}$. The expected performance under this policy is:

$$\overline{X} = \lambda p_1(\theta^H + 1) + \lambda(1-p_1)\theta^H + (1-\lambda)p_1(\theta^L + 1) + (1-\lambda)(1-p_1)\theta^L$$

$$= \lambda\theta^H + (1-\lambda)\theta^L + p_1$$

This policy leads to a higher expected performance because both types of officers prefer to work hard.

Suppose the PD policy is given by $\theta^L < \theta^H < \theta^L + 1 < x_1 < \theta^H + 1$. In this case all L-type officers will be screened out and only H-type officers will want to work hard if $U_1^H \geq U_0^H$. The PD will want to set its wage, $w_1 = w_a^H + \frac{1}{p_1 - p_0}$. The expected performance under this policy is:

$$\overline{X} = p_1(\theta_H + 1) + (1 - p_1)\theta_H = \theta_H + p_1$$

This is the highest expected performance.

3.5 A MODEL OF INCENTIVES

During the selection period the PD has filtered out officers that were either unable or unwilling to meet the probationary performance standards set by the PD. The remaining officers are retained. These officers have proven themselves to meet the performance standard set by the PD in the selection period and they receive the wage of w_1. The next period is the incentive period, and spans the officer's entire career. In this period the PD will promote officers and will set the standard for promotion, x_2. The PD will not promote any officer whose performance is observed to be below the standard, $X < x_2$.

During an officer's career he/she will have opportunities for promotion and advancement. Although increases in the wage at some PDs are based upon job longevity, some are based upon performance. This may depend partly on the degree of unionization. Suppose that all officers are offered the possibility of advancement to the rank of sergeant based upon their performance. The promotion comes with an increase in wage to w_2. To be promoted, the officer must perform to a higher standard than his/her current rank, or perform better than his/her peers as the promotions are competitive. The PD has a standard level of performance that they expect from officers for promotion, x_2. Officer performance is a function of unobserved ability and unobserved effort.

The type of officers and the relative mix of each is determined during the selection period and will be the base to draw on for promotions in the incentive period. In the same way as in the selection model above, the model will be used to examine the need to have incentive wages for the promotion policy. The analysis is analogous to the previous cases, except that the performance standard used is x_2, the promotion wage is w_2. All officers have the same alternate wage, and the level of effort of an officer who does not want to try for promotion is e=0.

Case 1: Perfect performance separation between H and L-type officers.

In this case only H-type officers were hired in the selection period. Suppose that the PD wants to implement the policy of promoting hard-working officers. The PD will want to set the performance standard such that: $\Theta^H < x_2 < \Theta^H + 1$. The PD must provide them with the incentive to work hard to meet the promotion standard otherwise the officers will continue their current level of performance. The officer's expected utility is:

$$U_e^H = \begin{cases} p_0\, w_2 + (1-p_0)w_1 & if\ e = 0 \\ p_1\, w_2 + (1-p_1)w_1 - 1 & if\ e = 1 \end{cases}$$

Now the officer will prefer to work hard to be promoted only if $U_1^H \geq U_0^H$ which implies:

$$(2) \qquad (p_1 - p_0)(w_2 - w_1) \geq 1$$

This inequality says that in order to provide the H-type officer with the incentive to work hard in order to be promoted, the PD must provide a wage premium,($w_2 - w_1$), such that the expected wage premium compensates for the disutility of having to expend the extra effort. The expected performance: $\overline{X} = p_1(\theta_H + 1) + (1 - p_1)\theta_H = \theta_H + p_1$

Case 2: Imperfect performance separation between H and L-type officers.

In this case the PD has a mixture of H-type and L-type officers where λ and (1- λ) are the proportions of H-type and L-type officers, respectively, or the PD has all H-type officers. If the PD has all H-type officers then the results are the same as in case # 1 above. If the PD has a mixture of officers then there are three possible policy choices for the PD.

If the PD sets a promotion policy of $\theta^L < x_2 < \theta^H < \theta^L + 1$ the H-type officer will always be promoted . The probability that an L-type officer gets promoted, given the effort *e*, is $P_e^L = p_e$. L-type officers will want to work hard only if $U_1^L \geq U_0^L$ which implies: $(p_1 - p_0)(w_2 - w_1) \geq 1$. Thus, the incentive wage w_2 must include an incentive premium in order to attract L-type officers who are willing to work harder in order to be promoted. With this policy, the PD will promote all H-type officers, and to promote the proportion p_1 of hard-working L-type officers. The expected performance under this policy is:

$$\begin{aligned}\overline{X} &= \lambda p_0(\theta^H + 1) + (1-\lambda)p_1(\theta^L + 1) + \lambda(1-p_0)\theta^H + (1-\lambda)(1-p_1)\theta^L \\ &= \lambda\theta^H + (1-\lambda)\theta^L + \lambda p_0 + (1-\lambda)p_1\end{aligned}$$

If the PD wants to implement the policy of promoting both types of officers, the PD will want to set the promotion performance standard such that

$\theta^L < \theta^H < x_2 < \theta^L + 1 < \theta^H + 1$. L-type officers will want to work hard only if $U_1^L \geq U_0^L$ which implies $(p_1 - p_0)(w_2 - w_1) \geq 1$. H-type officers will want to work hard only if $U_1^H \geq U_0^H$ which also implies $(p_1 - p_0)(w_2 - w_1) \geq 1$. Thus, the promotion wage w_2

must include an incentive premium in order to attract both L and H-type officers who are willing to work harder. The expected performance under this policy is:

$$\overline{X} = \lambda p_1(\theta^H + 1) + \lambda(1-p_1)\theta^H + (1-\lambda)p_1(\theta^L + 1) + (1-\lambda)(1-p_1)\theta^L$$

$$= \lambda\theta^H + (1-\lambda)\theta^L + p_1$$

This policy leads to a higher expected performance because both types of officers prefer to work harder and try for promotion.

If the PD policy is to promote only high-ability officers the PD will want to set the promotion performance standard such that: $\theta^L < \theta^H < \theta^L + 1 < x_2 < \theta^H + 1$. All L-type officers will be screened out for promotion and only H-type officers will want to work hard if $U_1^H \geq U_0^H$. The expected performance under this policy is:

$$\overline{X} = p_1(\theta_H + 1) + (1 - p_1)\theta_H = \theta_H + p_1$$

This is the highest expected performance because only high-ability officers prefer to work hard and try for promotion.

3.6 PREDICTIONS OF THE MODELS

The models predict the following:

1) As the police department increases the performance standards for hiring or promoting, low-ability officers and officers who shirk will be filtered out.
2) The PD must increase the wage rate to one that is above the alternate wage in order to provide an incentive for hard work and not to shirk. The wage that provides the incentive to work hard is an efficiency wage in the sense that it is an optimal wage for the PD to offer. The PD would be worse off by offering any

different wage. High performance standards are not effective unless there is a corresponding wage premium to provide incentives to work hard.

3) As performance standards increase, the expected performance will increase.

CHAPTER 4
DESCRIPTION OF DATA

4.1 DATA SOURCES

1. Law enforcement Management and Administrative Statistics (LEMAS) under the Bureau of Justice Statistics, provides data on state and local law enforcement agencies. Data is compiled from a survey sent every three years. For the 2003 survey, 2,859 agencies responded, approximately 90% of all local and state law enforcement agencies. The data contains information for each law enforcement agency on, among other things: the number of sworn officers, the number of dismissals, the number of probationary rejections, the minimum education requirements, the pay of police officers, and the types of testing that police departments use such as polygraph exams or drug testing. Pay for officers is reported for minimum and maximum officer wages, sergeant or equivalent (minimum and maximum), and chief (minimum and maximum). Although the survey is taken every three years, only the most recent data of 2003 contains probationary rejection and dismissal information. The 2003 data covers the period from July 2002 to the end of June 2003.
2. The U.S. Census Bureau, historical income tables contain mean earnings for full-time year-round workers by age and education.
3. Edward Glaeser and Raven Saks (2006) calculate the per capita state conviction rate of public officials convicted of corruption related crimes. Their information is

derived from the Justice Department's "Report to Congress on the Activities and Operations of the Public Integrity Section".

4. Department of Justice, FBI uniform Crime reports, "Crime in the US 2003" Table 5, contains violent crime rates per 100,000 inhabitants.

4.2 INDEPENDENT VARIABLES

The LEMAS data contains information on probationary rejections. These are officers who have been through the selection process, hired, and trained in the academy. If they are rejected (fired) during the subsequent field training program they are counted as probationary rejections. Of the total police departments, 87% have zero probationary rejections. Still, of the 13 % of PDs that did fire probationers there were 993 rejections out of 27,226 entry level new hires, or around 3-4%. The **rejection rate** is the number of probationary rejections that are rejected, divided by the number of new hires. The **selection rate** is one minus the rejection rate.

The LEMAS data contains information on the minimum **Education** requirements of the department ranging from 1 (college degree) to 5 (no education requirement). i.e. greater the number, the ***less*** the minimum education requirement of the PD. Specifically:

VALUE	REQUIREMENT
1	Four-year college degree required
2	Two-year college degree required
3	Some college but no degree
4	High school diploma or equivalent
5	No formal education requirement

The LEMAS data contains information about what tests the PD uses in the hiring process, such as interview, psychological exam, written exam, etc. fourteen of these screening elements are combined to create a variable, **Screen**, that ranged from 1-14 where each element counted 1 point. The screening elements are: problem solving ability, background investigation, credit history check, criminal history check, driving record check, drug test, medical exam, personal interview, personality inventory, physical agility test, polygraph exam, psychological exam, voice stress analyzer, and written aptitude test.

The LEMAS data contains information on **Union** participation**.** Unions help officers with job security and provide representation of officers in danger of being terminated. Union participation data is provided in the LEMAS sample as either a yes or a no for each agency.

The LEMAS data contains information on the number of **Officers** in each PD. This is the number of full-time paid officers with arrest powers. This variable is used as a measure of the size of the police agency.

The US Census Bureau data from the 2000 census contains earnings by occupation and education and is used as an estimate of the alternate wage of entry-level police officers. These data are at the state level and it is the median earnings of high school graduates aged 21-24 for the year 2000.

The **Selection wage** is calculated by the ratio of the minimum officer wage divided by the alternate wage from the Census Bureau. The **Promotion wage** is calculated by the ratio of the minimum sergeant wage divided by the minimum officer wage.

The Uniform Crime Reports contain data on the level of **Violent Crime** in 2003 compiled by state.

A measure of the public official **Corruption** rate is used from data calculated by Edward Glaeser and Raven Saks (2006). It is the number of public officials convicted of corruption-related crimes by state between 1990 and 2002, divided by the average state population from the 1990 and 2000 census. The data is presented as convictions per 100,000 people. For this paper the variable is not meant to be a measure of the corruption level of the PD but a measure of level of corruption in the area over which that the police officers have jurisdiction

.

4.3 CONTROL VARIABLES

The control variables listed here are those variables that may also impact wages.

A. Regional interactions of the four U.S. census regions. This is to help reduce omitted variable bias to the extent that the omitted variables are correlated with these geographic regions. The geographic regions are: **Northeast, Midwest, South, and West.**

B. Agency type interaction. There are six types of law enforcement agencies in the LEMAS sample, the number of each is shown in parenthesis:

TYPE 1: Sheriff departments (863)
TYPE 2: County police (39)
TYPE 3: Municipal police (1881)
TYPE 5: State police (49)
TYPE 8: Tribal police (17)
TYPE 9: Regional police (2)

Table 4-1

VARIABLE STATISTICS:

Variable	µ	SD	minimum	maximum
Promotion Wage	1.36	0.34	0.57	5.51
Selection Wage	1.59	0.41	0.47	4.63
Selection Rate	0.95	0.15	0	1
Violent Crime	443.35	150.	77.8	793.5
Officers	166.5	852.6	1	35,973
Education	3.72	0.67	1	5
Union	0.50	0.50	0	1
Corruption	3.03	1.52	0.52	7.48
Screens	9.24	2.36	1	13

CHAPTER 5

EMPIRICAL EVIDENCE OF THE MODEL

5.1 INTRODUCTION

This chapter looks for evidence in support of the theoretical model developed in chapter 3. In that model there are two types of workers, low-ability workers and high-ability workers. The wage paid is positively related to the hiring / promotion performance standards of the PD. Low-ability officers are more likely to be unable to meet the performance standards and be terminated because their performance is less than the high- ability officers with the same amount of effort. High-ability officers can meet the performance standards but unless they are paid a premium over the alternate wage they will shirk. This model is unusual in that it contains both selection and incentive effects as mechanisms of the efficiency wage, and this section will separate out the two effects. Section 5.2 tests the hypothesis that a wage premium exists for police officers. Section 5.3 tests the selection model where entry-level performance standards are associated with minimum real-wage premiums, and section 5.4 will test the incentive model where promotion performance standards are associated with real promotion wage premiums. Section 5.5 examines the relationship between hiring performance standards and both race and gender.

5.2 THE EXISTENCE OF A WAGE PREMIUM

The vast majority of new officers (90%) are hired at the entry level position. These are applicants without any prior law enforcement experience who are hired and then sent to an academy to be trained. Most of the new hires (68%) are hired by agencies that have either no formal education requirement or only a high school diploma as the minimum education requirement. The LEMAS data set can be thought of as the entire industry of "police protection" and each individual police department could be thought of as a "firm" within that industry. This section will test for the existence of an industry-wide entry-level wage that is greater than the alternate wage by testing the hypothesis:

$$\mathbf{H_o}: \boldsymbol{W_1 \leq W_a}$$

$$\mathbf{H_a}: \boldsymbol{W_1 > W_a}$$

The hypothesis H_o states that the wage offered to officers is the same or less than the alternate wage. The alternate hypothesis is that the wage offered to officers is greater than the alternate wage.

An estimate of the wage paid by police agencies will be an average of the officer minimum wage. In 2003, there were 27,226 entry-level officers hired. The average minimum officer wage for those entry level officers was $35,140. This average is partitioned into the five categories of educational levels (see table 5-1). Each category contains the number of agencies that have set this educational level as a minimum requirement, the number of officers those agencies hired in 2003, the average minimum wage paid to those new hires, and the standard deviation of the wage.

An estimate of the alternative wage, w_a, is the average earnings of full-time year-round workers aged 18 to 24. This age is used because it most closely approximates the alternative wage of applicants who are applying for entry-level positions with no prior experience. Table 5-2 displays the average earnings in 2003 (average for the year) for the five categories of educational attainment.

RESULTS

The t statistic to test this hypothesis is $(\bar{X}-\mu) / (S_x/\sqrt{N})$. The test is a one-tail test. The hypothesis that police officers are paid their alternate wage (or less) can be rejected for every category at the 99.5 % confidence level.

Table 5-1 Minimum officer salaries by minimum educational requirements.

	Category	Agencies requiring the level of education in column 1.	Number of officers hired by those agencies in column 2.	Average minimum salary of those officers and standard deviation. μ	σ
1	4 year degree	32	456	35,018	5853
2	2 year degree	222	1341	38,162	6798
3	Some college	291	6984	37,597	5389
4	High School graduate	2268	18,040	33,997	8762
5	No education req.	38	405	33,825	6119
Total		**2851**	**27,226**	**35,140**	

Source: LEMAS sample 2003

Table 5-2 Average earnings of full-time year-round workers aged 18-24

	Category	Average yearly earnings in 2003.	t statistic.
1	4 year degree	30,315	17.16
2	2 year degree	24,879	71.55
3	Some college	21,902	243.39
4	High School graduate	21,532	191.07
5	Grade 9-12. No degree	19,163	48.22

Source: U.S. Census Bureau Historical Income tables P-32 Male and female earnings are averaged together.

5.3 THE PROBATIONARY / SELECTION PERIOD

After new hires finish a lengthy academy training session and become full-fledged officers they additionally spend months on probation going though field training. During this process, officers are not only trained but those that are not able to meet the performance standards are terminated. To really understand how this time period is also a selection period consider this: if the average field training period lasts six months, the chances of being terminated during those six months is approximately twenty times higher than being terminated as an officer who has finished probation during a later six month time interval.

There is no data available on the performance standards of probationary officers for each police agency. The theoretical model prediction (1) was that performance standards are correlated with rejections of low-ability and shirking officers. Therefore, the selection rate of officers (one minus the rejection rate) is used as an instrument for hiring performance standards. The assumption here (from proposition 1 in section 3.6) is that a PD which has high performance standards for hiring will be more likely to reject officers (less likely to select) for not meeting those high standards and only the high performing officers would pass the probationary period.

A linear Ordinary Least Squares (OLS) model will be used to examine the relationship between hiring performance standards (as measured by probationary rejections) and the incentives to work as a police officer (as measured by the real-wage premium over the alternate wage). In addition, a system of equations model will be used to correct for possible correlations between the selection rate and the other independent variables.

OLS MODEL

$$\textbf{SELECTION WAGE} = \alpha + \beta_1\ \textbf{SELECTION RATE}_i + \beta_2\ \textbf{VIOLENT CRIME}_i + \beta_3\ \textbf{OFFICERS}_i + \beta_4\ \textbf{EDUCATION}_i + \beta_5\ \textbf{UNION}_i + \beta_6\ \textbf{CORRUPTION}_i + X\phi_i + e_i$$

The symbol ϕ_i is a vector of control variables for the ith city such as the type of law enforcement agency and geographic regions. The symbol e_i (and for future reference μ_i) represent unmeasured factors and errors in the collection and measurement of data. Assume that SELECTION RATE_i, VIOLENT CRIME_i, OFFICERS_i, EDUCATION_i, UNION_i, CORRUPTION_i, ϕ_i (and for future reference, RACE_i, GENDER_i, and SCREEN_i) are nonstochastic predetermined variables, independent of e_i. Further assume $\text{cov}(e_i, e_j) = 0$ for i not equal to j, $\text{Var}(e_i) = \sigma^2$ and $E(e_i) = 0$.

The selection wage is measured by the ratio of the entry level officer wage divided by the alternate wage. The alternate wage is measured by the average state earnings of high school graduates aged 18 to 24. Only police agencies that hired officers in 2003 will be used. This limits the data to 1,971 observations.

RESULTS

Table 5-3 shows the OLS results. The coefficient of the selection rate is negative and statistically significant. An increase in the selection rate results in lowering the minimum wage premium. An increase in the selection rate by 10% reduces wages around 2%. This shows a positive correlation between hiring performance standards and minimum officer wage premiums.

The presence of a union is correlated with a large and statistically significant increase in the wage premium. A union adds a 29% premium over the alternate wage. The effect of education is positive. (A negative coefficient here means a positive relationship between education and wage.) Each increase in educational requirement (i.e. a high school degree over no degree) adds about 5% to the wage. The effect of violent crime, corruption, and the number of officers in the PD are positive and statistically significant. A 10% increase in violent crime and the number of officers raises the wage by approximately 1% and .03% respectively.

To test the impact of the hiring performance standards on the selection wage the following hypothesis is tested:

$$\mathbf{H_o}: \quad \beta_1 \geq 0$$
$$\mathbf{H_a}: \quad \beta_1 < 0$$

The hypothesis H_o states that the selection rate has no impact or a positive correlation with the real wage rate. The alternative hypothesis is that the correlation of the selection rate on the wage is negative. The hypothesis that the selection rate has no impact or a positive impact on the entry level real wage can be rejected at the 99 % confidence level.

Table 5-3
Selection results, OLS
DEPENDENT VARIABLE: SELECTION WAGE

Variable	Coefficient	Standard Error	t statistic
Constant	2.156	.337	6.53
Selection rate	-.19919	.050	-3.99
Violent Crime	.00029	.549D-04	5.41
Officers	.2464D-04	.744D-05	3.31
Education	-.04834	.011	-4.26
Union	.29139	.019	15.3
Corruption	.00922	.005	1.78

Adjusted $R^2 = .43$ 1971 observations

SYSTEM OF EQUATIONS METHOD

The main focus of this empirical analysis is on the relationship between the selection rate (standards) and the wage, but some of the other independent variables may have an influence on the selection rate. For example, the violent crime rate may be correlated with wages, but PDs in cities with high violent crime may set the performance standards higher because they feel the need to have high-performing officers to fight that crime. The OLS regression coefficient measures the change in the dependent variable for a given change in the independent variable, other things being equal. If two independent variables are correlated then any change in one variable may also change the other variable. Two or more independent variables that are highly correlated exhibit the problem of multicollinearity.

If there is multicollinearity between the selection rate and the other independent variables, $\boldsymbol{\beta_1}$(the coefficient on the selection rate), will be an unbiased estimator but inconsistent. This may show up as a high standard error as the more correlated the variable is with other variables the greater the variance will be. To correct for this a system of equations will be used to estimate the parameters using Generalized Least Squares (GLS) with Seemingly Unrelated Regressions (SUR). The estimator will then be consistent and efficient. The systems of equations method is a two-stage procedure. The first stage involves creating an instrument for the explanatory variable. The second stage uses that instrument in the second equation with GLS. In this case, an instrument will be created for the selection rate (equation 1), and that instrument will be used to estimate the coefficient for the selection rate in the wage equation (equation 2). Equation 1 contains all the independent variables in equation 2 and with the addition of two more variables, Screens and Education. The equations are as follows:

1. **SELECTION RATE = $\alpha + \beta_1$ VIOLENT CRIME$_i$ + β_2 OFFICERS$_i$ + β_3UNION$_i$ + β_4 CORRUPTION$_i$ + β_5 EDUCATION$_i$ + β_6 SCREENS$_i$ + $X\phi_i$ + μ_i**

2. **SELECTION WAGE = $\alpha + \beta_1$ SELECTION RATE$_i$ + β_2 VIOLENT CRIME$_i$ + β_3 OFFICERS$_i$ + β_4 UNION$_i$ + β_5 CORRUPTION$_i$ + $X\phi_i$ + e_i**

RESULTS

The results are shown in tables 5-4 and 5-5. The direction of all coefficients is the same as in the OLS model. The selection rate, the presence of a union, violent crime, and the number of officers are still statistically significant. Corruption has become statistically insignificant. The coefficient of violent crime has been reduced by one third. A 10% increase in the violent crime rate will increase the wage premium by 0.8%. Perhaps the biggest difference between the models is the increase in the magnitude of the selection rate on wage. A 1% increase in the selection rate lowers the wage by approximately 4.5%. The standard error is about the same. The presence of a union will still increase the wage rate, but less that the OLS estimate. Now the wage is approximately18% over the alternate wage and the standard error has increased. The effect of the size of the department is greater. A 10% increase in the number of officers raises the wage by approximately .06%.

In the selection rate equation (eq. 1) used to create the instrument, Screens and Education are both statistically significant. More screens correspond with a lower selection rate (more probationary rejections), and higher minimum education standards are associated with a lower selection rate (high education requirements are associated with higher standards). PDs that have high education requirements and more screening of applicants are associated with more probationary rejections.

Overall, the results show that there is an association between hiring standards (as measured by probationary rejections), violent crime, unions, and the size of the PD with the incentives to work. Unions are associated with more probationary rejections as well. Some of the effect of unions on wages in the OLS model may actually be through its effect on the selection rate. The level of public official corruption does not have a statistically significant correlation with the minimum officer wage premium.

Table 5-4

Selection results, system of equations - equation 1

DEPENDENT VARIABLE: SELECTION RATE

Variable	Coefficient	Standard Error	T statistic
Constant	1.04	.147	7.04
Violent Crime	-.209D-04	.245D-04	-0.85
officers	.413D-05	.338D-05	1.22
Union	-.0123	.00853	-1.45
Corruption	-.0030	.00234	-1.23
Education	.0059	.00226	2.62
Screens	-.0112	.00074	-15.1

Table 5-5

Selection results, system of equations - equation 2

DEPENDENT VARIABLE: SELECTION WAGE

Variable	Coefficient	Standard Error	T statistic
Constant	5.92	0.699	8.47
Selection rate	-4.44	0.047	-94.58
Violent Crime	0.000196	0.0001	1.69
Officers	0.382D-04	0.160D-04	2.38
Union	0.179	0.040	4.46
Corruption	0.0018	0.011	0.16

1970 observations

5.4 THE PROMOTION / INCENTIVE PERIOD

The real incentive for promotion to sergeant will be measured by the ratio of the minimum sergeant wage divided by the minimum officer wage. This will measure the real incentive that officers have to be promoted to the rank of sergeant.

Data is not available on the performance requirements to become a sergeant within each police agency. The number of screening requirements of new applicants is used as an instrument for promotion performance standards. The assumption here is that a police department which requires heavier screening of applicants is more likely to have higher standards of promotion of officers so that only high-performing officers are promoted to sergeant.

A linear OLS model will be used to examine the association between promotion performance standards (as measured by the number of screening elements) and the incentives to try for promotion (as measured by the real promotion wage premium). In addition, a system of equations model will be used to correct for possible correlations of the other independent variables on the number of screens.

OLS MODEL

$$\textbf{PROMOTION WAGE} = \alpha + \beta_1 \textbf{ SCREEN}_i + \beta_2 \textbf{ VIOLENT CRIME}_i + \beta_3 \textbf{OFFICERS}_i + \beta_4 \textbf{ UNION}_i + \beta_5 \textbf{ CORRUPTION}_i + X\phi_i + e_i$$

RESULTS

Table 5-6 shows the OLS results. The instrument for promotion standards (Screen) is positive and statistically significant, as well as union and corruption. An increase in the number of screens by 10% (about one screening item) increases the promotion wage premium approximately 1% over the minimum officer wage. This shows a positive correlation between promotion performance standards and the minimum sergeant wage premium.

The presence of a union is correlated with a large and statistically significant increase in the promotion wage premium. A union adds a 12% premium over the minimum officer wage.

The correlation of public official corruption convictions is positive and significant. One additional corruption conviction (out of 100,000 inhabitants) will increase the sergeant wage premium by 2%. The correlation of the size of the PD and violent crime with the promotion wage premium is not statistically significant.

The hypothesis to test the impact of performance standards on the incentive wage is:

$$\mathbf{H_o:} \quad \boldsymbol{\beta_1 \leq 0}$$

$$\mathbf{H_a:} \quad \boldsymbol{\beta_1 > 0}$$

The hypothesis H_o states that the promotion standards either have no impact or a negative correlation with the promotion wage. The alternative hypothesis is that the correlation of promotion standards with the promotion wage is positive. The hypothesis can be rejected at the 99% confidence interval.

Table 5-6

Incentive results, OLS

Variable	Coefficient	Standard Error	T statistic
Constant	.950	0.222	4.28
Screen	.0107	0.0028	3.84
Violent Crime	-.211D-04	0.435D-04	-0.49
Officers	.105D-04	0.697D-05	1.51
Union	.124	0.0152	8.16
Corruption	.021	0.0040	5.25

Adjusted R^2 = .21 Number of observations = 2848

SYSTEM OF EQUATIONS METHOD

Again, as in the selection model, to correct for multicollinearity between the variable Screen and other independent variables, a system of equations will be used to estimate the parameters using Generalized Least Squares (GLS) with Seemingly Unrelated Regressions (SUR). The estimator will then be consistent and efficient. In this case, an instrument will be created for Screen (equation 1), and that instrument will be used to estimate the coefficient for Screen in the wage equation (equation 2). Equation 1 contains all the independent variables in equation 2 and with the addition of an additional variable, Education. The equations are as follows:

1. $\mathbf{SCREEN = \alpha + \beta_1 VIOLENT\ CRIME_i + \beta_2 OFFICERS_i + \beta_3 UNION_i + \beta_4 CORRUPTION_i + \beta_5\ EDUCATION_i + X\phi_i + \mu_i}$

2. $\mathbf{PROMOTION\ WAGE = \alpha + \beta_1\ SCREEN_i + \beta_2\ VIOLENT\ CRIME_i + \beta_3 OFFICERS_i + \beta_4\ UNION_i + \beta_5\ CORRUPTION_i + X\phi_i + e_i}$

RESULTS

The results, shown in table 5-7 are similar to the OLS results. The instrument for promotion standards (screen), corruption, and union, are still statistically significant. Perhaps the biggest difference between the models is the increase in the magnitude of screening on the wage premium. A 10% increase in the number of screens (one screening element) is associated with an approximate 6% increase in the promotion wage. The standard error is the same.

The presence of a union will still increase the wage premium, but less that the OLS estimate. Now about 6% over the minimum officer wage and the standard error is about the same. The magnitude of corruption is about the same. Violent crime and the size of the department are not significant, which is the same as in the OLS model result. The standard errors of all variables are very close to the same standard errors in the OLS model. The major difference between results of the two models is the magnitudes of Screen (the coefficient is approximately 5 times larger) and the presence of a union (the coefficient is less than half).

In the screening equation (table 5-8, eq. 1) used to create the instrument, Education, Corruption, Union, and Officers are all statistically significant. Large PDs do more screening of applicants. PDs in states with high corruption have *less* screening. The presence of a union has a large impact on increased screening of applicants, approximately a 20% increase in the number of screening elements. An increase in the number of screening elements by 20% would have the effect of increasing the wage by about 12%, so a union may have a larger effect on the wage from an increase in the number of screening elements than it has on the wage directly. Education and Screen go hand in hand as higher minimum education requirements are associated with more screening.

Overall, the results of the incentive models show that there is an association with PD size, unions, education, and corruption with the amount of screening required of new applicants. The level of screening is positively associated with the promotion wage.

Corruption is positively associated with the promotion wage premium but was not significant with the minimum officer wage premium in the selection model. The opposite is true about the violent crime rate. Violent crime rate is positively associated with the minimum wage premium in the selection model but not significant with the promotion wage premium in the incentive model.

Table 5-7

Incentive results, system of equations - equation 1

DEPENDENT VARIABLE: SCREEN

Variable	Coefficient	Standard Error	t statistic
Constant	9.98	1.48	6.73
Violent crime	0 .00037	0.00029	1.28
Officers	0.000141	0.465D-04	3.03
Union	1.536	0.099	15.5
Corruption	-0.115	0.027	-4.19
Education	-0.337	0.059	-5.74

Table 5-8

Incentive results, system of equations - equation 2

DEPENDENT VARIABLE: PROMOTION WAGE

Variable	Coefficient	Standard Error	t statistic
Constant	.528	0.231	2.28
Screen	.0582	0.00279	20.9
Violent Crime	-.348D-04	0.455D-04	-0.77
Officers	.345D-05	0.729D-05	0.47
Union	.0460	0.0159	2.90
Corruption	.0278	0.0043	6.50

5.5 OFFICER PERFORMANCE AND RACE

A linear Ordinary Least Squares (OLS) model will be used to test for correlation between the percentage of minority officers in the PD and the performance standard. The selection rate will be used as an instrument of the hiring standard. Each race - Black, Hispanic, and Asian - will be run separately to avoid multicollinearity. An OLS model will also be used to test for a correlation between gender and the performance standard.

OLS MODEL

$$\textbf{SELECTION RATE} = \alpha + \beta_1 \textbf{ VIOLENT CRIME}_i + \beta_2 \textbf{ OFFICERS}_i + \beta_3 \textbf{UNION}_i + \beta_4 \textbf{ CORRUPTION}_i + \beta_5 \textbf{ EDUCATION}_i + \beta_6 \textbf{ RACE}_i + X\phi_i + \mu_i$$

$$\textbf{SELECTION RATE} = \alpha + \beta_1 \textbf{ VIOLENT CRIME}_i + \beta_2 \textbf{ OFFICERS}_i + \beta_3 \textbf{UNION}_i + \beta_4 \textbf{ CORRUPTION}_i + \beta_5 \textbf{ EDUCATION}_i + \beta_6 \textbf{ GENDER}_i + X\phi_i + \mu_i$$

RESULTS

The results are shown in tables 5-10 to 5-14. In all three race regression coefficients no correlation is found between the percentage of the PD that is a specific minority and the performance standards of the PD as measured by the selection rate, however, gender does show a correlation: There is a negative association between the percentage of female officers and the selection rate. Departments that have more female officers, as a percentage of the total force have more probationary rejections.

Table 5-9

Race (Black) on Selection Rate results, OLS

Variable	% Black	Standard error	t stat
Constant	0.951	0.148	6.4
Violent Crime	-0.191E-04	0.2451E-04	-0.8
Officers	0.314E-05	0.340E-05	0.9
Union	-0.032	0.009	-3.7
Corruption	-0.00086	0.0024	-0.4
Education	-0.004	0.005	-0.8
Black	-0.021	0.03	-0.7

Number of observations = 1971 $R^2 = .06$

Table 5-10

Race (Asian) on Selection Rate results, OLS

Variable	% Asian	Standard error	t stat
Constant	0.953	0.148	6.4
Violent Crime	-0.198E-04	0.245E-04	-0.8
Officers	0.297E-05	0.338E-05	0.9
Union	-0.031	0.009	-3.6
Corruption	-0.001	0.002	-0.4
Education	-0.004	0.005	-0.8
Asian	-0.080	0.143	-0.6

Number of observations = 1971 $R^2 = .06$

Table 5-11

Race (Hispanic) on Selection Rate results, OLS

Variable	coefficient	Standard deviation	t stat
Constant	0.952	0.148	6.4
Violent Crime	-0.143E-04	0.25E-04	-0.6
Officers	0.317E-05	0.34E-05	0.9
Union	-0.031	0.009	-3.5
Corruption	-0.001	0.002	-0.6
Education	-0.004	0.005	-0.8
Hispanic	-0.037	0.032	-1.1

Number of observations = 1971 $R^2 = .07$

Table 5-12

Gender (Female) on Selection Rate results, OLS

Variable	Coefficient	Standard deviation	t stat
Constant	0.956	0.148	6.5
Violent Crime	-0.153E-04	0.245E-04	-0.6
Officers	0.385E-05	0.339E-05	1.1
Union	-0.031	0.009	-3.6
Corruption	-0.001	0.002	-0.4
Education	-0.005	0.005	-1.1
% Female	-0.115	0.047	-2.4

Number of observations = 1971 $R^2 = .07$

CHAPTER 6
RESULTS AND CONCLUSIONS

6.1 RESULTS

EFICIENCY WAGES

The theoretical selection model predicted that the PD will have to offer a premium over the alternate wage to obtain the high-ability hard-working officers that can meet the performance standards. The empirical results reject the hypothesis that police officers are not paid a premium over their alternate wage. This offers evidence in support of an efficiency wage paid to police officers.

PERFORMANCE STANDARDS FOR HIRING

The theoretical model predicted a positive correlation between the hiring performance standard and the real wage. The study results reject the hypothesis that there is either no correlation or a negative correlation. The study does provide evidence in support of the selection model. Performance standards for hiring (as instrumented by the selection rate of probationary officers) are positively correlated with real minimum officer wage premiums, which is the premium over the alternate wage. To select high-performing officers, the PD must pay a wage that will provide that necessary incentive.

PERFORMANCE STANDARDS FOR PROMOTION

The theoretical model predicted a positive correlation between the promotion performance standard and the real promotion wage. The study results reject the hypothesis that there is either no correlation or a negative correlation. The study does provide evidence in support of the incentive model. Performance standards for promotion (as instrumented by the number of screening elements of applicants) are positively correlated with real promotion wage premiums, which is the premium over the minimum officer wage. To have high-performing officers strive for promotion, the PD must pay a promotion wage that will provide the appropriate incentive.

UNIONIZATION

Approximately half of the PDs are unionized. The study finds that the presence of a union will increase both the minimum officer wage and the promotion wage, increase the number of probationary rejections, and increase the number of screening elements for applicants. The effects are, for the most part, quite statistically significant, and these are unions that do not have the power of strike. The effect of unions appears not only to increase the wages of officers, but to raise the barriers for entry into the police profession. The presence of a union is associated with an increase in the number of screening elements of new applicants thus making it more difficult to be hired, also the presence of a union is associated with an increase in the rejection rate of officers during a probationary period, further increasing the entry barriers.

It is not clear why unions are associated with increased entry barriers. Two possible explanations are offered: a. When PDs are unionized, the department may believe that it is harder to fire an officer once the officer has passed through probation. So if police management suspects a weak officer they had better terminate employment while the officer is still under probation. I.e., the department may not get another chance once he/she has completed probation and covered under the protection of the union. b. The second explanation arises from the effect that unions have on wage. When the PD sets the standard they must set a wage that will provide the incentive for that standard. If a union is able to negotiate a higher wage for the officers than is necessary to meet that standard, the PD can then increase the standard with no additional cost to the PD.

CORRUPTION

This study finds a positive relationship between the level of state public corruption, as measured by convictions in *federal* courts, and the promotion wage premium of local police departments. However, this study also reveals no statistically-significant relationship between the level of state public corruption and the minimum officer wage premium. Consider the following: Corrupt public officials want to be on good terms with the local police, particularly police management. At some point these bureaucrats may need a favor, or strings pulled, at the police department, particularly at a high level, to turn a blind eye or squash a criminal investigation. An out-and-out bribe can be expensive, illegal and risky. A public official who is in a position to oversee the PD, and who can influence wages of the police or police budgets, e.g. a mayor or city councilman, may be able to make friends or return favors in a way that is less risky, less expensive, and even legal. There would be no reason to influence entry-level wages, only wages of PD management. The positive relationship between corruption of public officials and promotion wages to management may represent a measure of legal albeit immoral bribery that has been paid to PD management in the past by those who oversee the PD to avoid prosecution of crimes by the PD who are the local enforcers of the laws.

VIOLENT CRIME

There is a positive correlation with the amount of violent crime in the state and officer wage premiums (t=1.69). This may represent the amount that officers must be compensated to make the officer's utility indifferent to the increase in occupational risk. The amount of violent crime is not statistically significant in a correlation with the promotion wage in the incentive model. Possibly, as one is promoted, there is no additional job risk from violent crime. In fact, there may be less occupational risk as an officer is promoted as he/she may be likely to spend more time behind a desk as opposed to being on patrol in the middle of the night in a dangerous section of town.

There is a positive correlation with the violent crime rate and the amount of screening of job applicants. Possibly the high violent crime areas are thought to be associated with a less desirable pool of applicants from which to draw, so the PD needs to screen applicants more carefully. Another explanation is that a higher crime rate may indicate the need to have higher performing officers. In this case there would be more screening but there should also be a lower selection rate. The correlation between violent crime and the selection rate is not statistically significant.

SIZE OF THE DEPARTMENT

The size of the department, as measured by the number of officers, is positively correlated with the number of screening elements for job applicants, and real minimum officer wage premiums. Increases in the number of screening elements by large PDs may be from economies of scale or a larger budget. The higher wage may also reflect the increased cost of living in a larger city. The measure of alternate wages is at the state level (unavailable at the city level) so it will not accurately measure the increase in the cost of living in larger cities.

EDUCATION

There is a negative correlation between the minimum education requirements of the PD and the selection rate. Low minimum education requirements means higher selection rates (less rejections). This is consistent that PDs with lower standards have a higher selection rate. Remember that the data provided by LEMAS gives a lower number to the education variable as minimum requirements are increased. There is a positive correlation between minimum education requirements and the number of screening elements of applicants. High minimum education requirements are associated with high screening of applicants. This study is unable to shed light as to whether college-educated officers' performance is superior to other officers with less formal education.

6.2 CONCLUSIONS

Efficiency-wage models offer explanations for involuntary unemployment and the rigidity of wages, which prevent the rapid adjustment and clearing of the labor market, prolonging economic downturns. Evidence of an efficiency wage could be a wage premium paid to workers in some industries compared to the wages of workers with similar characteristics in other industries. Evidence could also show up as a positive wage - performance relationship within a firm or industry within a relevant range. This study provides a theoretical model for a positive relationship between officer performance standards and officer wages. It finds empirical evidence of a wage premium being paid by police departments, offering support for the efficiency wage hypothesis. In addition, the study finds evidence of a positive correlation between the performance standards set by PDs and the real wages offered for both the selection model and the incentive model. This offers evidence for both the adverse selection and incentive or shirking models of efficiency wages. The results imply that police departments can increase the expected performance of their officers either through more restrictive selection of employees or by providing incentives to current employees. In the first case, performance may be more likely to be affected through ability, and in the second case, more likely to be affected through effort.

This study also finds evidence that the presence of a union in the PD serves to increase not only the wage premium of police officers and the promotion wage premium, but to increase the performance standards of new hires. Unions are associated with more screening of applicants and more rejections of officers during their probationary period, both of which serve as barriers to entry into the profession.

This study finds evidence that officers must be compensated for the additional risk they take from working in high crime areas and that the additional premium can be quantified.

This study finds evidence that state public official corruption is associated with the promotion wage premium of officers. This raises the question of the possibility of corruption or attempted corruption of the PD management by corrupt public officials.

This study is unable to find evidence that the racial composition of the police force is associated with hiring performance standards.

6.3 FUTURE RESEARCH

Perhaps the biggest shortcoming of this research is the lack of data. Only one year of data is available at this time for probationary rejections and in that reference year almost one third of the agencies did not hire any new officers. Of the two thirds remaining, 87% did not reject any probationary officers, meaning 87% of the data points in this limited data set are zero. The next issue is the unavailability of local-level data. Alternate wage data, public corruption data, and violent crime data are all only available at the state level. These two data issues may help explain the low R square results. The main obstacle in the performance model estimation is that there is no data available for officer performance standards. The probationary rejection rate is used as an instrument for hiring standards which may be reasonable but there is nothing similar to use for promotion standards. The variable chosen, screens, may be more closely related to hiring standards than it is to promotion standards.

Although unions and the percentage of female officers are associated with lower selection rates, it is not clear as to how and why this occurs. There may be the problem of omitted variables. Lastly, this research has raised the question of the possibility of past attempted bribery of law enforcement management by corrupt public officials because of the association between promotion wages and public official corruption rates. More investigation should be done to determine if there is some causality between public official corruption and management wage premiums.

REFERENCES

Akerlof, George A; Yellen Janet L. "The Fair Wage-Effort Hypothesis and Unemployment*" The Quarterly Journal of Economics*, 105, No.2, (May 1990), 255-283

Akerlof, George, "Labor Contracts as Partial Gift Exchange", *Quarterly Journal of Economics*, 97, (November 1982), 543-569

Becker, Gary S. and Stigler, George J. "Law Enforcement, Malfeasance, and Compensation of enforcers" *The Journal of Legal Studies*,3, (1974), 1-18

Bowles, S. "The Production Process in a Competitive Economy: Walrasian, Neo-Hobbesian and Marxian Models" *American Economic Review* 75 march 1985 16-36

Calvo, G. "Quasi-Walrasian Theories of Unemployment" *American Economic Review* 69, May 1979 102-107
________. " The inefficiency of Unemployment: The Supervision perspective" *Quarterly Journal of Economics* 100 May 1985 373-87

Campbell III, Carl and Kamlani, Kunal. "The Reasons for Wage Rigidity: Evidence From a Survey of Firms" *Quarterly Journal of Economics* August 1997, 759-789

Capelli, Peter and Chauvin, Keith. "An interplant test of the efficiency wage hypothesis" *The Quarterly Journal of Economics*, August 1981, 769-787

Eaton, Curtis and White, William. "The Economy of High Wages: An Agency Problem" *Econometrica* Vol 50 No. 198 (May 1983) 175-181

Federal Bureau of Investigation. Uniform Crime Reports. Washington D.C: Federal Bureau of Investigation.

Finnigan, James C. "A Study of Relationships Between College Education and Police Performance in Baltimore Maryland", *The Police Chief*, (August 1976) 60

Guasch, J and Weiss, Andrew "Self-Selection in the Labor Market" *The American Economic Review*, Vol 71, No. 3 (Jun 1981) 275-284

Glaeser, Edward L. and Saks, R. "Corruption in America" *Journal of Public Economics*, 2006 V90 (6-7, Aug) 1053-1072

Huang, Tzu-Ling Et al. "Empirical Tests of Efficiency Wage Models", *Economica*, 65, (1998), 125-143

Katz, L. "Efficiency Wage Theories: A Partial Evaluation" in NBER *Macroeconomics Annual* 1 1986, 235-275

Kedia, Prahlad Ray “ Assessing the Effect of College Education on Police Job Performance” The University of Southern Mississippi, Dissertation. (1985)

Krueger, A and Summers, L. “Efficiency Wages and the Inter-Industry Wage Structure”, *Econometrica,* Vol 56, No 2 (March 1988) 259-293

Leibenstein, H. “Economic backwardness and Economic Growth” New York: Wiley (1957)

Lott, J “Does a Helping Hand Put Others at Risk?: Affirmative Action, Police Departments, and Crime” *Economic Inquiry* Vol 38, No. 2, April 2000, 239-277

Malcomson, James M. “Unemployment and the Efficiency Wage Hypothesis” *The Economic Journal*, 91 (December 1981): 848-866

Salop, S. “A Model of the Natural Rate of Unemployment”, *American Economic Review,* 69 (March 1979)

Sanderson, B.E. “Police Officers: The Relationship of a College Education to Job Performance” *Police Chief,* 44, (1977), 42

Shapiro, Carl and Stiglitz, Joseph “Equilibrium Unemployment as a Worker Discipline Device” *The American Economic Review,* Vol 74, No. 3 (Jun 1984) 433-444

Shleifer, Andrei and Vishny, Robert W. “Corruption” *The Quarterly Journal of Economics,* 108, No. 3 (August,1993) 599-617

Solow, Robert M. “Another Possible Source of Wage Stickiness”, *Journal of Macroeconomics* 1 (1979) 79-82

Stiglitz, Joseph. “Wage Determination and Unemployment in L.D.C.’s: The Labor Turnover Model” *Quarterly Journal of Economics*, 88, (May 1974),194-227
_____________. “The Efficiency Wage Hypothesis, Surplus Labor, and the Distribution of Income in L.D.C.s” *Oxford Economic Papers* (July 1976) 28, 185-207
_____________. “Equilibrium Wage Distributions” *Economic Journal,* 95, (Sept 1985) 595-618

U.S. Dept. of Justice, Bureau of Justice Statistics. LAW ENFORCEMENT MANAGEMENT AND ADMINISTRATIVE STATISTICS (LEMAS): 2003 SAMPLE SURVEY OF LAW ENFORCEMENT AGENCIES [Computer file]. ICPSR04411-v1. Washington, DC: U.S. Dept. of Commerce, Bureau of the Census [producer], 2006. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2006-05-10. doi:10.3886/ICPSR04411

Van Rijckeghem, Caroline; Weder, Beatrice. " Corruption and the rate of Temptation: Do Low Wages in the Civil Service Cause Corruption?" IMF Working Paper, *International Monetary Fund*, (1997)

Weiss Andrew. "Job Queues and Layoffs in Labor Market with Flexible Wages" *Journal of Political Economy*, 88, (June 1980), 526-538

Yellen Janet L. "Efficiency Wage Models of Unemployment" *The American Economic Review*, 74, No. 2, (May 1984), 200-205

APPENDIX

8.1 PRINTOUT OF REGRESSIONS RUN

MINIMUM REAL OFFICER WAGE OLS REGRESSION

REGRESS;Lhs=RLWAGE;Rhs=ONE,Selrat,VCRIME,OFFICER,v69, UNION,CORRUP,TYPE1,...

```
**********************************************************************
*
 * NOTE: Deleted    880 observations with missing data. N is now   1971
*

**********************************************************************
*


+-----------------------------------------------------+
| Ordinary    least squares regression                |
| Model was estimated Sep 05, 2009 at 06:44:06PM      |
| LHS=RLWAGE   Mean                 =   1.650489      |
|              Standard deviation   =   .4272715      |
| WTS=none     Number of observs.   =       1971      |
| Model size   Parameters           =         15      |
|              Degrees of freedom   =       1956      |
| Residuals    Sum of squares       =   202.0377      |
|              Standard error of e  =   .3213895      |
| Fit          R-squared            =   .4382304      |
|              Adjusted R-squared   =   .4342095      |
| Model test   F[ 14,  1956] (prob) = 108.99 (.0000) |
| Diagnostic   Log likelihood       =  -551.9144      |
|              Restricted(b=0)      =  -1120.216      |
|              Chi-sq [ 14]  (prob) =1136.60 (.0000) |
| Info criter. LogAmemiya Prd. Crt. =  -2.262621      |
|              Akaike Info. Criter. =  -2.262621      |
| Autocorrel   Durbin-Watson Stat.  =  1.4484621      |
|              Rho = cor[e,e(-1)]   =   .2757690      |
+-----------------------------------------------------+
+---------+--------------+----------------+--------+---------+---------
-+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of
X|
+---------+--------------+----------------+--------+---------+---------
-+
 Constant      2.15637514      .33012345     6.532   .0000
 SELRAT        -.19919600      .04985803    -3.995   .0001
.95124244
 VCRIME         .00029247    .540092D-04     5.415   .0000
459.001674
 OFFICER      .246402D-04    .744253D-05     3.311   .0009
210.511416
```

```
 V69           -.04833857      .01135874    -4.256   .0000
3.70776256
 UNION          .29139448      .01904210    15.303   .0000
.50887874
 CORRUP         .00922377      .00518093     1.780   .0750
3.02402841
 TYPE1         -.17046983      .32217659     -.529   .5967
.30187722
 TYPE2          .06775803      .32622478      .208   .8355
.01826484
 TYPE3         -.02736934      .32188955     -.085   .9322
.65449011
 TYPE8         -.22940759      .33968397     -.675   .4994
.00456621
 TYPE5          .05951430      .32592823      .183   .8551
.02029427
 NORTH         -.48913741      .02592056   -18.871   .0000
.18569254
 MDWEST        -.47055233      .02391095   -19.679   .0000
.25012684
 SOUTH         -.46019858      .02446465   -18.811   .0000
.38305429
```

MINIMUM REAL OFFICER WAGE SURE REGRESSION

```
--> SURE;Lhs=rlwage,selrat;Eq1=ONE,CORRUP,VCRIME,OFFICER,selrat,
union,TYPE1,...
    TYPE3,TYPE8,TYPE5,NORTH,SOUTH,MDWEST;Eq2=ONE,CORRUP,VCRIME,OFFICER,
    screen,V69,UNION,TYPE1,TYPE2,TYPE3,TYPE8,TYPE5,NORTH,SOUTH,MDWEST$

************************************************************************
*
 * NOTE: Deleted    881 observations with missing data. N is now   1970
*

************************************************************************
*

Iteration    0, GLS           =    448.2290
Iteration    1, GLS           =    448.9125
Iteration    2, GLS           =    449.7584
Iteration    3, GLS           =    450.8007
Iteration    4, GLS           =    452.0773
Iteration    5, GLS           =    453.6291
Iteration    6, GLS           =    455.4974
Iteration    7, GLS           =    457.7198
Iteration    8, GLS           =    460.3255
Iteration    9, GLS           =    463.3284
Iteration   10, GLS           =    466.7213
Iteration   11, GLS           =    470.4706
Iteration   12, GLS           =    474.5160
Iteration   13, GLS           =    478.7742
```

```
Iteration   14, GLS          =    483.1475
Iteration   15, GLS          =    487.5355
Iteration   16, GLS          =    491.8468
Iteration   17, GLS          =    496.0066
Iteration   18, GLS          =    499.9610
Iteration   19, GLS          =    503.6769
Iteration   20, GLS          =    507.1387
Iteration   21, GLS          =    510.3445
Iteration   22, GLS          =    513.3016
Iteration   23, GLS          =    516.0234
Iteration   24, GLS          =    518.5263
Iteration   25, GLS          =    520.8280
Iteration   26, GLS          =    522.9462
Iteration   27, GLS          =    524.8980
Iteration   28, GLS          =    526.6993
Iteration   29, GLS          =    528.3646
Iteration   30, GLS          =    529.9074
Iteration   31, GLS          =    531.3393
Iteration   32, GLS          =    532.6712
Iteration   33, GLS          =    533.9125
Iteration   34, GLS          =    535.0716
Iteration   35, GLS          =    536.1562
Iteration   36, GLS          =    537.1730
Iteration   37, GLS          =    538.1280
Iteration   38, GLS          =    539.0264
Iteration   39, GLS          =    539.8732
Iteration   40, GLS          =    540.6725
Iteration   41, GLS          =    541.4283
Iteration   42, GLS          =    542.1440
Iteration   43, GLS          =    542.8226
Iteration   44, GLS          =    543.4670
Iteration   45, GLS          =    544.0798
Iteration   46, GLS          =    544.6632
Iteration   47, GLS          =    545.2193
Iteration   48, GLS          =    545.7500
Iteration   49, GLS          =    546.2570
Iteration   50, GLS          =    546.7419
Iteration   51, GLS          =    547.2061
Iteration   52, GLS          =    547.6510
Iteration   53, GLS          =    548.0778
Iteration   54, GLS          =    548.4875
Iteration   55, GLS          =    548.8812
Iteration   56, GLS          =    549.2599
Iteration   57, GLS          =    549.6244
Iteration   58, GLS          =    549.9754
Iteration   59, GLS          =    550.3139
Iteration   60, GLS          =    550.6403
Iteration   61, GLS          =    550.9555
Iteration   62, GLS          =    551.2599
Iteration   63, GLS          =    551.5542
Iteration   64, GLS          =    551.8388
Iteration   65, GLS          =    552.1142
Iteration   66, GLS          =    552.3810
Iteration   67, GLS          =    552.6394
Iteration   68, GLS          =    552.8899
```

```
Iteration   69, GLS           =    553.1329
Iteration   70, GLS           =    553.3687
Iteration   71, GLS           =    553.5977
Iteration   72, GLS           =    553.8201
Iteration   73, GLS           =    554.0362
Iteration   74, GLS           =    554.2463
Iteration   75, GLS           =    554.4507
Iteration   76, GLS           =    554.6496
Iteration   77, GLS           =    554.8432
Iteration   78, GLS           =    555.0317
Iteration   79, GLS           =    555.2154
Iteration   80, GLS           =    555.3944
Iteration   81, GLS           =    555.5690
Iteration   82, GLS           =    555.7392
Iteration   83, GLS           =    555.9053
Iteration   84, GLS           =    556.0674
Iteration   85, GLS           =    556.2257
Iteration   86, GLS           =    556.3803
Iteration   87, GLS           =    556.5313
Iteration   88, GLS           =    556.6788
Iteration   89, GLS           =    556.8231
Iteration   90, GLS           =    556.9641
Iteration   91, GLS           =    557.1021
Iteration   92, GLS           =    557.2370
Iteration   93, GLS           =    557.3691
Iteration   94, GLS           =    557.4984
Iteration   95, GLS           =    557.6250
Iteration   96, GLS           =    557.7489
Iteration   97, GLS           =    557.8704
Iteration   98, GLS           =    557.9893
Iteration   99, GLS           =    558.1059
Iteration  100, GLS           =    558.2203

+----------------------------------------------------+
| Estimates for equation: RLWAGE                     |
| Generalized least squares regression               |
| Model was estimated Sep 05, 2009 at 06:51:16PM     |
| LHS=RLWAGE   Mean                 =   1.650785     |
|              Standard deviation   =   .4271766     |
| WTS=none     Number of observs.   =       1970     |
| Model size   Parameters           =         14     |
|              Degrees of freedom   =       1956     |
| Residuals    Sum of squares       =   947.2736     |
|              Standard error of e  =   .6959103     |
| Fit          R-squared            =  -1.655291     |
|              Adjusted R-squared   =  -1.672939     |
| Diagnostic   Log likelihood       =  -2074.091     |
|              Restricted(b=0)      =  -1119.210     |
| Info criter. LogAmemiya Prd. Crt. =  -.7179874     |
|              Akaike Info. Criter. =  -.7179876     |
| Not using OLS or no constant. Rsqd & F may be < 0. |
| Log-determinant of W    -6.2425        Log-likelihood        558.2203
|
| Durbin-Watson Stat.=     1.9471        Autocorrelation   =      .0265
|
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	5.92514348	.69954895	8.470	.0000	
CORRUP	**.00181737**	**.01113826**	**.163**	.8704	3.02420812
VCRIME	**.00019645**	**.00011652**	**1.686**	.0918	458.996396
OFFICER	**.382177D-04**	**.160569D-04**	**2.380**	.0173	210.616751
SELRAT	**-4.44339831**	**.04697862**	**-94.583**	.0000	.95121769
UNION	**.17949217**	**.04019977**	**4.465**	.0000	.50913706
TYPE1	-.18337678	.69556143	-.264	.7921	.30152284
TYPE2	-.11878336	.70424809	-.169	.8661	.01827411
TYPE3	-.12312924	.69490389	-.177	.8594	.65482234
TYPE8	-.60311353	.73329544	-.822	.4108	.00456853
TYPE5	.12637096	.70359676	.180	.8575	.02030457
NORTH	-.02907866	.05503419	-.528	.5972	.18527919
SOUTH	-.15868354	.05220075	-3.040	.0024	.38324873
MDWEST	-.15319338	.05038376	-3.041	.0024	.25025381

Estimates for equation: **SELRAT**

Generalized least squares regression

Model was estimated Sep 05, 2009 at 06:51:16PM

LHS=SELRAT	Mean	= .9512177
	Standard deviation	= .1503200
WTS=none	Number of observs.	= 1970
Model size	Parameters	= 15
	Degrees of freedom	= 1955
Residuals	Sum of squares	= 41.57693
	Standard error of e	= .1458320
Fit	R-squared	= .5834257E-01
	Adjusted R-squared	= .5159924E-01
Model test	F[14, 1955] (prob)	= 8.65 (.0000)
Diagnostic	Log likelihood	= 1005.061
	Restricted(b=0)	= 938.3200
	Chi-sq [14] (prob)	= 133.48 (.0000)
Info criter.	LogAmemiya Prd. Crt.	= -3.843015
	Akaike Info. Criter.	= -3.843015

```
| Not using OLS or no constant. Rsqd & F may be < 0. |
| Log-determinant of W    -6.2425        Log-likelihood        558.2203
|
| Durbin-Watson Stat.=     1.9434        Autocorrelation   =      .0283
|
+----------------------------------------------------+
+---------+--------------+----------------+--------+---------+---------
-+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of
X|
+---------+--------------+----------------+--------+---------+---------
-+
 Constant      1.03768404      .14730926     7.044   .0000
 CORRUP        -.00302212      .00234473    -1.289   .1974
3.02420812
 VCRIME     -.209071D-04    .244936D-04     -.854   .3933
458.996396
 OFFICER     .413283D-05    .337574D-05     1.224   .2208
210.616751
 SCREEN        -.01118077      .00073799   -15.150   .0000
9.66903553
 V69            .00592672      .00225915     2.623   .0087
3.70862944
 UNION         -.01234999      .00853547    -1.447   .1479
.50913706
 TYPE1         -.02980580      .14620453     -.204   .8385
.30152284
 TYPE2         -.04553856      .14802076     -.308   .7583
.01827411
 TYPE3         -.03533505      .14605919     -.242   .8088
.65482234
 TYPE8         -.10665960      .15412764     -.692   .4889
.00456853
 TYPE5          .01228518      .14788570      .083   .9338
.02030457
 NORTH          .09365091      .01155761     8.103   .0000
.18527919
 SOUTH          .06361136      .01096933     5.799   .0000
.38324873
 MDWEST         .06105376      .01063220     5.742   .0000
.25025381
```

PROMOTION WAGE OLS

REGRESS;Lhs=PRORATE;Rhs=ONE,CORRUP,VCRIME,OFFICER,union,screen,TYPE1,TYPE...
TYPE8,TYPE5,NORTH,SOUTH,MDWEST$

```
**********************************************************************
*
 * NOTE: Deleted      9 observations with missing data. N is now   2841
*
```

****
*

```
+----------------------------------------------------+
| Ordinary    least squares regression               |
| Model was estimated Sep 05, 2009 at 08:40:57PM     |
| LHS=PRORATE  Mean                 =   1.363152     |
|              Standard deviation   =   .3485131     |
| WTS=none     Number of observs.   =       2841     |
| Model size   Parameters           =         14     |
|              Degrees of freedom   =       2827     |
| Residuals    Sum of squares       =   269.6835     |
|              Standard error of e  =   .3088619     |
| Fit          R-squared            =   .2181960     |
|              Adjusted R-squared   =   .2146008     |
| Model test   F[ 13,  2827] (prob) =  60.69 (.0000) |
| Diagnostic   Log likelihood       =  -686.4066     |
|              Restricted(b=0)      =  -1036.064     |
|              Chi-sq [ 13]  (prob) = 699.32 (.0000) |
| Info criter. LogAmemiya Prd. Crt. =  -2.344807     |
|              Akaike Info. Criter. =  -2.344807     |
| Autocorrel   Durbin-Watson Stat.  =  1.2407156     |
|              Rho = cor[e,e(-1)]   =   .3796422     |
+----------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.95003004	.22172869	4.285	.0000	
CORRUP	.02145609	.00408419	5.253	.0000	3.03229849
VCRIME	**-.211386D-04**	**.434920D-04**	**-.486**	.6269	443.484864
OFFICER	**.105347D-04**	**.697238D-05**	**1.511**	.1308	165.638508
UNION	**.12440584**	**.01524665**	**8.160**	.0000	.49912003
SCREEN	**.01074028**	**.00279710**	**3.840**	.0001	9.24076030
TYPE1	.12259728	.21888450	.560	.5754	.30130236
TYPE2	.27212534	.22426165	1.213	.2250	.01372756
TYPE3	.14181104	.21864257	.649	.5166	.66103485
TYPE8	.17619629	.23142616	.761	.4464	.00598381
TYPE5	.07385301	.22322708	.331	.7408	.01724745
NORTH	.27451536	.02103821	13.048	.0000	.20415347

```
 SOUTH          -.00244372      .02016728     -.121   .9036
.34811686
 MDWEST          .00824354      .01921570      .429   .6679
.29250264
```

PROMOTION WAGE SURE REGRESSSION

--> SURE;Lhs=PRORATE,screen;Eq1=ONE,CORRUP,VCRIME,OFFICER,screen,union, TYPE1...
,TYPE3,TYPE8,TYPE5,NORTH,SOUTH,MDWEST;Eq2=ONE,CORRUP,VCRIME,OFFICER
,V69,UNION,TYPE1,TYPE2,TYPE3,TYPE8,TYPE5,NORTH,SOUTH,MDWEST$

```
**********************************************************************
*
 * NOTE: Deleted      9 observations with missing data. N is now   2841
*

**********************************************************************
*

Iteration    0, GLS          =   -6773.567
Iteration    1, GLS          =   -6773.499
Iteration    2, GLS          =   -6773.433
Iteration    3, GLS          =   -6773.367
Iteration    4, GLS          =   -6773.303
Iteration    5, GLS          =   -6773.239
Iteration    6, GLS          =   -6773.177
Iteration    7, GLS          =   -6773.115
Iteration    8, GLS          =   -6773.054
Iteration    9, GLS          =   -6772.995
Iteration   10, GLS          =   -6772.936
Iteration   11, GLS          =   -6772.878
Iteration   12, GLS          =   -6772.821
Iteration   13, GLS          =   -6772.765
Iteration   14, GLS          =   -6772.710
Iteration   15, GLS          =   -6772.655
Iteration   16, GLS          =   -6772.602
Iteration   17, GLS          =   -6772.550
Iteration   18, GLS          =   -6772.498
Iteration   19, GLS          =   -6772.448
Iteration   20, GLS          =   -6772.398
Iteration   21, GLS          =   -6772.350
Iteration   22, GLS          =   -6772.302
Iteration   23, GLS          =   -6772.255
Iteration   24, GLS          =   -6772.209
Iteration   25, GLS          =   -6772.163
Iteration   26, GLS          =   -6772.119
Iteration   27, GLS          =   -6772.075
Iteration   28, GLS          =   -6772.033
Iteration   29, GLS          =   -6771.991
Iteration   30, GLS          =   -6771.950
```

```
Iteration   31, GLS           =   -6771.909
Iteration   32, GLS           =   -6771.870
Iteration   33, GLS           =   -6771.831
Iteration   34, GLS           =   -6771.793
Iteration   35, GLS           =   -6771.756
Iteration   36, GLS           =   -6771.719
Iteration   37, GLS           =   -6771.683
Iteration   38, GLS           =   -6771.648
Iteration   39, GLS           =   -6771.614
Iteration   40, GLS           =   -6771.580
Iteration   41, GLS           =   -6771.547
Iteration   42, GLS           =   -6771.515
Iteration   43, GLS           =   -6771.483
Iteration   44, GLS           =   -6771.452
Iteration   45, GLS           =   -6771.421
Iteration   46, GLS           =   -6771.392
Iteration   47, GLS           =   -6771.362
Iteration   48, GLS           =   -6771.334
Iteration   49, GLS           =   -6771.306
Iteration   50, GLS           =   -6771.278
Iteration   51, GLS           =   -6771.252
Iteration   52, GLS           =   -6771.225
Iteration   53, GLS           =   -6771.200
Iteration   54, GLS           =   -6771.174
Iteration   55, GLS           =   -6771.150
Iteration   56, GLS           =   -6771.126
Iteration   57, GLS           =   -6771.102
Iteration   58, GLS           =   -6771.079
Iteration   59, GLS           =   -6771.056
Iteration   60, GLS           =   -6771.034
Iteration   61, GLS           =   -6771.012
Iteration   62, GLS           =   -6770.991
Iteration   63, GLS           =   -6770.970
Iteration   64, GLS           =   -6770.949
Iteration   65, GLS           =   -6770.929
Iteration   66, GLS           =   -6770.910
Iteration   67, GLS           =   -6770.891
Iteration   68, GLS           =   -6770.872
Iteration   69, GLS           =   -6770.854
Iteration   70, GLS           =   -6770.836
Iteration   71, GLS           =   -6770.818
Iteration   72, GLS           =   -6770.801
Iteration   73, GLS           =   -6770.784
Iteration   74, GLS           =   -6770.767
Iteration   75, GLS           =   -6770.751
Iteration   76, GLS           =   -6770.735
Iteration   77, GLS           =   -6770.720
Iteration   78, GLS           =   -6770.705
Iteration   79, GLS           =   -6770.690
Iteration   80, GLS           =   -6770.675
Iteration   81, GLS           =   -6770.661
Iteration   82, GLS           =   -6770.647
Iteration   83, GLS           =   -6770.633
Iteration   84, GLS           =   -6770.620
Iteration   85, GLS           =   -6770.607
```

```
Iteration   86, GLS           =   -6770.594
Iteration   87, GLS           =   -6770.581
Iteration   88, GLS           =   -6770.569
Iteration   89, GLS           =   -6770.557
Iteration   90, GLS           =   -6770.545
Iteration   91, GLS           =   -6770.534
Iteration   92, GLS           =   -6770.522
Iteration   93, GLS           =   -6770.511
Iteration   94, GLS           =   -6770.500
Iteration   95, GLS           =   -6770.490
Iteration   96, GLS           =   -6770.479
Iteration   97, GLS           =   -6770.469
Iteration   98, GLS           =   -6770.459
Iteration   99, GLS           =   -6770.449
Iteration  100, GLS           =   -6770.440

+-----------------------------------------------------+
| Estimates for equation: PRORATE                     |
| Generalized least squares regression                |
| Model was estimated Sep 05, 2009 at 08:49:41PM      |
| LHS=PRORATE  Mean                  =   1.363152     |
|              Standard deviation    =   .3485131     |
| WTS=none     Number of observs.    =       2841     |
| Model size   Parameters            =         14     |
|              Degrees of freedom    =       2827     |
| Residuals    Sum of squares        =   295.7413     |
|              Standard error of e   =   .3234395     |
| Fit          R-squared             =   .1384093     |
|              Adjusted R-squared    =   .1344473     |
| Model test   F[ 13,  2827] (prob) =  34.93 (.0000) |
| Diagnostic   Log likelihood        =  -817.4280     |
|              Restricted(b=0)       =  -1036.064     |
|              Chi-sq [ 13]  (prob) = 437.27 (.0000) |
| Info criter. LogAmemiya Prd. Crt. =  -2.252570     |
|              Akaike Info. Criter. =  -2.252571     |
| Not using OLS or no constant. Rsqd & F may be < 0. |
| Log-determinant of W     -.9095        Log-likelihood      -6770.4398
|
| Durbin-Watson Stat.=     1.2494        Autocorrelation   =      .3753
|
+-----------------------------------------------------+
+---------+-------------+----------------+--------+---------+---------
-+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of
X|
+---------+-------------+----------------+--------+---------+---------
-+
 Constant       .52805902      .23193491     2.277   .0228
 CORRUP         .02775629      .00427304     6.496   .0000
3.03229849
 VCRIME      -.348549D-04    .455197D-04     -.766   .4438
443.484864
 OFFICER      .345114D-05    .729636D-05      .473   .6362
165.638508
```

```
 SCREEN         .05825041      .00278827    20.891   .0000
9.24076030
 UNION          .04604876      .01588977     2.898   .0038
.49912003
 TYPE1          .13340027      .22909332      .582   .5604
.30130236
 TYPE2          .16353952      .23471249      .697   .4859
.01372756
 TYPE3          .09899514      .22883879      .433   .6653
.66103485
 TYPE8          .14915619      .24221950      .616   .5380
.00598381
 TYPE5         -.02725971      .23363082     -.117   .9071
.01724745
 NORTH          .33835665      .02198678    15.389   .0000
.20415347
 SOUTH          .02153229      .02110309     1.020   .3076
.34811686
 MDWEST         .06727689      .02008135     3.350   .0008
.29250264


+----------------------------------------------------+
| Estimates for equation: SCREEN                     |
| Generalized least squares regression               |
| Model was estimated Sep 05, 2009 at 08:49:41PM     |
| LHS=SCREEN   Mean                 =   9.240760     |
|              Standard deviation   =   2.360422     |
| WTS=none     Number of observs.   =       2841     |
| Model size   Parameters           =         14     |
|              Degrees of freedom   =       2827     |
| Residuals    Sum of squares       =   12020.57     |
|              Standard error of e  =   2.062052     |
| Fit          R-squared            =   .2365635     |
|              Adjusted R-squared   =   .2330529     |
| Model test   F[ 13,  2827] (prob) =  67.38 (.0000) |
| Diagnostic   Log likelihood       =  -6080.224     |
|              Restricted(b=0)      =  -6470.670     |
|              Chi-sq [ 13]  (prob) = 780.89 (.0000) |
| Info criter. LogAmemiya Prd. Crt. =   1.452319     |
|              Akaike Info. Criter. =   1.452319     |
| Not using OLS or no constant. Rsqd & F may be < 0. |
| Log-determinant of W     -.9095        Log-likelihood      -6770.4398
|
| Durbin-Watson Stat.=     1.7414        Autocorrelation   =      .1293
|
+----------------------------------------------------+
+---------+-------------+----------------+--------+---------+---------
-+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of
X|
+---------+-------------+----------------+--------+---------+---------
-+
 Constant      9.98060196     1.48339532     6.728   .0000
```

CORRUP	**-.11454935**	**.02733596**	**-4.190**	.0000	3.03229849
VCRIME	**.00037320**	**.00029069**	**1.284**	.1992	443.484864
OFFICER	**.00014072**	**.464892D-04**	3.027	.0025	165.638508
V69	**-.33712301**	**.05869635**	-5.744	.0000	3.72263288
UNION	**1.53621630**	**.09899658**	15.518	.0000	.49912003
TYPE1	-.01046436	1.46181896	-.007	.9943	.30130236
TYPE2	2.44089944	1.49687257	1.631	.1030	.01372756
TYPE3	1.06936423	1.45991858	.732	.4639	.66103485
TYPE8	.76970483	1.54542700	.498	.6184	.00598381
TYPE5	2.27396212	1.49001552	1.526	.1270	.01724745
NORTH	-1.34937759	.13820103	-9.764	.0000	.20415347
SOUTH	-.57420390	.13485728	-4.258	.0000	.34811686
MDWEST	-1.36334012	.12791470	-10.658	.0000	.29250264

MINORITY REGRESSIONS

Regression Analysis: selection rate versus 2003 v crime, v42, ...

```
The regression equation is
selection rate = 0.951 - 0.000019 2003 v crime + 0.000003 v42 - 0.0317 v127
                 - 0.00086 corrup - 0.00439 v69 - 0.0208 percent black
                 + 0.109 d-northeast + 0.0695 d-south + 0.0691 d-midwest
                 - 0.004 type =1 - 0.047 type = 2 - 0.026 type=3 - 0.090 type=8
                 + 0.010 type=5
```

1971 cases used, 880 cases contain missing values

Predictor	Coef	SE Coef	T	P
Constant	0.9512	0.1482	6.42	0.000
2003 v crime	-0.00001906	0.00002451	-0.78	0.437
v42	0.00000314	0.00000340	0.92	0.356
v127	-0.031663	0.008608	-3.68	0.000
corrup	-0.000857	0.002370	-0.36	0.718
v69	-0.004386	0.005150	-0.85	0.395
percent black	-0.02079	0.02981	-0.70	0.486
d-northeast	0.10882	0.01151	9.45	0.000
d-south	0.06949	0.01117	6.22	0.000
d-midwest	0.06906	0.01073	6.43	0.000
type =1	-0.0044	0.1461	-0.03	0.976

type = 2	-0.0474	0.1479	-0.32	0.749
type=3	-0.0262	0.1460	-0.18	0.858
type=8	-0.0901	0.1540	-0.58	0.559
type=5	0.0103	0.1478	0.07	0.944

S = 0.145733   R-Sq = 6.6%   R-Sq(adj) = 6.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	14	2.95228	0.21088	9.93	0.000
Residual Error	1956	41.54179	0.02124		
Total	1970	44.49408			

Regression Analysis: selection rate versus 2003 v crime, v42, ...

```
The regression equation is
selection rate = 0.952 - 0.000014 2003 v crime + 0.000003 v42 - 0.0305 v127
                 - 0.00135 corrup - 0.00420 v69 - 0.0367 percent hispanic
                 + 0.106 d-northeast + 0.0663 d-south + 0.0660 d-midwest
                 - 0.005 type =1 - 0.049 type = 2 - 0.026 type=3 - 0.089 type=8
                 + 0.010 type=5
```

1971 cases used, 880 cases contain missing values

Predictor	Coef	SE Coef	T	P
Constant	0.9523	0.1481	6.43	0.000
2003 v crime	-0.00001427	0.00002494	-0.57	0.567
v42	0.00000317	0.00000338	0.94	0.349
v127	-0.030543	0.008644	-3.53	0.000
corrup	-0.001351	0.002361	-0.57	0.567
v69	-0.004196	0.005153	-0.81	0.416
percent hispanic	-0.03668	0.03208	-1.14	0.253
d-northeast	0.10578	0.01172	9.03	0.000
d-south	0.06629	0.01109	5.98	0.000
d-midwest	0.06598	0.01103	5.98	0.000
type =1	-0.0050	0.1461	-0.03	0.973
type = 2	-0.0486	0.1479	-0.33	0.742
type=3	-0.0260	0.1459	-0.18	0.858
type=8	-0.0890	0.1540	-0.58	0.563
type=5	0.0100	0.1478	0.07	0.946

S = 0.145703   R-Sq = 6.7%   R-Sq(adj) = 6.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	14	2.96971	0.21212	9.99	0.000
Residual Error	1956	41.52437	0.02123		
Total	1970	44.49408			

Regression Analysis: selection rate versus 2003 v crime, v42, ...

```
The regression equation is
selection rate = 0.954 - 0.000020 2003 v crime + 0.000003 v42 - 0.0309 v127
                 - 0.00102 corrup - 0.00439 v69 - 0.080 percent asian
                 + 0.106 d-northeast + 0.0667 d-south + 0.0672 d-midwest
                 - 0.006 type =1 - 0.046 type = 2 - 0.027 type=3 - 0.092 type=8
                 + 0.009 type=5


1971 cases used, 880 cases contain missing values


Predictor              Coef     SE Coef      T      P
Constant             0.9537      0.1482   6.44  0.000
2003 v crime   -0.00001980  0.00002449  -0.81  0.419
v42             0.00000297  0.00000338   0.88  0.380
v127             -0.030868    0.008680  -3.56  0.000
corrup           -0.001020    0.002351  -0.43  0.664
v69              -0.004395    0.005151  -0.85  0.394
percent asian      -0.0800      0.1430  -0.56  0.576
d-northeast        0.10646     0.01200   8.87  0.000
d-south            0.06673     0.01124   5.94  0.000
d-midwest          0.06723     0.01114   6.04  0.000
type =1            -0.0055      0.1461  -0.04  0.970
type = 2           -0.0460      0.1480  -0.31  0.756
type=3             -0.0271      0.1460  -0.19  0.853
type=8             -0.0916      0.1540  -0.59  0.552
type=5              0.0092      0.1478   0.06  0.950


S = 0.145740   R-Sq = 6.6%   R-Sq(adj) = 6.0%


Analysis of Variance

Source            DF        SS       MS     F      P
Regression        14   2.94860  0.21061  9.92  0.000
Residual Error  1956  41.54548  0.02124
Total           1970  44.49408
```

Regression Analysis: selection rate versus 2003 v crime, v42, ...

```
The regression equation is
selection rate = 0.956 - 0.000015 2003 v crime + 0.000004 v42 - 0.0307 v127
                 - 0.00093 corrup - 0.00548 v69 - 0.115 percent female
                 + 0.106 d-northeast + 0.0691 d-south + 0.0679 d-midwest
                 + 0.004 type =1 - 0.039 type = 2 - 0.020 type=3 - 0.085 type=8
                 + 0.013 type=5


1971 cases used, 880 cases contain missing values


Predictor               Coef     SE Coef      T      P
Constant              0.9559      0.1479   6.46  0.000
2003 v crime     -0.00001533  0.00002452  -0.63  0.532
v42               0.00000385  0.00000339   1.13  0.257
v127               -0.030688    0.008600  -3.57  0.000
corrup             -0.000933    0.002347  -0.40  0.691
v69                -0.005476    0.005160  -1.06  0.289
```

percent female	-0.11472	0.04710	-2.44	0.015
d-northeast	0.10631	0.01151	9.24	0.000
d-south	0.06906	0.01098	6.29	0.000
d-midwest	0.06787	0.01072	6.33	0.000
type =1	0.0043	0.1459	0.03	0.977
type = 2	-0.0390	0.1478	-0.26	0.792
type=3	-0.0199	0.1458	-0.14	0.891
type=8	-0.0846	0.1538	-0.55	0.583
type=5	0.0130	0.1476	0.09	0.930

S = 0.145531   R-Sq = 6.9%   R-Sq(adj) = 6.2%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	14	3.06757	0.21911	10.35	0.000
Residual Error	1956	41.42650	0.02118		
Total	1970	44.49408			