Experimental Investigations of the Fair Wage-Effort Hypothesis

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By

Evan Edward Meredith

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Abstract

Neoclassical economic theory's assumption of a strictly utility of money maximizing economic actor has been unable to explain such economic phenomena as involuntary unemployment and above market clearing wages. Efficiency wage theory, in its various forms, has provided some explanation for these labour market features. Akerlof's (1982) Fair Wage-Effort Hypothesis or Partial Gift Exchange model of the labour market explains involuntary unemployment through the productivity enhancing effects of higher wages. In Akerlof's model this is done through a sort of unspoken gift exchange in which higher wages given to the workers are returned to the firm in the form of higher effort or productivity.

The Partial Gift Exchange model can also be modeled in a laboratory setting where its various predictions and assumptions can be tested. This has been done by a number of researchers over the last 15 years, who have generally found support for the validity of the theory using a one sided oral auction procedure. This thesis seeks to conduct a similar experiment, but in the form of a survey, the focus of which is the relationship between wages and effort.

A number of the results of previous experiments supporting the Fair Wage-Effort Hypothesis have also been generated in the survey, for example a positive relationship between wages and effort. New and interesting findings not previously examined in the lab or not present in previous experiment were also present in the survey: the negative effect of wage inequity; a positive coefficient for the gender dummy variable; and the negative effect of unemployment insurance.

The survey has produced some new and interesting results, transporting the survey back into the laboratory setting from which it was inspired would provide an interesting comparison.

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Chapter One: Introduction

The setting of wages above market clearing levels and workers performing above the minimum standards set by the firm has often conflicted with the standard neoclassical model of the labour market. The neoclassical model predicts that the firm will pay the minimum, or market clearing, wage and the worker will provide the minimum amount of effort necessary to retain employment. This follows from the neoclassical assumptions of the firm being a strict profit maximizer and the worker a strict utility maximizer; with tangible concepts like income or consumption the only arguments included in the utility or profit functions. To explain behaviour that runs contrary to the neoclassical model a number of theories have been developed and grouped under the heading of efficiency wage theory.

In all of the various efficiency wage theories the firm pays wages above the market clearing level and is compensated by an increase in productivity; how this increase in productivity is brought about is where the theories differ. In developing countries, where the workers may be malnourished, the payment of higher wages enables the workers to improve their health; this improvement enables them to work more productively (Leibenstein, 1963). The firm is compensated for the increase in the wage bill by an increase in productive output. The higher wages may also allow the firm to attract more productive workers when advertising for job openings or to

keep the workers it currently has employed from leaving. Another theory involves the concept of shirking or slacking off at work (Shapiro and Stiglitz, 1984). The relatively higher wages increase the cost of getting fired if caught shirking; therefore employees are less likely to shirk and a more productive environment transpires.

The most interesting form of efficiency wage theory, and the focus of this paper, is that wages affect worker effort through a partial gift exchange framework. This theory was first developed by Akerloff (1982) and later elaborated upon in Akerloff and Yellen (2004). The degree to which this partial gift exchange takes place is based the evaluation of the level of fairness present in the transaction. The theory provides an easily understood explanation of the high wages and effort that conflict with the neoclassical theory. In addition to it's simply explanation, it also is easily tested in laboratory experiments first developed by Fehr, Kirchsteiger, and Riedl (1993). In Chapter Two this paper provides an overview of the importance of including considerations of fairness in labour market transactions, as modeled in Akerloff's (1982) partial gift exchange model, and a review of the various laboratory experiments designed to examine the role of fairness in the labour market.

In an attempt to transpose this experimental framework from a lab experiment to a survey experiment, a survey was developed to test whether the lab experiment results could be replicated in a survey format. In addition to this test of replication a number of new labour market features were included in the survey: an unemployment benefit; the knowledge of co-worker wages; and a high degree of supervision. The development and implementation of this survey is detailed in Chapter Three. From the predictions of the Fair Wage-Effort Hypothesis, or Partial Gift Exchange Model,

and the results of previous experiments, four Hypotheses regarding the outcome of the survey were posed. They are outlined below.

Hypothesis A:

Effort is positively correlated with wages. Higher wages will correspond to a higher choice of effort.

This hypothesis is a straightforward prediction of the fair wage-effort model and has been a result of the previous experimental studies, with the noted exception of Rigdon (2002).

Hypothesis B:

An increase in possible unemployment benefits will reduce the amount of effort for a corresponding wage from the effort put forth in the absence of unemployment benefits. As unemployment benefits increase, the workers conception of a fair wage also increases, and to elicit the same effort as previous a higher wage must be offered.

Unemployment benefits are included in the reference wage as an alternative to employment. As they increase this alternative becomes more attractive. They also contribute to the employee's conception of a fair wage. As the benefits increase so does the fair wage.

Hypothesis C:

The observance of a coworkers' wage will have negative effects on effort for a wage lower than the coworkers and positive effects on effort for a wage higher than the coworkers. Workers base their evaluation of the fairness of the wage offer on the reference point of similar worker's wages. If their wages are lower they will regard the wage unfair and reduce their effort accordingly. If their wages are higher they will regard the wage as exceeding the fair wage and will increase their effort accordingly.

Co-worker wages, like unemployment benefits, are also included in the reference wage. Increases in a relatively similar co-worker's wages, holding the other

worker's wages constant, would raise the other worker's conception of what constitutes a fair wage. Co-worker wages have been examined before in a lab setting by Charness and Kuhn (2004). They found that wage inequality had no effect on the relatively lower paid workers effort.

Hypothesis D:

The degree to which workers are supervised or monitored will have an effect on the effort they put forth. Working under a small degree of monitoring reduces the chances of being caught shirking. Workers who have a high degree of supervision will find it difficult to shirk without detection. Therefore the level of effort under a high degree of supervision will be higher than under low supervision.

The degree of supervision has only been examined by Rigdon (2002), who found that in the absence of supervision the market reverted to the neoclassical model's predictions. In contrast, Hypothesis D predicts the behaviour of workers who experience a high degree of supervision. It maintains that workers who receive higher levels of supervision put forth more effort.

This may not always be the case; low supervision need not lead to low levels of effort inputs. The extent to which minimal supervision affects the effort of workers depends on the work culture of the firm; high levels of effort inputs can be harmonious with minimal supervision (Altman, 2002). The hypothesis formed here stems from the previous experimental results (Rigdon, 2002) and predicts a positive correlation between effort and supervision.

An examination of the data generated by the survey is presented in Chapter Four. The basic results are a complete acceptance of Hypothesis A, partial acceptance of Hypotheses B and C, and a rejection of Hypothesis D. In addition to these

decisions there were two other results of note: gender plays a significant role in the wage-effort relationship; and place of origin also plays a significant role in the wage-effort relationship, though not as economically significant as the role of gender. These two interesting results are in opposition to the findings of previous experiments. For a more detailed examination of the previous experiments, the methodology of the survey and the results extracted from the gathered survey data, please read on.

Chapter Two: Literature Review

This chapter presents the literature that forms the basis for this thesis. The importance of fairness in the labour market and the use of reference sets to evaluate fairness are detailed in the first section of this chapter. This is followed by a summary of the Fair Wage-Effort Hypothesis, or Partial Gift Exchange Model of the labour market, developed by Akerlof (1982). Lastly a survey of the lab experiments testing the validity of the fair wage-effort hypothesis is given. A few survey investigations into the fair wage-effort hypothesis are also outlined in this section. This then leads into the next chapter, a discussion of the survey construction and implementation used in this thesis.

2.1 Fairness and Reference Sets

2.1.1 Labour: A Different Good

The need to treat labour markets differently than other goods markets is stressed in the work of a number of economists. The selling of labour is different from other market goods because a job not provides a source of income, but also a large status symbol and source of pride for many workers (Solow, 1990). The derivation of pride from employment stems partly from the level of the wage you are paid relative to the position you occupy. Undercutting the wages of others and selling

yourself cheaper is a debasement of the self and is often seen as shameful (Solow, 1990). The debasement of one's self has negative effects on the individual's utility outside of the lower wage received by undercutting wages. The level of wage under which accepting employment becomes detrimental to one's utility depends on the concept of fairness and whether the wage violates the norms that govern what constitutes a fair wage. In order to compensate for the loss in utility, from lower wages and the violation of fairness norms, the worker may lower the level of effort they put forward in their job; this helps to compensate for the utility loss because effort provision is costly. Reducing effort also allows for the worker to punish the firm, for what it views as disregarding general norms of fairness, through reduced output and possibly even active revenge, like sabotage. The need to treat labour different from other goods leads to the inclusion of perceptions of fairness, and the norms which govern this perception, when examining labour markets.

2.1.2 The Importance of Fairness

Outside of the field of economics fairness has often been an important factor. An oft found example of this is in union wage contracts. In these contracts there commonly exists a clause which states that an increase in wages for another union, which has workers of a similar occupation, must be accompanied by an increase in wages for the original union's workers (Rees, 1993). This increase in wages is in line with the need to conform to a norm of fairness regarding maintaining wage equity across occupations. It should be noted that fairness is primarily a supply side consideration; it is the workers which insist on fairness, not the firms. It is through

the possibility of increased productivity, or retaliation, that firms take fairness under consideration; causing a demand side effect as well (Rees, 1993). The violation of fairness norms, like not observing union wage equity clauses, can have negative effects for the firm: increased turnover of workers; decreases of effort and productivity; increased shirking; and possibly strikes (Rees, 1993). While the negative effects of not taking fairness into account when setting wages are well illustrated in this example, the possible positive effects, outside of an absence of the negative ones, are not as clear.

The importance of fairness can also be found in the field of Human Resources and Management. Human Resource textbooks and manuals, which train people who will later on be involved in the setting of wages, impart the knowledge that equity and perceived equity are indispensable to good industrial relations (Solow, 1990). In the absence of fair wages the management will experience high levels of quits, low morale and the accompanying low productivity; just like in the union example.

Albert Rees (1993) provides more anecdotal evidence; in all the various positions he held, regarding wage determination, he found that neoclassical theory was not of much help. Fairness was found to be an overwhelming factor in the determination of wages. Wages are not fully determined by market forces, but through collective, or individual, bargaining in which fairness plays a very important part.

The importance of fairness can be seen in other areas of economics besides labour markets. In Ultimatum and Dictator Games a movement towards fair outcomes, and a willingness to resist an unfair outcome, have been reported; the

outcome dictated by neoclassical theory, in which fairness in not considered, is often not observed. Fair offers and acceptances, with occasional refusals if the offer is too low, are the common results for these laboratory games[1] (Kahneman, Knetsch, and Thaler, 1986a). These fair outcomes also occur under strict anonymity with no option of retaliation. In the Ultimatum game in the second, or punishment, stage the participants showed willingness to punish an unfair allocator, and simultaneously reward a fair one, with a clear majority of 74% (Kahneman, Knetsch, and Thaler, 1986a). The behaviour observed in these games gives further credence to the importance of fairness in economic transactions.

2.1.3 General Rules of Fairness

The importance of considering fairness when examining labour markets has been outlined in the previous section. To further our understanding of fairness, what factors lead to a situation's fairness must be examined. To examine the evaluating of fairness general rules of fairness and the concept of a reference set, or reference transaction, must be developed.

In a series of surveys conducted by Kahneman, Knetsch, and Thaler (1986b) fairness was found to play an important role in a number of economic transactions. In the surveys questions regarding a firm's actions, in a price or wage setting decision affecting one or more of the transactors, were evaluated as acceptable or unfair by the respondents. The results of the surveys lead the authors to offer propositions about labour market behaviour: wages will be relatively insensitive to excess supply; firms

[1] For an explanation of the exact mechanics of Ultimatum and other experimental bargaining games see Kahneman, Knetsch, and Thaler (1986a).

may cut wages to protect a profit similar to their reference profit; and a number of other points less relevant to labour market transactions.

In another paper Kahneman, Knetsch, and Thaler (1986a) develop two general rules for fairness that are similar to the two mentioned above; these two rules are more formal statements of the ones described above. The first is that it is unfair for a firm to exploit an increase in market power to alter the terms of the reference transaction at the direct expense of a customer, tenant or employee. The second states that it is acceptable for a firm to maintain its profit at the reference level by raising prices or by cutting costs as necessary. In order to understand these rules a more in-depth discussion of what is a reference set, or transaction, is necessary; as reference sets figure prominently in the fair wage effort hypothesis.

2.1.4 Reference Transactions and Sets

A reference transaction is a previous transaction which the specific bargainers, or bargainers whom the specific bargainers judge to be similar, were involved in and regard as a benchmark of what constitutes fair activity. A reference transaction can consist of market prices, posted prices, and the history of transactions between the two bargainers (Kahneman, Knetsch, and Thaler, 1986b). For instance the firm may consider the profit levels they have maintained for over a previous number of years to be their reference profit. Akerloff's (1982) Partial Gift Exchange Model is concerned with the reference set and the behaviour of workers, so the reference transaction is abandoned at this point.

The reference set is made up of all the factors which the worker uses to judge the degree of fairness contained in their current situation. This set may not always

seem rational to the outside observer; only to the individual using the reference set. The most common elements of the set are the wages paid to other workers who are thought to be in similar situations to the individual. These wage, or compensation, comparisons are made with another union, employer, or worker (Rees, 1993). As mentioned previously, unions often use workers in similar occupations to determine whether an increase in wages in necessary for their own members. This conforms to the individuals need to maintain their reference set level of wage equity to maintain fairness and a acceptable level; along with their utility levels being maintained.

Reference sets are not always perfectly rational and are subject to both framing effects (Kahneman, Knetsch, and Thaler, 1986a) and self serving biases (Charness and Harvey, 2000). These effects may lead to the perception of the reference set as being irrational.

A number of possible modifications of the neoclassical theory may be made to present a more realistic representation of reality and to help explain phenomena, like involuntary unemployment, that seem at odds to its predictions. Kahneman, Knetsch, and Thaler (1986a) suggest that a more realistic description of transactors should include caring about receiving fair treatment, a willingness to resist unfair firms at a cost to the individual and systematic rules that specify which actions of firms are considered unfair. Rees (1993) recommends that the utility functions of the employees not only contain the arguments wages and leisure, but also the wages of others in the reference set; which would enter the function in a negative manner. Akerloff's (1982) Fair Wage-Effort Hypothesis, which is presented in the following section, takes both these suggestions into account.

2.2 The Fair Wage-Effort Hypothesis

In the Fair Wage-Effort Hypothesis, or Partial Gift Exchange Model, the employer provides a gift to the employee in the form of a wage, which is higher than market clearing, and the employee reciprocated with the provision of effort above the minimum requirements set forth by the firm. This model is used to explain involuntary unemployment and the theory of dual labour markets; in which there exists a primary market, where the gift component is large enough to permit higher than market clearing levels, and the secondary market, where market clearing persists. An earlier simpler model in which effort levels are tied to wages is presented in Solow (1979).

2.2.1 Motivations

Akerloff's interest in exchange of this type follows from Homan's (1953, cited in Akerloff, 1982) study of cash posters at a utility company. The study found that production exceeded the minimum required from the company. The increased production was not considered to be the result of an attempt at promotion; there was little room for it and the level of voluntary quits was quite high. It was also not considered to be stemming from the threat of punishment; for falling below the minimum standard the worker was only given a mild rebuke. Akerloff (1982) considers these observations to be in conflict with neoclassical theory. Why did the workers not reduce their output to the minimum requirement? Why did the firm not raise the standard high and fire those who fell short? The explanation for these questions is that workers provide effort above the minimum requirement and in return

require a fair reward or compensation for their efforts. What this fair treatment is may differ between groups or individuals; Akerloff (1982) considers leniency for the worker from the employer if their output were to fall, but later drops this to concentrate on the concept of a fair wage.

2.2.2 The Neoclassical Model: a simple example

Before diving into the Fair Wage-Effort Hypothesis it may be helpful to briefly explain how the effort and wages would be set under neoclassical assumptions using a simple model. The workers in this example (Akerlof, 1982) have utility functions which include the wage paid and the effort they put forth as arguments.

$$U=(w,e)$$

If firms were to pay a wage and make it necessary to perform to some minimum work standard, e-min, the employee would then set their effort equal to the minimum necessary to maintain employment. In maximizing utility, for the worker, and profit, for the firm, both economic actors will expect the other to set the choice variables equal to the minimum and the equilibrium will result in a market clearing wage and minimum effort on behalf of the workers. In order to modify the model to be more consistent with empirical observations the objective functions of the firm and worker must be changed.

2.2.3 The Partial Gift Exchange Model

The modification presented by Akerlof (1982) is that fairness exerts an influence on the market through its effects on workers effort provision. The gift exchange is a higher than market clearing wage, from the firm to the worker, and a

higher than minimum required effort, from the worker to the firm; the magnitude of which is affected by the perceptions of the fairness apparent in the transaction. This exchange could be beneficial to both parties. The worker is receiving a higher wage, which would offset the cost of providing higher effort, and the firm a higher level of effort or productivity, which would offset the cost of paying a higher wage. To be beneficial the costs of the gifts being provided must be more than merely offset by the gifts received; the employee must receive a wage that would more than compensate for the higher level of effort provided. The equilibrium in this situation would result in higher than market clearing wages, effort above the minimum requirement, sticky wages and involuntary unemployment.

Akerlof (1982) calls this type of exchange a partial gift exchange. Each party has an expectation that if not met would cause the exchange to cease; the partial gift exchange would revert back to the neoclassical model discussed previously. The firms expect higher effort for their higher wages and the workers expect higher wages for their higher effort; it is not a fully altruistic exchange.

The model states very simply that fair behaviour will result in higher effort and higher wages. What exactly is fair behaviour will be dependant on the actors' reference sets. With regards to effort provision, what is fair will be based upon norms concerned with what constitutes a fair day's work. This will be based upon the comparison of one's own effort with others in the worker's of firm's reference set (Akerloff, 1982). The determination of the firm's minimum work standards will be based upon the performance of past workers or workers at similar firms.

A more formal statement of what is contained in a worker's reference set in Akerlof's (1982) model is presented below.

$$w^f_{i,t+1} = f\left(w_{i,t}, w_0, b_u, u, e_i, e_0\right)$$

Where

$w^f_{i,t+1}$ is the perceived fair wage of individual i at time $t+1$

$w_{i,t}$ are the actual wages of individual i in previous periods

w_0 are the wages of others in the individual's reference set in current and past periods

b_u are the available unemployment benefits

u is the number of unemployed

e_i are the individual's work rules

e_0 are the work rules of others in the individual's reference set

These factors all influence the worker's conception of what is a fair wage given the current situation. The failure of a firm to pay a wage which is greater that or equal to this fair wage will result in a lack of reciprocation on behalf of the workers. It should also be included in this function that a firm's profit opportunities play an important role in the determination of a fair wage. Higher profitability opportunities for a firm would require a higher fair wage; this is in line with Kahneman, Knetsch, and Thaler's (1986a) general rules of fairness.

Akerlof (1982) then develops a mathematical model[2] which maintains the neoclassical assumptions of utility or profit maximization, but includes the possibility of variable effort provision; which is affected by the evaluation of the fairness of the wage being offered. Putting this model through theoretical examples, the first involving fixed work rules and adjustable wages, the second with fixed wages and adjustable work rules, he finds that involuntary unemployment will result. The

[2] The concern of this paper is with the experimental tests of this model, so the exact mathematical mechanics of the model are not presented; see Akerlof (1982) for the algebraic workings of the model.

resulting wages and effort will be above the levels that the strictly neoclassical example dictates; neither work rules nor wages can be adjusted to equate supply and demand and clear the markets.

Uniqueness of the efficiency wage generated by the Akerlof (1982) model is a product of the shape of the wage-productivity curve used. Alternative wage-productivity curves such as a quasi-linear shape (Altman, 2001), or other shapes (Stiglitz, 1987), allow for a range of non-unique efficiency wages. Models using these alternative curves may clear; the Akerlof (1982) model does not clear the markets because of the assumption of a unique efficiency wage.

The theoretical model presented by Akerlof (1982) provides a very compelling explanation for involuntary markets and the payment of wages above market clearing levels. In addition to the explanation given for these phenomena, the model is also easily tested in laboratory experiments; the results of which generally conform to the predictions of the theoretical model.

2.3 Labour Market Experiments

As attractive as mathematical models can be, many researchers like Gary Charness(2004); Ernst Fehr, Erich Kirchler, Andreas Weichbold, and Simon Gatcher (1998); R. Lynn Hannan, John H. Kagel, and Donald V. Moser (2002); and others; have extended the work of earlier experimental economists like Vernon Smith (1976, 1989, 1991)[3] and developed experimental or simulated labour markets to test the

[3] There are just a few of the papers Smith has written regarding experimental economics. For a in depth examination of the works of Vernon Smith see Altman (2004a).

partial gift exchange theory. The experiments differ in certain ways, like how the wages are determined (Charness, 2004) or examining subject pool differences (Hannan, Kagel, and Moser, 2002). Aside from their differences, a common result is that higher wages lead to higher effort provision; though the magnitude of this varies as the experiments differ.

2.3.1 Why Labour Market Experiments?

The advantages of using labour market experiments to test theories and their predictions or assumptions are numerous. For example, they allow for the direct testing of assumptions and predictions; with the ability to control for a number of environmental factors which may be present in field data (Falk and Fehr, 2003). Vernon Smith (1976) points to two reasons for the importance of experimental methods in the evolution of economic theory: they allow for the pretesting of economic theory before the use of field data tests; and they can be directly important to the field data's study and interpretation. These and other advantages of the laboratory have lead to a rich literature on the implementation and interpretation of laboratory methods and results.[4]

These labour market experiments have attempted to adhere to Vernon Smith's experimental design methods: the use of salient pay or induced value theory (Smith, 1976); and trying to maintain as close a relationship with reality as possible. Whether or not they have succeeded in this is subject to debate.

These experiments are not without their problems and a variety of criticisms and objections have been put forth: subject pool bias due to the majority of subjects

[4] See Kagel and Roth (1995) for a collection of experimental economics literature.

being students; small numbers of participants; invalid stake sizes; and too simple abstractions from reality (Falk and Fehr, 2003). These problems may be dealt with through careful sample selection, inference and experimental design; addressing them directly is also an option as Fehr, Fischbacher, and Tougevera (2002) do with the problem of small stake size and as Gneezy (2003) does with the problem of the absence of real effort provision. Small stake size is often criticized as leading the participants to not take the experiment seriously; the wager on each individual transaction is often less then one dollar, whereas in reality the wages and behaviour of the worker can have a large impact on their livelihoods. The numerical choice of effort instead of actually doing some physical or mental task is also thought by critics to lead to a lack of seriousness on behalf of the participants; there is no real cost of effort outside of how it may affect their earnings. These two problems are addressed directly by replacing the small stakes with very high ones, three times the participants' monthly incomes (Fehr, Fischbacher, and Tougavera, 2002), and by requiring the participants to provide some concrete level of effort, like having them solve a mazes on a computer (Gneezy, 2003). Properly designed and conducted experiments can deal with the problems mentioned and will generate a more realistic picture of human nature while enhancing our understanding of how labour markets function (Falk and Fehr, 2003).

2.3.2 The Initial Experimental Design

As previously mentioned the Fair Wage-Effort, or Partial Gift Exchange, model of the labour market and its implications can be easily tested using laboratory experiments; the first of which was conducted by Fehr, Krichsteiger, and Riedl (1993). This investigation also set forth the basic laboratory method for experimentation of this kind and has been used by other researchers in the same manner, or with minor modifications.

The design consists of what is called a one sided oral auction and consists of two stages. Initially the participants were gathered into one room and explained the mechanics of the auction; they were then divided into two groups randomly and separated into two rooms, between which contact was conducted by the investigators using a telephone. The auction then started. The first stage involves the employers offering wages to a group of potential employees; they have no choice in specifying an individual employee to offer a wage to. The wage offers had to be in multiples of five and the wage offering stage of the auction lasted three minutes. If the employer found that their wage offer was not being accepted they could change the offer, but only upward. If the wage was accepted by an employee a binding contract was formed; if the employer found no acceptance after the three minutes was up they earned no profits that round. After contracts were formed the second stage began. In this stage the employees chose a level of effort, which was costly to them, to provide to the employer, which entered positively in the production function of the employer. This choice was revealed only to the specific employer they had formed a contract with and the employer also had no knowledge of exactly whom the contract had been formed with; this was to prevent a reputational equilibrium. After this was completed

the employers and employees then calculated their payoffs for that round; then the next round commenced. In order to keep possible productive of human capital differences between participants the same, payoff functions were provided to them; these functions differ slightly from study to study but retain the same basic structure. A cost of effort table was also provided to the workers to keep the cost of effort the same for each individual. With regards to information, everyone knew the payoff functions of firms and workers, the cost of effort schedule, and the wage offers. The private information was limited to the effort provided to the specific employer and the anonymity of the individuals forming the contract. These two stages and payoff functions, and cost of effort table, form the basic structure of the laboratory experiment.

Using this structure Fehr, Kirchstieger, and Reidl (1993) conducted an experiment using four sessions consisting of one trial period and twelve periods of actual experimentation. The sessions lasted approximately two hours with the average subject earning $25 per session. In each session the number of workers was greater than the number of employers to create competitive pressure. The payoff functions imposed on the participants were as follows.

$$\text{Employee}: u_j = p_i - c - m(e_j)$$
$$\text{Employer}: \prod_i = (v - p_i)e_j$$

Where c is a fixed cost of employment, p is the wage, m(e) is the cost of provision of the effort level selected, v is the productive capacity of the firm and e is the effort level chosen. Fehr, Kirchsteiger, and Reidl (1993) fixed the values of v and c, at 126 and 26, while providing a cost of effort table, which is presented below in Table 1.

Table 1: Cost of Effort Choice Table

e	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
m(e)	0	1	2	4	6	8	10	12	15	18

These values were chosen to eliminate the possibility of losses for the firm; in order to eradicate possible loss aversion behaviour.

Fehr, Kirchsteiger, and Reidl (1993) then conduct the experiment to test the implications of the Fair Wage-Effort Hypothesis's implications that the effort level is increasing in the wage, average wages are considerably greater than market clearing, the wage does not converge towards market clearing and average effort is above the minimum. Market clearing in this investigation is where supply is equal to demand, given the payoff functions imposed and the competitive pressures; minimum levels of effort would be a choice of $e = 0.1$ with a cost of $m(e) = 0$.

The results of the experiment support the theories implications: average effort was four times higher than as predicted by the neoclassical model; the average and median effort level increased with the wage; regressing effort on wage and a constant resulted in a coefficient on wage than is positive and highly significant; dummy period variables indicate workers to not behave significantly different across periods; the average payment is above, and does not converge towards, market clearing; and the average effort level was above the minimum in every session in all periods.

To investigate further and to examine why the participants behaved as they did a follow up survey was conducted. In order to lend support to the observation of

involuntary unemployment, those employees who did not accept a wage offer were asked why; in only 10 of the 144 cases was an answer given of no acceptable offer was available. The rest of the workers would have liked to worked, but were unable to find an offer due to the competitive pressure in the market; their unemployment was involuntary (Fehr, Kirchsteiger, and Reidl, 1993). To examine the behaviour of firms, the firms were asked why they offered the higher than minimum wages; the response was that they were trying to coax a higher level of effort from the workers (Fehr, Kirchsteiger, and Reidl, 1993). The possibility that this behaviour is maintained by some sort of group reputation is refuted by the observation that the high wages and effort are still present in the final period. All the participants knew when the session was to end, so why did they not reduce their wages or effort in the final period; this contradicts the group reputation explanation (Fehr, Kirchsteiger, and Reidl, 1993).

While being supportive of the Fair Wage-Effort Hypothesis the experiment has many criticisms, like too low stakes or subject pool homogeneity. Further experiments, conducted using the same framework, have been used to examine these and other criticisms or behaviour.

2.3.3 Other Experiments and Extensions

To examine if differing profitability opportunities for the firm affect the behaviour of the participants in the experiment, as they would in the fair wage effort hypothesis, Fehr and Gatcher (1998) implemented an experiment similar to the basic design of Fehr, Kirchsteiger, and Reidl (1993). The main difference being that firms

differed in their profitability and there also existed a possibility for the firms to punish or reward the workers if the effort level provided was not in line with the firms expectations. The payoff functions also slightly differed and are given below.

$$\text{Firms} : (q - w)e - k(p)$$
$$\text{Workers} : (\text{w} - \text{c}(\text{e}) - f)p$$

Where q is the redemption, or profitability, value of the firm, w is the wage, e is the effort level provided, c(e) is the cost of providing that effort, f is the fixed cost of working, p is the punishment value and k(p) is the cost of dealing that punishment .

The experiment consisted of 16 periods in which a three stage auction was conducted. The first stage was the wage offer and acceptance stage, this time the workers chose among the wages in a randomly determined order. In the second stage the workers were informed of their employer's redemption value and chose a level of effort to provide, along with incurring its cost of provision. In the third stage, firms were informed of the effort level provided and could elect to punish or reward their employee with a choice of $p<1$ or $p>1$; this choice came with a cost k(p), with $k(1) = 0$.

The results indicate that the firms chose to punish or reward despite its cost to them, workers display a highly significant positive wage effort relationship even when controlling for redemption values and in the first stage firms pay a wage that is positively correlated to their redemption value (Fehr and Gatcher, 1998).

In a very similar experiment to their 1993 paper Fehr, Kirchsteiger, and Reidl (1998) conduct another experiment; the difference being that participants were called

buyers and seller, not firms and workers. The change led to no significant differences in the results.

In an experiment to determine whether the results of previous investigations represented non-competitive outcomes, Fehr, Weichbold, and Gatcher (1998) conducted an experiment with three different markets: a bilateral gift exchange (BGE); a gift exchange market (GEM); and a complete contract market (CCM). The GEM is a replication of the basic design, in the CCM all wage offers come with a required level of effort that has to be honoured and in the BGE all the workers are matched with all the firms in a sequence; eliminating any competition for jobs. Comparing the GEM with the CCM provides evidence of whether the high wages in the GEM are due to high reservation wages. Comparing the BGE with the GEM allows a determination of whether competition plays a role in the GEM.

In an experiment similar to the CCM Hannan, Kagel, and Moser (2002) investigated the effect of effort proposals on behaviour; in this case the proposals did not have to be honoured. They found that the requests for effort were only partially honoured by the workers.

The results of the experiment adhered to the predictions and assumptions of the fair wage effort hypothesis. In the BGE and the GEM effort is positively correlated with wages and there is no tendency for this to decline over time. At the aggregate level the higher wages in the BGE and GEM elicited higher effort provision. Tobit regressions found a positive, stable and highly significant wage coefficient; the square of the wage was negative in both the BGE and GEM regressions, but only significant in the BGE, indicating a concave relationship in the

BGE, but not the GEM. The inclusion of individual dummy variables found highly significant individual effects; period effect dummy coefficients were found to insignificant, but always had positive slopes which did not vary over periods, indicating no decline in reciprocity over time. These statistical examinations lead to results which conform to Akerlof's (1982) model.

When comparing the results of the three markets; Fehr, Weichbold, and Gatcher (1998) conclude that the high wage in the GEM are not due to high reservation wages, or compensating differentials, and the wage offered in the GEM is a non-competitive wage. The average wages in the GEM are initially significantly lower than those in the BGE, but from period five onwards it is difficult to see any difference; the conclusion is that the wage depressing effects of competition are only temporary.

In addition to investigating the above questions Fehr, Weichbold, and Gatcher (1998) also examine possible subject pool effects. They compared the results of using a group of soldiers as subjects to the results obtained using students. They found the wages of the students to be lower that those of the soldiers; indicating subject pool differences are present. Hannan, Kagel, and Moser (2002) also found subject pool differences when comparing MBA students and undergraduates; the MBA students provided more effort and received higher wages on average.

To examine what role, if any, the responsibility alleviation effect has on an experiment of this type, Charness (2000) conducted an investigation using the basic model of experimentation. The responsibility alleviation effect states that shifting responsibility for an outcome to an external authority dampens the internal impulse

towards honesty, loyalty and generosity; efficiency and performance may be affected by this. Charness (2000) acknowledges that previous experiments have reported positive wage effort correlation, but have only examined the case when firms determine wages. Charness (2000) examines what effect the determination of wages by a third party, or random mechanism, has on worker behaviour.

The experiment was the same as Fehr, Kirchsteiger, and Reidl (1998), except that the employer could not determine the wage and the employee could not reject the offer. Four sessions were conducted, two in which the wage was determined randomly by a bingo cage drawing and two in which the same random wages were attributed to a third party by the investigators; each employee was only in one of the sessions.

The responsibility alleviation effect, that employees will provide higher effort levels when a wage has been randomly determined than when determined by a third party, is present in the results; high effort provision is much more common in the random wage sessions (Charness, 2002). The conclusion reached by Charness (2002) is that third party intervention has a slight negative effect on the level of effort provided. This may be applied to minimum wage debates; which can be seen as third party intervention in wage setting.

Charness (2004) conducted another experiment which was the same as Charness (2002), but this time included a session in which firms determined wages. The results which show a positive wage-effort correlation across all treatments, but with much higher coefficients in the employer determined wage treatment than in the random or third party sessions.

To examine the impact that minimum wage and the direction of competition may have on the behaviour of participants in the experiment, Brandts and Charness (2004) conducted an experiment consisting of 16 sessions; twelve of which were multi-period sessions and four one shot sessions. Of the twelve multi-period sessions four had an excess supply of firms (ESF), four contained and excess supply of workers (ESL) and four had a minimum wage with an excess supply of workers (MW). The range of wage and effort levels was limited to (0,10), in the absence of a minimum wage, and to (5,10), in the presence of minimum wage (min wage = 5). The one shot games had different payoff functions, than the multi-period sessions, to offset the different payouts subjects would receive at the end of the session. The conduct of the sessions was the same as the basic design (Fehr, Kirchsteiger, and Reidl, 1993).

The results of the experiment show that patterns in the ESF and ESL are similar, with a modal outcome of wage = 10 and effort = 10. With the addition of minimum wage, the MW session, the number of times a wage of 10 is offered drops dramatically. In the ESF and ESL session the effort provided rarely exceeded the wage offered and in the final period there was a substantial drop in both. Random effects ordered probit regressions, including wages along with period and treatment dummies, had significant positive wage coefficients and significant negative period coefficients, for the final two periods, in all sessions. Differences in wages between the ESL and the ESF are small and not significant. When comparing the ESL and MW regressions there is no significant differences in wages when considering all levels of wage, but when examining wages of at least 5, the wages in the ESL are

higher; overall effort is also lower in the MW sessions when comparing wages of at least five.

Differences in competitive direction are found to play a very small role in this experiment. This is consistent with Akerlof's (1982) theory and the results of previous experiments, which find a high degree of gift exchange despite competitive pressure. The imposition of a minimum wage was found to have an effect, a negative effect on effort provision and wages. This conforms to Charness (2000) and the responsibility alleviation effect; third party intervention, in the form of a minimum wage, reduces the degree of gift exchange.

Seeking to examine the role that intentions may play in the labour market, Charness and Levine (2003) designed and implemented an experiment that allows for the intentions of firms to enter prominently in the choice of the workers effort. This experiment is inspired from the concepts of procedural and distributive justice. Distributive justice is concerned primarily with the outcome of a situation while procedural justice is also concerned with the path that has arrived at the outcome. To illuminate these concepts further Charness and Levine (2003) present a comparison of murder and manslaughter. While both these criminal charges spring from the same situation, a taken life, the intentions of the perpetrators in both situations are very different. Distributive justice would make no distinction between these two crimes. Procedural justice would note a very relevant difference and this is reflected in the possible sentences for these crimes.

To incorporate this concept into an experimental labour market Charness and Levine (2003) included the possibility of business conditions changing after the wage

offer has been made. The firms offered either a high or low wage and then the flip of a coin determined whether the condition was favorable or unfavorable. Favorable conditions increased the wage and unfavorable conditions decreased the wage. Two sessions were run, one in which the business conditions did not affect the firms payoff and one in which they did. This presents two paths in which the wage to the worker is the same: high wage and poor conditions; and low wage and good business conditions. The degree to which the effort choices differ between these two situations would indicate the relevance of the firm's intentions in the labour market.

Charness and Levine (2003) find that the wage itself is related positively to effort, similar to the previous experiments, and that there is a significant difference in effort between the two paths leading to the same wage. This indicated that the intentions of firms, in the wage setting process, are taken into account by the worker when making a effort choice decision.

Coworker wages are an important part of the reference wage theory. When making a comparison to evaluate the fairness of their wage the first place a worker may look is the wages that others in the firm are being paid. It is easily the most available and easy comparison to make. Charness and Kuhn (2004) extended the basic experimental labour market design to allow for two differently productive workers to be employed by each firm.

The pair of workers employed by each firm entered differently into the firm's payoff function, this is where the difference in productivity is made. The more productive worker provided a higher payoff to the firm, than the lesser productive one, for the same wage offer. The firm knew which worker was the more productive

one, but the pair of workers knew only that one was differently productive than the other, not which one was more productive. The payoff functions and the cost of effort table were the same for all workers. Two different sessions were run with this same structure, the difference being that wage offers in the first were private knowledge and in the second were public. This was to observe whether wage secrecy may influence the firms wage offers.

The results of the experiment indicate that workers are far more concerned with their own wages than those of their coworkers. The wage of coworkers had no significant influence on the effort decisions of the other worker. The workers own wages had a significant positive effect, similar to the previous experimental findings. The firms were more likely to compress the wages when they were public knowledge than when they were private, mirroring the common practice of firms to institute wage secrecy. In this experiment firms may have overestimated the workers reaction to wage differentials.

These experiments all derive their design from Fehr, Kirchsteiger, and Reidl (1993), but differ in certain ways to examine varying aspects of the labour market and Akerlof's (1982) theory. One common result is that the experiments generated data which is consistent with the Fair Wage-Effort Hypothesis or Partial Gift Exchange Model of the labour market. These experiments also have their own critics and detractors, who raise a number of relevant points regarding the validity of the data generated by the experiments. A number of these points have been examined directly using modifications of the basic design, these investigations are detailed in the following section.

2.4 Experimental Investigations of Design Criticisms

The first of these objections to be addressed was that the presence of the experimenters, in the lab, causes the participants to act more generously than they would under complete anonymity; a feature that may be more common in reality. Rigdon (2002) implemented an experiment, using computers, which allowed for complete anonymity in the transactions. The lack of a presence of investigators in the lab is meant to model a situation under which the firm finds it to costly to observe worker effort and output; this is stated, by Rigdon (2002), to be a reality that many firms face. Another criticism that is acknowledged by this study, is that the marginal cost of effort provision used previously was too low. The marginal cost structure used in this study was much more restrictive.

The results have wage and effort levels converging to the minimum levels predicted by the neoclassical theory. Employees tend to shirk on agreements; the firm initially attempts a more efficient outcome, offering high wages, and when experiencing low levels of effort, reverts to offering low wages. This is the only study, mentioned in this paper, which finds results not conforming to the predictions of the fair wage effort hypothesis.

To examine the objection that the stake sizes were to low, Fehr, Fischbacher, and Tougavera (2002) conducted an experiment, in Russia, in which session payouts of around three times the participants' monthly incomes were made; the basic one sided oral auction design was used. Contrary to the critics' objections, large stakes

led to outcomes similar to the other experiments, which contained relatively small stakes. Gift exchange still occurred, in sizeable amounts, despite the fact that the transactions were very costly to the participants. High stakes did not undermine the effect that fairness may have on the behaviour of participants (Fehr, Fischbacher, and Tougavera, 2002).

Uri Gneezy (2003) addressed the criticism that real effort provision would change the results; the previous experiments involved simply choosing a level of effort from a cost table. The workers were required to provide real effort in the form of solving mazes on a computer, though how much this may be real effort is debatable. The results of this experiment, a substantial positive relationship between wages and effort, are similar to other experiments. The choosing of a numerical effort level, instead of providing real effort, may therefore be a reasonable one.

Charness, Frechette, and Kagel (2004) conducted an investigation which examined the effect that including a payoff calculation table, as in Hannan, Kagel and Moser (2002), might have on the experiment. The inclusion of the table was found to reduce the average wages and average effort even more. The inclusion of a payoff table may therefore bias the results of the experiment upward and should be avoided in future experimentation.

The ability of the experimental design to address the objections made to its results, through modifications to the design, is a very advantageous feature of its construction. This allows for a number of criticisms to be discounted or proven sound, and have been, as in the above experiments.

2.5 Survey Investigations

Instead of conducting a laboratory experiment to study the relationship between wages and productivity, Bewley (1999) conducted a series of interviews with various managers and C.E.O.s in the northeastern United States. These interviews were conducted during the early 1990's when the U.S. was in the middle of a recession. The main finding of Why Wages Don't Fall In A Recession (Bewley, 1999) is that the wage rigidity stems from a desire to encourage loyalty for the firm among the workers.

Bewley's (1999) interviews uncover the beliefs that managers have about the importance of wages in productivity. Wages chiefly affect the morale of workers. Morale can be defined as "...emotional attitudes towards work, coworkers, and the organization." (Bewley, 1999). If low wages are harmful to morale, and low morale harms productivity, then low wages will harm productivity. Of course the definition of low wages depends on the wages of those in the workers reference group and Bewley (1999) addresses this by questioning the managers as to the importance of internal and external wage equity. Internal wage equity is noted as very important by the managers, as it has a large effect on morale. External wage equity has a lesser effect on morale. Managers maintain that external wage equity is primarily important for its effects on turnover, recruitment and the quality of labour hired, it has little effect on morale. This may be explained by the high degree of firm specific jobs that make market comparisons difficult, labour unions and close knit communities may overcome this difference, but this extends to only a small fraction of the labour force

(Bewley, 1999).

Bewley's (1999) findings are in line with the Fair Wage-Effort Hypothesis put forth by Akerlof (1982); higher wages exhibit a positive influence on productivity through their positive effect on morale. Internal and external equity, which are factors in the workers reference set and are used in evaluating the fairness of the wage, have the same effect as noted by Akerlof (1982), though external wage equity seems to play a far lesser role.

To examine the effects of differences in wages on workplace attitudes and behaviors Levine (1993) conducted a survey of over 8000 employees in nearly 100 companies in the U.S. and Japan. Similar to the use of interviews by Bewley (1999), Levine (2003) used a survey composed of various questions regarding the workers happiness with their job and pay and their perceptions of the fairness of their situation.

The resulting data indicates that pay equity affects performance, absenteeism and turnover; also workers who receive high wages are less likely to quit, are more satisfied with their pay, and report that they work harder than they have to (Levine, 2003). Like Bewley (1999), Levine (2003) finds that within organization comparisons are much more important that between firm comparisons.

Levine (2003) also examines whether the effect of a higher than average wage has the same effect as a lower than average wage. In other words, do overpaid workers experience the same level of discomfort that similarly underpaid workers do? In the U.S. data there is no evidence that this is true, virtually no Americans view themselves to be overpaid. In the surveys from Japan however, workers who are

highly paid compared to others in the plant appear to experience discomfort, they do enjoy being paid more than similar workers in other plants though. Levine (2003) notes that this conforms to the old Japanese saying; "the nail that stands out gets hammered down."

These results of Bewley (1999) and Levine (2003) were achieved through the use of survey data, a method that is usually disparaged by experimental economists. The common complaint made about survey data is that the subjects may respond falsely to the questions asked of them if the answer allows the subject to present themselves in a more favorable light than their actual behaviour would present. For example, a subject may report that they work harder than they actually do since the culture views a hard work ethic as favorable. Another common complaint of survey data is that there are no incentives for the subjects to behave as they would in the real world. The monetary payment to the subjects, if one exists[5], is not tied to their performance or decisions they make during the course of the experiment. Bewley (1999) suggests that the relation between circumstances and claimed motivation be examined to aid in controlling for this problem.

It would be interesting to examine whether results similar to the experimental laboratory experiments mentioned above could be achieved using a survey format while remaining as close as possible to the initial experimental design developed by Fehr, Kirchsteiger and Reidl (2003).

The size of the relationship between wages and effort estimated in the experiments is also an important. Is the relationship not only statistically significant but also economically significant? The size of the coefficients in the various

[5] There may be a flat payout to subjects for completing the survey.

experiments seems to be large enough to be of some importance. If the coefficients were statistically significant but too small to make any noticeable impact on the economy they would be of no use. The relationships found previously indicate that this is not the case; the effect of wages on effort is large enough to be of interest. The relationship is strong enough that high wages need not lead to higher production costs for the firm; they are offset by increased productivity. The higher wages can lead to a situation in which there exists involuntary unemployment, which is not possible under neoclassical assumptions. Any policies formed under the assumption of only voluntary unemployment could therefore have detrimental effects on the economy and its population.

The survey used in the investigation presented in this thesis attempts to examine this question of replication along with the addition of a few new or previously unimportant variables to the hypothetical labour market and remain comparable to the previous experimental investigations. These new variables include an unemployment benefit, knowledge of co-worker wages, high probability of detection of low effort provision, and individual subject characteristics. The details of the methodology of the survey and the motivation for the inclusion of the mentioned variables are given in the next chapter.

Chapter 3: Methodology

The motivations for the investigation and the particular methods used to carry out the experiment are detailed in this chapter. Reasons for the inclusion of the examined variables and their importance to Akerlof's (1982) Fair Wage-Effort Hypothesis are given. Descriptions of the variables and the predicted effects these variables may have are also noted with reference to the predictions of Akerlof's (1982) theory and the results of previous experiments.

3.1 Motivations

The aim of this experiment is to examine the relationship that may exist between wages and effort when the structure of the underlying labour market changes. The changes that are examined are the addition of an unemployment benefit, the additional knowledge of co-worker wages, and the presence of close personal work supervision. Individual subject characteristics, such as gender and age, are also important variables in this investigation. These variables have not been included or found to be of significance in previous experiments. The experiment also attempts to examine these features using a survey or questionnaire format instead of the lab experiment used in previous investigations.

The Fair Wage-Effort Hypothesis predicts a positive relationship between wages and effort. The previous experiments, with the noted absence of Rigdon (2002), have all found a positive relationship to exist between wages and effort

choice. The main difference between this investigation and the others is the use of a survey instead of a lab experiment.

The presence of an unemployment benefit has not been previously implemented in an experimental labour market. This may be to the possible complexity involved in constructing an easily understandable experiment involving an unemployment benefit. Unemployment benefits are a feature of the reference wage, as detailed in Akerlof (1982), and figure importantly into the employee's evaluation of the degree of fairness the wage they currently receive; this then figures into the amount of effort they would chose to put forth. Receiving an unemployment benefit is an alternative to maintaining employment and the theory predicts an increase in unemployment benefits would erode the effort put forth by the employee. This prediction is refuted by Altman (2004b) for a number of reasons: there exists little empirical evidence for the negative effects of unemployment insurance; a number of the negative effects predicted stem from institutional features which do not exist or are limited in reality, for instance the availability of benefits for those voluntarily quit their jobs; and the availability of unemployment insurance reduces the costs of searching for an occupation to which the individual is a better fit, this increases employment length and productivity. This experiment does not allow for a change in the level of the unemployment benefit, only the additional presence of it.

Co-worker wages are another essential component of the reference wage that is included in the investigation. The wages that other workers in the same firm receive are possibly the most important variable, outside of the employee's own wage, considered in the formation of effort. They also are part of the reference wage

in presented by Akerlof (1982). Possible effects that the knowledge of co-worker wages may have on the level of effort choice have been investigated by Charness and Kuhn (2004). They found that the wages of co-workers have no significant effect on the effort choice of workers, though firms tend towards wage compression when these wages are public information. The effects of internal wage equity have also been examined by Bewley (1999) and Levine (1993) who note that internal wage inequity has negative effects on morale and productivity.

The lack of consideration of co-worker wages in Charness and Kuhn (2004) may be due to the way they enter the firm's payoff function; one worker contributed explicitly more to the firm's payoff function than the other worker. The comparisons made in this experiment are with co-workers with similar work experience and education. A janitor is more likely to compare his pay with another janitor than with that of a manager.

Close supervision of workers by managers is a variable that has not been included in other investigations. Rigdon (2002) found that the complete absence of supervision eroded the gift exchange environment and lead to the predictions of the narrow neoclassical model; minimum effort choice and wages. This experiment is concerned with the addition of close supervision of work by superiors. The close supervision variable is included in this survey as a high probability of detection when providing low effort. Ease of low effort detection may lead to an increase in effort provision. It may also lead to lower job acceptance level, as closely supervised work may be considered uncomfortable and undesirable by the subjects. This variable does not figure into Akerlof's (1982) reference wage.

Individual subject characteristics, like gender and age, have not been a concern of previous experiments. When they are included in the investigation, as they are in Charness and Levine (2003), they are found to be statistically significant. The individual subject's age, gender, place of origin, major of study, year of study and employment experience are examined for the possible effects they may have on the wage-effort relationship. While these variables are not included the Fair Wage-Effort Hypothesis, they are included in this investigation.

The use of a survey instead of a lab experiment, to conduct the investigation, is another prominent difference between this and other experiments. Using surveys to investigate economic phenomenon may be discouraged by other investigators, like Friedman and Cassar (2004) or Friedmann and Sunder (1994), for numerous reasons including the absence of financial incentives tied to behaviour and possible false responses.

This experiment allows the examination of whether the results of the previous experiments, a positive relationship between wages and effort, could be replicated in the absence of monetary incentives. Would subjects always respond with high effort choices when there is no cost to providing effort or possible future reward for doing so?

The drawback of the use of a survey is that the analysis is restricted to the behaviour of workers. Effort responses to varying wages are given by the subjects. Other subjects playing the role of firms do not determine the wage offers; all subjects receive the same nine wage offers per market. The survey also excludes the time dimension that is present in lab experiments. The game examined in labs is a repeated

one; a survey does not allow for this. Therefore the analysis of convergence over time, as is often included in other lab experiments, is not possible. Despite these drawbacks the use of a survey is less expensive and simpler to implement than lab experiments.

3.2 Survey Structure

The survey[6] was constructed to be as close as possible to the lab experiments that have been previously conducted to investigate the fair wage-effort hypothesis, while keeping in mind the suggestions of Friedman and Cassar (2004) and Freidman and Sunder (1994) regarding experimental design. Under these suggestions the survey was kept as simple and short as possible and the subjects used were restricted to undergraduates.

The survey was designed in an attempt to remain close to the design of the simulated labour market designed by Fehr, Kirchsteiger, and Reidl (1993), while using a questionnaire format. The survey requires subjects to respond to a wage offer for a hypothetical job with a numerical response. It should be noted that the effort choice being measured is not real effort, it is simply a numerical choice noting the level of effort he subject indicates they would put forth in the situation. In this survey and the previous experiments, with the exception of Gneezy (2003), the effort choice is strictly hypothetical. The hypothetical job in question was one which the subject would expect to obtain upon completion of their degree.

[6] See appendix one for the complete survey used in the investigation.

The numerical responses are defined in the following manner. A response of zero denoted a decline of the wage offer and a response between one and ten denoted an effort level. Table 2 presents the meaning and range of possible numerical responses to a wage offer.

Table 2: Possible Response Choices

0	1 2 3 4 5 6 7 8 9 10
(Decline the offer)	(very low effort……..very high effort)

Wage offers extended from 6 to 22 dollars per hour, even numbers only. This presented nine wage offers per market, or 36 wage offers in total, for the respondent to consider.

The same nine wage offers were presented in four different markets. The first market was characterized by no unemployment insurance, no knowledge of what wages workers in similar positions with similar experience and education are receiving, and a small probability that you may be caught when providing low effort.

The second market includes an unemployment benefit equivalent to receiving a 10$ per hour wage. This may seem to simple an abstraction from the unemployment benefit option available in the real world, but it presents a simple alternative to employment in the artificial labour market presented in the survey. An attempt to present a more realistic benefit may prove to confusing or difficult to implement.

The third market includes knowledge of the wages of co-workers a similar position with similar experience and education receive. In the survey this was set at 14$ per hour.

The fourth market includes a high probability of getting caught providing low effort, as opposed to the low probability present in the first market. This is an attempt to include a high degree of close supervision by managers into the survey labour market. A weakness present in this market is that the cost of being caught shirking is not addressed in the description of the market. Responses in this market may be dependant upon this cost; it is reasonable to assume that the punishment of being fired would have a larger effect than a lesser punishment such as a reprimand or pay reduction. This weakness could be easily addressed through a further refinement of the description of the fourth market regarding the cost of shirking. There also exists the issue of monitoring costs that the firm may incur for observing workers output, but this is an issue for studies examining firm behaviour and the focus here is on worker behaviour.

A number of individual characteristics were also requested of the subjects. These include age, gender, place of origin, employment experience, major and year of study. The employment experience aspect of the survey also includes union and fulltime work experience, as opposed to only part time work experience.

This structure enables the relationship between wages and effort choice to be examined along with the effects that unemployment insurance, knowledge of co-worker wages, high probability of low effort detection and differing individual characteristics may have on this relationship. The first market may be considered as the base market with the other three markets presented one differing feature. Comparison of the second, third and fourth markets with the first will be the concern of the analysis.

The subject pool was restricted to undergraduates at the University of Saskatchewan. Undergraduates present a good choice for subjects because of easy access, low opportunity cost, steep learning curve, and that they seldom know much about your hypothesis (Freidman et.al., 1994, 2004).

Once the survey structure was finalized an application for ethics approval was presented to the University of Saskatchewan Behavioural Research Ethics Board[7] and approval with minor modifications was granted on October 25th 2005. The requested modifications were made and submitted the following week.

3.3 Surveying Process and Recruitment

To detect any possible problems with the survey a pilot session was conducted on November 28th. There was some confusion generated by the layout of the survey so minor layout modifications were made and the final survey was implemented over a number of days in February and March.

Recruitment methods used included the placement of posters in various locations about the University of Saskatchewan and classroom announcements or poster distribution in the days preceding the experiment[8]. The poster placed around campus and the poster distributed among students was the same. Due to the lack of subjects obtained through these methods, no volunteers were generated by these methods on the first day of experimentation, other methods were necessary to gather

[7] For complete application documents and approval certificate see appendix one.
[8] See appendix one for recruitment posters used.

subjects.

Approaching potential subjects outside the classroom used for experimentation and asking if they wished to fill out a short survey was used as a method of recruitment on February 22nd and March 8th. If the potential subject desired more information about the survey the recruitment poster was shown to them and any questions regarding the survey were answered.

Classroom visits were also used to generate completed surveys. The following Economics classes were visited: Economics 417 on February 22nd; Economics 214 on February27th; and Economics 227 on February 28th.

All experiments were conducted between the hours of 11:00 a.m. and 1:30 p.m. in order to control for possible time of day effects. The classrooms were all located in the Arts building classroom wing and had similar layouts and seating. In total these methods yielded 83 completed surveys, four had to be discarded due to incorrect completion. No monetary payment was given to any of the subjects for their participation.

All sessions were conducted in the same manner. Participants were given a consent form and survey form which they were asked to read over carefully and complete. It was also made clear that clarifying questions were acceptable. Participants were provided with a pen if they had none. Consent forms and surveys were stored separately and not examined until after the session was completed, as to ensure anonymity.

3.4 Sample Size Selection

When sampling it is necessary to determine an optimal sample size given your choice of the level of significance and the maximum allowable difference between the population and the sample means. This is done to restrict the possible sampling error that may occur. To compute the optimal sample size I have used a formula given in Desu and Raghavarao (1999) derived from the binomial distribution[9]. This reflects the binomial nature of the response to the various wage offers presented in the survey; subjects respond to a wage offer with a choice of accept or decline.

Optimal Sample Size Formula

$$n^* = \frac{z^2_{\alpha/2}}{4D^2} + 1$$

Where

$n^* =$ the optimal sample size

$\alpha =$ the chosen level of significance

$z^2_{\alpha/2} =$ the corresponding statistic from the normal distribution

$D^2 =$ the square of the maximum allowable difference

Using the above formula and opting for a level of significance of 0.05 and a maximum allowable difference of 0.1 the optimal sample size is 97. Due to the difficulty in finding subjects for the survey a compromise was made in the choice of the level of significance. The level of significance was now taken to be 0.1; the maximum allowable difference was the same. This new level of significance

[9] Optimal sample size was also calculated using a formula given in Desu and Raghavarao (1999) derived from the normal distribution. This was done to incorporate the possible range of responses to the wage offers presented in the survey; beyond a choice of accept or decline, the subjects also choose a level of effort in the event they accept the wage offer. The optimal sample size calculated in this manner was less restrictive than the one used above.

generates an optimal sample size of 69. The sample obtained in the implementation of the surveys yielded 83 respondents. This exceeds the restriction on optimal sample size and therefore satisfies the conditions it puts forth.

Other studies have used sample sizes ranging from 58, in Fehr, Kirchsteiger and Reidl (1998), to 306, in Brandts and Charness (2004). The sample size of 83 used in this thesis is in the lower range of the previous experiments, but satisfies the conditions set forth by the formula above. It may be taken as a reasonable sample size given the degree of sampling error specified in the formula.

It should also be noted that this sample was not generated using probabilistic sampling and the results should therefore not be taken as representative of the entire population. This weakness is also present in all the previous experimental studies which used student populations as their sampling group; this study and the others all face possible external validity issues. At worst this survey and the other experiments could be taken as case studies. An advantage of the design of this survey and the lab experiments it was derived from is it could easily address these questions of external validity through replications with other more representative populations. There is nothing in the design that precludes the use of other populations.

3.5 Model and Descriptions/Predictions of Variables

This section presents the model used to examine the relationship between wages and effort along with the other variable included in the survey and subsequent analysis. A description of the variables is then given. This is followed by a listing of the reasons for their inclusion and the possible effects they may have on the wage effort relationship.

3.5.1 The Model

$$Y = \alpha + BX$$

Where
Y = the dependant variable effort
α = a constant
B = a vector of the coefficients on the independant variables
X = a vector of the independant variables

The variables used in this functional form are specified and defined in Table 3 presented below.

Table 3: Definition of Variables

Variable	**Definition**
EFFORT	Effort level choice: range 0-10 (dependant variable)
ACCEPT	Dummy variable for effort (Decline = 0; Accept = 1) (dependant variable)
WAGE	The wage offer presented to the subject: range 6-22, even numbers
AGE	Age of the subject
FEMALE	Dummy variable for gender (Male = 0; Female = 1)
OUTOFPROV	Dummy variable for place of origin (In province = 0; Outside of province = 1; Outside of Canada = 0)
OUTOFCANADA	Dummy variable for place of origin (In province = 0; Outside of province = 0; Outside of Canada=1)
NONECONMAJOR	Dummy variable for area of study (Economics = 0; Other = 1)
YEAROFSTUDY	Subjects year of study: range 1-4
EMPLOYMENTEXP	Dummy variable for employment experience (No previous

	employment = 0; previous employment = 1)
UNIONEXP	Dummy variable for union experience (No previous union employment = 0; previous employment with unions = 1)
FULLTIME	Dummy variable for fulltime employment (Part time employment only = 0; fulltime employment = 1)
EIOPTION	Dummy variable for observation's market location (Observation from market one = 0; observation from market two = 1; observation from market three = 0; observation from market four = 0) further defined as EILOWEROREQUAL (if wage offer is equal to or lower than 10 then =1, 0 otherwise) and EIHIGHER (if wage offer is higher than 10 then=1, 0 otherwise).
COWORKERWAGE	Dummy variable for observation's market location (Observation from market one = 0; observation from market two = 0; observation from market three = 1; observation from market four = 0) further defined as WAGELOWER (if wage offer is lower than 14 then=1, 0 otherwise), WAGEEQUAL (if wage offer is 14 then=1, 0 otherwise) and WAGEHIGHER (if wage offer is larger than 14 then=1, 0 otherwise).
SUPERVISION	Dummy variable for observation's market location (Observation from market one = 0; observation from market two = 0; observation from market three = 0; observation from market four = 1)

3.5.2 The Base Group

The dummy variables define the base group as observations located in market one made by male subjects from Saskatchewan, majoring in economics, with no previous employment experience. The dummy variables, with the exception of EMPLOYMENTEXP, were chosen to reflect the personal characteristics that occur with the highest frequency. EMPLOYMENTEXP was defined as it is because the effect of previous employment on effort provision is the variable under consideration, not the effect on effort of no previous employment experience. The market dummy variables were defined as they are, with market one as the base market, because the relevant comparisons to be made are those between the first market and the other

three. Market one is marked by the absence of the three features that the other three markets each add separately. Comparisons made between the second to fourth markets would not make sense.

3.5.3 Descriptions and Predictions

The points that follow present descriptions of the variables and predictions made as to their effects on the dependant variable, effort, and the relationship between wage and effort.

- **EFFORT** is the dependant variable in the model. It is the effort level that the subject decides to choose, not real effort, when offered a particular wage. The possible choices range from 0 to 10; with 0 indicating a decline of the wage offer and 1 to 10 representing increasing effort.
- **ACCEPT** is another way of representing the dependant variable EFFORT. It is a dummy variable taking on the value 0 if the subject declines the job, effort choice of zero, and 1 if the subject accepts the job, effort choices of 1 through 10. This variable is defined to reflect the possible two stage choice made when considering a wage offer. First the subject decides whether or not to accept the job and second they decide on a level of effort to provide.
- **WAGE** denotes the wage offer that the subject considers when making their effort choice and is a continuous variable. It ranges from 6 to 22, even numbers only. This range was chosen to keep the survey understandable and to reflect the possible range of earnings that a typical undergraduate may expect upon graduation. The relationship between wages and effort in Akerlof's (1982) theory is a positive one and previous experimental studies

have found this relationship to be valid. The same relationship is expected to be found here, as stated in hypothesis A. In addition to this positive relationship, the square of the variable WAGE is expected to have a negative coefficient; the wage effort relationship is expected to be concave.

- **AGE** is the age of the subject and is a continuous variable. No previous studies have explicitly included the age of the subjects, Hannan et.al. (2002) may have captured some age differences when examining different subject pools that would expectedly have different ages; undergraduates and M.B.A. students. AGE is expected to have a small positive coefficient. This is predicted because as a subject ages they may gain more experience as to how in the labour market higher effort may be rewarded by higher wages.
- **FEMALE** is a dummy variable denoting the gender of the subject. In previous studies the gender of the participants has not been included in the analysis, with the exception of Charness and Levine (2003), who found the female dummy variable to have a small, negative and statistically insignificant effect. The fair wage-effort hypothesis (Akerlof, 1982) has no predictions pertaining to gender. The variable was included in the analysis to control for some of the differences in subject population and to investigate a possible effect on the wage effort relationship that has mostly been left out of previous studies. A study conducted by Eckel and Grossman (1998) found women to behave less selfishly in dictator games than men. Contrary to the results of the dictator game findings, no statistically significant coefficient is predicted for this variable.

- **OUTOFPROV** is a dummy variable representing the subject's place of origin. It is used to examine the possible effect that cultural differences may have on the effort wage relationship. Different cultures may have differing attitudes towards work and different countries may have labour markets that operate differently. Fehr, Fischbacher and Tougavera (2002) compared the results of an experiment using Russian subjects to one using Austrian subjects. They found no statistical difference in the behaviour of the two subject pools. The fair wage-effort hypothesis (Akerlof, 1982) makes no predictions as to the effect of place of origin. No statistically significant effect is predicted for this variable due to the predictions of the theory and the results of previous studies.
- **OUTOFCANADA** is another dummy variable used to represent place of origin. Similar to the OUTOFPROV variable no statistically significant effect is expected based on cultural differences. A possible source of difference, outside of a cultural one, may be expected due to subject's native language differences and difficulty in understanding the questions asked of them in the survey. No statistically significant effect is expected for this variable for the same reasons mentioned in the discussion of the OUTOFPROV variable.
- **NONECONMAJ** is a dummy variable used to include the effects that a subjects educational background might have on the wage effort relationship. It takes the value 0 if the subject is majoring in economics; this includes business and agricultural economics. Educational background has previously been examined in a study conducted by Hannan, Kagel and Moser (2002).

They found that M.B.A. students provide a higher level of effort in the experiment than undergraduate students, in the experiment presented in this thesis all the subjects are undergraduates. This variable was included to account for possible exposure to efficiency wage theory. Subjects who have knowledge of the theory under examination may unconsciously or consciously record answers conforming to what they know the theory predicts. In this case they might provide higher levels of effort for a given wage than a subject who has no knowledge of the fair wage-effort hypothesis. Frank, Gilovich and Regan (1993) have investigated whether the study of economics reduces cooperation in laboratory games. Does the study of theory which models economic actors as selfish induce that behaviour in laboratory subjects? Frank, Gilovich and Regan (1993) have found that it does tend to reduce the level of cooperation. For this reason a positive coefficient is expected for this variable.

- **YEAROFSTUDY** is a continuous variable taking the values 1 to 4. This variable has not been included in previous studies which use undergraduates as subjects. A small negative coefficient is expected. As a student progresses through their educational program they may develop a more concrete expectation of what kind of wage they may expect to find in the job market. This would then lead them to expect a higher wage for a given level of effort, resulting in a negative coefficient on the YEAROFSTUDY variable.
- **EMPLOYMENTEXP** is a dummy variable capturing the employment experience of the subject in question. This variable has not been under

examination in any previous studies nor is it mentioned in the fair wage-effort hypothesis (Akerlof, 1982). It is expected to have a small positive coefficient. A subject with workplace experience has a better understanding of how the workplace operates and how effort may be rewarded with higher wages. This is the same reason given for the prediction of a small positive coefficient on AGE.

- **UNIONEXP** is a dummy variable noting whether or not the subject has had experience in a union job. No previous studies have included this variable nor does the fair wage-effort hypothesis (Akerlof, 1982) include it. It is predicted to have a small negative coefficient. Union employees usually have more effective and rigid procedures for complaints related to the workplace than non union employees do. Rules related to punishing employees for shirking are specified and common knowledge; they cannot be dismissed as easily as non union employees. Union employees may therefore provide lower effort for a given wage than a non union employee, as they have knowledge the exact consequences of their actions. In order to avoid a prediction in which the individual has no employment experience and union experience, an impossible combination, the variable is entered into the regression as UNIONEXP*EMPLOYMENTEXP; this will negate that situations possible existence.
- **FULLTIME** is a dummy variable relating whether or not the subject has had fulltime employment. It has not been included in any previous studies and is

not included in the fair wage-effort hypothesis (Akerlof, 1982). No statistically significant effect is expected for this variable.

- **EIOPTION** is a dummy variable used to capture the possible difference that may occur between market one, the base market, and market two, the market with the unemployment benefit feature. No previous studies have included this variable. In order to account for the possible different effects of wage offers being above or below the benefit the dummy variable is separated into two dummy variables; EILOWEROREQUAL, for wage offers lower than or equal to the benefit, and EIHIGHER, for wage offers higher than the benefit. It is part of the fair wage conception in the fair wage-effort hypothesis (Akerlof, 1982). Increasing the level of unemployment benefits available raises the wage the employee considers fair and lowers the effort level an employee puts forth holding their wage constant. It is therefore predicted to have a negative coefficient. This is the prediction of hypothesis B.
- **COWORKERWAGE** is a dummy variable used to examine the differences that may occur between market one, the base market, and market three, the market which includes knowledge of coworker wages. This has been included in a previous experiment conducted by Charness and Kuhn (2004). In their study no statistically significant effect was found. In order to examine the possible effect of wages offers being above, equal or lower than the co-worker wage, the market dummy was separated into three dummies: WAGEHIGHER for wage offers above the co-worker wage; WAGEEQUAL for wage offers equal to the co-worker wage; and WAGELOWER for wage offers below the

co-worker wage. Wage inequity in the fair wage-effort hypothesis (Akerlof, 1982) has a negative effect on the effort an employee provides for a given wage. Even though no significant effect was found in a previous study, a negative effect is expected in this thesis. This is the prediction of hypothesis C.

- **SUPERVISION** is a dummy variable used to compare market four, the market with a high probability of being caught providing low effort, with market one, the base market. It has been examined previously by Rigdon (2002) who found that, in the absence of supervision, wages and effort reverted to the neoclassical predictions of the lowest effort levels and wages possible in the experiment. The level of supervision is not part of the fair wage-effort hypothesis (Akerlof, 1982). In this study it is predicted to have a small positive coefficient. Facing a high probability of being caught providing low effort the employee may increase the level of effort for a given wage relative to facing a low probability. This is the prediction of hypothesis D.

These predictions are compared to the actual results of the survey in the next chapter, which examines the data using descriptive statistics and econometric analysis. Attention is paid as to whether or not the survey data conforms to the fair wage-effort hypothesis and the predictions made above; this includes the Hypotheses outlined in the introduction.

Chapter Four: Results

This chapter presents a summary and analysis of the results of the survey. The first section is devoted to descriptive statistics and interpretations of the results. This includes statistics which describe the features of the sample used and an investigation into the differences between the four markets.

The second section is an econometric analysis of the data. This analysis is separated into two subsections: the first pools all the data into one market, with dummy variables to capture market differences; the second groups and analyzes the data in separate markets. In this section the two econometric models used to examine the data, the ordinary OLS model and the conditional model, will be described and their results interpreted. Attention will be paid to the size of the coefficients in addition to their statistical significance. The elasticity of effort with respect to wages and its conformity to the Solow (1979) condition is also examined.

4.1 Descriptive statistics

4.1.1 Description of the Sample

To examine the composition of the sample used in this investigation the means, modes and standard deviations of the variables were calculated. These statistics are presented in Table 4 below.

Table 4: Descriptive Statistics

Variable	Mean	Mode	S.D.
EFFORT	5.193775	6	3.678801
ACCEPT	0.770080	1	0.420851
WAGE	14.000000	14	5.164842
AGE	22.975900	22	3.318909
FEMALE	0.373494	0	0.483813
OUTOFPROV	0.144578	0	0.351734
OUTOFCANADA	0.289157	0	0.453447
NONECONMAJOR	0.530120	1	0.499175
YEAROFSTUDY	2.831325	3	0.916133
EMPLOYMENTEXP	0.795515	1	0.403392
UNIONEXP	0.240964	0	0.427740
FULLTIME	0.469880	0	0.499175
EIOPTION	0.250000	0	0.433085
COWORKERWAGE	0.250000	0	0.433085
SUPERVISION	0.250000	0	0.433085

From Table 4 it can be seen that the means of the dummy variables, with the exception of NONECONMAJOR and EMPLOYMENTEXP, are all less than 0.5. This shows that the base group chosen represents the most common occurring subject. The variables NONECONMAJOR and EMPLOYMENTEXP were chosen in the manner they are so that their coefficients could be interpreted as the effect of their presence, in contrast to the effect of their absence. The means of the dummy variables used to capture individual subject characteristics show the percentage of the sample which contains that characteristic. For example, he mean of FEMALE shows that

37.3494% of the subjects used were women and the mean of NONECONMAJOR shows that 53.012% of the subjects had majors other than economics.

The dummy variables EIOPTION, COWORKERWAGE and SUPERVISION all have a mean of 0.25. This demonstrates that every market has the same number of observations; in the survey all subjects were exposed to each market and each market had the same number of wage offers.

The continuous independent variables WAGE, AGE and YEAROFSTUDY have means of 14, 22.9759 and 2.831325. The mean of AGE is in the range of typical undergraduate ages, possibly towards the higher end of undergraduate ages. The YEAROFSTUDY mean illustrates that the sample used is made up proportionally more upper year undergraduates. It is higher than 2.5 which is the middle value of the possible range of values which YEAROFSTUDY contains. The mean of wage does not have much of an interpretation here; it is constructed artificially to be used in the survey.

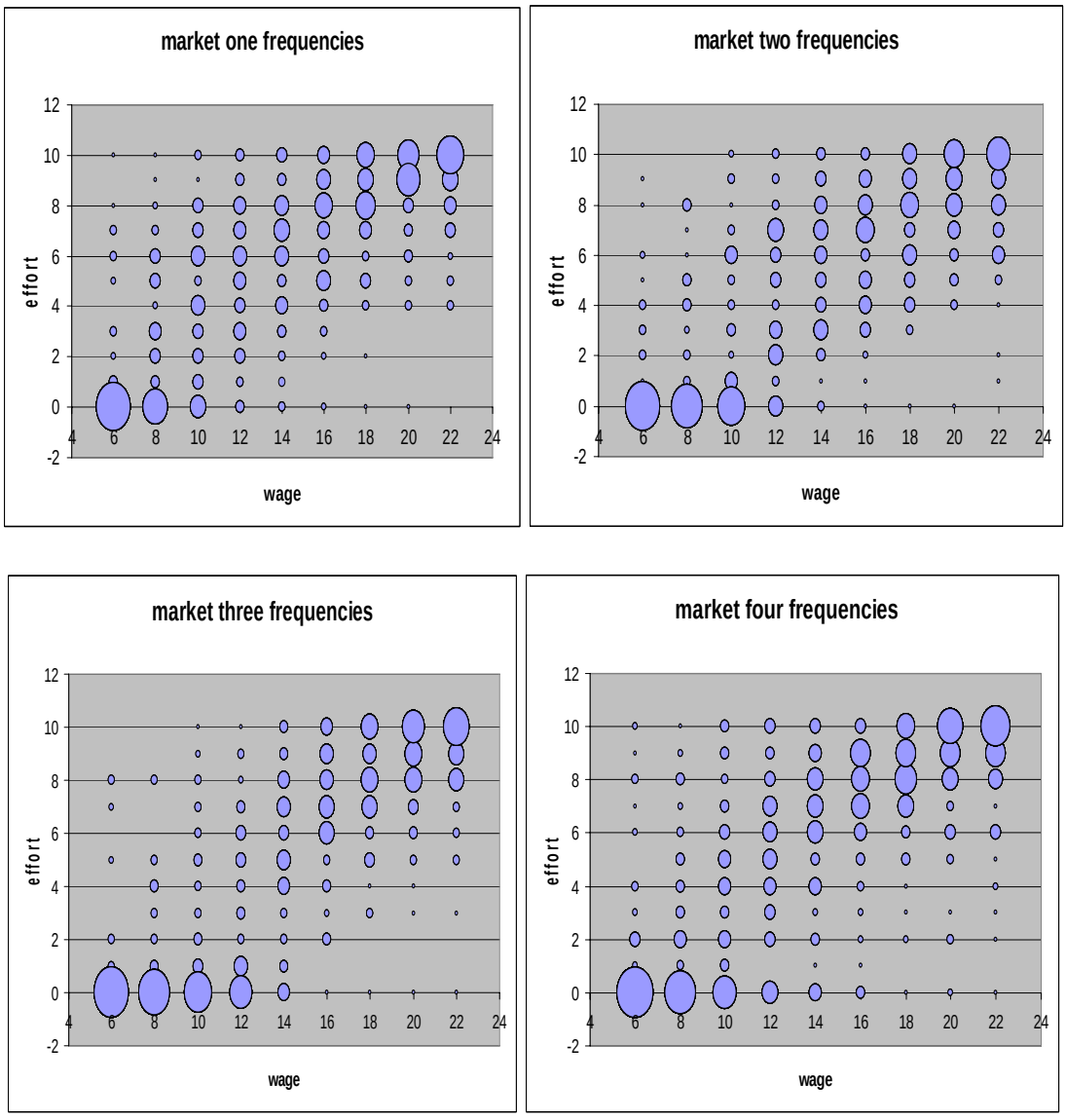
These descriptive statistics illustrate the structure of the sample that the experiment used. More interesting statistics involve the responses to the wage offers that the survey generated. These are examined in the following sections.

4.1.2 Graphical Analysis

This subsection deals with the effort responses to the wage offers the survey presented to the subjects. An initial investigation into the wage-effort relationship, and the effect that the four markets have on the relationship, is conducted by plotting the frequencies of the various possible effort-wage pairings and examining the

resulting graphs. These frequencies are presented in Graph 1 below. Observations are separated into the four markets used in the survey.

Graph 1: Frequencies of Effort-Wage Pairings



The most immediately recognizable feature of the resulting graphs is positive wage-effort relationship in all four markets. A visual line drawn through the scatter of the observations has a positive slope, though there is much variation around this line.

In order to properly examine these graphs attention must be paid to the size of the bubbles.

The size of the bubbles notes the frequency of that effort-wage pairing; a larger size notes a higher frequency. The size of the frequency bubbles reveals more about the relationship than a simple scatter plot does. The bubbles still illustrate a positive relationship, but they additionally show a concentration of observations near the pairings of (0,6) and (10,22). This concentration occurs in all four markets. This may occur because of the structure of the survey; wage offers range from 6 to 22 and effort responses range from 0 to 10. This demonstrates that subjects are more undivided in their responses at the corners of the possible pairings than they are in the middle. Though there remains a positive visual relationship, the size of the bubbles is smaller and more spread out in-between the corners. In other words subjects have more common responses at extremes than between these extremes. The spread of the responses increases between the two corner pairings. This illustrates that subjects have less in common in their choices between the corners. Firms offering wages at the low and high ends of the wage spread can be surer of the level of effort they can expect workers to input. Wages offered in the middle range have a larger range of corresponding effort values, firms can not be as sure of the level of reciprocation they can expect for a wage increase in the middle range. Firms desiring a high level of effort input may have to offer wages at the high end of the range to ensure a corresponding high effort level. If firms a very risk averse this may lead to high and low wage sectors of the economy, with firms sorting themselves into either sector depending on whether they require high or low effort inputs.

The concentration at (0,6) may also follow from the wage offer of 6 being below the minimum wage in Saskatchewan and the rest of Canada. The occurrence of some acceptances at the wage offer of six may reflect a lack of knowledge of the labour market or differences in the labour markets of Canada and foreign countries; 28.9157% of the subjects come from outside of Canada

In examining the differences and similarities that exist between the four markets the most prominent similarity is a positive wage-effort relationship. The four markets all exhibit increasing effort responses when increasing the wage offers. This is in line with the predictions of Akerlof's (1982) model and Hypothesis A. Previous experiments have also found a positive wage-effort relationship, with the exception of Rigdon (2002).

The differences between markets may be seen in the size of the bubbles. The bubbles in all four markets are similar at the upper right corner, but differ in the lower left corner. Market two has more persistently large bubbles along the 0 effort line than market one. The bubbles stay reasonably large until a wage of 12, as opposed to market one where they stay large until a wage of 10. For example, it is more common to decline a wage offer of 10 in market two than in market one. This is due to the possibility of an unemployment benefit, equivalent to a wage of 10, in market two. Market three also has more persistently large bubbles along the 0 effort line than market one. The bubbles in market three stay reasonably large until a wage offer of 14. For example, it is more common to decline a wage offer of 12 in market three than in market one. This is due to the knowledge of coworker wages present in market three; the subject knows that similar workers are being paid a wage of 14.

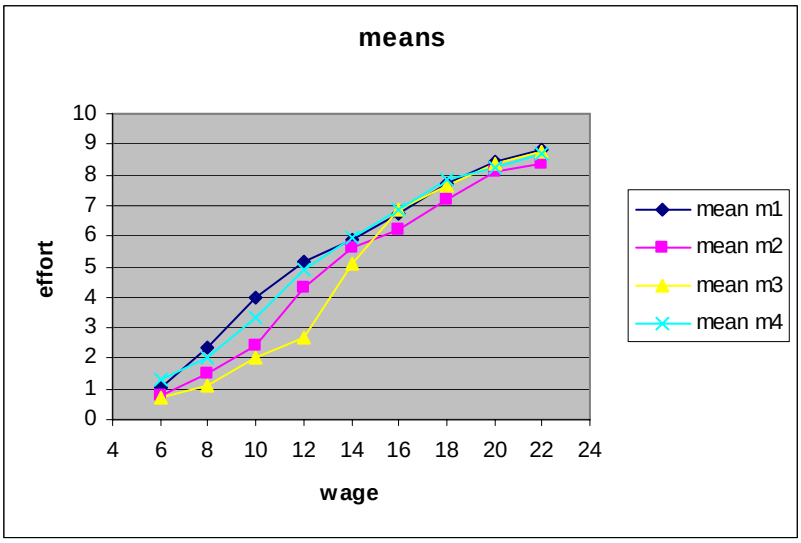
This is opposed to market one, where the subject has no knowledge of coworker wages. Wage offers in market three made below 14 are deemed unfair by the subject and declined. The differences found between markets one and markets two and three conform to the predictions of the Akerlof's (1982) model and Hypotheses B and C. In contrast to the findings presented here the previous experiment regarding coworker wages (Charness and Kuhn, 2004) found coworker wages to have no effect on the wage-effort relationship. Markets one and two have no discernable visual differences; this is in opposition to Hypothesis D which predicts a positive effect on the relationship when compared to market one.

A more revealing analysis may be conducted by examining the effort means conditional on the wage offers. This is presented in the next subsection.

4.1.3 Effort Response Means Conditional on Wage Offers

The effort response means conditional on the wage offers are presented in Graph 2 below. The means are also separated according to the market they are derived from.

Graph 2: Conditional Means



The frequency graphs presented in the previous subsection reveal a positive wage-effort relationship, the same is found when examining the conditional effort means. In all four markets the mean of effort increases with the wage offer made. For example, in market one the mean of effort increases from 2.36146 to 3.975904 as the wage offer increases from 8 to 10. This conforms to the predictions of the fair wage-effort hypothesis and Hypothesis A.

The means in market two are slightly below those in market one up to the wage offer of 14, after which they are similar to those in market one. The means in market three are further below the means in market one up to the wage offer of 16, after which they are similar to those in market one. The similarity that exists after the co-worker wage shows that being paid more than co-worker wages has no effect on effort. This is in line with the findings of Levine (1993) regarding U.S. workers; wage inequality only affects effort when the worker under examination is paid less than similar workers and not when they are paid more. These results are explained with the same reasoning used to explain the differences between market one and

markets two and three found in the frequency graphs. The means in market two are lower up to the wage offer of 14 because the subjects have an option of receiving an unemployment benefit of equivalent to a wage of 10. The means in market three are lower up to the wage offer of 16 because they have knowledge that similar workers are paid a wage of 14. This corresponds to the predictions of the fair wage-effort hypothesis and Hypotheses B and C. The lower means in market three are differ from the lack of effect of co-worker wages on the wage-effort relationship found in Charness and Kuhn (2004). Like the frequency graphs there is no noticeable difference between markets one and four; this is in conflict to Hypothesis D.

Aside from visual inspection of the conditional means it is useful to conduct a statistical test to examine the differences between the markets. Two sample T-tests[10] conducted under the null hypothesis of equal means and a level of significance of 0.05 are presented in Table 5

Table 5: Two Sample T-Tests[11]

Wage Offer	Market Two	Market Three	Market Four
6	0.671039	0.988273	-0.667939
8	2.043007*	3.374809*	0.806931
10	3.348689*	4.287651*	1.283817
12	1.832331	5.504902*	0.502446
14	0.643869	1.708969	-0.112459
16	1.345562	0.431338	-0.432616
18	1.630200	0.376255	-0.423118
20	1.204463	0.370307	0.655419
22	1.545642	0.135938	0.421388

[10] For formula see Harnett and Murphy (2000, page 415).
[11] * denotes a rejection of the null hypothesis at a level of significance equal to 0.05

The only significant differences in the means between market one and the other markets occurs at the wage offers of 8 and 10 in market two and the wage offers of 8, 10 and 12 in market three. There are no significant differences in the means between markets one and four. The lack of significant differences between markets one and four is in opposition to Hypothesis D.

The differences between markets one and two occur because of the unemployment benefit. With the exception of the lowest wage offer of 6, if the subject faces a wage offer equal to or lower than the unemployment benefit, the mean effort is significantly lower than the mean effort in the absence of the unemployment benefit. This conforms to the predictions of the fair wage-effort hypothesis and Hypothesis B. The significant differences between markets one and three occur because of the knowledge of co-worker wages; similar co-workers receive a wage of 14. With the exception of the lowest wage offer of 6, if the subject faces a wage lower than that which similar co-workers receive, the mean effort is significantly lower than in the absence of the knowledge of co-worker wages. This is in line with the predictions of the fair wage-effort hypothesis and Hypothesis C. The findings of Charness and Kuhn (2004) regarding co-worker wages, co-worker wages have no significant effect on effort, are not reproduced here. The lack of significant differences at and above the co-worker wage of 14 demonstrates that paying workers equal to or more than similar coworkers will have no effect on wages; where paying less has a significant negative effect on effort. This is similar to the findings of Levine (1993) regarding U.S. workers.

The lack of significant differences in the effort means at the wage offer of 6, in contrast to the differences that occur at higher wages in markets two and three, further illustrates the effect that the range of wage offers given. This is mentioned in the analysis of the frequency graphs. It should also be noted that a wage of 6 is below the minimum wage in Saskatchewan; a wage offer of 6 is illegal so no one should accept it. The observation of some acceptances at this wage offer may reflect a lack of knowledge regarding the labour market or possible differences between the Canadian and foreign labour markets; 28.9157% of the subjects come from outside of Canada.

In summary the conditional effort means correspond to the predictions of the fair wage-effort hypothesis and Hypotheses A, B and C while refuting the predictions of Hypothesis D.

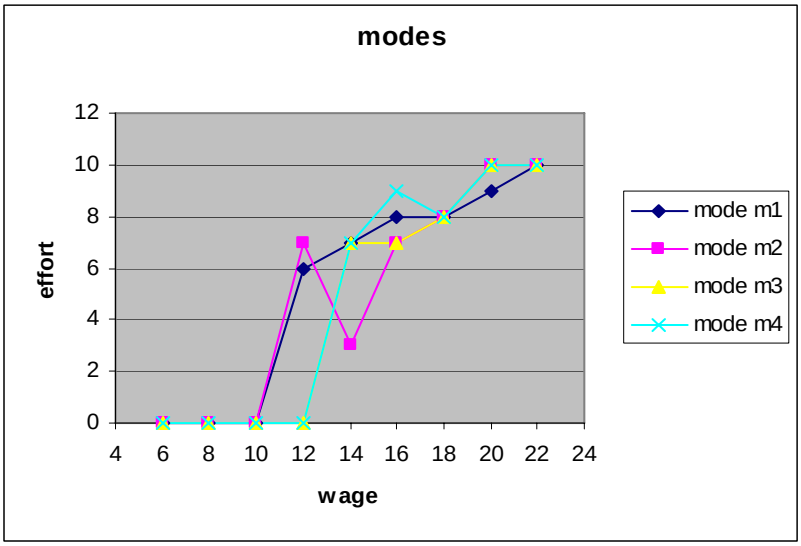
4.1.4 Effort Modes Conditional on Wage Offers

Due to the ordinal nature of the effort response choices a possible better measure than the mean of effort may be the mode. While the mean allows for any value in the range of effort responses, including any division between the values; the mode only allows for whole values. This reflects the limited choices offered to the subjects; they may only choose the whole numbers, representing effort, offered to them, not any possible number in the range of values.

Examining the mode of effort also allows the persistence of wage offer declines at the lower wages to be observed. The choice of zero in the lower range of wage offers is visually evident in the mode graph; in the mean graph it is less apparent. The effort mode conditional on the wage offer is presented in Graph 3

below. The modes are separated into the four markets to enable comparisons between markets.

Graph 3: Conditional Modes



Graph 3 reveals implications similar to those made using the mean of effort for analysis. The mode of effort is increasing in wage, conforming to the fair wage-effort hypothesis and Hypothesis A. What are not as easily noticeable are differences between the markets. Markets one and four again seem to exhibit no noticeable differences; market four does seem more erratic though. Different than the conclusions reached in the examination, are the similarities of markets one and two. While an examination of the means revealed significant differences between markets one and two, an examination of the modes reveals no differences; the only exception being the dip occurring at the wage offer of 14 in market two. The mode of 0 persists for longer in market three than in the other markets; in the other markets it occurs

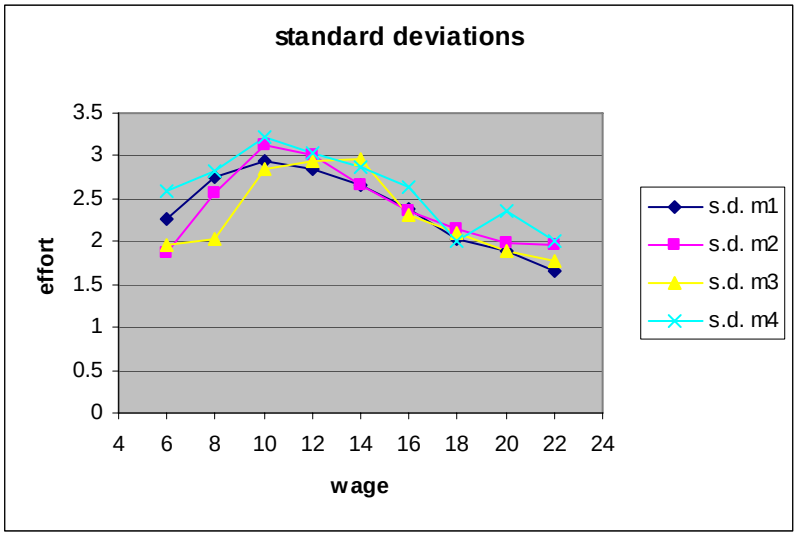
until a wage offer of 10, in market three until a wage offer of 12. This reflects the effect that a co-worker wage of 14 has on the subject's effort choice.

The visual differences present in the modes conforms to the predictions of the fair wage-effort hypothesis, with the exception of the effect of unemployment benefits, and Hypotheses A and C, while opposing Hypotheses B and C.

4.1.5 Standard Deviations Conditional on Wage Offers

As can be seen in the frequency plots the spread of the effort responses is larger in the middle of the range of wage offers than at the extremes of the wage offers. Are more formal analysis of this spread can be seen in the standard deviations of effort responses conditional on the wage offers. Graph 4 illustrates these conditional standard deviations.

Graph 4: Conditional Standard Deviations



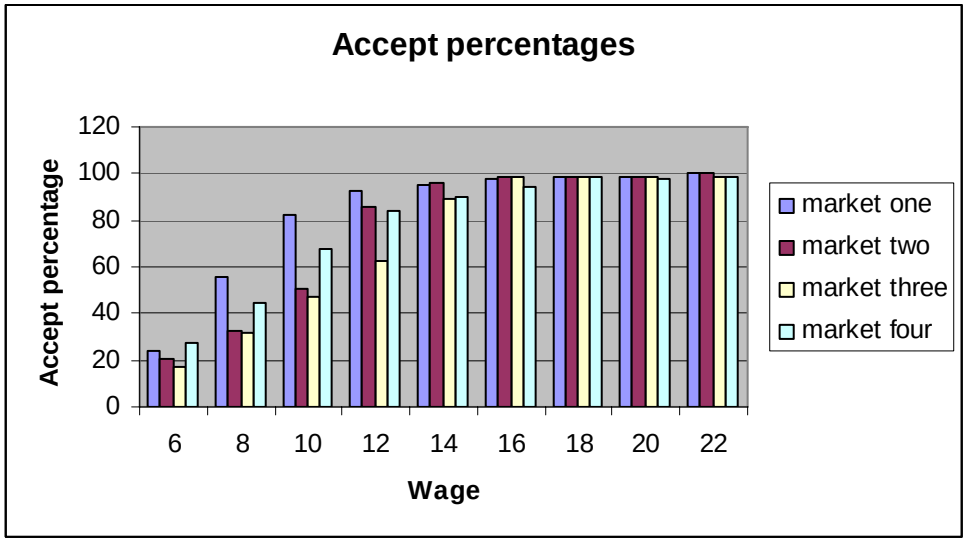
Graph 3 further demonstrates than subjects have less common responses at middle wages than at the extreme wage offers; this occurs in all four markets. This is

due to the effect of the range of wage offers and effort choices mentioned in the frequency graph analysis. The importance of the shape of these standard deviation curves is the same as the reasons given for the clustering of the effort-wage pairings in the bubble graph previously examined. Firms can be surer of the effect of wages on effort at the low and high end of the wage offer range. This may result in two different sectors: one with high wages and effort; and one with low wages and effort.

4.1.6 Accept/Decline Percentages

In Graph 5, presented below, the percentage of accepts and declines conditional on wage offers is given for the four markets. This is done to examine the effects that wages and the market differences may have on the second dependant variable used, ACCEPT.

Graph 5: Accept Decline Percentages



The graph of accept percentages reveals that increasing the wage offer increases the percentage of the subject accepting the job, for all four markets. This is in line with the predictions of the fair wage-effort hypothesis and Hypothesis A. At the lower wage offers there exist differences between the markets, high wage offers erase these differences. This follows from the features that the four markets possess.

In market two there exists accept percentage differences from market one until the wage offer of 12, after which they are similar. This follows from the unemployment benefit, equivalent to a wage of 10, available in market two. When presented with an alternative to not working equal to a wage of 10, the subject declines the wage offer in favour of not working and collecting the unemployment benefit. This conforms to the predictions of the fair wage-effort hypothesis and Hypothesis B. In market three these differences persist until a wage offer of 12. This follows from the knowledge that similar co-workers earn a wage of 14; wage offers made below 14 are considered unfair and are more likely to be declined than in the absence of the knowledge of co-worker wages. This is different than the findings of Charness and Kuhn (2004), who find no effect for co-worker wages. Wage offers equal to or above the co-worker wage of 14 have no noticeable effect on the accept percentage of the subject, similar to the findings of Levine (1993) for U.S. workers. These conclusions are in line with the predictions of the fair wage-effort hypothesis and Hypothesis C.

The graph also reveals differences in accept percentages between markets one and four at the lower wages; analyzing previous statistics revealed no differences between these markets. For a given wage in the range of 8 to 12, the accept

percentage in market four is noticeably lower than in market one. While the high probability of being caught providing low effort in market four may have no effect on the provision of effort, it may have an affect on the decision to accept or decline the offer. The lower accept percentage in market four indicates that workers may have to be compensated for the high degree of supervision with a higher wage. These differences disappear in the higher range of wage offers, in which the wage may be suitably high enough to compensate for the uncomfortable working conditions.

An interesting result of the survey that is observable here is the relatively large amount of accepts that occur at the wage offer of 6, which is below the minimum wage. On e explanation for this may be the lack of knowledge of the labour market possessed by the survey subjects. Out of the 74 accepts present at the wage of six , 54 had no employment experience. That is 73% of the accepts at the wage offer of 6 have no employment experience and therefore may have no knowledge of the labour market characteristics they may face in the real world. Another possible explanation is that the subjects may feel that they have no choice in the theoretical framework presented here. In this artificial labour market no mention was made of the existence of a minimum wage and the subjects may have thought it not to exist, as other features of the labour market were explicitly defined. This explanation cannot be as easily examined as the latter.

There also exist a high number of acceptances in the second market, the market with unemployment benefits, at wage offers equal to and lower than the benefits the subjects would be entitled to in the absence of accepting the offer.

In market two, 86 of the 249 wage offers of ten and below were accepted or 34.54%. Unlike the explanation of lack of employment experience that may explain the acceptance of wage offers below the minimum wage, there exists no such easily illustrated explanation here. One theoretical explanation is that in the real world receiving unemployment benefits may carry some social stigma and this may carry over into the decisions made in the artificial world of this survey, therefore people may still accept wage offers even though they may receive a larger or equal amount when collecting the benefit.

To summarise the findings of the descriptive statistics, the results of the survey seem to lend credence to the fair wage-effort hypothesis and the validity of Hypotheses A, B and C. They do not, however, provide any support for Hypothesis D, with the exception of the degree of supervision's effect on the decision to accept or decline the wage offer. A more enlightening analysis of the survey results is conducted in the next section, which conducts an econometric investigation of the data.

4.2 Econometric Analysis

This section details the regressions used to analysis the survey data and discusses the implications of their results. It is divided into two subsections: the first deals with the pooled data; the second with the data separated into the four markets.

All regression were estimated using the EVIEWS 3.1 package with the exception of the marginal effects, which were calculated using PCGIVE and GIVEWIN.

4.2.1 Pooled Markets

Two different econometric models, involving a total of three regressions, are used to inspect the data. The first model is a simple OLS regression using EFFORT as the dependant variable and the remaining variables as the independent variables; a square of the WAGE variable, WAGE^2.

The second model is referred to as the conditional model and involves two separate regressions. This model reflects the two stage decision that the subjects make when faced with a wage offer. They first decide whether or not to accept the offer and then they decide what level of effort to put forth. The model is referred to as the conditional model because, making an effort level choice is conditional on accepting the wage offer. This model uses two regressions to examine this two stage decision making process. The first regression is binary choice Probit model with ACCEPT, a dummy variable with decline=0 and accept=1, as the dependant variable. All the other variables with a squared WAGE variable, WAGE^2, are included as independent variables. The second regression is a simple OLS regression like in the first model, but with the zeros not included[12]. The zeros are discarded from this regression because the represent declining the wage offer and this decision is already included in the first regression.

The square of the wage variable, WAGE^2, is included to test for a possible non-linear relationship between wages and effort. This relationship is often present in

[12] There is a question of possible sample selection bias from excluding the zeros that is ignored here

efficiency wage literature, including Akerlof's (1982) model, and it is useful to examine whether or not this theoretical relationship is present in the experimental data.

Initial estimation of these regressions showed presence of heteroscedasticity[13], this was expected to be a problem because of the changing variances as wage increased, see Graph 3. In order to correct for the problems this presents in making accurate decisions about the statistical significance of the variables in the regression, White Heteroscedasticity-Consistent Standard Errors and Covariances[14] were used in the OLS regressions and Huber\White Standard Errors and Covariances were used in the Probit regressions.

The results of the two models and three regressions are summarized in Table 6 below. Table 6 also includes: the adjusted R^2 for the OLS regressions and the McFadden R^2 for the Probit regression; the number of observations included in the regressions; the F-statistic for the OLS regression and the LR statistic for the Probit regression, testing whether the independent variables are jointly statistically insignificant; and, for the Probit regression, the percentage of correct predictions, with a success cut-off of 0.5, and the percentage gain in correct predictions from using the estimated equation as opposed to one of constant probability.

[13] Using Whites general test with and without cross terms, see Gujarati (2003) page 413.
[14] See Gujarati (2003) page 417.

Table 6: Summary of Regressions (pooled data)[15][16]

Variable	OLS	Conditional Model	
		Probit	OLS
C	-3.531146**	-4.255966**	3.049328**
	(0.525797)	(0.438579)	(0.675236)
WAGE	0.774085**	0.445787**	0.211618**
	(0.056150)	(0.047465)	(0.074655)
WAGE^2	-0.010667**	-0.008907**	0.003602
	(0.001894)	(0.001877)	(0.002378)
AGE	0.035284*	0.058074**	-0.004499
	(0.016459)	(0.014247)	(0.016040)
FEMALE	1.169831**	0.312584**	1.162586**
	(0.095828)	(0.074685)	(0.093427)
OUTOFPROV	-0.368208**	-0.398594**	-0.017326
	(0.126634)	(0.090609)	(0.128769)
OUTOFCANADA	-0.403747**	0.245298*	0.723266**
	(0.125250)	(0.099695)	(0.124419)
NONECONMAJOR	-0.131535	0.031774	-0.158094
	(0.104366)	(0.076923)	(0.099942)
YEAROFSTUDY	-0.199310**	-0.030971	-0.227652**
	(0.062432)	(0.044029)	(0.060922)
EMPLOYMENTEXP	0.483385**	0.315072**	0.249418
	(0.140325)	(0.110643)	(0.134135)
UNIONEXP*EMPLOYMENTEXP	-0.099005	-0.227575**	0.099095
	(0.120410)	(0.088025)	(0.115622)
FULLTIME	-0.368198**	-0.283184**	-0.161931
	(0.107429)	(0.081974)	(0.105969)
EILOWEROREQUAL	-1.004359**	-0.646003**	-0.434244**
	(0.200620)	(0.112571)	(0.128399)
EIHIGHER	-0.420743**	0.030279	-0.243623
	(0.137199)	(0.141770)	(0.267533
WAGELOWER	-1.524015**	-0.789013**	-0.897910**
	(0.176200)	(0.103623)	(0.237234)
WAGEHIGHER	-0.003907	0.013188	0.067461
	(0.140718)	(0.222687)	(0.130854)
WAGEEQUAL	-0.727054*	-0.396534	-0.523200
	(0.323625)	(0.207414)	(0.283263)
SUPERVISION	-0.102564	-0.276557**	0.173846
	(0.127279)	(0.091897)	(0.120576)
Adjusted R^2/McFadden R^2	0.577081	0.450346	0.398916
F-stat/LR-stat	240.7536**	1451.077**	89.08682**
# of observations	2988	2988	2301
Percent correct		86.51	
Percent gain		41.34	

[15] * indicates significance at the 5% level, ** at the 1% level. Standard Errors are in parentheses.
[16] Base group are male subjects from Saskatchewan majoring in economics with no employment experience and facing wage offers in the first market.

A discussion of the regressions is presented in points below. Attention is paid to the size and direction of the coefficients, the statistical and economic significance of the variables, the differences between the two models and the implications the results have for Hypotheses A through D. This discussion is limited to examining the effects of the variables on the EFFORT dependant variable, the first model and the second stage of the conditional model. An examination of the effects of the variables on ACCEPT, the Probit specification, are presented in more depth following this discussion.

- The coefficients on the WAGE and WAGE^2 variables present a statistically significant positive and concave relationship with effort in the first model. In the second stage of the conditional model the coefficient on WAGE is still positive and significant, but the coefficient on WAGE^2 is now positive. The positive coefficient on WAGE^2 would indicate a convex relationship with wage, but the estimate is statistically insignificant, so the relationship may be interpreted as having no significant curvature in the second stage of the conditional model. The positive relationship has been found in all previous studies, with the exception of Rigdon (2002). A concave relationship has also been found in studies conducted by: Fehr, Tougavera and Fischbacher (2002); Fehr, Kirchler, Weichbold, and Gachter (1998); and Hannan, Kagel and Moser (2002). This positive relationship found in the regressions conforms to the predictions of the fair wage-effort hypothesis and Hypothesis A.
- The joint significance of the variables including WAGE, this includes WAGE^2 and the interaction terms, may be a better examination of their

significance than the t-tests presented in the regression output. Conducting F-tests for the joint significance of the WAGE variables yields statistical significance for all regressions.[17]

- The coefficient on WAGE is also of an analytically significant size in both models, though larger in the first. For example increasing the wage offer from 8 to 10 yields an increase in estimated effort of 1.2 in the first model and 0.6 in the second. This follows from the exclusion of the zero observations in the second stage of the conditional model. The inclusion of the zeros would drag the intercept of the model downwards and, holding other things constant, would increase the slope of the regression line. Therefore, including the zeros increases the size of the coefficient on WAGE, relative to the model where zeros are excluded.
- The FEMALE variable is also statistically significant in both models. Relative to the base group a female subject makes a higher effort choice for a given wage. This may also be interpreted as female subjects requiring a lower wage for a given effort level. For example if the estimated effort level of the base group is 5, a female subject would have an estimated effort of 6.2 in the first model and 6.2 in the conditional model. Contrary to the predictions made in Chapter Three and the findings of Charness and Levine (2003), gender plays an economic and statistically significant role in the relationship examined here. This effect may result from the lower wage expectations women may have and possibly from the higher effort levels women may have to put forth to stand out in the labour market. Socialization and cultural differences may

[17] See Appendix Two for all F-test statistics.

also play a role. For example; women may be socialized towards more commitment to the workplace, or towards a higher level of cooperation (Eckel and Grossman, 1998). The validity of these explanations is subject for further study.

- OUTOFPROV has a negative and statistically significant coefficient in the first model, but is statistically insignificant in the second stage of the conditional model. The effect is of negligible analytical significance in the both models; it decreases the predicted effort choice by 0.4 in the first model and 0.02 in the conditional model. Higher wage expectations possessed by subjects originating outside of Saskatchewan may cause this effect to exist. The effect present here is in opposition to the predictions made in Chapter Three and to the findings regarding regional differences made by Fehr, Fischbacher and Tougavera (2002). OUTOFCANADA, the other variable used to capture the effects of place of origin, also has a negative coefficient. In contrast to OUTOFPROV this coefficient maintains its statistical significance across the two models. The size of the effect is also considerable larger in the conditional model, -0.7 compared to -0.4; this may be due to the effects of examining only the positive effort choices and not the choices to decline the wage offer. Subjects in this study with a place of origin outside of Canada have a lower predicted effort than those from Canada. This effect may follow from higher wage expectations possessed by subjects originating from outside of Canada or from a lack of understanding of the labour market by subjects not familiar with Canada's labour market structure and laws, for

example they may have little knowledge of the minimum wage laws and unemployment benefits available in Canada. The effects that OUTOFCANADA have on the wage-effort relationship also oppose the predictions made in Chapter Three and the findings of previous studies.

- In line with the predictions made in Chapter Three the coefficient on the YEAROFSTUDY is negative and statistically significant in both models. The effect is not very large, approximately -0.2 in the first model and -0.2 in the conditional model, so the statistical significance may be discounted by the small size of the variable. The effect also does not differ much between the two models. Economic significance aside, this result matches the predictions made in Chapter Three; as a subject progresses through their program of study they develop a more concrete conception of their expected wage and therefore require a higher wage for a given level of effort.
- EMPLOYMENTEXP also matches the predictions made in Chapter Three. A positive coefficient was predicted, as subjects with more labour market experience have a greater understanding of how their effort levels may be rewarded with higher wages. The coefficients estimated here are positive and statistically significant in the first model only. The effect in the conditional model is considerably smaller than in the first, approximately half the size of the first model's coefficient; it only increases the predicted effort by around 0.25, as opposed to the first model where it increases effort by about 0.5.
- In contrast to the expectation of no significant effect for the FULLTIME variable, a statistically significant effect was found for the first model; the

conditional model yielded a statistically insignificant estimate. Coefficients in both models are negative and of marginal size. These estimates are in line with the predictions made in Chapter Three, though their effects are small.

- The AGE, NONECONMAJOR and UNIONEXP coefficients are all statistically and economically insignificant for both models; except for UNIONEXP in the probit model, which then has a small negative coefficient. This is in contrast to the predictions made in Chapter Three; positive coefficients for AGE and NONECONMAJOR and a negative coefficient for UNIONEXP.
- Hypotheses B and C can both be confirmed by the regression results of the first model; the conditional model can only lend its support to Hypotheses C. The coefficients on the dummies measuring the effect of the unemployment benefit demonstrate that the presence of the benefit has a negative effect on the effort choice made. This effect is larger when the wage offer is lower than or equal to the benefit; this can be seen in the larger coefficient on EILOWEROREQUAL than the coefficient on EIHIGHER. The dummy variables for co-worker wages also find different effect sizes dependant on the wage offer. For wage offers above the co-worker wage of 14$/hr there is no significant effect. For wage offers equal to or below the co-worker wage there is a negative effect on effort choice; with the effect being larger when the offer is lower than the co-worker wage then when it is equal, -1.5 versus -0.7. This reflects the observations made in the significance tests on the conditional means between the markets. Recall that the only significant differences

between market one and the other markets was when the wage offers were below the unemployment benefit or the co-worker wage. The large effect that COWORKERWAGE presents is opposite to the findings of Charness and Kuhn (2004), who found co-worker wages to have no effect on the wage-effort relationship. The coefficient on SUPERVISION is statistically insignificant except in the first stage of the conditional model, where it has a slight negative effect.

To extend this analysis to include the Probit model, the first stage of the conditional model, the marginal effects calculated at the independent variable means are included in Table 7 below. The marginal effects are calculated as follows.

$$\text{Marginal Effect} = \frac{\partial effort}{\partial x_{ik}} = f\left(X_i', \beta\right)\beta_k$$

Where

$f\left(X_i', \beta\right)$ is the standard normal probaility density function of the variables and coefficents evaluated at their means

β_k is the coefficent of the variable x_{ik} in question

Following Table 7 is a series of points regarding the implications of the Probit model and the differences between the first model and the conditional model.

Table 7: Marginal Effects (Probit Model)

Variable	Mean	Marginal Effect
WAGE	14.00000	0.081873
WAGE^2	222.67000	
AGE	22.97600	0.010666
FEMALE	0.37349	0.057410
OUTOFPROV	0.14458	-0.073207
OUTOFCANADA	0.28916	0.045052
NONECONMAJOR	0.53012	0.007696
YEAROFSTUDY	2.83130	-0.005835
EMPLOYMENTEXP	0.79552	0.057867
UNIONEXP	0.24096	-0.041797
FULLTIME	0.46988	-0.052010
EILOWEROREQUAL	0.08333	-0.118650
EIHIGHER	0.16667	0.005561
WAGELOWER	0.11111	-0.144910
WAGEEQUAL	0.02778	-0.072828
WAGEHIGHER	0.11111	0.002422
SUPERVISION	0.25000	-0.050793

- WAGE has a positive and statistically significant effect on the decision to accept a wage offer. Like in the first model the relationship is also concave, the coefficient on WAGE^2 is negative. The variable's effects are also economically significant; the marginal effects show that increasing the wage by 1 dollar increases the probability of accepting the wage offer by 8.1 percent.
- The estimate of the coefficient for OUTOFCANADA is positive and statistically significant. This is differs from the negative coefficients found for the variable in the first model and in the second stage of the conditional model. OUTOFCANADA has a negative effect on effort, but a positive one on the decision to accept a wage offer. In other words, a subject from outside Canada is more likely to accept an offer for a given wage and also will choose a lower effort level for that wage, than a subject from Canada. This effect is also economically significant, it has a marginal effect of 0.04; a subject from

outside Canada is 4% more likely to accept a given wage offer than a subject from Canada.

- A number of the variables have coefficients which present an interesting change when estimating the two models. These variables are statistically significant in the first model, but statistically insignificant in the second stage of the conditional model. They are, however, statistically significant in the first stage of the conditional model; their effects have been shifted from affecting EFFORT to affecting ACCEPT. In other words, what initially affected the subject's effort choice now only affects the decision to accept or decline the wage offer; it has no effect on the effort choice once the decision to accept the wage offer has been made. The first model has incorrectly estimated the variables effects on EFFORT. These variables include OUTOFPROV, EMPLOYMENTEXP, and FULLTIME. OUTOFPROV has a negative coefficient and is statistically and economically significant; its marginal effect is -0.07. This may reflect subjects from outside of Saskatchewan having higher wage expectations. EMPLOYMENTEXP has a positive and statistically and economically significant coefficient also; its marginal effect is 0.04. FULLTIME has a negative and statistically significant coefficient; its marginal effect is -0.05. These variables all note effects that differ between the first and the conditional model.
- The SUPERVISION variable, noting observations resulting from market four, also has a very interesting implication when estimated using the conditional model. While it had statistically and economically insignificant coefficients in

the first model and the second stage of the conditional model, it now has a negative and statistically and economically significant effect in the Probit model; its marginal effect is -0.05. Supervision may not affect the provision of effort but it does have a negative effect on the decision to accept the wage offer initially. This may follow from a high degree of supervision making the job uncomfortable and causing potential employees to decline the offer unless paid a wage high enough to compensate for this aspect of the job; once the job has been accepted the effort level of the employee is not further affected by the degree of supervision. The lack of negative effect found here is consistent with alternative viewpoints which posit that low supervision can be consistent with high effort levels (Altman, 2002).

- Observations resulting from the third market, the one containing knowledge of co-worker wages, also have a negative effect on the decision to accept the wage offer. This effect depends on whether or not the wage offer in question is above or below the co-worker wage of 14$/hr. If the wage is lower, the WAGELOWER variable, the marginal effect is quite large, about 14%, as opposed to when the wage offer is higher than, the WAGEHIGHER variable, or equal, the WAGEEQUAL variable, to the co-worker wage, 0.2% and 7% respectively. Subjects seem to take into account wage inequity vary strongly when making their decisions on acceptance. Like the first model the wage offers below or equal to the co-worker wage also have a statistically significant negative effect on effort choice, with lower wages having a greater negative effect than wages equal to the co-worker wage. Like co-worker

wages the response to wage offers in the market in which unemployment benefits are present is dependant upon the level of the wage offer. For wage offers below or equal to the benefit, EILOWEROREQUAL, the marginal effect is much larger, 11%, when compared to wage offers above the benefit, EIHIGHER has a marginal effect of 0.5%. Like the first model the conditional models second stage presents negative coefficients for the market two dummy variables, though EIHIGHER loses its statistical significance in the conditional model and the coefficients are smaller than in the first model.

- Another variable which maintains it statistical and economic significance between the two stages of the conditional model is FEMALE. It has a positive effect on both the decision to accept a wage offer and the provision of effort for that wage offer. The marginal effect is also of an economically significant size; it is 0.05. This may reflect the lower wages female subjects may require when accepting a wage offer and the lower wages they may require for a given level of effort.
- One more interesting difference between the two stages in the conditional model involves the effects of YEAROFSTUDY. It has a statistically and economically insignificant positive effect on ACCEPT in stage one and a statistically and economically significant negative effect on EFFORT in stage two. It is the only variable to behave in this manner; all other variables affect either both stages or only stage one and not stage two. YEAROFSTUDY seems to have no significant effect on the decision to accept a wage offer, but has a significant effect on the effort choice decision.

4.2.1.1 Elasticity

The Solow (1979) condition states that the efficiency wage will only exist if the elasticity of effort with respect to wage must be equal to unity. This is based on a production function in which wages enter in a labour augmenting manner. Many efficiency wage theories construct their models to reflect this condition[18]. It is not appropriate to discuss the results generated here in relation to the Solow condition, only the relationship between effort and wages has been examined, not between wages and productivity. In order to examine the relevance of the Solow condition it would be necessary to impose production functions and insert the estimated effort choice functions from the survey into these production functions. The other experimental studies examining the Solow condition have also derived their conclusions from the specification of the production function they have imposed. Differing production functions would have different conclusions regarding the relevance of the Solow condition.

The regression estimated for the pooled markets may be used to estimate this elasticity. Because of the interaction terms between the wage and market dummy variables the elasticities are calculated for each market in the first model and each market in the second stage of the conditional model. The elasticity calculated here measures the ratio of the percentage change in effort generated from the same percentage change in the wage offer. The formula used is detailed below.

$$elasticity = \frac{\partial E}{\partial W}\frac{\overline{W}}{\overline{E}}$$

[18] See Akerlof (1982) page 562.

For the regressions estimated this yields

$$elasticity = (\beta_1 + 2\beta_2 * \overline{W} + Market\ Dummy\ Coefficient * \overline{D})\frac{\overline{W}}{\overline{E}}$$

The results of using the regressions are listed in Table 8 below. They have been separated by the market they pertain to and the equation used to estimate them.

Table 8: Elasticity of Effort with respect to Wage (pooled markets)[19]

Model	Elasticity of Effort with respect to Wage			
	Market One	Market Two	Market Three	Market Four
OLS	1.314443**	1.381103**	1.558081**	1.315656**
Stage Two of Conditional Model (OLS)	0.789049**	0.738673**	0.917179**	0.730330**

Table 8 shows that the estimated elasticities are close to unity; t-tests of the elasticity being equal to unity to reject the null hypothesis though. In the second stage of the conditional model they are elastic and in the second stage of the conditional model they are inelastic; this is probably due to the expulsion of the zeros in the second stage of the conditional model. This means that in the first model the effort choice is more responsive to a wage change than in the conditional model. Market three seems to be more elastic compared to the other markets, which all seem to have quite similar elasticities. An additional effect of the inclusion of co-worker wages seems to be an increase in elasticity relative to the other markets. The knowledge of

[19] ** denotes a statistically significant difference from 1 at the significance level of .01, * denotes the same at the significance level of .05. For the formula used to calculate the t-tests used to test the null hypothesis of unit elasticity see the appendix three.

co-worker wages may increase the responsiveness of effort choice to wages because they now have more information to base their decision of effort choice on.

4.2.2 Separate Markets

The data gathered using the survey can also be examined by separating the observations and estimating separate regressions for each market; as opposed to the pooled regressions, which use dummy variables to capture market differences. The models used are the same as in the pooled markets section. The first model is an OLS estimation including the zero effort choices. The second model, or conditional model, involves an initial stage, a Probit regression with ACCEPT as the dependant variable, and a second stage, an OLS regression excluding the zero effort choices. Table 9 summarizes the regression results for the first model. Tables 10 and 11 summarize the regression results for the first and second stage of the conditional model.

As the estimated contained in the tables reveal, no new insight is gained from the separation of the data into individual markets. The statistical significance of many of the variables has changes; variables which were significant in the pooled regressions are now insignificant, the economic significance of the variable is also questionable.

Occasionally a coefficient has also changed sign from its corresponding estimate in the pooled regressions, resulting in an estimate which no longer makes sense in the context of the model; for instance the positive coefficients on WAGE^2 in the second stage of the conditional model for markets one through three. This may

not be of great concern because both the statistical and economic significance of the variable are also negligible.

The weaker results of the separate markets estimates are probably due to the decrease in sample size for each regression relative to its corresponding pooled markets regression; Tables 9 through 11 below list these weaker results.

Table 9: OLS (separate markets)

	OLS			
Variable	Market One	Market Two	Market Three	Market Four
C	-5.610917**	-3.494077**	-3.926812**	-5.691308**
	(0.927130)	(0.913349)	(0.912510)	(1.091505)
WAGE	0.955585**	0.843401**	0.659337**	0.933379**
	(0.099034)	(0.097922)	(0.100899)	(0.112083)
WAGE^2	-0.016714**	-0.011823**	-0.002904	-0.015689**
	(0.003438)	(0.003483)	(0.003570)	(0.003892)
AGE	0.061627	-0.012295	0.023549	0.055081
	(0.032218)	(0.030345)	(0.029487)	(0.036046)
FEMALE	1.238158**	1.251113**	1.113147**	1.065032**
	(0.192767)	(0.199441)	(0.195365)	(0.194823)
OUTOFPROV	-0.023635	-0.525627*	-0.702134**	-0.299783
	(0.259828)	(0.234196)	(0.250542)	(0.268302)
OUTOFCANADA	-0.365424	-0.261051	-0.477061	-0.604475*
	(0.221405)	(0.272455)	(0.262409)	(0.256772)
NONECONMAJOR	-0.160394	-0.299077	-0.302945	0.303033
	(0.198366)	(0.211691)	(0.195187)	(0.226127)
YEAROFSTUDY	-0.111797	-0.276040*	-0.266532*	-0.037444
	(0.127231)	(0.126751)	(0.112106)	(0.137977)
EMPLOYMENTEXP	0.367056	0.420560	0.657271*	0.317228
	(0.256131)	(0.280311)	(0.294736)	(0.279092)
UNIONEXP	-0.131304	0.184064	0.053165	0.095399
	(0.248094)	(0.231221)	(0.223354)	(0.239965(
FULLTIME	-0.235226	-0.436472*	-0.407647*	-0.419368
	(0.214449)	(0.217328)	(0.207538)	(0.224627)
Adjusted R^2	0.558206	0.572772	0.630175	0.511219
F-Stat	86.068802**	91.92175**	116.5611**	71.93147**
# of Observations	747	747	747	747

Table 10: Probit/First stage of Conditional Model (separate markets)

	Conditional Model (Probit/Stage One)			
Variable	Market One	Market Two	Market Three	Market Four
C	-5.944347**	-4.462143**	-4.015065**	-8.444085**
	(0.872219)	(1.048257)	(0.896964)	(1.639929)
WAGE	0.651261**	0.421477**	0.328221**	0.676444**
	(0.086529)	(0.148761)	(0.126967)	(0.171518)
WAGE^2	-0.015915**	-0.004592	-0.002449	-0.010917
	(0.003235)	(0.006774)	(0.005512)	(0.006997)
AGE	0.072535*	0.033321	0.041519	0.149063**
	(0.028340)	(0.027466)	(0.024872)	(0.050956)
FEMALE	0.303663	0.480823**	0.094005	0.668604*
	(0.163025)	(0.155403)	(0.139128)	(0.261541)
OUTOFPROV	-0.053484	-0.361869	-0.625010**	-0.962660**
	(0.194525)	(0.191977)	(0.175989)	(0.318857)
OUTOFCANADA	0.469333*	0.313009	0.096530	0.216014
	(0.215969)	(0.203967)	(0.192720)	(0.331649)
NONECONMAJOR	0.144645	-0.001143	-0.136065	0.373905
	(0.161563)	(0.156078)	(0.143908)	(0.263109)
YEAROFSTUDY	-0.007417	-0.038657	-0.005890	-0.030160
	(0.093568)	(0.091050)	(0.081519)	(0.156085)
EMPLOYMENTEXP	0.119912	0.385206	0.335279	0.382290
	(0.232080)	(0.227549)	(0.210758)	(0.359421)
UNIONEXP	-0.361219	0.027935	-0.120508	-0.254597
	(0.188466)	(0.178088)	(0.159712)	(0.296044)
FULLTIME	-0.151783	-0.383753	-0.171300	-0.715678*
	(0.177304)	(0.170380)	(0.154541)	(0.281264)
McFadden R^2	0.452216	0.498705	0.449881	0.387164
LR-Stat/F-stat	310.8671**	412.5573**	402.5804**	303.4572**
# of Observations	747	747	747	747
Percent Correct	88.89	87.42	85.14	85.01
Percent Gain	35.66	48.07	48.13	31.29

Table 11: OLS/Second stage of Conditional Model (separate markets)

	Conditional Model (OLS/Stage Two)			
Variable	Market One	Market Two	Market Three	Market Four
C	1.296004	4.603865**	1.949618	2.114737
	(0.145385)	(1.245752)	(1.381825)	(1.370335)
WAGE	0.295435*	0.120647	0.281644	0.329931*
	(0.128443)	(0.135367)	(0.156344)	(0.145571)
WAGE^2	0.001417	0.006506	0.003646	-0.000822
	(0.004176)	(0.004400)	(0.004911)	(0.004625)
AGE	0.027473	-0.041150	-0.009287	-0.012802
	(0.029040)	(0.033577)	(0.030726)	(0.033247)
FEMALE	1.256206**	1.153121**	1.420977**	0.875021**
	(0.182743)	(0.201854)	(0.189328)	(0.179485)
OUTOFPROV	-0.015810	-0.305124	-0.162380	0.425014
	(0.255385)	(0.257938)	(0.277326)	(0.223488)
OUTOFCANADA	-0.772365**	-0.567323*	-0.778169**	-0.846392**
	(0.2206840	(0.274619)	(0.260274)	(0.255170)
NONECONMAJOR	-0.259942	-0.340237	-0.161062	0.173977
	(0.186130)	(0.210711)	(0.195002)	(0.204661)
YEAROFSTUDY	-0.138205	-0.327299*	-0.327190**	-0.038434
	(0.123148)	(0.129996)	(0.109738)	(0.125944)
EMPLOYMENTEXP	0.304663	0.140702	0.388670	0.080716
	(0.249853)	(0.274983)	(0.290063)	(0.253122)
UNIONEXP	0.140595	0.204994	0.221258	0.256441
	(0.232238)	(0.234721)	(0.221258)	(0.208348)
FULLTIME	-0.147170	-0.206587	-0.384554	0.063930
	(0.204771)	(0.226296)	(0.204011)	(0.212246)
Adjusted R^2	0.405830	0.331324	0.473617	0.352677
F-stat	39.31121**	23.45025**	44.51561**	29.87561**
# of Observations	618	566	533	584

4.2.2.1 Elasticity

Estimated of the elasticity of effort with respect to wage was also calculated for the regressions generated by the separating the data according to market. The same formula and procedures were used as in the pooled markets section[20], the only difference being the absence of market dummy variables. The elasticity estimates are listed in Table 12 below.

[20] See appendix three

Table 12: Elasticity of Effort with respect to Wage (separate markets)

	Elasticity of Effort with respect to Wage			
Model	Market One	Market Two	Market Three	Market Four
OLS	1.226962**	1.449738**	1.684779**	1.266772**
Stage Two of Conditional model (OLS)	0.770151**	0.792412**	0.953332	0.726244**

The estimates listed in Table 12 are similar to those obtained in the pooled market regressions: the first model has higher elasticises than the conditional model; marker three is more elastic than the other models; and the estimates are all close to one. A difference that occurs between the pooled and separate regressions is that the null hypothesis of unit elasticity can not be rejected in the third market of the conditional model.

4.3 Analytical/Economic Significance

In the discussion of the regressions above the term analytically significant was used to describe a variable's coefficient. The term means that the variable in question, aside from being statistically significant, is of a size large enough that it would have some impact on the analysis of the economic theory in question. For example the WAGE variable has estimated coefficients around the range of 0.7 to 0.9, for a dollar increase in wage the effort input increases by approximately 0.8. Is this of a size large enough to be important to the theory? An increase of one unit of effort choice may seem small, but the scale only extends from zero to ten; an increase of around one is about ten percent of the overall possibility of effort choices; this is large enough to be

of importance. In contrast to the WAGE variable the AGE variable has coefficients that are statistically significant, but are of a very small size, ranging from 0.03 to 0.05. For an increase in the age of the subject the estimated effort choice would increase by 0.03 to 0.05, considerably less than the increase brought about by wage. The variable AGE therefore could be viewed as having no real analytical significance to the discussion of the theory in question. In order to comment on the economic significance of the variables it would be necessary to assume some sort of production functions in order to gauge the variable's impact on the economy, therefore the term analytical significance is used here. The importance of the wage-effort choice relationship to the economy depends on how the effort choice increases brought about by wages translates into increased productivity. Various wage-productivity curves would lead to differing conclusions about the importance of these results. Assuming a direct one to one relationship between effort and productivity, higher wages would result in significantly higher productivity levels. Other assumed relationships would produce a spectrum of conclusions about the effort enhancing effects of higher wages importance to the economy.

The majority of the other variables examined in the regressions are of no considerable size or analytical significance, with the notable exception of the variables FEMALE, WAGELOWER, WAGEEQUAL and EILOWEROREQUAL. The largest of the dummy variables is WAGELOWER. The presence of this variable results in a decrease in the amount of effort chosen by 1.5 units. For a subject choosing an effort level of eight, the presence of the knowledge that similar co-workers are receiving a wage of 14 dollars an hour, reduces the effort choice level to

6.5; this is a decrease in the effort level of about 19%. For other changes this percentage of course would depend on where the subject initially is operating regarding effort choice. The large decrease in effort choice emphasizes the importance of internal wage equity as noted by many managers (Bewley, 1999). The presence of an unemployment benefit similarly reduces the effort choice, but by one unit, this still is large enough to have an economically significant effect. The FEMALE variable moves in opposition to the market dummy variables. Female subjects make an effort choice of about 1.2 units higher than those of male subjects receiving the same wage. The percentage increase of the presence of this variable, like the market variables, depends on the initial effort level the subject is at. Assuming a male subject has chosen an effort level of eight for a given wage, a female subject is estimated to choose an effort level of 9.2, an increase of 15%, slightly less than the WAGELOWER variable, but still quite large. How this affects the productivity of the firm once again depends on the relationship between effort and productivity.

The marginal effects of the first stage of the conditional model can also be discussed in terms of economic significance. Does an increase in the probability of accepting a wage offer of 8.1%, resulting from an increase in the wage of 1 dollar an hour, have any economic significance? It is less than the estimated marginal effects for WAGELOWER (-14.9%) and EILOWEROREQUAL (-11.8), but larger than that of FEMALE (5.7); all other estimated marginal effects were very small, this is probably a result of the very high amount of wage offers that were accepted. The

significance of these effects to the economy and the theory is in doubt here, 8.1% does not seem like a very large number.

Unlike statistical significance, which has explicitly defined ranges and points used to determine its existence, economic and analytical significance has no easily defined boundaries. In this study making these definitions is further complicated from its abstraction from reality; an artificial labour market is being examined, with effort choice not real effort being examined.

Chapter five: Conclusion

The data generated by the survey provide strong support for certain predictions of the Fair Wage-Effort hypothesis: a positive relationship between wages and effort; unemployment benefits producing a negative effect on the wage-effort relationship; and knowledge of co-worker wages, specifically knowledge of wage inequity, exhibits a negative effect on the wage-effort relationship.

To pose these results in terms of the Hypotheses outlined in the introduction, the data shows strong support for Hypothesis A: wage increases correspond to effort increases. In the case of Hypothesis B the negative effect is stronger when the wage is equal to or less than the wage offer, when faced with a wage offer higher than the unemployment benefit the negative effect is about half as strong. Hypothesis C is also only partially correct, the negative effect is only present when the knowledge of co-worker wages results in the subject facing a relatively lower wage offer; for wages greater than or equal to 14 there is no significant difference between markets one and three. Also the variables WAGELOWER and WAGEEQUAL are statistically significant, not WAGEHIGHER. No evidence exists for the acceptance of Hypothesis D; the only effect it has is on the decision to accept the wage offer, there is no significant effect on the choice of effort.

Aside from the Hypotheses A through D, a number of other interesting results have been illuminated by the regressions. The gender of the subject, which previously

was found to have no significant effect (Charness and Levine, 2003), has a large statistically and economically significant positive effect; female subjects choose a higher level of effort for a given wage than male subjects. This could also be interpreted as female subjects requiring a lower wage for a given effort level.

Place of origin was also found to exhibit significant effects not found in previous studies (Fehr, Fischbacher, and Tougavera, 2002). Subjects from outside Canada provide lower effort for a given wage than subjects originating from Canada, but are more likely to accept a given wage offer than Canadian subjects.

The Fair Wage-Effort Hypothesis has found substantiation in the data generated by the survey. A positive relationship was found between wages and effort; increasing the wage offers lead to an increase in the choice of effort provision. This relationship was also found to be concave; there are declining returns in effort for corresponding wage increases. Previous lab experiments have also reported a positive concave relationship and replication of this relationship was an interest of this thesis.

While often disparaged as ineffectual and incorrect, the survey has shown that it can replicate the previous laboratory experiments. It also has produced a number of interesting results that have not previously been found. Gender variables that were previously found insignificant, now have a statistically and economic significance. Co-worker wages were also previously found insignificant, in this survey they are quite the opposite. A variable that has not been included in past studies, unemployment benefits, was also found to have a significant, though not as large, effect like co-worker wages.

A number of practical applications stemming from the results of this investigation can also be mentioned. The large negative effect found when wage inequity, precisely when the subject receives wages lower than the wages of co-workers, emphasizes the importance of wage equity. This result recommends firms move towards higher degrees of wage equity if possible or institute a wage secrecy policy in which wages are not discussed in the firm or are not made public.

The effort choice augmenting effect of wages also may play a role in firm or public policy. Wage increases need not necessarily result in overall cost increases for the firm, they may in fact lead to profit increases depending on the shape of the production function. Firms may then expect higher wages to not only create larger labour pools to choose workers from, but possibly higher productivity and profit and therefore need not institute a policy of low wages. With regards to public policy the labour augmenting effect of wages emphasizes the importance of avoiding low wage policies. If the economy is not maximizing the amount of productivity that can be achieved due to a lower wage structure, then it would not be operating on the boundary of the production possibility frontier and an amount of lost production or inefficiency would be present. Policy formation avoiding situations such as this would then be advisable.

Concern that remains over the validity of these results, stemming from the use of a survey, could be addressed by converting the features of the survey into a simulated labour market experiment. The survey was designed to remain as close as possible to the structure of the laboratory experiments, moving the other way shouldn't present much of a problem. Using the basic design outlined in Chapter Two

and adding the market features included in the survey, would result in a similarly structured lab experiment that could be used to further test the relevance of Hypotheses A through D.

Another question remaining is how the positive relationship between wages and effort translates into more productivity. In other words, what does the relationship between wages and productivity look like? The concern of much of economics is how various things affect the economy, so how wages affect productivity and the economy as a whole is an important question. Previous experiments have imposed a production function on the subjects representing firms and workers. They new explicitly how an effort choice translated into increased productivity for the firm. This was not done in the survey presented here; the concern was on the effect of wages on effort. The validity of the production functions imposed, or how the function should be modeled to accurately reflect reality, is subject to further debate and research.

The data examined here lends further weight to the importance of examining the assumptions of neoclassical economics in an experimental setting and the validity of Fair Wage-Effort Hypothesis form of efficiency wages. Continued experimental examination, be it in a laboratory or survey setting, would be of value in the further refinement and expansion of economic theory.

Appendix One: Ethics Application and Approval

Application for Approval of Research Protocol

1. **Researcher**: Evan Edward Meredith, M.A. student, Department of Economics
Supervisor: Morris Altman, Professor, Department of Economics

1a. **Student**: Evan Edward Meredith, M.A. student

1b. **Anticipated start date of study**:
Anticipated completion date of study:

2. **Title of Study**: Experimental Investigation of the Fair Wage-Effort Hypothesis

3. **Abstract**: The failure of labour markets to clear, even in the long run, is a phenomenon that has long been a concern of economists. In an attempt to explain this failure a number of efficiency wage theories have been developed. Among these is the possible labour augmenting effects of wages (Solow, 1979). This theory was further elaborated on by Akerlof (1982) who developed a somewhat sociological explanation of the labour market as a partial gift exchange dependant on the norms of fairness. In this partial gift exchange the gift of a higher than market clearing wage, or fair wage, is reciprocated by higher that minimum effort. The fair wage is dependant on the workers frame of reference. This frame includes such arguments as past wages, coworkers' wages, the unemployment rate, and unemployment benefits. The goal of this research is to examine what effects, if any, a change in the level of these arguments has on the level of dependency of effort on wages.

Hypothesis A: Effort is positively correlated with wages. Higher wages will correspond to a higher choice of effort.

Hypothesis B: An increase in possible unemployment benefits will reduce the amount of effort for a corresponding wage from the effort put forth in the absence of unemployment benefits. As unemployment benefits increase, the workers conception of a fair wage also increases, and to elicit the same effort as previous a higher wage must be offered.

Hypothesis C: The observance of a coworkers' wage will have negative effects on effort for a wage lower than the coworkers and positive effects on effort for a wage higher than the coworkers. Workers base their evaluation of the fairness of the wage offer on the reference point of similar workers wages. If their wages are lower they will deem the wage unfair and reduce their effort accordingly. If their wages are higher they will deem the wage as exceeding the fair wage and will increase their effort accordingly.

Hypothesis D: The degree to which workers are supervised or monitored will have an effect on the effort they put forth. Working under a small degree of monitoring reduces the chances of being caught shirking. Therefore a worker who

feels they are receiving an unfair wage may reduce their effort with less chance of retribution from their employers.

4. **Funding**: None.

5. **Expertise**: The research does not involve special or vulnerable populations, distinct cultural groups, and is not above minimal risk.

6. **Conflict of Interest**: The research involves no known potential conflicts of interest.

7. **Participants**: Participants will be solicited through announcements in undergraduate economics classes, posters placed in various areas on campus, and/or asking students walking down hallways on campus to participate.

7a. **Recruitment Material**: Poster is attached in addendum.

8. **Consent**: The participants will be informed of their rights and will signify their understanding of these rights through the reading and subsequent signing of a consent form. Participants will be informed that they may refrain from answering any of the survey questions they choose not to and may withdraw from the research at any time they wish to, with the information gathered from them to be destroyed upon their request. If they wish to withdraw without others knowing they may not fill out the survey, wait, and turn it in when the other participants do. The consent form is attached in addendum.

9. **Methods/Procedures**: The proposed research will require the participants to complete a questionnaire. This questionnaire will be administered to them in a classroom. The questionnaire to be used is attached in addendum. Before the issuing of the questionnaire the participants will be asked to carefully read and sign a consent form. The instructions for the completion of the questionnaire will be printed on the survey forms. Any questions the participants will be addressed at any time during the research.

10. **Storage of Data**: Data storage will be the responsibility of the researcher and will be stored in hard copy form, as completed surveys, and on a computer disk. As the consent forms will be stored separately from the surveys, which contain no identifying questions, the potential loss of confidentiality is low. All data will be stored by the research supervisor for a minimum of 5 years after the completion of the study.

11. **Dissemination of Results**: The collected data will be used in the development of a M.A. thesis.

12. **Risk, Benefits, and Deception**: There are no known risks or benefits in the study and it involves no amount of deception.

13. **Confidentiality**: The collected data will be published and presented at seminars, but will be presented aggregate form so no possible individual identification can be made. Also the consent forms will be stored separately from the surveys so no names can be associated with the corresponding answers. The participants will also be asked to put no identifying information on the questionnaires.

14. **Data/Transcript Release**: The participants will only be asked to respond to questions with very short answers (i.e. numerical effort choice, major of study) and there will be no direct words to identify that participant. The anonymity of participants will not be compromised.

15. **Debriefing and Feedback**: A copy of the thesis containing the results of this research will be made available in the Department of Economics Library (Timlin Room).

16. **Required Signatures**:

Supervisor and Department Head *Student*

Morris Altman Evan Edward Meredith

Dean of College

Jo-Anne Dillon

17. **Contact Name and Information**:

Evan Edward Meredith, Tel: (306)652-4485
Email: eem566@mail.usask.ca
Address: 901 B Temperance Street, Saskatoon, Sask. S7N 0N3, Canada.

Wage-Effort Survey

Please read the instructions carefully and respond to the corresponding questions appropriately. If you find any question objectionable you may refrain from answering it. **Also please do not put your name or any other identifying**

information on the questionnaire. You may also withdraw from the study at anytime and the information provided by you with be destroyed on your request.

Instructions for Wage/Effort Response

Please read the following instructions carefully.

In the following four sections you will be asked to respond to a wage offer, in terms of dollars per hour, with an effort choice.

The wage offer is for a job which you would expect to obtain upon completion of your degree.

There will be four job markets which differ in certain ways. Please take note of these differences when making your choices regarding the wage offers.

In the job markets a wage offer will be presented to you and you will make a choice to accept or decline the offer. If you accept this wage offer you will be asked to indicate the level of effort you would put forth in this job, given the wage you are paid. The number zero will indicate you have declined the offer. A number between 1 and 10 will indicate the amount of effort you would put forth if accepting the job. 1 represent a very low level of effort and 10 a very high level of effort.

The possible responses are noted in the table below. When making your choice please circle your responses in the tables presented.

Table of Possible Response Choices

0	1 2 3 4 5 6 7 8 9 10
(Decline the offer)	(very low effort……..very high effort)

Part A

Please provide the following information.

Age:_____:
Gender: (Male / Female)
Place of Origin: (Province:_____ / Outside of Canada)
Your area of study (Major):_____:
Year in the program:____:
Have you held paid employment before: (yes / no)
Was the job: (full time / part time)
Was the job union: (yes / no)

Part B

Please respond to the wage offers in the following four sections while taking into account the differences between the four markets.

Market 1

In this market there is no unemployment insurance, you have no knowledge of what wages workers in similar positions with similar experience/education are receiving, and there is a small probability that you may be caught when providing low effort.

Please circle your response in the table below

Wage Offer $/hour	**Response to Wage Offer**										
	Decline	**Accept/ Effort Level**									
6	0	1	2	3	4	5	6	7	8	9	10
14	0	1	2	3	4	5	6	7	8	9	10
12	0	1	2	3	4	5	6	7	8	9	10
16	0	1	2	3	4	5	6	7	8	9	10
10	0	1	2	3	4	5	6	7	8	9	10
8	0	1	2	3	4	5	6	7	8	9	10
18	0	1	2	3	4	5	6	7	8	9	10
20	0	1	2	3	4	5	6	7	8	9	10
22	0	1	2	3	4	5	6	7	8	9	10

Market 2

In this market in the event you decline a wage offer you have the option of collecting an unemployment benefit equivalent to receiving a 10$/hour wage, you have no knowledge of what wages workers in similar positions with similar experience/education are receiving, and there is a small probability that you may be caught when providing low effort.

Please circle your response in the table below

Wage Offer $/hour	**Response to Wage Offer**										
	Decline	**Accept/ Effort Level**									
22	0	1	2	3	4	5	6	7	8	9	10
6	0	1	2	3	4	5	6	7	8	9	10
10	0	1	2	3	4	5	6	7	8	9	10
16	0	1	2	3	4	5	6	7	8	9	10
12	0	1	2	3	4	5	6	7	8	9	10
8	0	1	2	3	4	5	6	7	8	9	10
14	0	1	2	3	4	5	6	7	8	9	10
18	0	1	2	3	4	5	6	7	8	9	10
20	0	1	2	3	4	5	6	7	8	9	10

Market 4

In this market there is no unemployment insurance, you have knowledge that workers in similar positions with similar experience/education are receiving a wage of 14$ per hour, and there is a small probability you may be caught when providing low effort.

Please circle your response in the table below

Wage Offer $/hour	**Response to Wage Offer**										
	Decline	**Accept/ Effort Level**									
18	0	1	2	3	4	5	6	7	8	9	10
16	0	1	2	3	4	5	6	7	8	9	10
10	0	1	2	3	4	5	6	7	8	9	10
14	0	1	2	3	4	5	6	7	8	9	10
8	0	1	2	3	4	5	6	7	8	9	10
20	0	1	2	3	4	5	6	7	8	9	10
12	0	1	2	3	4	5	6	7	8	9	10
22	0	1	2	3	4	5	6	7	8	9	10
6	0	1	2	3	4	5	6	7	8	9	10

Market 4

In this market there is no unemployment insurance, you have no knowledge of what wages workers in similar positions with similar experience/education are receiving, and there is a large probability you may be caught when providing low effort.

Please circle your response in the table below

Wage Offer $/hour	**Response to Wage Offer**										
	Decline	**Accept/ Effort Level**									
10	0	1	2	3	4	5	6	7	8	9	10
22	0	1	2	3	4	5	6	7	8	9	10
6	0	1	2	3	4	5	6	7	8	9	10
20	0	1	2	3	4	5	6	7	8	9	10
12	0	1	2	3	4	5	6	7	8	9	10
8	0	1	2	3	4	5	6	7	8	9	10
14	0	1	2	3	4	5	6	7	8	9	10
16	0	1	2	3	4	5	6	7	8	9	10
18	0	1	2	3	4	5	6	7	8	9	10

Thank you for completing this survey. If you have any further questions you may contact the researcher (Evan Meredith) at Email: eem566@mail.usask.ca

Consent Form

You are invited to participate in a study entitled (inset title). Please read this form carefully, and feel free to ask questions you might have.

Researcher: Evan Edward Meredith, M.A. student, Department of Economics, University of Saskatchewan, (306) 652-4485.

Research Supervisor: Morris Altman, Ph.D., Professor and Department Head, Department of Economics, University of Saskatchewan, Arts 820, altman@sask.usask.ca, (306) 966-5198.

Purpose and Procedure: This study aims to examine the possible relationship between wages and effort provision and the changes that may be brought to this relationship brought about through the addition of unemployment benefits and the observation of coworkers' wages. This study will require you to fill out a questionnaire and will require from approximately 10 to 15 minutes of your time.

Potential Risks: There are no known risks associated with this study.

Potential Benefits: There are no known potential benefits associated with this study.

Storage of Data: The data collected will contain no identifying information and the consent forms will be stored separately from the questionnaires to prevent and correlation of names with given responses. All data will be stored by the research supervisor for a minimum of 5 years after the completion of the study.

Confidentiality: The data collected in this study will be published and presented at seminars, but will be presented in an aggregate form in which no individuals may be identified. Consent forms will also be stores separately form the questionnaires to prevent individual identification with responses. Please do not put your name or any other identifying information on the questionnaires.

Right to Withdraw: *You may withdraw from the study for any reason, at any time, without penalty of any sort (and without loss of relevant entitlements, without affecting academic of employment status, without losing access to relevant services, etc.), you may refuse to answer individual questions. If you wish to withdraw without others knowing you may not fill out the survey, wait, and turn it in when the other participants do. If you withdraw from the study at any time any data that you have contributed will be destroyed at your request.*

Questions: *If you have any questions concerning the study, please fell free to ask at any point; you are also free to contact the researcher at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Sciences Research Ethics Board on (insert date). Any questions regarding your rights as a participant may be addressed to that committee through the Office of Research Services (996-2084). Out of town participants may call collect. The results of the study may be viewed upon completion*

in the published thesis available in the Department of Economics Library (Timlin Room).

Consent to Participate: *I have read and understood the description provided above; I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I consent to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.*

_____ _____

(Name of Participant) (Date)

_____ _____

(Signature of Participant) (Signature of Researcher)

Interested in Experimental Economics?

All undergraduates at the University of Saskatchewan are needed to participate in a M.A. research study investigating the relationship between effort and wages.

Participation will require 10 to 15 minutes of your time and will involve the completion of a short questionnaire in a classroom on campus.

Location: Arts 104
Time: Tuesday, February 21, 11:30 a.m. to 1:00 p.m.
Wednesday, February 22, 11:30 a.m. to 1:30 p.m.

If you wish to participate please show up anytime during the times mentioned above. If you require more information feel free to contact:

Evan Meredith at
Email: eem566@mail.usask.ca

University of Saskatchewan
Behavioural Research Ethics Board (Beh-REB)

NOV 0 3 2005

28-Oct-2005

Certificate of Approval with Minor Modifications

PRINCIPAL INVESTIGATOR	DEPARTMENT	BEH#
Morris Altman	Economics	05-261

STUDENT RESEARCHER(S)
Evan Meredith

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED (STUDY SITE)
University of Saskatchewan

SPONSOR
Unfunded

TITLE
Experimental Investigation of the Fair Wage-Effort Hypothesis

ORIGINAL APPROVAL DATE	CURRENT RENEWAL DATE
25-Oct-2005	01-Oct-2006

CERTIFICATION

Thank you for submitting the above application to the Behavioural Research Ethics Board for review. The Beh-REB has **approved** your research proposal on ethical grounds, **subject to the following minor modifications:**

- Please ensure that all data is stored by the research supervisor for a minimum of 5 years after the completion of the study. This needs to be stated in the both the application and the consent form.
- Due to the fact that the research supervisor is the department head, a signature from the Dean of the College is required.
- Please revise the consent form to include the research supervisor's contact information.
- Please clarify how the survey will be administered. If it is going to be administered in a classroom, some provision will be required to inform participants how they can withdraw once the study is underway without others knowing (e.g. instructing participants that if they wish to withdraw they may simply not fill out the survey, wait, and turn it in when everyone else does). This should be made clear on the consent form.

Please send one copy of your revisions to the Ethics Office for our records. Please highlight or underline any changes made when resubmitting.

The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

This letter serves as your Certificate of Approval, **effective as of the time that the requested modifications are received by the Ethics Office**. If you require a letter of unconditional approval, please so indicate on your reply, and one will be issued to you.

Please send all correspondence to:

Ethics Office
University of Saskatchewan
Room 306 Kirk Hall, 117 Science Place
Saskatoon SK S7N 5C8
Telephone: (306) 966-2084 Fax: (306) 966-2069

ONGOING REVIEW REQUIREMENTS

The term of this approval is five years. However, the approval must be renewed on an annual basis. In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: http://www.usask.ca/research/ethical.shtml .

(GORD BINSTED)

Dr. Valerie Thompson, Chair
Behavioural Research Ethics Board
University of Saskatchewan

Please send all correspondence to:

Ethics Office
University of Saskatchewan
Room 306 Kirk Hall, 117 Science Place
Saskatoon SK S7N 5C8
Telephone: (306) 966-2084 Fax: (306) 966-2069

Appendix Two: Full Regression Output

Market One

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 12:40
Sample: 1 747
Included observations: 747
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.610917	0.927130	-6.051920	0.0000
WAGE	0.955585	0.099024	9.649996	0.0000
WAGE^2	-0.016714	0.003438	-4.861587	0.0000
AGE	0.061627	0.032218	1.912795	0.0562
FEMALE	1.238158	0.192767	6.423092	0.0000
OUTOFPROV	-0.023635	0.259828	-0.090963	0.9275
OUTOFCANADA	-0.365424	0.221405	-1.650476	0.0993
NONECONMAJOR	-0.160394	0.198366	-0.808573	0.4190
YEAROFSTUDY	-0.111797	0.127231	-0.878693	0.3799
EMPLOYMENTEXP	0.367056	0.256131	1.433080	0.1523
UNIONEXP	-0.131304	0.248094	-0.529251	0.5968
FULLTIME	-0.235226	0.214449	-1.096886	0.2731

R-squared	0.564720	Mean dependent var	5.563588
Adjusted R-squared	0.558206	S.D. dependent var	3.504828
S.E. of regression	2.329576	Akaike info criterion	4.545183
Sum squared resid	3988.788	Schwarz criterion	4.619337
Log likelihood	-1685.626	F-statistic	86.68802
Durbin-Watson stat	0.758635	Prob(F-statistic)	0.000000

Probit (decline=0,accept=1)
Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 04/04/06 Time: 12:50
Sample: 1 747
Included observations: 747
Convergence achieved after 5 iterations
QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-5.944347	0.872219	-6.815200	0.0000
WAGE	0.651261	0.086529	7.526490	0.0000
WAGE^2	-0.015915	0.003235	-4.919980	0.0000
AGE	0.072535	0.028340	2.559506	0.0105
FEMALE	0.303663	0.163025	1.862673	0.0625
OUTOFPROV	-0.053484	0.194525	-0.274946	0.7834
OUTOFCANADA	0.469333	0.215969	2.173146	0.0298
NONECONMAJOR	0.144645	0.161563	0.895290	0.3706
YEAROFSTUDY	-0.007417	0.093568	-0.079264	0.9368
EMPLOYMENTEXP	0.119912	0.232080	0.516686	0.6054
UNIONEXP	-0.361219	0.188466	-1.916628	0.0553
FULLTIME	-0.151783	0.177304	-0.856060	0.3920

Mean dependent var	0.827309	S.D. dependent var	0.378233
S.E. of regression	0.282375	Akaike info criterion	0.536229
Sum squared resid	58.60584	Schwarz criterion	0.610383
Log likelihood	-188.2815	Hannan-Quinn criter.	0.564807
Restr. log likelihood	-343.7150	Avg. log likelihood	-0.252050
LR statistic (11 df)	310.8671	McFadden R-squared	0.452216
Probability(LR stat)	0.000000		
Obs with Dep=0	129	Total obs	747
Obs with Dep=1	618		

Accepts only

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 12:43
Sample: 1 618
Included observations: 618
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.296004	1.145385	1.131500	0.2583
WAGE	0.295435	0.128443	2.300133	0.0218
WAGE^2	0.001417	0.004176	0.339381	0.7344
AGE	0.027473	0.029040	0.946051	0.3445
FEMALE	1.256206	0.182743	6.874154	0.0000
OUTOFPROV	-0.015810	0.255385	-0.061906	0.9507
OUTOFCANADA	-0.772365	0.220684	-3.499875	0.0005
NONECONMAJ	-0.259942	0.186130	-1.396560	0.1631
YEAROFSTUDY	-0.138205	0.123148	-1.122262	0.2622
EMPLOYMENTEXP	0.304663	0.249853	1.219369	0.2232
UNIONEXP	0.140595	0.232238	0.605392	0.5451
FULLTIME	-0.147170	0.204771	-0.718705	0.4726

R-squared	0.416423	Mean dependent var	6.724919
Adjusted R-squared	0.405830	S.D. dependent var	2.651331
S.E. of regression	2.043710	Akaike info criterion	4.286637
Sum squared resid	2531.112	Schwarz criterion	4.372589
Log likelihood	-1312.571	F-statistic	39.31121
Durbin-Watson stat	0.688385	Prob(F-statistic)	0.000000

Market two

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 12:46
Sample: 1 747
Included observations: 747
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.494077	0.913349	-3.825566	0.0001
WAGE	0.843401	0.097922	8.612999	0.0000
WAGE^2	-0.011823	0.003483	-3.395021	0.0007
AGE	-0.012295	0.030345	-0.405161	0.6855
FEMALE	1.251113	0.199441	6.273108	0.0000
OUTOFPROV	-0.525627	0.234196	-2.244385	0.0251
OUTOFCANADA	-0.261051	0.272455	-0.958143	0.3383
NONECONMAJ	-0.299077	0.211691	-1.412799	0.1581
YEAROFSTUDY	-0.276040	0.126751	-2.177809	0.0297
EMPLOYMENTEXP	0.420560	0.280311	1.500331	0.1340
UNIONEXP	0.184064	0.231221	0.796052	0.4263
FULLTIME	-0.436472	0.217328	-2.008353	0.0450

R-squared	0.579071	Mean dependent var	4.947791
Adjusted R-squared	0.572772	S.D. dependent var	3.618348
S.E. of regression	2.365050	Akaike info criterion	4.575409
Sum squared resid	4111.195	Schwarz criterion	4.649563
Log likelihood	-1696.915	F-statistic	91.92175
Durbin-Watson stat	1.112361	Prob(F-statistic)	0.000000

Probit(decline=0,accept=1)

Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 04/04/06 Time: 12:49
Sample: 1 747
Included observations: 747
Convergence achieved after 6 iterations
QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-4.462143	1.048257	-4.256726	0.0000
WAGE	0.421477	0.148761	2.833258	0.0046
WAGE^2	-0.004592	0.006774	-0.677836	0.4979
AGE	0.033321	0.027466	1.213167	0.2251
FEMALE	0.480823	0.155403	3.094039	0.0020
OUTOFPROV	-0.361869	0.191977	-1.884959	0.0594
OUTOFCANADA	0.313009	0.203967	1.534601	0.1249
NONECONMAJ	-0.001143	0.156078	-0.007321	0.9942
YEAROFSTUDY	-0.038657	0.091050	-0.424566	0.6712
EMPLOYMENTEXP	0.385206	0.227549	1.692853	0.0905
UNIONEXP	0.027935	0.178088	0.156862	0.8754
FULLTIME	-0.383753	0.170380	-2.252341	0.0243

Mean dependent var	0.757697	S.D. dependent var	0.428763
S.E. of regression	0.299877	Akaike info criterion	0.587282
Sum squared resid	66.09579	Schwarz criterion	0.661436
Log likelihood	-207.3498	Hannan-Quinn criter.	0.615860
Restr. log likelihood	-413.6285	Avg. log likelihood	-0.277577
LR statistic (11 df)	412.5573	McFadden R-squared	0.498705
Probability(LR stat)	0.000000		
Obs with Dep=0	181	Total obs	747
Obs with Dep=1	566		

Accepts only

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 12:52
Sample: 1 566
Included observations: 566
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.603865	1.245752	3.695652	0.0002
WAGE	0.120647	0.135367	0.891258	0.3732
WAGE^2	0.006506	0.004400	1.478657	0.1398
AGE	-0.041150	0.033577	-1.225539	0.2209
FEMALE	1.153121	0.201854	5.712658	0.0000
OUTOFPROV	-0.305124	0.257938	-1.182935	0.2373
OUTOFCANADA	-0.567323	0.274619	-2.065854	0.0393
NONECONMAJ	-0.340237	0.210711	-1.614708	0.1069
YEAROFSTUDY	-0.327299	0.129996	-2.517751	0.0121
EMPLOYMENTEXP	0.140702	0.274983	0.511676	0.6091
UNIONEXP	0.204994	0.234721	0.873351	0.3828
FULLTIME	-0.206587	0.226296	-0.912907	0.3617

R-squared	0.344342	Mean dependent var	6.530035
Adjusted R-squared	0.331324	S.D. dependent var	2.633679
S.E. of regression	2.153629	Akaike info criterion	4.393159
Sum squared resid	2569.517	Schwarz criterion	4.485143
Log likelihood	-1231.264	F-statistic	26.45025
Durbin-Watson stat	0.851339	Prob(F-statistic)	0.000000

Market three

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 13:01
Sample: 1 747
Included observations: 747
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.926812	0.912510	-4.303310	0.0000
WAGE	0.659337	0.100899	6.534602	0.0000
WAGE^2	-0.002904	0.003570	-0.813622	0.4161
AGE	0.023549	0.029487	0.798631	0.4248
FEMALE	1.113147	0.195365	5.697790	0.0000
OUTOFPROV	-0.702134	0.250542	-2.802458	0.0052
OUTOFCANADA	-0.477061	0.262409	-1.818006	0.0695
NONECONMAJ	-0.302945	0.195187	-1.552075	0.1211
YEAROFSTUDY	-0.266532	0.112106	-2.377494	0.0177
EMPLOYMENTEXP	0.657271	0.294736	2.230033	0.0260
UNIONEXP	0.053165	0.223354	0.238032	0.8119
FULLTIME	-0.407647	0.207538	-1.964209	0.0499

R-squared	0.635629	Mean dependent var	4.803213
Adjusted R-squared	0.630175	S.D. dependent var	3.841371
S.E. of regression	2.336061	Akaike info criterion	4.550743
Sum squared resid	4011.027	Schwarz criterion	4.624897
Log likelihood	-1687.702	F-statistic	116.5611
Durbin-Watson stat	1.650725	Prob(F-statistic)	0.000000

Probit (decline=0,accept=1)
Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 04/04/06 Time: 13:02
Sample: 1 747
Included observations: 747
Convergence achieved after 6 iterations
QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-4.015065	0.896964	-4.476283	0.0000
WAGE	0.328221	0.126967	2.585096	0.0097
WAGE^2	-0.002449	0.005512	-0.444398	0.6568
AGE	0.041519	0.024872	1.669283	0.0951
FEMALE	0.094005	0.139128	0.675676	0.4992
OUTOFPROV	-0.625010	0.175989	-3.551405	0.0004
OUTOFCANADA	0.096530	0.192720	0.500883	0.6165
NONECONMAJ	-0.136065	0.143908	-0.945497	0.3444
YEAROFSTUDY	-0.002890	0.081519	-0.035450	0.9717
EMPLOYMENTEXP	0.335279	0.210758	1.590822	0.1116
UNIONEXP	-0.120508	0.159712	-0.754534	0.4505
FULLTIME	-0.171300	0.154541	-1.108448	0.2677

Mean dependent var	0.713521	S.D. dependent var	0.452419
S.E. of regression	0.325246	Akaike info criterion	0.691137
Sum squared resid	77.75206	Schwarz criterion	0.765291
Log likelihood	-246.1397	Hannan-Quinn criter.	0.719715
Restr. log likelihood	-447.4299	Avg. log likelihood	-0.329504
LR statistic (11 df)	402.5804	McFadden R-squared	0.449881
Probability(LR stat)	0.000000		
Obs with Dep=0	214	Total obs	747
Obs with Dep=1	533		

Accepts only

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 13:03
Sample: 1 533
Included observations: 533
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.949618	1.381825	1.410901	0.1589
WAGE	0.281644	0.156344	1.801441	0.0722
WAGE^2	0.003646	0.004911	0.742436	0.4582
AGE	-0.009287	0.030726	-0.302247	0.7626
FEMALE	1.420977	0.189328	7.505381	0.0000
OUTOFPROV	-0.162380	0.277326	-0.585520	0.5585
OUTOFCANADA	-0.778169	0.260274	-2.989806	0.0029
NONECONMAJ	-0.161062	0.195002	-0.825951	0.4092
YEAROFSTUDY	-0.327190	0.109738	-2.981563	0.0030
EMPLOYMENTEXP	0.388670	0.290063	1.339951	0.1808
UNIONEXP	0.242386	0.221258	1.095488	0.2738
FULLTIME	-0.384554	0.204011	-1.884961	0.0600

R-squared	0.484501	Mean dependent var	6.731707
Adjusted R-squared	0.473617	S.D. dependent var	2.772256
S.E. of regression	2.011333	Akaike info criterion	4.257730
Sum squared resid	2107.686	Schwarz criterion	4.354057
Log likelihood	-1122.685	F-statistic	44.51561
Durbin-Watson stat	1.292155	Prob(F-statistic)	0.000000

Market four

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 13:04
Sample: 1 747
Included observations: 747
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.691308	1.091505	-5.214182	0.0000
WAGE	0.933379	0.112083	8.327589	0.0000
WAGE^2	-0.015689	0.003892	-4.031188	0.0001
AGE	0.055081	0.036046	1.528066	0.1269
FEMALE	1.065032	0.194823	5.466655	0.0000
OUTOFPROV	-0.299783	0.268302	-1.117334	0.2642
OUTOFCANADA	-0.604475	0.256772	-2.354128	0.0188
NONECONMAJ	0.303033	0.226127	1.340102	0.1806
YEAROFSTUDY	-0.037444	0.137977	-0.271379	0.7862
EMPLOYMENTEXP	0.317228	0.279092	1.136642	0.2561
UNIONEXP	0.095399	0.239965	0.397552	0.6911
FULLTIME	-0.419368	0.224627	-1.866950	0.0623

R-squared	0.518426	Mean dependent var	5.460509
Adjusted R-squared	0.511219	S.D. dependent var	3.692537
S.E. of regression	2.581559	Akaike info criterion	4.750598
Sum squared resid	4898.368	Schwarz criterion	4.824751
Log likelihood	-1762.348	F-statistic	71.93147
Durbin-Watson stat	1.419839	Prob(F-statistic)	0.000000

Probit (decline=0,accept=1)

Dependent Variable: ACCEPT
Method: ML - Binary Logit
Date: 04/04/06 Time: 13:04
Sample: 1 747
Included observations: 747
Convergence achieved after 6 iterations
QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-8.444085	1.639929	-5.149056	0.0000
WAGE	0.676444	0.171518	3.943857	0.0001
WAGE^2	-0.010917	0.006997	-1.560280	0.1187
AGE	0.149063	0.050956	2.925299	0.0034
FEMALE	0.668604	0.261541	2.556405	0.0106
OUTOFPROV	-0.962660	0.318857	-3.019096	0.0025
OUTOFCANADA	0.216014	0.331649	0.651333	0.5148
NONECONMAJ	0.373905	0.263109	1.421102	0.1553
YEAROFSTUDY	-0.030160	0.156085	-0.193228	0.8468
EMPLOYMENTEXP	0.382290	0.359421	1.063626	0.2875
UNIONEXP	-0.254597	0.296044	-0.859997	0.3898
FULLTIME	-0.715678	0.281264	-2.544509	0.0109

Mean dependent var	0.781794	S.D. dependent var	0.413305
S.E. of regression	0.321880	Akaike info criterion	0.675150
Sum squared resid	76.15106	Schwarz criterion	0.749304
Log likelihood	-240.1686	Hannan-Quinn criter.	0.703729
Restr. log likelihood	-391.8972	Avg. log likelihood	-0.321511
LR statistic (11 df)	303.4572	McFadden R-squared	0.387164
Probability(LR stat)	0.000000		
Obs with Dep=0	163	Total obs	747
Obs with Dep=1	584		

Accepts only

Dependent Variable: EFFORT
Method: Least Squares
Date: 04/04/06 Time: 13:05
Sample: 1 584
Included observations: 584
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.114737	1.370335	1.543227	0.1233
WAGE	0.329931	0.145571	2.266469	0.0238
WAGE^2	-0.000822	0.004625	-0.177653	0.8591
AGE	-0.012802	0.033247	-0.385046	0.7003
FEMALE	0.875021	0.179485	4.875175	0.0000
OUTOFPROV	0.425014	0.223488	1.901734	0.0577
OUTOFCANADA	-0.846392	0.255170	-3.316976	0.0010
NONECONMAJ	0.173977	0.204661	0.850073	0.3956
YEAROFSTUDY	-0.038434	0.125944	-0.305170	0.7603
EMPLOYMENTEXP	0.080716	0.253122	0.318884	0.7499
UNIONEXP	0.256441	0.208348	1.230833	0.2189
FULLTIME	0.063930	0.212246	0.301210	0.7634

R-squared	0.364890	Mean dependent var	6.984589
Adjusted R-squared	0.352677	S.D. dependent var	2.604542
S.E. of regression	2.095521	Akaike info criterion	4.337815
Sum squared resid	2511.771	Schwarz criterion	4.427608
Log likelihood	-1254.642	F-statistic	29.87561
Durbin-Watson stat	0.975296	Prob(F-statistic)	0.000000

Pooled markets (with dummies for the individual markets, market one being the base, and interaction coefficients between the market dummies and wage)

Dependent Variable: EFFORT
Method: Least Squares
Date: 06/29/06 Time: 13:13
Sample: 1 2988
Included observations: 2988
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.531146	0.525797	-6.715791	0.0000
WAGE	0.774085	0.056150	13.78592	0.0000
WAGE^2	-0.010667	0.001894	-5.631472	0.0000
AGE	0.035284	0.016459	2.143830	0.0321
FEMALE	1.169831	0.096828	12.08153	0.0000
OUTOFPROV	-0.368208	0.126634	-2.907662	0.0037
OUTOFCANADA	-0.403747	0.125250	-3.223540	0.0013
NONECONMAJ	-0.131535	0.104366	-1.260325	0.2077
YEAROFSTUDY	-0.199310	0.062432	-3.192457	0.0014
EMPLOYMENTEXP	0.483385	0.140325	3.444751	0.0006
UNIONEXP*EMPLOYMENTEXP	-0.099005	0.120410	-0.822230	0.4110
FULLTIME	-0.368198	0.107429	-3.427351	0.0006
EILOWEROREQUAL	-1.004359	0.200620	-5.006274	0.0000
EIHIGHER	-0.420743	0.137199	-3.066667	0.0022
WAGELOWER	-1.524015	0.176200	-8.649372	0.0000
WAGEHIGHER	-0.003907	0.140718	-0.027762	0.9779
WAGEEQUAL	-0.727054	0.323625	-2.246596	0.0247
SUPERVISION	-0.102564	0.127279	-0.805822	0.4204

R-squared	0.579488	Mean dependent var	5.193775
Adjusted R-squared	0.577081	S.D. dependent var	3.678801
S.E. of regression	2.392408	Akaike info criterion	4.588483
Sum squared resid	16999.13	Schwarz criterion	4.624642
Log likelihood	-6837.194	F-statistic	240.7536
Durbin-Watson stat	1.183804	Prob(F-statistic)	0.000000

Probit (decline=0,accept=1)

Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 06/29/06 Time: 13:12
Sample: 1 2988
Included observations: 2988
Convergence achieved after 6 iterations
QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-4.255966	0.438579	-9.703989	0.0000
WAGE	0.445787	0.047465	9.391959	0.0000
WAGE^2	-0.008907	0.001877	-4.745535	0.0000
AGE	0.058074	0.014247	4.076117	0.0000
FEMALE	0.312584	0.074685	4.185383	0.0000
OUTOFPROV	-0.398594	0.090609	-4.399060	0.0000
OUTOFCANADA	0.245298	0.099695	2.460485	0.0139
NONECONMAJ	0.031774	0.076923	0.413058	0.6796
YEAROFSTUDY	-0.030971	0.044029	-0.703418	0.4818
EMPLOYMENTEXP	0.315072	0.110643	2.847638	0.0044
UNIONEXP*EMPLOYMENTEXP	-0.227575	0.088025	-2.585346	0.0097
FULLTIME	-0.283184	0.081974	-3.454550	0.0006
EILOWEROREQUAL	-0.646003	0.112571	-5.738630	0.0000
EIHIGHER	0.030279	0.141770	0.213580	0.8309
WAGELOWER	-0.789016	0.103623	-7.614321	0.0000
WAGEEQUAL	-0.396534	0.207414	-1.911805	0.0559
WAGEHIGHER	0.013188	0.222687	0.059220	0.9528
SUPERVISION	-0.276557	0.091897	-3.009424	0.0026

Mean dependent var	0.770080	S.D. dependent var	0.420851

S.E. of regression	0.307638	Akaike info criterion	0.604772
Sum squared resid	281.0846	Schwarz criterion	0.640931
Log likelihood	-885.5292	Hannan-Quinn criter.	0.617781
Restr. log likelihood	-1611.068	Avg. log likelihood	-0.296362
LR statistic (17 df)	1451.077	McFadden R-squared	0.450346
Probability(LR stat)	0.000000		
Obs with Dep=0	687	Total obs	2988
Obs with Dep=1	2301		

Accepts only
Dependent Variable: EFFORT
Method: Least Squares
Date: 06/29/06 Time: 13:22
Sample(adjusted): 1 2300
Included observations: 2300 after adjusting endpoints
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.049328	0.675236	4.515946	0.0000
WAGE	0.211618	0.074655	2.834619	0.0046
WAGE^2	0.003602	0.002378	1.514711	0.1300
AGE	-0.004499	0.016040	-0.280497	0.7791
FEMALE	1.162586	0.093427	12.44385	0.0000
OUTOFPROV	-0.017326	0.128769	-0.134551	0.8930
OUTOFCANADA	-0.723266	0.124419	-5.813155	0.0000
NONECONMAJ	-0.158094	0.099942	-1.581854	0.1138
YEAROFSTUDY	-0.227652	0.060922	-3.736758	0.0002
EMPLOYMENTEXP	0.249418	0.134135	1.859452	0.0631
UNIONEXP*EMPLOYMENTEXP	0.099095	0.115622	0.857056	0.3915
FULLTIME	-0.161931	0.105969	-1.528091	0.1266
EILOWEROREQUAL	-0.243623	0.267533	-0.910625	0.3626
EIHIGHER	-0.434244	0.128399	-3.381983	0.0007
WAGELOWER	-0.897910	0.237234	-3.784917	0.0002
WAGEEQUAL	-0.523200	0.283263	-1.847049	0.0649
WAGEHIGHER	0.067461	0.130854	0.515546	0.6062
SUPERVISION	0.173846	0.120576	1.441799	0.1495
R-squared	0.398916	Mean dependent var		6.743478
Adjusted R-squared	0.394438	S.D. dependent var		2.667173
S.E. of regression	2.075536	Akaike info criterion		4.306112
Sum squared resid	9830.516	Schwarz criterion		4.351038
Log likelihood	-4934.028	F-statistic		89.08682
Durbin-Watson stat	0.837839	Prob(F-statistic)		0.000000

Prediction Tables

Market one

Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 04/04/06 Time: 12:50
Sample: 1 747
Included observations: 747
Prediction Evaluation (success cutoff C = 0.5)

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	80	34	114	0	0	0
P(Dep=1)>C	49	584	633	129	618	747
Total	129	618	747	129	618	747
Correct	80	584	664	0	618	618
% Correct	62.02	94.50	88.89	0.00	100.00	82.73
% Incorrect	37.98	5.50	11.11	100.00	0.00	17.27
Total Gain*	62.02	-5.50	6.16			
Percent Gain**	62.02	NA	35.66			

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
E(# of Dep=0)	70.87	58.51	129.38	22.28	106.72	129.00
E(# of Dep=1)	58.13	559.49	617.62	106.72	511.28	618.00
Total	129.00	618.00	747.00	129.00	618.00	747.00
Correct	70.87	559.49	630.36	22.28	511.28	533.55
% Correct	54.94	90.53	84.39	17.27	82.73	71.43
% Incorrect	45.06	9.47	15.61	82.73	17.27	28.57
Total Gain*	37.67	7.80	12.96			
Percent Gain**	45.53	45.18	45.35			

*Change in "% Correct" from default (constant probability) specification
**Percent of incorrect (default) prediction corrected by equation

Market two

Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 04/04/06 Time: 12:49
Sample: 1 747
Included observations: 747
Prediction Evaluation (success cutoff C = 0.5)

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	129	42	171	0	0	0
P(Dep=1)>C	52	524	576	181	566	747
Total	181	566	747	181	566	747
Correct	129	524	653	0	566	566

% Correct	71.27	92.58	87.42	0.00	100.00	75.77
% Incorrect	28.73	7.42	12.58	100.00	0.00	24.23
Total Gain*	71.27	-7.42	11.65			
Percent Gain**	71.27	NA	48.07			

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
E(# of Dep=0)	114.57	65.72	180.28	43.86	137.14	181.00
E(# of Dep=1)	66.43	500.28	566.72	137.14	428.86	566.00
Total	181.00	566.00	747.00	181.00	566.00	747.00
Correct	114.57	500.28	614.85	43.86	428.86	472.71
% Correct	63.30	88.39	82.31	24.23	75.77	63.28
% Incorrect	36.70	11.61	17.69	75.77	24.23	36.72
Total Gain*	39.07	12.62	19.03			
Percent Gain**	51.56	52.08	51.82			

*Change in "% Correct" from default (constant probability) specification
**Percent of incorrect (default) prediction corrected by equation

Market three

Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 04/04/06 Time: 13:02
Sample: 1 747
Included observations: 747
Prediction Evaluation (success cutoff C = 0.5)

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	153	50	203	0	0	0
P(Dep=1)>C	61	483	544	214	533	747
Total	214	533	747	214	533	747
Correct	153	483	636	0	533	533
% Correct	71.50	90.62	85.14	0.00	100.00	71.35
% Incorrect	28.50	9.38	14.86	100.00	0.00	28.65
Total Gain*	71.50	-9.38	13.79			
Percent Gain**	71.50	NA	48.13			

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
E(# of Dep=0)	135.49	78.51	214.00	61.31	152.69	214.00
E(# of Dep=1)	78.51	454.49	533.00	152.69	380.31	533.00
Total	214.00	533.00	747.00	214.00	533.00	747.00
Correct	135.49	454.49	589.99	61.31	380.31	441.61
% Correct	63.31	85.27	78.98	28.65	71.35	59.12
% Incorrect	36.69	14.73	21.02	71.35	28.65	40.88
Total Gain*	34.67	13.92	19.86			
Percent Gain**	48.59	48.59	48.59			

*Change in "% Correct" from default (constant probability) specification

**Percent of incorrect (default) prediction corrected by equation

Market four

Dependent Variable: ACCEPT
Method: ML - Binary Logit
Date: 04/04/06 Time: 13:04
Sample: 1 747
Included observations: 747
Prediction Evaluation (success cutoff C = 0.5)

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	93	42	135	0	0	0
P(Dep=1)>C	70	542	612	163	584	747
Total	163	584	747	163	584	747
Correct	93	542	635	0	584	584
% Correct	57.06	92.81	85.01	0.00	100.00	78.18
% Incorrect	42.94	7.19	14.99	100.00	0.00	21.82
Total Gain*	57.06	-7.19	6.83			
Percent Gain**	57.06	NA	31.29			

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
E(# of Dep=0)	87.37	75.63	163.00	35.57	127.43	163.00
E(# of Dep=1)	75.63	508.37	584.00	127.43	456.57	584.00
Total	163.00	584.00	747.00	163.00	584.00	747.00
Correct	87.37	508.37	595.73	35.57	456.57	492.14
% Correct	53.60	87.05	79.75	21.82	78.18	65.88
% Incorrect	46.40	12.95	20.25	78.18	21.82	34.12
Total Gain*	31.78	8.87	13.87			
Percent Gain**	40.65	40.65	40.65			

*Change in "% Correct" from default (constant probability) specification
**Percent of incorrect (default) prediction corrected by equation

Pooled markets

Dependent Variable: ACCEPT
Method: ML - Binary Probit
Date: 04/04/06 Time: 13:07
Sample: 1 2988
Included observations: 2988

Prediction Evaluation (success cutoff C = 0.5)

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	447	163	610	0	0	0
P(Dep=1)>C	240	2138	2378	687	2301	2988
Total	687	2301	2988	687	2301	2988
Correct	447	2138	2585	0	2301	2301
% Correct	65.07	92.92	86.51	0.00	100.00	77.01
% Incorrect	34.93	7.08	13.49	100.00	0.00	22.99
Total Gain*	65.07	-7.08	9.50			
Percent Gain**	65.07	NA	41.34			

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
E(# of Dep=0)	402.06	284.61	686.67	157.95	529.05	687.00
E(# of Dep=1)	284.94	2016.39	2301.33	529.05	1771.95	2301.00
Total	687.00	2301.00	2988.00	687.00	2301.00	2988.00
Correct	402.06	2016.39	2418.44	157.95	1771.95	1929.91
% Correct	58.52	87.63	80.94	22.99	77.01	64.59
% Incorrect	41.48	12.37	19.06	77.01	22.99	35.41
Total Gain*	35.53	10.62	16.35			
Percent Gain**	46.14	46.20	46.17			

*Change in "% Correct" from default (constant probability) specification
**Percent of incorrect (default) prediction corrected by equation

F-Stats testing joint significance of WAGE variables

EQ1

Market one

Redundant Variables: WAGE WAGE^2			
F-statistic	446.8434	Probability	0.000000
Log likelihood ratio	594.3571	Probability	0.000000

Market two

Redundant Variables: WAGE WAGE^2			
F-statistic	472.5352	Probability	0.000000
Log likelihood ratio	617.5602	Probability	0.000000

Market three

Redundant Variables: WAGE WAGE^2			
F-statistic	610.0845	Probability	0.000000
Log likelihood ratio	730.8360	Probability	0.000000

Market four

Redundant Variables: WAGE WAGE^2			
F-statistic	372.3778	Probability	0.000000
Log likelihood ratio	522.7220	Probability	0.000000

Pooled Markets

Redundant Variables: WAGE WAGE^2 WAGE*EIOPTION WAGE *COWORKERWAGE WAGE*SUPERVISION

F-statistic	750.0637	Probability	0.000000
Log likelihood ratio	2439.922	Probability	0.000000

EQ2

Market one

Redundant Variables: WAGE WAGE^2

F-statistic	290.9747	Probability	0.000000
Log likelihood ratio	297.1613	Probability	0.000000

Market two

Redundant Variables: WAGE WAGE^2

F-statistic	380.9822	Probability	0.000000
Log likelihood ratio	399.2292	Probability	0.000000

Market three

Redundant Variables: WAGE WAGE^2

F-statistic	340.8463	Probability	0.000000
Log likelihood ratio	389.3476	Probability	0.000000

Market four

Redundant Variables: WAGE WAGE^2

F-statistic	226.5114	Probability	0.000000
Log likelihood ratio	277.2598	Probability	0.000000

Pooled markets

Redundant Variables: WAGE WAGE^2

F-statistic	1200.865	Probability	0.000000
Log likelihood ratio	1339.225	Probability	0.000000

EQ3

Market one

Redundant Variables: WAGE WAGE^2

F-statistic	179.5923	Probability	0.000000
Log likelihood ratio	287.6416	Probability	0.000000

Market two

Redundant Variables: WAGE WAGE^2

F-statistic	119.3616	Probability	0.000000
Log likelihood ratio	202.8031	Probability	0.000000

Market three

Redundant Variables: WAGE WAGE^2

F-statistic	190.5190	Probability	0.000000
Log likelihood ratio	292.5673	Probability	0.000000

Market four

Redundant Variables: WAGE WAGE^2

F-statistic	131.2760	Probability	0.000000
Log likelihood ratio	220.6095	Probability	0.000000

Pooled markets

Redundant Variables: WAGE WAGE^2 WAGE*EIOPTION WAGE *COWORKERWAGE WAGE*SUPERVISION

F-statistic	245.9782	Probability	0.000000
Log likelihood ratio	991.6135	Probability	0.000000

Appendix Three: Mathematical Appendix

The t-stat for the elasticity in the pooled market regressions is calculated in the following manner.

$$\text{Elasticity} = \frac{\partial e}{\partial w}\frac{w}{e}$$

Where e is effort and w is the wage

The equation used to generate the derivative of effort with respect to wage is the estimated econometric model relevant to the elasticity being examined. All elasticices are evaluated at the means.

$$\text{Therefore: Elasticity} = \left[\left(\beta_1 + 2\beta_2\overline{W} + \gamma_i\overline{D_i}\right)\left(\frac{\overline{W}}{\overline{E}}\right)\right]$$

Where β_1 is the coefficient on the wage variable, β_2 is the coefficient on the squared wage variable, γ_i is the coefficient on the relevant market dummy variable and D_i is the relevant market dummy variable. As usual, the overlined variables denote the means of these variables. This equation can be expanded to equal

$$\left(\frac{\overline{W}}{\overline{E}}\right)\beta_1 + 2\left(\frac{\overline{W^2}}{\overline{E}}\right)\beta_2 + \overline{D_i}\left(\frac{\overline{W}}{\overline{E}}\right)\gamma_i$$

The elasticity is therefore a linear function of a number of variables of which we know the variances and covariances and can be estimated in the following manner

$$\text{var(elasticity)} = \text{var}\left[\left(\frac{\overline{W}}{\overline{E}}\right)\beta_1 + 2\left(\frac{\overline{W^2}}{\overline{E}}\right)\beta_2 + \overline{D_i}\left(\frac{\overline{W}}{\overline{E}}\right)\gamma_i\right]$$

$$= \left(\frac{\overline{W}}{\overline{E}}\right)^2 \text{var}(\beta_1) + 4\left(\frac{\overline{W^2}}{\overline{E}}\right)^2 \text{var}(\beta_2) + \left[\overline{D_i}\left(\frac{\overline{W}}{\overline{E}}\right)\right]^2 \text{var}(\gamma_i) + 4\left(\frac{\overline{W}}{\overline{E}}\right)\left(\frac{\overline{W^2}}{\overline{E}}\right)Cov(\beta_1,\beta_2)$$

$$+ 2\left[\overline{D_i}\left(\frac{\overline{W}}{\overline{E}}\right)\right]\left(\frac{\overline{W}}{\overline{E}}\right)Cov(\beta_i,\gamma_i) + 4\left(\frac{\overline{W^2}}{\overline{E}}\right)\left[\overline{D_i}\left(\frac{\overline{W}}{\overline{E}}\right)\right]Cov(\beta_2,\gamma_i)$$

For the seperate markets the elasticity and the variance of the elasticity can be calculated in a similar manner yielding the following equations

$$\text{Elasticity} = \left(\frac{\overline{W}}{\overline{E}}\right)\beta_1 + 2\left(\frac{\overline{W^2}}{\overline{E}}\right)\beta_2$$

$$\text{Var(Elasticity)} = \left(\frac{\overline{W}}{\overline{E}}\right)^2 \text{var}(\beta_2) + 4\left(\frac{\overline{W}^2}{\overline{E}}\right)^2 \text{var}(\beta_2) + 4\left(\frac{\overline{W}}{\overline{E}}\right)\left(\frac{\overline{W}^2}{\overline{E}}\right)\text{cov}(\beta_1, \beta_2)$$

T - stat calculated under null hypothesis of Elasticity = 1 is given as

$$= \frac{\hat{\varepsilon} - 1}{\sqrt{\text{var}(\hat{\varepsilon})}}$$

Table of calculated t-stats for elasticity of effort w.r.t. wage

Pooled markets	Market			
	1	2	3	4
EQ1 (first model/OLS)	5.985320	8.346211	12.207426	7.023254
EQ2 (conditional model/second stage)	-5.2739	-8.168344	-2.608616	-8.498023

Separate markets	Market			
	1	2	3	4
EQ1 (first model/OLS)	6.629631	11.142921	16.54029	6.388151
EQ2(conditional model/second stage)	-6.482984	-3.927957	-0.951023	-6.156875

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