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The Impact of Minimum Wages on Hours and Employment Revisited

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Abstract

Using a standard production function the equilibrium hours per worker wage locus is shown to be u-shaped in a competitive labour market. A minimum wage may thus either increase or decrease hours per worker and, by extension, the number of workers. We provide supporting evidence for this using data from Trinidad and Tobago. We argue that examining total employment or full-time equivalents is not a meaningful way to measure the employment response to a minimum wage.

Keywords: minimum wages, hours, employment.

JEL classification: J30

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I. Introduction

There exists an abundance of studies estimating the employment effects of the minimum wage [see Brown (1999) for a survey]. This literature typically abstracts from any effect on hours by estimating the impact in terms of either the number of employees or the number of full-time equivalents. For the studies that examine the effect on hours explicitly there is conflicting evidence on the direction of the change in hours per worker in response to a minimum wage increase, although most of the evidence suggests considerable variation. For example, Zavodney (2000) using a panel of U.S. states finds a significant increase in hours, while Katz and Krueger (1992) discover a fall in part-time work. In contrast, Neumark et al.(2000b) and Couch and Wittenberg (2001) find a significant reduction in hours using a panel of U.S states, where the former argue that minimum wage workers are adversely affected by a minimum wage increase. Similarly, Nolan et al. (2002) find a significant increase in part-time work resulting from the introduction of a minimum wage in Ireland.

The possibility that a minimum wage would lead to a reduction in hours per worker is, however, difficult to rationalise if all workers face a positive relationship between wages and hours, as is commonly assumed. A more realistic scenario may instead be a u-shaped wage-hours locus, so that workers with few hours face a negative, while those with relatively more hours will be subject to a positive relationship between hours and wages. As a matter of fact, there is already a body of empirical evidence suggesting that many workers would alter their working hours at the current wage given the choice. Some examples are Stewart and Swaffield (1997) for the U.K. who show that a large fraction of workers desire a shorter working week at the current wage and that these tend to be working longer hours, while a smaller

fraction desires longer hours at the current wage and tend to work short hours. Kahn and Lang (1991) using Canadian data investigate biases in labour supply estimates when workers face hours constraints, or Altjoni and Paxson (1988) for the U.S. look at the relationship between hours and wage changes for quitters in their old and new jobs and find that workers are compensated for being away from desired hours.

In this paper we show that within a competitive model reasonable assumptions about workers' indifference curves and firm's production technologies can produce a u-shaped wage-hours locus. A minimum wage³ increase within such a framework will then either increase or decrease hours per worker and, by extension, the number of workers. More precisely, workers with longer hours who are on the upward sloping portion of the locus will wish to shorten hours, but will in fact be obliged to work longer hours, in response to a minimum wage. In contrast, workers who are on the downward segment with low hours are more likely to wish to work longer hours as their hours worked will fall in response to a rise.^{4, 5} Importantly, such a u-shaped relationship between hours and the hourly wage suggests that, in terms of empirical work, estimating the impact of a change in the minimum wage on employment by looking at the number of employees alone may give a misleading answer in that it need not move in the same direction as the firms aggregate demand for labour.

In order to gain empirical support for our theoretical model we appeal to the prediction that an increase in the minimum wage will cause some workers with low hours to want to work more hours. Specifically, we examine how the introduction of

³ We will assume throughout the paper that the minimum wage is binding.

⁴ Hours work are typically much lower than average for minimum wage workers. See, for instance, any of the studies quoted in the previous paragraph.

⁵ One should note that, in contrast to the theoretical framework presented here, the canonical model of labour supply assumes that workers are offered a wage and choose hours. However, Manning (2001), restating an argument originally made in Lewis (1969) shows that it is only if the labour aggregator over hours and workers is their product that the canonical model is consistent with profit maximisation. Konoshito (1987) similarly develops a model where firms offer wages and choose hours. These types of models, though, typically assume that the equilibrium locus between hours and wages is always upward sloping.

a first time national minimum wage in Trinidad and Tobago in 1998 affected the incidence of involuntary part-time employment. Following a panel of workers over the implementation of this legislation our evidence shows indeed that the incidence of involuntary part-time employment in Trinidad and Tobago increased as a consequence of the minimum wage. As argued above, one can only rationalise this if some workers in Trinidad and Tobago had been facing a negatively sloped segment of the wage-hours locus.

The remainder of the paper proceeds as follows. In the following section we outline our theoretical model. We then describe market equilibrium of our model in Section III. Section IV contains our empirical analysis using the Trinidad and Tobago data set. Concluding remarks are provided in the final section.

II. The Model

We will assume a representative worker who has a reservation indifference curve over wages, w , and hours, h , as shown in Figure 1. There are no frictions in the model so firms can hire as many workers as they wish along any point on the indifference curve. One can think of a variety of firms with production functions that differ in the relative intensity with which hours and workers are combined to produce output. This will determine the shape of the firm's isoprofit curves. As we illustrate in more detail below, firms with a more hours intensive technology will optimise by choosing an hours wage combination to the right of h_3 and those with a less hours intensive technology to the left of h_3 . Say the firm optimally chooses a level of hours less than h_3 . In this case at the margin the firm pays higher wages to induce the worker in to working fewer hours than they would choose at that wage. If hours are to the right of h_3 the worker is compensated for working more hours than they would

choose at the wage. If a minimum wage of w^* , as shown, were introduced, then the firm could choose any hours combination between h_1 and h_2 at the minimum wage. The point where the higher indifference curve is tangent to the minimum wage line shows the number of hours the worker would like at the minimum wage.

Stated more formally, the labour market is frictionless and the price taking firm's profit function is:

$$pf(n, h) - w(h)hn \quad (1)$$

where we assume that $f_n > 0$, $f_h > 0$, $f_{nn} < 0$, $f_{hh} < 0$ and $f_{nh} > 0$. The hours wage locus is given by $h(w)$. The firm's choice of n at an interior solution satisfies:

$$pf_n(n, h) = w(h)h$$

The choice of h at an interior solution satisfies:

$$pf_h(n, h) = w_h(h)hn + w(h)n \quad (2)$$

We can assess the impact of a minimum wage on n by totally differentiating the first order condition on n :

$$pf_{nn}dn + (pf_{nh} - w_h h - w)dh = 0 \quad (3)$$

Evaluating at the initial equilibrium

$$\frac{dn}{dw} = \frac{\left[\frac{f_h}{n} - f_{nh} \right]}{f_{nn}} \frac{dh}{dw} \quad (4)$$

One should note that if the firm chooses a wage hours bundle on a negative part of the wage hours locus corresponding to a choice to the left of h_3 in Figure 1 then: $\frac{dh}{dw} < 0$.

If the choice of hours is to the right of h_3 then: $\frac{dh}{dw} > 0$. Following Hammermesh

(1993) we use the function $f(z) = n^b x(h)$ as an example of a technology where the scale effects of a firm's output on hours per worker are zero⁶.

Profits are:

$$px(h)n^b - w(h)hn \quad (5)$$

The first order conditions on n and w are:

$$\pi_n(n, h) = b \frac{px(h)n^b}{n} - w(h)h \quad (6)$$

$$\pi_h(n, h) = px_h(h)n^b - w_h(h)hn - w(h)n \quad (7)$$

Using these first order conditions we get:

$$w_h \frac{h}{w} = \frac{x_h h}{x} \frac{1}{b} - 1 \quad (8)$$

In the Cobb-Douglas example used later $f(z) = h^c n^b$ so that:

$$\frac{w_h h}{w} = \frac{c - b}{b} \quad (9)$$

It is worth noting that while we will assume a representative worker with a u-shaped indifference curve to solve the model explicitly, equation (9) implies that if firms with technologies where $c < b$ are producing in equilibrium any equilibrium wage hours locus must have a negative slope at their wage hours choice while firms with $c > b$ must be on a positive wage hours locus. This implies that if there are some firms with $c < b$ and some with $c > b$ any equilibrium wage hours locus will have both a positive and negative segment. Using the production function from equation (5) in equation (4) the effect on the number of workers of a minimum wage is:

$$\frac{dn}{dw} = - \frac{x_h n}{bx} \frac{dh}{dw} \quad (10)$$

⁶ As Hamermesh notes "There is no evidence that weekly hours of full-time workers at General Motors differ substantially from hours at the local steel fabricator."

We see that the minimum wage will increase the number of workers in a firm operating on the negatively sloped part of the wage hours locus. One should note that this is a partial equilibrium result in that we assume that the wage hours locus is unaffected by the minimum wage. An additional point worth noting is that the analysis is for a just binding minimum wage, it would be more difficult to pin down the firms response if the minimum wage is not binding. In terms of Figure 1 this means we are analysing the impact of a minimum wage of w^* on firms located at h_1 or h_3 .

As noted earlier empirical studies often estimate the employment response of minimum wages by looking at full-time equivalents. That is if we think of employment as nh . In this case the employment effect would be:

$$\frac{d(nh)}{dw} = n \frac{dh}{dw} + h \frac{dn}{dw} \quad (11)$$

Using the impact on the number of workers in (10) this is:

$$\frac{d(nh)}{dw} = n \left[1 - \frac{x_h h}{x} \frac{1}{b} \right] \frac{dh}{dw} < 0 \quad (12)$$

This will always be negative since from equation (8) the term in square brackets will always have the opposite sign to $\frac{dh}{dw}$. It might be argued that this brings us back to the standard neo-classical result. While minimum wages may lead to substitution between hours per worker and workers, overall hours fall unambiguously. The difficulty with this argument is that total hours is not especially meaningful in this context, it does not measure the firms aggregate labour input in the production function. For example using the labour aggregator assumed in the production function used above it is straightforward to show that even though total hours fall output is unchanged by a minimum wage:

$$\frac{d[x(h)n^b]}{dw} = x_h n^b \frac{dh}{dw} + b \frac{xn^n}{n} \frac{dn}{dw} = 0 \quad (13)$$

We now solve the model explicitly where competitive firms have a Cobb-Douglas production function $h^c n^{1-c}$. For illustrative purposes we assume a representative worker and solve explicitly for the wage hours locus. The budget constraint ($x=wh$) is substituted into a Cobb-Douglas utility function ($u = x^a l^{(1-a)}$) to give the following relationship between the wage and hours:

$$w = \frac{u^{\frac{1}{a}}}{h(t-h)^{\frac{1-a}{a}}} \quad (14)$$

We assume that the consumer price index of prices for workers is unity so w is a real wage. Using the above expression for the wage the profit function is:

$$ph^c n^{(1-c)} - \frac{nu^{\frac{1}{a}}}{(t-h)^{\frac{1-a}{a}}} \quad (15)$$

The first order conditions on n and w imply:

$$h = t \frac{ac}{ac + (1-a)(1-c)} \quad (16)$$

and

$$n = \left[\frac{(1-c)(1-a)}{ac} \right]^{\frac{1-a}{ac}} [p(1-c)]^{\frac{1}{c}} h^{\frac{1-a+ac}{ac}} \quad (17)$$

If workers have a strong preference for leisure: (a is small), or firms a strong preference for workers over hours (c is small), then the solution for hours will be on the negatively sloped part of the indifference curve in Figure 1. If a minimum wage just above the optimal choice induces the firm to lower hours, then the number of workers will increase. If initial hours are on the positively sloped part of the

indifference curve the number of employees falls. The point is that in the simplest competitive framework hours or employment can either rise or fall in response to a minimum wage. Important for our empirical work, for example, one can derive the proposition that there might be *workers already working a small number of hours, or less than they would like to work, who will have their hours fall in response to an increase of the minimum wage.*

II. Equilibrium in the Market

While the previous section discussed the behaviour of a single price taking firm, in this section we discuss how equilibrium is maintained in the market. We continue with the Cobb-Douglas example for ease of exposition. We think of a distribution of firms with different values of c between zero and unity. Each firm produces a different variety of output and has a different output price. We assume that there is free entry of firms and a reservation profit level π . Free entry guarantees that prices adjust until profits are equalised across all firm types. We also assume $\pi = u = t = 1$ and $a = 0.5$. From equation (16) one can see that $h = c$ in this case. Also, given the parameter assumptions, from (17) $n = c^{\frac{1+c}{c}} \left[\frac{1-c}{c} \right]^{\frac{1}{c}} (1-c)^{\frac{1}{c}} p^{\frac{1}{c}}$. Substituting each of these values into the profit function one can solve for the price that equalises profit in firms with different hours intensity's (c 's):

$$p = \frac{\left[\frac{(c-1)^2}{c} \right]^c}{c^c - 2c^{c+1} + c^{c+2}} \quad (18)$$

Since firms are price takers we use the price in (18) to trace out the firm's isoprofit curves in the wage hours space. To do this we go back into the profit function and use the first order condition for n to solve for the optimal level of employment.

Substituting this back into the profit function using equation (18) for price and fixing the level of profit at unity, we trace out the isoprofit curves in the wage hours space for different values of c , along side the worker indifference curve. Figure 2 illustrates the equilibrium for three such firms. Accordingly, the U shaped curve is the indifference curve, the negative sloped curve is for a firm with $c=0.1$, the positive slope for a firm with $c=0.9$, and the horizontal one for $c=0.5$. This last case is the only one where the firm would allow workers to choose their own hours as noted earlier. Firms with technologies that are less intensive in hours will have negatively sloped isoprofit curves, firm entry will drive the price up or down until firms make normal profits, and the isoprofit curve will be tangent to the wage hours locus.

Finally one must note that a counterargument against the above framework is that there could be a distribution of workers with different preferences. Workers with preferences for low hours would be sorted into firms which wish low hours as in the standard compensating differentials model outlined in Rosen (1986). The locus of tangency between hours and wages is always achieved so that the curve will be upward sloping. Clearly, however, especially if there were fixed costs to working, such a scenario is unlikely to be true below a certain level of hours. For example, while a restaurant owner may find it optimal to have workers work ten hours a week (lunchtime every day), it may be unreasonable to assume that there is a large group of workers who would accept such a small number of hours unless the wage was increased. A similar argument can be made for very high hours. A complementary argument to this is the point made earlier that for standard production functions some firms will have negatively sloped isoprofit curves which can only be part of an equilibrium where the wage hours locus slopes downward.

IV. Empirical Analysis

In order to gain empirical support for our theoretical model we appeal to the prediction that an increase in the minimum wage will cause some workers with low hours to want to work more hours. To do this we investigate the case of Trinidad and Tobago where relatively recent events provide us with a natural case study with which to examine the effects of the minimum wage on the labour market. More specifically, in April of 1998 the Trinidad and Tobago government introduced a national minimum wage for the first time^{7, 8}, setting the minimum wage at the rate of \$TT7.00 per hour, regardless of the characteristics of the worker or the nature of work involved. Of course, one of the problems with assessing the impact of minimum wages on the labour market in developing countries is that if compliance is low due to weak regulatory structures, in essence minimum wages can be ineffectual. However, as shown by Strobl and Walsh (2003), although there was a large degree of non-compliance in Trinidad and Tobago, the national minimum wage did push up the wage rate of some workers, while others consequently lost their job.

The data source for our empirically analysis is the Trinidad and Tobago Continuous Sample Survey of Population (CSSP). The CSSP is a quarterly multi-purpose household survey with its primary objective being to provide up-to-date data on the labour force characteristics of the population of Trinidad and Tobago on a continuing basis, for which we have access to the 1996-98 CSSP surveys. Moreover, it is a rotational survey in that households are surveyed three times – a year after the

⁷ While the legislative framework enabling the introduction of minimum wages in Trinidad and Tobago was first passed in 1976, only very few sectoral minimum wages were introduced until 1998, most of which were well below the 1998 level and in practise not strictly enforced; see Strobl and Walsh (2003).

⁸ The minimum wage rate was implemented in response to recommendations from a 1995 World Bank report on poverty in Trinidad and Tobago and was largely unanticipated by the public and, hence, can be considered a largely exogenous change; see Strobl and Walsh (2003) for details.

first interview and a last time the quarter subsequent to the second interview.⁹ This latter aspect allows us to create short panels for a significant number of individuals.¹⁰ For all calculations in the present paper we use information on the first two observations, i.e., those which lie a year apart, of the continuously employed, but exclude the self-employed and those working in the government sector.

Ideally we would like to have information on both whether those that work less hours because of the minimum wage desire more and whether those that work more as a consequence desire less hours. Not surprisingly such detailed question are not asked of the surveyed individuals. Fortunately, the CSSP does, however, have, apart from data on earnings, hours worked, human capital and working place characteristics, information on the reasons why individuals worked part-time (defined as working less than 33 hours per week). Specifically, one is able to distinguish between the voluntarily and involuntarily part-time employed. Using this information we thus assume that a move to involuntary part-time employment is utility decreasing, as would occur in Figure 1 for those initially on the downward sloping part of the curve.¹¹ This allows us thus to seek support for at least one side of the story told here, namely that some workers will in response to the minimum wage desire more than the level of hours that they are given.

In comparing whether the incidence of involuntary part-time employment increased due to the minimum wage it is of course important to choose the correct study and comparison groups. This becomes somewhat more complicated in a

⁹ For a more extensive description of this data set see Strobl and Walsh (2001).

¹⁰ Given the CSSP's close parallel in structure to the US CPS, we used a similar algorithm to that proposed by Madrian and Lefgren (1999) to link individuals over time. This involves using questionnaire, household and time invariant individuals information to link individuals and then using age and its anticipated possible range of changes over time to double check the merges. This allowed us to link 64,700 individuals, of which about 46,000 were of working age.

¹¹ Persons working less than 33 hours are asked to choose among a number of reasons, namely (a) no more work available, (b) new job, (c) illness, (d) temporary layoff, (e) own choice, (f) vacation, and (g) other. Using this information we classified part-time workers as involuntary if they stated either (a), (b), or (d) as reasons.

developing country relative to developed countries given the possibility of non-compliance. Normally, i.e., under complete compliance, the natural study group would simply be those workers whose first wage observation is below \$TT 7.00 (in appropriate 1998 prices) and occurs before the minimum wage, but whose second observation falls at some point thereafter. When there is the possibility of non-compliance, however, only those whose second observation is actually at least at the minimum level can be considered to be affected, and it is this sub-group that serves as our study group. As a control group we use those individuals whose first observation is below the minimum level and whose second observation falls before the introduction of the minimum wage. Examining the yearly wage distributions for the same sample as here, Strobl and Walsh (2001) show that the only apparent shift in the wage distribution over the entire sample seems to have occurred after the implementation of the minimum wage.¹² However, for further verification that any changes in the incidence of involuntary part-time employment were not due to other factors that may have coincided with the minimum wage, we also use non-compliant workers as a secondary study group. Hence a high degree of non-compliance is not necessarily a disadvantage in terms of what we are trying to measure here, but rather provides us with another study group to check the robustness of our results.

One of the problems with interpreting an increase in the incidence of involuntary part-time in response to the minimum wage as empirical support for our theoretical arguments is that the desire to work more hours may simply be a response to the increase in the higher wage rate and not to a reduction in hours, i.e., it may simply be a movement along the worker's supply curve. Actually, a worker may

¹² One might be inclined to also use the non-compliant workers as a control group. However, there clearly could be spillover effects from the compliant sector, so we do not rely on these workers as our main control group. For instance, in the case of Ghana Jones (1998) shows that there were spillover effects in the informal sector due to changes in the minimum wage that affected the formal sector.

become involuntarily part-time even if his hours have increased. Thus, ideally, one would like to identify only those who have become involuntary part-time because of a reduction in hours. However, the hours information given by the CSSP is categorical in the sense that the number of weekly hours worked is categorized into one the following categories: (a) under 1, (b) 1-8, (c) 9-16, (d) 17-24, (e) 25-32, (f) 33-40, (g) 41-50, (h) 51-60, (i) 61-70, and (j) 71+ hours.¹³ It is thus difficult to identify all of those who experienced a reduction in hours. As a matter of fact, not surprisingly, given the fairly wide categorical bands, most workers remained in the same category over the yearly interval and we do not know for certain whether their actual hours have changed. We thus proceeded as follows. First of all, those persons who desired more than 33 hours but whose hours increased were not classified as involuntarily part-time. Secondly, we checked the robustness of the results of the overall sample by also separately examining the much smaller sample of workers whose hours definitely decreased by moving to a lower hours category, some of which became involuntarily part-time.

Summary statistics for the sample of workers who were potentially affected by the minimum wage, i.e., those whose second observation fell after April 1998, relative to all others in the sample, are given in Table 1. As can be seen, the incidence of involuntary part-time employment rose after the minimum wage. However, one must also note that other characteristics were higher for the sample of workers potentially affected – for instance, employer size, education attainment, and the initial wage rate are also higher for this group. Hence, one cannot draw any clear a priori conclusions with regard to these simple means and we thus proceed to investigate the relationship between minimum wage and involuntary part-time employment econometrically.

¹³ For the calculation of the hourly wage rate from our measure of monthly income, we use the midpoints of all categories except for (a), (f), and (j) where we used 1, 40, and 71 hours respectively, as in Strobl and Walsh (2002).

Using the sample just described we ran a simple probit model on changes in the incidence of involuntary part-time employment controlling for highest educational attainment, gender, age and its value squared, occupation, industry, employer size, region, the initial wage rate, and year and seasonal effects, where our study and control group are as stated earlier. In order to assess the impact of compliance to the minimum wage on the incidence of involuntary part-time work, we included a simple dummy variable for whether an individual's second observation fell after the introduction of the minimum wage. One should note that since the time between the actual implementation and when the second observation occurred differs for individuals, from anywhere between one day up to nine months, we are implicitly assuming that the impact was the same regardless of time elapsed.

Our results for this exercise for the overall sample are given in Table 2, where the coefficients are reported as marginal effects. As can be seen, only a few factors help to predict who is more likely to become involuntarily part-time employed. Specifically, workers who work in large firms and workers who receive higher (initial) wages, possibly indicative of higher ability or higher tenure¹⁴, are less likely to experience involuntary part-time employment. Most importantly, we find that, after controlling for other factors, for workers who experienced compliance the introduction of the minimum wage also significantly increased the probability of a person becoming involuntarily part-time employed. In order to confirm that this is not due to other changes occurring at the same time of the minimum wage, we also used those workers who second observation fell after implementation but who were not subjected to compliance in the second column of Table 2. Accordingly, for this group, although the results on the other variables are similar, we do not find a similar

¹⁴ Unfortunately the CSSP does not collect information on an employed person's tenure.

effect of the minimum wage - the coefficient on the zero-one dummy is decisively insignificant.

V. Conclusion

We develop a competitive theoretical framework that generates a u-shaped equilibrium hours per wage locus. In this setting an increase in the minimum wage may lower the hours of some workers who work short hours and desire more hours, while raising the hours of others who would like to work less hours. The predicted effect of a minimum wage on employment, even if employment is the product of hours and workers, then becomes unclear. Utilising data from Trinidad and Tobago, we find that the implementation of a first time national wage increased the number of workers who were made involuntarily part-time employed, thus providing at least some support for our model. Overall our results imply that examining total employment or full-time equivalents is not a meaningful way to measure the employment response to a minimum wage.

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Appendix

Proof of Proposition (1):

The profit function is $pf[x(n)y(h)] - w(h)hn$ and the first order conditions given in (2) and (3) hold. A binding minimum wage imposed at the market wage. From equation (4) it is clear that since f_m can easily be shown to be negative, if the term in square brackets in (4) is negative the proposition holds. The term in square brackets is:

$$\frac{f_h}{n} - f_{nh} = (f_{zz}z + f_z)x_n y_h - f_z y_h \frac{x}{n}$$

If $\frac{f_{zz}z}{f_z} < 1$ the above is negative.

Figure 1

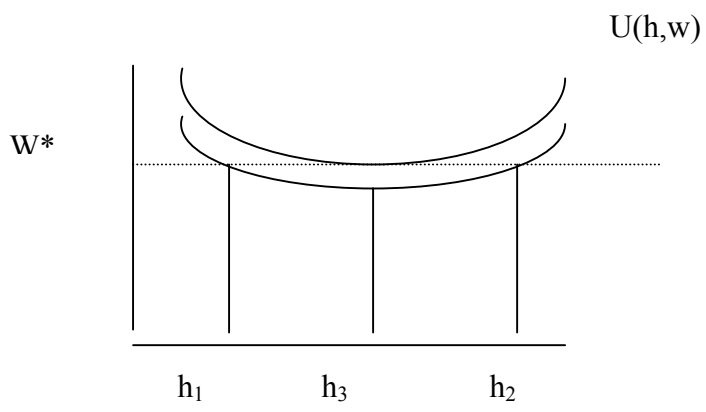
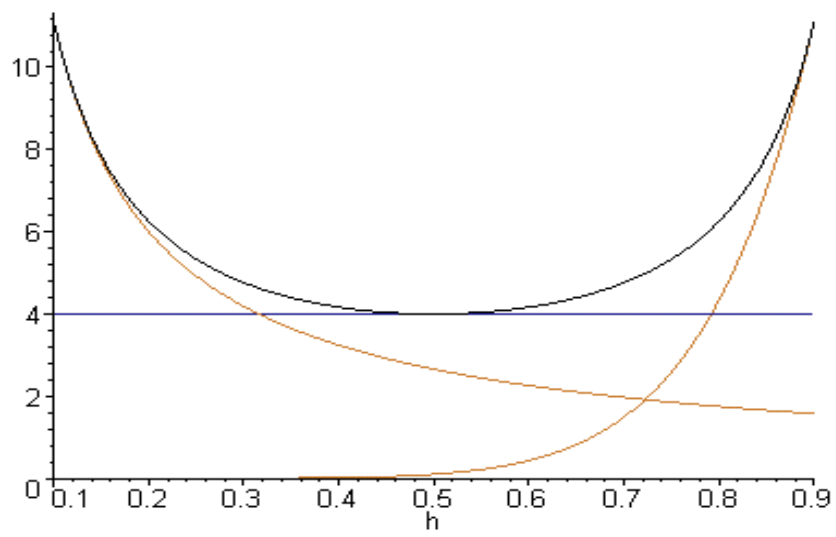


Figure 2



**Table 1: Summary Statistics for those potentially affected by the minimum wage
versus others in the sample**

	BEFORE	AFTER
INV PTIME	0.040	0.071
Log(INITIAL WAGE)	4.834	5.012
EMPLOYER SIZE	0.447	0.459
MALE	0.551	0.568
AGE	28.560	28.255
MARITAL STATUS	0.186	0.193
COMMUTE	0.459	0.453
URBAN	0.564	0.579
PRIMARY EDUCATION	0.531	0.561
SECONDARY EDUCATION	0.258	0.262

**Table 2: The Impact of the Minimum Wage on the Incidence of Involuntary
Part-Time Employment in Trinidad and Tobago**

	(1)	(2)	(3)	(4)
MINIMUM WAGE	0.065** (0.041)	0.034 (0.030)	0.224** (0.125)	0.134 (0.121)
AGE	-0.004 (0.003)	-0.002 (0.003)	-0.022 (0.014)	-0.017 (0.015)
AGE2	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
MALE	-0.004 (0.016)	-0.007 (0.016)	-0.093 (0.072)	-0.138 (0.087)
MARITAL STATUS	0.020 (0.021)	0.016 (0.020)	0.111 (0.091)	0.176 (0.117)
PRIMARY EDUCATION	0.006 (0.015)	-0.007 (0.014)	-0.004 (0.070)	-0.055 (0.068)
SECONDARY EDUCATION	0.003 (0.020)	-0.014 (0.015)	-0.080 (0.072)	-0.134* (0.070)
COMMUTE	-0.035** (0.014)	-0.034** (0.013)	-0.162*** (0.053)	-0.172*** (0.056)
URBAN	0.015 (0.013)	0.006 (0.013)	0.047 (0.061)	0.033 (0.066)
EMPLOYER SIZE	-0.027* (0.014)	-0.028** (0.014)	-0.137** (0.056)	-0.131** (0.058)
Log(INITIAL WAGE)	-0.010** (0.005)	-0.011** (0.005)	-0.014 (0.023)	-0.028 (0.024)
Observations	650	685	181	184
Test	58.70***	66.49***	43.59***	52.31***
PSEUDO R2	0.20	0.21	0.25	0.26

Notes: (1) Coefficients reported as marginal effects.

(2) ***, **, and * signify 1, 5, and 10 per cent significance levels.

(3) Includes 1998 year dummy, gender dummy seasonal dummies, and one digit occupational and industry dummies.

(4) PRIMARY EDUCATION and SECONDARY EDUCATION are highest educational attainment dummies, MARITAL STATUS is a marital status dummy, COMMUTE is a commuting to work dummy, URBAN is an urban workplace dummy, EMPLOYER SIZE is a dummy for whether employer has at least ten employees and MINIMUM WAGE is a dummy indicating whether the worker was affected by the minimum wage.