**Relations industrielles
Industrial Relations**

Some Evidence of the Impact on Non-Wage Labour Cost on Overtime Work and Employment
L'impact des avantages sociaux sur les heures supplémentaires et l'emploi

Leonard Laudadio and Michael Percy

See table of contents

Explore this journal

Cite this article

Article abstract

Total labour costs can be considered to be a function of the hourly wage, a quasi-fixed component {mainly fringe benefits and training cost) and overtime rate. The theoretical model employee in this paper suggests that an increase in the ratio of quasi-fixed cost to overtime rate leads to an increase in the amount of scheduled overtime work instead of employment. The model, tested with Canadian data, yields statistically significant results.

Some Evidence of the Impact of Non-Wage Labour Cost on Overtime Work and Environment

L. Laudadio and M. Percy

Total labour costs can be considered to be a function of the hourly wage, a quasi-fixed component (mainly fringe benefits and training cost) and overtime rate. The theoretical model employed in this paper suggests that an increase in the ratio of quasi-fixed cost to overtime rate leads to an increase in the amount of scheduled overtime work instead of employment. The model, tested with Canadian data, yields statistically significant results.

As long as labour costs can be considered completely variable, there is little reason for any establishment to employ overtime work except for unforeseen occurrences such as rush orders and absenteeism. But if labour is a quasi-fixed factor of production, the decision to employ overtime work may be a deliberate one, not simply the result of emergencies. In fact, there is substantial evidence that a large proportion of overtime work is scheduled in advance, indicating that employers make a deliberate decision to incur much higher hourly wage cost instead of increasing the number of employees [1]. At the same time, there has been an increasing tendency to regard cost of labour not as entirely variable and, therefore, labour itself not as completely variable factor. The reasons are to be found, in part, in investment cost such as on-the-job training programs,

LAUDADIO, L., Associate Professor of Economics, University of Victoria, Victoria, B.C.

PERCY, M., Graduate Student in Economics, Queen's University, Kingston, Ont.

---

[1] J. GARBARINO, « Fringe Benefits and Overtime as Barriers to Expanding Employment, » *Industrial and Labour Relations Review*, April, 1966, pp. 426-42.

tendency to regard cost of labour not as entirely variable and, therefore, labour itself not as a completely variable factor. The reasons are to be found, in part, in investment cost such as on-the-job training programs, and, even more, in other non-wage costs such as medical and unemployment insurance and paid vacation [2].

The purpose of this paper is to investigate the relationship between the present structure of overtime rates, the size of non-wage cost per man, and the number of hours of overtime worked. A given level of production requires a certain amount of labour services (L). These services are a result of hiring a certain number of employees (N), each working a given number of hours (H). There are several combinations of N and H that yield the same amount of L. The employer's aim is to choose the combination that minimizes labour cost. Therefore

(1) $L = f(N,H)$ $\delta L/\delta N > \delta L/\delta H > O$

and

(2) $MRS_{NH} = \dfrac{\delta L/\delta N}{\delta L/\delta H}$

The labour cost which the employer attempts to minimize is made up of a mainly variable component, which depends strictly on the hourly wage (W), and a quasi-fixed component (C) made up of training cost per man, insurance and other « fringe benefits. » Then the total cost of labour can be expressed as :

(3) $T = NHW + NC$

The partial derivatives $\dfrac{\delta T}{\delta N} = HW + C$ and $\dfrac{\delta T}{\delta H} = NW$ are the marginal cost of employment and hours respectively.

Minimum labour cost for a given amount of labour is attained when the marginal rate of substitution is equal to the ratio of marginal cost :

(4) $\dfrac{\delta L/\delta N}{\delta L/\delta H} = \dfrac{HW+C}{NW} = \dfrac{H+C/W}{N}$

If the marginal cost of employment rises relative to the marginal cost of hours, employment will decrease and hours will increase. A rise in the ratio C/W, other things remaining the same, will lead to this result.

---

    [2] S ROZEN, « On the Inter-industry Wage and Hours Structure, » *Journal of Political Economy*, April, 1969, pp. 249-73.

Although no explicit acknowledgement has been made of the over-time wage rate, the introduction of this additional variable does not change the conclusion. Let h be the number of overtime hours per employees and W_o the overtime wage rate; then the total cost is

(5) $T_1 = NHW + NC + NhW_o$

Since we are interested in the trade off between employment and over-time work, find the marginal costs of employment and overtime:

$$\frac{\delta T}{\delta N} = HW + C + hW_o$$

$$\frac{\delta T_1}{\delta h} = NW_o$$

The introduction of overtime work changes slightly the labour input function to

(6) $L_1 = g(NHh)$

Again, since our interest is focussed on the relationship between N and h, we find that total labour cost for a given amount of labour is minimized when:

(7) $$\frac{\delta L_1/\delta N}{\delta L_1/\delta h} = \frac{HW + C + hW_o}{NW_o} = \frac{H\dfrac{W}{W_o} + \dfrac{C}{W_o} + h}{N}$$

The conclusion that follows is that a rise in $\dfrac{C}{W_o}$ will tend to raise over-time work instead of employment.

This theoretical introduction suggests that there is a relationship between total overtime hours and the ratio of non-wage labour cost to overtime rate. It is, of course, possible that other factors influence the amount of overtime work. The most recent attempt, and the only one using regression analysis, to explain the amount of overtime work is a paper by Ronald G. Ehrenberg, who uses as additional explanatory variables the ratio of new to senior workers, the absentee rate, and the quit rate for each reporting establishment [3]. However, the only independent variable that was statistically significant was the ratio of non-wage labour cost to overtime rate. The other variables had the expected sign, but

---

[3] R. G. EHRENBERG, « The Impact of the Overtime Premium on Employment and Hours in U.S. Industry. » *Western Economic Journal*, June, 1971, pp. 199-207.

they were all insignificant, and, for this reason, they were omitted from the published research.

TABLE I

CANADIAN MANUFACTURING INDUSTRIES — 1968

(*Estimated Overtime Hours and Premium Pay* C, W_o)

	Annual Overtime Hours/ Employee	*Calculated Premium Wage*	C/W_o
Food & Beverages	96	3.55	4.17
Tobacco Processing & Prod.	94	4.48	5.47
Rubber Products	123	4.10	6.21
Leather Products	81	2.62	3.28
Textile Products	108	3.13	3.85
Knitting Mills	43	2.21	2.77
Clothing	40	2.28	3.40
Wood Products	55	3.78	3.44
Furniture & Fixtures	71	3.02	3.44
Paper & Allied Industries	145	4.59	4.52
Printing, Publishing & Allied Industries	94	5.43	3.46
Primary Metals	109	4.79	5.67
Metal Fabricating	79	4.05	4.19
Machinery (except electrical)	107	3.75	5.87
Transportation Equipment	193	4.33	6.88
Electrical Products	76	3.91	4.53
Non-Metallic Mineral Products	137	3.98	4.63
Petroleum & Coal Products	146	5.58	5.91
Chemicals & Chemical Products	109	4.73	4.51
Misc. Mfg. Industries	73	3.40	4.20
MEAN VALUE	= 98.95		4.52

Sources : (1) *Labour Cost in Manufacturing, 1968. D.B.S. Department of Labour* Survey.

(2) The information in column 1 was obtained through correspondence with a D.B.S. statistician.

THE CANADIAN EVIDENCE

The Dominion Bureau of Statistics, (now, Statistics Canada), has provided in *Labour Costs in Canadian Manufacturing, 1968,* a specific breakdown of wage and non-wage costs for salaried and wage earning employees for 20 industries [4]. On request by the authors, D.B.S. also provided estimates of annual overtime worked by employees and the cost of overtime hours for the 20 industries. Table I contains all the information obtained from D.B.S., either from its publication or from correspondence. No data are gathered in Canada regarding the ratio of new to senior workers or the absentee rate. However, the data in Table I permits us to estimate the equation :

$$T = A_o + a_1 (C/W_o)$$

where :

T = estimated number of annual overtime hours per wage earning employee

C = non-wage labour cost [5] per man week comprised of :

1) Paid absences

2) Employees pension and benefit plans

3) Miscellaneous direct payments

4) Payments required by law

W_o = hourly wage paid for overtime work.

Using the information in Table I, we have :

$$T = 17.02 + 25.65 \left(\frac{C}{W_o}\right) \qquad \text{Adjusted } R^2 = .578$$

t-values $(-.74)$ (5.198)

The very significant estimate of a_1 and the sizeable R^2 points to a statistical verification of the theoretical model.

These estimates are useful in that they help us answer this question « what would be the effect on overtime work if there were a change in the ratio C/W_o ? »

---

[4] The survey included all manufacturing establishments with 100 or more employees and about 10 per cent of the establishments with 20 or more employees. An estimate for all Canadian manufacturing establishments was then provided.

[5] Some components of the non-wage labour cost are strictly fixed, others vary in some fashion with the number of hours (regular and overtime) worked. Given the nature of the available statistics there is no possibility of isolating the purely fixed labour cost per employee.

This requires the computation of the elasticity coefficient :

$$\epsilon = \frac{dT}{d\frac{c}{W_o}} \times \frac{C/W_o}{T} \text{ which is equivalent to}$$

$\epsilon = a_1 (\bar{C}/W_o)/T = 1.17$. The bars above the variables indicate mean values. To illustrate the meaning of elasticity, if the overtime rate (W_o) rose sufficiently to reduce C/W_o by one per cent, other things remaining the same, overtime work would fall by more than one per cent.

As an exercise, it would be useful to employ the information provided in the American study to make a direct comparison with the Canadian result. Ehrenberg provides sufficient information so that an aggregate estimate for the 16 industries can be obtained. Reestimating the American equation for the information provided by Ehrenberg, we have :

$T = 37.88 + 30.55 (C/W_o)$ Adjusted $R^2 = 0.0975$
    (.3856)   (1.619)

Elasticity $= .806$

We have no ready explanation for the very low R^2, the barely significant estimate of a_1, and for the smaller value of the elasticity coefficient yielded by the American data. These data appear to suggest that a much larger percentage of overtime hours was scheduled overtime in Canada than in the United States. Thus, the large random elements might have reduced the significance of the American estimates.

Finally, and more interestingly, we can estimate the effect on overtime hours of employment following a given change in the overtime rate, keeping the quasi-fixed labour cost the same.

The current overtime rate is generally 1.5 times the regular rate. If the overtime rate were raised from 1.5 to 2.0 times the regular rate, the ratio C/W_o would be decreased by twenty-five per cent. The annual decrease in overtime is found by multiplying the coefficient of C/W_o by one fourth of the mean volume of C/W_o, that is : (C/W_o) $(\frac{1}{4})a_1$. The annual average decrease in overtime work would be 29.0 hours worked or 29.3 per cent of annual overtime worked. If each employee works 40 hours per week and 50 weeks per year, the number of man hours per employee per year is 2,000. Thus a decrease of annual overtime worked of 29.0 hours would result in an increased employment of 1.45 per cent. If these estimates were applied to the actual employment in the 20 manufacturing industries of 1,639,400 and if the decrease in number of over-

time hours were fully translated into new employment, then there would be an increase in employment of 23,711 workers.

Several qualifications are necessary. The assumption of *ceteris paribus* may not be entirely appropriate. An increase in overtime rates that reduces the demand for overtime hours may lead to an increase in moonlighting, thus decreasing the potential rise in employment. Also, and more importantly, an increase in overtime rate is an increase in total labour cost and may induce employers to substitute capital for labour.

Nevertheless, in spite of these qualifications, the results should be of interest not only to students of labour economics, who long have suspected that an increase in quasi-fixed labour cost tends to reduce the number of jobs, but also to public officials who have the responsibility of designing labour laws consistent with social goals.

L'IMPACT DES AVANTAGES SOCIAUX SUR LES HEURES SUPPLÉMENTAIRES ET L'EMPLOI

En autant qu'on peut considérer le coût des salaires comme un facteur essentiellement variable, il n'y a guère de motifs qui puissent justifier le recours au travail supplémentaire, si ce n'est dans des cas fortuits : surplus de commandes et absentéisme, par exemple. Cependant, si le coût du travail devient un facteur de production presque fixe, on pourra recourir aux heures supplémentaires délibérément, non plus en cas d'urgence seulement. En réalité, il y a beaucoup d'indices permettant de croire qu'une bonne partie du travail supplémentaire est prévu de longue date, ce qui démontre que les employeurs préfèrent verser davantage en salaire plutôt que d'augmenter le nombre de leurs employés. Comment cela peut-il s'expliquer ? On en trouverait la motivation dans le coût de la formation en atelier et, ce qui plus est, dans le coût des avantages sociaux, comme les assurances médicales et les vacances payées.

Le but du présent article est de tenter d'établir les interrelations entre la structure actuelle des taux pour travail supplémentaire, l'ampleur du coût des avantages sociaux par homme et le nombre d'heures supplémentaires accomplies. Une quantité donnée de production exige une certaine somme de travail et l'embauchage d'un certain nombre d'employés travaillant un nombre donné d'heures.

Ces différents facteurs peuvent se combiner de diverses manières et l'employeur recherche la combinaison qui minimise davantage le coût de la main-d'œuvre. Si le coût marginal de l'emploi s'élève par rapport au coût marginal des heures, l'emploi diminuera et le nombre des heures s'accroîtra.

Cette explication théorique indique qu'il y a un rapport entre le nombre total d'heures supplémentaires autorisées et le coût de la main-d'œuvre hormis le salaire proprement dit. Sans doute, il y a d'autres facteurs qui entrent en jeu, mais le seul

variable indépendant qui soit significatif, c'est le rapport entre ce coût et le nombre des heures supplémentaires.

L'analyse scientifique que l'Auteur a faite, a partir de données statistiques canadiennes, est fort intéressante en cette matière. Les résultats se révèlent utiles, non seulement aux spécialistes de l'économie du travail qui se doutaient de l'influence du coût des avantages sociaux sur le niveau de l'emploi, mais aussi aux hommes publics qui ont la responsabilité d'élaborer une législation du travail conforme aux buts sociaux qu'ils recherchent.

LE PUBLIC ET L'INFORMATION EN

RELATIONS DU TRAVAIL

Introduction, GÉRARD DION – L'information et le public, GÉRARD DION – L'information en relations du travail et le public, PIERRETTE SARTIN – Servitudes et difficultés de l'information, THOMAS SLOAN – L'employeur et l'information du public, GHISLAIN DUFOUR – Les syndicats et l'information du public, RICHARD DAIGNAULT – L'Etat-employeur et l'information du public, B.M. ERB – L'Etat-gouvernement et l'information du public, JEAN BERNIER – Les média et l'information du public : la presse écrite, VINCENT PRINCE – Les média et l'information du public : la presse électronique, GEORGES LAHAISE – La presse et le 24ième congrès annuel des relations industrielles de Laval, JACQUES RIVET et MARCEL GILBERT.

1 volume, 226 pages – Prix : $5.50

LES PRESSES DE L'UNIVERSITÉ LAVAL

Case Postale 2447   **Québec 10**   **Tél.: 656-2131**