

## **Determinants of Weekly Work Hours in Canada** **Facteurs déterminant la durée de la semaine de travail au Canada**

Keith Newton et Norm Leckie

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Résumé de l'article

Les données relatives aux États-Unis et au Canada indiquent qu'au cours des dernières années, le processus de diminution de la durée de la semaine de travail a ralenti.

Les auteurs examinent deux études antérieures sur les facteurs qui déterminent la durée de la semaine de travail. La pertinence possible des variables de l'offre dans le contexte canadien est démontrée à l'aide de données canadiennes utilisées dans un modèle construit initialement pour les États-Unis. Les auteurs en concluent qu'un modèle appropriée des déterminants des heures de travail doit inclure les variables de l'offre et de la demande, et, en conséquence, ils élaborent un système à deux équations simultanées, dont ils font l'estimation pour le Canada et pour huit industries choisies. En général, les résultats corroborent les relations postulées et la technique utilisée.

# Determinants of Weekly Work Hours in Canada

**Keith Newton**  
**and**  
**Norm Leckie**

*This paper is an attempt to shed some empirical light on the underlying determinants of the length of the work week.*

The secular decline in the length of the average working week has accounted for a significant element in the historical erosion of work-life hardship. Technological change and its attendant improvements in productivity have enabled the release of an increasing number of units of labour to enjoy increasing amounts of leisure. These have come in the form of more statutory holidays, vacations with pay, leave provisions, and a shortening of the standard week and the standard day. Welcome as they may appear, such developments do, of course, imply a diminution in one dimension of aggregate labour input. So their continuation, especially if accompanied by a less rapidly-growing labour force and time lost because of absenteeism and industrial disputes, may impose limits on our macroeconomic potential.

A glance at Figure 1 serves to confirm the downward trend of the weekly hours series in both the United States and Canada.<sup>1</sup> A more interesting feature, however, is the “flattening out”<sup>2</sup> of the series, reflecting a deceleration in the rate of decline in the length of the work-week. The two features prompt an interest in the underlying determinants of the length of the work-week, and the present study is, accordingly, an attempt to shed some empirical light on these factors.

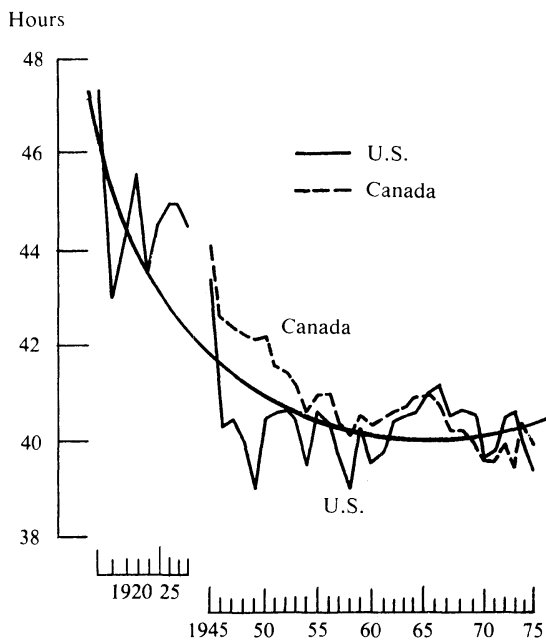
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- NEWTON, Dr Keith, Economic Council of Canada  
LECKIE, Norm, Research Assistant, Economic Council of Canada.

- This paper derives from research undertaken in the Social Indicators Group at the Economic Council of Canada. Helpful suggestions were made by Surendra Gera and Prof. Shmuel Sharir. Neither they nor the Council are responsible for remaining shortcomings of the paper or the views expressed.

1 The anomalous periods of the Great Depression and the Second World War, respectively, have been omitted.

2 A freehand curve has been superimposed on the plotted series to emphasize this phenomenon.

**FIGURE 1**  
**The Slowdown in the Decline**  
**of the Length of the Work-Week:**  
**Paid Hours in U.S. and Canadian**  
**Manufacturing Industries**



Section 2 examines the work of two previous researchers in this field, contrasts their different approaches, and indicates the shortcomings of each. The need to take account of both demand and supply side variables suggests the utilization of a two-simultaneous equation model, estimated with the aid of the two-stage least squares technique, as described in Section 3. A detailed description of the data then follows in Section 4, with a discussion of the results in Section 5. Concluding comments and observations are contained in Section 6.

## PREVIOUS RESEARCH

Econometric techniques have been employed by Hameed<sup>3</sup> and by

<sup>3</sup> HAMEED, S.M.A., "Economic and Institutional Determinants of the Average Work-Week in Canada", in S.M.A. Hameed and O. Cullen (eds), *Work and Leisure in Canada*, Faculty of Business Administration and Commerce, University of Alberta, 1975, pp. 1-17.

Owen<sup>4</sup> to analyse the determinants of weekly working hours in Canada and the United States, respectively. The studies are instructive in that not only do they afford a comparison of the two countries, but also exemplify emphases upon the demand-side and supply-side, respectively.

### Supply-Side

Owen, examining U.S. data, draws attention to the slowing down in the rate of decline of working hours after World War II and the coincident leap in post-war birth rates. He contends that the financial responsibilities of family formation dampened workers' desires to trade income for more leisure. His regressors therefore include an earnings measure, on the assumption that higher earnings tend to permit workers to take more leisure time, and real education expenditures per capita labour force to reflect child-rearing costs. It is argued that the post-war extension of schooling that accompanied the baby-boom contributed much to the average cost of raising a child and, further, that education costs are a useful index of all child-rearing costs since they indirectly reflect trends in the time period during which children are supported at home. A final worker-oriented variable measures the relative weight in the CPI of recreation costs, and is included on the grounds that as the relative costs of leisure-time activities increase the worker will tend to opt for more work hours.

The approach is heavily supply-oriented in the sense that it concentrates on those factors influencing the workers' offer of work hours in the work-leisure calculus. It appears to assume that hours of work are largely discretionary, determined by workers of their volition. While in some cases workers may have the chance to accept or reject overtime offered by a foreman, it seems likely that, more generally, their scope for altering average weekly hours over a year is limited to the decision as to whether or not to take their vacation entitlement.

While Owen never actually discusses his implicit assumptions, a case might be made on their behalf as follows: to the extent that workers can convince unions that they do not want a shorter work-week, to the extent that unions can impress upon management, through collective bargaining, the aspirations of workers, and to the extent that the gains by union members filter through to the unorganized sector, then the supply-side emphasis may have some validity.<sup>5</sup>

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4 OWEN, J.D., "Work-Week and Leisure, An Analysis of Trends, 1948-1975", *Monthly Labor Review*, August 1976, pp. 3-8.

5 Professor SHARIR has pointed out that, in addition, workers may choose among different occupations, industries, and employers offering different combinations of hours and wages.

We have estimated a similar model for Canada, with results which are compared to Owen's in Table I. The Canadian parallel is approximate only, since there are inevitable differences in the nature of the data. First, while Owen's dependent variable is average paid weekly hours (adjusted for paid holiday and vacation) for all male non-agricultural, non-student employees, we were constrained to the use of average paid weekly hours (similarly adjusted) for all manufacturing employees. Our corresponding set of explanatory variables is a close approximation to those in the U.S. study, though one final limitation is that while the American time series runs from the turn of the century, the Canadian begins in 1950.

The results indicate, for both countries, the anticipated positive (and statistically significant) impact of education costs upon weekly hours worked, and the negative (and likewise significant) effect of hourly earnings. The results for recreation costs are not shown in Owen's paper - probably because of statistical insignificance. In the Canadian case, also, the variable appears 'just' significant and has, interestingly enough, the 'correct' sign.

### Demand-side

The work of S.M.A. Hameed<sup>6</sup> views hours of work as deriving from the conditions and techniques of production. During an economic upswing employers will utilize existing personnel more intensively and ultimately hire more workers and/or schedule increasing amounts of overtime. The variable used to capture this effect is the capacity utilization rate, which is presumed, *a priori*, to be positively related to hours of work. However, one may conceive a situation in which, while total labour hours of input are expanded, this may be achieved by increasing the number of persons in employment so that the average number of weekly hours worked per individual actually decreases. To take account of the possibility of employers hiring more persons rather than scheduling more hours, Hameed introduces an 'employment utilization rate'.

Apart from economic conditions, labour productivity will also affect the number of person-hours required in the production process, so output per unit of labour input was included in Hameed's analysis.

His final variable is the level of earnings which, in a manner reminiscent of Owen, he contends "has contributed to the *workers' decision* to work fewer hours ... (and), buy more leisure".<sup>7</sup>

<sup>6</sup> *Op. cit.*,

<sup>7</sup> HAMEED, *op. cit.*, p. 10, emphasis ours.

**TABLE 1**  
**Percentage Change\* in Weekly Hours Resulting From**  
**A One Per Cent Change in Explanatory Variables:**  
**Linear Regression Results for Canada and the U.S.**

	<i>Canada</i>				<i>U.S.A.</i>	
	% <i>Change</i>	<i>t</i> - <i>Ratio</i>	† <i>b</i>	† <i>mean</i>	% <i>Change</i>	<i>t</i> - <i>Ratio</i>
Real hourly earnings	-.32	-7.15	-4.699	2.50	-.20	-4.78
Child Rearing costs	.04	3.64	0.003	489.45	.10	4.55
Recreation Costs	.12	2.00	4.386	0.99	*	*
Weekly Hours			37.18			†
R <sup>2</sup>			.92			.98
Durbin Watson						
Statistics			1.25			1.94
Sample Size (years)			22			75

Notes: † Owen chose to present his results in a % change manner rather than the conventional b-coefficient display. See Appendix I for an explanation of the relation between these two methods.

\* Owen chose not to present any results for his relative cost of recreation variable.

Sources: For the U.S.A., Owen, *op. cit.*, p. 6. For Canada, our own estimates. The hours data are weekly hours paid by manufacturing hourly rated workers taken from *Canadian Statistical Review*, 1970, Statistics Canada 11-003, Table 19 and *Review of Employment and Average Weekly Wages and Salaries*, Statistics Canada, 72-202. The child rearing costs are actually real per capita labour force total expenditure on education taken from *Survey of Educational Finance*, Statistics Canada 81-208, Table 7. The relative cost of recreation is the recreation component of the consumer price index, 1971-based, CANSIM Series No. 626429; the CPI itself is in CANSIM Series No. 626429. The hourly earnings series is taken from the *Canadian Statistical Review*, 1970, Statistics Canada, 11-0033, Table 18, and the *Review of Employment and Average Weekly Wages and Salaries* Statistics Canada, 72-202.

Hameed's results, disaggregated to seven manufacturing industries, indicate the generally weighty impact of the capacity utilization and earning variables, and the negligible influence of the employment rate.

### The Model

The foregoing discussion of the approaches of Hameed and of Owen suggests the propriety of employing a model which can incorporate both the

demand-side<sup>8</sup> and the supply-side factors affecting weekly hours of work. Our specification therefore involves two simultaneous equations with two endogenous variables,  $H$  and  $W$ . The semi-structural equations are:

$$H_t^s = A_0 + A_1 W_t + A_2 E_t + A_3 R_t + U_t \quad \text{supply equation (1)}$$

$$H_t^d = b_0 + b_1 W_t + b_2 P_t + b_3 C_t + V_t \quad \text{demand equation (2)}$$

where  $H = H^s = H^d$  = average weekly hours actually worked by all workers in Canada,

$W$  = average earnings per hour actually worked in constant 1961 dollars,

$E$  = index of child-rearing costs expressed as a ratio the 1961-based CPI; described in Appendix II,

$R$  = per capita personal expenditure on recreation equipment services in 1961 dollars,

$P$  = labour productivity measured as 1961-based index of real domestic product per employee,

$C$  = capacity utilization rate (percentages), the calculation of which is described in Appendix III, and

$U, V$  = error terms

$H$  and  $W$  are endogenous variables,  $t = 1941$  to 1973.

To estimate these relations it was necessary to put them into one reduced form equation to calculate the wages variable  $W$ , and then to substitute this "purged"  $\hat{W}$  back into equation (1) in order to explain the labour supply of hours. Two-stage least squares is, in other words, the technique of the relationship may be asymmetric, in the following sense. A *fall* in the rate equation.

$$\begin{aligned} (\text{stage 1}) W_t &= \left( \frac{A_0 - b_0}{b_1 - A_1} \right) + \left( \frac{A_2}{b_1 - A_1} \right) E_t + \left( \frac{A_3}{b_1 - A_1} \right) R_t \\ &+ \left( \frac{b_2}{b_1 - A_1} \right) (-P_t) + \left( \frac{b_3}{b_1 - A_1} \right) (-C_t) + \left( \frac{U_t - V_t}{b_1 - A_1} \right) \end{aligned}$$

$$\text{or } W_t = \delta_0 + \delta_1 E_t + \delta_2 R_t + \delta_3 (-P_t) + \delta_4 (-C_t) + U_t^* \quad (3)$$

<sup>8</sup> It has been pointed out to us that the concept of actual hours on the demand-side of course includes overtime hours. The important, but more specific, question of the trade-off between overtime hours and additional people is beyond the scope of the present paper, which is more concerned with the broad underlying determinants of hours worked from the demand and supply sides respectively.

from which we get a calculated wage term  $\hat{W}$  purged of its stochastic elements and substitute it into our supply equation:

$$(stage\ 2)\ H_t^S = A_0 + A_1\hat{W}_t + A_2E_t + A_3R_t + U_t^* \quad (4)$$

Some discussion of the rationale underlying the selection of the variables seems in order before turning to a description of the characteristics of the data employed.

The earnings measure,  $W$ , is considered a relevant inclusion from both the supply and the demand sides. It is contended by Owen for example, that real increases in hourly earnings have encouraged workers to enjoy more leisure time. In addition to this income effect, however, it must be pointed out that there is also an offsetting substitution effect in the sense that, in some ranges, rising wage-rates constitute an increased opportunity cost of leisure. The final net impact of increased earnings will depend on the relative strengths of the price and income elasticities of hours with respect to wages. Or, as Milton Friedman puts it, "much depends on the ... value attached (by the worker) to goods purchased with money (earned) through the market, relative to goods that can be acquired (that is, pleasure) through non-market activity."<sup>9</sup>

From the employer's side, also, earnings per hour are an important consideration inasmuch as neo-classical wage theory suggests that the entrepreneur chooses to operate with that level of labour input which equates its marginal cost to its marginal revenue product. The important point concerns the interdependence of the determination of wages and hours. We have seen the ways in which wages may affect hours but, equally, the intensity with which the labour input is utilized will affect its productivity and the wage rate it can command. One might also argue, from the supply side, that insofar as individuals have a notion of target earnings and the constraint of a standard number of hours per week, they will implicitly choose a reservation wage-rate. This simultaneity suggests the need to treat the wage rate not as a pre-determined variable but rather as one which is endogenous to the system.

Child-rearing expenses,  $E$ , are included on the grounds that the rising costs of maintaining the larger post-war families may have contributed to the deceleration of work-week reduction. The supply-side orientation and rationale for this variable were discussed in Section 2 above. Suffice it to say at this point that Owen's measure of education expenditures as a proxy for

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<sup>9</sup> FRIEDMAN, M., *Price Theory*, Chicago, Aldine, 1965, p. 204.



child-rearing costs was felt to be inadequate for the purpose at hand, on the grounds that schooling is only one facet of raising a child. Accordingly, we employ an index of the expense of a more comprehensive basket of child-rearing goods.<sup>10</sup>

Next, consider the cost of recreation goods,  $R$ . While it has been contended that the effect of increasing affluence may cause many workers to take more leisure time rather than more earned income, it is also hypothesized that the commercialization of leisure time pursuits has increased their costs substantially. Leisure time has, in other words, become the basis for an industry which has spawned an increasingly sophisticated array of highly-prized leisure goods.<sup>11</sup> Paradoxically, the purchase of such goods may in some cases be achieved only by sacrificing part of the leisure time in which they may be enjoyed. One might therefore anticipate a positive impact of "per capita expenditure on recreation goods",  $R$ , upon hours.

Labour productivity,  $P$ , is introduced on the grounds that to the extent that qualitative improvements in the economy's aggregate inputs improve output per man-hour then, in principle, hours may be reduced without sacrificing output. An important corollary of this proposition is, of course, that slower productivity gains retard the potential for reductions in working hours.<sup>12</sup>

Our final determinant of hours of work is capacity utilization,  $C$ , for which actual output is taken as a percentage of "the maximum output obtainable under normal technological and market conditions".<sup>13</sup> One might surmise that, as the economy draws closer to full utilization of its capital stock, hours of labour will be extended, probably through overtime, to meet the increased production requirements.

As far as the effects of capacity utilization upon the endogenous wage variable are concerned, it should be borne in mind that in certain instances

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<sup>10</sup> Section 4, below, provides a more detailed description of the data used for each of the variables.

<sup>11</sup> For example, snowmobiles, colour TV's, summer cottages, hi-fi sets, golf club membership, etc...

<sup>12</sup> Another aspect of the relationship is that in certain cases, over certain ranges of labour input, there may be a positive feedback of reduced hours upon productivity. If shorter hours reduce fatigue, increase alertness, and improve job satisfaction, then performance may be enhanced. See EVANS, A.A., *Hours of Work in Industrialized Countries*, Geneva, ILO, 1975, p. 47.

<sup>13</sup> Statistics Canada, Construction Division, National Wealth and Capital Division, *Capacity Utilization Rates in Canadian Manufacturing by Quarters, 1961 - Second Quarter 1976*, p. vi.

the relationship may be asymmetric, in the following sense. A *fall* in the rate of capacity utilization may lead to lay-offs of the most recently-acquired, less-experienced and/or lower skilled members of the work force, and the retention of the more highly-skilled (and higher-paid) workers who might be difficult to replace during the subsequent cyclical upswing.<sup>14</sup> In this way the average wages of the employed work force may actually *increase* during a recession. At the same time, however, a sharp upswing in economic activity accompanied by increasing rates of capacity utilization may lead to relative labour shortages and upward pressure on wages.

## THE DATA

There exist three major definitions of weekly hours which may be used in the analysis of working time. *Standard hours*, first of all, are the normally-scheduled hours worked in a week and are generally determined by legislation and/or bargaining.<sup>15</sup> Hours worked in excess of a standard daily or weekly total are generally referred to as "overtime" for which a premium may be paid.

*Paid hours*, secondly, are those for which the worker is paid, whether they have been worked or not. Thus, a worker whose standard work-week is 40 hours may have worked 4 hours overtime at a premium rate of "time-and-a-half", so that the 'hours paid-for' total 46. Similarly, vacations, holidays, and sick leave all constitute hours paid for but not actually worked.

*Actual hours*, finally, are those spent at the job. Thus, in the example of the last paragraph, they would include four hours of actual overtime. They would, however, exclude all absences due to holidays, vacations, sickness, and the scheduled time that is not worked owing to business slowdowns, equipment failures, and industrial disputes.

It is apparent that the different series may each prove more appropriate for a particular purpose: standard hours are a very general indicator of one important aspect of working conditions, for example, while hours paid are

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<sup>14</sup> This concept of "labour hoarding" is discussed in BLAIN, L., "Recent Developments in Aggregate Labour Productivity", *Bank of Canada Review*, January 1977, pp. 1-15. Note that stagnant or declining output coupled with labour hoarding imply under-employment and falling average output per manhour.

<sup>15</sup> Thus Economic Council of Canada Staff, for example, observe hours of 8:30 a.m. to 12:30 p.m. and 1:30 p.m. to 5:00 p.m. each day Monday through Friday for a standard work week of 37 1/2 hours.

critical for the computation of labour cost, and actual hours reflect business conditions.

We have chosen to use a series for average *actual* hours per week<sup>16</sup>, on the grounds that it reflects both demand and supply factors while according closely with the concept of aggregate labour input. The measure inevitably involves certain shortcomings, however. First, it does not take into account the increasingly important factor of commuting time, nor the time invested in the acquisition of human capital. Furthermore, the *average* form of the data masks such underlying developments as movements toward the 7-hour day and/or four-week vacation, the compressed work-week, flexi-time, etc.

The earnings variable,  $W$ , was derived from total annual wages and salaries by normalizing by number of employees and the hours series, and deflating by the CPI to yield a real hourly wage-rate for Canada and eight selected industries. The productivity variable,  $P$ , is also derived in a straightforward manner by dividing the 'volume indexes of real domestic product (RDP) by industry of origin' by a similarly-based index of employment.

Data for the recreation expenditures variable,  $R$ , were derived by adding the series for personal expenditures on recreation, sporting, and camping equipment, and recreational services, respectively. These were deflated by the CPI and expressed in per capita terms.

Information on child-rearing costs consists of four components relating to the feeding, clothing, education, and dental care of children. Personal expenditures on educational and cultural services were indexed and merged with the food, clothing, and dental fillings components of the CPI.

Capacity utilization is calculated by applying the capital stock series from 'Flows and Stocks of Fixed Non-Residential Capital' to the minimum capital-output ratio. The latter is the quotient of the capital stock series and the RDP series referred to above. The capacity utilization rate is then simply the ratio of actual to potential output in any year.

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<sup>16</sup> 'Average Hours Worked per Week of Persons Employed' for Canada and eight selected industries. These series, and all others used in estimating the model, are drawn from the CANSIM data Bank.

## RESULTS

## Canada

Table 2 displays the results of applying the two-stage least-squares technique to our model using the computer package MASSAGER. The signs of the first stage coefficients appear unexceptionable and all variables are significant. The negative impact of the capacity utilization variable is consistent with the hypothesis of labour hoarding described above: the acquisition of less-skilled, less-experienced and less-well-paid workers in cyclical upswings serves to reduce the average rate of remuneration.

TABLE 2  
2 SLS Estimates of the Coefficients of the Hourly Wage (W) and Hours (H) Equations Involving Labour Productivity (P), Capacity Utilization (C), Child Rearing-Costs (E), and Recreation Expenditures (R) for the Total Domestic Economy of Canada, 1941-1973

<i>Explanatory Variable</i>	<i>Mean</i>	<i>b</i>	<i>t-statistic</i>
Stage 1: Dependent Variable: W (mean = 1.65) ( $\bar{R}^2 = .999$ )			
E	1.16	0.321	6.56
R	62.37	0.002	2.27
P	104.55	0.017	27.76
C	92.95	-0.007	- 5.96
Constant	1.00	.014	
Stage 2: Dependent Variable: H (mean = 40.06) ( $\bar{R}^2 = .993$ )			
$\hat{W}$		- 6.56	-22.89
R		0.040	6.03
E		.541	1.13
Constant		47.797	

In the second stage the computed wage variable,  $\hat{W}$ , and recreation expenditure,  $R$ , are both significant and of the expected sign. However, the child-rearing index, though of the anticipated sign, is insignificant.

## Industrial Disaggregation

The analysis undertaken for the total domestic economy suggests some reasons underlying the overall trend of hours in Canada. However, the differences between industries with low productivity and long hours, such as agriculture, and those with shorter and more productive hours, such as manufacturing, should prove additionally informative.

Accordingly, Table 3 presents the results of a disaggregated analysis for the eight industry sectors of agriculture; forestry; mines, milling, and oil wells; manufacturing; construction; electric power, gas and water utilities; transportation, storage and communication; and wholesale and retail trade. The data manipulations described in Section 4 were repeated, for each industry, for the variables  $H$ ,  $W$ ,  $P$  and  $C$ . The child-rearing cost index,  $E$ , and recreation expenditures,  $R$ , could not be attributed to particular industries and remain as before.

The results for the individual industry sectors tend to parallel, for the most part, those for the total economy. The productivity variable, for example, is positive and significant for Canada and in six of the eight industries, the exceptions being utilities, where the coefficient is insignificant, and forestry where it is negative. Similarly the capacity utilization variable is negative and significant for Canada, and for four of the eight industries, the exceptions being construction and trade, respectively, where it is negative but not significant, and utilities and mining, milling and oil wells, respectively, where it is positive. The child-rearing variable performs reasonably in five of the eight cases. Half of the industries have coefficients for the recreation variable which are insignificant, and in two of these cases the sign is negative.

These latter variables perform less well in stage 2, where, however, the only glaring anomalies are the negative coefficients for  $E$  in the case of trade and of agriculture. Without attempting to be overly inventive in explaining these cases we would simply suggest tentatively that the characteristics of working time in these industries may be fairly distinctive in the following sense. It is possible that the process of family formation may, in the case of retail trade particularly, have contributed to the trend toward part-time employment of low-paid youngsters in lieu of longer hours by full-time staff. In agriculture the process of family formation in many cases means not only extra expense but also additional help which may alleviate somewhat the long hours of the average farm worker.

Finally, it remains to point out that in stage 2 the computed earnings variable  $\hat{W}$  is negative and significant in every case except agriculture, where it has the expected sign but is not significant.



## CONCLUDING COMMENTS

What we hope to have demonstrated in this paper is, first, the economic importance of the hours of work issue and, second, the need to take explicit account of both demand- and supply-side influences in investigating its determinants. In pursuing the latter objective, two earlier studies of the length of the work-week were examined and our replication of the American supply-oriented model, using Canadian data indicated the potential role of supply-side influences in the Canadian context. It was determined that both demand- and supply-side variables should, ideally, be incorporated and, accordingly, a two-simultaneous equation system was constructed to take account of both types of influence. The results suggest that some modest success may be claimed for the relationships posited, though the candidacy of the supply variable  $E$  is less impressive in the presence of  $\bar{W}$  in stage 2 of the estimation procedure.

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Les données relatives aux États-Unis et au Canada indiquent qu'au cours des dernières années, le processus de diminution de la durée de la semaine de travail a ralenti.

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Une nouvelle édition

*A New Edition*

### VOCABULAIRE FRANÇAIS-ANGLAIS DES RELATIONS PROFESSIONNELLES

### GLOSSARY OF TERMS USED IN INDUSTRIAL RELATIONS (ENGLISH-FRENCH)

Gérard DION

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