





#### DISCUSSION PAPER NO. 128

Tentative Measure of Labour Hoarding, 1961-1977

> by Tom Siedule and Keith Newton

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#### SUMMARY

The official aggregate unemployment rate has been criticized as an inadequate indicator of the state of the labour market. An important dimension of this criticism has to do with the measurement of relative tightness or slack in the market. The official measure does not, for example, take into account those persons without work who have given up the search for jobs because of adverse market conditions. Nor does it take account of those persons who are employed but underutilized -- nor can it, since it does not incorporate the hours dimension of labour supply.

This paper is addressed specifically to this latter question and presents some estimates of the magnitude of this underutilization (called "labour hoarding") in Canada. It is well-known that in times of cyclical recession employers may retain workers and employ them less intensively rather than lay them off and incur the costs of hiring and training in the subsequent upswing. It is also understood that some employers may choose to keep a 'cushion' of underutilized labour for the flexibility it affords, or simply because they do not singlemindedly pursue the objective of profit-maximization. What is less well-known is the prevalence and the magnitude of labour hoarding. As far as is known, in fact, the present estimates are the first of their kind for Canada.

The study measures hoarding as the difference between the man-hours of labour actually employed in a given year and the man-hours that would have been required to produce the

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output of that year if the work force had been *efficiently* employed. The estimation of the man-hour requirements for 'efficient' production consists essentially of first abstracting from the effects of technological change on labour productivity and then applying to the historical output series that ratio of labour input to real output which reflects the most intensive utilization of man-hours.

The results indicate that hoarding assumes considerable orders of magnitude when compared to the unemployment rate: it is typically more than half the latter measure and actually exceeded it in three years of the period covered. Furthermore, the trend in hoarding since 1971 is generally upward. The industry estimates show differences in patterns and orders of magnitude, though manufacturing, construction, and the sector covering transportation, communications, and other utilities all show high rates and a definite upward surge since about 1971. With the exception of the last-mentioned sector, however, the service industries are generally characterized by rather lower rates of labour hoarding.

The significance of the labour hoarding phenomenon lies in a number of its implications. First, it serves to emphasize that there may exist in the economy significant quantities of unutilized labour which the official unemployment statistics are unable to take into account. An important corollary of this fact is, of course, that stimulative measures to alleviate measured unemployment may appear remarkably unsuccessful until such time as hoarded labour has become fully utilized and employers

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are forced to hire additional personnel to produce the anticipated extra output.

Next, it is apparent that if paying for ("employing") hours not actually worked is in fact a rather widespread practice one must question the meaning of popular productivity measures such as output per man-hour. By the same token, if one suspects that hoarding may not always be the outcome of a rational profit-maximizing calculus on the part of entrepreneurs, but rather the result of institutional constraints, enlightened personnel policy, or the quest for a quiet life, then it is clear that the practice raises unit labour costs. On the other hand it does constitute an enormous, privately-financed example of a concept which is at present being rather hesitantly advanced on an experimental, publicly-financed level -- namely, work-sharing.

The study suggests that further research at the level of the organization, and especially with an occupational breakdown, would prove useful in shedding further light on where, how, and to what extent labour hoarding is practiced in Canadian industry.

#### RESUME

Le taux officiel du chômage global a fait l'objet de critiques; il est considéré comme un indicateur insatisfaisant de l'état du marché du travail. Ces critiques portent en bonne partie sur le calcul de la détente ou du resserrement relatifs du marché. Par exemple, la mesure officielle ne tient pas compte des personnes sans travail qui ont cessé de se chercher un emploi en raison des conditions défavorables du marché. Elle ne rend pas compte non plus des personnes employées mais sousutilisées -- et ne saurait le faire, car l'élément heures de l'offre de travail n'y est pas incorporée.

Le présent document traite précisément de cette dernière question et présente des estimations de l'ampleur de cette sous-utilisation (appelée "thésaurisation de travailleurs") au Canada. Il est reconnu qu'en période de récession cyclique, les employeurs peuvent conserver les travailleurs et les employer de façon moins intensive, au lieu de les licencier et d'avoir ensuite à supporter les coûts de l'embauche et de la formation lorsque la relance se produit. Il est également admis que certains employeurs peuvent choisir de maintenir une "réserve" de travailleurs sous-utilisés pour la flexibilité qu'elle procure, ou simplement parce que l'objectif de la maximisation des profits n'est pas le seul qu'ils poursuivent. Mais ce qui est moins connu, c'est l'usage qui est fait de la thésaurisation des travailleurs, ainsi que l'ampleur du phénomène. A notre connaissance, les présentes estimations sont les premières du genre à être publiées au Canada.

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Aux fins de l'étude, la thésaurisation de travailleurs représente la différence entre les heures-personnes de travail effectivement employées dans une année donnée et les heurespersonnes qui auraient été nécessaire pour réaliser la production de cette même année si l'effectif de travail avait été employé *efficacement*. L'estimation des heures-personnes nécessaires à une production "efficace" suppose essentiellement que l'on extrait d'abord les effets du changement technologique sur la productivité du travail et qu'on applique ensuite aux séries chronologiques de la production le rapport des intrants de travail sur la production réelle qui reflète l'utilisation la plus grande des heures-personnes.

Les résultats de l'étude indiquent que la thésaurisation de travailleurs revêt des ordres de grandeur considérables en comparaison du taux de chômage; elle représente ordinairement plus de la moitié de cette dernière mesure et l'a effectivement dépassée dans trois des années de la période étudiée. En outre, depuis 1971, cette tendance est généralement à la hausse. Les estimations de l'industrie révèlent des différences dans les tendances et les ordres de grandeur, bien que la fabrication, la construction et le secteur couvrant le transport, les communications et les autres services d'utilité publique indiquent tous des taux élevés et une nette poussé depuis environ 1971. Toutefois à l'exception du dernier secteur mentionné, les industries de services sont généralement caractérisées par d'assez faibles taux de thésaurisation de travailleurs.

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L'importance du phénomène de thésaurisation de travailleurs se mesure à ses conséquences. Elle permet de nous rendre compte, d'abord, qu'il peut exister dans l'économie d'importantes quantités de travailleurs inutilisés que les statistiques officielles sur le chômage ne peuvent compter. Un corollaire important de cette constatation est évidemment le fait que des stimulants visant à alléger le chômage calculé peuvent se révéler remarquablement infructueux tant et aussi longtemps que les travailleurs objet d'une thésaurisation ne sont pas utilisés et que les employeurs ne sont pas contraints d'embaucher du personnel supplémentaire afin d'assurer la production additionnelle prévue.

Il apparaît ensuite que si le paiement d'heures ("d'emploi") non effectivement travaillées constitue en fait une pratique assez répandue, il convient de s'interroger sur la signification de certaines mesures courantes de la productivité comme la production par heures-personne. Dans le même ordre d'idées, si l'on est porté à croire que la thésaurisation de travailleurs n'est pas toujours le résultat d'un calcul rationnel de maximisation des profits de la part des entrepreneurs, d'une politique du personnel éclairée, ou de la tendance à éviter les problèmes, il est alors évident que cette pratique a pour effet d'accroître les coûts unitaires du travail. D'autre part, elle constitue un exemple frappant et pratiqué, financé par le secteur privé, d'un concept qui n'est mis de l'avant et financé que d'une façon prudente et à titre expérimental par le secteur public, nommément le partage du travail.

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L'étude montre que de plus amples recherches au niveau de l'organisation, s'attachant particulièrement aux diverses professions, contribueraient à mieux faire connaître de quelle façon et dans quelle mesure la thésaurisation de travailleurs est pratiquée dans l'industrie canadienne.

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# Introduction

The official aggregate unemployment rate is frequently used as an indicator of the magnitude of underutilization or "slack" in the national labour market. In this capacity, however, the unemployment figure suffers from a number of shortcomings. First, a substantial component is attributable to structural and frictional factors rather than to the adequacy of demand and the resulting tightness of the labour market. Second, the official measure does not include those persons without work who have given up the search for jobs in the face of depressed market conditions. Third, and most crucial for our present purposes, the unemployment rate does not take into account the underutilization of employed persons since it does not explicitly incorporate the hours dimension of labour supply.

The present paper is an attempt to address this third concern by producing some estimates of the magnitude of labour hoarding in Canada. By "hoarding" is meant the practice of maintaining labour surplus to requirements.<sup>1</sup> That is, during periods of reduced output employers tend to avoid laying off workers if the process of screening, hiring, and training new employees in the subsequent upswing is perceived to be more costly than retaining workers during the current recession. As a result of this practice it is possible that significant amounts of underutilization of labour may be disguised. Of

<sup>1</sup> Useful analyses of this topic can be found in Kuh (1965), Taylor (1972, 1974, 1976), McKendrick (1975), and Leslie and Laing (1978).

course, a certain amount of hoarding may be undertaken at the best of times as a cushion against uncertainty.<sup>2</sup> Our concern with the phenomenon of labour hoarding is twofold: (1) the fluctuation in hoarding which accompany cycles in business activity, (2) the possible existence of some long-run fundamental changes in labour hoarding since 1961.<sup>3</sup>

The exercise which follows is a preliminary report on one component of a broader study of labour market measurement which deals with the unemployment gap.<sup>4</sup> It should be regarded as exploratory rather than definitive since very little work of this kind has been undertaken in Canada to date. Moreover, since it is based upon a methodology containing a number of crucial assumptions as to measurement, the results cannot be regarded as more than indicative. With these reservations in mind the following sections set out, first, a simple approach to the calculation of labour hoarding, followed by some estimates of its magnitude for Canada and broad industry groups, respectively.

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<sup>2</sup> In Leibenstein's schema it is the manifestation of the pervasive phenomenon of organizational slack. See Leibenstein (1966), and Kuh (1965).

<sup>3</sup> Fundamental changes in labour hoarding may take place for a variety of reasons. Greater concentration and market power amongst its constituent firms, for example, may permit an industry to carry a larger cushion of underutilized manhours.

<sup>4</sup> Defined as the difference between the potential man-hours available for full capacity output and the man-hours required for current output.

#### Concept and Method of Estimation

Labour hoarding may be thought of as the difference between the man-hours of labour actually 'employed'<sup>5</sup> in a given period and the man-hours that would have been required to produce the output of that period if the work force had been *efficiently* employed.

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$$LH = E_1 t_1 - E_0 t_0$$

where LH = labour hoarding,  $E_1$  and  $E_0$  are the actual and required numbers of persons, respectively, and  $t_1$  and  $t_0$  are the numbers of hours, similarly defined.

Taylor<sup>6</sup> has further refined the concept by referring to the number of hours of labour which are potentially available to the employer. That is, one may think of the number of hours which each person *might wish* to work (if given the opportunity, for example, or if asked to work to the limit) rather than the number of hours which people *are* working in a given period. Thus the hoarding measure becomes

$$LH = E_1 t_f - E_0 t_0'$$

where t<sub>f</sub> is the *potential* total hours a person would work if it were possible to do so. LH may then be further decomposed into paid and unpaid portions as follows:

6 See Jim Taylor (1972, 1974, 1976).

<sup>5</sup> We have used inverted commas here because of the special sense in which the word is used: hoarded workers are 'employed' in the sense of retaining attachment to a job but may be underemployed in the sense of working fewer paid hours than normal and for being paid for time not worked.

LH =  $E_1 t_f - E_0 t_0$ =  $E_1 (t_1 + \Delta t) - E_0 t_0$ , and Paid LH =  $E_1 t_1 - E_0 t_0$ , while

Unpaid LH =  $E_1 \Delta t$ ,

where  $\Delta t$  is the additional potential hours a person could work. Corresponding rates may be defined by expressing 'Paid LH' and 'Unpaid LH' as percentages of  $E_1 t_1$ .

The variable  $\Delta$ t takes account of the fact that many workers, though they keep their jobs during periods of economic slack, are forced to work fewer hours than they wish. We know that many persons who are working part time would prefer to work full time, and it is possible that many persons who are already working "full time" by Labour Force Survey definitions<sup>7</sup> would prefer to work more hours per week if possible. While we are unable to obtain a measure of this particular effect, we are able to derive a crude approximation of potential extra hours by utilizing an estimate of those persons involuntarily working part time because of economic conditions.

Algebraically, the average number of hours of work per week in the Labour Force Survey may be expressed as

$$HRW = HRW_{full} \cdot \frac{E_{full}}{E_{l}} + HRW_{part} \cdot \frac{E_{part}}{E_{l}}$$
$$= HRW_{full} \cdot \frac{E_{full}}{E_{l}} + HRW_{part} \cdot \frac{E_{can't} + E_{don't}}{E_{l}},$$

7 Thirty hours or more.

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where HRW = average weekly work hours per person,

HRW<sub>full</sub> = average weekly work hours of full-time workers, HRW part = average weekly work hours of part-time workers, E<sub>full</sub> = number of full-time workers employed, Ecan't = number of part-time workers who can't find full-time work (and want it), Edon't = number of part-time workers who don't want full-time work,  $E_1 = total number of persons employed.$ 

Assuming that the part-time workers who can't find full-time jobs are indeed willing to work full time the previous identity may be reformulated to yield an estimate of the average potential hours of work per person per week (HRW\*):

$$HRW* = HRW_{full} \cdot \frac{E_{full} + E_{can't}}{E_{l}} + HRW_{part} \cdot \frac{E_{don't}}{E_{l}}$$

Since E is always greater than or equal to zero, and HRW full is greater than HRW part, the potential hours of work per person per week is always greater than or equal to observed average hours of work per person per week. Total potential hours of work per year available to employers (t\*) is therefore

$$t^* = 52 \text{ HRW}^* \cdot \text{E}_1$$
.

The estimation of the required man-hours of work for a given output level is problematic. What follows is the application of existing theory and methodology the plausibility of which depends upon the realism of the inherent assumptions.

<sup>8</sup> An alternative method for estimating technological change and labour hoarding is to calculate them from an estimated production function. The difficulty in this approach is that in estimating the production function, researchers usually use the observed labour inputs and existing capital stock, not the required inputs. Hence, the problem of input is more or less assumed to be unimportant.

One might begin by arguing that the man-hours-tooutput ratio of that year in which labour was utilized most intensively might constitute an appropriate benchmark for calculating the labour inputs *required* to produce the actual outputs of other years. The problem with such an approach is that, because of technological change, the  $E_1t_1/Q_1$  ratio (where  $Q_1$  is the real output produced by  $E_1$  workers working  $t_1$  hours) is typically strongly downtrended, so that the lowest ratio would be one of the last few observations. The application of this ratio to preceding years would therefore be unrealistic since it would implicitly involve the attribution of the latest technology to the historical period.

What we have assumed, rather, is that the non-linear trend of the  $E_1t_1/Q_1$  ratio provides a reasonable approximation of the course of technological change and that shifting this trend to tangency with the strongest point (e.g., point A in Figure 1) of the series will provide us with the set of required ratios for the various years.<sup>9</sup> Further assumptions are of course, implicit in this procedure: first, that the trend of the man-hours/output ratio will capture the effects of technological change; second that by using a non-linear trend we may preserve the cyclical sensitivity of labour

9 The criterion for choosing the degrees of the polynomial trend is described in Appendix A of this paper.

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productivity;<sup>10</sup> and third that at the strongest point actual and required labour inputs are nearly equal.





Once the series of required man-hours per unit of output has been determined the total *required* man-hours,  $E_0t_0$ , are obtained by multiplying the former series by the historical real output data.

<sup>10</sup> It is recognized that workers' productivity will be higher the greater the availability of complementary resources. This is the reason for the cyclical sensitivity in labour productivity. The function of the non-linear trend is to follow the cyclical productivity pattern rather than to correct for the biases introduced by cyclical variation. In other words, the objective is to find out, at each point of the business cycle, whether or not workers could possibly be more productive than they actually were.

## Empirical Estimates

The estimates of labour hoarding in this section are presented in rate form rather than as levels:

Paid Labour Hoarding Rate =  $[(E_1t_1 - E_0t_0)/(E_1t_1)]100$ Unpaid Labour Hoarding Rate =  $[(E_1\Delta t)/E_1t_1)]100$ 

The various procedures used in obtaining the material necessary to estimate these rates are described in Appendix A.

## (i) The Total Economy

The paid and unpaid labour hoarding hours and their rates have been estimated for nine broad industry sectors, namely agriculture; forestry, fishing, trapping, and mining; manufacturing; construction; transportation, communication, and other utilities; trade; finance, insurance, and real estate; community, business, and personal services; and public administration. These paid and unpaid labour hoarding hours are then aggregated across industries to give an estimate for the total economy. The observed hours of work,  $E_1t_1$  of the total economy are similarly obtained by the summation method. It should be noted that while the method of estimation dictates that at the "strongest point" the paid labour hoarding rate for an industry is zero, it is unlikely to be zero for the total economy, because of differences in timing.

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Table 1 presents some estimates of paid labour hoarding for the overall economy and for selected industries,<sup>11</sup> and the overall picture is conveyed by Figure 2. The unpaid hoarding rate is small and relatively stable but the paid rate has some interesting features. Some signs of an upward surge in labour hoarding can be detected in the last six years. The paid labour hoarding rate surpasses the unemployment rate in 1974 and 1975, drops slightly in 1976, and stays at a relatively high level of about 6 per cent in 1977.<sup>12</sup>

Table 1							
PAID	LABOUR	HOARDING	RATES	FOR	SELECTED	INDUSTRY	SECTORS
		FOR	THE Y	EARS	1961-1977	7	

	Manufacturing	Construction	Transportation, Communication, and Other Utilities	Trade	Finance, Insurance, and Real Estate	Total Economy
1961	1.0%	3.8%	1.6%	2.78	1.9%	4.1%
1362	0.6	4.5	4.9	1.7	3.7	2.4
1963	1.8	5.9	5.7	1.0	3.1	2.0
1964	3.2	0.0	1.4	0.6	0.5	3.1
1965	0.2	4.5	3.5	0.0	1.3	3.1
1966	1.3	6.8	1.0	0.1	4.0	2.7
1967	2.6	5.3	6.7	2.9	3.7	6.0
1968	0.0	2.4	5.4	2.8	1.0	. 3.8
1969	0.5	4.4	6.1	2.6	2.3	3.4
1970	3.6	6.6	4.1	5.1	3.9	4.4
1971	1.5	3.7	3.9	1.1	3.9	2.7
1972	1.9	5.6	5.4	1.2	0.4	3.2
1973	2.5	11.0	8.0	1.8	0.0	3.9
1974	4.9	14.9	8.7	1.7	4.1	6.0
1975	8.3	11.1	12.0	6.2	3.7	7.6
1976	9.4	11.6	12.7	1.9	2.8	6.1
1977	7.3	8.3	12.1	4.5	2.0	6.2

Source: Based on data from Statistics Canada and estimates by the authors.

- 11 We have chosen to highlight those industries in which the concept of labour hoarding appears intuitively most appropriate.
- 12 Differences in concepts and definitions render accurate comparisons with the U.S. rather hazardous. Estimates based on aggregate U.S. data suggest that, on average, the American hoarding rate is about three-fifths the size of its Canadian counterpart.



# Figure 2 LABOUR HOARDING AND UNEMPLOYMENT IN CANADA FOR THE YEARS 1961-1977

## (ii) Industry Sectors

Since the concept of total potential hours available to employers and the measurement of output can be quite different among these sectors, indiscriminate inter-industry comparison can be meaningless. In Figure 3, the paid hoarding rates noted for the five selected sectors in Table 1 are presented in graphic form.<sup>13</sup> Since the goods and services provided by these sectors are bought and sold in the market, and the concept of man-hours paid and man-hours required is particularly meaningful

<sup>13</sup> The unpaid labour hoarding rates are relatively small and stable for all of these sectors, and will not be discussed in detail here.

to them, they may provide an acceptable basis for comparison. Results for the rest of the nine sectors will not be presented here.

The main features of these estimates are as follows. First, considerable differences in patterns and orders of magnitude are apparent among the sectors. Of the goods-producing sectors, manufacturing and construction have relatively moderate rates up to 1972 at which point they climb markedly. Among the service sectors, transportation, communication, and other utilities exhibit high rates of labour hoarding, especially for the years 1973 to 1977. The rest of the service sectors are characterized by relatively low rates of hoarding.

#### Figure 3



PAID LABOUR HOARDING RATES FOR SELECTED INDUSTRY SECTORS FOR THE YEARS 1961-1977

Source: Based on data from Statistics Canada and estimates by the authors.

## Concluding Remarks

The concept of labour hoarding is significant because of a number of implications. First, it is apparent there may exist in the economy at any time quite sizeable quantities of unutilized labour that are not taken into account by the official unemployment statistics. It is clear that the time dimension of labour supply is crucial to a comprehensive examination of labour slack. Such considerations are clearly important to computations of the Okun's Law variety inasmuch as a more refined measure of unutilized labour may yield more accurate estimates of potential.<sup>14</sup>

Secondly, examination of hoarding serves to bring into sharp focus the troublesome question of the interpretation of productivity. If paying for ("employing") man-hours not worked is a widespread practice one wonders what sense can be made of popular productivity measures such as output per man-hour. Interindustry differences in productivity may be significantly affected by differences in the propensities to hoard.

Third, it appears that work-sharing, which has received considerable attention lately, is in fact practiced rather widely in Canadian industry. From a policy standpoint it would seem that periods of cyclical downturn characterized by hoarding might well be utilized for skill-upgrading through on-the-job training.

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<sup>14</sup> See Okun (1962). As mentioned earlier, an ideal measure would involve a conceptually improved unemployment measure which took account of hoarding and the discouraged worker phenomenon. A crude measure of unutilized manpower incorporating official unemployment figures and labour hoarding is shown in Appendix B.

Fourth -- and particularly important in our view -it is apparent that the existence of hoarding may introduce a good deal of insensitivity of the unemployment rate to expansionary fiscal and monetary measures. This is simply because output may be expanded considerably before hoarded labour is fully employed and additional workers are required.

Finally, it seems appropriate to pose a number of speculative questions which might well constitute the foci for further research. What, for example, are the reasons for hoarding? The standard economist's answer is that hoarding is the (long-run) profit-maximizing entrepreneur's response to the vagaries of the business cycle in which the costs of retaining workers are weighed against the costs of screening, hiring, and training. But what if, as economists, we are ascribing to employers a rationality that they do not apply in this particular case. If this is true, then hoarding clearly means higher unit labour costs. One might then want to know whether hoarding comes about because of institutional constraints inherent in employment contracts, because of humanitarian personnel policies, or because of sheer managerial inertia. Studies at the level of the organization, particularly if focussed on the occupational dimension of hoarding, would clearly aid our understanding of this important phenomenon.

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#### APPENDIX A

#### Data Sources and Manipulation

The Labour Force Survey of Statistics Canada has been the major source of data used in this study. In addition, it was necessary to carry out a fair amount of data manipulation. The following description will note the data sources and the way any estimations were carried out, and will make various necessary points of clarification.

The average-hours-worked-per-week data for the total economy are from the old and new Labour Force Surveys, but the corresponding data for the major industrial sectors are from *Aggregate Productivity Measures*, (Catalogue No. 14-201, annual) of Statistics Canada's input-output division. Average hours of work per week for full-time and part-time employment, reasons for part-time employment, and full-time and part-time employment by industry are obtained from the Labour Force Survey Division in work-sheet form. All other employment data used can be found in *The Labour Force*, (Catalogue No. 71-001, monthly) of Statistics Canada.<sup>15</sup>

Output data are from Statistics Canada's Real Domestic Product By Industry, (1971 = 100), (Catalogue No. 61-213, annual). Since data for 1961 to 1971 are available only on "1961 = 100" base, they have been mechanically converted to the "1971 = 100"

<sup>15</sup> With the exception of the unpublished data mentioned, all of the data used can be retrieved from the databank of CANSIM.

base to produce a continuous record for 1961 to 1977. This involves multiplying the 1961 base indexes by 100.0 and dividing by the 1971 index value on a 1961 base.<sup>16</sup>

The switching from the old Labour Force Survey to the new Labour Force Survey in the post-1975 period by Statistics Canada, and the lack of some relevant information for the period 1961 to 1965 have created some discontinuity of information and data for this paper. With respect to the difference between the data from the old and new Labour Force Surveys, our practice is to keep the 1961 to 1975 data on the old survey basis. For 1976-1977, the 1975 ratios of the old and new Labour Force Surveys' figures have been used to revise these two years' data back to the old Labour Force Survey concept.

Data for average hours worked per week for full-time and part-time employment, reasons for part-time employment, and full-time and part-time employment by industry are available only for 1966 to 1977. Trend-line equations have been estimated and used to extrapolate these series backward to 1961. For the part-time and full-time employment by industry series, the backward extrapolated figures for 1961-1965 will sum up to figures that are slightly different from the published total employment by industry data. Therefore, the backward-extrapolated part-time and full-time employment by industry figures are only

<sup>16</sup> This method is described in *The 1977 Summary Reference Index*, CANSIM, (Catalogue No. 12-202E, annual).

used to determine the proportionality of part-time and full-time employment by industry.<sup>17</sup>

Average hours worked per week for full-time and parttime employment are required for estimating the potential hours available to employers. This information is only available for the total economy. For the major industrial sectors included in this study, we have to derive the information as follows.

$$HRW_{i} = (HRW_{f,i} \cdot E_{f,i}/E_{i}) + (HRW_{p,i} \cdot E_{p,i}/E_{i}), \quad (1)$$

where

HRW<sub>i</sub> = average hours worked per week per person in industry "i",

- HRW<sub>f,i</sub> = average hours worked per week per full-time employed person in industry "i",
  - Ef,i = number of full-time people employed in industry "i",
- HRW = average hours worked per week per part-time
  employed person in industry "i",
- Ep,i = number of part-time people employed in industry "i",
  - E, = total number of people employed in industry "i".
- 17 Let E<sub>i</sub>, E<sub>i</sub>, part, and E<sub>i</sub>, full be the observed total employment, backward-extrapolated-part-time employment, and backward-extrapolated-full-time employment of industry "i" respectively. The final estimate for part-time employment for industry "i" is,

 $\hat{\tilde{E}}_{i,part} = E_i [\hat{E}_{i,part} / (\hat{E}_{i,part} + \hat{E}_{i,full})].$ 

Similarly, the final estimate for full-time employment for industry "i" is,

$$\hat{\tilde{E}}_{i,full} = E_i [\hat{E}_{i,full} / (\hat{E}_{i,part} + \hat{E}_{i,full})].$$

We have data for  $HRW_i$ ,  $E_{f,i}$ ,  $E_i$  and  $E_{p,i}$ , but not  $HRW_{f,i}$  and  $HRW_{p,i}$ . By assuming that the ratio of  $(HRW_{p,i}/HRW_i)$  of industry "i" is approximately the same as the corresponding ratio for the total economy,  $(HRW_p/HRW)$ , we can estimate  $HRW_{p,i}$  by

$$\hat{HRW}_{p,i} = HRW_{i} (HRW_{p}/HRW), \qquad (2)$$

Where HRW and HRW<sub>p</sub> are the known time series for average hours worked per week per person and average hours worked per week per part-time employed person, respectively, for the total economy, and the symbol "^" denotes that  $\widehat{HRW}_{p,i}$  is an estimate of  $\widehat{HRW}_{p,i}$  rather than an observed value. Using  $\widehat{HRW}_{p,i}$  of Equation 2 to replace  $\widehat{HRW}_{p,i}$  in Equation 1, and re-arranging the terms, we obtain the following equation for estimating  $\widehat{HRW}_{f,i}$ .

$$\hat{HRW}_{f,i} = (HRW_i - HRW_{p,i} \cdot E_{p,i}/E_i)E_i/E_{f,i}$$

From the Labour Force Survey, we have, for the total economy, some information on workers' reasons for part-time employment. Some people worked part time because they could only find part-time work. The rest of them worked part time because they did not want full-time work or could not assume full-time duty for various personal reasons. This information is not available on industry basis. In the labour hoarding by industry calculation, it is assumed that the proportion of people who could only find part-time work to total part-time employment for an industry is approximately the same as the corresponding ratio for the total economy. The extensive data massaging mentioned above has been performed solely for the purpose of filling the data gaps in the existing data base. It is used in the calculation of unpaid labour hoarding by industry, but it has no influence on the estimates of paid labour hoarding.

As has been mentioned in the text, non-linear polynomial trends are needed as a means for estimating the required man-hours. An attempt is made to follow the principle of parsimony, i.e., employing the smallest possible number of parameters for adequate representation, in determining the appropriate degrees for the polynomials. Each trend is estimated by regressing the observed man-hours/real output ratios on T,  $T^2$ ,  $T^3$ , and T<sup>4</sup>, where T is simply a time series with values 1, 2, 3, ... for the first, second, third, ..., observations. Working backward from the highest degree regressor, T<sup>4</sup>, it will be dropped from the trend equation, if it does not contribute to the corrected coefficient of determination,  $\overline{R}^2$ . The procedure continues until a suitable polynomial is found. The degrees of the polynomials used in this study are 3, 2, 4, 3, 2, 3, 2, 2, 2, 4, 3, and 2 for agriculture; forestry; fishing and trapping; mines, quarries and oil wells; manufacturing; construction; electric power, gas and water utilities; transportation and communication; trade; finance, insurance and real estate; community, business and personal service; and public administration, respectively. The sample period for estimating these polynomials is 1961 to 1977, except that for manufacturing, construction, and transportation and communication the sample period is 1961 to 1972, for

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forestry 1961 to 1973, and for trade 1961 to 1974. The reason for truncating the data for estimating these five polynomials is that the data points for the last few years, in these cases, appear to be anomalies and the inclusion of them in the sample period will distort the general slopes of the polynomials. All the estimated polynomial equations (including the truncated cases) are employed to estimate the required man-hours/real output ratios for the sample period 1961 to 1977.

## APPENDIX B

While the deficiencies of the official unemployment statistics are considerable and their simple augmentation by our hoarding estimates is clearly open to criticism we felt that the calculation of such a combined measure is an interesting way of illustrating the orders of magnitude contained in the main body of the paper. We must emphasize, however, that our purpose goes no further than this. The deficiencies of the official unemployment figures as measures of cyclical phase, labour market "tightness", and inflationary potential are wellknown, <sup>18</sup> so that the present exercise should be regarded as purely academic and in no way construed as the presentation of a viable alternative labour market indicator.

Unutilized Manpower Rate =  $\left(\frac{U + LH/t_f}{L}\right)$  100

where LH is total (paid and unpaid) labour hoarding in man-hours for a particular time period, t<sub>f</sub> is the potential hours of work per person for the same time period, and U and L are the numbers of persons unemployed and in the labour force, respectively. Dividing LH by the average potential number of hours worked per person serves to express this portion of the numerator in terms of number of persons.

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<sup>18</sup> See, for example, Economic Council of Canada, People and Jobs, (Ottawa: Information Canada, 1976), ch. 10, and Economic Council of Canada, A Time for Reason, Fifteenth Annual Review (Ottawa: Minister of Supply and Services Canada, 1978) pp. 83-92.

Year	Unutilized Manpower Rate (Per Cent)	Unemployment Rate (Per Cent)
1961	11.3	7.2
1962	8.6	5.9
1963	7.9	5.5
1964	8.1	4.7
1965	7.3	3.9
1966	6.7	3.6
1967	10.4	4.1
1968	9.1	4.8
1969	8.5	4.7
1970	10.7	5.9
1971	9.5	6.4
1972	9.9	6.3
1973	9.8	5.6
1974	11.5	5.4
1975	14.7	7.1
1976	13.4	7.3
1977	14.5	8.3

# UNUTILIZED MANPOWER RATE\*

1976-77 data have been revised by the \* 1975 ratios of the old and new Labour Force Surveys back to the old Labour Force Survey basis. All other raw data used are from the old Labour Force Survey.

Based on data from Statistics Source: Canada and estimates by the authors.

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