REAL WAGES AND CYCLICAL VARIATIONS IN EMPLOYMENT: A RE-EXAMINATION OF THE EVIDENCE*

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Salaires réels et variations cycliques dans l'emploi : une approche nouvelle. Cet article constitue une étude des relations entre les salaires réels et les changements cycliques dans l'utilisation de la main-d'oeuvre. L'analyse s'attache plus spécialement à vérifier si, selon les conceptions de Keynes et Rueff, les salaires réels des travailleurs sont bas durant la phase de prospérité du cycle économique. Au niveau des données existantes et de l'univers réel, le chercheur, dans l'examen de cette question, doit vraisemblablement tenir compte de la hausse séculaire des salaires réels. La plupart des études de ce problème ont largement échoué, selon le présent auteur, faute d'avoir pu régler de façon adéquate les problèmes d'intercorrélations comme celles, par exemple, entre les changements dans les salaires réels et les salaires nominaux. Le présent travail évite cet écueil en se préoccupant des relations entre deux variables mesurées indépendamment l'une de l'autre : les salaires réels (après élimination de l'influence de la hausse séculaire) et le chômage (ou un autre indice de comportement cyclique). Pour les salaires réels, l'exclusion de l'influence de l'augmentation séculaire s'effectue de deux façons distinctes : 1, en comparant les taux de changements observés à un taux « normal » ; 2, en éliminant la composante séculaire des salaires réels. De plus, une autre mesure de comportement cyclique a été élaborée afin de pouvoir tenir compte du chômage déguisé; cette nouvelle variable ne conduit pas à des résultats différents. Pour l'analyse des séries de salaires nominaux, on tient compte des variations dans les prix en utilisant à la fois l'indice des prix à la consommation et les indices individuels de prix. Les données sur les salaires réels concernent le Canada et les Etats-Unis; dans chacun des cas on a adopté, successivement, une perspective historique à très long terme et un échantillon trimestriel pour la période d'après-guerre. Les résultats essentiels (compte tenu de quelques exceptions) ne confirment pas l'enseignement traditionnel; au contraire, il tendent à justifier partiellement les plus anciens critiques de Keynes, tels Dunlop et Tarshis.

I / Introduction

Rates of wage payments adjusted for variations in the purchasing power of money have shown a pronounced upward trend, for virtually all developed economies over the past century. An interesting issue, however, arises when one considers the shorter period of time implicit in the analysis of business

fluctuations. When employment rises owing to a fuller utilization of productive capacity (as would occur in the recovery from a recession), do real rates of wage payments also increase or do they show a contracyclical movement?

This issue can be approached from the viewpoint of the recent literature on wage adjustment relationships. As a general rule, the rate of increase of prices accelerates during a cyclical expansion; moreover, virtually all fitted wage adjustment relationships indicate that the partial effect of a higher rate of increase of consumer prices is a less than proportionate increase in the money rate of wage payments.[1] Consequently, it is tempting to assert that real wages (money wages corrected for variations in consumer prices) will, as a general rule, decrease during a cyclical expansion. (This presumed decline in real wages must, in a growing economy, be measured relative to the trend in real wages; with a vigorous trend, the decline may merely be a retardation in the rate of growth.) But the story is more complicated than this. The rate of change of money wage rates is also sensitive to unemployment rates and profit margins, and the influence of both of these variables tends to produce higher rates of increase in money rates of wage payments during prosperity conditions. Thus, when these additional effects are taken into account, the influence of cyclical conditions on real wages becomes an open question, under this approach.

An alternative method of attacking this issue is that of Jacques Rueff[2] and John Maynard Keynes.[3] Keynes, following traditional theory, assumed a fixed stock of capital in the short run, pure competition, and profit-maximizing entrepreneurs. Under the additional assumption of diminishing returns, it followed that the money wage divided by the price of labour's product had to decline as the fixed stock of capital was used more intensively, i.e., as employment increased or unemployment declined.[4] Keynes also believed that money wages would be directly related to the cyclical utilization of the labour force (or inversely related to the unemployment rate). From these two basically independent relationships, he argued that the correlation of real and money wages, over the cycle, would be an inverse one. It is worth letting Keynes himself summarize the argument:

[1]For a documentaton of this assertion see Ronald G. Bodkin, Elizabeth P. Bond, Grant L. Reuber, and T. Russell Robinson, *Price Stability and High Employment: The Options for Canadian Economic Policy*, Special Study no. 5 prepared for the Economic Council of Canada (Ottawa, 1967), chap. 3.

[2]Rueff developed the implications of orthodox economics in this regard as early as 1925, as Keynes acknowledged in his 1939 comment (John Maynard Keynes, "Relative Movement of Real Wages and Output," *Economic Journal*, XLIX, no. 193 (March 1939), 34–51) on these issues. Indeed, in the French-language literature on this subject, the assertion of an inverse relationship between employment and the real wage is known as "la Loi de Rueff." (The references to Rueff's original papers in 1925 and 1931, which were unsigned at the time they appeared, may be found in Jacques Rueff, "Nouvelle discussion sur le chômage, les salaires et les prix," *Revue d'Economie politique*, LI (1951), 761–91.

[3]John Maynard Keynes, *The General Theory of Employment, Interest, and Money* (London, New York, 1936).

[4]The argument can still be maintained under conditions of imperfect competition, provided that one assumes that a measure termed "the degree of monopoly power" remains unchanged over the course of the cycle. See R. J. Ball and R. G. Bodkin, "Income, the Price Level, and Generalized Multipliers in Keynesian Economics," *Metroeconomica*, XV, no. 2–3 (Aug.–Dec. 1963), 59–81, where the argument is developed more fully.

But in the case of changes in the general level of wages, it will be found, I think, that the change in real wages associated with a change in money-wages, so far from being usually in the same direction, is almost always in the opposite direction. ... This is because, in the short period, falling money-wages and rising real wages are each, *for independent reasons*, likely to accompany decreasing employment; labour being readier to accept wage-cuts, when employment is falling off, yet real wages inevitably rising in the same circumstances on account of the increasing marginal return to a given capital equipment when output is diminished.[5]

If this conclusion is accepted, it does not follow that total labour income will decline during prosperity, because hours of work per worker and employment itself expand with a decline in cyclical unemployment.[6] There does follow, however, the point that there will be a substantial group in the community who will suffer a decline in economic well-being as stronger aggregate demand reduces cyclical unemployment.[7] The argument, however, was not accepted without question; within a period of four years, there were a number of statistical studies[8] which attempted to subject the issue to an empirical test. Dunlop and Tarshis basically correlated real and money wage rates, obtaining (not surprisingly) a positive relationship, contrary to what Keynes had predicted.[9] Keynes reviewed the debate in 1939 and, though sceptical himself, appeared willing enough to disencumber himself from a relationship that he felt was not needed to make his system work.[10] Richardson and Ruggles both dissented, for quite different reasons, with the findings of Dunlop and Tarshis. James Tobin, reviewing the debate in 1947,[11] agreed with Ruggles that the issue was "statistically ... inconclusive." On the other hand, a leading text in

[5]Keynes, *General Theory*, 10. (Emphasis has been added.) Even if one argues that the money wage is absolutely rigid downward, as is done in some interpretations of Keynes' system, the argument can be maintained if one interprets the declines and rises in the quotation above as movements relative to the respective secular trends.
[6]This point was made by J. Henry Richardson, "Real Wage Movements," *Economic Journal*, XLIX, no. 195 (Sept. 1939), 425–41. In this article is also presented some statistical evidence showing that total labour income in real terms does indeed increase with increasing utilization of the labour force.
[7]Thus Sidney Weintraub, who has studied the distribution implications of the Keynesian system in some detail, asserts: "In sum, only entrepreneurs and the actual unemployed have an unequivocal stake in maximum employment, while rentiers and the employed find their interests best served at lower levels of activity." Sidney Weintraub, *An Approach to the Theory of Income Distribution* (Philadelphia, 1958), 60.
[8]John T. Dunlop, "The Movement of Real and Money Wage Rates," *Economic Journal*, XLVIII, no. 191 (Sept. 1938), 413–34; Keynes, "Real Wages and Output"; Richardson, "Real Wage Movements"; Richard Ruggles, "The Relative Movements of Real and Money Wage Rates," *Quarterly Journal of Economics*, LV (Nov. 1940), 130–49; and Lorie Tarshis, "Changes in Real and Money Wages," *Economic Journal*, XLIX, no. 193 (March 1939), 150–4.
[9]If there are errors of observation in the money wage series, then both the money wage and the real wage series will have a common measurement error. Thus a positive intercorrelation between these two series, which is spurious in the sense that it has nothing to do with the basic structural equations of the system, will be present. This was stated by Ruggles ("Movements of Real and Money Wage Rates") who preferred, however, to raise the question of what would happen if the numerator and the denominator of the real wage series were pure random numbers.
[10]As pointed out in James Tobin, "Money Wage Rates and Employment," in Seymour Harris, ed., *The New Economics* (London, 1958), 572–87, one can argue that if the real wage need not fall with increasing employment, the involuntary nature of unemployment becomes even clearer than on Keynes' original definition.
[11]Tobin, "Money Wage Rates and Employment."

intermediate macro-economic theory by Dernburg and McDougall[12] basically accepts the Dunlop-Tarshis view and then modifies the formulation of the profit-maximizer's demand for labour so that the elasticity of demand for the product of an imperfect competitor is explicitly included in the formulation.[13]

The purpose of the present paper is primarily to have a fresh look at the issue of whether real wages tend to fall or to rise with an increasing utilization of the labour force, over the course of the business cycle. This might well be worth doing in any case, with more than a quarter of a century of data available since the last published statistical examination of this issue. In addition, a somewhat different approach avoiding at least some of the pitfalls of the Dunlop and Tarshis studies may shed further light on these issues. This study utilizes both postwar and long-term historical data from both the Canadian and the US economies; as noted in the conclusions of section V, some interesting contrasts between these two economies appear to emerge.

II / The approach of the present study and the data employed

In this paper, two basic methods of attacking the issue of the cyclical sensitivity of real wages are utilized: the regression approach and the frequency table approach (which leads naturally to a χ^2 test of the association between the variables). In both cases, independently measured variables are utilized as the basis for the tests, so that hopefully the present results are free of spurious correlation of the sort described in note 9 above. In almost all cases, the cyclical variable is an unemployment rate, although in two instances an alternative cyclical variable has been employed. (This alternative variable will be described in more detail at the point of presentation of the results, in the following section.) The unemployment rate has been selected as the basic cyclical variable because this variable has an almost automatic correction for the varying scale of the economy, whereas an employment measure (either for the economy as a whole or for a particular sector) needs some correction for the changing capacity of the economy (or some particular sector) to produce, over time.

In the regression approach, the real wage series (which is a money wage series divided by a consumer price index) is first detrended. In some variants,

[12]Thomas F. Dernburg and Duncan M. McDougall, *Macro-Economics*, 2nd ed. (New York, San Francisco, Toronto, London, 1963).

[13]See Dernburg and McDougall, *Macro-Economics*, 158. Two more recent studies bearing on this issue are Nicolas Parisiadès, *Essai sur les relations entre le chômage, le salaire, les prix et le profit: Etude critique de la loi de M. Rueff* (Paris, 1949), and James Worthington White, "Some Aspects of Real Wage and Money Wage Behaviour in Canada: 1920–1965," unpublished BA thesis, Queen's University, Kingston (April 1967). Parisiadès re-examined Rueff"s evidence and concluded that the data did not support Rueff as strongly as Rueff had claimed. However, in the opinion of the present writer as well as that of Rueff, Parisiadès failed to make his case. White's study, based exclusively on Canadian data, was an examination of the time diagrams of real wages (either detrended or after computing rates of change) and of the unemployment rate. Using largely impressionistic methods, White concluded that there was some evidence in support of the Keynes-Rueff view. White can be faulted for using impressionistic methods when more precise statistical tests are available (under appropriate assumptions), but the bringing together of two independently measured series which should be related according to the theory under consideration is quite sound, in the opinion of the present writer.

an arithmetic trend was fitted to the data and in other variants a semi-logarithmic trend; in most cases, the period under study was broken into sub-periods, so that the fitted trend would be certain to pass through the peaks and troughs of the real wage data which seemed attributable to cyclical variability. After the trends were fitted, their residuals (or the antilogarithms of these residuals, the ratio of the actual values to the trend levels, in the case of the semi-logarithmic trends) were regressed on the unemployment rate and, in some cases with the quarterly postwar data, on seasonal dummies. (With quarterly data, observations were generally left in the original form, rather than being deseasonalized, where that was possible.) In the regression approach, the sign and significance of the coefficient of the unemployment variable is the crucial matter. The traditional theory of Rueff and Keynes suggests that trend-corrected real wages will be negatively related to cyclical activity and hence positively related to the rate of unemployment. On the other hand, the views of Dunlop and Tarshis would lead one to predict that trend-corrected real wages will be positively related to cyclical activity and hence *negatively* related to the rate of unemployment. Of course, a theory will be judged to be corroborated only if the regression coefficient of the unemployment variable is statistically significant, by conventional standards; variations that can reasonably be attributed to chance should not be given much weight in evaluating the results of regression computations.

In the frequency table approach, the real wage series is not explicitly detrended. Instead, the year-to-year movement of real wages is compared to a "normal" rate of growth, in order to judge whether real wages rose more or less than could be expected on the basis of the long term trend. (This long term "normal" rate of growth is obtained from the semi-logarithmic trend for the relevant sub-period; also, in the case of quarterly data, the comparison is made between corresponding quarters of adjacent years, rather than between adjacent quarters, in order to obviate problems of seasonality.) The movement of real wages (relative to a "normal" growth rate) is then compared with the development of the unemployment rate over the two years (or over corresponding quarters of adjacent years). In this manner, a 2 by 2 frequency table displaying the association (or lack of association) between movements of real wages (relative to a "normal" growth rate) and of unemployment can be presented. Such a table can easily be employed in a χ^2 test of the significance of the association of variations in unemployment rates and in the growth rates of real wages.[14] Again, the theory adopted by Keynes in his *General Theory* would suggest a deviation from a uniform direction, with significantly more of the observations in the cell with high growth rates and increases in unem-

[14]The reader who is familiar with the literature on econometric techniques will probably wonder why a simple autoregressive transformation, such as a first-difference transformation, has not been employed to do the work that the frequency table is being asked to do. Actually, the two techniques are fairly similar, and the autoregressive transformation would be a reasonable alternative method of attacking the issue of whether there is a significant association between variations in growth rates of real wages and changes in the rate of unemployment. Some trial computations were made using autoregressive transformations, and these results are briefly summarized in the concluding section. The frequency table approach is presented in the text, however, because, being a non-parametric test, it would appear to require fewer assumptions with regard to the form of the relationship or the explicit manner in which the stochastic element appears in such a relationship.

ployment than the cell with low growth rates and decreases in unemployment. The Dunlop-Tarshis view would suggest just the opposite type of association.

Before turning to the results, some comments on the data seem in order. The basic sources of the data employed in this paper are presented in the Appendix, but some conceptual issues are worth bringing out into the text. The wage series are average hourly earnings; thus variations in hours worked per week of a standard employee are taken explicitly into account. In the view of the present writer, this is an appropriate adjustment to make, as the traditional view of a declining real wage with an increase in economic activity is based on the notion of declining marginal physical productivity. Implicit in this concept is the notion that a labour unit remains the same between prosperity and recession periods; this assertion seems more applicable to the payment for a man-hour than to the payment for a man-week of varying length, part of whose variations are cyclical in nature. The wage series are generally payments to production workers; the payments to salaried or non-production workers are generally not included, with one exception explicitly detailed below.

The historical Canadian data, which largely rest on the detailed reconstruction by Urquhart and Buckley,[15] yield two series on money wages. The first is an average hourly earnings measure for Canadian manufacturing, while the second is an index of hourly earnings on an economy-wide basis. The Urquhart and Buckley wage series generally exclude overtime premia; thus they are most comparable to a straight-time hourly earning series. Urquhart and Buckley's work presents a consumer price index, which is then divided into the two money wage series to obtain two real wage series. Similarly, the unemployment series is a reconstruction of a fairly standard concept, which is converted into an unemployment rate by dividing absolute unemployment by the civilian labour force. It is worth noting that the second real wage series (real hourly earnings for the economy as a whole) is basically the series utilized by White in his study.

In the postwar quarterly Canadian data, the wage series refers to average hourly earnings in the manufacturing sector. The consumer price index is the implicit deflator of the consumption component in the GNP accounts, and so has somewhat broader coverage than the usual consumer price index. The unemployment rate is a standard series, although some work was entailed in extending this series back to the first qurter of 1949. The money wage and the unemployment series in the Canadian postwar quarterly sample were left seasonally unadjusted, with adjustment for the influence of seasonality made in the regressions themselves. It might be pointed out that the postwar quarterly Canadian data are fundamentally the data utilized by Bodkin *et al*, in the earlier ECC *study*.

The US historical data basically come from the careful reconstructions of Rees[16] on the wage series and Lebergott[17] for the unemployment rate and con-

[15]M. C. Urquhart and K. A. Buckley, *Historical Statistics of Canada* (Toronto, 1965).
[16]Albert Rees (assisted by Donald P. Jacobs), *Real Wages in Manufacturing 1890–1914* (Princeton, 1961).
[17]Stanley Lebergott, *Manpower in Economic Growth: The American Record since 1800* (New York, San Francisco, Toronto, London, 1964).

sumer price index series. The wage concept is average hourly earnings in manufacturing; Rees' series includes supplements as well as the basic wage payments. The unemployment series utilized is based on the post-1957 definition of unemployment; thus the temporarily laid-off with order to return on a specific date are counted as unemployed. As with the Canadian historical sample, war years are excluded from the analysis.

Finally, the US postwar quarterly sample is generally made up of standard series. The source of the series on average hourly earnings in manufacturing is the US Bureau of Labor Statistics, and the source of the unemployment series is the US Department of Commerce. Some work was entailed, however, to make the unemployment series consistent through the period; the data have been adjusted to the post-1957 definition of unemployment. (Thus the temporarily laid-off are considered to be unemployed, and housewives, students, and others in similar categories with definite jobs to begin at a future date are considered not to be in the labour force.) As with the postwar Canadian quarterly sample, the consumer price index is the implicit deflator of consumption in the GNP accounts. Finally, an alternative wage series, namely the wage series utilized in the Office of Business Economics econometric model,[18] has been employed in this study. This wage series is an economy-wide wage series; it is the total wage bill of the private sector divided by the product of the number of private employees times an index of average hours worked per week. Thus this standardized yearly wage, which takes into account variations in hours worked, applies to both production and non-production employees; moreover, the coverage is the broadest of all the wage series utilized in this study.[19] This series was made available to the author in only a deseasonalized form, and so its apparent lack of sensitivity to the seasonal variable in Table III below is hardly surprising.

Finally, the choice of a deflator for the money wage series may be briefly discussed. In general, a consumer price index has been utilized, on the view that this is the appropriate deflator if one looks at the matter from the viewpoint of the welfare of the typical worker. But one can argue, as Ruggles did, that the appropriate deflator is one which comes closest to measuring the wage of a unit of labour in terms of the product that the labour produces; thus Ruggles argued that a wholesale price index was a more appropriate deflator if the wage series covered only the manufacturing sector. Some alternative regression results, in which the deflator is selected to correspond as closely as possible to a price index of the output of the sector or sectors covered in the wage series, are reported at the end of the following section. The deflators selected for these alternative computations are: the Canadian general wholesale price index (used to deflate average hourly earnings in the Canadian manufacturing sector); the US wholesale price index of manufactures (used to deflate average hourly earnings in the US manufacturing sector); and the

[18]Maurice Liebenberg, Albert A. Hirsch, and Joel Popkin, "A Quarterly Econometric Model of the United States: A Progress Report," *Survey of Current Business*, 46, no. 5 (May 1966) 13–39.
[19]This series is not a published series, but instead was constructed by the OBE group for use in their econometric model. The author would especially like to thank Maurice Liebenberg and his co-workers George R. Green and Albert A. Hirsch for their kindness in making these data available to him.

US implicit deflator of GNP expenditures (used to deflate the average wage payment in the US private economy).

III / Results: the regression approach

The results of analysing the data under the regression approach appear in Tables I through IV. Although the column headings are largely self-explanatory, some elaboration may be desirable. As explained in the preceding section, the dependent variable in these regressions is always a real wage series adjusted for trend. When the trend fitted was an arithmetic one, the dependent variable is the difference between actual and estimated real wages, denoted by the symbol RW_{act}/RW_{est}. When the fitted trend was a semi-logarithmic one, the dependent variable is the antilogarithm of the residual, which is equivalent to the ratio of actual real wages to its estimated value, denoted by the symbol RW_{act}/RW_{est}. In the columns after the first four and before the final two, the upper number is a regression coefficient, while the number below it, written in parentheses, denotes the associated standard error. For the unemployment variable (or the alternative cyclical variable, in two cases), the lowermost entry, which is written in square brackets, is a t ratio, the ratio of the regression coefficient to the associated standard error. The symbol U denotes the regression coefficient on the rate of unemployment, while the columns headed D_2, D_3, and D_4 represent the regression coefficients of seasonal dummy variables. (Thus D_i is equal to unity in the ith quarter and zero otherwise.) The symbol R^2 denotes the coefficient of multiple determination, unadjusted for degrees of freedom lost in the fitting, and d is the Durbin-Watson test statistic.

Turning to the results, we see that the regression coefficients of the unemployment variable, for the postwar Canadian quarterly data, are all negative, as the Dunlop-Tarshis thesis would suggest. However, the association is very weak, as may be seen by a look at the t ratios of the unemployment variable or the coefficient of multiple determination. In none of the four cases is the unemployment variable statistically significant, by conventional criteria.[20] Thus there is little evidence of an association either way between detrended real wages and the rate of unemployment, and this conclusion is substantially unaffected by whether the real wage series is detrended by an arithmetic or by a semi-logarithmic formulation. It is interesting to note in passing that, although the money wage series was not seasonally adjusted, the detrended real wage variable appears to have little sensitivity to seasonal influences.

No significant association between detrended real wages and the rate of unemployment appears to be present in the Canadian historical data, either. Here, however, the point estimate of the influence of the unemployment rate

[20]In fact, application of conventional test of statistical significance is a procedure of doubtful validity in view of the evidence of autocorrelated residuals provided by the Durbin-Watson test statistic. As the presence of autocorrelated residuals generally leads to an overstatement of t-ratios, the existence of a significant statistical relationship is still further called into question. Nevertheless, one might still wish to test for a significant relationship among the changes, which is essentially what is done in the following section.

TABLE I

REGRESSIONS FOR THE POSTWAR CANADIAN DATA

Equation number	Coverage of wage series	Dependent variable	Period	Constant term	U	D_2	D_3	D_4	R^2	d
1	Manufacturing	$RW_{act}-RW_{est}$	49 I −65 IV	1.00720 (0.99549)	−0.14567 (0.12879) [1.13]	−0.55142 (0.67482)	−0.44097 (0.76892)	−0.31063 (0.69648)	0.025	0.41
2	Manufacturing	$RW_{act}-RW_{est}$	49 I −65 IV	0.43209 (0.48604)	−0.09236 (0.09437) [0.98]	—	—	—	0.014	0.43
3	Manufacturing	RW_{act}/RW_{est}	49 I −65 IV	1.00777 (0.00786)	−0.00114 (0.00102) [1.12]	−0.00390 (0.00533)	−0.00328 (0.00607)	−0.00239 (0.00550)	0.023	0.33
4	Manufacturing	RW_{act}/RW_{est}	49 I −65 IV	1.00352 (0.00383)	−0.00074 (0.00074) [1.00]	—	—	—	0.015	0.34

SOURCES: see text.

TABLE II

REGRESSIONS FOR THE HISTORICAL CANADIAN DATA

Equation number	Coverage of wage series	Dependent variable	Period	Constant term	U	R^2	d
1	Manufacturing	RW_{act}/RW_{est}	1921–65 less 40–46	0.99578 (0.00611)	0.00071 (0.00079) [0.91]	0.022	0.69
2	Manufacturing	RW_{act}/RW_{est}	1921–39	0.99323 (0.01004)	0.00080 (0.00099) [0.99]	0.037	0.97
3	Manufacturing	RW_{act}/RW_{est}	1947–65	0.98987 (0.01305)	0.00277 (0.00321) [0.86]	0.042	0.46
4	General index	RW_{act}/RW_{est}	1921–65 less 40–46	0.99488 (0.00486)	0.00086 (0.00063) [1.36]	0.050	1.02
5	General index	RW_{act}/RW_{est}	1921–39	0.99048 (0.00759)	0.00112 (0.00075) [1.50]	0.116	1.42
6	General index	RW_{act}/RW_{est}	1947–65	0.99252 (0.01080)	0.00210 (0.00266) [0.79]	0.035	0.59

SOURCES: see text.

TABLE III

REGRESSIONS FOR THE POSTWAR US DATA

Eqn. no.	Coverage of wage series	Dependent variable	Period	Constant term	$(E/P)_{14+}$	U	D_2	D_3	D_4	R^2	d
1	Manufacturing	$RW_{act}-RW_{est}$	49 I −65 IV	0.02119 (0.00950)	—	−0.00300* (0.00153) [1.96]	−0.00327 (0.00525)	−0.01493 (0.00541)	−0.00678 (0.00551)	0.138	0.85
2	Manufacturing	$RW_{act}-RW_{est}$	49 I −65 IV	0.00882 (0.00758)	—	−0.00177 (0.00147) [1.20]	—	—	—	0.021	1.00
3	Manufacturing	RW_{act}/RW_{est}	49 I −65 IV	1.01334 (0.00479)	—	−0.00201* (0.00077) [2.61]	−0.00184 (0.00264)	−0.00755 (0.00273)	−0.00381 (0.00278)	0.161	0.89
4	Manufacturing	RW_{act}/RW_{est}	49 I −65 IV	1.00680 (0.00382)	—	−0.00136 (0.00074) [1.83]	—	—	—	0.048	1.02
5	Economy	RW_{act}/RW_{est}	53 I −66 IV	1.03346 (0.00697)	—	−0.00626† (0.00113) [5.55]	0.0021 (0.00352)	−0.00327 (0.00367)	−0.00205 (0.00372)	0.397	0.93
6	Economy	RW_{act}/RW_{est}	53 I −66 IV	1.03017 (0.00528)	—	−0.00586† (0.00101) [5.80]	—	—	—	0.382	0.97
7	Economy	RW_{act}/RW_{est}	53 I −66 IV	0.72921 (0.09469)	0.00520† (0.00184) [2.83]	—	−0.00495 (0.00513)	−0.00915 (0.00606)	−0.00221 (0.00490)	0.164	0.80
8	Economy	RW_{act}/RW_{est}	53 I −66 IV	0.83006 (0.06431)	0.00322* (0.00121) [2.65]	—	—	—	—	0.115	0.80

*Denotes a significant coefficient, at the 5 per cent level, by conventional criteria.
†Denotes a significant coefficient, at the 1 per cent level, by conventional criteria.
SOURCES: see text.

TABLE IV

REGRESSIONS FOR THE US HISTORICAL DATA

Equation number	Coverage of wage series	Dependent variable	Period	Constant	U	R^2	d
1	Manufacturing	RW_{act}/RW_{est}	1900–65 less 17–18 and 42–46	1.01036 (0.00743)	−0.00136 (0.00079) [1.71]	0.049	0.75
2	Manufacturing	RW_{act}/RW_{est}	1900–41 less 17–18	1.01309 (0.01001)	−0.00148 (0.00092) [1.60]	0.063	0.78
3	Manufacturing	RW_{act}/RW_{est}	1947–65	1.01585 (0.02832)	−0.00322 (0.00567) [0.57]	0.019	0.24

SOURCES: see text.

is positive, rather than negative; thus, taken at face value, the traditional theory as interpreted by Rueff and Keynes gains some support. Regressions 4 through 6 are the results of the present study most analogous to the time diagram analysis of White. The best case for the traditional view can be made with equation 5 of Table II, where the coefficient of determination, though still modest, is considerably higher than elsewhere in this table. More importantly, the ratio of the regression coefficient to its associated standard error is close to being significant at the 10 per cent level, and the conventional test of statistical significance is much less affected here than elsewhere by apparent autocorrelation of the residuals.[21] It is interesting to note that White concluded, on the basis of his analysis of the time diagrams of the deflated general index of wages and of unemployment, that a case for the traditional view could be made on the basis of the interwar data, although in his view much less of a case could be made from the postwar data. The coefficients of multiple determination and the t ratios of the unemployment rate variable generally bear White out, although, as we have noted, one would have to accept a large risk of a type i error in order to conclude that the interwar relationship is statistically significant.

Turning now to the regressions based on the US quarterly data, we see that the results are quite different from those from the Canadian data. The influence of the rate of unemployment on trend-adjusted real wages is negative and significant (if one ignores the likely presence of autocorrelated residuals), and this is true for both manufacturing and economy-wide real wages. (With manufacturing real wages, the negative association of unemployment with the residuals after trend has been eliminated does not appear until the influence of seasonality has also been taken into account.) Thus these results are consistent with the Dunlop-Tarshis view that real wages (trend-adjusted) rise in prosperity periods, with increasing utilization of the labour force. Regressions 7 and 8 report on an experiment in which the cyclical variable is taken to be the proportion of the non-institutional population, 14 years of age and older, that is actually employed. This was done to check on the possibility that the measured unemployment rates are vitiated by such factors as disguised unemployment, of the sort pointed up in Dernburg and Strand.[22] It is interesting to note that this formulation of the problem is closer to the presumed structural relationship between real wages and labour force utilization as stated in Keynes' formulation of the traditional view. It is also interesting to note that here also the sign of the regression coefficient is significant in the opposite direction from what would be predicted by the traditional (the Keynes-Rueff) view. As noted earlier, the presence of autocorrelated residuals should lead us to interpret the computed t ratios cautiously; however, the association among the changes, examined in the succeeding section, is significant also in the same direction as the results of these regressions.

[21]H. Theil and A. L. Nagar, "Testing the Independence of Regression Disturbances," *Journal of the American Statistical Association*, LVI, no. 296 (Nov. 1961), 793–806. According to the Theil-Nagar test, the residuals of equation 5 are *not* significantly autocorrelated, at standard levels of statistical significance.
[22]T. F. Dernburg and K. T. Strand, "Hidden Unemployment, 1953–62: A Quantitative Analysis by Age and Sex," *American Economic Review*, LVI, no. 1 (March 1966), 71–95.

The results of the regressions based on the US historical data appear in Table IV. The key result is the first regression (that for the entire period), in which the regression coefficient on the unemployment rate is negative but not significant, however, by conventional standards.[23] The results are thus weakly consistent with the results of the analysis of the postwar quarterly US data; Dunlop and Tarshis are again mildly confirmed, at the expense of the traditional view.

Several alternative regressions have been computed, in which the real wage variable is a money wage series divided by the price index judged closest to the price level of the sector covered by the money wage series. When detrended in the same manner as before, this real wage variable serves as an alternative dependent variable. In the following results, the first regression is based on Canadian data for 1949 I through 1965 IV, and the deflator of money wages is the Canadian Wholesale Price Index (WPI). The second regression is based on the OBE economy-wide US money wage series, for the same period as before, and the price index in the denominator of real wages is the implicit deflator for all gross national product (P_{GNP}). The third regression is based on the US manufacturing money wage series, for the same period as before, and the deflator is the US Wholesale Price Index of Manufactures (WPI_m). The results of these computations are as follows:

$$(\text{I.4a}) \qquad \left(\frac{W}{WPI}\right)_{dt} = \underset{(0.0086)}{0.9918} + \underset{(0.00167)}{0.00215}\, U, \qquad\qquad \begin{array}{l} r^2 = 0.025 \\ d = 0.404; \end{array}$$
$$[1.29]$$

$$(\text{III.5a}) \qquad \left(\frac{W}{P_{GNP}}\right)_{dt} = \underset{(0.00541)}{1.0337} - \underset{(0.00104)}{0.00639}\, U, \qquad\qquad \begin{array}{l} r^2 = 0.411 \\ d = 0.949; \end{array}$$
$$[6.14]$$

$$(\text{III.3a}) \qquad \left(\frac{W}{WPI_m}\right)_{dt} = \underset{(0.00929)}{0.9826} + \underset{(0.00183)}{0.00385}\, U - \underset{(0.00661)}{0.00234}\, D_1$$
$$[2.10]$$

$$+ \underset{(0.00629)}{0.00066}\, D_2 - \underset{(0.00620)}{0.00497}\, D_3, \qquad \begin{array}{l} r^2 = 0.089 \\ d = 0.308. \end{array}$$

It is interesting to note that the use of a price index which is closer to that of a price level of the sector covered by the wage series does produce somewhat different results, in the case of the first and third regressions. For detrended Canadian real wages in which the deflator is the Wholesale Price Index, the association between this variable and the unemployment rate becomes positive (in contrast to the negative coefficient of the unemployment variable in equation 4 of Table I above); however, this association remains statistically insignificant, by conventional criteria. The choice of the deflator

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[23]If one employs the 10 per cent level of statistical significance (in a two-tailed test), the regression coefficient on unemployment in equation 1 of Table IV would be judged to be statistically significant. When these data are analysed by the alternative frequency table technique of the following section, the negative association between unemployment changes and growth of real wages (relative to "normal" rates), in Table X below, is statistically significant, by conventional criteria. (See Table XII below.)

makes almost no difference in the analysis of the OBE series of a money wage variable for the entire US economy; equation III.5a is very similar to its counterpart in Table III above. The greatest difference to the results occurs when one analyses the US manufacturing wage series. If the Wholesale Price Index of Manufactures is utilized in place of a consumer price level as a deflator of money wages, the association between detrended real wages and unemployment becomes apparently statistically significant in a positive direction, instead of significant by standard criteria in a negative direction. One can call the significance of the unemployment variable's regression coefficient in equation III.3a into question, especially in light of the very low value of the Durbin-Watson test statistic for this equation.[24] Nevertheless, this result should probably be given some weight as evidence in favour of the Keynes-Rueff thesis.

IV / Results: the frequency table approach

The results of the analysis of the data according to the frequency table approach are presented in Tables V through XI. The results of the formal χ^2 tests based on these tables appear in Table XII. It is interesting to note that, with one exception, the results of this approach agree almost completely with the results of the regression analysis, presented in the preceding section.

Turning to the frequency table based on postwar Canadian data, it is apparent that there is very little association one way or the other. Thus, for the postwar data tabulated in Table V, in the 30 quarters in which the unemployment rate was higher than in the corresponding quarter of the preceding year, real wages rose more rapidly than the "normal" rate in only one third of these quarters. By contrast, in the thirty-four quarters in which unemployment was lower than during the same quarter of the preceding year, real earnings rose more rapidly than "normal" in almost a half (48.5 per cent) of these quarters. This suggests a mild negative association between unemployment changes and the growth (relative to trend) of real earnings, consistent with the negative

TABLE V

FREQUENCY TABLE OF REAL WAGE GROWTH (MANUFACTURING SECTOR) AND
UNEMPLOYMENT CHANGES, CANADA, 64 QUARTERS BETWEEN 1949 I AND
1965 IV

		Real wages		
		Rose more rapidly than "normal"	Rose less rapidly than "normal"	Totals
Unemployment	Rose	10	20	30
	Fell	16	18	34
	Totals	26	38	64

[24]Thus, when one performs autoregressive transformations on the variable of this regression to eliminate the autocorrelation in the residuals, the coefficient on the unemployment rate, while it remains positive in sign, loses statistical significance by the standard tests. It is also interesting to note that when these data are analysed by the frequency table approach of the following section, the relationship again switches to a negative but statistically insignificant relationship. (See Tables XI and XII below.)

TABLE VI

FREQUENCY TABLE OF REAL WAGE GROWTH (MANUFACTURING SECTOR) AND
UNEMPLOYMENT CHANGES, CANADA, 37 YEARS BETWEEN 1921–1939,
1946–1965

Real wages

		Rose more rapidly than "normal"	Rose less rapidly than "normal"	Totals
Unemployment	Rose	9	9	18
	Fell	7	12	19
	Totals	16	21	37

TABLE VII

FREQUENCY TABLE OF REAL WAGE GROWTH (GENERAL INDEX) AND
UNEMPLOYMENT CHANGES, CANADA, 37 YEARS BETWEEN 1921–1939,
1946–1965

Real wages

		Rose more rapidly than "normal"	Rose less rapidly than "normal"	Totals
Unemployment	Rose	8	10	18
	Fell	9	10	19
	Totals	17	20	37

TABLE VIII

FREQUENCY TABLE OF REAL WAGE GROWTH (MANUFACTURING SECTOR) AND
UNEMPLOYMENT CHANGES, USA, 64 QUARTERS BETWEEN 1949 I AND 1965 IV

Real wages

		Rose more rapidly than "normal"	Rose less rapidly than "normal"	Totals
Unemployment	Rose	4	20	24
	Fell	26	14	40
	Totals	30	34	64

TABLE IX

FREQUENCY TABLE OF REAL WAGE GROWTH (ECONOMY) AND UNEMPLOYMENT
CHANGES, USA, 52 QUARTERS BETWEEN 1953 I AND 1966 IV

Real wages

		Rose more rapidly than "normal"	Rose less rapidly than "normal"	Totals
Unemployment	Rose	7	14	21
	Fell	26	5	31
	Totals	33	19	52

TABLE X

FREQUENCY TABLE OF REAL WAGE GROWTH (MANUFACTURING SECTOR) AND
UNEMPLOYMENT CHANGES, USA 58 YEARS BETWEEN 1900–1916, 1918–1941,
AND 1946–1965

		Real wages		
		Rose more rapidly than "normal"	Rose less rapidly than "normal"	Totals
Unemployment	Rose	6	22	28
	Fell	16	14	30
	Totals	22	36	58

TABLE XI

FREQUENCY TABLE OF REAL WAGE GROWTH (MANUFACTURING SECTOR, WITH
THE WHOLESALE PRICE INDEX OF MANUFACTURES AS THE DEFLATOR OF
MONEY WAGES), USA, 64 QUARTERS BETWEEN 1949 I AND 1965 IV

		Real wages		
		Rose more rapidly than "normal"	Rose less rapidly than "normal"	Totals
Unemployment	Rose	8	16	24
	Fell	18	22	40
	Totals	26	38	64

TABLE XII

COMPUTED VALUES OF χ^2 FOR THE ASSOCIATIONS BETWEEN REAL WAGE GROWTH AND
UNEMPLOYMENT CHANGES, TABLES V THROUGH XI

Table number	Country	Coverage of wage series	Period or periods	Relationship positive or negative	Computed value of χ^2
V	Canada	Manufacturing	1949 I–1965 IV	Negative	1.24
VI	Canada	Manufacturing	1921–1939 1946–1965	Positive	0.652
VII	Canada	General Index	1921–1939 1946–1965	Negative	0.032
VIII	USA	Manufacturing	1949 I–1965 IV	Negative	14.07†
IX	USA	Economy	1953 I–1966 IV	Negative	13.80†
X	USA	Manufacturing	1900–1916 1918–1941 1946–1965	Negative	6.26*
XI	USA	Manufacturing (with the Wholesale Price Index of Manufactures as the Deflator)	1949 I–1965 IV	Negative	0.85

*Significant at the 2 per cent level.
†Significant at the 0.1 per cent level.

regression coefficients of Table I. However, the formal χ^2 test in Table XII indicates that this association, like that in the levels, is not significant by conventional criteria. For the Canadian long term historical data presented in Tables VI and VII, the absence of an association is almost complete. (There is a very mild positive association between unemployment changes and the growth (beyond "normal" rates) of real wages in Table VI and a very minuscule negative association between these variables in Table VII.) The formal χ^2 test confirms the absence of a significant association among the variables, consistent with the results of regressions 1 and 4 of Table II.

Turning to the frequency tables based on US data, in which the money wage variables are deflated by our measure of the consumer price level, the results are once more consistent with those from the regression analysis; there appears to be a definite negative association between rates of growth of real wages (over and above "normal" trend rates) and unemployment changes. The views of Dunlop and Tarshis are thereby confirmed, at the expense of the traditional view that real wages fall along with diminishing marginal productivity of the labour input. Turning to Table VIII, we find that, in the 24 quarters for which the unemployment rate was higher than in the corresponding quarter of the preceding year, real wages rose less rapidly than "normal" for 20 quarters (83.3 per cent). On the other hand, for the 40 quarters during which the unemployment rate fell, real wages rose more rapidly than "normal" during 26 (65 per cent) of them. This is fairly striking evidence of a negative association between the growth rates of real wages (in excess of what could be attributed to "normal" trend) and unemployment changes, which is confirmed by a very high computed value of the χ^2 statistic, significant at a very conservative level of statistical significance. The results for the economy-wide real wage data presented in Table IX are very similar; if anything, the negative association is even more striking here. The historical data of Table X also give rise to a negative association which is, however, less pronounced. Nevertheless, the association is still significant at the 2 per cent level, according to the χ^2 test statistic.

One can also construct a frequency table in which the real wage variable is defined as money wages divided by a price index whose sectoral coverage is close to that of the money wage series. This has been done in Table XI, in which the US money wage series for the manufacturing sector in the postwar period is re-examined with the Wholesale Price Index of Manufactures selected as the denominator of the real wage series. Turning to the results, we find that, in the 24 quarters for which the unemployment rate was higher than in the corresponding quarter of the preceding year, real wages rose more rapidly than "normal" in only 8 quarters (one third of the total). On the other hand, in the 40 quarters during which the unemployment rate fell, real wages rose more rapidly than "normal" during 18 (45 per cent) of them. Thus, there is a fairly weak negative association between the growth rates of real wages (as defined by this measure) relative to "normal" trends and changes in the unemployment rate; Table XII confirms the suspicion that this association is not statistically significant, when one applies a formal χ^2 test. This weak, insignificant association with the wholesale price level deflator contrasts fairly

strongly with the strong, significant association obtained in Table VIII with the consumer price level as the chosen deflator. As noted in the preceding section, the frequency table analysis of these data does not agree with the regression analysis, in which a positive and apparently significant association between unemployment and the detrended own-product wage (as measured by this ratio) was obtained.[25]

According to the formal probability model underlying the tests performed above, the computed test static has a χ^2 distribution with exactly one degree of freedom. The 5 and 1 per cent points of this distribution are 3.84 and 10.83 respectively. Since the mathematical model underlying the derivation of this result is based on the assumption that all of the observations are selected at random, the computed values of the test statistic must be regarded as indicative, not definitive. Nevertheless, the information resulting from the combined regression and frequency table analyses should definitely be given more weight (when they agree, as they generally do) than the information from either analysis by itself.

V / Concluding comments

Before passing to the conclusions proper of this study, some qualifications and caveats should be presented. In this study, the association between two *independently* measured series has been examined, and so the results are presumably free of the influence of spurious correlation of the sort alluded to in section i. Nevertheless, it would be overly optimistic to assume that the results of this study are completely free from the problem of measurement error. If the measurement errors of the dependent and independent variables are independent, then in the bivariate problem the effect is to bias the least squares estimator of the slope coefficient towards zero, at least for a reasonably large sample. This type of difficulty would appear to be less harmful than a measurement error problem that could easily lead to the wrong conclusion, but it must be admitted that such imperfections in the data tend to reduce the efficacy of a statistical approach to the theoretical issue in question.

Another complication which has been ignored in this study is one arising out of the fact that we have focused on one equation plucked from a simultaneous system. Thus we have examined a possible relationship between real wages and the rate of employment (or unemployment) derived in theory from the behaviour of profit-maximizing entrepreneurs operating in purely competitive product and labour markets, with diminishing returns to a fixed (in the short run) capital stock. But since total wage payments are an important component of the community's income, which in turn plays the dominant role in explaining aggregate demand in a simple Keynesian system, there could well be a feedback between real wages and unemployment via the other relationships in our system, which has been left implicit in this paper. In this case, we incur an indeterminate amount of single equation bias by employing single equation methods (e.g., least squares regression) to estimate the parameters of our presumed relationship. The presumed structural relationship should ideally be

[25]The qualifications of note 24 above should, however, be kept in mind at this point.

estimated by a simultaneous equations estimation technique, although in the present writer's judgment this type of refinement is probably badly applied to such a poorly specified relationship. (This comment anticipates point 5 below in the specific conclusions.) For what it is worth, the author re-estimated equations 5 and 6 of Table III by the method of two-stage least squares[26]; the results were very similar to those obtained by the ordinary regression technique.

Several other possible difficulties may be discussed briefly. The problem of autocorrelated residuals, pointed up in the discussion of sections 3 and 4 above, may be recalled, along with the author's efforts to take this issue into account.[27] Also, it should be noted that this paper deals with wage and price level aggregates; the behaviour of these aggregates will generally not typify the behaviour of all components of the aggregate, and it is entirely possible that a different sort of relationship would be found on a lower level of aggregation. In addition, the author has attempted to approximate the short-period assumptions of a fixed capital stock and no technical change through the device of detrending the real wage series that were analysed; the roughness of this technique should be openly admitted. Finally, to terminate this self-flagellating discussion (probably a task better left to others) on a positive note, this study is free of the problems of interpretation that arise when the final relationships are the result of much experimentation to obtain a desirable specification. All of the computations performed in this study (with the exception of several regressions of the variables under autoregressive transformations and the two-stage estimates alluded to in the preceding paragraph) have been presented in this paper. Thus there has been virtually no experimentation to find the most satisfactory form of the structural relationship.

The tentative conclusions of this study can now be presented.

1. The traditional view, developed by Rueff in 1925 and adopted by Keynes in his *General Theory*, that real wages are inversely related to the cyclical utilization of the labour force, receives little support from the data examined in this paper. Only in two instances (a sub-period of the Canadian historical series and the regression analysis of postwar US manufacturing wages divided by the Wholesale Price Index of Manufactures, after detrending) is there a hint of a significant relationship corroborating the traditional view. Even in these two instances, the significance of the positive association between unemployment and real wages relative to trend can be called into question; in the first case, one must be willing to incur a relatively large risk of committing a type I error, while in the second instance the positive association neither survives an adjustment designed to take autocorrelation in the residuals explicitly

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[26]This was done by utilizing the predetermined variables of the OBE Econometric Model in the first stage regressions; in this connection, the OBE group must once again be thanked for their kindness in making the series of the first five principal components of their set of exogenous variables available to the author.

[27]In several instances, regression equations were computed under an autoregressive transformation of the variables. The value of the coefficient of autocorrelation was not specified uniquely in advance; instead, a rough grid of values from 0 to 1 was employed. One instance in which this technique was utilized has been mentioned in note 24 above. Equations 5 and 6 of Table III have been re-estimated in this fashion, with the autocorrelation in the residuals largely disappearing for intermediate values of the coefficient of autocorrelation and the regression coefficient of the unemployment variable remaining negative and statistically significant.

into account, nor is the association corroborated by the frequency table approach. Using conventional levels of statistical significance, one would conclude that the Canadian data (both the postwar quarterly sample and the historical series) show no relationship between the two variables (trend-adjusted real wages and the rate of unemployment) under study. (The use of the Wholesale Price Index as a deflator for the postwar quarterly wage series does not alter this conclusion.) On the other hand, the majority of the analyses performed with the US data support the Dunlop-Tarshis view that real wages are positively related to the cyclical utilization of the labour force.[28] This is true regardless of the choice (between two) of the cyclical utilization variable and, when the consumer price level is used as the deflator, regardless of whether the wage series covers only production workers in manufacturing or is an economy-wide series measuring the earnings of both production and non-production workers alike. However, the evidence from the historical data is weaker than that from the postwar quarterly data; moreover, the results of deflating the money wage in the US manufacturing sector by the Wholesale Price Index of Manufactures does not constitute evidence in support of the position that the own-product wage is positively related to the cyclical utilization of the labour force.

2. The outcome of a set of tests like those of this paper may be fairly sensitive to the choice of a deflator to convert a money wage series into a "real" wage series. If one's interest is in testing the theoretical proposition that the own-product real wage declines in the short run with increasing intensity of use of the fixed factors, then it is better to use a price index whose sectoral coverage is closest to the wage series utilized. If, on the other hand, one is interested in the return to an hour of labour from the wage-earner's point of view, a consumer price level is a better deflator. The results are somewhat different, as we have noted in sections III and IV above. For Canada, the results are inconclusive, regardless of which deflator is employed to obtain the real wage series. However, for the United States, the two "real" wage series designed to approximate an own-product wage series gave mixed results; the analysis of the economy-wide own-product wage series supported the Dunlop-Tarshis view, while the examination of the manufacturing wage divided by the Wholesale Price Index of Manufactures gave some evidence in support of the Keynes-Rueff view, although this evidence could be called into question. With the consumer price level as a deflator, all the significant results supported the Dunlop-Tarshis position.

3. In attempting to explain the differing outcomes for the two North American economies, one can return to the point made by both Keynes and Ruggles that the generalization strictly applies, in a multi-product economy, to the

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[28]Clarence D. Long, "The Illusion of Wage Rigidity: Long and Short Cycles in Wages and Labor," *Review of Economics and Statistics*, XLII, no. 2 (May 1960), 140–51. It is interesting to note that this recent study of the US historical data utilizing a National Bureau approach to these issues came to a similar conclusion. Long noted that the specific cycles of real wages were fairly similar to the reference cycle and to the specific cycle of (inverted) unemployment and that there appeared to be a conformity between the long cycles in real wages and those of real GNP per man-hour. On the other hand, the conformity of the ratio of money wages to wholesale prices, with regard to the reference cycle, was much less clear; Long noted that in some cases this ratio appeared to move in opposite phase to the reference cycle.

own-product real wage. Thus Ruggles expected that the relationship between a money wage series divided by a consumer price index and the cyclical utilization of the labour force would be subject to the many extraneous influences between the price level of the commodities produced by labour and consumer prices (the prices of wage-goods, in the language of the earlier discussion). If this type of reasoning is accepted, one would expect that the relationship between real wages and labour force utilization would be considerably weaker for an open economy, like the Canadian, than for an almost closed economy, like that of the US. The findings of this study are consistent with this supposition.[29]

4. In attempting to explain the central tendency of the results for the US, one can simply return to theoretical discussions of Dunlop and Tarshis, which stressed changes in the degree of monopoly power between depression and prosperity, relatively flat marginal cost curves, and mark-up pricing practices.[30] These discussions seem surprisingly current, despite the passing of approximately three decades. In reworking the explanation, one might wish to draw upon some of the recent empirical work on short run production functions,[31] which has suggested that the average productivity of labour generally rises with increasing cyclical utilization of the labour force. If the pricing of most consumer goods then follows a standard mark-up procedure, there will be a tendency for real wages to rise along with the average productivity of labour. (It is true that most mark-up theorists stress "normal" or standard capacity levels of costs as those to which an appropriate mark-up is applied; however, in a dynamic context, it may be difficult for a businessman to disentangle the effects on productivity of increased cyclical utilization of his labour force from those due to trend.) In any case, the results of this study have a very slight tendency to reinforce the conclusion which can be drawn from the short-run production function studies, namely that classical diminishing returns is probably confined in its operation to a range very close to full utilization of the labour (and capital) factors of production.

5. The results of this study (the generally modest coefficients of multiple determination, for instance) do not make one wildly enthusiastic about an econometric model in which one of the relationships "explains" real wages in terms of a trend and the cyclical utilization of the labour force. In this connection, it is interesting to note that the OBE econometric model[32] has a wage adjustment relationship explaining the change in money wages and a price level relationship in which the price level of private output is explained pri-

[29]The differing results for the two economies may also reflect the influence of conditions abroad, particularly in the US, on money wage determination in Canada. In this connection, it is interesting to note that the detrended ratio of Canadian manufacturing rates to the consumer price level is much better correlated with the US unemployment rate than with the Canadian rate; both variables have a negative regression coefficient, but the former variable (the US unemployment rate) is statistically significant (by a standard criterion), while the latter variable is not (as we saw in Table I).

[30]Of course, it should be recalled that the results for the Canadian economy show no significant relationship in either direction. In this connection, the conclusions of Ruggles and Tobin in the nineteen-forties seem depressingly current.

[31]See, for example, Thomas A. Wilson and Otto Eckstein, "Short-Run Productivity Behaviour in US Manufacturing," *Review of Economics and Statistics*, XLVIII, no. 1 (Feb. 1964) 41–5.

[32]Liebenberg *et al.*, "Econometric Model."

marily in terms of labour costs. Given several relatively simple relationships tying components of the consumer price level to the price level of private output, we can say that the real wage (using either the consumer price level or the price level of private output as a deflator) is basically obtained in this model as a ratio of two variables explained directly.

6. Finally, we may note that the distributional conflicts as full employment is approached are probably less severe than an orthodox Keynesian treatment[33] would suggest.[34] In particular, these results suggest that already employed workers probably do not suffer real income losses as full employment is approached. This point is probably reinforced when one takes into consideration increased opportunities to work longer hours (e.g., overtime and/or secondary jobs) or greater opportunities for secondary workers in the household.

Appendix

SOURCES OF DATA

The study is concerned with several time series for the US and Canada. For Canada, annual data for 1921–65 were employed; for the US, annual data over the period 1900–65 were utilized. For both countries, quarterly data for the postwar period were used. Data are considered for the economy as a whole and for manufacturing separately for each country. Sources (for each series) are listed here in detail.

I Canada

A. HISTORICAL

1. Manufacturing wages
1921–60: Urquhart and Buckley, *Historical Statistics of Canada*, 84, series D 5.
1961–65: *Wage Rates, Salaries and Hours of Labor*, 1965, Report No. 48 Department of Labour, Ottawa, Table B.
2. Consumer price index
1921–60: Urquhart and Buckley, 304, series J 147.
1961–65: *Canadian Statistical Review*, monthly, (11–003), DBS.
3. Civilian labour force
1921–60: Urquhart and Buckley, 61, series C 50.
1961–65: *The Labour Force*, Supplement, (Sept. 1965), (71.001), DBS.
4. Unemployment
1921–60: Urquhart and Buckley, 61, series C 54.
1961–65: *The Labour Force*, Supplement (Sept. 1965).
5. General wage index
1921–60: Urquhart and Buckley, 84, series D 1.
1961–65: *Wage Rates, Salaries and Hours of Labour*, 1965, Table B.

B. POSTWAR

6. Average hourly earnings in manufacturing
1949 ɪ – 1965 ɪᴠ: *Canadian Statistical Review*, 1965 Annual Supplement, (11–206), DBS.
7. GNP implicit price deflator of consumer goods and services
1949 ɪ – 1961 ɪᴠ: *National Accounts, Income and Expenditure* (13–518), DBS
1962 ɪ – 1965 ɪᴠ: *National Accounts, Income and Expenditure* (13–001).
8. Wholesale price index
1949 ɪ – 1965 ɪᴠ: *Canadian Statistical Review* (1965 Annual Supplement) (11–206).
9. Unemployment rate
1949 ɪ – 1965 ɪᴠ: *ibid.*

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[33]Weintraub, *Theory of Income Distribution*.
[34]However, it would be foolish to suggest that these results imply the absence of all conflicts, in this best of all possible worlds. Rentiers (those on truly fixed property incomes and individuals on fixed salaries with a complete absence of opportunities for additional work) are bound to suffer as full employment is approached, so long as prices tend to be higher (or to accelerate more rapidly) at higher levels of utilization of the economy.

II United States

A. HISTORICAL

10. Average hourly earnings in manufacturing
1900–57: R. G. Bodkin, *The Wage-Price Productivity Nexus* (Philadelphia, 1966), 123. (This series was taken from the two Rees publications cited in the text.)
1950–65: *Employment and Earnings for the United States 1909–65*, US Department of Labor (1965), 41–2.
Note: these two series are incompatible and were spliced using a regression technique to get the 1958–65 observations.
11. Consumer price index (1914 = 100).
1900–60: Lebergott, *Manpower in Economic Growth*, 523.
1960–65: *Economic Report of the President*, 1967, 262.
12. Unemployment rate
1900–60: Lebergott, *Manpower in Economic Growth*, 512.
1960–65: *Economic Report of the President*, 1967, 236.

B. POSTWAR

13. Average hourly earnings in manufacturing
1949 I – 1965 IV: *Employment and Earnings Statistics for the United States, 1909–65*, 41.
14. Standardized annual wage rate per private employee
1953 I – 1966 IV: series underlying OBE Quarterly Econometric Model of the United States, in *Survey of Current Business* (May 1966), supplied by the authors.
15. Implicit price deflator (1958 = 100) of consumption expenditures.
1949 I – 1965 IV: *The National Income and Product Accounts of the United States, 1929–1965*, Supplement to *Survey of Current Business*, US Department of Commerce (1966), 158.
16. Implicit price deflator (1958 = 100) of Gross National Product
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17. Unemployment rate.
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1956: *Economic Report of the President*, 1958.
1957 I – 1960 IV: *Business Statistics, 1961*, Biennial Supplement to *Survey of Current Business*, US Department of Commerce, 67.
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1965: *Economic Report of the President*, 1966, Table C-20, 233.
Note: the definition of unemployment follows the post–1957 revisions for the entire postwar period, as explained in the text.
18. Employment as a percentage of non-institutional population over 14 years old
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19. Wholesale price index of manufactures
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1965 I – 1965 IV: *Survey of Current Business* (March 1966), S-8.