Relations industrielles
Industrial Relations

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Volume 39, Number 3, 1984

URI: https://id.erudit.org/iderudit/050055ar
DOI: https://doi.org/10.7202/050055ar

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Publisher(s)

Département des relations industrielles de l'Université Laval

ISSN

0034-379X (print)
1703-8138 (digital)

Explore this journal

Cite this article

Devoretz, D. & Reed, C. G. (1984). Evidence from the Skilled-Unskilled Canadian Wage Index. *Relations industrielles / Industrial Relations*, *39*(3), 526–537. https://doi.org/10.7202/050055ar

Article abstract

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D.J. Devoretz
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Evidence from the skilled-unskilled wage index has had a long history in the literature of income distribution. In several recent case studies this measure has become the focal point of heated debates. Although contemporary Canadian studies have been few in number, the work has been uncritically accepted and incorporated into present undergraduate textbooks.[1] These studies indicate that in recent decades a significant movement toward equality has taken place in the relative wages of skilled versus unskilled Canadian workers.[2] Peitchinis (1975) summarizes the result as follows:

> One of the most notable changes in the occupational wage structure over the past 30 years has been the very substantial contraction in wage differences between skilled and unskilled wage earners. In many industries the percentage differences narrowed by more than one-half.[3]

In this paper we attempt to revise this view by correcting for the obvious measurement errors inhererent in this analysis of the skilled-unskilled wage trend. Our re-measurement is based on the following corrections: (1) we compute real as opposed to nominal wages — i.e., corrections are made in the data for relative shifts in the cost of living between the two skill groups;[4] (2) wage ratios are used instead of differentials to measure changes in the skilled-unskilled relative wage;[5] and (3) regression analysis is

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** Expanded versions of this paper were originally presented at the Ninth Conference on the Application of Quantitative Methods in Canadian Economic History, London, March 1978.

Relat. Ind., vol. 39, no 3, 1984 © PUL ISSN 0034-379 X

substituted for year to year comparisons as a technique for trend measurements. Finally, a regional disaggregation of the wage ratio is made to test for the separability of labor markets.[6]

DATA

The wage data we use — urban wages for the printing, building, municipal and railroad industries — is a subset of the data used by Peitchinis (1974, 1975) and Ostry and Zaidi (1972). Our choice of these industries was based upon the following considerations. First, these skill groups were relatively homogeneous over the time period with reference to job description; second, wage data by region was generally available; third, the number employed in these skill groups was large; and finally, these industry groups follow all conceivable skill-unskilled nominal wage trends. Namely our selected industries wage trends range from an *extreme* convergence (i.e., building trades) in the *nominal* wage ratio to a growing divergence (i.e., municipal workers).[7]

Since one of our principal revisions is the introduction of explicit price deflators by income groups, our choice of budget weights is crucial. For each skill group we have selected the budget weights which correspond to their full time equivalent income. Furthermore, in one example we alter our budget weights to measure the sensitivity of our results to the specific budget weights chosen.[8] The choice of budget weights was made invariant for ten year intervals. This implies a Laspeyres formula and the inherent bias must be recognized in our analysis.[9]

The price deflators used were derived from published sources for five major commodity groups: food, clothing, shelter-household, transport and sundry (health, personal care and recreation). These commodity groupings accounted for 96 to 100 percent of total budget *expenditures.*

Our regional disaggregation is straightforward, but naive due to data limitations. We use urban wages for five major cities: Vancouver, Winnipeg, Toronto, Montréal and Halifax.[10] Using the data sources described above, skilled and unskilled real wage series from the early 1930's to 1978 were computed for the printing, municipal and railroad industries while the building trades only covered the 1930-72 period. Our decision to examine the trend in skilled-unskilled wage *ratios* as opposed to *differentials* is consistent with other recent work on relative wages in which the primary focus has been income distribution.[11]

Our final correction, substituting regression analysis for year to year comparisons, was done in order to minimize the potential bias in trend measurement resulting from the arbitrary choice of base and terminal years. This regression analysis will also allow us to separate the cyclical from the trend movements in the ratio as suggested by Gunderson (1976).

Before turning to an analysis of our results, it should be noted that inherent data and computational biases will cause our calculations to overstate the true decline in the *deflated* skilled-unskilled wage index. First, the skilled group definitions (e.g., carpenters and laborers in building trades) are arbitrary and over time these groupings will change in their skill mix. We anticipate that since in recent years unskilled workers in general appear to have upgraded their skill levels relative to skilled workers,[12] our deflated unskilled index will tend to overstate the growth in the unskilled wage level. Second, there is the bias resulting from the use of the Laspeyres price index. Since our intention is to argue that a limited decline has actually occurred, these inherent biases serve to strengthen our conclusions.

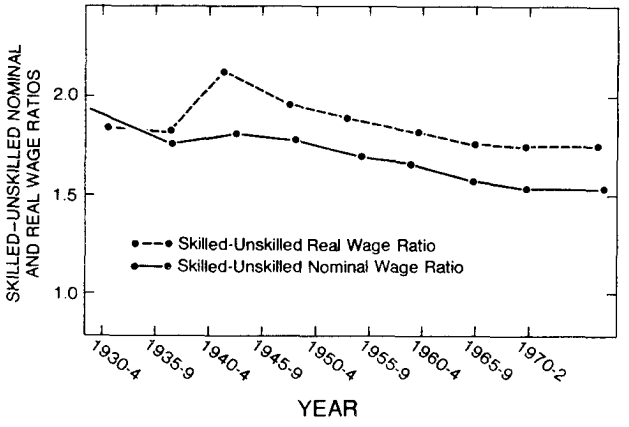
RESULTS

A summary of our findings is provided in Figures 1 and 2. For the building trades industry (see Figure 1) the nominal index substantially overstates the decline in the real skilled-unskilled wage ratio. In addition, the periods of greatest overstatement are the nineteen forties and the nineteen sixties. It is these periods which have been singled out in the literature as periods of declining inequality.[13] Figure 2 depicts the trend in the *real* wage ratio for our remaining industries. For the railroad industry the collapse in the real wage ratio occurs twice, in 1940-44 and again in 1960-70. For municipal workers the real ratio does not decline but grows by 19 percent over the period 1930-1973. The nominal wage ratio (unreported) which also grew over the period showed a smaller 11 percent rise. Our printing trade example experienced a substantial collapse in both the real and nominal (unreported) ratios from 1930 to 1972 (19% and 41% decline respectively) however by 1978 both the real and nominal ratio had risen to their early 1930's levels.

Table 1 presents our regression results and more succintly states the complex trends depicted in the above figures. In short, the time parameter reported for each of our regressions is the percentage change in the skilled-unskilled deflated wage ratio over the relevant time period. What is important to note is that with the major exception of building trades' regression this time parameter is either very small (railroads or printing), or the wrong

Figure 1

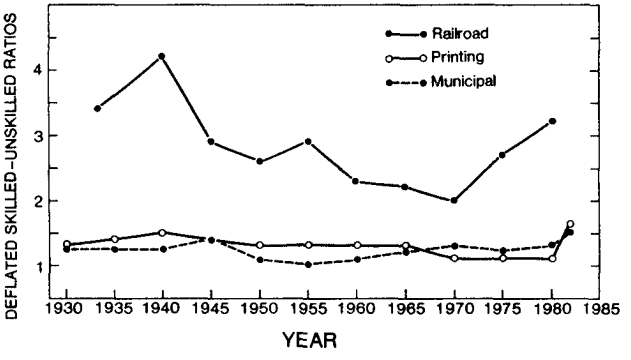
All City Wage Ratios[a] Plotted Against Time in 5 Year[b] Averages: Building Trades



Notes: a) The all city ratio is the unweighted average of the individual city ratios.
b) Except for period 1970-2.

Figure 2

Time Plot of Deflated Canada-Wide Wage Ratios: Railroad, Printing and Municipal Industries



sign (municipal). For example, in the railroad industry with a yearly convergence of three tenths of one-percent in the deflated ratio over 130 years would have to pass for the alleged 50% skill premium to appear.

Several alternative specifications of the time trend regression were estimated to detect cyclical variation as well as further possible measurement problems. The Gunderson (1976) hypothesis that unemployment effects the rate of convergence is confirmed. The unemployment variable is *significant* for only the railroad and municipal regressions and does not substantially alter the time parameters estimates. In addition, we tested the robustness of our results to alternative budget weights (the key adjustment in the deflation process) by re-estimating the railroad equations under alternative budget weights. Our original results remained the same.[14]

TABLE 1

Time Regressed on the Skilled-Unskilled Wage Indexes[a]

Industry	*Constant*	*Time*	*D-W*	*Rho*[c]	$\bar{R}^2$
Building (1930-72)	89	−.009* [b] (− 9)	2.2	N.A.	.15
Railroads (1937-78)	.53	−.003** (− 8)	1.84	.70	.22
Printing (1930-72)	2.30	−.004* (−5.4)	1.9	.44	.83
Municipal (1935-76)	−1.9	+.009* (+17)	1.79	−.62	.06

Notes: a) Form of regression: Log $[\frac{\text{Skilled Wage}}{\text{Unskilled Wage}}]$ = A + B (Time). The semi-log form is used in order to calculate the time coefficient in units of percent/year.

b) Single and double asterisks indicate 95 and 98% confidence levels for one tailed significance tests.

c) When generalized least squares were used the relevant rho value is reported.

Next, Table 2 reports a variety of sub-period results which test two further hypotheses. First, Peitchinis argued that the building trades experienced a significant convergence between 1930 and 1956; thereafter no significant convergence took place. Our results (Table 2, Row 5) indicate the opposite; no significant convergence occurs for the earlier period while a slower significant convergence occurs in the latter years. Also, the effects of the rapid post 1972 inflation rates are depicted in the printing sub-period regres-

TABLE 2

Nominal and Real Wage Ratios Required on Time and Unemployment[a]

Industry	*Constant*	*Time*	*Unemployment*	$\bar{R}^2$	*D-W*	*Rho*[c]
1. Railroad (1937-78)						
Nominal	.60	−.004 (−9.6)	+.03 (2.3)**[b]	.45	1.91	N.A.
Real	.53	−.003 (−1.5)	+.05 (6.1)**	.82	1.84	.57
2. Printing						
a) (1930-72)						
i) Nominal	.46	−.004 (−3.3)	+.002 (.21)	.24	1.40	N.A.
ii) Real	.30	−.002 (−3.2)	+.004 (.41)	.46	1.76	.43
b) (1930-72)						
i) Real Toronto	.38	−.001 (−1.8)	N.A.	.07	1.66	N.A.
ii) Real Winnipeg	.48	−.005 (−13)	N.A.	.39	1.86	N.A.
3. Building (1930-72)						
Nominal	1.97	−.018 (−5.7)	−.01 (.59)	.46	1.78	.30
Real	.76	−.007 (−5.1)	−.02 (−1.1)	.40	2.1	−.27
4. Municipal (1935-72)						
Nominal	− .75	.07 (19)	+.21 (2.9)**	.91	1.34	N.A.
Real	−1.75	.002 (.4)	+.04 (10)	.01	2.1	−.04
5. Building Trades (1930-55)						
Real	.89	−.01 (.8)	N.A.	.19	2.6	−.16
(1956-72)						
Real	.62	−.004 (2.6)	N.A.	.66	1.2	.64
6. Printing (1930-78)						
Real	1.2	−.001 (−.72)	N.A.	.02	1.96	−.83

Notes: a) Functional form: $\text{Log}\left[\frac{\text{Skilled Wage}}{\text{Unskilled Wage}}\right] = A + B_1\,(\text{Time}) + B_2$ (Canada-wide unemployment rate).

b) Single and double asterisks indicate 95 and 98 percent confidence levels for one-tailed significance tests.

c) When generalized least squares is used the rho value is reported.

sions. By adding the most recent inflationary period possible (1972-1978) our time trend parameter estimate (Row 6) becomes insignificant. This result is consistent with the Williamson (1977) finding for the U.S. that the unusual nature of the post 1970 inflation reversed previous convergence trends.[15]

Finally, we used our regression results to detect any aggregation bias. To wit, is there a significant difference in the time trend by cities? In fact there is. In Toronto, in the printing trades (Table 2, Row 2-b-i) for example, the rate of real wage convergence is in general one-half the all-Canada rate while in Winnipeg (row 2-b-ii) it was in general 20% greater. Thus, if we could weight the wage ratio by city level employment the time trend would be even lower.[16]

CONCLUSIONS

In sum we have found that deflating wage indexes and regressing them against time substantially alters the existing views about the rates of convergence in the skilled-unskilled wage ratios in Canada. The building trades industry with the most dramatic rate of convergence for the real index declines only 32% for the 1930-72 period and not the 72% decline calculated from the nominal index. In the remaining convergent cases, railroads and printing, the rates of convergence are so slow that over 130 years would have to pass to experience the average 50% convergence that Peitchinis argues occurred in 40 years. Moreover, when we disaggregate the data by city and include the cyclical effects of unemployment and inflation these rates of *real* convergence become even slower.[17]

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Footnotes

1 See S. OSTRY (1959), S. OSTRY and M. ZAIDI (1972) and PEITCHINIS (1974, 1975).

2 This interpretation follows the view of S. KUZNETS who argued that for the United States during the period of the 1920's to the 1950's a unique historical collapse in the skilled-unskilled wage differential occurred. Recently, Kuznet's findings have been challenged on many fronts. First, MINCER's (1970) theoretical work on skilled-unskilled earning's functions demonstrates that human capital theory offers ambiguous predictions on the direction of change in this ratio over time. NUGENT (1983) has also challenged Kuznet's assertation that income inequality measures collapse as development proceeds. Nugent found that measurement error, especially lack of cost of living adjustments can reverse distributional findings.

3 OSTRY and ZAIDI (1972) make a similar generalization. They find that in Canadian manufacturing, «Whereas skill premiums of 60 — 100 percent or more were common in the twenties and thirties, in recent years differentials of 40 — 50 percent are more typical.» Ostry and Zaidi note, however, that there is wide variation from industry to industry with some groups experiencing a skill premium increase (e.g., municipal service and urban transport). Their overall conclusion is therefore more cautious, «The long-run tendency of the skilled-unskilled wage differential in Canada displays a moderate contractionist trend.»

4 Using cost of living measures by skill and income groups several authors have reversed traditional inequality findings. The correction of FIELDS' (1977) findings for the Brazilian inequality experience by BECKERMAN and COES (1980) is perhaps the most dramatic. Their simple correction of deflating income groups by specific cost of living indices reduced the real growth of income for the poorest Brazilian group by 50% while leaving the highest income group's real income level unchanged. In the United States J.G. WILLIAMSON (1976) has published revised estimates of the U.S. unskilled-skilled wage differentials for the period 1820 to 1948. He finds that except for the period 1936 — 1948, the nominal inequality was reinforced by the pattern of consumer good's prices. In another paper, WILLIAMSON (1977) incorporates relative price movements into a general measure of income inequality (Atkinson's Index) and reports increasing income inequality in the post W.W. II. era.

5 If the percentage change in the skilled-unskilled wage ratio between (t) and (t + n) is:
(1)

$$\frac{(Ws/Wu)t+n - (Ws/Wu)t}{(Ws/Wu)t}$$

the formula for the percentage change in the skilled-unskilled wage differential is:
(2)
[(Ws-Wu/Wu)t + n - (Ws-Wu/Wu)t] / (Ws-Wu/Wu)t
which can be rewritten as:
(3)

$$\frac{[(Ws/Wu)t+n - (Ws/Wu)t]}{[(Ws/Wu)t]-1}$$

A comparison of formulae (1) and (3) indicates that formula (3) with a negative one in the denominator will yield an upward bias when measuring the change in skilled-unskilled wage rates.

6 COELHO and GHALI (1971) found that regional nominal wage differentials in the U.S. when deflated disappear. We indirectly test their hypothesis for Canada when we compute real skill differentials by cities. It should be noted that GUNDERSON's (1976) study of male-female differentials in one region, Ontario, contradicts the general findings of PEITCHINIS in that this proxy grouping (i.e., male-female) for the skilled-unskilled wage differential did not collapse over the 1946-1971 period.

7 OSTRY and ZAIDI offer the most comprehensive series of industry examples detailing the time path of the skilled-unskilled relative wage. Twelve of these examples show declining skill differentials for the period 1930-1969. The average decline is 58.2 percent. The average decline for the building trades across the 5 cities reported is 71.8 percent for the same period. Peitchinis (1975) offers ten industry examples, using 1939 and 1970 for comparison years. The average decline for the ten industries is 58.7 percent.

8 The full time equivalent income for each skill group in year (t) was calculated by multiplying the nominal wage rate in year (t) for that group by the standard hours worked in the industry group in year (t). The full time equivalent income was then used to select the corresponding weights from the budget studies listed below. Actual incomes could not be used for this purpose because of data limitations. Our budget weight sources were as follows:

1930-1939 weights from *Family Income and Expenditure in Canada, 1937-1938*
1940-1944 weights from *Survey of Family Expenditures, 1947-1948*
1945-1954 weights from *City Family Expenditures, 1953*
1955-1964 weights from *Urban Family Expenditure, 1959*
1965-1976 weights from *Urban Family Expenditure, 1969*

9 The fixed budget weights in the Laspeyres index imply that consumers are unable to substitute commodities in response to relative price changes. Unless this substitution is invariant with respect to income class, the deflated wage indexes will be biased. We argue that the Laspeyres index overstates the decline in the skilled-unskilled index since higher income groups, i.e., skilled workers, will more rapidly adjust consumption bundles in response to relative price changes than lower income groups, i.e., unskilled workers. Thus, through budget reallocation, skilled workers will maintain their real wages better than unskilled workers in the face of changing prices. The basis for this argument is that market information is a superior good and that higher educated skilled workers are able to acquire and process such information at a lower cost. In addition, BRAITHWAITH (1980) provides an estimate of the substitution bias inherent in the Laspeyres index. He finds that for a 15 year period in the U.S. the Laspeyres index has an upward bias of only 1.5 points. Clearly, our bias is smaller since our weights are maintained for only 10 years.

10 See *Wage Rates and Hours of Labour*, Department of Labour, Annual Reports.

11 See, for example, SMITH and WELCH (1977). It should be noted here that skilled and unskilled wages have also been analyzed in connection with investment in human capital. In this regard, BECKER (1964) has pointed out that absolute differences between skilled and unskilled wages is the relevant index to examine. In Canada these absolute differences have widened substantially at the same time the differentials have been contracting.

12 PEITCHINIS (1975) stresses this trend.

13 PEITCHINIS (1975) finds that «in most industries the narrowing process took place largely in the period 1939-52.» OSTRY and ZAIDI (1972) offer a more detailed story. «Most skilled differentials in Canada narrowed markedly during the war years... the decline in skill premiums continued in the early, inflationary, post war years... in most cases the narrowing process slowed down by the early fifties and a widening tendency appeared again by the mid-fifties. This tapered off toward the late fifties and since then has registered a general contracting trend through the sixties.»

14 For the lower income unskilled group we raised the budget weights to the next higher income class implied by their full-time equivalent incomes. We made an opposite adjustment for the skilled group, i.e., they assumed the budget weights of the next lower income class.

15 In fact we followed WILLIAMSON's (1977) hypothesis in more detail; namely we sought a strategic good whose price fluctuations significantly effected the trend in the real wage ratio. We found a significantly negative relationship between our food index and the real wage ratio in the non-municipal industries.

16 Actually, both Toronto and Montréal in general had a lower rate of convergence and since they employ the bulk of the workers in the industries reported proper weights would remove the upward bias due to aggregation.

17 It is also possible that disaggregating by union-non-unionized classifications could also reveal different rates of convergence. However, MACDONALD's study (1983) which reports substantial union-non-union differentials by skill groups is suspect because again skill level wage rates are not separately deflated.

Les différences de salaires au Canada entre les travailleurs qualifiés et non qualifiés

Les fluctuations des indices de salaires entre les ouvriers qualifiés et la main-d'oeuvre non qualifiée tiennent depuis longtemps une place importante dans la littérature traitant du partage des revenus. Bien que les études contemporaines sur le sujet au Canada soient peu nombreuses, celles-ci ont été acceptées comme allant de soi et on les retrouve dans les manuels. Ces études démontrent que, au cours des décennies récentes, il y aurait eu un mouvement significatif dans le sens de l'égalisation des salaires entre les travailleurs canadiens qualifiés et non qualifiés.

Dans cet article, nous nous efforcerons de reviser cette opinion en corrigeant les erreurs de mesure qui nous paraissent les plus manifestes. Notre propre appréciation se fonde sur les corrections suivantes: nous opposons les salaires réels aux salaires nominaux, c'est-à-dire que des corrections sont faites en tenant compte des changements dans le coût de la vie entre les deux groupes; on utilise les *ratios* de salaires au lieu des différences pour mesurer les changements dans les taux de salaires relatifs des travailleurs qualifiés et non qualifiés; on remplace les comparaisons annuelles par l'analyse de régression.

L'utilisation des statistiques

Les statistiques salariales sur lesquelles nous nous fondons — les taux de salaires urbains dans l'imprimerie, la construction, les municipalités et les chemins de fer — sont un sous-ensemble des données utilisées par Peitchinis (1974, 1975) et Ostry et Zaidi (1972). Le choix de ces industries s'appuie sur les considérations suivantes: premièrement, ces catégories d'emplois étaient relativement homogènes par rapport à la période étudiée si on tenait compte de la description de la tâche; en second lieu, les données salariales étaient disponibles régionalement; troisièmement, les travailleurs engagés dans ces groupes d'emploi étaient nombreux; enfin, ces groupes industriels étaient conformes aux tendances normales des salaires nominaux parmi les travailleurs qualifiés et non qualifiés. Surtout, les tendances des salaires dans les industries choisies varient d'une convergence extrême du *ratio* du salaire nominal (les métiers de la construction) à une divergence croissante (les employés municipaux).

Les résultats obtenus

En résumé, les constatations sont les suivantes. En ce qui concerne l'industrie des métiers de la construction, l'indice nominal accentue substantiellement la baisse dans le *ratio* de salaires entre les travailleurs qualifiés et non qualifiés. En outre, les périodes marquées de forte exagération sont les décennies 1940 à 1960. Ce sont ces

périodes qui ont été retenues dans les textes comme des périodes d'inégalité déclinante. Pour l'industrie des chemins de fer, l'abaissement du *ratio* dans le salaire réel se produit à deux reprises entre 1940 et 1944, puis entre 1960 et 1970. Dans le cas des employés municipaux, le *ratio* du salaire réel ne diminue pas, mais s'accroît de 19 pour cent pendant la période 1930-1973. L'exemple de l'industrie de l'imprimerie fait voir un affaissement substantiel à la fois dans le *ratio* du salaire réel et du salaire nominal de 1930 à 1972 (baisse de 19 et de 41 pour cent respectivement) cependant que, en 1978, l'un et l'autre *ratios* se sont élevés à leur niveau antérieur de 1930.

Les résultats de la régression démontrent de façon succincte ces tendances complexes. En résumé, le paramètre temps noté pour chaque régression est le changement en pourcentage dans le *ratio* de salaire dévalué pour la période s'y rapportant. Ce qu'il faut noter, c'est que, à l'exception importante de la régression des métiers du bâtiment, le paramètre temps est faible (chemin de fer et imprimerie) ou négatif (les employés municipaux).

Différentes particularités de la tendance de la régression dans le temps furent calculées de façon à découvrir la variation cyclique de même que les problèmes de mesure pour l'avenir. L'hypothèse de Gunderson selon laquelle le chômage influencerait le taux de convergence est confirmée. Par la suite, l'étude a été divisée en plusieurs sous-périodes de manière à vérifier deux hypothèses supplémentaires. En premier lieu, Peitchinis avait signalé une convergence marquée entre 1930 et 1956. Par après, il n'avait découvert aucune telle convergence. Les résultats obtenus indiquent le contraire. En outre, les conséquences des taux galopants d'inflation après 1972 sont démontrées dans les sous-périodes de régression dans l'industrie de l'imprimerie. Compte tenu de la période inflationniste récente (1972-1978), l'évaluation faite de la tendance du paramètre temps devient sans signification.

Enfin, on a utilisé les résultats de la régression pour tenter de découvrir les déviations d'ensemble. À Toronto, dans l'industrie de l'imprimerie par exemple, le taux de convergence du salaire réel est en général la moitié du taux pour l'ensemble du Canada, tandis qu'à Winnipeg, il était en général vingt pour cent plus élevé. En conséquence, si on pouvait calculer le *ratio* de salaire par le niveau d'emploi pour chaque ville, la tendance dans le temps serait même plus basse.

En somme, l'article démontre que, si l'on dévalue les indices des salaires et qu'on les fait régresser dans le temps, il y a modification importante des opinions courantes sur les taux de convergence des *ratios* de salaires au Canada entre les travailleurs qualifiés et non qualifiés. L'industrie de la construction, dont le taux de convergence est le plus marqué pour l'indice des salaires réels ne décline que de trente-deux pour cent pendant la période 1930-1972, ce qui est loin du déclin de 72 pour cent calculé à partir de l'indice nominal. Dans les autres cas, chemins de fer et imprimerie, les taux de convergence bougent si lentement qu'il faudrait plus de 130 ans pour en arriver à une convergence moyenne de 50 pour cent qui, selon Peitchinis, se produirait en quarante ans.