FURTHER TESTS OF THE LINK BETWEEN UNIONIZATION, UNEMPLOYMENT, AND EMPLOYMENT: FINDINGS FROM CANADIAN NATIONAL AND PROVINCIAL DATA

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EXECUTIVE SUMMARY

There is a substantial international economics literature regarding the impact of labour market and social institutions (such as trade unions and collective bargaining systems) on labour market performance (measured by indicators such as unemployment rates and job-creation). Some recent installments in that literature include OECD (2006), Howell (2005), and Hein, Heise and Truger (2006). The broad finding of this international research is that there is no predictable relationship either way between trade unionization, unemployment rates, and employment levels. Countries with stronger or weaker unions and collective bargaining regimes may experience stronger or weaker labour market outcomes, depending on the other, more important economic and structural factors that affect labour markets (such as macroeconomic conditions and demographics).

Despite these international findings, certain opponents of proposed changes to U.S. labour law (and, in particular, the *Employee Free Choice Act*) have attempted to argue that Canada's labour market experience "proves" that unionization and collective bargaining produce higher unemployment and lower employment. One consultant's study (Layne-Farrar 2009) has been especially important in making this argument. On the basis of an econometric investigation of labour market and unionization data from Canadian provinces, Layne-Farrar makes several sensational predictions regarding the negative impact of the *Employee Free Choice Act* (if passed) on U.S. labour markets – claiming that it would increase U.S. unemployment by 5 million or more persons, and result in the destruction of 2 million or more U.S. jobs. These shocking predictions are justified by reference to the Canadian historical experience, and hence U.S. policy-makers are urged to avoid the same "mistakes" made by their northern

neighbours (by rejecting measures, like the *Employee Free Choice Act*, which might lead to increased U.S. union membership).

In reality, however, Canadian labour market performance has been significantly stronger than in the U.S. for several years (even though Canada's unionization is rate more than twice as high). Canada's unemployment rate is significantly lower than America's, and Canada's employment rate (the proportion of working-age Canadians holding jobs) has been higher than in America for several years. Hence this warning to "beware" the Canadian labour market experience is counter-intuitive and immediately surprising. It turns out that, on careful review, the empirical evidence from Canada shows that unionization has had no predictable impact on unemployment or employment, in either direction. This article conducts a detailed econometric re-examination of Layne-Farrar's counter-intuitive and sensational findings. Our main conclusions include:

- The Layne-Farrar regressions use an inappropriate econometric technique to analyze clearly trended (or "non-stationary") time-series data. It is well-known in econometrics that inappropriate estimations of non-stationary data easily produce seeming "correlations" that are spurious and unbelievable – and which result solely from the fact that the analyst is comparing various time series which all embody non-stationary trends. (To demonstrate this risk, the present article reports the results of several nonsensical regressions successfully linking Canadian unionization, via *exactly the same econometric specification* utilized by Layne-Farrar, to a range of other obviously unrelated economic variables – including a price index of tobacco and alcohol products! In fact, these nonsensical regressions actually perform *better* than Layne-Farrar's more "serious" reported results.)

- If the regressions are corrected for non-stationary data variables, following standard econometric procedures (by first-differencing relevant series, thus focusing analysis on the change in crucial variables rather than on their level), then unionization loses its consistent significance as a determinant of unemployment or employment.

- Moreover, if the regressions are further corrected to include other key variables which are clearly relevant in explaining unemployment and employment outcomes in Canada (such as macroeconomic conditions, interest rates, export and commodity price cycles, and demographic factors such as women's labour force participation), then there is *no visible relationship whatsoever between unionization and either the unemployment rate or the employment rate in Canada*. This finding is consistent with the findings of the above-cited international literature on the employment and

unemployment effects of labour market institutions. This point is especially important with respect to Layne-Farrar's analysis of Canadian employment rates; Layne-Farrar excluded what has obviously been the most important determinant of the long-term increase in the employment rate – namely, the rise in women's labour force participation. When this key variable included in the regression, the significance of unionization in explaining employment disappears entirely.

- A preliminary analysis of U.S. data (including both time-series data for the U.S. economy as a whole, and cross-sectional comparisons of unemployment and employment outcomes across states) indicates that ***there is no visible relationship between unionization and labour market outcomes in the U.S. context***, either. In fact, we remain puzzled why Layne-Farrar conducted her analysis of Canadian data in the first place (rather than focusing on the U.S. experience, which is of obviously more direct relevance to the *Employee Free Choice Act* debate). Layne-Farrar's claim that Canada's history provides a "natural experiment" for her hypothesis that unionization causes higher unemployment and lower employment, is not valid. Any data sample incorporating variation (over time and/or across jurisdictions) would have been equally well-suited to her study, not just the Canadian data. The fact that U.S. data seems to contradict her hypothesis might explain her decision to focus on Canadian (rather than American) historical experience to justify her claim that unionization causes higher unemployment and lower employment – all the more so if U.S. observers were unaware of some of the Canadian peculiarities which Layne-Farrar omitted from her analysis (such as the importance of global commodity price swings to Canadian labour market developments). ***An informed and correctly specified analysis of time-series data from Canadian provinces shows conclusively that the claim that unionization in Canada has produced higher unemployment and lower employment is not supported by the empirical evidence***.

1. INTRODUCTION

In the U.S. debate over proposed changes to federal labour law (embodied in the *Employee Free Choice Act*), some lobbyists have cast their gaze northward to Canada.[2] Union membership and collective bargaining coverage are significantly higher in Canada than in the U.S. Given the other similarities between the two countries, this provides an obvious object for investigation of the impacts of labour law changes which would, if implemented, likely lead to an expansion of trade union representation in the U.S.

However, policy debates can get heated, and evidence can be manipulated in the interests of promoting a point of view. In this regard, understanding among American policy-makers of Canada's economic and labour market conditions has not been furthered by a widely-circulated consultant's report which argues that Canada's stronger unionization record has caused higher unemployment, and lower employment, than would otherwise be the case: *An Empirical Assessment of the Employee Free Choice Act: The Economic Implications*, by Anne Layne-Farrar (2009). This author suggests, on the basis of an econometric analysis of Canadian data, that a one percentage point increase in the unionization rate leads to an increase of 0.30-0.35 percentage points in the unemployment rate, and a decrease of 0.17-0.23 percentage points in the employment rate. Extrapolated to U.S. data (and utilizing ad hoc estimates of the possible increase in unionization that could be expected to result from the policy changes being debated), the author predicts that the *Employee Free Choice Act* would cause a loss of 1.81-2.61 million U.S. jobs, and an increase of 5 million or even more in U.S. unemployment (Layne-Farrar 2009, pp. 23-25).

These are headline-grabbing predictions, to be sure, and opponents of the proposed legislation have seized on Layne-Farrar's Canadian results to fan opposition to the *Employee Free Choice Act*. Printed commentary and paid advertising alike has urged U.S. law-makers to avoid Canada's negative experience with unionization (see, for example, Packer 2009). On the basis of Canadian experience, the bill's opponents predict substantial increases in U.S. joblessness (at the worst possible time, given the current recession) if the legislation were enacted.

These claims are immediately surprising to many Canadians, given our strong labour market performance in comparison to the U.S. situation. The unemployment rate is lower in Canada, employment is higher as a share of the working age population, and both income inequality and poverty (including poverty among employed persons) are notably less severe in Canada than in the U.S.[3] So how can Canada's relatively stronger labour market experience be invoked to make such dire predictions regarding the impact of changes in labour laws that would still almost certainly leave U.S. unions weaker and proportionately smaller than unions in Canada?

The Layne-Farrar findings are worthy of detailed reconsideration, to review the precise empirical methodology and formulation which the author utilized, and to consider whether her key finding (that unionization in Canada has increased unemployment and reduced employment) is valid.

This article will conduct this reconsideration in the following manner. Section 2 summarizes the Layne-Farrar findings and raises several issues regarding the author's methodology and empirical approach. Section 3 briefly introduces several key features of Canada's recent labour market evolution, for the benefit of American readers who may not be aware of the structure and

history of Canadian labour markets. Section 4 introduces the data sources and variable definitions used in the rest of the article. Section 5 considers whether the links between unionization, unemployment and employment are visible in properly formulated analyses of aggregate national Canadian data. Section 6 reviews in detail the specific Layne-Farrar findings (which relied on pooled time-series data from all ten Canadian provinces). For both the unemployment rate and the employment rate regressions which constitute the core of Layne-Farrar's hypothesis, Section 6 first attempts to re-create the initial Layne-Farrar results, then corrects them for non-stationarity in included variables, and finally presents a more complete and appropriate formulation. This exercise indicates conclusively that there is no impact of unionization visible in appropriately analyzed Canadian data on either the unemployment rate or the employment rate. Section 7 provides an initial parallel analysis of the relationships (if any) between unionization, unemployment, and employment in the U.S. data. Section 8 summarizes our main conclusions.

This article complements the commentaries on Layne-Farrar's approach and findings that are provided in other contributions to this special issue of *Just Labour* – in particular, the papers from Fortin (2009) and Johnson (2009) – and we recommend that interested readers also consult those contributions.

2. THE LAYNE-FARRAR HYPOTHESIS: SUMMARY AND ISSUES

(A) HYPOTHESIS AND MAIN FINDINGS

The Layne-Farrar study begins with a review of the main features of the proposed *Employee Free Choice Act*, and introduces her argument that the "unintended consequences" of that act may include a reduction in employment and an increase in unemployment. She then asserts that Canada's labour market experience constitutes a "natural experiment" (p.3, p.15) for considering the likely impacts of the proposed U.S. legislation. This is because most Canadian labour law is enacted at the provincial level (about 10 percent of Canadian workers are covered by federal labour jurisdiction, but most fall under provincial labour laws). There has been considerable variation over the years in Canadian provincial policies regarding the same issues which are addressed in the U.S. *Employee Free Choice Act* (in particular, different methods of union certification and first contract arbitration). Hence, Layne-Farrar argues, studying the impacts of that policy variation across Canadian jurisdictions would provide insight into the likely effects of U.S. policy changes.

The main empirical research conducted by Layne-Farrar is reported in Section 3 of her paper. Here she presents the results of 3 sets of regressions: one linking the unemployment rate to unionization, one linking the employment rate

to unionization, and one linking business investment to unionization. The 3 regressions reported by Layne-Farrar are:

- Unemployment rate regressed on a constant, union density (lagged one year), change in provincial GDP (lagged one and two years), and provincial consumer price inflation (lagged one year).
- Employment rate regressed on a constant, union density (lagged one year), provincial GDP per capita (lagged one year), and the change in provincial GDP per capita (lagged one and two years).
- Net business investment rate regressed on a constant, union density (lagged one year), the square of union density (lagged one year), and the change in GDP normalized as a share of the economy's capital stock (lagged one and two years).

All regressions are performed on a pooled set of data which includes annual data for all 10 Canadian provinces, utilizing three different regression techniques (ordinary least squares, random effects, and fixed effects models). The regression of business investment does not find that unionization has any statistically significant impact on business investment.[4] For both the unemployment rate and the employment rate, however, the Layne-Farrar regressions seem to indicate that higher unionization in Canada is associated with both higher unemployment and lower employment (after analyzing trends both across Canadian provinces and over time).[5] Those results form the basis for her extrapolation to the U.S. economy, and the startlingly pessimistic (and widely cited) predictions noted above.

(B) CONCERNS WITH THE LAYNE-FARRAR APPROACH

Before reviewing and replicating Layne-Farrar's empirical study in detail, we will summarize a number of conceptual concerns raised by her approach.

I. NO "NATURAL EXPERIMENT"

Layne-Farrar introduces and motivates her Canadian study by suggesting that inter-provincial variation in labour law constitutes a "natural experiment" of the effects of labour law on labour market and economic performance. Strangely, however, her article does not actually consider that "natural" experiment: nowhere in the report is any empirical consideration conducted of the relationship between Canadian labour law and labour market outcomes (such as unemployment and employment). Rather, the Layne-Farrar report considers a quite different relationship: the impact of *unionization* on unemployment and employment. It is certainly true that labour legislation (such

as certification and first-contract arbitration procedures) can affect unionization, but so do many other factors (including demographic, industrial structure, macroeconomic, cultural, and other determinants). Union density can in no way be considered a "proxy" for labour law, yet labour law itself is not incorporated into Layne-Farrar's analysis. There is no reference whatever in Layne-Farrar's regressions to the inter-provincial variation in labour laws that supposedly sparked her interest in Canada in the first place.

This strange disconnect between the stated goal of the study, and the actual question which it considers, begs the question why Layne-Farrar focused on Canadian data. Exactly the same study could have been conducted using pooled time series and cross-sectional data on unionization and labour market performance across the 50 U.S. states, or across the collection of OECD economies, or across any other sample of data featuring variation (across time and across jurisdictions) in union density. There is nothing in Layne-Farrar's question or methodology that justifies a particular focus on Canada. Surely, since the article is addressed to a U.S. policy debate, one would have assumed the author would be most interested in whether there is any impact of unionization visible on labour market performance in the U.S.[6] Instead, the focus is directed to Canada.

II. SAMPLE PERIOD

Layne-Farrar reports that her regressions utilize a data sample of annual statistics from the ten Canadian provinces from 1976 through 1997. The choice of this particular sample period is curious (a point raised by Johnson 2009). It likely occurred in part because the author references earlier empirical work by Johnson (2002), which *did* empirically analyze the impact of inter-provincial variation in Canadian labour law on union density over the period up to 1997. (Layne-Farrar, contrary to the implied goal of her study, does not directly consider the impact of that inter-provincial variation in labour law.) Since Layne-Farrar is testing the relationship labour market performance and unionization (not labour law), there is no empirical reason to conform her sample to Johnson's earlier work, but she does anyway.[7] In reality, her actual data sample is different from the stated 1976 to 1997 period. First, provincial level GDP and inflation data is not available prior to 1981 and 1980, respectively (a point which Layne-Farrar acknowledges in her data appendix, but not in her discussion of regression results). Moreover, the data series for union density used by Layne-Farrar ends in 1995.[8] Arbitrarily (and presumably again to "match" her sample period with that of Johnson 2002, even though there is no empirical or methodological reason to do so), Layne-Farrar then extends the data set by two years by "linearly extrapolating" the key independent variable used in all of her regressions (namely, union density), thus allowing her to conduct her regressions on a

sample set extending to 1997. This is a highly unusual approach, which would seem to carry a significant risk of mistaken inference utilizing these artificially-extended data series.

In effect, the Layne-Farrar results are based on a true original data set which only begins in 1981 (with the advent of provincial GDP data) and ends in 1995 – for a total of fifteen years of true data (as opposed to her "linearly extrapolated" data set). After accounting for lags in her specification of control variables, the adjusted regression sample begins only in 1984 (the first year for which the regression can include the twice-lagged change in GDP and GDP per capita, as noted above), thus providing for twelve years of data. The re-creation of Layne-Farrar's core results conducted in Section 6 below utilizes this 12-year sample period; it then conducts additional regressions utilizing the longer sample period afforded by the inclusion of data up to 2008.

III. NON-STATIONARITY OF VARIABLES

This is probably the most serious methodological weakness in the Layne-Farrar approach, and the one which casts most doubt on both her empirical findings and subsequent U.S. predictions. It is well-known in econometrics that regression of non-stationary variables (or, equivalently, variables which possess a unit root) can give rise to spurious correlations and invalid conclusions. The essence of this problem can be summarized simply as follows: many economic variables demonstrate a tendency to move in a direction over time. Regressing one time-trended variable on another can then suggest an apparent "causal link" between them, simply because both demonstrate a time trend.[9] Economists have grappled with this methodological issue by developing a portfolio of methods to test for the presence of a time trend (or "non-stationarity") in the variables included in a regression. Where such trends exist, it is important for the practitioner to adjust the variables (by normalizing them, or measuring period-to-period changes in the data rather than their level) before conducting econometric analysis.

Layne-Farrar does not report any tests for the stationarity of her variables. We have conducted these tests on all variables appearing in the two key regressions above (for the unemployment rate and the employment rate, respectively); the results of these stationarity tests are reported (on a province-by-province basis) in Table 1. Not surprisingly, there is very strong evidence to conclude that nearly all of the variables considered by Layne-Farrar are non-stationary. If the variables were adjusted by converting into first-differenced formulations, the problem of non-stationarity would largely be avoided (as indicated on the right side of Table 1).

This is not an abstract, "technical" issue. The problem of non-stationarity is fundamental to the credibility of the regression results which form the

foundation for Layne-Farrar's startling predictions.   To understand the importance of this problem, consider the set of regressions summarized in Table 2. The first regression (in Column A) reproduces the Layne-Farrar regression for the unemployment rate (in which unemployment is explained by lagged unionization, once- and twice-lagged change in real GDP, and lagged CPI inflation), applied to aggregate national Canadian data.[10] This core equation generates results broadly similar to the pooled results reported by Layne-Farrar: lagged unionization seems to have a strongly significant positive impact on the unemployment rate; the control variables have varying degrees of significance (the lagged change in GDP is especially significant); and the equation has an overall "good fit" (with an adjusted R^2 value of 0.725, indicating that the equation "explains" almost three-quarters of the variation in Canadian unemployment over time).

　　　To dramatize the dangers of regressing non-stationary variables, however, the subsequent columns of Table 2 then take *exactly the same set of explanatory variables* (lagged unionization, once- and twice-lagged change in GDP, and lagged inflation) to "explain" four other seemingly unrelated macroeconomic variables: the level of taxes paid to the Canadian government by non-residents, depreciation (or capital consumption) allowances charged against Canadian fixed capital, the total outstanding stock of consumer credit, and the level of prices for tobacco and alcohol products. With *no changes in data or specification of the equation*, unionization does a "better job" of explaining each of these other Canadian variables, than it does of "explaining" the unemployment rate. Equations B through E all demonstrate a better fit, and a better range of significant explanatory variables, than does the regression of the unemployment rate on unionization. A plausible theory could be developed to explain each of these correlations.[11] But of course the regressions are spurious, "proving" only that it is awfully easy to find significant correlations among non-stationary variables. Unionization does a better job of explaining beer and cigarette prices, than of explaining Canadian unemployment! This should give the serious analyst considerable pause before leaping to dramatic conclusions about the supposedly destructive labour market impacts of unionization.

　　　For this reason, a central theme of the analysis reported below is to test the Layne-Farrar results for their sensitivity to the inclusion of non-stationary variables. It turns out that when the regressions are corrected for this problem (by using first-differenced variables, which are less likely to possess a unit root), the purported relationship between unionization and poor labour market performance collapses.

IV. RANDOM EFFECTS METHODOLOGY

Layne-Farrar reports three full sets of pooled regression results, for each of the considered equations: one using OLS estimation, one with random effects adjustments to the constant terms, and one with fixed effects adjustments to the constant terms. There is some difference in the precise coefficients resulting from each of these estimation methodologies,[12] but no major qualitative shift in her parameter estimates. However, the author's use of the random effects estimation (also called, in some applications, an "error components" approach) is puzzling in this context. The random effects specification assumes that the cross-sectional units are randomly selected from a larger sample, and hence the error term corresponding to each cross-section will itself reflect the properties of a random variable. This situation would not seem to apply to the present regressions, which utilize a pooled data set for the complete set of ten Canadian provinces (not a sample of jurisdictions); hence the variables being measured reflect the performance of an entire provincial labour market (not a random sample of agents). In our judgment the random effects estimation methodology is not appropriate in this setting; however, to preserve the completeness of the comparison of our results to Layne-Farrar's in the following sections, we will nevertheless report random effects estimations of our major equations. In some cases in the corrected regressions which follow, the choice of specific estimator does make an important difference (qualitatively as well as quantitatively) to parameter estimates (see Tables 6 and 8). In these cases, it is our judgment that the random effects results should be discounted from the analysis, and more emphasis placed on the OLS and fixed effects findings.

V. ARBITRARY INCLUSION OF CONTROL VARIABLES

Layne-Farrar includes in her regressions a particular set of macroeconomic "control" variables which are held to account for the many other influences on unemployment and employment (other than the hypothesized effect of unionization). However, there are a very large number of different ways in which those control variables can be specified (including different variables, different forms of those variables, and different lag structures). For example, her unemployment rate regression utilizes the change in real GDP as a control variable, but the employment rate regression utilizes the change in real per capita GDP as a control variable. The criteria on which a control variable is included or not included is not discussed; the criteria is not statistical significance (in fact, neither of the change in per capita GDP control variables included in the employment rate regressions are statistically significant in any of the three specifications reported, yet they were retained within the final reported specifications; and several control variables included in the reported

unemployment rate variables are also not statistically significant). This indicates a degree of arbitrariness in equation specification and estimation which throws into question the robustness of the resulting findings. Without specifying the sensitivity of estimated results to the inclusion and non-inclusion of various forms and combinations of these control variables, and/or without specifying a search algorithm through which the final specification was generated, we cannot know if the particular results reported are simply those which simply seemed to support the author's case most strongly.

Remember in this context that Layne-Farrar has not just indicated that, based on these results, she expects stronger unionization to lead to weaker labour market performance in the U.S. She has actually provided *precise numerical predictions* regarding the likely scale of those effects (claims which generated considerable public attention for her point of view). In this context, however, it is not just whether an included control variable affects the statistical significance of the union density term (which is her main object of inquiry); it also becomes very important how they affect the specific numerical value of each coefficient. In reality, the precise job loss estimates projected by Layne-Farrar will vary dramatically based on the specific control variables included; this important but technical issue was surely not understood or even considered in the popular commentary that was sparked by her findings.

VI. OMITTED VARIABLES

Other than the seemingly arbitrary inclusion of a couple of macroeconomic "control" variables discussed above, the Layne-Farrar regressions seem to presume that unionization is the only independent explanatory variable which causes variation in unemployment and employment performance over time. In reality, of course, labour market performance reflects a wide range of macroeconomic, structural, and demographic causal factors. (In the Canadian context, some of these factors are summarized in Section 3 of this paper.) By reducing the issue to a simple test of the relevance or not of unionization as an explanation for unemployment or employment, the Layne-Farrar regressions miss the importance of these other factors. In econometric terms, the regressions likely suffer from mis-specification bias, throwing into further doubt the reliability and credibility of the estimated coefficients.[13]

VII. SERIAL CORRELATION OF ERROR TERM

It is conventional practice in econometric analysis to report a measure of observed serial correlation in the residuals generated by estimated equations (the most commonly reported measure is the Durbin-Watson statistic). This information helps to determine whether the error term is appropriately "well-

behaved" to allow for standard statistical inference to be conducted on the significance of estimated parameters. Unusually, Layne-Farrar does not report this information (neither in the summary tables, nor in the more detailed regression results included in the appendix to her paper). Given the non-stationarity of her considered variables, as well as the strong possibility of bias resulting from omitted variables (bias which is often signified by very low Durbin-Watson scores), we would suspect Durbin-Watson scores in her regressions to be low – and thus consistent with the presence of serial correlation. In Tables 5 and 8 below, we have re-created Layne-Farrar's results using a pooled data set covering the same time period as her regressions. In those re-created regressions, Durbin-Watson scores were indeed very low (significantly lower than the critical threshold of 2, and below 1 in most cases), strongly suggesting the presence of serial correlation and/or mis-specification bias (which should be corrected using techniques such as autoregressive estimation, the inclusion of omitted variables, and other methods). In this case the standard tests of statistical significance invoked by Layne-Farrar to justify her findings are not valid. Her failure to even report Durbin-Watson scores, let alone to correct her findings for obvious problems in the residuals, is a serious shortcoming of her analysis.

VIII. INTERPRETATION OF ESTIMATED COEFFICIENTS

In spite of all these methodological concerns with the basic Layne-Farrar approach, even if the estimated coefficients could be considered to provide a reasonable and reliable portrayal of the impact of unionization on labour market performance, Layne-Farrar's sensational application of those estimated coefficients in order to generate predictions regarding the large estimated effects of the *Employee Free Choice Act* on U.S. labour market performance is also questionable. (Johnson 2009 also considers these issues in detail.)

First, since Layne-Farrar did not actually investigate the impact of changes in labour law on union density, she relies on various ad hoc estimates of the possible impact of the new U.S. labour law on U.S. unionization (citing the hopeful predictions of several U.S. union leaders) to "base" her counter-factual simulations and predictions. Her subsequent predictions of the economic after-effects of those assumed changes in unionization thus depend completely on the validity of these initial projections of the impact of the legislative change on unionization (since unionization, not legislation, is the independent variable in her model). She eventually settles on two simulation cases (summarized in her Table 14, p. 41): one in which the new legislation boosts unionization by five percentage points, and one in which it boosts unionization by ten percentage points. This approach is extremely arbitrary.

Second, Layne-Farrar assumes (on the basis of her equation specification) that the full impact of a change in unionization is experienced within a *single* year. The simulation summarized in her Table 14 assumes that unionization grows by 5 or 10 percentage points in the year immediately following the implementation of the new legislation. This is an impossible suggestion, given the lengthy periods of adjustment through which labour markets would respond to deep institutional and structural changes.

Third, Layne-Farrar's regressions actually estimate the impact of unionization on the unemployment and employment rates. But her headline-generating predictions are also phrased in terms of absolute numbers of unemployed and employed.   To convert from an estimated impact of unionization on unemployment and employment *rates*, to estimated impacts in *absolute numbers* of unemployed and employed, requires strong assumptions to be made regarding the evolution of demographic and labour market variables in the presence and absence of the counterfactual policy shock. Layne-Farrar documents these assumptions (pp. 41-45), but provides no specific argumentation to support the assumptions that are embedded in her extrapolation.   Her estimates of the impact of higher unionization on unemployment and employment (reported in the fourth and sixth columns of her Table 14) assume no change in labour force participation, monetary and fiscal policy, or any of the other macroeconomic or demographic variables which are likely to change in the event of such a seemingly large and sudden labour force shock. Moreover, those separate estimates are not internally consistent. Layne-Farrar predicts increases in absolute unemployment that are approximately 2.5 times as large as the predicted decrease in employment. (This is because the upper and lower bounds of her estimated coefficients for lagged unionization in the unemployment rate equations are about 2.5 times larger, in absolute terms, than the corresponding coefficients on lagged unionization in the employment rate equations.)   In her worst-case simulation, unemployment grows by 5.42 million, even though employment only fell by 2.27 million. This implies that 3 million additional Americans must have joined the labour market (equivalent to a substantial increase in the participation rate of about 1.25 percentage points, experienced at exactly the same time as millions of jobs were disappearing). Indeed, a strict reading of Layne-Farrar's simulation suggests that by far the largest labour market impact of unionization is on labour force participation (not on employment *per se*). This is implausible. More important, the assumed significant (and counter-intuitive) increase in labour force participation is inconsistent with the assumption of constant labour force participation which was required in the first place for Layne-Farrar to convert her estimate of a change in the unemployment rate into a change in absolute unemployment.

Layne-Farrar performs a second and even more curious simulation exercise, summarized in her Table 15 (p. 42), where the change in unionization is

assumed to be experienced over a multi-year period, again justified by reference to an ad-hoc (and clearly hopeful!) prediction made by a union leader. This simulation extrapolates an annual increase in union membership of 1.5 million per year over the next decade (resulting in a near-doubling of unionization over that period). On the basis of assumptions regarding labour force and employment growth (including the odd and inconsistent assumption that employment grows at the same rate as the labour force, despite the doubling of unionization which Layne-Farrar believes will have strong negative impacts on job-creation), Layne-Farrar then predicts that unemployment will more than double, and the unemployment rate would rise by about 9 percentage points (reaching about 15 percent). Layne-Farrar does not simulate her employment rate coefficients in this simulation (no doubt because she has already assumed, in the extrapolation, that employment grows at the same rate as the labour force – and hence there is no impact of unionization on employment at all). The underlying assumption that unemployment could rise to 15 percent with no impact on future labour force growth, fiscal and monetary policy, or other macroeconomic linkages is, frankly, bizarre.

On the whole, the scale of predicted impacts of unionization utilized in Layne-Farrar's simulations seems extraordinarily large. To give another perspective on this, consider her oft-quoted "rule of thumb" (based on the Canadian regressions) that an increase in unionization of one percentage point, leads to an increase in the unemployment rate of around 0.3 percentage points. On that basis, assume that Canadian policy-makers actually believed these findings, and decided it would be sensible to reduce unionization in Canada to U.S. levels. The resulting decline in union density (from around 30 percent at present in Canada, to around 12 percent to match U.S. levels) would result in an unemployment rate approximately equal to zero. In several provinces, the unemployment rate would become negative! (Which begs another obvious question: namely, why, if lower unionization leads to such improved labour market performance, does any unemployment exist at all in the U.S.?)

The Layne-Farrar findings, based on Canadian data, have proven to be powerful ammunition in the aggressive effort by U.S. employer lobbyists to defeat the proposed *Employee Free Choice Act*. However, they are based on an approach that violates important rules of elementary econometrics (regarding spurious regressions of non-stationary variables). They ignore other important determinants of Canadian labour market performance. Layne-Farrar's application of her own findings to make predictions of the impact of legislative changes on U.S. labour market outcomes is arbitrary, internally inconsistent, and unbelievable. Finally, there was no particular reason for her to base her research on Canadian data in the first place – since the so-called "natural experiment" that sparked her initial interest in Canada was not actually incorporated into her own empirical analysis.

For all these reasons it would be far-fetched to conclude that the Layne-Farrar findings provide any reasonable insight into the behaviour of Canadian labour markets (including the impact, whether positive or negative, of unionization) – let alone that those findings would provide any reliable guide to the impact of labour law changes in the U.S. (a country where Layne-Farrar could have performed exactly the same analysis, but chose not to).   The remaining sections of this paper shall attempt to provide a more complete analysis of the impact of unionization on labour market performance in Canada (using both national and provincial-level data), and a more reasonable discussion of the application of those findings to the U.S. context.

3. STRUCTURES AND TRENDS IN CANADIAN LABOUR MARKETS

The Layne-Farrar study focuses its attention on a single core explanatory variable, union density, which is hypothesized to explain unemployment, employment, and business investment in the ten Canadian provinces. While her regressions include selected macroeconomic "control" variables (and, as noted above, the specification and inclusion of those control variables was rather arbitrary), there is no full-fledged discussion of the various macroeconomic, demographic, and structural factors which together could provide a more complete depiction of trends in Canadian labour market performance over time and across provincial jurisdictions. Here are several of the key features of Canada's recent labour market performance which U.S. readers should keep in mind, as they consider whether Canada's stronger patterns of unionization have had any impact on economic and labour market performance.

(A) SWINGS IN MONETARY POLICY

Monetary policy and central bank behaviour are obvious key factors influencing the evolution of labour market performance. Canada has experienced important swings in monetary policy-making during the period covered by Layne-Farrar's regressions, and these factors should be included within any credible analysis of unemployment and employment. In particular, during the late 1980s and 1990s, Canada's central bank demonstrated a uniquely aggressive and strict approach to inflation control. The Bank of Canada was one of the first in the world to adopt inflation targeting as its central behaviour rule, and it stuck to its interest-rate guns very strictly during the early years of this regime. During the early 1990s, Canada's real interest rates were uniquely high in comparison to other countries, and this was a key factor in the uniquely deep and long recession which Canada experienced at that time (with consequent impacts on unemployment and employment rates). Policy showed more flexibility in later years, and Canadian monetary and credit conditions became

more typical of those in other OECD countries. This history is discussed in detail in MacLean and Osberg (1996) and Banting, Sharpe, and St.-Hilaire (2001). It is important to note that the period of strictest monetary policy conforms to a period of relatively high unionization in Canada.[14] Since the mid-1990s, monetary policy has eased (reflected in falling real interest rates) at the same time as unionization has declined. A complete model of unemployment or employment would include interest rates, credit conditions, and/or other variables reflecting monetary policy and monetary conditions.

(B) OTHER FACTORS IN THE 1990S RECESSION

Canada's labour market indicators have historically tracked U.S. performance closely, however there was a marked divergence during the 1990s – following Canada's uniquely severe recession, and subsequently slow recovery. Early in that decade Canadian unemployment rates rose far above U.S. levels, and employment rates plunged even further (fueled both by job loss and declining labour force participation).[15] In addition to Canada's divergent monetary policy discussed above, other factors which contributed to that uniquely weak period in Canadian labour market performance include the adjustment to the new Canada-U.S. free trade agreement (which was associated with a major decline in Canada's manufacturing sector), adjustment to an overvalued exchange rate (reflecting in part very high Canadian interest rates), and a subsequent major fiscal retrenchment by government beginning in 1995. This unique conjuncture of circumstances in the 1990s makes it especially important to consider the full range of potential macroeconomic conditions before attributing Canada's poor labour market performance at that time to unionization.

(C) COMMODITY BOOMS AND BUSTS

Canada is a major exporter of natural resource products (including energy, minerals, forestry, and agricultural goods). Swings in global market conditions for these primary exports have been associated with major swings in Canada's overall macroeconomic conditions (including unemployment and employment, exchange rate and terms of trade shocks, and major swings in international trade and investment balances). Moreover, an important issue for the purposes of this study is the fact that these resources (especially petroleum and mineral deposits) are distributed unevenly across Canada. This means that inter-provincial variation in labour markets will depend, in part, on the state of commodity markets, exports, and production. This effect has been especially important in the post-free-trade era of Canada's economic development, during which period the relative importance of petroleum and other mineral exports has

grown significantly, at the same time as unprecedented global price volatility has been experienced in those energy and minerals markets. The richest three Canadian provinces (on the basis of per capita GDP) are those which produce and export petroleum (Alberta, Saskatchewan, and Newfoundland). Attempting to account for interprovincial variation in labour market performance without taking account of the regionally diverse nature of these resource shocks would immediately strike any Canadian economist as a serious conceptual error. To address this shortcoming, resource price, exchange rate, and export performance variables will be included in the more complete models of Canadian unemployment and employment specified below.[16]

(D) OTHER INSTITUTIONAL VARIATIONS

Some economists have argued that changes in Canada's unemployment insurance system have influenced unemployment rates, in large part via the impact of the system's rules on the decision of non-employed individuals to participate or not participate in the labour force. A very substantial tightening of the program's accessibility beginning in the early 1990s may have contributed to a decline in reported unemployment rates (if not to an increase in actual employment) since that time. Varying evidence on the importance of this factor is reported by Fortin, Keil and Symons (2001); Riddell (2005); and Zagorsky (1996). In its comprehensive review of international experience, the OECD (2006) finds that unionization is not significantly correlated with unemployment, but suggests that the generosity of unemployment insurance may be.[17] An attempt to explain the evolution of Canadian unemployment and employment rates on the basis of variation in institutional and policy variables should probably have considered this important feature of Canada's labour policy landscape, which past research has suggested could be significant.

(E) DEMOGRAPHIC TRENDS

Labour markets are composed of both supply and demand sides, and demographic trends in labour supply are surely a central factor which should be included in any comprehensive model of employment and unemployment performance. Of particular relevance in the Canadian case has been the secular increase in women's labour force participation which dominates changes in labour supply over the past three decades. Canadian female participation has grown virtually every year since 1976 (when the current household labour force survey was initiated); it increased during this time from 45 percent to 63 percent. The rise in women's participation is also clearly the dominant factor behind the long-run increase in the employment rate in Canada. There are significant differences in female participation between Canadian provinces (reflecting the

age and mobility of the workforce). In particular, rapidly-growing petroleum-rich provinces (such as Alberta and Saskatchewan) are characterized by a younger workforce, with more inward migration, and higher female labour force participation. These demographic factors should be incorporated into analysis of labour market performance over time or across provinces; otherwise, the importance of differences in female participation could be "picked up" (in a mis-specified model) by any other time-trended variable.

This risk seems especially acute in Layne-Farrar's employment rate regressions. By modeling a time trended variable (the employment rate) but excluding from the right-hand side of the equation an underlying secular change (women's growing participation) that is closely associated with that trend, she could mis-attribute the growth in employment rate to some other time-trended variable which *was* included in her regression (namely, in her case, the secular decline in unionization).

In summary, before relying on the Canadian experience to provide a guide to the likely impact in America of legislative changes being considered there, the analyst would be well-advised to consider the full range of structural, macroeconomic, and demographic variables which have clearly influenced Canadian labour market performance over time. The Layne-Farrar analysis takes no effect of monetary policy and credit conditions; export, terms of trade, and commodity market developments; or demographic trends (such as the dramatic growth of female labour force participation). This throws into question the reliability of the resulting estimated coefficients (which would almost certainly be biased as a result of excluding or mis-attributing the explanatory power of omitted variables). The analysis reported below shall attempt to fill in these gaps with a more complete analysis.

4. DATA DEFINITION AND SOURCES

This section describes the variables included in the regression analyses reported below. For Canadian series, the identifier number for the relevant original data table from the Statistics Canada CANSIM database is provided. All series are annual.

(A) CANADIAN SERIES (PROVINCE-SPECIFIC)

Unemployment rate: Unemployed as share of labour force, 15 and over (2820002).

Employment rate: Employed as share of working age population, 15 years or older (2820002).

Unionization: Union membership/coverage as proportion of employment. Source for pre-1995 data is the CAULRA survey of trade unions, union membership as share total paid employment (2790027). Source for post-1997 data is the household labour force survey; union coverage is calculated as union-covered workers divided by total paid employment (2820078). The data point for 1996 is interpolated between the 1995 and 1997 values.

Change in real GDP: The first difference in real (chained $2002) GDP (Canada 3800017; provinces 3840002). For province-specific data, this series commences in 1981.

CPI inflation: To be compatible with the comparisons reported below between levels and first-differenced equations, the log of CPI (all items, 2005 basket, 2002=100; 3260021) is utilized as a measure of consumer prices in levels equations, and the first difference of the log of CPI is utilized in first-differenced equations. Province-specific CPI data becomes available beginning in 1979.

(B) CANADIAN SERIES (AGGREGATE NATIONAL)

The following national-level-only data series were also included as potential explanatory variables in the pooled regressions below.

Change in interest rate: First difference of the annual average of the Bank of Canada bank rate (from *Canadian Economic Observer Historical Statistical Supplement*, 11-210X, Table 7.1).

Change in business and household credit: First difference of the total outstanding stock of business and household credit, as reported by the Bank of Canada (1760032).

Change in commodity prices: First difference of the log of Bank of Canada index of non-energy commodity prices (in $US, 1760001).

Change in oil prices: First difference of the log of Bank of Canada index of energy prices (in $US, 1760001).

Change in exports: First difference in real (chained $2002) exports of goods and services (3800017).

(C) Spurious Regression Dependent Variables (Aggregate National)

The following national-level-only data series were included as dependent variables in the spurious regressions reported in Table 2 above.

Tax payments of non-residents: Aggregate tax revenues paid on income by non-residents to all levels of Canadian government (3800007).

Capital consumption allowance: Depreciation allowance on fixed capital from national income and expenditure accounts (3800016).

Consumer credit: Total outstanding stock of consumer debt, as reported by the Bank of Canada (1760032).

Price index of alcoholic beverages and tobacco products: 2005 basket, 2002=100 (3260021).

(D) U.S. National Time Series Data

The following variables are utilized for the time-series regressions of national U.S. data reported in Tables 11 and 12.

Union membership as share employment, all wage and salary workers: from http://www.unionstats.com.

Unemployment rate: Unemployment as share of labour force, Bureau of Labor Statistics series LNU04000000.

Employment rate: Employment as share of working-age population, 16 and over, Bureau of Labor Statistics series LNU02300000.

Change in real GDP ($2005 chained): from Table 1.1.6, Bureau of Economic Analysis, National Income and Product Accounts, economicindicators.gov database.

Consumer prices: Log of consumer prices (U.S. all items all urban consumers, 1982-84=100) and change in the log, for first-differenced regressions, as reported by Bureau of Labor Statistics series CUUR0000SA0.

(F) U.S. CROSS-SECTIONAL DATA

The following data series were utilized in the cross-sectional regressions of U.S. state data reported below in Table 13.

State unemployment rate (2008):   Unemployment as share labour force, statewide, from Bureau of Labor Statistics Local Area Unemployment Statistics http://data.bls.gov/cgi-bin/dsrv.

State employment rate (2008): Employment as share non-institutional civilian population ager 16 or over, statewide, from Bureau of Labor Statistics Local Area Unemployment Statistics http://www.bls.gov/lau/rdscnp16.htm.

Union membership as share total employment (2007): lagged one year, as reported by the Statistical Abstract of the U.S., Table 644, http://www.census.gov/compendia/statab.

Change in state real GDP (2006 and 2007, chained $2000): lagged one and two years, as reported by the Statistical Abstract of the U.S., Table 649, http://www.census.gov/compendia/statab.

State inflation (2007): lagged one year. No CPI data are available for U.S. states. Inflation is therefore measured by the change in the GDP price deflator for each state, as calculated from current and chained GDP data reported by the Statistical Abstract of the U.S., Table 649, http://www.census.gov/compendia/statab.

Women's labour force participation (2007): lagged one year, as reported by the Statistical Abstract of the U.S., Table 573, http://www.census.gov/compendia/statab.

5. REGRESSIONS UTILIZING NATIONAL CANADIAN TIME-SERIES DATA

In this section, the two key reported Layne-Farrar specifications (relating the unemployment rate to lagged unionization, once and twice-lagged GDP growth, and lagged inflation; and relating the employment rate to lagged unionization and once and twice-lagged GDP per capita) are applied to aggregate Canadian data collected at the national level. The purpose of these estimations is to consider whether Layne-Farrar's findings are visible in national time series data (as distinct from the pooled cross-sectional/time-series provincial data which she analyzes), and also to highlight the sensitivity of her findings to the non-stationarity issue highlighted above.

Table 3 reports the results of 3 regressions applied to national Canadian data on the unemployment rate. Column A reports the replication of the exact equation structure for the unemployment rate reported in Layne-Farrar's Table 3. It indicates (consistent with her findings) that lagged unionization is a statistically significant (at the 99% level) determinant of unemployment, with the expected positive sign. Once-lagged GDP is also significant; the other Layne-Farrar "control" variables (twice-lagged GDP and lagged CPI) are not.[18] As reported in Table 1 above, however, all the variables contained in this specification demonstrate strong secular time trends, and this non-stationarity introduces a significant risk of invalid (spurious) inference.

Converted to first-difference terms (in which case the hypothesis of non-stationarity on the unemployment rate can be rejected at the 99% level, and for the right-hand-side variables at the 95% level, all as reported in Table 1), the equation is re-estimated in Column B. In this case the equation loses most of its explanatory power. None of the right-hand-side variables (including unionization) are statistically significant, and the adjusted R^2 value falls by two-thirds. In other words, after controlling for the non-stationarity of all of the variables modeled by Layne-Farrar, no evidence is found that unionization is a significant predictor of the unemployment rate.

We hypothesized earlier that a complete model of Canadian labour market performance would incorporate several key macroeconomic, structural, and demographic factors that were ignored by Layne-Farrar's approach. Column C therefore reports the findings of a more complete model (appropriately formulated in first-difference terms) of the Canadian unemployment rate. This model includes changes in consumer prices, changes in interest rates, changes in credit conditions, changes in export demand, and changes in commodity prices as explanatory variables. All are significant with expected signs. With this more complete set of right-hand-side variables, the lagged first-difference of GDP loses its significance. Most important for this discussion, the coefficient for unionization is near-zero and non-significant in this specification (in fact, it is slightly negative). In other words, when the complete set of macroeconomic and structural factors is incorporated into the analysis, unionization has no value as an explanatory variable of the unemployment rate.

Table 4 reports results of the same exercise applied to national-level Canadian time-series data on the employment rate. Again, Column A simply applies exactly the same specification reported in Layne-Farrar's Table 4 (lagged unionization, lagged GDP per capita, and once- and twice-lagged GDP per capita). In this case, unionization is not statistically significant even in the levels regression (Column A). Lagged GDP per capita is the only significant right-hand-side variable in Layne-Farrar's initial set. In a first-differenced regression of the same specification (Column B), none of the right-hand-side variables are

significant, and the equation loses most of its explanatory power. In a complete first-difference formulation incorporating macroeconomic, structural, and demographic determinants (Column C), a strong fit is attained (with adjusted R^2 higher than in the original levels regression), and strong significance is attached to changes in GDP, changes in interest rates, changes in oil prices, and changes in consumer credit. As expected, demographic factors – namely the rise in women's labour force participation – are highly significant in understanding the behaviour of the employment rate. Unionization is found to have no significant influence on the employment rate in any of these specifications.

These experiments already suggest that Layne-Farrar's findings may indeed be highly dependent on correlations among time-trended variables, and that her inferences based on regressions of those non-stationary variables are suspect. In a fully-specified and stationary model of unemployment and employment rates using Canadian national time-series data, there is no statistically significant relationship between unionization and either the unemployment rate or the employment rate.

6. REGRESSIONS UTILIZING POOLED PROVINCIAL CROSS-SECTIONAL TIME-SERIES DATA

This section conducts a similar exercise as Section 5, but this time utilizing the same pooled cross-sectional/time-series provincial approach that Layne-Farrar utilized in her own analysis. We first attempt to replicate her findings using level regressions, for the time period covered by her true original data (1984 to 1995).[19] We also apply her specification to the full time period covered by available data (stretching out to 2008), in order to consider whether her findings are sensitive to the time period being covered. Finally, in light of the fact that the Canadian data set for unionization experiences a break in the 1995-1997 period[20], we also conduct the analysis for the post-splice sample period. For the levels regressions this post-splice sample period begins in 1998 and runs through 2008; for the first-differenced equations, it begins in 1999.[21] After replicating her results, we re-estimate the model using first-differenced variables (to correct for the non-stationarity of her data). Finally, we also incorporate other key determinants of unemployment and employment into the model (including macroeconomic, structural, and demographic variables). In the end, the relationship Layne-Farrar posits between unionization and unemployment or employment collapses entirely. This entire exercise is performed in two parts: first for the unemployment rate equation, and then for the employment rate equation.

(A) *UNEMPLOYMENT RATE REGRESSIONS*

I. RE-CREATING THE LAYNE-FARRAR RESULTS (LEVELS)

Table 5 reports our effort to re-create the broad results which Layne-Farrar attained using a levels regression on pooled cross-sectional time-series data from the ten Canadian provinces (and which were reported in her Table 3).[22] Following Layne-Farrar, the pooled regression is conducted using three different methodologies: OLS, fixed effects, and random effects.[23] Exactly the same specification is utilized, with the unemployment rate dependent on lagged unionization, once- and twice-lagged changes in GDP, and lagged consumer prices. Using levels data in the initial shorter sample period (1984 through 1995), we find (as did Layne-Farrar) that the lagged unionization rate seems to be a strongly significant determinant of unemployment, with coefficients ranging from approximately 0.30 to 0.47 (depending on choice of estimator). In fact, these coefficients are slightly larger than those reported by Layne-Farrar (which ranged from 0.30 to 0.35); this difference may reflect our decision not to extrapolate the dependent variable to 1996 and 1997, the specific formulation of our inflation variable, or other small differences in the regression. The GDP control variables are significant; our inflation variable is not. Qualitatively, these levels results are comparable to those reported in Layne-Farrar's Table 3. The Durbin-Watson statistic[24] for the levels regressions is low (well below the critical threshold of 2.00), indicating strong serial correlation in the error term and perhaps, therefore, the mis-specification of the model.[25]

The latter segments of Table 5 replicate the regressions on the two alternative sample periods. Applying the Layne-Farrar model to the full data period (from 1984 through to 2008) leads to a reduction in the estimated size of the unionization coefficient (which now ranges from 0.19 to 0.27). This would affect the estimated absolute unemployment effects calculated in Layne-Farrar's counter-factual simulations, but does not affect the qualitative direction of those findings. In the longer sample period, lagged consumer prices are now significant. For the post-splice data period (beginning in 1998) the unionization coefficient is smaller still (ranging from 0.13 to 0.23), but again still significant. We are thus able to re-create Layne-Farrar's findings for the unemployment rate using a levels regression of pooled cross-sectional time-series levels data.

II. FIRST DIFFERENCE REGRESSIONS OF THE LAYNE-FARRAR SPECIFICATION

Now we test the sensitivity of Layne-Farrar's findings to the crucial problem of non-stationarity in all her variables that was identified above. These results are reported in Table 6. Again we have applied exactly the same specification as Layne-Farrar reported in her Table 3, but converted into first-

difference format to eliminate the problem of non-stationarity in both the dependent and the independent variables.[26] (By converting to first-difference form, the control variables now consist only of the lagged changes in GDP and lagged change in consumer prices; the former lagged level of GDP, converted to first-difference form, is redundant with the lagged change in GDP which was already included in her levels regressions.) In the first-difference regressions on the initial (1984-1995) sample period, the unionization variable is significant only with the random effects estimator (the appropriateness of which, in this context, was questioned above). Unionization is not significant in the OLS or fixed effects estimations. Applied to the full sample period, the unionization variable is found to be weakly significant in the OLS and random effects variants, but not in the fixed effects estimation. For the post-splice period (1999 through 2008) the unionization variable is not significant in any case. Across all of these regressions, the coefficient on unionization is much smaller than in the levels regressions (ranging from 0.06 through 0.12, and not statistically significant in most cases). The adjusted R^2 scores for the first-differenced regressions are also much lower than in the levels regressions. Applying the Layne-Farrar model to (stationary) first-differenced data is seen therefore to result in smaller coefficients, very weak and inconsistent statistical significance, and greatly reduced explanatory power.

III. COMPLETE SPECIFICATION

Finally, we now consider a more complete model of the Canadian unemployment rate, appropriately specified in first-difference terms, and taking into account the full range of macroeconomic and structural factors discussed above. These regressions are reported in Table 7, once again utilizing the same three estimators utilized by Layne-Farrar (OLS, fixed effects, and random effects). We preserve the same variables utilized in the Layne-Farrar regressions: lagged unionization, once- and twice-lagged changes in GDP, and lagged changes in consumer prices. We include a set of additional macroeconomic and structural factors, in line with the discussion in Section 3 above, including: changes in interest rates and credit conditions, changes in oil and other commodity prices, and changes in export demand. To save space (given the longer list of right-hand-side variables included here), the fully-specified regression results are reported only for the full sample period (1984 through 2008).[27] The random effects results are reported in two different columns, C and D, for the following reason: in a random effects regression the number of coefficients cannot exceed the number of cross-sections in the pooled data set (in this case, ten), and hence one of the right-hand-side variables had to be dropped. It is most appropriate to drop any non-significant variables (in this case, unionization, as was done in column D); however, to confirm that the non-

significance of unionization is maintained throughout, we also dropped one of the less significant other explanatory variables (the oil price) in column C. In the fully-specified first-difference equation, the unionization coefficient is near-zero and statistically insignificant in every single formulation.

Our re-creation of Layne-Farrar's model of the Canadian unemployment rate confirms that the significant positive relationship she reported between the unemployment rate and lagged unionization is entirely dependent on her use of time-trended (ie. non-stationary) variables, and her exclusion of the broader macroeconomic and structural variables that are important to Canadian labour market performance. Layne-Farrar's results collapse when the model is corrected for non-stationarity in both its dependent and independent variables, and when the full range of macroeconomic and structural factors explaining Canadian labour market performance is incorporated into the analysis.

(B) *EMPLOYMENT RATE REGRESSIONS*

I. RE-CREATING THE LAYNE-FARRAR RESULTS (LEVELS)

This section performs the same exercise to re-create Layne-Farrar's reported findings for the employment rate,[28] and then to test their sensitivity to the non-stationarity of included variables and the exclusion of other relevant explanatory variables. Table 8 re-creates Layne-Farrar's findings, in level terms, from her Table 4. We utilize her same specification: the employment rate is dependent on lagged unionization, lagged GDP per capita, and once- and twice-lagged changes in GDP per capita. The top panel of the table reports regression results for the true original data from the sample period she considered (1984 through 1995); the latter panels report results for the complete sample period (1984 through 2008) and the post-splice sample period (1998 through 2008). The top panel indicates that we are indeed able to re-create Layne-Farrar's findings using our own pooled cross-section time-series set of provincial data. In the initial time period (1984 through 1995), lagged unionization is seen to be a consistently significant, important, and negative determinant of the employment rate. The attained coefficients vary from -0.36 to -0.43. Once again, these are substantially larger (in absolute terms) than the coefficients reported in Layne-Farrar's Table 4 (which ranged from -0.17 to -0.23). Lagged GDP per capita is a strongly significant control variable (not surprisingly, considering that its secular rising trend mirrors the long secular rise in women's labour force participation which has clearly been important to Canada's rising employment rate over time). Lagged changes in GDP per capita are not generally significant (also consistent with Layne-Farrar's Table 4 results).

Over the full sample period (1984 through 2008), the absolute size of the unionization coefficient diminishes (now equaling -0.13 for the fixed effect and

random effect regressions, but a much larger -0.33 for the OLS regressions), but the results are otherwise qualitatively similar. In the post-splice sample period (1998 through 2008), the unionization variable is not significant with any of the estimators (and in fact becomes positively signed, contrary to expectation, in the fixed effects and random effects estimations). This suggests that even in the levels regressions, both the size and the significance of the unionization coefficient in explaining the employment rate are very sensitive to the sample period and estimator considered. This should give immediate caution to interpreting Layne-Farrar's coefficients in such a precise, quantitative manner as she does with her numerical simulations of the impact of labour law changes on U.S. employment performance.

II. FIRST DIFFERENCE REGRESSIONS OF THE LAYNE-FARRAR SPECIFICATION

Table 9 reports the results of the same Layne-Farrar specification of the employment rate model, converted into first-difference terms. Now the change in the employment rate is regressed on the lagged change in unionization and the once- and twice-lagged changes in GDP per capita. This time the unionization variable is significant (at the 95% level) even in the first-differenced equation for the initial time period (1984 through 1995). The first lag of change in GDP per capita is strongly significant. Over the longer sample period, the unionization variable is significant in all formulations at the 99% level. In both cases, the size of the unionization coefficient is much smaller than in the levels regression: about 0.10 in all formulations. In the latter post-splice data period (1999 through 2008), the unionization coefficient falls to near zero and is insignificant. These results, therefore, are inconclusive: the unionization coefficient is significant but smaller in the longer sample periods; its significance disappears in the latter sample period (since 1998). Now we will consider whether this weaker support for the Layne-Farrar hypothesis that unionization reduces the employment rate is sustained in the context of a more complete specification of the determinants of employment.

III. COMPLETE SPECIFICATION

In addition to the various macroeconomic and structural variables which we incorporated into our complete unemployment rate model above, the Layne-Farrar employment rate regressions also omit what is the most obvious cause of the long-run secular trend in that dependent variable – namely, the secular rise in women's labour force participation. Table 10, therefore, reports the results of the estimation of what we consider a more convincing and complete model of the Canadian employment rate. It includes lagged changes in female labour participation. It considers the same macroeconomic variables that were included

in the unemployment model (lagged credit, consumer prices, and commodity prices). After including female labour force participation, the long-run growth in GDP per capita is no longer significant as a determinant of the employment rate. However, changes in GDP itself are significant as an indicator of cyclical macroeconomic conditions.

After considering this broader set of explanatory variables, and in particular the crucial effect of female labour force participation, unionization loses all of its significance as a determinant of the employment rate. The coefficient on unionization is near-zero and statistically insignificant in all three formulations presented in Table 10.[29] Increases in female labour force participation are a consistent and strongly significant determinant of the rise in the employment rate. The other macroeconomic and structural variables are also all strongly significant in every formulation.

These results demonstrate conclusively that the negative correlation reported by Layne-Farrar between unionization and the employment rate is entirely due to an inappropriate, spurious correlation between the secular time trends in those two variables. When a full account is taken of the underlying demographic factors driving changes in the employment rate (especially the obvious influence of women's changing labour force participation), the significance of unionization disappears entirely.

In sum, then, the results reported by Layne-Farrar in her Tables 3 and 4 (and which provided the empirical basis for her sensational claims regarding the destructive impact of proposed labour law changes on U.S. labour market performance) are based on an inappropriate and incomplete methodology. After correcting for non-stationarity in all of her included variables, and correctly specifying more complete models of labour market outcomes (incorporating the obvious impact of macroeconomic, structural, and demographic determinants), there is no evidence whatsoever that unionization has caused either higher unemployment rates or lower employment rates in Canada. Any attempts to extrapolate that faulty conclusion, based on a deep misunderstanding of how Canadian labour markets actually function, to the experience of other countries (and to the U.S. in particular) is both illegitimate and unconvincing.

7. PRELIMINARY REGRESSIONS UTILIZING U.S. DATA

The whole notion that an estimate of the potential impact of labour law legislation in the U.S. should be simulated on the basis of econometric estimates fitted to Canadian data is inherently counter-intuitive. Why not conduct this research using empirical data from the U.S. labour market – which is, after all, the jurisdiction where the proposed policy changes are being considered? Nominally, Layne-Farrar justifies the "Canadian connection" on the basis of a "natural experiment" associated with inter-provincial variation in labour

legislation in Canada. But as we have seen, her analysis in no way considers that inter-provincial variation in legislation.   It considers only inter-provincial variation in *unionization*, which is entirely distinct. Moreover, inter-jurisdictional variation in unionization rates would allow her experiment to be conducted on any other cross-sectional sample – including, most obviously, the U.S.

Is the Layne-Farra hypothesis that unionization causes higher unemployment rates, and lower employment rates, supported by the empirical evidence from her own country? It is beyond the scope of the present paper to conduct a full-fledged analysis of pooled cross-sectional time-series data for the 50 U.S. states (plus the District of Columbia) that would be truly comparable to Layne-Farrar's Canadian analysis; that would be a daunting (but interesting) analytical project in its own right. However, we can conduct some preliminary tests on two different (and simpler) forms of U.S. data: time-series data for the U.S. economy as a whole, and a point-in-time cross-sectional analysis of inter-state variation in unionization and labour market performance (for 2008). This section presents the results of those preliminary tests. We find that the evidence for the claim that unionization increases unemployment and reduces employment is even weaker in the U.S. data, than it is in the Canadian data.[30]

(A) NATIONAL TIME-SERIES UNEMPLOYMENT RATE REGRESSIONS

Table 11 provides the results from two simple applications of the Layne-Farrar hypothesis regarding the unemployment rate (as reported in her Table 3, where the unemployment rate is dependent on lagged unionization, once- and twice-lagged changes in GDP, and lagged consumer prices) to aggregate time series data for the U.S. economy as a whole. Even in the levels regression (which would be inappropriate anyway, given the likely non-stationarity of the U.S. data on unemployment, unionization, GDP, and inflation), unionization is not found to be a significant determinant of the U.S. unemployment rate (Column A). In a more appropriate first-differenced formulation (Column B), the unionization rate is again not statistically significant. Lagged changes in GDP are significant in both formulations; lagged consumer prices are significant in the first-differenced regression only. A more thorough investigation would be required to construct a complete behavioural specification for the U.S. unemployment rate (which would presumably incorporate a broader set of macroeconomic, structural, and demographic factors similar to those utilized in the complete Canadian regressions reported above).   But the evidence already indicates that unionization is not a significant determinant of the U.S. unemployment rate.

(B) NATIONAL TIME-SERIES EMPLOYMENT RATE REGRESSIONS

Table 12 reports the results of a similar exercise conducted utilizing aggregate national-level U.S. data on the employment rate and its potential determinants. Again, the same specification reported in Layne-Farrar's Table 4 is applied to the U.S. data (relating the employment rate to lagged unionization, lagged GDP per capita, and once- and twice-lagged changes in GDP per capita). This time the levels regression (Column A) seems to indicate a significant negative impact of unionization on the employment rate (with an estimated coefficient much larger in absolute terms than those reported by Layne-Farrar, equal to -0.56). Lagged changes in GDP per capita are also significant, and the simple equation attains a high adjusted R^2 value of 0.788. Again, however, the correlation is spurious, based on the secular time trend readily visible in both the U.S. unionization rate (which has steadily declined) and the U.S. employment rate (which has steadily increased, driven fundamentally, as in Canada, by the increase in female labour force participation). By correcting for the non-stationarity of the variables and conducting the regression in first-difference terms, the unionization variable loses significance entirely (Column B). Once again, in a more complete specification (which considers macroeconomic and demographic factors), the non-importance of unionization in explaining the U.S. employment rate would be confirmed.

(C) SIMPLE CROSS-SECTIONAL RESULTS

Another simple approach is to consider variation in unionization across the U.S. states at a point in time, to see if there is any immediate cross-sectional support for the claim that unionization causes higher unemployment and lower employment. We assembled data on unemployment and employment rates for all 50 states plus the District of Columbia for 2008. We also assembled data (lagged one year to avoid simultaneity problems) for unionization and three key additional explanatory variables: change in real GDP, inflation, and female labour force participation (the latter for the employment rate regression). Results are reported in Table 13.

A straight regression of the unemployment rate on lagged unionization (Column A) indicates a weakly significant correlation between higher unionization and higher unemployment. The coefficient on unionization in this simplest regression (0.06) is about one-fifth as large as the coefficients which Layne-Farrar reports in her Table 3. Moreover, simply including the two most obvious state-level macroeconomic indicators (change in GDP and inflation) causes an entire loss of significance for the unionization variable, strong significance for the macroeconomic variables, and a dramatic improvement in the explanatory power of the equation (Column B). After accounting for

macroeconomic conditions, therefore, unionization has no significance in explaining cross-state variation in U.S. unemployment rates.

In the case of the employment rate, the results are even weaker for the Layne-Farrar hypothesis. In this case there is no support for even a simple correlation between the employment rate and lagged unionization (Column C). Macroeconomic conditions (GDP growth) and demographic factors (female labour force participation) can explain over 85 percent of cross-state variation in employment rates, even in this simple behavioural formulation (Column D). There is no evidence whatsoever that state-level employment rates depend on unionization.

In summary, neither national time-series data nor state-level cross-sectional analysis seems to provide any initial support for the claim that unionization causes higher unemployment rates and lower employment rates in the U.S. context. Considering that this is a U.S. policy debate, examining the U.S. data (rather than Canadian data) would have seemed the logical place to begin.

8. CONCLUSIONS

There is a substantial international literature on the impact of labour market and social institutions on relative labour market performance. Some recent installments in that literature include OECD (2006), Howell (2005), and Hein, Heise and Truger (2006). The OECD 2006 report, in particular, provides a very comprehensive and complete review of the empirical evidence regarding the impact of labour market and social institutions (including unions and collective bargaining coverage, along with other institutional variables like unemployment insurance and employment protection laws) on aggregate labour market performance, adjusting for macroeconomic conditions and other explanatory factors. It concludes explicitly that "the effects of trade-unions and employment protection legislation [on unemployment] are statistically insignificant" (p. 212). Moreover, the OECD study finds that the degree of centralization of collective bargaining is negatively associated with unemployment rates (suggesting that European-style co-determination arrangements can be very effective in combining extensive collective bargaining with very low unemployment). Coming from the same international institution which once advocated wholesale labour market deregulation as the solution to all unemployment ailments, these findings are extraordinary.

This evidence has not stopped anti-union researchers from seeking an empirical "smoking gun" to support their inherent opposition to legislative changes which might arrest or even reverse the long-term decline in union membership in the U.S. and other industrial countries. The Canadian experience, however, provides no such "smoking gun." After correctly specifying the econometric methodology (in particular, by ensuring that

included variables do not exhibit secular trends over time), and considering the impact of all determinants of unemployment and employment performance (in the Canadian case by including variables reflecting monetary policy, exchange rate and terms of trade issues, commodity prices, and demographic trends), there is no statistically significant relationship visible, in either direction, between unionization and either unemployment rates or employment rates in Canada. Unionization is not a significant determinant of aggregate Canadian labour market performance. Layne-Farrar's results were based on an inappropriate methodology: her regressions on non-stationary series, and her exclusion of important explanatory variables. Preliminary analysis indicates that there is no statistically significant relationship between unionization and either the unemployment rate or the employment rate visible in the U.S. data, either.

These findings are consistent with the international literature which finds that macroeconomic policy and conditions are the dominant determinants of labour market performance. Stronger collective bargaining structures can be associated with either weak or strong labour market performance, depending on the state of the other, more important determinants of unemployment and employment (such as macroeconomic and demographic factors).

The Layne-Farrar prediction that passage of the *Employee Free Choice Act* would lead to an increase in U.S. unemployment of up to 5 million people is a sensational and seemingly precise numerical claim that has captured considerable attention in the U.S. debate over proposed labour law changes. But that claim has no credible empirical basis: it is rooted in an unrealistic and internally inconsistent numerical extrapolation to the U.S. context of econometric findings that were inappropriately estimated on the basis of Canadian data which did not even incorporate the link between labour legislation and labour market performance which Layne-Farrar purports to address in the first place. Those sensational predictions should not be considered as credible reflections of Canada's historical labour market experience.

Here is an alternative way of summarizing (in a simple numerical "take-away") the crucial comparisons between the Canadian and U.S. labour markets. The international economic literature finds consistently that there is no systematic link between unionization and key indicators of labour market performance (such as unemployment and employment). So Canada's stronger pattern of unionization and collective bargaining will not likely explain any differences between the aggregate performance of the Canadian and U.S. labour markets. However, taken as a whole, the complex of Canadian macroeconomic and institutional policies and factors has created a labour market which has performed consistently better than the U.S. labour market in recent years, demonstrating stronger job-creation and employment rates, lower unemployment, and less wage and income inequality. Based on 2008 data, if America's labour market had been performing as well as Canada's (stronger

unions and all), about ***3.3 million more Americans would be employed, unemployment would fall by over 750,000 (or about one-tenth), and an additional 2.5 million Americans would be participating in the labour force***.[31] Better yet, over 5 percent of American households (or 6.5 million households in total) would be lifted out of poverty.[32]

Especially during this moment of profound economic crisis and very high unemployment, the de-unionizing U.S. labour market can hardly be held up as a model of an "efficient" market outcome (never mind the human and social consequences of the widespread poverty and inequality that are a clear and longer-lasting consequence of the weaker collective bargaining structures, and the more *laissez-faire* approach to labour market and social policy in general, that exist in the U.S.). Indeed, a plausible connection could be made between the current crisis and the underlying inequality of U.S. labour market outcomes. Consider, for example, the extent to which unsustainable mortgage lending practices may have reflected the economic desperation felt by many U.S. households reaching for a better life despite their low earnings. In this context, the claim that American policy-makers should beware the Canadian experience in formulating their own labour relations legislation seems strongly counter-intuitive. Unionization alone is not likely to improve or detract from aggregate labour market performance, based on the international and Canadian data. However, as part of an overall package of economic and social policies aimed at promoting economic growth and efficiency, simultaneously with greater social equality and inclusion, unionization can be reasonably considered as a positive feature of a more economically sustainable policy framework. In other words, unionization could help Americans attain better, more sustainable, and more socially inclusive labour market outcomes – rather than leading to massive unemployment and job loss as predicted by Layne-Farrar.

APPENDIX A:
TABLES

Table 1: Tests for Unit Root (Non-Stationarity) of Variables Included in Layne-Farrar Regressions												
Province	**Levels**						**First Differences**					
	UE	**ER**	**UZ**	**GDP**	**GDP/CAP**	**CPI**	**UE**	**ER**	**UZ**	**GDP**	**GDP/CAP**	**CPI**
AB	Not	Not	Not	Not	Not	99%	99%	99%	99%	99%	99%	99%
BC	Not	Not	Not	Not	Not	Not	95%	99%	Not	99%	99%	99%
MN	Not	Not	Not	Not	Not	Not	99%	99%	99%	99%	99%	99%
NB	Not	Not	Not	Not	Not	99%	99%	99%	95%	99%	95%	99%
NF	Not	Not	Not	Not	Not	Not	99%	95%	Not	99%	99%	99%
NS	Not	Not	Not	Not	Not	Not	99%	99%	Not	Not	Not	99%
ON	95%	95%	Not	Not	Not	99%	99%	95%	99%	95%	95%	99%
PE	Not	Not	Not	Not	Not	Not	99%	99%	Not	99%	99%	99%
QU	Not	Not	Not	Not	Not	Not	99%	99%	Not	99%	99%	99%
SK	Not	Not	95%	Not	Not	99%	99%	99%	95%	99%	99%	99%
Summary of Provincial Totals	9 Not 1 95%	9 Not 1 95%	9 Not 1 95%	10 Not	10 Not	6 Not 4 99%	1 95% 9 99%	2 95% 8 99%	5 Not 2 95% 3 99%	1 Not 1 95% 8 99%	1 Not 2 95% 7 99%	10 99%
National Canadian Data	Not	Not	Not	Not	Not	Not	99%	95%	95%	95%	99%	99%
Contents of each cell indicate whether hypothesis of unit root can be rejected at the 99% level of significance, the 95% level of significance, or cannot be rejected. Unit roots tests utilize Augmented Dickey-Fuller methodology with intercept included. Variable codes: UE=unemployment rate; ER=employment rate; UZ=union density; GDP=real GDP; GDP/cap=real GDP per capita; CPI=change in consumer price index.												

	A.	**B.**	**C.**	**D.**	**E.**
	Table 2: Spurious Regressions of Non-Stationary Variables				
		Other Spurious Regressions			
	Core Layne-Farrar Theorem: Unemployment Rate	**Taxes Paid by Non-Residents**	**Capital Consumption**	**Consumer Credit**	**CPI Sub-Index: Alcohol & Tobacco Products**
Constant	-7.184 *(5.006)*	8197.8* *(3220.5)*	-58683.0 *(43439.5)*	328828.2* *(135514.9)*	-85.210* *(36.852)*
Identical Vector of Independent Variables:					
Lagged Union Density	0.6095** *(0.1326)*	-771.77** *(85.29)*	-14090.7** *(1150.4)*	-39077.9** *(3588.9)*	-7.742** *(0.9760)*
Lagged Changes in GDP: *One Lag* *Two Lags*	-3.50E-11** *(1.18 E-11)* -2.17E-11 *(1.25 E-11)*	2.56E-9 *(7.57E-09)* -1.10E-9 *(8.03E-09)*	5.94E-8 *(1.02E-07)* -1.22E-7 *(1.08E-07)*	1.70E-9 *(3.18E-07)* -5.42E-7 *(3.38E-07)*	-1.97E-10* *(8.66E-11)* -1.90E-10* *(9.19E-11)*
Lagged Log CPI	-0.7937 *(0.6083)*	-4777.9** *(391.3)*	148368** *(5278.5)*	266327.7** *(16467.1)*	98.9823** *(4.4780)*
Observations	30	30	30	30	30
Adjusted R²	.725	.911	.975	.939	.953
Durbin-Watson	1.102	1.206	1.271	0.972	0.895

* Significant at 95% level. ** Significant at 99% level. Sample 1976 – 2008 (with endpoints adjusted for lags, 1979 – 2008). OLS regressions. Standard errors of estimates in brackets. See appendix for definitions and sources of data.

Table 3: Unemployment Rate Regressions, Aggregate Canadian National Data					
A.		**B.**		**C.**	
Levels		**1st Differences, Unchanged**		**1st Differences, Complete Model**	
Dependent Variable	Unemployment Rate	**Dependent Variable**	Change in Unemployment Rate	**Dependent Variable**	Change in Unemployment Rate
Constant	-7.184 *(5.006)*	**Constant**	-0.4674 *(.4813)*	**Constant**	.8453* *(0.3080)*
Unionization *One lag*	0.6095** *(0.1326)*	**Change in Unionization** *One lag*	0.2330 *(0.2716)*	**Change in Unionization** *One lag*	-0.0417 *(0.1701)*
Change in GDP *One lag* *Two lags*	-3.50E-11** *(1.18E-11)* -2.17E-11 *(1.25E-11)*	**Change in GDP** *One lag* *Two lags*	-1.63E-11 *(1.21E-11)* 1.35E-11 *(1.05E-11)*	**Change in GDP** *One lag* *Two lags*	Not significant
Log CPI *One lag*	-0.7937 *(0.6083)*	**Change in Log CPI** *One lag*	11.988 *(6.074)*	**Change in Log CPI** *One lag*	17.577** *(4.256)*
				Change in Interest Rate *One lag*	0.1761** *(0.0496)*
				Change in Exports *One lag*	-2.20E-05* *(8.13E-06)*
				Change Log Commodity Prices	-3.697** *(1.177)*
				Change Log Consumer Credit	-15.133** *(3.285)*
Observations	30	**Observations**	30	**Observations**	31
Adjusted R²	0.725	**Adjusted R²**	0.269	**Adjusted R²**	0.726
Durbin-Watson	1.102	**Durbin-Watson**	1.739	**Durbin-Watson**	1.356
Dependent variable is the unemployment rate. *Significant at 95% level. **Significant at 99% level. Sample 1976 – 2008 (with endpoints adjusted for lags, 1979 – 2008). OLS regressions. Standard errors of estimates in brackets.					

Table 4:					
Employment Rate Regressions, Aggregate Canadian National Data					
A.		B.		C.	
Levels		**1st Differences, Unchanged**		**1st Differences, Complete Model**	
Dependent Variable	Employment Rate	**Dependent Variable**	Change in Employment Rate	**Dependent Variable**	Change in Employment Rate
Constant	-59.760** *(6.437)*	**Constant**	-0.1349 *(0.2426)*	**Constant**	-1.4215** *(0.2894)*
Unionization *One lag*	-0.2442 *(0.1645)*	**Change in Unionization** *One lag*	-0.2272 *(0.2631)*	**Change in Unionization** *One lag*	-0.1871 *(0.1479)*
GDP per Capita *One lag*	2.68E-4** *(5.00E-5)*	**GDP per Capita** *One lag*	Redundant with below	**GDP per Capita** *One lag*	Not significant
Change in GDP per Capita *One lag* *Two lags*	2.90E-4 *(3.67E-4)* 4.89E-4 *(3.88E-4)*	**Change in GDP per Capita** *One lag* *Two lags*	6.22E-4 *(3.06E-4)* -9.88E-6 *(2.92E-4)*	**Change in GDP** *One lag*	2.88E-11** *(6.58E-12)*
				Change in Female Participation Rate *One lag*	0.6286** *(0.2116)*
				Change in Interest Rate *One lag*	-0.2329** *(0.0502)*
				Change in Log Oil Price *One lag*	-0.9685* *(0.4717)*
				Change Log Consumer Credit	7.513* *(3.403)*
Observations	30	**Observations**	30	**Observations**	31
Adjusted R²	0.700	**Adjusted R²**	0.168	**Adjusted R²**	0.736
Durbin-Watson	0.661	**Durbin-Watson**	1.922	**Durbin-Watson**	2.186
Dependent variable is the employment rate. *Significant at 95% level. **Significant at 99% level. Sample 1976 – 2008 (with endpoints adjusted for lags, 1979 – 2008). OLS regressions. Standard errors of estimates in brackets.					

	A.	**B.**	**C.**
Table 5: Re-Creating Layne-Farrar Regressions Unemployment Rate Level, Canadian Pooled Data			
	OLS	**Fixed Effects**	**Random Effects**
Adjusted Initial Layne-Farrar Sample Period (1984-1995)			
Constant	-0.189 *(7.835)*	Province-specific	1.1830 *(4.0564)*
Unionization *One lag*	0.2990** *(0.0334)*	0.4714** *(0.0620)*	0.4099** *(0.0519)*
Change in GDP *One lag* *Two lags*	-1.33E-10* *(6.59E-11)* -1.64E-10* *(6.78E-11)*	-6.91E-11* *(3.22E-11)* -1.31E-10** *(2.97E-11)*	-7.46E-11* *(3.33E-11)* -1.35E-10** *(3.08E-11)*
Log CPI *One lag*	0.2667 *(1.8300)*	-1.0545 *(0.7926)*	-1.038 *(0.824)*
Observations	120	120	120
Adjusted R²	0.500	0.909	0.901*
Durbin-Watson	0.179	1.154	0.907*
Full Sample Period (1984-2008)			
Constant	18.563** *(4.909)*	Province-specific	22.668** *(2.8288)*
Unionization *One lag*	0.2715** *(0.0302)*	0.1892** *(0.0281)*	0.2015** *(0.0280)*
Change in GDP *One lag* *Two lags*	-1.38E-10* *(5.60E-11)* -9.66E-11 *(5.55E-11)*	-1.02E-10** *(2.68E-11)* -7.21E-11** *(2.47E-11)*	-1.05E-10** *(2.81E-11)* -7.42E-11* *(2.59E-11)*
Log CPI *One lag*	-3.9262** *(1.0392)*	-5.3683** *(0.4828)*	-5.2363** *(0.5033)*
Observations	250	250	250
Adjusted R²	0.410	0.897	0.885†
Durbin-Watson	0.090	0.458	0.400†
Post-Data Splice Sample Period (1998-2008)			
Constant	50.364* *(19.748)*	Province-specific	47.742** *(5.591)*
Unionization *One lag*	0.1334* *(0.0626)*	0.2254** *(0.0728)*	0.2182** *(0.0690)*
Change in GDP *One lag* *Two lags*	-1.44E-10 *(9.40E-11)* -6.45E-11 *(9.44E-11)*	-8.91E-11** *(2.25E-11)* -1.17E-11 *(-1.17E-11)*	-9.01E-11** *(2.23E-11)* -1.24E-11 *(2.02E-11)*
Log CPI *One lag*	-9.9194* *(4.2172)*	-9.9927** *(0.8932)*	-10.0354** *(0.880)*
Observations	110	110	110
Adjusted R²	0.168	0.971	0.971†
Durbin-Watson	0.046	1.212	1.117†

Dependent variable is the change in the unemployment rate.
Post-data-splice sample begins in 1998 for levels, 1999 for first-differences.
*Significant at 95% level. **Significant at 99% level. Pooled regressions across 10 Canadian provinces. Standard errors of estimates in brackets.
† Adj. R² and D-W of GLS transformed regression.

Table 6: First Difference Regressions of Layne-Farrar Specification Unemployment Rate, Canadian Pooled Data			
	A.	**B.**	**C.**
	OLS	**Fixed Effects**	**Random Effects**
Adjusted Initial Layne-Farrar Sample Period (1984-1995)			
Constant	-0.7728** (0.1949)	Province-specific	-0.7169** (0.1861)
Unionization *One lag*	0.0684 (0.0422)	0.0556 (0.0431)	0.1217** (0.0437)
Change in GDP *One lag*	-8.82E-11** (2.19E-11)	-1.07E-10** (2.52E-11)	-6.98E-11** (2.01E-11)
Two lags	4.09E-11 (2.29E-11)	3.29E-11 (2.36E-11)	5.239E-11* (2.46E-11)
Change in Log CPI *One lag*	20.1345** (4.8933)	20.4574** (4.9948)	16.7121** (5.1436)
Observations	120	120	120
Adjusted R²	0.277	0.264	0.133†
Durbin-Watson	1.500	1.649	1.284†
Full Sample Period (1984-2008)			
Constant	-0.6115** (0.1079)	Province-specific	-0.6145** (0.0951)
Unionization *One lag*	0.0593* (0.0298)	0.0575 (0.0304)	0.0639* (0.0293)
Change in GDP *One lag*	-6.26E-11** (1.39E-11)	-7.06E-11** (1.63E-11)	-5.95E-11** (1.30E-11)
Two lags	5.23E-11** (1.37E-11)	4.73E-11* (1.46E-11)	5.62E-11** (1.37E-11)
Change in Log CPI *One lag*	15.5935** (3.2387)	15.3221** (3.3072)	15.0482** (3.2850)
Observations	250	250	250
Adjusted R²	0.193	0.175	0.139†
Durbin-Watson	1.737	1.781	1.165†
Post-Data Splice Sample Period (1999-2008)			
Constant	-0.6349** (0.1583)	Province-specific	-0.6166** (0.1301)
Unionization *One lag*	0.1003 (0.0734)	0.0921 (0.0774)	0.1222 (0.0728)
Change in GDP *One lag*	-2.64E-11 (1.88E-11)	-2.40E-11 (2.24E-11)	-2.69E-11 (1.88E-11)
Two lags	3.92E-11* (1.82E-11)	4.17E-11 (2.26E-11)	3.91E-11* (1.81E-11)
Change in Log CPI *One lag*	15.3470* (6.7310)	15.5134* (7.5647)	14.7686* (5.8300)
Observations	100	100	100
Adjusted R²	0.100	0.030	0.039†
Durbin-Watson	2.359	2.404	2.227†
Dependent variable is the change in the employment rate. *Significant at 95% level. **Significant at 99% level. Pooled regressions across 10 Canadian provinces. Standard errors of parameter estimates in brackets. † Adj. R² and D-W of GLS transformed regression.			

Table 7: Complete First Difference Specification Unemployment Rate, Canadian Pooled Data				
	A.	**B.**	**C.**	**D.**
	OLS	**Fixed Effects**	**Random Effects** *(no oil price)*¦	**Random Effects** *(no unionization)*¦
Constant	0.3857* *(0.1732)*	Province-specific	0.4799** *(0.1703)*	0.3852* *(0.1788)*
Unionization *One lag*	0.0143 *(0.0264)*	-0.0124 *(0.0269)*	0.0274 *(0.0261)*	--
Change in GDP *One lag* *Two lags*	-4.30E-11** *(1.23E-11)* 3.58E-11** *(1.21E-11)*	-4.74E-11** *(1.44E-11)* 3.27E-11* *(1.30E-11)*	-4.38E-11** *(1.24E-11)* 3.71E-11** *(1.22E-11)*	-4.45E-11** *(1.29E-11)* 3.45E-11** *(1.23E-11)*
Change in Log CPI *One lag*	16.605** *(3.206)*	16.656** *(3.254)*	15.406** *(3.195)*	17.124** *(3.056)*
Change in Interest Rate *One lag*	0.0671* *(0.0267)*	0.0699* *(0.0272)*	0.0852** *(0.0258)*	0.0677* *(0.0266)*
Change in Log Total Credit	-10.724** *(1.185)*	-10.644** *(1.842)*	-11.402** *(1.809)*	-10.843** *(1.784)*
Change in Log Oil Prices	0.5444* *(0.2312)*	0.5520* *(0.2336)*	--	0.5725* *(0.2244)*
Change in Log Commodity Prices	-3.220** *(0.5261)*	-3.214** *(0.5314)*	-2.864** *(0.5086)*	-3.224** *(0.5224)*
Change in Exports *One lag*	-1.26E-5** *(3.33E-6)*	-1.24E-5** *(3.38E-6)*	-1.21E-5** *(3.35E-6)*	-1.27E-5** *(3.31E-6)*
Observations	250	250	250	250
Adjusted R²	0.419	0.407	0.408†	0.427†
Durbin-Watson	1.915	1.962	1.906†	1.928†

Dependent variable is the change in the unemployment rate.
*Significant at 95% level. **Significant at 99% level. Pooled regressions across 10 Canadian provinces. Full sample period 1984-2008 (adjusted for endpoints of data). Standard errors of parameter estimates in brackets.
¦ Random effects model could not be estimated for the complete specification reported in columns A and B, because in a RE regression the total number of estimated coefficients cannot exceed the number of cross-sections in the pooled data set. In column C the least significant variable in columns A and B *other* than the unionization variable was dropped (oil prices), in order to demonstrate that the unionization variable remains insignificant. In column D, the unionization variable (which was not significant in any of the complete specifications) was dropped.
† Adj. R² and D-W of GLS transformed regression.

	A.	B.	C.
Table 8: Re-Creating Layne-Farrar Regressions Employment Rate Level, Canadian Pooled Data			
	OLS	**Fixed Effects**	**Random Effects**
Adjusted Initial Layne-Farrar Sample Period (1984-1995)			
Constant	51.529** (2.451)	Province-specific	62.117** (3.155)
Unionization *One lag*	-0.3632** (0.0402)	-0.4101** (0.0710)	-0.4291** 0.0623)
GDP per Capita *One lag*	7.34E-4** (5.35E-5)	3.39E-4** (7.18E-5)	4.07E-4** (6.73E-5)
Change in GDP per Capita *One lag*	-2.36E-5 (3.25E-4)	4.62E-5 (1.50E-4)	3.72E-5 (1.53E-4)
Two lags	-3.72E-5 (2.97E-4)	2.86E-4* (1.44E-4)	2.35E-4 (1.45E-4)
Observations	120	120	120
Adjusted R²	0.814	0.961	0.960*
Durbin-Watson	0.120	0.697	0.619*
Full Sample Period (1984-2008)			
Constant	54.284** (2.134)	Province-specific	52.010** (2.001)
Unionization *One lag*	-0.3254** (0.0398)	-0.1273** (0.0343)	-0.1344** (0.0341)
GDP per Capita *One lag*	5.57E-4** (3.73E-5)	3.78E-4** (2.42E-5)	3.80E-4** (2.42E-5)
Change in GDP per Capita *One lag*	-6.86E-4* (3.15E-4)	-3.12E-5 (1.29E-4)	-4.19E-5 (1.30E-4)
Two lags	-6.20E-4* (2.98E-4)	1.02E-4 (1.22 E-4)	9.14E-5 (1.23E-4)
Observations	250	250	250
Adjusted R²	0.689	0.951	0.951†
Durbin-Watson	0.081	0.299	0.283†
Post-Data Splice Sample Period (1998-2008)			
Constant	46.292** (3.667)	Province-specific	40.601** (3.454)
Unionization *One lag*	-0.1192 (0.0760)	0.1266 (0.0860)	0.0585 (0.0825)
GDP per Capita *One lag*	6.06E-4** (5.70E-5)	5.51E-4** (2.84E-5)	5.42E-4** (2.95E-5)
Change in GDP per Capita *One lag*	-1.72E-3** (5.27E-4)	-1.20E-4 (1.01E-4)	-1.42E-4 (1.10E-4)
Two lags	-1.02E-3 (5.35E-4)	-1.16E-4 (9.77E-5)	-1.20E-4 (1.06E-4)
Observations	110	110	110
Adjusted R²	0.595	0.987	0.985†
Durbin-Watson	0.137	1.121	0.842†

Dependent variable is the employment rate. Post-data-splice sample begins in 1998 for levels, 1999 for first-differences. *Significant at 95% level. **Significant at 99% level. Pooled regressions across 10 Canadian provinces. Standard errors of parameter estimates in brackets.
† Adj. R² and D-W of GLS transformed regression.

Table 9: First Difference Regressions of Layne-Farrar Specification Employment Rate, Canadian Pooled Data			
	A.	**B.**	**C.**
	OLS	**Fixed Effects**	**Random Effects**
Adjusted Initial Layne-Farrar Sample Period (1984-1995)			
Constant	-0.02449 (0.0921)	Province-specific	-0.0101 (0.0747)
Unionization *One lag*	-0.1010* (0.0403)	-0.0969* (0.0415)	-0.1049* (0.0406)
Change in GDP per Capita *One lag*	5.09E-4** (9.88E-5)	5.34E-4** (1.02E-4)	4.85E-4** (9.93E-5)
Two lags	1.25E-5 (9.25E-5)	2.03E-5 (9.51E-5)	5.29E-6 (9.37E-5)
Observations	120	120	120
Adjusted R²	0.217	0.188	0.181*
Durbin-Watson	1.397	1.485	1.207*
Full Sample Period (1984-2008)			
Constant	0.07856 (0.0660)	Province-specific	0.1061* (0.0533)
Unionization *One lag*	-0.1002** (0.0288)	-0.1010** (0.0293)	-0.0988** (0.0288)
Change in GDP per Capita *One lag*	3.57E-4** (6.53E-5)	3.77E-4** (6.69E-5)	3.26E-4** (6.47E-5)
Two lags	2.04E-5 (6.15E-5)	3.09E-5 (6.26E-5)	5.21E-6 (6.17E-5)
Observations	250	250	250
Adjusted R²	0.150	0.138	0.118*
Durbin-Watson	1.703	1.765	1.612*
Post-Data Splice Sample Period (1999-2008)			
Constant	0.3652** (0.1178)	Province-specific	0.3269** (0.0901)
Unionization *One lag*	-0.0269 (0.0824)	-0.0293 (0.0862)	-0.0165 (0.0831)
Change in GDP per Capita *One lag*	8.30E-5 (9.55E-5)	4.87E-5 (1.05E-4)	1.38E-4 (9.01E-5)
Two lags	2.46E-5 (9.60E-5)	1.77E-5 (1.04E-4)	1.79E-5 (9.30E-5)
Observations	100	100	100
Adjusted R²	-0.019	-0.077	-0.119*
Durbin-Watson	2.568	2.649	2.387*
Dependent variable is the change in the employment rate. *Significant at 95% level. **Significant at 99% level. Pooled regressions across 10 Canadian provinces. Standard errors of parameter estimates in brackets. * Adj. R² and D-W of GLS transformed regression.			

Table 10: Complete First Difference Specification Employment Rate, Canadian Pooled Data			
	A.	**B.**	**C.**
	OLS	**Fixed Effects**	**Random Effects**
Constant	0.03815 *(0.1473)*	Province-specific	0.0124 *(0.1517)*
Unionization *One lag*	-0.0303 *(0.0263)*	-0.0285 *(0.0263)*	-0.0299 *(0.0262)*
Change in GDP *One lag*	3.63E-11** *(1.19E-11)*	6.06E-11** *(1.38E-11)*	4.27E-11** *(1.24E-11)*
Two lags	-2.95E-11* *(1.17E-11)*	-1.56E-11 *(1.23E-11)*	-2.59E-11* *(1.18E-11)*
Change in Female Participation *One lag*	0.4312** *(0.1057)*	0.3791** *(0.1059)*	0.4180** *(0.1051)*
Change in Log Total Credit *Current*	21.005** *(2.679)*	21.169** *(2.654)*	21.047** *(2.657)*
One lag	-12.227** *(2.103)*	-12.733** *(2.086)*	-12.360** *(2.086)*
Change in Log CPI *One lag*	-19.650** *(2.998)*	-17.968** *(3.025)*	-19.243** *(2.989)*
Change in Log Commodity Prices *One lag*	-1.475** *(0.546)*	-1.601** *(0.542)*	-1.508** *(0.542)*
Observations	250	250	250
Adjusted R²	0.404	0.416	0.414[†]
Durbin-Watson	1.860	2.012	1.897[†]
Dependent variable is the change in the employment rate. *Significant at 95% level. **Significant at 99% level. Pooled regressions across 10 Canadian provinces. Full sample period 1984 – 2008 (adjusted for endpoints of data). Standard errors of parameter estimates in brackets. †Adj. R² and D-W of GLS transformed regression.			

Table 11: Unemployment Rate Regressions Aggregate U.S. National Data			
A.		**B.**	
Levels		**First Differences**	
Dependent Variable	**Unemployment Rate**	**Dependent Variable**	**Change in Unemployment Rate**
Constant	-14.249 *(16.525)*	**Constant**	-0.7502 *(0.4983)*
Unionization *One lag*	0.4190 *(0.2362)*	**Change in Unionization** *One lag*	0.1552 *(0.2984)*
Change in GDP *One lag* *Two lags*	-4.006E-3** *(1.141E-3)* -2.795E-3* *(1.064E-3)*	**Change in GDP** *One lag* *Two lags*	-1.465E-3 *(1.123E-3)* 2.184E-3* *(1.043E-3)*
Log CPI *One lag*	3.1005 *(2.5598)*	**Change in Log CPI** *One lag*	15.023* *(5.646)*
Observations	30	**Observations**	30
Adjusted R²	0.750	**Adjusted R²**	0.313
Durbin-Watson	1.387	**Durbin-Watson**	1.876
*Significant at 95% level. **Significant at 99% level. Sample 1976 – 2008 (with endpoints adjusted for lags, 1979 – 2008). OLS regressions. Standard errors of estimated parameters in brackets.			

Table 12: Employment Rate Regressions Aggregate U.S. National Data			
A.		**B.**	
Levels		**First Differences**	
Dependent Variable	Employment Rate	**Dependent Variable**	Change in Employment Rate
Constant	73.748** *(4.475)*	**Constant**	-0.1367 *(0.2427)*
Unionization *One lag*	-0.5578** *(0.1251)*	**Change in Unionization** *One lag*	-0.1290 *(0.2559)*
GDP per Capita *One lag*	-1.07E-4 *(7.41E-5)*	**GDP per Capita** *One lag*	Redundant with below
Change in GDP per Capita *One lag* *Two lags*	7.06E-4* *(3.13 E-4)* 7.23E-4* *(3.14E-4)*	**Change in GDP per Capita** *One lag* *Two lags*	5.54E-4* *(2.25E-4)* -2.69E-4 *(2.33E-4)*
Observations	30	**Observations**	30
Adjusted R²	0.788	**Adjusted R²**	0.128
Durbin-Watson	0.732	**Durbin-Watson**	1.668
*Significant at 95% level. **Significant at 99% level. Sample 1976 – 2008 (with endpoints adjusted for lags, 1979 – 2008). OLS regressions. Standard errors of estimated parameters in brackets.			

	A.	**B.**	**C.**	**D.**
Table 13: Cross-Sectional Regressions U.S. State-Level Data				
	Unemployment Rate		**Employment Rate**	
	Simple Correlation	**Behavioural Specification**	**Simple Correlation**	**Behavioural Specification**
Constant	4.5915** (0.3923)	7.6764** (0.9932)	63.644** (1.313)	8.7522** (3.0944)
Unionization *One lag*	0.0638* (0.0316)	0.0384 (0.0293)	-0.0229 (0.1058)	-0.0425 (0.0388)
Change in GDP *One lag*		-28.821* (11.230)		35.311* (15.173)
Inflation *One lag*		-80.903** (29.309)		
Female Labour Force Participation *One lag*				0.8938** (0.0506)
Observations	51	51	51	51
Adjusted R²	0.058	0.237	-0.019	0.866
Durbin-Watson	2.163	2.052	2.145	1.685
Dependent variable is the change in the employment rate. *Significant at 95% level. **Significant at 99% level. Cross-sectional data for 2008 (and year earlier for right-hand-side variables) for 50 U.S. states plus the District of Columbia. Standard errors of estimated parameters in brackets.				

NOTES

1. The authors' names are listed alphabetically.
2. Similar references to Canada have been made, by both sides, in the U.S. debate over health care reform, so U.S. political "junkies" are getting to know a lot about Canada these days!
3. For summary statistics on Canada-U.S. labour market performance, see Table 1 that accompanies the "Open Statement by Canadian Scholars on Unionization and the Economic and Social Well-Being of Canadians," reproduced in this issue of *Just Labour*.
4. Indeed, it is unusual for an author to report regression results when the main explanatory variable considered is not statistically significant. The author claims in the text (p. 27) that in some regressions the unionization variable is "nearly significant."
5. The discussion that follows focuses on the two sets of statistically significant regression results reported by Layne-Farrar (and which were referenced in her predictions of the negative impact of the *Employee Free Choice Act* on U.S. labour market outcomes); the non-significant regression linking unionization to business investment is not considered.
6. In Section 7 below some initial analysis of U.S. data is presented, which suggests that there is no evidence in the U.S. experience of a negative correlation between unionization and labour market performance.
7. And Layne-Farrar's claim (p. 20, fn 58) that no such data is available after 1997 is false.
8. Statistics Canada replaced its previous CALURA union membership data series, based on a survey of unions, with a more comprehensive and robust series based on the LFS survey of households, beginning in 1997. This leaves one year (1996) for which no unionization data are available; it also introduces a problem of potential non-consistency in the unionization data pre-1995 and post-1997, which we consider in our own regressions below.
9. The classic reference is Granger and Newbold (1974). Layne-Farrar recognizes the difference between correlation and causation (p. 22, fn 62), but her proposed solution to the issue (lagging the independent variable) does not address the problem of non-stationarity.
10. The Layne-Farrar regressions were performed on pooled data for all of the provinces. We re-create those regressions in Section 6 below. But as discussed, we also apply the Layne-Farrar specification to aggregate national Canadian data, in Section 5. The regression reported in Column A of Table 2 thus corresponds to the regression reported in Column A of Table 3.
11. For example, perhaps a theorist might argue that well-off foreigners will declare more of their income on Canadian tax returns if they were confident that the revenues they pay do not end up supporting welfare programs instituted thanks to union lobbying efforts; that businesses invest more (and hence write off their existing capital stock faster) when troublesome unions are less intrusive; that consumers must take on more debt when their wages are lower as a result of lower unionization; or that individuals are more likely to take up bad habits (like smoking and drinking) when they are forced to subsist on poverty-level wages thanks to the absence of unions. All of these "theories" are consistent with the econometric results reported in Columns B through E of Table 2 – and all, of course, are laughable.
12. And these differences are acknowledged by Layne-Farrar when she provides a range of possible predicted outcomes for U.S. employment and unemployment resulting from the *Employee Free Choice Act*.
13. One possible indicator of mis-specification is a low value (significantly lower than 2) for the Durbin-Watson test score which is routinely reported by econometric programs. Layne-Farrar does not report Durbin-Watson scores for her regressions. However, the re-creation of her findings which is conducted in Section 6 of this paper indicates that D-W scores for these equations are indeed too low, reinforcing the suspicion of mis-specification bias.
14. Palley (2006) reports international empirical evidence suggesting that in fact central banks increase interest rates more aggressively in jurisdictions with higher union density.
15. The divergence in labour market performance is considered by a special series of articles introduced by Riddell and Sharpe (1998).
16. Stanford (2008) considers some dimensions of this growing reliance on primary commodity exports, especially petroleum.
17. The OECD (2006) report does not specify whether this is due to a reduction in employment, or an increase in the labour force participation of the non-employed. Either can affect the reported unemployment rate, but with very different economic (and social) effects.

18. These other control variables were not consistently significant in the results reported in Layne-Farrar's Table 3, either. Here and below, we conclude that a variable is statistically significant if the null hypothesis can be rejected at the 95% level of confidence.

19. As discussed above, the original Layne-Farrar regressions are reportedly estimated over a longer sample period, from 1976 through 1997. But original data for all variables (excluding her "extrapolated" data and years for which provincial CPI and GDP data are unavailable) is only available (after adjusting for lags) for the period from 1984 through 1995.

20. In 1995 the former survey of unions was discontinued; beginning in 1997 unionization rates are calculated based on the labour force survey. For our regressions an approximate 1996 unionization rate was interpolated between the 1995 and 1997 data points.

21. The first data point from the new series on unionization was 1997. The first year for which the equation can consider lagged unionization is therefore 1998, and the first year it can consider the lagged change in unionization is 1999.

22. We hasten to emphasize that by successfully re-creating Layne-Farrar's findings (in this section and then, for the employment rate, in section 6.b.1) using our own data set, we are in no way validating the legitimacy or interpretation of those results – rather, we are simply confirming how those results were attained. For all the reasons described above, in our judgment Layne-Farrar's inferences are invalid and highly misleading.

23. As noted in Section 2 above, it is our opinion that the random effects approach is not appropriate in this setting, since it is modeling the labour market performance of entire jurisdictions, not randomly selected agents. However we report the results anyway to preserve full comparability with the Layne-Farrar analysis; random effects results should be interpreted with caution.

24. Layne-Farrar did not report Durbin-Watson statistics for her regressions.

25. As noted above, Layne-Farrar (unusually) did not report Durbin-Watson statistics for her regressions, nor attempt to correct her results for this clear evidence of autocorrelation in the error term.

26. As reported in Table 1, we can confidently conclude that first-differenced transformations of almost all of the variables included in Layne-Farrar's regressions are stationary.

27. There were no significant qualitative differences in these results for the two sub-periods considered above: 1984 through 1995, and 1999 through 2008. In particular, the unionization variable was never statistically significant in any of these sub-period regressions. Full results for these sub-periods are available on request from the authors.

28. As with the unemployment rate regressions, our re-creation of Layne-Farrar's results in no way should imply that those re-created results are robust or valid. We have simply demonstrated how they were attained.

29. Once again Table 10 presents only the results of this larger model for the full sample period (1984 through 2008). There were no major qualitative differences in the results for sub-samples (1984 to 1995, and 1999 to 2008), and unionization was never significant. Full results for the sub-sample periods are available from the authors.

30. Perhaps this helps to explain why Layne-Farrar conducted her analysis using Canadian data, rather than U.S. data.

31. These figures are calculated by simply applying Canada's higher employment and participation rates, and lower unemployment rate, to the U.S. working age population for 2008.

32. Measured by the share of households with less than half of median income, Canada's poverty rate in 2000-2004 was 11.4 percent, versus 17 percent in the U.S. This 5.4 percentage point difference, applied to the total population of U.S. households, is equivalent to 6.5 million households. Poverty data as reported in the United Nations Development Program *Human Development Report* 2007/08, Table 4.

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