THE ROBUSTNESS OF PROVINCIAL PANEL-DATA STUDIES OF MINIMUM WAGES IN CANADA

Tony Myatt
Department of Economics
University of New Brunswick
Fredericton
Canada NB, E3B 5A3
tmyatt@unb.ca

James Ted McDonald
Department of Economics
University of New Brunswick
Fredericton
Canada NB E3B 5A3
tedmcdon@unb.ca

Abstract.
A series of papers have established that minimum wages have negative employment effects on teenagers in Canada. Most of these papers assume identical coefficients across provinces, though some allow for province-specific effects – either for the minimum wage or other control variables. This paper systematically tests for province-specific effects. We not only find that these effects cannot be rejected, but that omitting them causes the model to fail Ramsey's test for specification error. Including only some province-specific effects appears to weaken the argument that minimum wages have adverse employment effects. However, this model is dominated by another that includes the full array of province-specific effects, and this latter model – on balance – supports the mainstream view.

Key Words: Minimum wages; teenage employment; panel data sets; specification error; province-specific effects.

JEL Codes: D40, J22, J23, J38, J80.

Résumé. La robustesse des études basées sur les panels de données provinciales concernant le salaire minimum au Canada
Une série d'articles ont démontré que le salaire minimum a un effet négatif sur l'emploi des adolescents au Canada. La plupart de ces articles combinent les données temps agrégées sur les provinces en panels de données, et la plupart présupposent des coefficients identiques à travers les provinces.

Un seul article (de Goldberg et Green, 1999) a trouvé des effets positifs sur l'emploi des adolescents. Cependant, Baker et al (2003) démontrent que ce résultat différait parce que Goldberg et Green avaient utilisé une spécification logarithmique plutôt que linéaire. En tenant compte des effets spécifiques aux provinces pour les variables de contrôle, ils démontrent que les deux modèles, linéaires et log-linéaires, attribuent au salaire minimum les mêmes effets négatifs.

Plusieurs autres articles tiennent également compte des effets spécifiques aux provinces. Par exemple, Grenier et Seguin (1991) tiennent compte des effets spécifiques aux provinces pour la variable salaire minimum elle-même. Plus récemment, dans leur étude internationale de vingt pays de l'OCDE, Neumark et Wascher (2004) tiennent compte des tendances temps spécifiques aux pays et des variables d'interaction entre le salaire minimum et les indicateurs de marché du travail.

Cet article examine la robustesse des résultats canadiens à la fois dans le choix de la forme fonctionnelle (linéaire ou log-linéaire) et dans l'utilisation des variables spécifiques aux provinces. Il semble que la forme linéaire continue d'être supérieure à la logarithmique dans la mesure où nous n'avons trouvé aucune spécification utilisant la forme logarithmique qui passe le test de Ramsey sur l'erreur de spécification. Si l'on inclut uniquement les effets spécifiques aux provinces pour le salaire minimum, cela affaiblit l'argument des effets négatifs sur l'emploi. De plus, ce modèle satisfait au test de Ramsey. Cependant, ce modèle est dominé par un autre qui inclut également   les effets spécifiques aux provinces pour les

variables de contrôle, et cet autre modèle – tout compte fait – soutient le point de vue dominant.

En ce qui concerne la spécification logarithmique, nous trouvons que non seulement les effets spécifiques aux provinces ne peuvent pas être rejetés, mais que si on les oublie, le modèle ne satisfait pas au test de Ramsey sur l'erreur de spécification. Cela suggère que les politiques publiques doivent trouver un équilibre entre, d'une part les effets bénéfiques de l'augmentation du salaire minimum sur les familles à faible revenu et la justice sociale et, d'autre part, ses effets négatifs sur l'emploi.

Cet article souligne le besoin de tester systématiquement l'erreur de spécification quand on utilise des données temps sur les provinces combinées en panels. Il suggère que l'omission des effets spécifiques aux provinces peut être une des causes de cette erreur. Dans des travaux ultérieurs nous avons l'intention de chercher d'autres causes d'erreur de spécification, dont le maintien de coefficients identiques pour les variables de contrôle sur une longue période.

Mots clé : Salaire minimum, emploi d'adolescents, panels de données, erreur de spécification.

Introduction

The degree of consensus among economists on the effects of minimum wages has weakened significantly since the early 1990s[1]. Partly this reflects the work of Card, Krueger, and others[2] who find that minimum wage increases often have a zero or even a positive impact on employment. Their results have ignited a lively debate. Neumark and Wascher (2004) point out that conflicting empirical evidence can be found for nearly every country in the world, with two notable exceptions: Spain and Canada. The most often cited explanation for the Canadian exception is Hammermesh's (2002) observation that Canada is "a desirable laboratory" for testing minimum wage effects because minimum wages are set provincially, which gives more identifying variation.

Recent studies yielding significant negative employment effects in Canada include Kan and Sharir (1996), Baker, Benjamin and Stanger (hereafter referred to as BBS) (1999), Baker (2003), Yuen (2003), Campolieti, Fang, and Gunderson (2005), and Campolieti, Gunderson and Riddell (2006).[3] All but two of these studies combine aggregate time-series data on provinces (or regions) into panel-data sets.[4]

The only paper to find no significant minimum wage effect is that by Goldberg and Green (1999). However, BBS show that this anomalous result is because Goldberg and Green use a logarithmic specification. They conjecture that this sensitivity to the choice of functional form arises because of "heterogeneity in the cyclical effects of various control variables across provinces that are accommodated differently in the linear and log-linear

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[1] See the surveys by Kearl et al (1979), Alston et al. (1992), and Fuller et al (2003).

[2] References can be found in Card and Krueger (1995).

[3] Yuen (2003) found sensitivity of the results to the definition of the control group. Excluding high-wage workers from the control group eliminated the minimum wage effect for teenage workers overall; but focusing on only 'longer term' low-wage workers, the minimum wage effect reappeared.

[4] The exceptions are Yuen (2003) and Campolieti et al (2005). The popularity of provincially aggregated data is because they are available for a much longer time span. For example, data from the Survey of Labor Income Dynamics (an individual panel data set) only has a 6 year duration.

specifications" (1999: 328). When BBS allow for province-specific effects for their control variables, they find that both linear and log-linear models have similar negative minimum wage effects.

Other papers also allow for province-specific effects – though for different control variables than BBS allowed. For example, Grenier and Seguin (1991) (using Canadian data) and Williams (1993) (using U.S. data) both allow for regional-specific effects for the minimum wage variable itself. More recently, in their international study of twenty OECD countries, Neumark and Wascher (2004) allow for country-specific time trends and for interaction terms between minimum wages and labour market indicator variables.

This paper investigates the robustness of Canadian results both to the choice of functional form, and to the use of province-specific variables – with the advantage of having both more data, and more recent data, than BBS (whereas, they have 18 years of data, we have 29 years). Given that the standard panel data model usually imposes identical coefficients across the spatial dimension, there is a gap in the literature: it is missing a systematic investigation of the effects of province-specific variables. We not only find that these effects cannot be rejected, but that omitting them causes the model to fail Ramsey's test for specification error. Including only province-specific effects for the minimum wage weakens the argument for adverse employment effects. However, this model is dominated by one that also includes province-specific effects for the control variables, and this model – on balance – supports the mainstream view.

The Econometric Specification

It is important to remember that it is not just differences in research design that can lead to different results. Dewald et al (1986) had great difficulty *replicating* published results. Replication is an essential component of scientific methodology, and is the only way to create a defensible, coherent body of knowledge. Yet, seldom are results replicated. They note: "It is widely recognised that errors occur in empirical economic research and appear in published empirical articles. Our results ... suggest that such errors may be quite common" (1986: 600)[5] McCullough et al (2003, 2006) suggest that things have not improved. With this in mind, and also to benchmark our data, we begin by replicating the base model of BBS, which can be written as:

$$E_{it} = \alpha + \beta_1 \cdot MINW_{it} + \varphi \cdot X_{it} + \sum_{i=1}^{N-1} \pi_i \cdot PROV_i + \sum_{t=1}^{T-1} \phi_t \cdot YEAR_t + \varepsilon_{it}$$

where E_{it} is the teenage employment-population ratio; $MINW_{it}$ is the ratio of the adult minimum wage to the average hourly wage in manufacturing[6]; X_{it} is the vector of control variables; $PROV_i$, is a set of time-invariant provincial dummies; and $YEAR_i$, is a set of year dummy variables. The control variables are the prime-aged male unemployment rate

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[5] William Broad and Nicholas Wade in *Betrayers of the Truth* (1983) present examples where the inability of other researchers to replicate published scientific findings revealed both inadvertent errors and outright fraud. However, Dewald et al (1986) found that the errors did not significantly affect the conclusions in the majority of cases.

[6] Several provinces have allowed sub-minimum wages for individuals under 18. However, Baker et al (1999) show that the wage distribution for teens has a prominent spike at the adult minimum wage. They use the adult minimum wage throughout their paper.

and the level of real provincial GDP (both used to control for aggregate economic activity), and the population share of teenagers relative to the working age population 15-64 (used to control for supply variation).

Column (1) of Table 1 replicates the base model of BBS using their time period, 1976-93, and the same nine Canadian provinces.[7] The resulting minimum wage elasticity (–0.25) is almost identical to theirs (–0.24).[8] Column (2) shows the results for the logarithmic version of the model and corroborates the Goldberg and Green (1999) result that minimum wages have no significant effect using data from 1976-93. The conclusion reached by BBS, that the linear model is preferred, is confirmed by the RESET test. The linear version (in column (1)) passes the RESET test (using a quadratic and cubic transformation) with a p-value of 0.13, while the logarithmic version fails with a p-value of 0.001. However, these conclusions do not survive extension of the data period.

Columns (3) and (4) re-estimate BBS's base model in linear and logarithmic forms (respectively) for the entire period, 1976-2004. There are two noticeable differences from the previous results: first, in the logged version the minimum wage coefficient is now significantly negative; and second, both versions now fail the RESET test, suggesting specification error.

The most obvious problem with the previous specifications is that they ignore the accumulation of evidence that minimum wage effects occur with a time lag. This problem is corrected in the 'pre-specified' model of Levine (2001), Neumark (2001), and Campolieti et al (2006).[9] Essentially the pre-specified model is BBS's base model with the addition of a lagged minimum wage term. A second possible source of specification error is heterogeneity of cyclical effects across provinces, as noted by BBS (1999: 328). Cyclical effects are captured both through the prime-aged male unemployment rate, and through the level of real provincial GDP. The inclusion of common year dummies implies that the real GDP coefficient will reflect divergences from a common trend (or common year shocks). If each province has a different trend (as is the case for Canadian provinces) this variable will not well capture the provincial business cycle. Including province-specific year dummies may help to alleviate this problem. Neumark and Wascher (2004) provide a precedent – they allow for country-specific time trends in their international study of twenty OECD countries.

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[7] They exclude the Province of Prince Edward Island (PEI) and the Yukon and Northwest Territories, since they were unable to obtain a complete series of all the variables of interest owing to small sample size. In the Canadian literature about half the published papers include PEI, and half exclude it.

[8] However, we obtain different coefficient estimates for the teenage population share and real GDP. The former arises because BBS deflate teenage population by total population 15 years of age and over, rather than total population of working age. The latter arises from different provincial real GDP data. See the Data Appendix for further discussion.

[9] In an attempt to cut through 'author biases' Levine (2001) committed the journal *Industrial Relations* to a 'pre-specified' research design where opposing teams would use the same econometric model to be agreed upon before the data became available.

TABLE 1 Benchmarking to the Existing Literature

	(1)	(2)	(3)	(4)	(5)	(6)
	Linear 1976-93	Logged 1976-93	Linear 1976-2004	Logged 1976-2004	Linear 1976-2004	Linear 1976-2004
MINW	-0.2992** (-3.41)	0.0046 (0.06)	-0.3091** (-6.24)	-0.2427** (-5.68)	0.0743 (0.67)	0.1163 (1.08)
MINW(-1)					-0.4452** (-3.96)	-0.3664** (-3.62)
Unemployment Rate	-1.664** (-13.90)	-0.2005** (10.92)	-1.7636** (-13.01)	-0.24067** (-11.94)	-1.7756** (13.66)	-1.786** (-13.86)
Teenage Population	-0.2529 (-0.54)	-0.6216** (-4.83)	-2.2554** (-6.47)	-0.78908** (-8.34)	-2.3768** (-7.03)	-0.9127* (-2.22)
Real GDP	0.4349** (4.11)	-0.04542 (-0.44)	-0.2028** (-4.85)	-0.1828* (-2.50)	-0.2035** (-4.91)	-0.2005 (-1.05)
Province dummies	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES
Province-specific time trend					NO	YES
Minimum wage elasticity	**-0.2501**** (-3.41)	**0.0046** (0.06)	**-0.2675**** (-6.24)	**-0.2427**** (-5.68)	**-0.3299**** (-7.60)	**-0.2164**** (-3.27)
RESET TEST (p-value)	0.127	0.001**	0.000**	0.003**	0.000**	0.001**
AIC	-5.325	-3.332	-4.906	-3.151	-5.003	-5.238
Adjusted R^2	0.968	0.96	0.935	0.937	0.942	0.955
Sample size	162	162	261	261	252	252

Note: ** denotes significance at the 1% level and * denotes significance at the 5% level. t-statistics are based on heteroskedastic-robust standard errors. All regressions throughout are weighted by province and year specific population.

Column (5) of Table 1 shows that the lagged minimum wage term is significant in the linear model and its inclusion increases the absolute value of the minimum wage coefficient by about 20% from –0.267 to –0.3299. But the model still fails Ramsey's RESET test. Column (6) adds province-specific trend terms. An F-test shows that these terms (as a group) are significantly different from zero, and their inclusion reduces the value of Akaike's Information Criterion score, further suggesting their inclusion is merited. But this model also fails the RESET test. Similar results (not shown) were obtained using the logarithmic version of the model. Evidently, the specification error indicated by the RESET test does not hinge on whether the linear or log-linear specification is used. In other results (not shown) we tried including other controls such as: unemployment insurance generosity (and eligibility); unionisation rates; industrial composition; and the proportion of the workforce that works part-time. None of these variables (either alone or collectively) corrected the specification error shown by the RESET test, neither in the linear nor the logarithmic version.

A plausible hypothesis is that the specification error is due to the imposition of common coefficients across heterogeneous provinces. But before proceeding to a more systematic investigation of this, we attempted to determine whether the linear or log-linear form would be more fruitful. Therefore, we ran a series of Box-Cox tests to compare them. As Table 2 shows, these confirmed the BBS result that the linear model is overwhelmingly preferred in the 1976-93 period, but there is only a slight preference for the linear model in

the whole period (1976-2004) (in so far as lambda is closer to unity than zero). In what follows, we focus on the linear model, and footnote comparisons with the logarithmic version.

TABLE 2 Box-Cox Test of Linear versus Logarithmic Specifications

A: PRE-SPECIFIED RESEARCH DESIGN		
	1976-93	1976-2004
Minimum Wage Elasticity	– 0.2801	– 0.2903
Lambda	0.7518	0.5077
Likelihood Ratio ($\lambda = 1$)	14.25	47.07
Likelihood Ratio ($\lambda = 0$)	70.14	75.98
B: PRE-SPECIFIED RESEARCH DESIGN + PROV SPECIFIC TRENDS		
	1976-93	1976-2004
Minimum Wage Elasticity	-0.21918	-0.18547
Lambda	0.9800	0.6390
Likelihood Ratio ($\lambda = 1$)	5.83	23.62
Likelihood Ratio ($\lambda = 0$)	106.25	39.27

Province-Specific Interaction Terms

A generalisation of the specification that includes province-specific time trends is one that also allows the impact of the controls, and even the minimum wage terms, to vary by province. There is precedent in the literature for minimum wage effects to be allowed to vary by province. For example, Grenier and Seguin (1991) and Williams (1993) both allow for regionally specific minimum wage effects. BBS allowed for provincial interaction terms for all their control variables but retained the restriction that minimum wages must have the same effect across provinces. More recently, Neumark and Wascher (2004) allow for interaction terms between minimum wages and other labour market indicator variables.

Our strategy (given what is already found in BBS) involves four specifications: (1) the standard panel data model – both the controls and the minimum wage are restricted to have the same effect across provinces; (2) a specification where the minimum wage has province-specific effects but the controls do not; (3) a specification where the controls have province-specific effects but the minimum wage does not (as in BBS); and (4) a specification without any restrictions – all independent variables (the control variables and the minimum wage) are allowed to have province-specific effects. Table 3 gives estimates for the linear functional form (both the pre-specified and 'full' models, where the latter adds province-specific time trends), for the entire data period (1976-2004).[10]

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[10] BBS show that allowing interaction terms for the control variables did not affect the estimated minimum wage elasticity in the linear formulation while the same exercise in the logarithmic specification brought the log estimates into line with the linear estimates. This is not the case for the longer 1976-2004 period: the minimum wage elasticity is substantially increased by allowing the control variables to have province-specific effects in both the linear and log-linear models. For example, comparing rows (3A) and (1A) of Table 3 we see an increase of around 50% in the pre-specified model estimates, and comparing rows (3B) and (1B) of Table 3 we see an increase of around 135% for the full model. (This comparison mirrors the procedure of BSS, page 328).   Similar results (not shown) were obtained using the log-linear model.

TABLE 3 Minimum Wage Elasticity Allowing for Interactions, 1976-2004

THE LINEAR FUNCTIONAL FORM

Province-Specific Variables	BC	AB	SK	MN	ON	PQ	NB	NS	NF	adj. R²	AIC	RESET
PRE-SPECIFIED MODEL												
1A None	-0.3299**	-0.3299**	-0.3299**	-0.3299**	-0.3299**	-0.3299**	-0.3299**	-0.3299**	-0.3299**	0.942	-5.003	0.0001
	-7.60	-7.60	-7.60	-7.60	-7.60	-7.60	-7.60	-7.60	-7.60			
2A Only MINW & MINW(-1)	-0.4456**	0.1172*	0.0715	-0.0910	-0.6414**	-0.1647**	-0.1910	-0.0049	0.1645	0.963	-5.417	0.0019
	-10.62	1.73	0.62	-0.85	-8.67	-2.12	-1.22	-0.03	0.64			
3A Everything Except MINW & MINW(-1)	-0.5077**	-0.5077**	-0.5077**	-0.5077**	-0.5077**	-0.5077**	-0.5077**	-0.5077**	-0.5077**	0.973	-5.711	0.0024
	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21	-7.21			
4A Everything	-0.2113**	-0.3162**	-0.4399	-0.3478**	-0.6578**	-0.555**	-0.0315	-0.0622	0.42267	0.981	-6.005	0.2698
	-2.40	-2.61	-1.64	-1.99	-9.33	-3.01	-0.11	-0.27	1.04			
Number of regressions where minimum wages have significant negative effects	4/4	3/4	2/4	3/4	4/4	4/4	2/4	2/4	2/4			
THE PRE-SPECIFIED MODEL + PROVINCE SPECIFIC TIME TREND												
1B None	-0.2164**	-0.2164**	-0.2164**	-0.2164**	-0.2164**	-0.2164**	-0.2164**	-0.2164**	-0.2164**	0.955	-5.238	0.0014
	-3.27	-3.27	-3.27	-3.27	-3.27	-3.27	-3.27	-3.27	-3.27			
2B Only MINW & MINW(-1)	-0.3152**	0.0888	0.1893	-0.0043	-0.5280**	-0.0605	0.1118	0.0606	0.2786	0.969	-5.547	0.0779
	-4.63	0.86	1.38	-0.03	-5.95	-0.66	0.55	0.25	0.81			
3B Everything Except MINW & MINW(-1)	-0.5256**	-0.5256**	-0.5256**	-0.5256**	-0.5256**	-0.5256**	-0.5256**	-0.5256**	-0.5256**	0.974	-5.729	0.1520
	-5.11	-5.11	-5.11	-5.11	-5.11	-5.11	-5.11	-5.11	-5.11			
4B Everything	-0.1043	-0.4080**	-0.3798	-0.3606	-0.6244**	-0.3725	-0.0808	-0.0356	0.5381	0.981	-5.975	0.3871
	-0.87	-2.73	-1.31	-1.57	-6.22	-1.65	-0.24	-0.15	1.1			
Number of regressions where minimum wages have significant negative effects	3/4	3/4	2/4	2/4	4/4	2/4	2/4	2/4	2/4			

Note: ** denotes significance at the 1% level and * denotes significance at the 5% level

Is allowing the minimum wage effect to vary across provinces important? Comparing row (2) with row (1) in Table 3 allows us to evaluate its importance when the other controls are restricted to have the same effect across provinces. In this context, the answer is unequivocal: allowing province-specific minimum wages seriously undermines the evidence that minimum wages have adverse employment effects. Whereas in rows (1A) and (1B) minimum wages are significantly negative, in row (2A) only two provinces show significantly negative employment effects, and in row (2B) as many as five (out of nine) provinces have positive (though insignificant) coefficients.

We can also evaluate the importance of province-specific minimum wage effects against a backdrop where the controls are allowed to have province-specific effects (by comparing rows (3) and (4)). In this context, the answer is more mixed. Whereas in rows (3A) and (3B) minimum wages have their most negative effects, in row (4A) minimum wages remain significantly negative in five provinces, while in row (4B) they remain significantly negative in only two provinces.

It seems that incorporating province-specific effects can either weaken or strengthen the argument that minimum wages have adverse employment effects, depending on which variables are allowed to have them. However, this non-robustness can be resolved through diagnostic testing. All but three regressions reported in Table 3 fail Ramsey's RESET test, indicating specification error.[11] The three equations that pass the RESET test are 4A, 3B and 4B. Furthermore, we can test the validity of the different sets of constraints implied by specifications (3), (2), and (1) by comparing them with specification (4) (the completely unconstrained version of the system) using standard F-tests. In all cases, the constraints are rejected in favour of the unconstrained specification. (We can see that the adjusted R^2 with everything province-specific is higher than any other specification.)

We are left with two well-specified regressions: rows 4A and 4B in Table 3. These equations appear to have quite different implications for adverse employment effects of minimum wages. In equation 4A (the pre-specified model) five of the nine provinces exhibit significant minimum wage effects, whereas in equation 4B (the full model) minimum wages are significant in only two of the nine provinces (Alberta and Ontario). Which specification is better? At issue is the appropriateness of including province-specific time trends. An F-test that the province-specific time trends are insignificantly different from zero rejects the null hypothesis. On the other hand, the Aikake Information Criterion (that penalizes models that become too parameterised) indicates a preference for the regression that omits the province-specific time trends. But since the difference in absolute terms between the two AIC numbers is so small (0.03), it seems there is very little basis to prefer one specification over another.

Fortunately, the view that the two equations have very different implications is questionable. A closer inspection reveals that the minimum wage effects in the two models are very close for almost every province, and (it turns out) not statistically different from each other. In effect, the two models have almost identical implications for minimum wage effects; they are just estimated a little more precisely in one model than in the other.

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[11] We also ran the province-specific interaction exercise using the logarithmic functional form (not shown). In this case, every single logarithmic equation failed the RESET test, often resoundingly. On balance, therefore, it seems that the superiority of the linear functional form (over the logarithmic) extends beyond 1993.

Conclusions

Canada's provinces are remarkably heterogeneous: BC is heavily reliant on forestry and Saskatchewan on wheat production; Alberta is an oil exporter, while Ontario and Quebec are oil importers and constitute the industrial heartland. It may be reasonable, therefore, to allow for differences in sensitivity to minimum wage effects as did Grenier and Seguin (1991). Just as reasonably, we could allow the other control variables to have province-specific effects, either with the restriction that minimum wage effects are the same across provinces, like in BBS (1999), or without it. None of these possibilities can be ruled out a priori.

   We have shown that the results are sensitive to which province-specific variables are included. In particular, when only minimum wages are allowed to be province-specific, as many as five (out of nine) provinces have positive (though insignificant) coefficients (row 2B, Table 3). We have also shown the importance of diagnostic testing. It turns out that, using Canadian data (1976-2004), allowing all right-hand side variables to have province-specific effects is necessary to avoid specification error as measured by Ramsey's RESET test. [12] Furthermore, the constraints implied by the imposition of common coefficients across provinces are rejected both for the control variables and for minimum wages themselves.

   On balance, our unrestricted estimates support the view that minimum wages adversely affect teenage employment in Canada. In the pre-specified model, eight of the nine provinces have negative coefficients, five of which are significant. In the full model, the same eight provinces have negative coefficients, though only two of these are significant. The Akaike Information Criterion indicates a slight preference for the first model. Furthermore, the coefficient estimates are not significantly different in the two models. Essentially, the two models have almost identical implications for minimum wage effects; it's just that they are estimated a little more precisely in one model than in the other. [13]

   In so far as higher minimum wages do adversely affect teenage employment, public policy must balance the beneficial income and equity effects from increasing the minimum wage against the adverse employment effects. It is worth noting that in a detailed study of the redistributive effects of the minimum wage, Fortin and Lemieux (2000) show that minimum wages remain a useful redistributive tool. [14]

   This paper underlines the need for routine testing for specification error when using pooled time-series data. It suggests that the omission of province-specific effects can be

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[12] Of course, this statement is not necessarily true for other data periods. Indeed, we show in Table 1 that allowing province-specific effects was not necessary in 1976 to 1993 period. The reasons for this are something of a puzzle.

[13] Allowing province-specific effects opens the door to trying to explain why some provinces have stronger effects than others. We are not able to go much beyond emphasizing the heterogeneity of the provinces. However, it is possible that the positive minimum wage coefficient in Newfoundland might be due to the minimum wage not being binding there. Using data from successive waves of the Statistics Canada Survey of Consumer Finances we obtained data on the proportion of employed teenagers with hourly wages less than 25 cents above the minimum wage between 1981 and 1997. Newfoundland had the lowest ratio at 0.37. Ontario had the second highest, at 0.41.

[14] Fortin and Lemieux find that find that individuals in the lower half of the distribution of the family income-to-needs ratio, benefit the most from the minimum wage. Indeed, they find that the minimum wage is almost as "progressive" as all government transfer programs considered together.

one source of such error. In future work we intend to look for other sources of specification error, and in particular, the imposition of identical coefficients over time.

A minor theme of this paper has been the choice of functional form. It seems that the linear form is still superior to the logarithmic for the period 1976-2004, in so far as we were unable to find any specifications using the logarithmic form that passed the RESET test.

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Data Appendix

Our estimates were obtained using the Stata software. Data and programs are available from the authors on request.

Our full dataset spans the years 1976-2004 and includes all Canadian provinces except Prince Edward Island. While the final dataset is annual, the minimum wage ratio is an average of monthly data, obtained from the following sources.

The minimum wage ratio:

Minimum wages for Canadian adult workers since 1965 are to be obtained from the Human Resources Development Canada website:

http://www110.hrdc-drhc.gc.ca/psait_spila/lmnec_eslc/eslc/salaire_minwage/index.cfm/doc/english

This data set gives the exact date when changes occurred, allowing us to construct monthly data on the adult minimum wage.

This was deflated by average hourly earnings (including overtime) of workers paid by the hour, in manufacturing industries. (The frequency of this data was also monthly.)

$ The 1983 to 2000 data was obtained from Cansim II, Table 2810004, series numbers (for B.C., Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia and Newfoundland respectively) are as follows: V312117, V305588, V299343, V293744, V287442, V279936, V273156, V268142, V259846.

$ The above series are the same as that used by Baker, Benjamin and Stanger (1999). They obtained data prior to 1983 from special tabulations performed by Stats Canada. We are grateful to them for sharing their data with us.

$ Since the series in Table 281004 were discontinued in 2000, we updated our series using Table 2810030. The series used (from B.C. to Newfoundland) were: V1807323, V1807171, V1807060, V1806904, V1806717, V1806534, V1806455, V1806369, V1806255.

Employment, unemployment, and population data:

Data on employment, population, and unemployment were all obtained from Table Number 2820001. Series numbers (for B.C., Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia and Newfoundland respectively) are as follows:

$	Teenage population, both sexes, 15 to 19 years: V2097397, V2096717, V2096087, V2095457, V2094827, V2094197, V2093567, V2092937, V2091668.

$	Total population, both sexes, 15 to 64 years: V2097396, V2096716, V2096086, V2095456, V2094826, V2094196, V2093566, V2092936, V2091667.

$	Teenaged employment, both sexes, 15 to 19 years: V2097439, V2096759, V2096129, V2095499, V2094869, V2094239, V2093609, V2092979, V2091710.

$	Prime-aged male employment rate (employed/population), 25-54 years: V2097793, V2097113, V2096483, V2095853, V2095223, V2094593, V2093963, V2093333, V2092064.

$	Prime-aged male unemployment rate, 25 to 54 years (unemployed/labour force): V2097751, V2097071, V2096441, V2095811, V2095181, V2094551, V2093921, V2093291, V2092022.

$	Aggregate unemployment rate, 15 years and over (used to construct EI generosity series): V2097536, V2096856, V2096226, V2095596, V2094966, V2094336, V2093706, V2093076, V2091807.

Real GDP:

Statistics Canada has only published provincial real GDP data since 1981. One option, the one chosen by Baker, Benjamin and Stanger (1999), is to deflate provincial nominal GDP by the provincial CPI's. The option we chose was to use Statistics Canada's official data post-1981, and to use the Conference Board of Canada's estimates prior to 1981. We obtained a consistent series by calculating GDP growth rates from the Conference Board data, and "backcasting" from the 1981 estimate provided by Stats Canada.

The Stats Canada real provincial GDP data is to found in Cansim II, Table 3840002. The series numbers (from B.C. to Newfoundland) are: V3840347, V3840301, V3840255, V3840209, V3840163, V3840117, V3840071, V3840025, V3839933.

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