Who Bears the Burden of British Columbia's Employer Health Tax?

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Insights from the Literature and Some Empirical Evidence

by Ergete Ferede

Contents

Executive Summary

This study investigates the effect of British Columbia's recently implemented Employment Health Tax (EHT) on the average worker's wage and employment income in the province. Beginning in January 2019, the British Columbia government began replacing the Medical Services Plan (MSP) premiums with the EHT; the MSP is being phased out in 2020. MSP premiums had been levied on individuals and families to help finance the province's health care system. Individuals and families with relatively high incomes were subject to maximum premium payments of up to $900, while individuals and families with relatively low incomes were exempted from paying for the MSP.

The EHT is levied on employers with payrolls in excess of $500,000. The government's main justification for replacing the MSP with the EHT is that it would eliminate the tax burden imposed on individuals and families associated with the MSP premiums and effectively shift that tax burden to employers. The underlying assumption is that the actual incidence of the EHT would be borne by employers and would not be passed through to employees in the form of lower wages and other unfavourable labour market outcomes. However, a large number of empirical studies show that between two-thirds and 90 percent of payroll taxes are ultimately passed through to employees, primarily in the form of lower wages, but also as reduced employment. One might therefore expect workers in British Columbia to bear a substantial portion of the EHT, since the latter is effectively a payroll tax.

Since the EHT was only recently introduced, there is insufficient data to identify its effect on wage rates in British Columbia directly. However, the likely future effect of the EHT on wage rates and wage incomes should be similar to the historical effect of changes in other payroll taxes. This study examines the labour market effect of the combined changes in the employer portion of the federal payroll tax, as well as the British Columbia Workers' Compensation Board's premium rates. The federal payroll tax imposed on employers in British Columbia covers employment insurance (EI) premiums and funding for the Canada Pension Plan (CPP). Premiums for the Compensation Board fund occupational health and safety at the provincial level. Focusing on the effects of these established payroll

taxes is an indirect way to estimate the likely labour market consequences of the EHT.

Using industry-level data for British Columbia covering the period from 1985 to 2017, this study finds that a 10 percent increase in employers' payroll tax is associated, on average, with a reduction of the hourly wage rate by approximately 1.1 percent in the short-run and by about 3 percent in the long-run. Since the EHT increases employer payroll taxes by approximately 22 percent, this increase can be expected to reduce the average hourly wage rate earned by workers in the province by $0.59 in the short-run and by $1.64 in the long-run (in 2019 constant dollars). Given the average number of hours worked in 2019, this translates into a reduction in average annual income for BC workers of $2,987 in 2019 constant dollars when the full effects of the EHT are passed through to employees.

The key implication of this study is that the burden of British Columbia's new EHT will be borne primarily by workers in the form of lower wage rates. This finding raises serious questions about the provincial government's assertion that replacing the MSP with the EHT will shift the burden of taxation to fund health care from individuals and families to owners of businesses in the province.

Introduction

Governments often use payroll taxes to finance various social security services including health care. British Columbia's recently introduced Employer Health Tax (EHT) is one such tax. The government of British Columbia (BC) replaced the Medical Services Plan (MSP) premiums with the EHT beginning in January 2019. The MSP premium was reduced by half in 2018 and again in 2019 and eventually phased out in 2020. The EHT is levied on employers with payrolls in excess of $500,000. The main justification for the introduction of the EHT was to eliminate the tax burden associated with MSP premiums from individuals and families. According to the government's own forecast, eliminating the MSP and replacing it with the EHT would save an average individual up to $900 annually (Government of British Columbia, 2018a). Although BC introduced the EHT as a way to shift the tax burden from individual employees to employers, such taxes generally tend to have wider impacts on the economy. Who actually bears the burden of employer payroll taxes such as the EHT?

The incidence of payroll taxes—the question of who bears the burden of payroll taxes—has been one of the most contentious issues in public finance. A number of previous theoretical studies show that employer payroll taxes distort labour markets. As Dahlby (1993, 2008) discussed, in a competitive labour market model employer payroll taxes raise the overall cost of hiring workers (inclusive of the payroll tax) and reduce the demand for labour. Other factors such as minimum wage legislation and higher rates of labour unionization also cause a reduction in demand for labour by employers. The decrease in the demand for labour causes a fall in the equilibrium wage rate and the level of employment. This is because firms attempt to offset the increase in labour costs caused by employer payroll taxes by lowering the wage rate that they pay to their employees. Thus, the burden of employer payroll taxes may partly fall on workers in the form of reduced wage rates. Further, as Hamermesh (1993) and others show, wage rates tend to adjust slowly in response to changes in labour demand influencing factors such as employer payroll taxes. Consequently, it may take a lengthy period of time for the labour market to achieve its long-run equilibrium and for an economy to feel the complete effect of employer taxes on wages. The implication of this is that the burden of employer

payroll taxes on workers is likely to be much larger in the long run than it first appeared to be in the short run. Many of the previous empirical studies surveyed in this paper also indicate that the burden of employer payroll taxes primarily falls on workers in the form of reduced wages.

This study's main objective is to shed light on the potential effect of BC's new EHT by examining the impact of employer payroll taxes on the wage rate. To this end, we conducted an empirical investigation of the effects of employer payroll taxes on wages using industry-level panel data from BC from 1985 to 2017. A notable feature of our empirical analysis is that it explicitly takes into account the dynamic adjustment of wage rates and identifies both the short-term and the long-term effects of employer payroll taxes on wages. This is an important contribution to the literature as previous empirical studies largely ignore this issue. This paper's empirical findings show that an increase in employer payroll taxes has adverse effects on the wage rate. According to this paper's main empirical result, a 10 percent increase in employer payroll taxes is associated with about a 1.1 percent and a 3.0 percent reduction in the wage rate in the short-run and the long-run respectively. Based on these results, we estimate that the introduction of the EHT, which raised employer payroll taxes by about 21.95 percent, is associated with a reduction in BC's average hourly wage rate in 2019 dollars by $0.59 in the short-term and $1.64 in the long-term. An important policy implication of this paper's empirical results is that part of the burden of employer payroll taxes such as the EHT is borne by workers in the form of reduced wage rates. This casts doubt on the BC government's initial justification for the introduction of EHT—namely, that under the EHT the tax burden would be shifted from individuals and families to employers and owners of businesses.

The remainder of this paper is organized as follows. The next section provides background information about the Employer Health Tax in BC. The section following gives a brief overview of related previous studies on payroll taxes. Then we present and discuss the empirical results before concluding.

Background

For many years, British Columbia used medical services plan (MSP) premiums levied on individuals and families to finance the provincial health care program. MSP premiums were based on family size and income. Over the years, these MSP premium payments were an important revenue source for the provincial government. The premiums and the income threshold for the various categories changed over time. One important aspect of the MSP was that individuals and families with relatively high income were subject to the maximum premium payments. On the other hand, individuals and families with very low income were not required to pay the premiums.[1] Table 1 shows the maximum MSP annual premium payments and the amount of revenue that the provincial government collected from these premiums over the four years prior to the plan's elimination in 2020.

As table 1 shows, over the last few years the provincial government raised more than $2 billion each year through MSP premiums. However, there was a concern that the burden of the MSP was much greater on low- and middle-income individuals and families than on those with high incomes. In fact, many people viewed MSP premiums as regressive. In response, the government reduced MSP premiums by 50 percent for 2018 and 2019. Table 1 shows that these cuts reduced the revenue from the source significantly.

In its 2017 budget, the provincial government announced that the MSP would be eliminated within four years. Not surprisingly, the government recognized that eliminating MSP premiums would require finding an alternative source to replace the lost revenue. To this end, the government appointed an MSP Task Force to study how to end the MSP premiums and find alternative ways of raising replacement revenue. The MSP Task Force (2018) made five recommendations for provincial tax reform initiatives. However, none suggested that an employer payroll tax be introduced,

[1] Low-income individuals and families with net income below a certain threshold amount were not required to pay premiums. For instance, from 2016 to 2019, families with a net income of less than $30,000 paid no MSP premiums.

Table 1: BC MSP Premiums and Revenues

	Annual maximum premium		
Year	Single	Family	Revenue (billions of dollars)
2016/17	$900	$1,800	$2.60
2017/18	$900	$1,800	$2.30
2018/19	$450	$900	$1.40
2019/20	$450	$900	$1.1 and $1.9[a]
2020/21	N/A	N/A	$1.9[a]

[a] Revenue from EHT

Source: Government of British Columbia (2020).

partly due to the concern that such taxes would hurt the province's business competitiveness, as was discussed by the Commission on Tax Competitiveness (2016). Nonetheless, the provincial government went ahead and introduced the Employer Health Tax (EHT)—a payroll tax imposed on employers—effective January 1, 2019, to recoup the revenue lost from the elimination of MSP premiums. While the provincial government used both the MSP premiums and EHT for 2019, it decided to completely eliminate MSP premiums beginning on January 1, 2020.[2] The government of British Columbia (2018a) has calculated that the elimination of MSP premiums will save average BC individuals up to $900 annually.

With the introduction of the EHT, British Columbia joined other Canadian provinces such as Ontario, Quebec, Manitoba, and Newfoundland and Labrador, which use similar taxes. In these provinces, as in BC, the applicable EHT rate for employers depends on their remuneration range. Employers in BC with remuneration less than $500, 000 are exempted from the EHT. On the other hand, employers with BC payrolls

[2] Prior to the introduction of EHT, some employers were already paying MSP premiums on behalf of their employees. But it should be emphasized that while the EHT is mandatory for employers with payrolls in excess of $500, 000, payment of MSP premiums by employers was voluntary. Although there is a paucity of data on the exact proportion of employers who used to pay MSP premiums for their employees, for such employers the impact of the EHT on their labour costs depends on whether their new tax bill is higher or lower.

Table 2: British Columbia Employer Health Tax Rate

Annual BC Remuneration	Applicable EHT rate	Tax liability	Tax as a percent of payroll
$500, 000 or less	0.00%	$0	0.00%
$750,000	2.93%	$7,313	0.98%
$1,000,000	2.93%	$14,625	1.46%
$1,250,000	2.93%	$21,938	1.76%
$1,500,000	2.93%	$29,250	1.95%
Over $1,500,000	1.95%	$29250 plus 1.95% of payroll over $1,500,000	1.95%

Source: Government of British Columbia (2018b).

between $500, 000 and $1,500,000 are subject to a 2.925 percent EHT rate. Finally, employers with BC remuneration in excess of $1,500,000 have an applicable EHT rate of 1.95 percent on their total payroll. Table 2 shows the EHT rate that has been effective in the province since January 1, 2019.

Table 2 gives the applicable EHT rates for the various possible BC remuneration amounts. It also shows the amount of tax liability and the amount of the tax as a percentage of payroll. The latter is simply the effective EHT rate. Note that the effective EHT rate rises with the remuneration amount and it ranges from 0 to 1.95 percent; large employers pay the higher EHT rate of 1.95 percent. While an important rationale for the EHT was to transfer the tax burden from individuals to employers, the BC government has attempted to shield small employers by allowing the EHT exemption amount of $500,000. Moreover, self-employed individuals are generally not required to pay EHT on income they generate from their businesses. Further, charities and non-profit organizations are subject to the EHT only when their annual remuneration exceeds $1,500,000.

Even before the introduction of the EHT, BC employers were subject to payroll taxes in the form of the federal Canada Pension Plan (CPP) and Employment Insurance (EI) premium payments. Employers also faced another payroll tax: Workers' Compensation Board premium payments. As is the case in other provinces, in BC, workers' compensation programs are financed with premiums collected from employers. Thus, the new EHT increases the BC employer payroll tax further, which will undoubtedly

raise labour costs in the province. Of course, as expected, the EHT will also help the government recover the revenue it lost from the elimination of MSP premiums.

Overview of the Literature

Previous theoretical studies show that payroll taxes can distort the labour market and affect both wage rates and employment. In a standard labour market theory, employer payroll taxes raise the cost of hiring workers and reduce the demand for labour. Given labour supply, the reduction in the demand for labour causes a fall in the equilibrium wage rate and in the level of employment. In this standard labour market theory, while an increase in employer payroll taxes causes a reduction in the wage rate, its net effect on employment largely depends on the relative strength of the response of labour supply and labour demand to the taxes. However, labour demand is generally viewed to be more responsive than labour supply, suggesting that the burden of payroll taxes mainly falls on workers. See Hamermesh (1993) and Saez et al. (2012) for additional discussion.

The response of wage rates to employer payroll taxes plays a crucial rule in any study of the incidence of these taxes. Consequently, a number of earlier studies focus on this issue and find that employer payroll taxes have adverse effects on wage rates. Gruber (1997) provides one of the earlier empirical studies that attempt to investigate the incidence of payroll taxes—the question of who bears the burden of payroll taxes. He used the significant reduction in payroll taxes in Chile in 1981 to analyze the labour market effects of payroll tax cuts. His empirical analysis used firm-level data for the manufacturing sector to analyze how payroll taxes affect wages and employment. He found that the payroll tax reduction in Chile was fully transferred to workers in the form of higher wages. Kugler and Kugler (2008) adopted the same empirical approach and used industry-level data from Colombia. They found that a 10 percent increase in payroll taxes was associated with a fall in wages of between 1.4 percent and 2.3 percent. They also found that employment would decline by between 4 and 5 percent when payroll taxes increased by 10 percent. By applying the same empirical method on Argentinian administrative data, Cruces et al. (2010) also obtained supportive evidence that increases in payroll taxes were partially shifted to workers in the form of reduced wages.

Some of the earlier studies took advantage of the natural policy experiments from countries that had reduced their payroll taxes. Finnish researchers Korkeamäki and Uusitalo (2009) used the payroll tax reduc-

tion in Northern Ireland as an experiment to investigate the effects of employer payroll taxes on wages. They used firm-level data and analyzed the relationship between payroll taxes and wages. They found that the reduction in payroll taxes led to wage increases. Bennmarker et al. (2009) employed a difference-in-difference empirical approach to investigate the effect of payroll taxes in Sweden. Their results indicate that payroll tax cuts affect wages positively. According to their main empirical estimate, a 1.0 percent reduction in the payroll tax rate is associated with a 0.25 percent increase in wage rates. In other words, their analysis indicates that about a quarter of the payroll tax cut is shifted from employers to employees in the form of higher wages. Komamura and Yamada (2004) also examine the effect of Japanese employers' contributions to health insurance levies on wages. According to their empirical estimates, the burden of the employers' contribution to health insurance will be transferred to workers entirely in the form of lower wages.

There are very limited empirical studies of the incidence of payroll taxes in Canada. Vaillancourt and Marceau (1990) is one of the earlier studies. It examined the effects of payroll taxes on wages using collective agreements data from the province of Quebec. Their analysis also confirmed that the burden of general payroll taxes is partly borne by workers in the form of lower wage rates. Ebrahimi and Vaillancourt (2016) also investigated the effects of the employer portion of payroll taxes on wages using individual-level data for Canada from 1998 to 2013. As the authors used a static panel regression method, their analysis does not distinguish between potential short-term and long-term effects. Their empirical investigation showed that payroll taxes have negative effects on wages. They found that a 10 percent increase in the payroll tax rate is associated with 0.3 percent to 1.4 percent reduction in the wage rate. As the authors use the static panel regression method, one can interpret their results as being long-term estimates. Similarly, using Canadian administrative individual-level data for the period from 2001 to 2011, Deslauriers et al. (2018) found that almost all the burden of payroll taxes is borne by workers in the form of lower wages.

The foregoing survey of earlier Canadian and international studies on the incidence of payroll taxes suggests that payroll taxes have negative effects on wage rates. Indeed, a large number of the empirical studies find that the burden of employer payroll taxes falls primarily on workers in the form of wage rate reductions. In fact, a meta-analysis of the labour market effects of payroll taxes, based on 52 previous empirical studies by Melguizo and González-Páramo (2013) confirms these general findings. They conclude that in the long-run, workers bear between 66 percent and 90 percent of the burden of payroll taxes. This burden occurs mainly through

a reduction in wages. Bev Dahlby (1993) also surveyed some of the earlier literature on the incidence of payroll taxes and Di Matteo and Shannon (1995) discussed the issue in the Canadian context.

The above survey of previous studies provides an important insight into the likely effects of British Columbia's recently adopted Employer Health Tax. Since the EHT is a type of employer payroll tax, based on the empirical findings of earlier studies one would expect that the burden of the EHT will at least partly fall on workers.

Payroll Taxes and Wages

Empirical specification

As indicated earlier, this paper's main objective is to obtain some insights on how BC's new Employer Health Tax will affect the province's wage rate. Ideally, we would like to study the effects of the EHT directly, but as the province introduced the EHT only a year ago, information on its effects is limited so a direct empirical analysis is not feasible. However, from the employers' perspective, the EHT is fundamentally an employer payroll tax so one can argue that its potential effects on wage rates will be quite similar to those of the employers' portion of the federal payroll taxes as well as British Columbia's Workers' Compensation Board premium rates. Thus, we can gain insights into the possible labour market effects of the new EHT by studying the relationship between all employer payroll taxes and wage rates. In addition, one may expect the effects of payroll taxes to be different in the short-term and the long-term. To that end, this section provides an empirical specification that enables us to estimate both the short-term and long-term effects of employer payroll taxes.

Previous studies such as Hamermesh (1993) and others have argued that, due to the rigidity of wage rates during the short-term, the effect of payroll taxes is normally delayed, suggesting that the burden of these taxes is likely to be higher in the long run. Consequently, to capture the possible short-run and long-run differential effects of payroll taxes on the wage rate, we employ a dynamic specification.[3] Such an approach was also employed in related previous studies such as Arulampalam, et al. (2012) and Dahlby and Ferede (2012) among others. Thus, the empirical model is specified as:

[3] Our specification is consistent with a partial adjustment model of wage rate determination. Perhaps an alternative specification to this would be to employ a distributed lag model where one uses current and lagged values of the payroll taxes as explanatory variables. However, given that tax rate changes are less common (than say changes in other economic variables), the key variables of interest would be highly correlated and as a result the coefficient estimates would be less precise.

$$ln\,(W_{it}) = \beta_0 + \beta_1\, ln\,(W_{it-1}) + \beta_2\, ln\,(\tau_t) + X + \mu_i + \varepsilon_{it} \quad (1)$$

where W_{it} is real wage rate in industry i in year t, $ln\,(W_{it})$ is the log of the wage rate, τ_t is the payroll tax rate, X is a vector of other possible determinants of wage rate, and ε_{it} denotes the error term. We capture industry specific fixed effects by μ_i. As noted before, the payroll tax rate is the sum of the employers' portion of the federal CPP and EI rates as well as the Workers' Compensation Board premium rates in British Columbia.

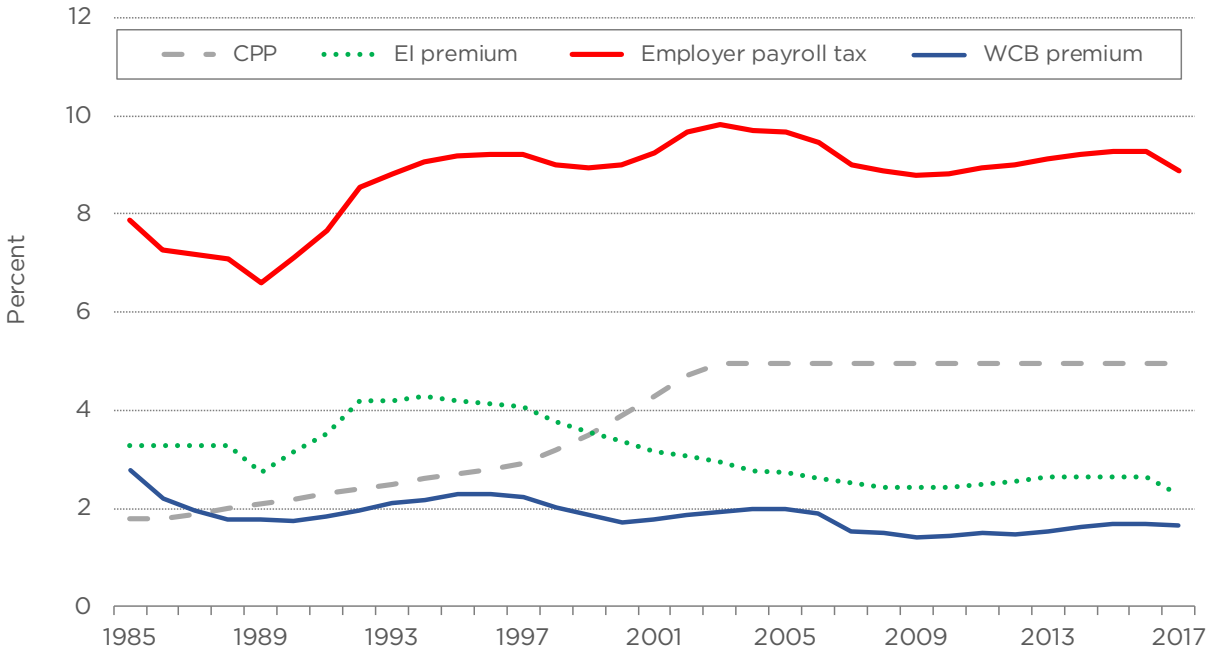
Note that in the above log-log specification, the coefficient of the log of the payroll tax rate (β_2) shows the short-term effects of the payroll tax on the wage rate. In other words, it represents the short-term elasticity of the hourly wage rate with respect to employer payroll taxes. We expect employer payroll taxes to reduce the wage rate, i.e., we expect $\beta_2<0$. Furthermore, from Equation 1, the long-term elasticity estimate can be obtained using $\left(\frac{\beta_2}{1-\beta_1}\right)$. Thus, the dynamic panel specification allows us to estimate both the short-term and long-term effects of payroll taxes on the wage rate. But for the dynamic specification to be stable the coefficient of the lagged dependent variable should satisfy that $0< \beta_2<1$.

The literature on wage rate determination suggests that, in addition to payroll taxes, various labour market conditions can affect the market wage rate. In our analysis, we include union density, the statutory minimum wage rate, the share of the population that is between 15 and 64 years of age with a university degree, and the labour force participation rate to capture the nature of the labour market conditions. We discuss these control variables in a later section.

Data

For several decades, payroll taxes collected from employees and employers have been important sources of revenue for the federal government. The Canadian federal government uses employment insurance (EI) premiums levied on both employees and employers to fund the country's employment insurance program. The federal government also imposes another national payroll tax on all employees and employers in the country (except Quebec) to fund the Canada Pension Plan (CPP). Quebec has its own pension plan and it is not part of the CPP system. See, for instance, Kesselman (1994) and Lin (2000) for a more detailed discussion of the payroll taxes in Canada. Further, all Canadian provincial governments also levy workers' compensation premiums on employers as part of the system for regulating occupational health and safety in the workplace. These employer payroll taxes are administered by the provincial Workers' Compensation Boards

Figure 1: Payroll Taxes Levied on Employers in British Columbia (in percent), 1985-2017



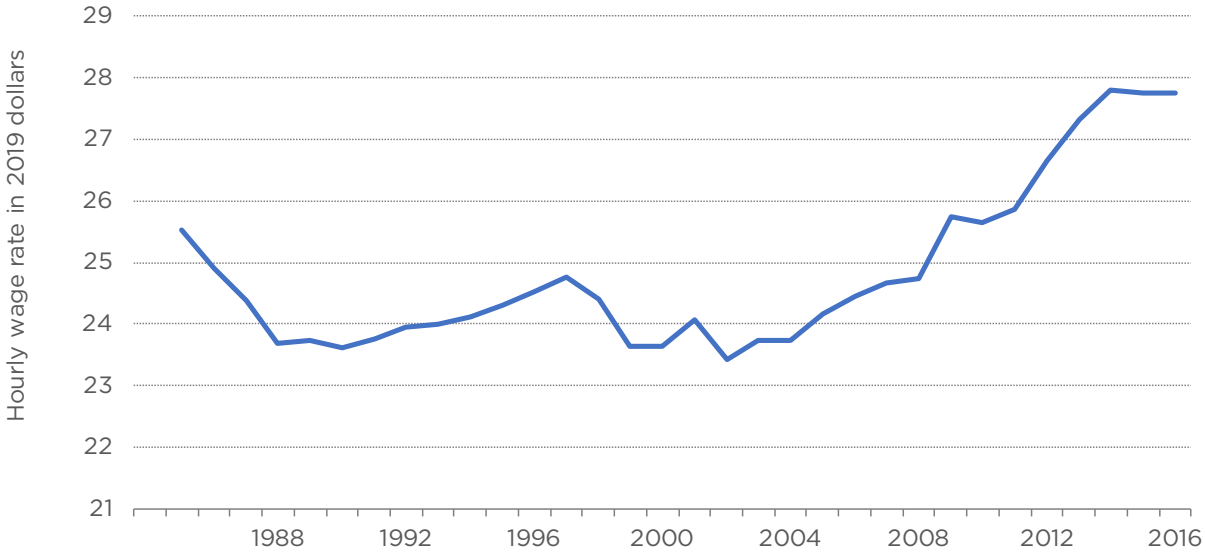
Source: Author's computation based on data obtained from sources indicated in Appendix 2.

(WCB). The WCB premium payments can vary across various sectors based on their potential risk and liability assessments. However, due to a lack of relevant data, we use the provincial average workers' compensation premium for all industries in our analysis.

Our primary interest is to get some insights on the possible impacts of BC's new EHT on workers by investigating the effects of the payroll taxes that already exist. Consequently, we focus on the employer portion of the other payroll taxes mentioned above. While CPP and EI are paid both by employees and employers, workers' compensation (WC) premiums are levied on and paid by employers only. In our analysis we focus on the employer's portion of CPP and EI as well as WCB premiums. We use the provincial average WCP premiums in the analysis. Figure 1 shows these taxes as applied in British Columbia.

As figure 1 shows, the payroll taxes that employers pay vary over the sample period. Between 1985 and 2017, the employer payroll tax burden (which is the sum of the employer-paid portion of CPP and EI, plus the

Figure 2: Average Hourly Wage Rate in British Columbia (in 2019 dollars), 1985-2019



Source: Author's computation based on data obtained from sources indicated in Appendix 2.

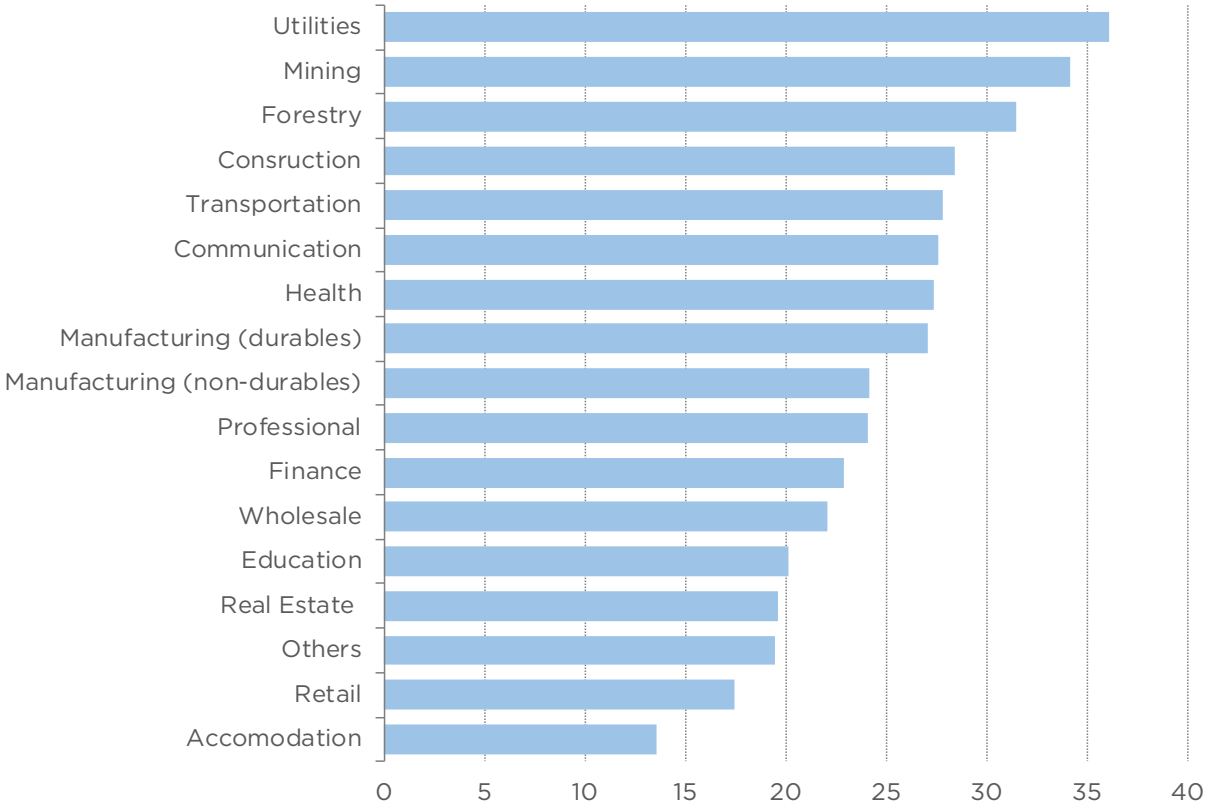
average of provincial WCB premiums) rises. The EI premium was the largest component of the employer payroll tax burden in British Columbia until 2000. However, after 2000, the CPP has become an increasingly significant portion of the employer payroll tax.

The provincial average real hourly wage rate also varies noticeably over time. We account for the effects of inflation by deflating the nominal hourly wage rate by the Consumer Price Index (CPI). During the 1985-2017 period, the average real hourly wage rate in British Columbia rose, particularly after 2002. Figure 2 shows the average hourly wage rate in 2019 dollars between 1985 and 2017. Before 1988, the average wage rate declined notably.

A closer look at the hourly wage rate dataset for British Columbia also reveals that there is considerable variation across industries (see figure 3).

Figure 3 reveals that the average hourly wage rate is generally higher in BC's key industries such as utilities, mining. The retail and accommodation sectors, on the other hand, have the lowest hourly wage rates. Our empirical analysis exploits this hourly wage rate variation across industries to investigate the effect of employer payroll taxes after controlling for vari-

Figure 3: Average Hourly Industry-level Wage Rate in 2019 Canadian Dollars, 1985-2017



Source: Author's computation based on data obtained from sources indicated in Appendix 2.

ous factors that can play part in determining the wage rate. Table 3 summarizes the basic statistics for our key variables of interest. Appendix 2 lists the data sources for the various variables used in the study.

Results and discussion

Table 4 presents the dynamic panel estimation results. All regressions include industry dummies to capture the potential impacts of time-invariant industry specific effects. Further, we include industry specific time trends to account for time shocks during the period under investigation.[4] The

[4] The industry-specific time trends are obtained by interacting the industry dummies with the time trend.

Table 3: Summary statistics of key variables of interest, 1985-2017

Variable	Mean	Std. Dev.	Min	Max
Real wage rate (in 2019 C$)	24.91	6.33	11.48	45.77
Employer payroll tax	8.74	0.84	6.61	9.83
Log (real wage rate)	3.18	0.26	2.44	3.82
Log (payroll tax)	2.16	0.1	1.89	2.29
Log (Union)	3.16	0.1	3.01	3.33
Log (real minimum wage)	2.25	0.14	1.94	2.45
Log (University)	-1.68	0.34	-2.29	-1.14
Log (participation rate)	-0.27	0.02	-0.3	-0.22
Log (trade to GDP ratio)	4.45	0.04	4.35	4.56

Note: The total number of observations is 561 (17 industries and 33 years)

analysis is also based on heteroskedasticity and autocorrelation robust standard errors. Note also that, as indicated earlier, the coefficient of the payroll tax variable shows the short-term elasticity of the average wage rate with respect to payroll taxes. Using this short-term elasticity estimate and the coefficient of the lagged dependent variable, we also compute the implied long-term elasticity of the wage rate and report it in table 4.

Column 1 presents the dynamic panel model using the Ordinary Least Square (OLS) estimation method. We estimate the hourly wage rate on just employer payroll taxes. The coefficient of the lagged wage rate is positive and statistically significant, indicating the persistence and possible slow adjustment in the wage rate determination process. This supports the validity of our choice of a dynamic specification to capture the persistence in the hourly wage rate. More importantly, the results reported in column 1 show that, as expected, employer payroll taxes have a statistically significant negative effect on the wage rate. Since the empirical model is based on a logarithmic specification, the result implies that the short-run elasticity of the hourly wage rate with respect to employer payroll taxes is -0.066. The corresponding implied long-run elasticity estimate is -0.174 and is also statistically significant. Thus, according to the empirical estimates developed in this paper, a 10 percent increase in the employer payroll tax burden is associated with a 0.66 percent reduction in the real hourly wage rate in the short run. However, the long-run impacts appear to be much higher. In fact, according to the above estimates, a 10 percent

Table 4: The Effects of Payroll Taxes on Wages in British Columbia, 1985-2017

	OLS (1)	OLS (2)	IV (3)	IV (4)	IV (5)
Lagged log (real wage rate)	0.618***	0.619***	0.623***	0.634***	0.642***
	(0.037)	(0.039)	(0.044)	(0.044)	(0.042)
Log (payroll taxes)	-0.066**	-0.070***	-0.067***	-0.115***	-0.108***
	(0.026)	(0.024)	(0.045)	(0.040)	(0.040)
Log (university degree)		0.030	0.051	0.285**	0.187**
		(0.063)	(0.060)	(0.117)	(0.085)
Log (labour participation)				-2.232**	-1.310*
				(1.090)	(0.790)
Log (real minimum wage)				(0.003)	0.050
				(0.040)	(0.036)
Log (union)				0.525**	0.269*
				(0.226)	(0.157)
Log (trade-to-GDP ratio)					-0.151*
					(0.080)
Constant	-2.034***	-1.376	-1.068	-1.685	-0.303
	(0.294)	(1.481)	(1.415)	(1.451)	(1.627)
Implied long-run elasticity[a]	-0.174***	-0.184***	-0.178**	-0.315***	-0.300**
	(0.061)	(0.070)	(0.059)	(0.095)	(0.096)
Observations	544	544	527	527	527
Adjusted R2	0.968	0.968	0.969	0.966	0.968

Note: The Dependent variable is the log of real wage rate. Heteroskedasticity and autocorrelation robust standard errors in parentheses. Significance levels are shown by * for 10% , ** for 5% , and *** for 1% . All regressions include industry specific fixed-effects and industry specific time trends. In columns (3) to (5), the lagged dependent variable and the participation rate are treated as endogenous. The instruments are the two period lagged values of the dependent variable and the lagged-growth rate of the labour force participation rate.

[a] The implied long-run elasticity is computed by dividing the coefficient of payroll taxes by one minus the coefficient of the lagged dependent variable.

increase in the employer payroll tax burden is associated with about a 1.74 percent reduction in the hourly wage rate.

A number of previous empirical studies have shown that the productivity of workers is usually an important determinant of hourly wages. In aggregate data-based studies such as ours, the share of the working age population with a university degree can be used to measure the effects of education on productivity and its impact on wages. Following previous similar studies, in column 2, we include the share of the population who are between 15 and 64 years of age with a university degree. See earlier Canadian studies such as Ebrahimi and Vaillancourt (2016) and McKenzie and Ferede (2017) for similar approaches. As expected, the coefficient of this variable is positive, but it is statistically insignificant. Our key variable of interest, the employer payroll tax burden, continues to have a negative and statistically significant effect on the wage rate both in the short-term and in the long-term. The magnitudes of the short-run and long-run elasticity estimates are now slightly higher (in absolute value).

The empirical analysis so far assumes that all the explanatory variables are exogenous. It is known that the federal components of employer payroll taxes are not tied to the hourly wage rate level for any particular province, including British Columbia. Further, the provincial average workers' compensation premium rate depends on the relative risk and injury claims experience of the sector rather than the wage rate. Thus, based on the nature and structure of employer payroll taxes, one can argue that these taxes are indeed exogenous and the OLS estimation method is therefore appropriate. The estimated coefficients from such a method are unbiased and consistent when the variables are exogenous. However, in a dynamic panel specification such as the one used in this paper, there still remains an endogeneity problem due to the inclusion of the lagged dependent variable as part of the explanatory variables. Since the lagged dependent variable is generally correlated with industry specific fixed effects and the error term, the variable is endogenous. In this case, OLS coefficient estimates for the lagged dependent variable are generally biased and inconsistent. See Baltagi (2008) for a discussion. In our case, since we are using long panel data, the coefficient of the lagged dependent variable may become consistent. Nonetheless, as is common in the literature, in column 3, we treat the lagged dependent variable as endogenous and use its own one-period lagged values as an instrument. See, for instance, Dahlby and Ferede (2012) and others for a similar strategy.[5]

The empirical results reported in column 3 suggest that once the endogeneity of the lagged dependent variable is addressed, its coefficient

[5] In the sensitivity analysis in Appendix 1, we also use alternative estimation strategies.

estimate becomes slightly higher. This suggests that the OLS estimates of the coefficient estimate are biased downwards, which may distort our long-run elasticity estimate. When we look at the coefficient of our key variable of interest, both the short-run and long-run elasticity estimates continue to be statistically significant.

Column 4 controls for various factors that can affect the labour market and hourly wage rate. In particular, we include the real statutory minimum wage rate, union density, and the labour force participation rate as additional control variables. The labour force participation rate measures the state of the labour market in the province. A lower labour force participation rate implies tighter labour market conditions, which may have a positive impact on the hourly wage rate. Thus, we expect the coefficient of the labour force participation rate to be negative. While the labour force participation rate can influence the wage rate, it is known that the decision of individuals to participate in the labour market also depends on the province's wage rate level suggesting that the variable is endogenous. Thus, we treat this variable as endogenous and use one period lagged first-difference of the variable as an instrument. Further, we include the real minimum wage rate to capture the potential effects of minimum wage legislation. We expect the statutory minimum wage rate to have positive effects on the average wage rate. Another important factor that influences the labour market in a jurisdiction is the prevalence and strength of labour unions. It is known that unionization of employees provides them with stronger bargaining power in labour negotiations. In fact, unionized employees tend to earn a higher wage rate than their non-unionized counterparts. To control for this labour market condition, column 4 includes the share of the employees who are unionized as an additional control variable. The results show that employer taxes have negative and statistically significant effects on the hourly wage rate. Note that both the short-run and the long-run elasticity estimates are now higher after we control for the labour market conditions.

Column 5 includes economic openness as measured by the trade-to-GDP ratio to capture the potential effects of global events on the (domestic) wage rate. As in the previous regression, we also control for the various variables that are deemed to influence the labour market and wage rate. As column 5 includes all the relevant control variables, this is our main empirical model. Consequently, we focus our discussion on the main empirical results of column 5. The coefficient of the employer labour tax continues to be negative and statistically significant at the five percent level. The results suggest that the short-run elasticity of the hourly wage rate with respect to employer payroll taxes is -0.108. The implied long-run elasticity estimate is -0.300 and it is statistically significant. These empir-

ical estimates imply that a 10 percent increase in employer payroll taxes is associated with a reduction of the hourly wage rate of about 1.1 percent in the short-term and 3 percent in the long run. An important implication of the empirical results is that an increase in employer payroll taxes is at least partly transferred to workers in the form of a lower wage rate. Regarding the other control variables, column 5 shows that they all have the expected signs. The coefficients of union and university education have their expected positive signs and they are statistically significant, suggesting that higher education and union density have positive effects on the hourly wage rate. Further, the coefficients of labour participation and the trade-to-GDP ratio are negative and statistically significant.

What does our key empirical finding imply for the new EHT in British Columbia? In 2017, the last year of our investigation, the employer payroll tax burden in BC was 8.88 percent. The introduction of an EHT of 1.95 percent for BC's large employers with payroll compensation of $1.5 million and above means that the employer payroll tax increases to about 10.8 percent. This is equivalent to a 21.95 percent increase in the employer payroll tax burden. The effective EHT is lower for employers with payroll remuneration below $1.5 million. Thus, according to our main empirical results, this increase in the payroll tax burden is associated with a reduction in the average hourly wage rate of $0.59 and $1.64 (in 2019 dollars) in the short-term and the long-term, respectively.[6] If we assume that the average employee works 35 hours per week, 52 weeks per year, then our result implies that the burden of EHT on the average employee is a reduction of wages by $1,075 in the short-run and $2,987 in the long-run (both in 2019 dollars).[7] Note that these short-term and long-term reductions in wages for an average BC worker are higher than the amount of average tax savings that individuals get from the elimination of MSP premiums. The key implication of these empirical estimates is that part of the burden of BC's new EHT will be borne by workers in the form of lower wage rates.[8]

[6] The hourly wage rate reduction in the short run is computed as -0.108 X 21.95 X $24.91= -$0.59. Similarly, the long-term impact on the hourly wage rate is computed as -0.300 X 21.95 X 24.91= -$1.64.

[7] Since each industry has its own average hourly wage rate, the magnitude of the impact of the EHT on the wage rate will vary by industry. The higher the average hourly wage rate, the higher will be the amount of the possible reduction in the wage rate associated with the EHT increase. But as our main focus is to highlight the policy implication of the paper's finding, we rely on the average wage rate for all employers.

[8] The effect of the EHT on BC's wages is lower than Dahlby's (1993) comparable estimates for Ontario. Dahlby (1993) finds that 92 percent of the burden of the EHT in Ontario is likely to be borne by workers in the form of reduced wages.

Were one to use our empirical estimates to analyze the net impact of eliminating the MSP and switching to EHT on workers, some important caveats would apply. First, some employers used to pay MSP premiums for their workers. For those employers, the net effect of the EHT on their labour costs and wages is likely to be lower. Thus, the possible impact of switching to the EHT on wages depends on the proportion of employers who paid MSP premiums for their employees and the net effect of the EHT on their labour costs. The second caveat is related to the implicit assumption in the above calculation that the same EHT is levied on all BC employers. Although such an assumption helps to shed light on the likely effects of the new EHT on BC's average hourly wages, it ignores variations in the effective EHT across employers based on the size of their payroll remunerations. Large employers with higher payroll remunerations tend to pay a higher EHT rate and the impact on wages for them would be higher. On the other hand, small businesses with payroll remuneration below the threshold of $500, 000 are not subject to EHT and its impact on wages for such businesses would be nil.

In sum, the foregoing empirical analysis indicates that employer payroll taxes have statistically significant adverse effects on British Columbia's hourly wage rate both in the short-term and in the long-term. The coefficient estimates are well within the range of those of earlier, similar empirical studies. As Appendix 1 shows, our main empirical model estimates are also robust to various sensitivity checks. An important policy implication of the empirical results is that a substantial part of the burden of the recently introduced BC's employer EHT—which is basically an employer payroll tax—is likely to be borne by British Columbia's workers in the form of reduced wages. While statements from the government imply that the EHT is paid and borne by BC employers, in reality part of the burden falls on workers in the form of lower wages.

Conclusions

This paper studies the impact of employer payroll taxes on wages to shed some light on the possible effects of BC's recent EHT. The provincial government indicates that the elimination of the MSP premiums and its replacement with the EHT reduces the tax burden of individuals and families since the new payroll tax is paid by employers. However, various economic theories and models suggest that employer payroll taxes such as EHT raise labour costs and distort the labour market. Although the statutory responsibilities of such taxes are on employers, workers may also be affected adversely. In fact, the various earlier studies reviewed in this paper find strong evidence that the burden of employer payroll taxes is primarily borne by workers in the form of lower wages and reduced employment levels.

This paper seeks to shed some light on the possible effects of the EHT on employees. To this end, we conducted an empirical investigation of the effects of employer payroll taxes on wages using industry-level panel data for BC from 1985 to 2017. Our dynamic panel estimation approach has allowed us to identify both the short-term and the long-term effects of employer payroll taxes on wages. According to this paper's main empirical result, a 10 percent increase in employer payroll taxes is associated with a reduction in the hourly wage rate by about 1.1 percent in the short-run and 3.0 percent in the long-run. To put this in perspective, our computation based on these empirical estimates suggests that the introduction of the EHT that raised the employer payroll taxes by about 21.95 percent is associated with a reduction in the province's average hourly wage by $0.59 in the short term and $1.64 and the long term (both in 2019 dollars). This paper's empirical finding is consistent with those of earlier studies and is robust to various sensitivity checks.

The key policy implication of this study is that the burden of employer payroll taxes such as the EHT is at least partly borne by workers in the form of lower wage rates. If one also considers the potential adverse effects of such payroll taxes on employment, as some previous empirical studies have done, then the share of the tax burden on workers may even be greater. This casts doubt on the initial justification for the BC government's introduction of the EHT—to reduce the tax burden on individuals and families.

Appendix 1: Sensitivity Analysis

In this appendix, we conduct various robustness checks to assess the sensitivity of our main empirical result. More specifically, we check the sensitivity of the empirical result to the use of various alternative estimation methods, alternative specifications, and the inclusion of additional control variables. Table A1 shows the results. For the sake of brevity, we report only the coefficient estimates of the key variables of interest. Note also that the robustness check is based on the main empirical model of column 5 of table 4.

Our main empirical analysis relies on the Two-stage Least Squares (2SLS) estimation to address the potential problem of endogeneity associated with the inclusion of the lagged dependent variable as an explanatory variable. While this instrumental variable estimation method is quite commonly used in empirical studies such as ours, one may be concerned that the coefficient estimates obtained from such a method may not be robust to arbitrary autocorrelation and heteroskedasticity. Such a concern is valid even though our standard error estimates are robust to autocorrelation and heteroskedasticity. To address this issue, in column 1 we use the general method of moments (GMM) estimation method instead of 2SLS. The coefficient estimates of column 1 are very similar to those of our main empirical result of column 5 of table 4, suggesting that the key results are robust to the use of an alternative estimation method.

A common problem in the instrumental variable estimation method is the possible use of weak instruments. In such cases, the Least Information Maximum Likelihood (LIML) estimation method, which is robust to the use of weak instruments, is often considered a better estimation method. To this end, in column 2 we employ LIML and re-estimate our key empirical model. The coefficient estimates are quite similar to those of our main empirical results of column 5 of table 4. This suggests that our results are not influenced by weak instruments.

The main empirical analysis of the previous section controls for university education to account for the impact of education on the wage rate through its possible effects on labour productivity. Column 3 includes the labour productivity growth rate as an additional control variable as in McKenzie and Ferede (2017). We measure labour productivity by divid-

Table A1: Robustness checks, 1985-2017

	Alternative estimation methods		Additional controls		Static specifications	
	GMM (1)	LIML (2)	Productivity growth (3)	PIT (4)	Contemporaneous (5)	Lagged (6)
Lagged log (real wage rate)	0.642***	0.641***	0.611***	0.567***		
	(0.042)	(0.042)	(0.046)	(0.061)		
Log (employer payroll taxes	-0.108***	-0.107***	-0.167***	-0.134***		
	(0.040)	(0.039)	(0.057)	(0.047)		
Productivity growth			0.250**			
			(0.115)			
Log (PIT rate)				0.142**		
				(0.063)		
Implied long-run elasticity	-0.300**	-0.299**	-0.429***	-0.309***	-0.292***	-0.384***
	(0.096)	(0.095)	(0.123)	(0.084)	(0.065)	(0.079)
Constant	(0.304)	(0.303)	0.720	(2.032)	-5.296*	0.561
	(1.628)	(1.628)	(1.863)	(1.904)	(2.853)	(3.218)
Observations	527	527	527	527	527	510
Adjusted R2	0.968	0.968	0.968	0.969	0.946	0.920

Note: The Dependent variable is the log of real wage rate. Heteroskedasticity and autocorrelation robust standard errors in parentheses. Significance levels are shown by * for 10% , ** for 5% , and *** for 1% . All regressions include industry specific fixed-effects and industry specific time trends. The robustness check is based on the main empirical model of column (5) of Table 4.

ing Gross Domestic Product (GDP) by total hours worked. As expected, labour productivity growth has positive and statistically significant effects on the hourly wage rate. Note in particular that the employer payroll tax variable continues to have statistically significant negative impacts on the wage rate. Both the short-run and the long-run elasticity estimates of the hourly wage rate with respect to employer taxes are now higher in absolute value.

Some of the previous empirical studies, such as McKenzie and Ferede (2017), find evidence that the personal income tax rate also has some effects on the wage rate. Workers normally care about the after-tax wage rate. An increase in the personal income tax (PIT) rate reduces the

after-tax wage rate and this may cause workers to negotiate for a higher gross wage rate to partly compensate for the higher personal income tax. If this is indeed the case, we expect the PIT to have positive impacts on the hourly wage rate. To account for this possible effect, and as part of our sensitivity analysis, we include the provincial and federal combined top marginal personal income tax rate (*PIT rate*) as an additional control variable in column 4. The coefficient of PIT is positive as expected and it is also statistically significant. More importantly, the employer payroll tax burden still continues to have statistically significant adverse effects on the wage rate. The magnitudes of both the short-run and the long-run coefficient estimates are now higher than in our main empirical result as outlined in the previous section.

Some of the earlier studies, such as Ebrahimi and Vaillancourt (2016), employ static panel data analysis to investigate the effects of payroll taxes on wages. In such a specification, the coefficient estimates capture the long-term impact of payroll taxes on the wage rate. Thus, as an additional robustness check and to facilitate the comparison of our finding with those of previous studies, in columns 4 and 5 we employ static specifications. While we regress the hourly wage rate on contemporaneous payroll taxes in column 4, we use one-period lagged values of the explanatory variables in column 5. Note that in both cases the specification provides only long-run elasticity estimates. Ebrahimi and Vaillancourt (2016) employed static panel analysis using one-period lagged values of the payroll taxes as a key variable. The use of lagged rather than contemporaneous payroll taxes is justified on the grounds that such a specification partly captures the short-term adjustment in wage rates. Thus, the estimated results of column 5 are directly comparable with those of Ebrahimi and Vaillancourt (2016). The results confirm that employer payroll taxes have a long-term adverse effect on the wage rate. While the long-term elasticity estimate based on the static specification reported in column 4 is close to our main empirical estimate, the estimate in column 5 is higher (in absolute value) than our preferred dynamic specification result. Nonetheless, the results confirm the robustness of our key finding to the use of alternative specifications.

In sum, the foregoing analysis shows that our main empirical model estimates are robust to various sensitivity checks. Thus, the main finding that employer payroll taxes have adverse effects on the wage rate appears to hold under different estimation methods and specifications as well as with the inclusion of various control variables. The coefficient estimates are also well within the range of results obtained in similar previous studies based on data from various countries.

Appendix 2

Definition of Variables and Data Sources

Variable	Definitions	Source(s)
Hourly wage rate	Average hourly earnings for employees paid by the hour (excluding overtime)	Statistics Canada, CANSIM Table 14100228 and Table 14100206
CPP	Canada Pension Plan employer contribution rate	Canada Revenue Agency
EI	Employment Insurance employer contribution rate	Canada Revenue Agency
WCB premium	Workers' Compensation premium rate	Association of Workers' Compensation Boards of Canada
CPI	Consumer Price Index (2002=100)	Statistics Canada, CANSIM Table 18100005
Union density	The share of employees who are unionized	Statistics Canada, CANSIM Table 14100129 and Table 14100187
Working age population	Population between 15 and 64 years of age	Statistics Canada, CANSIM Table 17100005
University	Population with university degree	Statistics Canada, CANSIM Table 14100118 (1990-2017) and Census data (1985-1990)
PIT	Federal and provincial top marginal income tax rate	Canada Revenue Agency
Minimum wages	Provincial minimum wage rate	Government of Canada Open Data Portal: https://open.canada.ca/data/en/dataset
Labour force	Total labour force	Statistics Canada, CANSIM Table 14100023
Exports	Total exports in current prices	Statistics Canada, CANSIM Table 36100222
Imports	Total imports in current prices	Statistics Canada, CANSIM Table 36100222
Nominal GDP	Gross Domestic prices in current prices	Statistics Canada, CANSIM Table 36100222

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