The Effect of Bill C-12 on Weekly Hours of Work

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Abstract

Two components of the changes in the Unemployment Insurance Program (UI) that were introduced in Bill C-12 substantially altered the relative costs and benefits of the program to workers on different weekly and annual work schedules: the extension of coverage to workers employed for fewer than 15 hours per week; and the change from a weeks-based to an hours-based formula for calculating program eligibility and benefit entitlement.

This paper examines two consequences of these program changes. First, we document the significant loss of benefit entitlement experienced by some part-time workers. Second, we generate evidence, based on Labour Force Survey data, that workers and firms responded to Bill C-12 by altering weekly work schedules in order to improve their chances of eligibility and benefit entitlement. We find that the proportion of jobs entailing fewer than 15 hours per week declined by about 5 percent in response to the extension of coverage to jobs in this category. In general, we find a tendency to longer hours among part-time workers. This tendency is most pronounced in the Atlantic provinces and in industries that employ large numbers of part-time workers. In seasonal industries, the share of 15-40 hour jobs has declined, while the share of 40 plus hour jobs has increased.

These findings have several implications: (1) these adjustments to working schedules allow workers to mitigate some of the loss in benefit income that they would otherwise have experienced; (2) removing the distinction between weeks of work involving more or fewer than fifteen hours has eliminated the practice of splitting jobs into short workweeks to avoid the UI payroll tax; (3) the move towards very long weekly hours in seasonal industries may reflect the elimination of the practice of splitting jobs into short workweeks to qualify a larger number of individuals for UI benefits; and (4) the reduction in the proportion of part-time jobs in unstable sectors may reflect a response to a new distortion that arises because, under the new hours-base system, a week of part-time work is not insured as fully as a week of full-time work.

1. Introduction

This paper examines the effects on weekly hours of work of two important changes to the Unemployment Insurance Program (UI) that were introduced in Bill C-12, which also changed the program name to Employment Insurance (EI): the extension of coverage to workers employed for fewer than 15 hours per week; and the change from a weeks-based to an hours-based formula for calculating program eligibility and benefit entitlement. These two changes, which became effective in January of 1997, substantially altered the relative costs and benefits of the program to workers on different weekly and annual work schedules.

One consequence of the differential effect of the move to an hours-based system on workers on different hourly schedules is that some workers, especially some of those who work part-time, experienced a significant loss of benefit entitlement. We document this change in entitlement for a number of cases in Section 2 of this paper. A second, more indirect, consequence is that the program changes create an incentive for workers and firms to alter both annual and weekly work schedules in order to improve their chances of eligibility and benefit entitlement. Section 3 describes these incentive effects. Sections 4 and 5 use data from the Labour Force Survey to explore whether workers and firms changed weekly work schedules in response to the new incentive structure.

Understanding these changes in behaviour is important for several reasons. First, the inclusion of workers employed for fewer than 15 hours per week under the EI program has eliminated an exemption that may have led some employers to split jobs into several very short shifts in order to avoid participating in the program. Second, some workers may have altered their previous pattern of hours per week and weeks per month in order to avoid the significant reductions in benefit entitlement and possible loss of eligibility that they would otherwise have experienced. While on the one hand such decisions would mitigate the hardship imposed on some individuals, it also would suggest that the EI program rules have created a *new* distortion in the hours of work decisions of workers and firms. Third, workers and firms in some highly UI-dependent seasonal industries may have responded to previous increases in the number of weeks of work required to ensure program eligibility by spreading the same number of total hours of work over more weeks. The hours-based system renders this strategy ineffective. This switch from the weeks-based to the hours-based system therefore would produce a move back towards longer work weeks in these industries that might be observable.

2. The Direct Effect of Bill C-12 on Eligibility and Entitlement across the Weekly Hours of Work Distribution

Under the old Unemployment Insurance (UI) system, weeks during which workers were employed for fewer than 15 hours were not covered by the program, so that these earnings were not subject to payroll tax deductions and did not contribute weeks towards UI eligibility. Furthermore, prior to Bill C-12, all weeks of employment of greater than 15 hours counted in the same way towards eligibility and benefit entitlement. Under the hours-based system, longer-hours weeks contribute more to eligibility and generate greater benefit entitlement than shorter hours weeks.

Table 1 summarizes these changes in program coverage and benefit entitlement for a number of important cases. The dark shaded rows at the bottom of Table 1 indicate cases where jobs that were previously not covered under the UI program became covered under the Employment Insurance (EI) program. Under EI, workers with these work arrangements now pay the EI payroll tax, and these hours of work contribute to eligibility and entitlement. As well as eliminating the incentive for workers and firms to distort their hours decisions, the inclusion of these weeks in the EI program was intended to broaden coverage to the growing number of workers in part-time jobs, including many who actually worked full-time hours, since broad coverage is important if the program is to continue to be effective as an automatic macroeconomic stabilizer. As the corresponding cells show, unless workers combine short weeks with longer weeks some time during the year, they will pay the payroll tax but never qualify for benefits. In cases where total annual earnings are less than $2000 per year, however, all of the payroll tax contributions of the worker and firm are reimbursed, so that the net effect of the EI system is zero.

The light shaded columns show the change in benefit entitlement under Bill C-12 for workers with a number of different work arrangements in the cases of the very lowest and highest unemployment rate categories. Scanning down the first of these shaded columns for the case of the lowest unemployment rate, we see that some workers who work regular schedules of 40 hours or more saw their benefit entitlement increase under EI. Workers employed on part-time schedules of 15 hours per week and more for a significant portion of the year saw their benefit entitlement decrease substantially. Workers employed on part-time schedules for fewer than 10 hours per week continued to be ineligible for benefits.

Scanning down the second of these shaded columns for the case of the highest unemployment rate, we see that some workers who work long work weeks gained benefit entitlement, while others lost it, depending on the number of weeks worked per year. Part-year workers who work long-hours when they do work saw an increase in benefits that is in some cases quite considerable. Again, workers on part-time schedules of 15 hours per week and more, experienced losses in benefit entitlement that are in some cases very large. Not all

TABLE 1
Change in Program Coverage and Weeks of Benefit Entitlement Under Bill C-12 for Different Patterns of Hours and Weeks Worked in the Qualifying Period

Hours per week	Weeks per year	Total hours	Weeks of benefit entitlement					
			Unemployment rate=6%			Unemployment rate=16%		
			EI	UI	change	EI	UI	change
45	52	2,340	29	36	**-7**	45	50	**-5**
	40	1,800	35	24	**11**	45	46	**-1**
	20	900	17	14	**3**	38	33	**5**
	12	540	0	0	**0**	33	32	**1**
	10	450	0	0	**0**	32	0	**32**
40	52	2,080	29	36	**-7**	45	50	**-5**
	40	1,600	29	24	**5**	54	46	**8**
	20	800	15	14	**1**	37	33	**4**
	12	480	0	0	**0**	32	32	**0**
	10	400	0	0	**0**	0	0	**0**
35	52	1,820	29	36	**-7**	45	50	**-5**
	40	1,400	24	24	**0**	45	46	**-1**
	20	700	14	14	**0**	36	33	**3**
	12	420	0	0	**0**	32	32	**0**
	10	350	0	0	**0**	0	0	**0**
20	52	1,040	18	36	**-18**	40	50	**-10**
	40	800	15	24	**-9**	37	46	**-9**
	20	400	0	14	**-14**	0	33	**-33**
	12	240	0	0	**0**	0	32	**-32**
	10	200	0	0	**0**	0	0	**0**
15	52	780	15	36	**-21**	37	50	**-13**
	40	600	0	24	**-24**	34	46	**-12**
	20	300	0	14	**-14**	0	33	**-33**
	12	180	0	0	**0**	0	32	**-32**
	10	150	0	0	**0**	0	0	**0**

TABLE 1 (continued)
Change in Program Coverage and Weeks of Benefit Entitlement Under Bill C-12 for Different Patterns of Hours and Weeks Worked in the Qualifying Period

Hours per week	Weeks per year	Total hours	Weeks of benefit entitlement					
			Unemployment rate=6%			Unemployment rate=16%		
			EI	UI	change	EI	UI	change
10	52	520	0	0	**0**	33	0	**33**
	40	400	0	0	**0**	0	0	**0**
	20	200	0	0	**0**	0	0	**0**
	12	120	0	0	**0**	0	0	**0**
	10	100	0	0	**0**	0	0	**0**
5	52	260	0	0	**0**	0	0	**0**
	40	200	0	0	**0**	0	0	**0**
	20	100	0	0	**0**	0	0	**0**
	12	60	0	0	**0**	0	0	**0**
	10	50	0	0	**0**	0	0	**0**

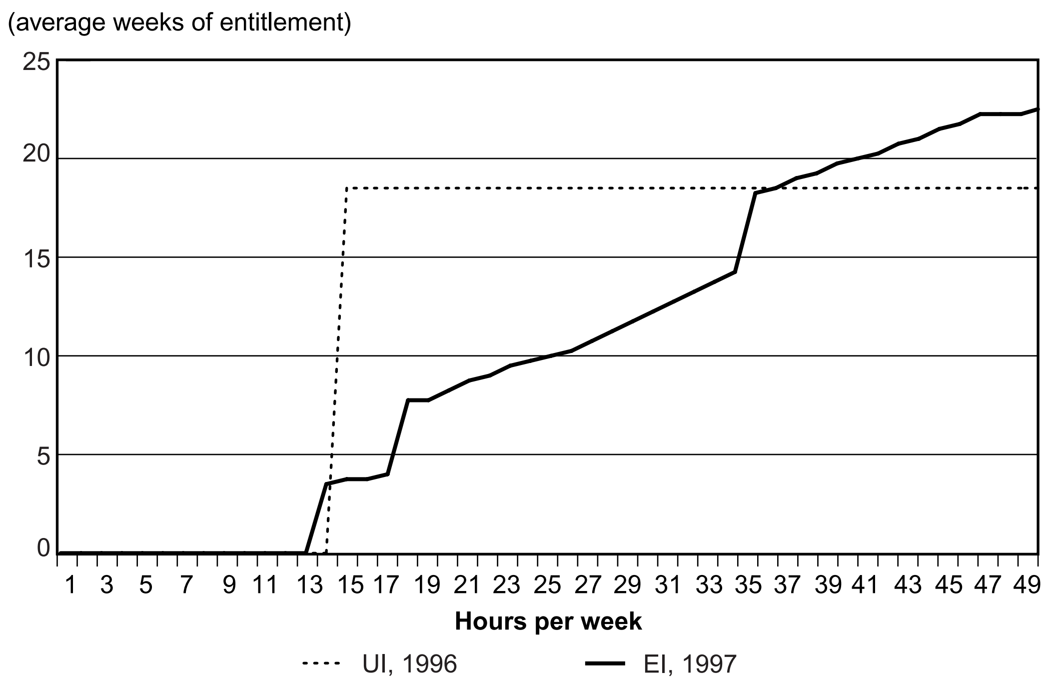
* Light shaded columns show difference between entitlement under EI and entitlement under UI. Dark shaded rows indicate jobs that were not covered by the program under UI (no payroll tax, no entitlement) that are now covered under EI.

part-time workers lost benefit entitlement under Bill C-12, however. We see that a worker employed for 10 hours per week for 52 weeks per year who would not have been covered under the UI program is entitled to 33 weeks of EI benefit.

Obviously many workers vary their schedules over the year or hold multiple jobs. While it is not possible to quantify easily the change in entitlement in these cases, we can make some general comments. First, weeks during which workers work fewer than 15 hours and weeks in which workers work more than 15 hours in total but less than 15 hours in any one job, contribute to eligibility and benefit entitlement under EI, but would not have done so under UI. For some workers, this additional contribution to eligibility and entitlement will more than compensate for the cost of the EI payroll tax, and therefore will make them better off. For others it will not. Second, weeks during which workers work at least 15 hours but less than 35 hours contribute less to eligibility and entitlement under EI than they did under UI. Third, in most cases, weeks during which workers work more than 35 hours contribute more to eligibility and entitlement under EI than they did under UI.

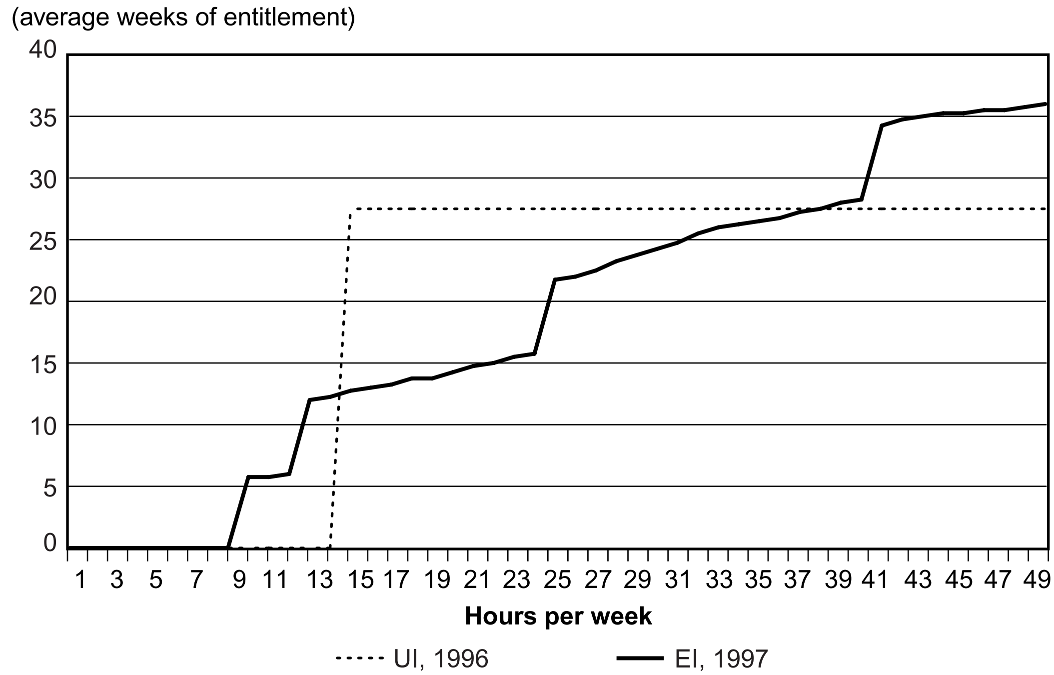
A summary measure of the number of weeks of benefit entitlement for each weekly hours schedule was computed by taking the number of weeks of benefit entitlement for a person working some number of hours per week for 12, 20, 40 and 52 weeks per year, and calculating the simple arithmetic average of these values. This summary measure calculated for 1996 and 1997 is plotted in Figures 1 through 3 for low, medium and high unemployment regions respectively. Under UI, workers who worked fewer than 15 hours per week never qualified for benefits. While workers who worked at least 15 hours per week saw their benefit entitlement increase with weeks worked, they did not see their entitlement increase as they increased their hours per week. Our constructed summary UI benefit entitlement measure therefore is a simple step function, increasing from zero weeks for workers with weekly schedules of less than 15 hours per week, to some number of weeks that depends on the unemployment rate at exactly 15 hours per week. The move to an hours-based system replaced the simple step-function at 15 hours under the UI program with a more gradual increase in benefit entitlement beginning at less than 15 hours and continuing through large portions of the hours distribution. The relative magnitude of these changes in regions with different unemployment rates can be seen more clearly in Figure 4, which plots the change in the value of the summary measure between 1996 and 1997. A positive value of this change indicates an increase in this measure of benefit entitlement under EI, a negative value indicates a loss. Again, we see that the change in entitlement was substantial in some regions of the hours distribution, and varied considerably across it.

FIGURE 1
Average Number of Weeks of Benefit Entitlement for a Worker Employed x Hours Per Week, Low Unemployment Rate Region*



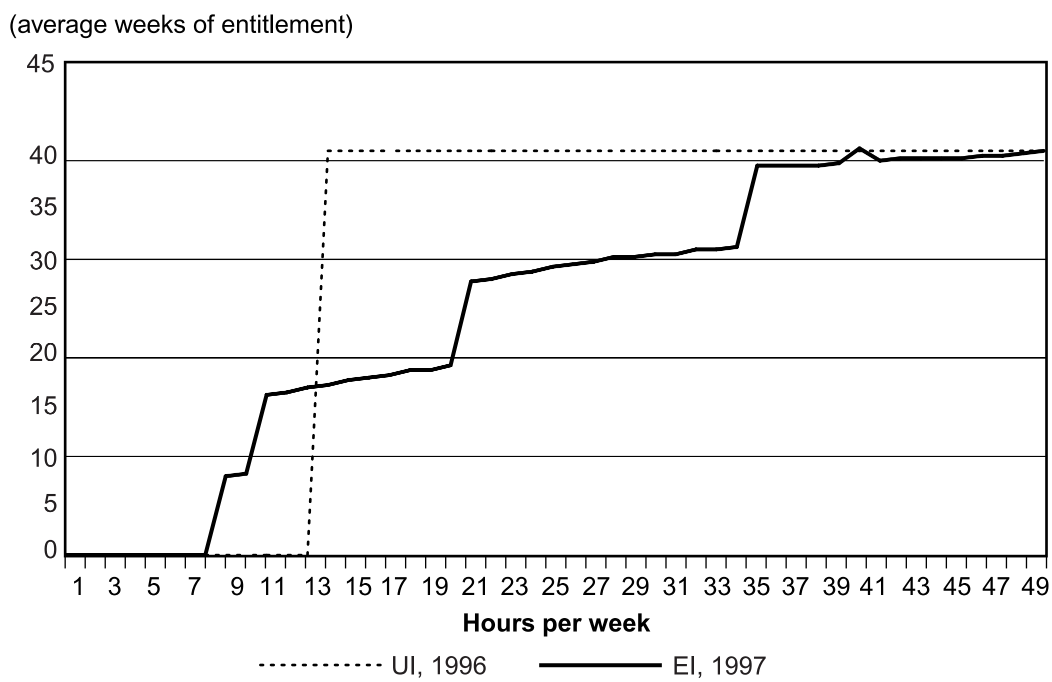
* avg. of # of weeks of entitlement at 12, 20, 40 and 52 weeks of work/year

FIGURE 2
Average Number of Weeks of Benefit Entitlement for a Worker Employed x Hours Per Week, Medium Employment Rate Region*



* avg. of # of weeks of entitlement at 12, 20, 40 and 52 weeks of work/year

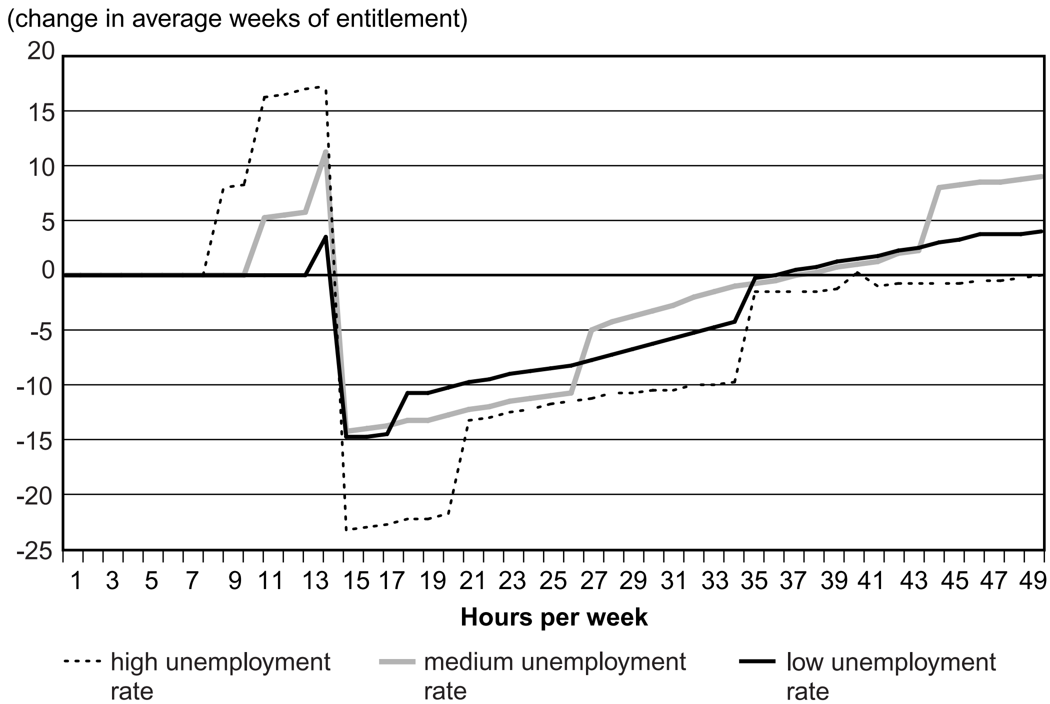
FIGURE 3
Average Number of Weeks of Benefit Entitlement for a Worker Employed x Hours Per Week, High Unemployment Rate Region*



* avg. of # of weeks of entitlement at 12, 20, 40 and 52 weeks of work/year

FIGURE 4

Change in Average Number of Weeks of Benefit Entitlement for a Worker Employed x Hours Per Week Under Switch to EI*



* avg. of # of weeks of entitlement at 12, 20, 40 and 52 weeks of work/year

3. *The Expected Indirect Effect of these Changes on Weekly Hours*

The exemption from the Unemployment Insurance (UI) program of jobs entailing fewer than 15 hours created an incentive for firms to alter weekly work schedules. The nature of the incentive depended on whether or not the firm generated unstable employment likely to generate a UI claim. Firms that generated a lot of UI claims would have wanted to avoid creating these schedules, because they would not generate UI eligibility for laid-off workers. Firms that did not generate a lot of UI claims would have wanted to create more of these schedules in order to avoid paying the UI payroll tax.

As intended, the extension of Employment Insurance (EI) coverage to jobs entailing fewer than 15 hours per week eliminated these distortions. As indicated in the third column on Table 2, we expect to see a reduction in these jobs in sectors that provide reasonably high levels of employment stability and an increase in jobs that entail slightly more than 15 hours per week as firms substitute away from very short jobs. All else equal, we would expect to see an increase in less than 15 hour a week jobs in less stable industries when this distortion ended and a commensurate reduction in jobs in the 15-34 hours category.

The changes in eligibility and entitlement rules imply that it is harder for workers employed on schedules in the 15-34 hours range, and easier for workers in the 36 plus hours range, to qualify for EI and to generate an entitlement to a considerable number of benefit weeks, regardless of whether the employer is a net contributor to, or beneficiary from, the EI program. As indicated in the fourth column of Table 2, we expect to see firms favouring longer weeks in sectors and regions that experience unstable employment patterns, where employment insurance is an important component of the remuneration package. Changes in eligibility and entitlement rules should not be sufficiently important for workers and firms in stable sectors to generate an observable change in behaviour.

The net effect of these two program changes is summarized in the last column of Table 2. We expect to see a possible increase in these jobs in unstable sectors, and a reduction in jobs entailing fewer than 15 hours per week in stable sectors. We expect to see a reduction in these jobs in unstable sectors, and a possible increase in jobs entailing 15-34 hours in stable sectors. Finally, we expect to see the proportion of jobs entailing at least 35 hours increase, particularly in unstable sectors.

TABLE 2
Predicted Effect of Change from UI to EI on the Share of Jobs in Each Hours Category, Stable and Unstable Sectors

		Coverage of <15 hours/ week	Change in eligibility / entitlement rules	Net change
<15 hours	Unstable	Increase	Small reduction	Possible increase
	Stable	Reduction	Small reduction	Reduction
15-34 hours	Unstable	Reduction	Reduction	Reduction
	Stable	Increase	Possible small reduction	Possible increase
34+ hours	Unstable	No change	Increase	Increase
	Stable	No change	Possible small increase	Possible small increase

4. Changes in the Hours Distribution — Informal Evidence

The discussion in the previous section suggests that we would expect to see a general trend towards longer hours in response to the introduction of the Employment Insurance (EI) program. In particular, we want to look for a reduction in the share of jobs that require fewer than 15 hours per week in stable sectors as the payroll tax distortion is eliminated, and a reduction in the share of jobs that provide 15 to 34 hours per week in sectors that do not provide stable jobs and therefore draw substantial net benefits from the EI system.

To explore these possibilities, we analyze data from several snapshots of the hours distribution from the Labour Force Survey, taken before and after the program changes that became effective in January 1997, to see if we can detect any pattern of changes that would be consistent with a plausible behavioural response among workers and firms. Changes to the Labour Force Survey (LFS) questionnaire beginning in January 1997 mean that the measure of usual hours is not consistent across the two survey years.[1] We use the reported measure of actual hours in all of our analysis in order to minimize the problems created by the redesign of the Survey. The possibility of changes in the way respondents answer the question about actual hours is considered further below.

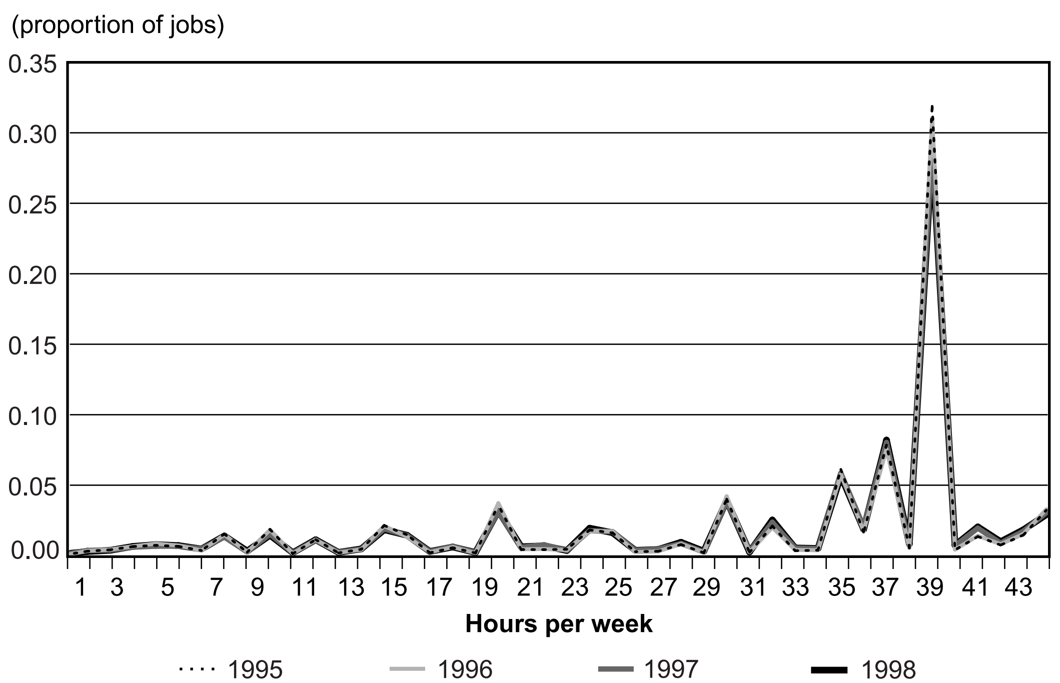
The appropriate timing of our before and after snapshots of the hours distribution depends on the assumptions made about the time it takes for workers and firms to understand the implications of the program changes and the structure of costs involved when workers and firms change weekly hours schedules. If rapid changes in hourly schedules are more costly to workers or firms than more gradual adjustment, adjustment may have begun as soon as the changes were announced in July 1996, and may have taken some time to complete. We would then want to compare data from the June 1996 LFS, just prior to the announcement of Bill C-12, to data from the June 1997 LFS, in the sixth month following the effective date of the legislation. Although the legislation had been effective for only six months in June 1997, employers and employees had knowledge of the changes for almost a year, so some response might be expected by that time. If rapid adjustment is not more costly than gradual adjustment, all changes would have been made as soon as the legislation became effective in January 1997. In this case the behavioural response would be evident in a comparison of data from December 1996 to January 1997. If rapid adjustment is not costly, but learning takes time, adjustment would have begun in January 1997 and take some time to complete. We would then want to compare data from December 1996 to December 1997.

Figure 5 presents plots of the density function of actual hours worked in the reference week for June 1995, 1996, 1997 and 1998. The height of these plots at 20 hours, for example, is equal to the proportion of all jobs in the Labour Force Survey data that entailed exactly 20 hours of work in the reference week. As expected, the distributions are dominated by the spike at forty hours per week, by far the most common work schedule. Note however

1 See Sunter, Kinack, Akyeampong and Charrette (1996).

that this spike is visibly smaller in 1997 and 1998 than in 1995 and 1996. Also evident from this plot is what appears to be a relocation of the spike at 38 hours in 1995 and 1996 to 37 hours in 1997 and 1998. This change is not expected in response to the program, nor does any other explanation for it seem plausible. In the remaining plots the density at 37 and 38 hours is added together to smooth this change away.

FIGURE 5
Hours Density Functions (Proportion of Jobs Entailing Exactly x Hours Per Week, June, Various Years)



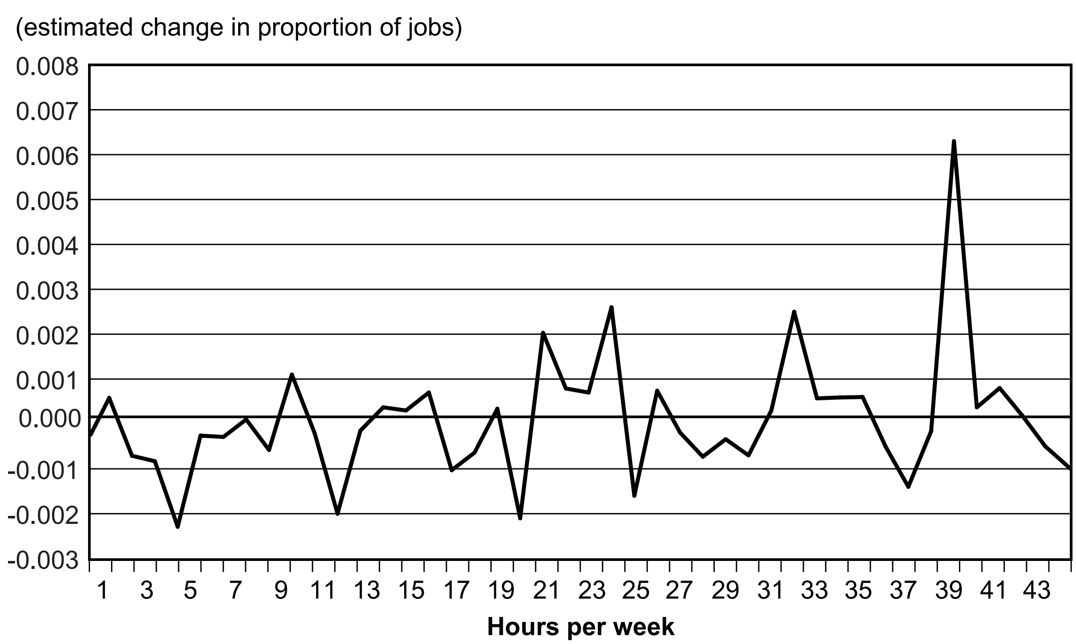
A simple comparison of the hours density function between June 1996 and June 1997 would reveal differences that could be attributed to at least three factors: (1) a behavioural response to the EI program; (2) changes in business cycle conditions; and (3) reporting changes due to changes in the Labour Force Survey questionnaire that were phased in over the latter half of 1996. We take several steps to isolate the changes that can be attributed to the EI program changes.

In order to eliminate the possible confounding effect of business cycle trends and seasonal effects that would generate changes in the hours density function, we compare the change between January and June of 1996 to the change between January and June of 1997. The change between January and June of 1996 may reflect business cycle trend and seasonal effects, while the change between January and June of 1997 may reflect behavioural responses to the EI program in addition to business cycle trend and seasonal effects. By looking at the *difference* between these changes, we can isolate the behavioural response to the EI program changes, assuming that the trend and seasonal effects are constant across years.

Although the question used to extract information on actual hours was not changed when the Labour Force Survey questionnaire was redesigned, exploration of the data revealed a greater tendency for workers to report that they worked common workweeks like 10, 20 and 40 hours, and a lesser tendency for them to report less common workweeks like 11, 17 and 23 hours. Our methodology eliminates the possibility that we might confound spurious reporting changes with a behavioural response. Although the 1997 data are generated by a different questionnaire than the 1996 data, the changes *within* each year are calculated by comparing months that use the same questionnaire. For this reason, the changes within each year do not capture spurious reporting changes. The difference *between* the within year changes therefore reflect behavioural changes alone.

Figure 6 plots this difference between the change in the hours density function in 1996 and 1997 for the full sample. To understand this plot, consider for example the proportion of jobs requiring exactly 20 hours per week. Between January and June of 1996, the proportion of jobs that required exactly 20 hours per week increased by 0.12 percentage points. Between January and June of 1997, the proportion of jobs in this category fell by 0.09 percentage points. If we assume that the proportion of jobs in this category would have increased in the same way across the two months in 1997 as in 1996, we would have expected it to increase by 0.12 percentage points. The reduction of 0.09 percentage points therefore represents a -0.09-(.12)= -0.21 percentage point change (reduction) in the proportion of

FIGURE 6
Estimated Change in Density Functions (Proportion of Jobs Requiring Exactly x Hours/Week) in Response to EI Program*



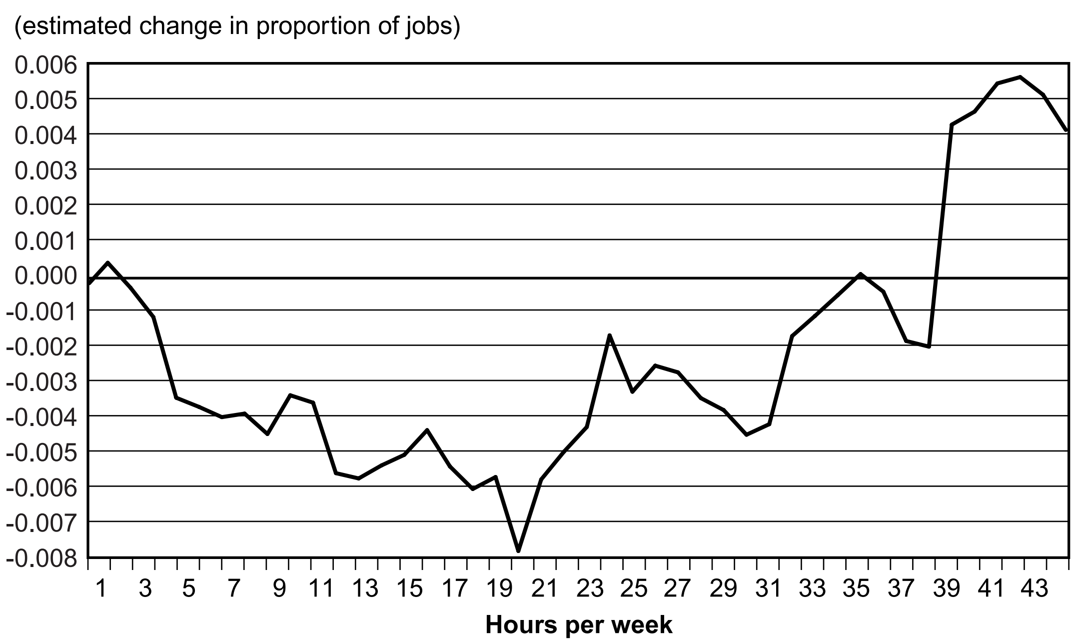
* Change in proportion of jobs requiring x hours/week between January and June 1997, minus change in proportion of jobs between January and June 1996.
=(june97-jan-97)-(june96-jan96)

these jobs, that can be attributed to the EI program changes. Visual inspection of Figure 6 indicates that there are more negative changes at lower hours and more positive changes at higher hours, again indicating a trend towards longer hours.

Figure 7 plots the difference between the change in the cumulative distribution function in 1996 and 1997 for the full sample corresponding to the density function in Figure 6. The value of the cumulative distribution function at 20 hours per week, for example, tells us the proportion of all jobs that entailed fewer than 20 hours per week. To understand this plot, consider for example the proportion of jobs requiring fewer than 20 hours per week. Between January and June of 1996, the proportion of jobs that required fewer than 20 hours per week fell by 2.5 percentage points. Between January and June of 1997, the proportion of jobs in this category fell by 3.2 percentage points. If we assume that the proportion of jobs in this category would have fallen in the same way across the two months in 1997 as in 1996, we would have expected it to fall by 2.5 percentage points. The reduction of 3.2 percentage points therefore represents a -3.2-(-2.5)= -0.7 percentage point change (reduction) in the proportion of these jobs that can be attributed to the EI program changes, in the full sample.

Figure 7 illustrates clearly the move toward longer hours. The plot slopes downward until about 20 hours, then slopes upwards and crosses the zero axis at 35 hours per week. This pattern indicates a reduction in the share of jobs requiring fewer than 20 hours per week, an increase in the proportion of jobs requiring 15-34 hours per week, and no change in the

FIGURE 7
Estimated Change in Cumulative Distribution Function (Proportion of Jobs Requiring Fewer than x Hours/Week) in Response to EI Program, Raw Data*



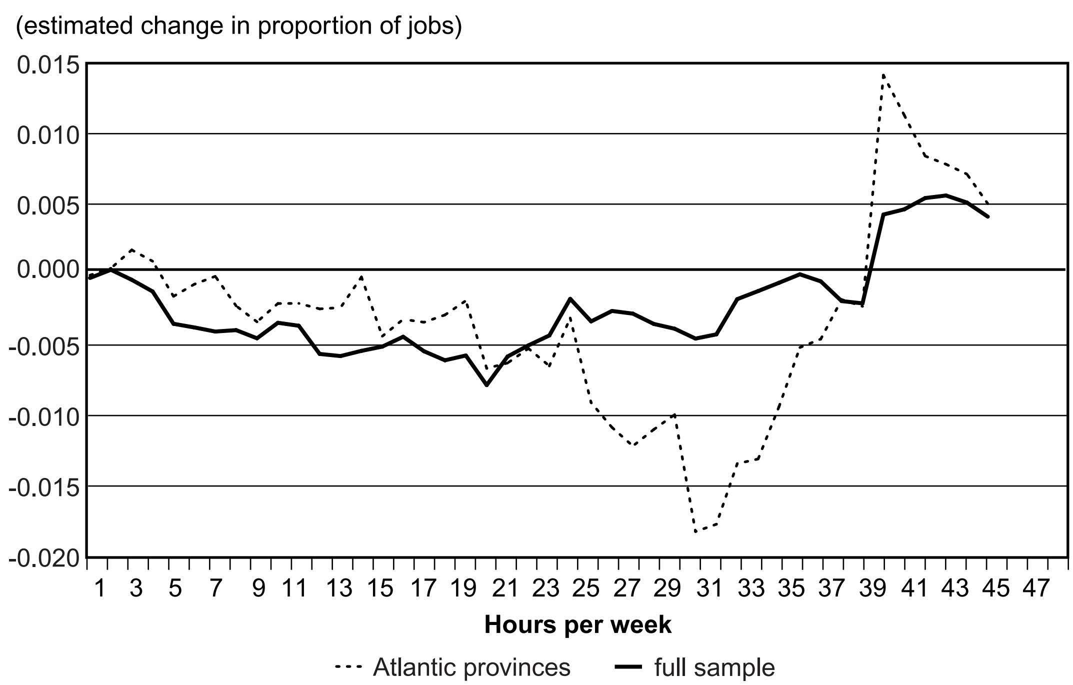
* Change in proportion of jobs requiring fewer than x hours/week between January and June 1997, minus change in proportion of jobs between January and June 1996.
=(june97-jan-97)-(june96-jan96)

proportion of jobs requiring at least 35 hours per week in the full sample. This pattern of changes is exactly what we would expect from a behavioural response to the EI program changes.

If these changes are EI-induced, we would expect to see a difference in their pattern between industries or regions that are more and less unstable and EI-dependent. As discussed earlier, in relatively unstable sectors we would expect to see a possible (but not very likely) increase in the share of jobs that require fewer than 15 hours per week, and a reduction in the share of part-time jobs that require at least 15 hours per week. In stable sectors we would expect to see a move away from jobs entailing fewer than 15 hours a week towards jobs entailing more than 15 hours a week. Because stable firms are not likely to be positioning themselves to increase EI entitlement, there is no reason a priori to expect a move towards longer jobs among stable firms that employ part-time workers for at least 15 hours per week. If firms substitute from less than 15 hours a week jobs to more than 15 hours a week part-time jobs, the proportion of jobs in this latter category would increase.

Figure 8 presents plots of the difference in changes in the cumulative distribution function in the full sample and in the Atlantic provinces, Figure 9 highlights the changes in a group of high turnover industries that employ a large number of part-time workers and Figure 10

FIGURE 8
Estimated Change in Cumulative Distribution Function (Proportion of Jobs Requiring at Least x Hours/Week) in Response to EI Program, Raw Data, Full Sample and Atlantic Provinces*

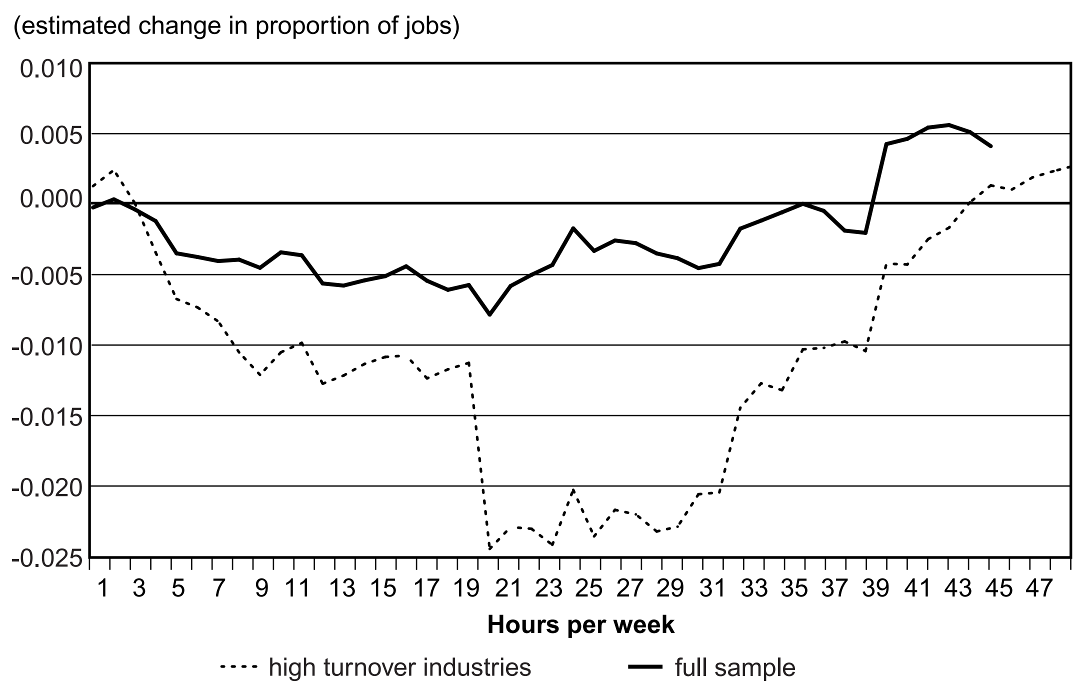


* Change in proportion of jobs requiring fewer than x hours/week between January and June 1997, minus change in proportion of jobs between January and June 1996.
=(june97-jan-97)-(june96-jan96)

highlights the changes in a group of seasonal industries.[2] The pattern of changes in the Atlantic provinces and in high turnover industries are more pronounced than in the full sample, as we would expect in these unstable, relatively EI-dependent sectors.

The pattern of changes in the seasonal industries is somewhat different, showing a pronounced move towards jobs entailing more than 40 hours per week. The plot in Figure 10 shows a varied pattern up to 30 hours per week, where it touches the zero axis. It then slopes downward quite dramatically until 40 hours per week, where it begins to climb back toward the zero axis. If we compare its value at 30 and 40 hours per week, we see that the EI program had no effect on the proportion of jobs requiring fewer than 30 hours per week, but reduced substantially the proportion of jobs requiring fewer than 40 hours per week. This pattern indicates a movement away from 30-40 hour per week jobs toward longer hours jobs. How much longer? The plot remains well below the zero axis even at 48 hours, indicating that substantial substitution towards the very long hours range.

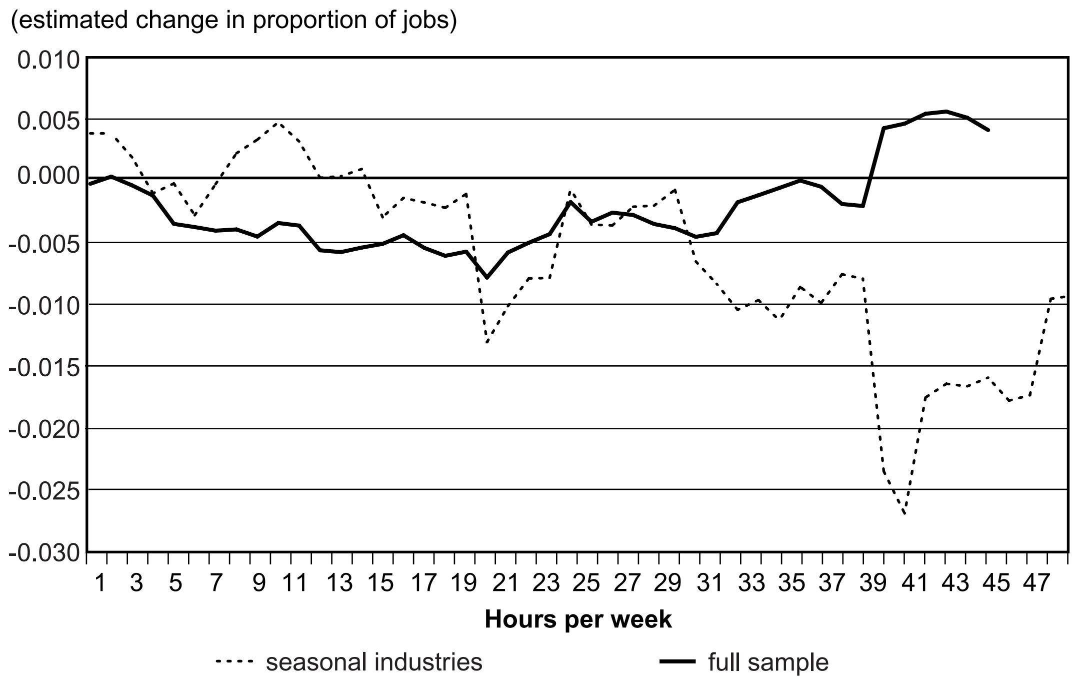
FIGURE 9
Estimated Change in Cumulative Distribution Function (Proportion of Jobs Requiring at Least x Hours/Week) in Response to EI Program, Raw Data, Full Sample and High Turnover Industries*



* Change in proportion of jobs requiring fewer than x hours/week between January and June 1997, minus change in proportion of jobs between January and June 1996. =(june97-jan-97)-(june96-jan96)

2 The group of high-turnover industries consists of agriculture, construction, retail trade, personal services and business and miscellaneous services. These industries employ the greatest proportion of part-time workers and exhibit high lay-off rates. The group of seasonal industries consists of agriculture, other primary and construction.

FIGURE 10
Estimated Change in Cumulative Distribution Functions (Proportion of Jobs Requiring at Least x Hours/Week) in Response to EI Program, Raw Data, Full Sample and Seasonal Industries*



* Change in proportion of jobs requiring fewer than x hours/week between January and June 1997, minus change in proportion of jobs between January and June 1996.
=(june97-jan-97)-(june96-jan96)

5. *Formal Analysis*

We now turn to more formal analysis of the data to determine whether econometric techniques can be employed to establish a causal link between these changes in the economy-wide pattern of weekly hours and the changes to the EI program. Readers not interested in the technical details of the formal estimation procedure may wish to proceed directly to Section 5.4, which describes a simulation exercise based on the econometric results that illustrates the "punchline".

5.1 The Econometric Framework

We use the method of Donald, Green and Paarsch (1995) to estimate a semi-parametric model of the hours distribution. This method employs a hazard function framework to estimate the effect of a set of covariates on the observed hours distribution. The hazard function framework is a convenient method for estimating conditional distributions and offers a number of advantages over other methods (for a discussion of these advantages see Donald, Green and Paarsch (1995) and Green and Paarsch (1996)). This approach allows the isolation of changes in the hours distribution that are due to the EI program changes.

The hazard function approach is useful in this context not because it is a natural way to think about the data, as is the case in duration studies, but because the hazard function is a convenient building block that can be used to construct estimates of density functions and cumulative distribution functions, both of which we will find useful. In traditional applications of the hazard function approach to duration data, the hazard function is the rate that gives instantaneous potential for an event to occur given survival up to time "t".

In the current application, the hazard function, $\lambda(h)$, is the probability that a job entails exactly h hours per week, given that it requires at least h hours per week. The density function, or the unconditional probability that a job entails x hours, f(h), can be estimated using the relationship $f(h)= \lambda(h) * S(h)$. The cumulative distribution function, F(h), is also of interest. F(h) is the probability that the job requires fewer than h hours per week, and is equal to one minus the survival function, S(h). S(h) in turn can be obtained from the hazard function, as

$$S(h^*)= [1-\lambda(h=1)]\cdot [1-\lambda(h=2)] \cdot \ldots \cdot [1-\lambda(h=h^*)].$$

We need to specify the model so as to allow the covariate vector to have a different effect on the hazard function at different points in the distribution. For example, being employed in a particular industry might greatly increase the probability of working 10 hours per week or fewer, and have relatively little effect on working more than 40 hours per week. This flexibility can be achieved by interacting the covariates with different baseline segments. A fully flexible specification would interact each "hour" with all covariates, so that each covariate would be allowed to affect the conditional probability that a job entails each possible number of hours in a different way. However, the number of parameters to be estimated becomes unwieldy extremely quickly with this approach. The number of parameters to be estimated can be reduced by restricting the number of covariates in the model and by allowing the affect of the covariates to vary only across certain segments of the baseline, rather than at each point in the baseline.

We estimate four different baseline segments, corresponding to 0-10 hours, 11-20 hours, 21-30 hours and 31-40 hours. Estimates of the hazard at more than 40 hours are not reported because the thinness of the data in this range made the standard errors in the simulations reported below very large. We include a total of 44 covariates, so we estimate a total of 176 covariate parameters and 40 baseline parameters.

5.2. Incorporating EI Effects

In order to identify the effect of EI payroll tax coverage on the hours distribution we compare data from before and after Bill C-12. In the results reported below we have pooled LFS data from June 1996 and June 1997 so that we can capture the program changes without concerning ourselves with seasonality. This choice of months also allows for learning and gradual adjustment.

Because benefit entitlement varies with hours worked, measures of benefit entitlement can be included in the hazard function framework in a way that is analogous to a time-varying covariate in duration analysis. We have modeled the effect of the EI program on the hours hazard using two types of variables. The first is a simple dummy variable that indicates exemption from the EI payroll tax. The effect of the EI payroll tax is captured by this dummy variable that is equal to one in the baseline segments corresponding to fewer than 15 hours per week during June 1996, and zero otherwise.

The second type of variable is intended to capture the effects of the disproportionate changes in benefit entitlement across the hours distribution. The basic building block for these variables is the simple arithmetic average of benefit entitlement at different numbers of weeks per year that is illustrated in Figures 1 through 3. Changes in the absolute magnitude of benefit entitlement that are uniform across the hours distribution would not be expected to have any effect on the hazard function. For example, an across-the-hours-distribution reduction in benefit entitlement would not alter firms' and workers' incentives to choose particular weekly hours schedules. Rather, it is relative changes in benefit entitlement that might alter preferred work schedules. We include three measures of relative benefit entitlement. The first, ENTCH, is equal to the difference between our summary measure of benefit entitlement for each weekly schedule and its value at 35 hours per week. This variable can be thought of as measuring the slope of the schedules illustrated in Figures 1 through 3, measured between the point corresponding to each particular hours schedule and the point at 35 hours. In 1996, this measure is zero for all schedules of at least 15 hours per week. In 1997, it remains at zero at exactly 35 hours, but takes on a negative value at all hours less than 35 and a positive value at all hours greater than 35. Furthermore its value varies across regions with different unemployment rates in 1997.

We include a second measure of relative benefit entitlement, ENTCHP, computed as the difference between our summary measure at each point and its value at the next spike in the hours distribution. If firms and workers are more easily able to increase weekly hours slightly, rather than dramatically, the more local slope of the benefit entitlement function may have a significant effect on the hours hazard. For example, the large step function at 15 hours in 1996 might be more likely to induce a movement from 12 hours to 15 hours, rather than from 12 hours to 35 hours.

If the hazard at any particular point is influenced by the relative value of the benefit entitlement at the next spike, then it follows that the hazard at the spikes will be affected by its relative value at the previous spike. We therefore include a variable called ENTCHM, which is equal to the relative value of the benefit entitlement measure at the previous spike at points in the hours distribution that themselves exhibit spikes, and zero at other points in the hours distribution.

The effect of the structure of EI benefits on the hours distribution is identified off two sources of variation in program parameters. The first source is the change in the benefit structure between 1996 and 1997 illustrated earlier in Figures 1 through 3. The second source is the variation across different unemployment regions within each of 1996 and 1997. Because the pattern of benefit changes between 1996 and 1997 differed across regions with different unemployment rates, the effect of the program can be identified separately from the effect of business cycle conditions. The formal econometric analysis reported next uses the TABS version of the Labour Force Survey files for June 1996 and June 1997. The TABS file identifies the relevant EI region for each record, enabling us to take advantage of the full cross-sectional variation in regional unemployment rates. Along with the four EI measures and the EI regional unemployment rate, the hazard function model includes as covariates occupational and industry dummies, measures of education, gender, marital status, age, and a public sector dummy. The hazard was modeled as a logit function.

5.3 Results

A series of nested sequential hypothesis tests were conducted to determine the most parsimonious specification of the employment insurance effects that was consistent with the data. The estimates of the EI program parameters from the preferred specifications are reported in Table 3. A full set of coefficient estimates is presented in Appendix Table A1.

The dummy variable indicating that weeks consisting of fewer than 15 hours were exempt from EI tax and did not contribute to eligibility or entitlement in 1996 was statistically significant in both the 0-10 hours and the 11-20 hours models. The positive coefficients indicate that workers were more likely to work very short weeks under the old UI rules that excluded these schedules from the program. The variable ENTCH was statistically significant in the 21-30 hours model, and ENTCHM was statistically significant in the 31-40 hours model. Both of these coefficients have negative signs, indicating a movement towards longer hours in response to the new EI rules. The variable ENTCHP, which measures the difference between program entitlement at that point in the hours distribution and at the next spike, is statistically significant in all four models. It has a negative sign in the 0-10 hours and

TABLE 3 Estimates of the EI Program Parameters, Hazard Function Framework								
	0-10 hours		11-20 hours		21-30 hours		31-40 hours	
	Coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
Exempt from EI	0.0604	0.0217	0.168	0.0856	—	—	—	—
ENTCH	—	—	—	—	-0.00722	0.0085	—	—
ENTCHP	-0.00504	0.0458	0.00877	0.022	0.0124	0.0032	-0.0134	0.0001
ENTCHM	—	—	—	—	—	—	-0.00504	0.0154
n	951687	—	875031		775768	—	627778	—

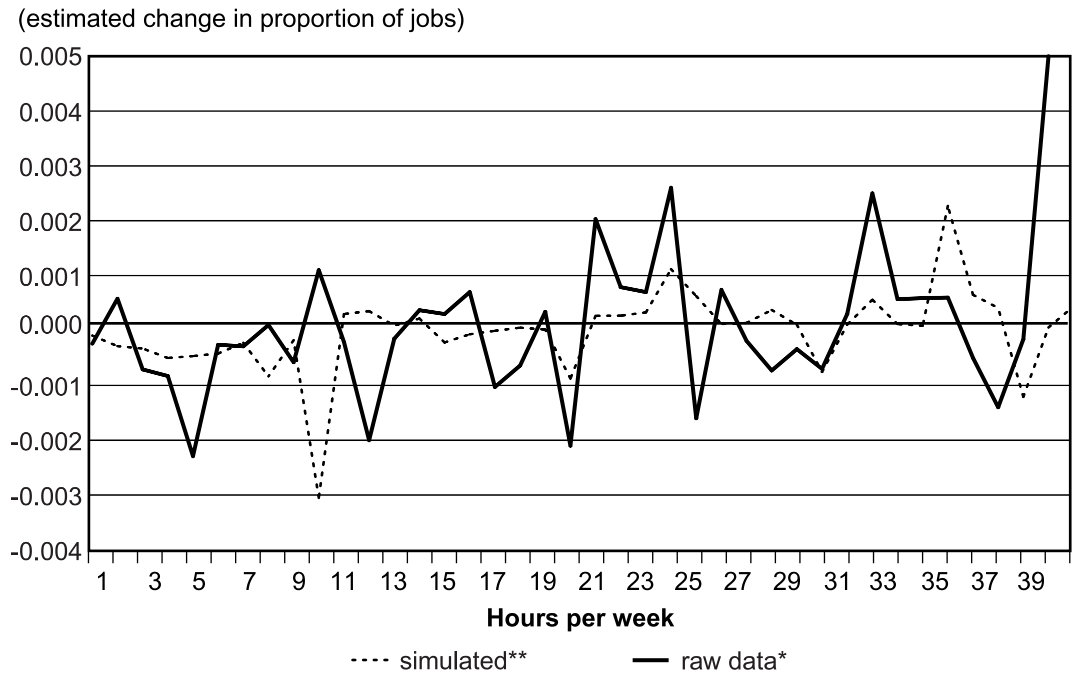
31-40 hours models, again indicating a tendency towards longer hours. It has a positive sign in the 11-20 and 21-30 hours models, which at first seems somewhat perplexing. One plausible explanation is that this variable is picking up the increase in the hazard in this range as workers and firms reorganize their work schedules in response to the taxation of less than 15 hour weeks. Although we modeled the effect of movements up the hours distribution that arise because of changes in the benefit schedule at lower hours, similar movements up the hours distribution that arise because of responses to the tax rate cannot be identified separately from slope effects.

5.4 Simulations

The parameter estimates produced by our econometric estimation can be used to generate predicted values for the hours density and the cumulative hours distribution. We do so under two scenarios. The first scenario uses the values of the EI program eligibility and entitlement measures calculated under the EI rules actually in effect in June 1997. The second scenario uses the values of the UI program measures calculated using the June 1997 data and the old UI rules to answer the counterfactual question “What would the hours of work distribution have looked like in June 1997 had the old UI rules still been in effect?” The difference between the predicted values under these two scenarios tells us how, according to these estimates from our formal econometric model, the program changes altered the June 1997 hours of work distribution.

These estimated differences are analogous to the differences in the density and cumulative distribution functions calculated from the raw data that were presented in Figures 6 and 7. In those plots we treated the changes from 1995 to 1996 as the counterfactual baseline. In the current exercise we use the values predicted by our model as the counterfactual baseline. The estimated program effects based on the raw data and from the formal econometric procedure are presented together in Figure 11. The simulated changes based on the econometric estimation do not exhibit the spikiness of the changes estimated from the raw data. The simulated changes from the econometric estimation indicate a substantial reduction in the hours density at less than 11 hours per week, and a mixed pattern from there on.

FIGURE 11
Estimated Change in Density Function (Proportion of Jobs Requiring x Hours/Week) in Response to EI Program

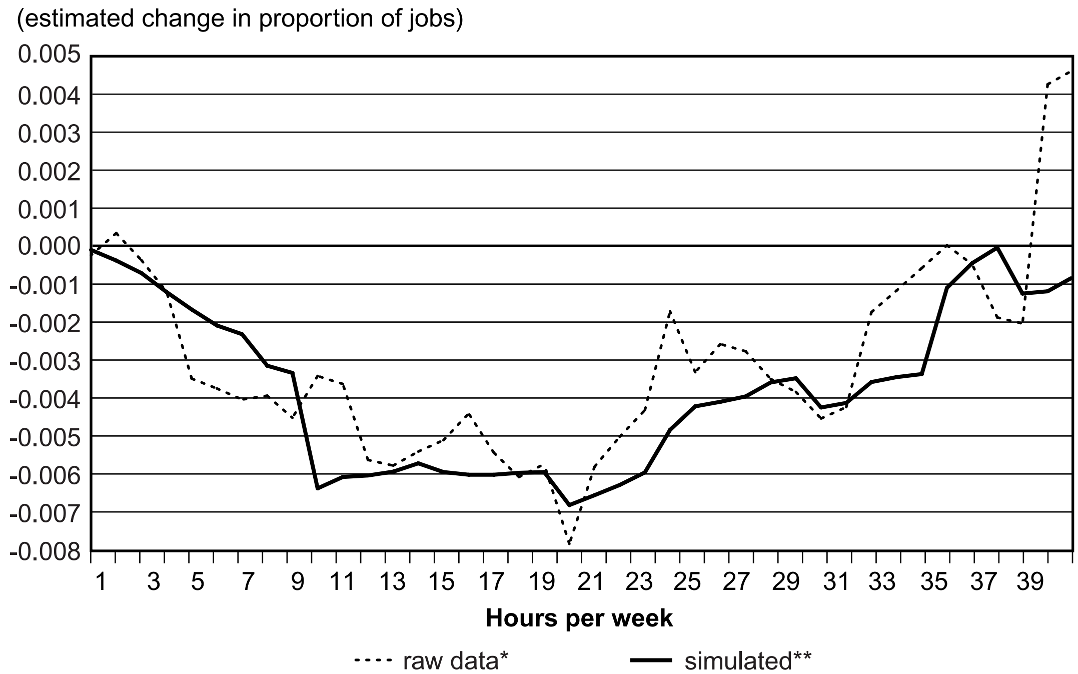


* Computed from raw data, reproduced from Fig. 6.
**Computed as difference between simulated probabilities using estimated hazard function coefficients, data from June 1997, and 1997 EI parameters, and simulated density function using 1996 UI parameters.

Although the changes in the hours density due to the EI program estimated from the raw data and the formal econometric procedure appear quite dissimilar, the estimated changes in the cumulative hours distribution function, presented in Figure 12, are strikingly similar. The cumulative distribution function smoothes out local differences in the actual and simulated density functions. According to the estimates produced by the hazard function model, virtually all of the change in the cumulative hours distribution between June 1996 and June 1997 can be accounted for by a response to the changes to the EI program.

According to these estimates the program changes caused a reduction of about 5 percent in the share of jobs that require fewer than 11 hours per week, or about one half of one percentage point. The cumulative hours distribution is estimated to be virtually unchanged between 11 and 20 hours, and to be increasing between 20 and 40 hours. This pattern is consistent with substitution from the 0-10 hours range into the 11-20 hours range, and from the 0-10 hours and 11-20 hours ranges into the 20-30 hours and 30-40 hours ranges. No significant substitution into schedules longer than 40 hours is apparent in these aggregate data.

FIGURE 12
Estimated Change in Cumulative Function (Proportion of Jobs Requiring at Least x Hours/Week) in Response to EI Program



* Computed from raw data, reproduced from Fig. 7.
**Computed as difference between simulated probabilities using estimated hazard function coefficients, data from June 1997, and 1997 EI parameters, and simulated density function using 1996 UI parameters.

5.5 Analysis of Sub-Groups

Our earlier theoretical discussion described how we would expect the pattern of hours responses to differ across stable and unstable sectors of the economy. These predictions, summarized in Table 2, were born out by the informal evidence presented in Figures 8, 9 and 10, which showed that the changes in the hours distribution were greater in the Atlantic provinces and in high turnover and seasonal industries than in the rest of the economy. Because of the relatively few observations in these subsectors, estimating the full econometric model is not feasible. Instead, we estimate less complex econometric models that still allow us to get a sense of the differences in behavioural responses across sectors.

Table 4 presents some results from logit regressions of the probability that a job requires less than 15 hours per week, and between 15 and 30 hours per week.[3] The first column presents parameter estimates that capture the difference in this probability between June and January of 1997 obtained from a regression on data pooled from these two months. The first row corresponds to a simple shift dummy for June 1997 compared to a base category of January 1997, the second row corresponds to a shift dummy interacted with a dummy

3 The empirical work reported in this sub-section used the public use version of the Labour Force Survey files.

variable for the Atlantic provinces, and the third row corresponds to a shift dummy interacted with a dummy variable for high turnover industries. The second column presents estimated coefficients on these same dummies from a pooled January/June sample for 1996. The difference across the two years in these estimates, presented in the third column captures the potential program effect. The final column presents t statistics for the difference between the parameter estimates.

TABLE 4
Difference in Estimated Logit Coefficients, Probability of Short Hourly Schedules, January to June

	parameter estimate 1997	parameter estimate 1996	difference 1997-1996	t statistic difference
prob h<15				
June dummy	-0.25	-0.20	-0.05	-1.03
June dummy*maritimes	-0.14	-0.20	0.06	0.69
June dummy*high turnover industry	-0.09	-0.03	-0.06	-0.89
n	94209	93902	—	—
prob 15<=h<=30				
June dummy	-0.03	-0.10	0.07	2.06
June dummy*maritimes	-0.11	0.05	-0.16	-2.45
June dummy*high turnover industry	0.00	0.09	-0.09	-1.90
n	94209	93902	—	—

The coefficients on the simple shift dummies indicate a statistically insignificant reduction in the probability that a job in a relatively stable industry outside the Atlantic provinces required less than 15 hours per week and a statistically significant increase in the probability that such a job required between 15 and 30 hours per week. These signs are consistent with an EI-induced move towards longer hours in these sectors.

Neither the Atlantic provinces interaction variable nor the high turnover industry interaction variable is statistically significant in the less than 15 hours per week equation. We did not have very strong priors on these estimates, so their lack of statistical significance is not surprising. The coefficients on the Atlantic provinces and high turnover industry interaction variables do indicate a statistically significant reduction in the frequency of 15 to 30 hour per week jobs exactly where we would expect the response to the reduction in entitlement in part-time jobs to be greatest — in high turnover, EI-dependent sectors.

6. Conclusion

The empirical analysis presented in this paper provides evidence that the inclusion of jobs entailing fewer than 15 hours per week and the move to an hours-based EI system has evoked a significant change in the hours of work distribution. When the raw data are presented so as to difference out both the effect of the redesign of the Labour Force Survey and seasonal effects, a clear tendency away from very short-hours jobs is apparent. Except in seasonal industries, there has been a substitution towards jobs that require fewer than 35-40 hours per week. Most of the change in seasonal industries is away from jobs requiring fewer than 40 hours per week to jobs that require more than 40 hours per week. Parameterizing the EI program changes into a hazard function model generated estimates that attributed virtually all of the changes in the hours distribution in the first half of 1997 to a behavioural response to the incentives created by the EI program. Further econometric analysis provided formal evidence supporting the evidence from the raw data that the pattern of changes is different in stable and unstable sectors in a way that is consistent with the behavioural interpretation.

These findings have several implications:

(1) Evidence that the share of jobs that require fewer than 15 hours per week is declining suggests that removing the distinction between weeks of work involving more or fewer than fifteen hours has eliminated a significant distortion in some employers' hours decisions.

(2) When workers adjust their working schedules in these ways, they mitigate some of the adversity that a reduction in program eligibility and benefit entitlement would otherwise entail.

(3) Evidence of a trend to very long hours jobs in seasonal industries may reflect a reduction in those industries in work-sharing arrangements that had in the past been designed by workers and firms to qualify a large number of individuals for UI benefits.

(4) Evidence that the share of 15-30 hours per week jobs in unstable sectors is declining relative to longer hours jobs suggests that a new distortion has been introduced into some hours decisions. This new distortion arises because under the old weeks-based system, benefit rates were based on earnings, but eligibility and entitlement rules were neutral with respect to hours worked per week, so long as at least 15 hours were reported. Under the new hours-based system, a week of part-time work is not insured as fully as a week of full-time work. The implications of this new distortion should be considered by researchers and policy analysts interested in the broader economic and social implications of hours of work decisions.

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Appendix A

TABLE A1
Hazard Model Estimates

	0-10 hours		11-20 hours		21-30 hours		31-40 hours	
	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
Intercept	-5.645	0.0001	-5.8081	0.0001	-5.6765	0.0001	-7.371	0.0001
Primary	-0.4857	0.0032	-0.7646	0.0001	-0.7274	0.0001	0.1121	0.1466
Non-dur. Manuf,	-0.5062	0.0001	-0.6999	0.0001	-0.6798	0.0001	0.5182	0.0001
Durable Manuf.	-0.903	0.0001	-1.1726	0.0001	-1.1892	0.0001	0.4218	0.0001
Constr.	-0.1082	0.4088	-0.2486	0.04	-0.0842	0.4847	0.2785	0.0001
Transport	-0.5069	0.0001	-0.5022	0.0001	-0.2882	0.0085	0.629	0.0001
Wholesale Trade	-0.6153	0.0001	-0.8376	0.0001	-0.9498	0.0001	0.3613	0.0001
Retail Trade	-0.1611	0.1466	0.2845	0.004	0.3964	0.0001	0.7539	0.0001
Fin, Ins and Real Estate	-0.4045	0.001	-0.4198	0.0001	-0.1349	0.2122	0.9966	0.0001
Comm. Services	0.0922	0.4133	0.1382	0.1719	0.2734	0.0081	1.091	0.0001
Personal Serv.	-0.2713	0.0133	0.1705	0.0838	0.3217	0.0016	0.7161	0.0001
Bus. Services	-0.0364	0.7462	-0.1443	0.1618	-0.1074	0.3118	0.7125	0.0001
Pub. Admin.	-0.301	0.0158	-0.3956	0.0005	-0.2106	0.0591	1.0462	0.0001
Age	-0.024	0.0001	-0.023	0.0001	-0.0103	0.0001	0.000821	0.1674
Married	-0.2509	0.0001	-0.2151	0.0001	-0.039	0.0809	-0.0678	0.0001
Female	0.38	0.0001	0.551	0.0001	0.7698	0.0001	0.6341	0.0001
High School	-0.6504	0.0001	-0.4794	0.0001	-0.098	0.0015	0.1772	0.0001
Some Post-sec.	-0.4376	0.0001	-0.324	0.0001	-0.0212	0.5696	0.1214	0.0001
Post-sec Cert.	-0.5652	0.0001	-0.4903	0.0001	-0.136	0.0001	0.1465	0.0001
Bachelor's Degree	-0.5937	0.0001	-0.533	0.0001	-0.2053	0.0001	-0.0494	0.0357
Natural Sciences	-0.034	0.7645	-0.2571	0.0398	0.2836	0.0011	0.5759	0.0001
Social Science	0.3555	0.0003	0.6158	0.0001	0.5341	0.0001	0.3283	0.0001
Religion	0.1843	0.4782	0.5162	0.0161	0.0628	0.7814	-1.3798	0.0001

TABLE A1 (continued) Hazard Model Estimates								
	0-10 hours		11-20 hours		21-30 hours		31-40 hours	
	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
Teaching	0.5413	0.0001	0.65	0.0001	0.746	0.0001	-0.6054	0.0001
Medicine	0.4041	0.0001	1.0112	0.0001	1.1142	0.0001	0.5014	0.0001
Artistic	1.5436	0.0001	0.9635	0.0001	0.7746	0.0001	0.3443	0.0001
Clerical	0.7345	0.0001	1.111	0.0001	0.9045	0.0001	0.8821	0.0001
Sales	0.7752	0.0001	1.1585	0.0001	0.9997	0.0001	0.5137	0.0001
Service	1.0192	0.0001	1.184	0.0001	1.1195	0.0001	0.4559	0.0001
Farming	0.7216	0.0001	0.824	0.0001	0.7162	0.0001	0.1856	0.0015
Forestry	-0.0955	0.7438	0.193	0.4937	0.7433	0.0004	0.5494	0.0001
Mining	-0.2954	0.3499	0.2153	0.4415	0.3317	0.1774	0.4233	0.0001
Processing	0.2314	0.0461	0.5445	0.0001	0.6333	0.0001	0.3891	0.0001
Machining	-0.0153	0.9313	0.0218	0.9063	0.152	0.339	0.4764	0.0001
Fabricating	-0.1557	0.1053	0.1858	0.0224	0.043	0.5679	0.4931	0.0001
Constr.	-0.2336	0.059	0.2006	0.0639	0.2388	0.012	0.4841	0.0001
Transport Equipment Operating	0.6043	0.0001	1.1262	0.0001	0.7733	0.0001	-0.1625	0.0001
Material Handling	0.6444	0.0001	1.1641	0.0001	1.1253	0.0001	0.5946	0.0001
Other Crafts	0.4235	0.0093	0.9038	0.0001	0.6705	0.0001	0.6273	0.0001
Public Sector	-0.1499	0.0016	-0.2484	0.0001	-0.2348	0.0001	0.2477	0.0001
Base=2	1.1311	0.0001	—	—	—	—	—	—
Base=3	1.2903	0.0001	—	—	—	—	—	—
Base=4	1.7397	0.0001	—	—	—	—	—	—
Base=5	1.9236	0.0001	—	—	—	—	—	—
Base=6	1.8481	0.0001	—	—	—	—	—	—
Base=7	1.2368	0.0001	—	—	—	—	—	—
Base=8	2.6145	0.0001	—	—	—	—	—	—
Base=9	0.8778	0.0001	—	—	—	—	—	—
Base=10	2.7179	0.0001	—	—	—	—	—	—
Base=12	—	—	1.9161	0.0001	—	—	—	—
Base=13	—	—	0.2702	0.0097	—	—	—	—
Base=14	—	—	1.0014	0.0001	—	—	—	—
Base=15	—	—	2.5336	0.0001	—	—	—	—
Base=16	—	—	2.1838	0.0001	—	—	—	—

TABLE A1 (continued) Hazard Model Estimates								
	0-10 hours		11-20 hours		21-30 hours		31-40 hours	
	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
Base=17	—	—	0.4411	0.0001	—	—	—	—
Base=18	—	—	1.43	0.0001	—	—	—	—
Base=19	—	—	0.3316	0.0022	—	—	—	—
Base=20	—	—	3.2111	0.0001	—	—	—	—
Base=22	—	—	—	—	0.00566	0.9304	—	—
Base=23	—	—	—	—	0.0528	0.4107	—	—
Base=24	—	—	—	—	1.3308	0.0001	—	—
Base=25	—	—	—	—	1.3561	0.0001	—	—
Base=26	—	—	—	—	-0.3421	0.0001	—	—
Base=27	—	—	—	—	-0.2347	0.001	—	—
Base=28	—	—	—	—	0.7325	0.0001	—	—
Base=29	—	—	—	—	-0.5943	0.0001	—	—
Base=30	—	—	—	—	2.3676	0.0001	—	—
Base=32	—	—	—	—	—	—	2.066	0.0001
Base=33	—	—	—	—	—	—	0.6625	0.0001
Base=34	—	—	—	—	—	—	0.5744	0.0001
Base=35	—	—	—	—	—	—	3.2099	0.0001
Base=36	—	—	—	—	—	—	2.0987	0.0001
Base=37	—	—	—	—	—	—	1.8549	0.0001
Base=38	—	—	—	—	—	—	3.591	0.0001
Base=39	—	—	—	—	—	—	1.3459	0.0001
Base=40	—	—	—	—	—	—	6.2504	0.0001
Unemp. Rate	-0.0302	0.0001	-0.0195	0.0001	-0.00892	0.0015	0.0121	0.0001
Exempt from EI	0.0604	0.0217	0.168	0.0856	—	—	—	—
ENTCH	—	—	—	—	-0.00722	0.0085	—	—
ENTCHP	-0.00504	0.0458	0.00877	0.022	0.0124	0.0032	-0.0134	0.0001
ENTCHM	—	—	—	—	—	—	-0.00504	0.0154
Exempt from EI	0.0604	0.0217	0.168	0.0856	—	—	—	—
ENTCH	—	—	—	—	-0.00722	0.0085	—	—
ENTCHP	-0.00504	0.0458	0.00877	0.022	0.0124	0.0032	-0.0134	0.0001
ENTCHM	—	—	—	—	—	—	-0.00504	0.0154