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The impact of Sunday shopping on employment and hours of work in the retail industry: Evidence from Canada

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Abstract

Between 1980 and 1998 every Canadian province passed legislation that in some way relaxed restrictions on Sunday shopping. This study exploits the variation in deregulation dates between provinces to identify how retail employers adjust employment and hours of work when deciding to open on Sundays. A major complication of this analysis is to first determine for which provinces the deregulation dates are useful indicators of increases in Sunday store openings. This paper uses a unique trading-day regression approach to identify these provinces and then uses aggregate data from the selected provinces to estimate a simple dynamic labour demand model that allows employment and hours to be imperfect substitutes in production. The results suggest that retailers' needs for Sunday labour were disproportionately satisfied through increases in employment levels. Comparison of the estimates at three levels of the retail industry suggests that the employment and hours gains were larger among general merchandise stores than among more specialized retail establishments and relatively modest at the aggregate retail industry level. In addition, despite evidence of an immediate shortfall in the employment level below the long-run optimal level, the results suggest that firms were unable to compensate by temporarily increasing the hours of their existing employees.

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1. Introduction

Over the past 40 years a number of countries in the Western world have witnessed the dismantling of legislation that has historically, in some cases for hundreds of years, restricted business activity on the Christian day of Sabbath. The international trend toward Sunday shopping deregulation has been most extensive in North America, but is more recently showing signs of gaining momentum in Western Europe. In the United States a steady decline in the number of states that impose a general ban on all Sunday business activity began in the early 1960s so that by 1985 only 22 states still had general bans compared to 35 in 1961.[1] A similar decline began in Canada in the early 1980s and continued until 1998, when Newfoundland became the last province in the country to pass some form of deregulating legislation. In contrast, in Europe only Belgium, Luxembourg, Sweden and Spain had taken any formal steps to deregulate Sunday retail activity prior to the 1990s.[2] However, over the following decade England and Wales, the Netherlands and then Finland opted to relax their restrictions on Sunday shopping. Furthermore, there is indication that France and Italy are similarly moving in the direction of deregulation.[3]

Reference to the popular press of these countries reveals that legislative changes have taken place amid contentious political and public debates about the costs and benefits of Sunday shopping. In fact, in some political jurisdictions opposition to Sunday shopping following a deregulating initiative has actually been strong enough to reinstate restrictions.[4] A common concern in all these debates is the expected labour demand impact of Sunday shopping. In particular, will retail firms satisfy their need for Sunday employment by increasing the weekly hours of existing employees or by hiring new workers? Or is it possible that deregulation has neither an hours nor an employment impact as labour demand is reduced during the rest of the week? Opponents and proponents of deregulation have often based their arguments on their expectations of these labour demand effects.

Despite the widespread debate in the popular press there is a dearth of empirical research examining the labour demand effects of Sunday shopping. In an early

[1] The research by Burda and Weil (2001) on "blue-laws" as they are known in the US, is the most recent complete collection of U.S. state legislation. Using state legislative records they track regulatory regimes in all US states between 1969 and 1993. Laband and Heinbuch (1987) contains information, but their time-line ends in 1985. Price and Yandle (1987) focus exclusively on variation in blue laws between US states in the years 1970 and 1984.

[2] Kajalo (1997) has done extensive research to collect information on the legality of Sunday retail business across Europe.

[3] For the French case see "Government grasps Sunday law nettle" *International Management*, October 1991, pp. 20–21 and for the Italian see "Open up!" *The Economist*, March 14, 1998, p. 59.

[4] In 1994 Spain moved from complete deregulation to only eight Sundays per year of unrestricted Sunday shopping (Kajalo, 1997). Nova Scotia, Canada opted to entirely repeal their legislation following a three month experiment which proved unpopular with retailers (see "Sunday store openings not worth it: retailers" *Halifax Chronicle Herald*, November 26, 1993, p. B6). More recently, Norway has repealed the exemption of large supermarkets from its strict Sunday shopping legislation (see "Norway's Sunday best" *The Economist*, August 1, 1998, p. 43) and Kajalo (1997) reports that in Finland there is evidence of growing support among citizens for renewed regulation.

attempt to evaluate the economic impact of Sunday shopping, Kay et al. (1984) use consumer surveys to predict the effect of deregulation on retail sales in England. More recently, Gradus (1996) estimates a model of retail behaviour for the Netherlands and simulates the employment impact of deregulating store opening hours using evidence from the Swedish experience with deregulation. The problem with these estimates is that both studies are simulations based on data from countries that have yet to experience deregulation. In contrast, Laband and Heinbuch (1987) compare raw averages of employment and hours of work in US states with general bans on all Sunday commercial activity to states with no restrictions, while Tanguay et al. (1995) consider changes in average overtime hours before and after deregulation in Quebec, Canada. The problem with these studies is that both depend on a single source of variation in legal regimes to identify a Sunday shopping effect (i.e. first-difference estimates). By tracking legal changes within states, Burda and Weil (2001) fully exploit the decentralized US legal structure and extend the Laband and Heinbuch (1987) study to a difference-in-differences analysis. They however ignore the source of their estimated positive employment effect of deregulation and the important issue of whether their blue-law indicator variables actually capture significant differences in the legality of Sunday retail opening hours within and between states.

The Canadian experience offers a similar ideal setting to examine the consequences of Sunday shopping as the legislation is provincial and was introduced at different times. As a result, a ‘‘natural experiment’’ exists in which common movements in the retail industry data between provinces can be controlled for so as to isolate the Sunday shopping effect. This paper exploits this setting to identify how retail employers that choose to open on Sundays following deregulation adjust their employment level and weekly hours of work. A complication of the analysis arises because there is reason to suspect that the provincial deregulation dates may, in some cases, be poor measures of when restrictions on Sunday store openings were relaxed. Using monthly sales data and a unique trading-day regression approach, which exploits the fact that some months have five Sundays while others have only four, I begin by first determining in which provinces the deregulation dates correspond to significant increases in Sunday retail sales. I then limit my analysis to these provinces and estimate a simple dynamic labour demand model that allows employment and hours to be imperfect substitutes in production. The resulting estimates indicate that retailers' needs for Sunday labour were disproportionately satisfied through increases in employment levels. There is also evidence that the job gains experienced were larger among general merchandise stores than among more specialized retail establishments and relatively modest at aggregate retail industry level. Despite short run rigidities in the employment level employers appear to have been unable to compensate by temporarily increasing the weekly hours of either new or existing employees.

The remainder of the paper is organized as follows. Section 2 presents the Canadian legal experience with Sunday shopping deregulation and identifies in which provinces deregulation resulted in significant increases in Sunday retail sales. Section 3 considers some simple difference-in-differences estimates of the employment and hours effects of Sunday shopping. The dynamic empirical specification and data are presented in Section 4 and in Section 5 the results are discussed.

2. The Canadian experience

2.1. The deregulation process

The Canadian process of Sunday shopping deregulation began in 1985 when the Supreme Court of Canada found the federal *Lord's Day Act*, which had designated Sunday as a weekly day of rest since its adoption in 1907, to be unconstitutional.[5] The immediate consequence of this ruling was that the 10 provinces became responsible for determining the legality of Sunday shopping within their own jurisdictions. At that time Newfoundland already had legislation in place restricting retail business on Sundays. British Columbia and Ontario had also opted out of federal control before 1985, but had passed legislation providing municipalities with exclusive autonomy to regulate retail business hours.[6] By 1993 all provinces had passed legislation either restricting Sunday shopping (Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick), providing municipal autonomy (Saskatchewan, Alberta, and British Columbia), or permitting wide-open Sunday shopping (Manitoba, Quebec, and Ontario).[7] Of the provinces that originally regulated business hours, all have now either experimented with Sunday shopping (Nova Scotia), permitted it during part of the year (Prince Edward Island and New Brunswick), or entirely deregulated (Newfoundland). The result is a patchwork of legislation that is not only complicated by municipal jurisdiction in some provinces, but also by season and type of retail establishment.

An attempt to empirically evaluate the labour demand consequences of Sunday shopping using provincial time-series data requires the use of an indicator variable for each province that identifies the extent to which Sunday shopping is permitted within a province. Combining information obtained from periodicals, government publications, and personal contact with government offices, Table 1 presents a unique historical record of provincial Sunday shopping deregulation in Canada between 1980 and 2001. The final column of the table defines periods in which the provincial government had in some way deregulated Sunday shopping. This information is used to construct dummy variables for each province which are used

[5] The ruling was based on the logic that the *Act* violated the guarantee of religious freedom enshrined in the *Charter of Rights and Freedoms* of 1982.

[6] Ontario passed legislation in 1975 and British Columbia in 1980. In Ontario by 1985, 13 of 45 cities had adopted early closing by-laws (Ferris, 1991). These by-laws were primarily intended to regulate non-Sunday shopping hours so that Ontario cities without municipal by-laws before 1985 continued to acquiesce to the Federal legislation banning Sunday shopping.

[7] Beginning in December 1992, Manitoba conducted a 10-month province-wide experiment with Sunday shopping. This experiment was followed by legislation providing exclusive municipal autonomy. Winnipeg, the largest city in the province, has chosen not to introduce restrictions.

Table 1
Provincial deregulation of Sunday shopping in Canada

Province	Legal change date: general rule	Legislation	Indicator Variable
Newfoundland	January 1998: amendment to the *Shops Closing Act* passed to permit wide-open Sunday shopping throughout the province	*Shops Closing Act* (1977)	January 1998 to end of sample period
Prince Edward Island	November 1992: legislation passed to permit business establishments to open on Sundays from the last Sunday in November to the Sunday preceding Christmas	*Retail Businesses Holidays Act* (1992)	Each December from 1992 to end of sample period
Nova Scotia	March 1990: temporary experiment which allowed stores less than 40,000 sq. feet to open on Sundays	*Retail Business Uniform Closing Act* (1985)	March 1990 to January 1991
	October 1993: temporary experiment with deregulation by legislative amendment	*An Act to Amend Chapter 402 of the Revised Statutes* (1993)	October 1993 to December 1993
New Brunswick	November 1991: temporary amendment to permit shopping in most retail establishments	*Days of Rest Act* (1985)	November 1991 to December 1991
	September 1992: amendment to *Days of Rest Act* which allows Sunday shopping from first Sunday following Labour Day to the Sunday immediately preceding Christmas	*Act to Amend the Days of Rest Act* (1992)	September to December from 1992 to 1995
	August 1996: amendment to *Days of Rest Act* which allows Sunday shopping from first Sunday in August to the second Sunday after Christmas		August to December from 1996 to end of sample period
Quebec	December 1992: move to wide-open Sunday shopping	*Act respecting commercial establishments business hours* (1990) *Act to amend this law* (1992)	January 1993 to end of sample period
Ontario	June 1990: the *Retail Business Holidays Act* found to be unconstitutional by Ontario Supreme Court and in March 1991 the Ontario Court of Appeal reversed this decision. Result was 9 months of wide-open Sunday shopping	*Retail Business Holidays Act* (1990)	July 1990 to March 1991

Table 1 (*continued*)

Province	Legal change date: general rule	Legislation	Indicator Variable
	December 1991: legislation amended to permit Sunday shopping in the month of December	*Retail Establishments Statute Law Amendment Act* (1991)	December 1991
	June 1992: Bill introduced to permit wide-open Sunday shopping	*Act to Amend the Retail Business Holidays Act in respect of Sunday Shopping* (1992)	June 1992 to end of sample period
Manitoba	December 1992 and April 1993: two separate amendments to *Retail Business Holiday Closing Act* which led to 10 month experiment with wide-open Sunday shopping	*Retail Business Holiday Closing Act* (1987)	December 1992 to end of sample period
	October 1993: municipal autonomy	*Bill 4, Retail Businesses Sunday Shopping* (1992) *Bill 23, An Amendment to Retail Businesses Sunday Shopping* (1993)	
Saskatchewan	May 1988: Province passed legislation providing municipal autonomy	*Urban Municipality Amendment Act* (1988)	May 1988 to end of sample period
Alberta	November 1983: Alberta Court of Appeal struck down *Lord's Day Act,* but wide-spread Sunday shopping began in major cities in November 1984 following joint-decision to open by three major department stores in province. In 1985, legislation passed officially providing municipal autonomy	*Municipal Government Amendment Act* (1985)	November 1984 to end of sample period
British Columbia	1980: legislation passed providing municipal autonomy	*Holiday Shopping Regulation Act* (1980)	Not defined

Sources: Human Resources Development Canada website at http://www.hrsdc.gc.ca/en/lp/spila/clli/eslc/04Weekly_rest_day_and_Sunday_closing.shtml, APEC Newsletter 36(8), various newspaper articles, and personal government with various provincial government officials.

as independent variables in employment and hours equations to identify the labour demand effects of Sunday shopping.

A complication with this identification strategy is that there are reasons to believe the provincial deregulation dates may be poor measures of when restrictions on retail stores within provinces were relaxed. First, provincial governments in Western Canada deregulated by downloading legal responsibility onto municipalities. Heterogeneity in preferences between city councils is likely to have produced contrasting decisions following provincial deregulation. An attempt was made to collect legal information from cities across British Columbia. The information obtained reveals that the transition to deregulation has been a piecemeal process and in some cases changes in the legality of Sunday shopping are quite ambiguous.[8] Second, many types of establishments, such as variety stores and retailers in the tourism sector, were never constrained by the *Lord's Day Act*. Finally, in a number of provinces there was widespread flouting of the provincial regulations and *de facto* relaxations on Sunday shopping before formal legislative deregulation. These possibilities suggest that our provincial deregulation dummy variables may contain measurement error, which will serve to dampen the estimated labour demand effects. However, it is also possible that retailers did not, in fact, respond to deregulation.[9] As a result, it will be unclear whether an insignificant estimate should be interpreted as a true weak labour demand effect of deregulation or as the consequence of a poorly measured deregulation indicator variable.

To address this complication, the estimation of labour demand effects is restricted to provinces where there is evidence that provincial deregulation was concomitant with a significant increase in Sunday retail opening hours. The empirical identification is therefore not the unconditional effect of Sunday shopping deregulation, but rather the effect of deregulation conditional on retailers responding to deregulation by opening on Sundays. To obtain some idea of the extent to which the conditional and unconditional effects differ, it is worth considering whether the dropped provinces are those with a poorly measured deregulation indicator variables or those where stores were particularly likely to remain closed on Sundays following deregulation.

2.2. Trading-day regressions

In the absence of data on daily opening hours of retail establishments, it is not obvious how to identify which provincial deregulation dates correspond to significant increases in Sunday opening hours. The approach taken here is to test for structural breaks at provincial deregulation dates in the trading-day regression given by

$$\begin{aligned} Q_{it} = {} & \alpha_i + \beta_{1i}\, SUN_t + \beta_{2i}\, MON_t + \beta_{3i}\, TUE_t + \beta_{4i}\, WED_t + \beta_{5i}\, THU_t \\ & + \beta_{6i}\, FRI_t + \beta_{7i}\, SAT_t + \gamma_1\, u_{it} + \gamma_2\, Y_{it} + \gamma_3\, r_t + \gamma_{4i}\, T_t + \gamma_{5i}\, T_t^2 + \varepsilon_{it}, \quad (1) \end{aligned}$$

[8] Richmond, Victoria, Vancouver and Coquitlam deregulated Sunday retail hours in 1981, Maple Ridge in 1985 and Chilliwack in 1990. Interestingly, Langley and Abbotsford have no restrictions on Sunday shopping despite the absence of a by-law formally deregulating it.

[9] This response is likely to be particularly relevant in small, rural and religious communities.

where Q_{it} is monthly, real, per capita retail sales, u_{it} is monthly unemployment rate, Y_{it} is monthly, real, per capita labour income, r_t is the national consumer loan rate, T_t is a simple linear trend and SUN_t to SAT_t are variables that take on values of 4 or 5 depending on the number of instances of that particular day in month t. The question of interest is for which provinces is the estimate of β_{1i} significantly different before and after the provincial deregulation date defined in the last column of Table 1? A significant increase in the estimate of β_{1i} suggests that provincial deregulation resulted in an immediate increase in Sunday retail activity, and by implication in Sunday opening hours.[10] In order to sharpen the results, in addition to using aggregate retail sales data, Eq. (1) is estimated using two sources of disaggregated data. The first is department store type merchandise (DSTM) sales, which are calculated as total retail sales minus food sales, all sales related to motor and recreational vehicles, and establishments selling alcoholic beverages. The DSTM sales data typically comprise about one-third of total retail sales. The second are total department store (TDS) sales, which are compiled from monthly surveys of all department stores in Canada and typically comprise slightly less than one-tenth of total retail sales. All the series run from January 1981 to December 2001.[11]

Since the days of the week variables are correlated with month (because some months have 31 days and others only 30) and month is correlated with sales, the estimates will be biased if month dummies are omitted from (1). In a finite sample, this seasonal adjustment becomes even more important because the average number of Sundays in a month will tend to vary across months, even after conditioning on the total number of days in a month. However, additive month effects may be insufficient to remove the relevant seasonal effects in this case. For example, consider the case where daily sales in December are twice what they are in other months of the year and there is no Sunday shopping. The monthly seasonal effect then depends on the number of Sundays in the month, but since the days of the week variables are restricted to be equal across months, so that adding a Sunday has the same effect in December as in February, some seasonal variation is left unexplained even when days of the week variables *and* month dummies are included. In the absence of Sunday shopping, the best fit for Eq. (1) is to overstate the month fixed effect for months with five Sundays and adjust downward with a negative Sunday effect. The fact that I obtain negative estimates of β_{1i} in all three data sources suggests that there is seasonal variation and the seasonal effects are, at least partly, on daily retail sales. Since the estimate of β_{1i} is sensitive to seasonal variation, I want to avoid using it to draw inferences about Sunday sales.

The estimates from (1) do, however, provide useful predictions of monthly sales conditional on a distribution of the days of the week. Given that I am interested in identifying the effect of deregulation on Sunday retail sales, the most natural

[10]At least theoretically, it is possible that Sunday store hours increase significantly without stores experiencing an increase in Sunday sales. However, such an equilibrium is unlikely to be stable so that including such provinces in the labour demand analysis identifying long-run effects is inappropriate.

[11]The DSTM data are published monthly in *Retail Trade*, Statistics Canada, Catalogue No. 63-005. The TDS data are published monthly in *Department store sales and stocks*, Statistics Canada, 63-002.

prediction is to compare sales in months with either 30 or 31 days and four Sundays to months with the same total days, but five Sundays. This is done by weighting the estimates of $\beta_{ji}, j = 1,\ldots,7$, by the vector $c = c_{5SUN} - c_{4SUN}$ where c_{kSUN} is a 7-element vector containing the means of SUN_t to SAT_t in months with k Sundays. The effect of adding an additional Sunday is then given by $c'\beta_i$. If the variables SUN_t to SAT_t in (1) are also interacted with the provincial deregulation indicator variables in a single regression, another vector δ_i is obtained. The estimate $c'(\beta_i + \delta_i)$ then gives the effect of adding an additional Sunday after Sunday shopping is legal. The Wald statistic given by

$$\frac{(c'\delta_i)^2}{c'\,Var(\delta_i)c} \sim \chi_1^2 \tag{2}$$

provides a test of whether the before and after point estimates are statistically different. Eq. (1) is estimated using all the data, since the elements of c must sum to 0 for the prediction to make sense, the prediction is done separately for months with 30 and 31 days.

The results from the trading-day regression analysis are presented in Table 2. British Columbia is excluded from the estimation because there is no provincial deregulation in the period 1981–2001, but the province was experiencing deregulation at the municipal level during the period. The TDS estimates also exclude Newfoundland and PEI because the DSTM and TDS series for these provinces were dropped by Statistics Canada in July 1995. When using the aggregate retail industry sales data, none of the before and after point estimates are statistically significant; although, with the exceptions of Newfoundland, Prince Edward Island, and Nova Scotia, all suggest an increase in Sunday sales following deregulation. However, when the data are disaggregated to isolate establishments more likely to have been affected by Sunday shopping restrictions, the estimates suggest significant increases in New Brunswick and Manitoba when using the DSTM data and in Ontario and Alberta when using the TDS data.

The identification of these four provinces is not inconsistent with the evidence available from newspapers. In Ontario, New Brunswick and Manitoba the legal changes were province-wide, while in Alberta there was a concerted decision by retailers in the two major cities, Calgary and Edmonton, to open stores in November 1984.[12] The weak results for Saskatchewan probably reflect the fact that, as in British Columbia, provincial deregulation was a piecemeal process with Regina deregulating in June 1989 and Saskatoon in October 1991.[13] The weak Quebec results were less expected, but are consistent with reports of widespread flouting of regulations prior

[12]For the Ontario case see "Shopping on Sunday wide open" *Globe and Mail*, July 4, 1990, p. A6; for New Brunswick see "N.B. retailers fight back with Sunday shopping" *Marketing*, November 19, 1991, p. 1; for the Manitoba case see "Sunday shopping opens up" *Winnipeg Free Press*, November 20, 1992, p. A1; for Alberta see "Floodgates open on Sunday shopping" *Calgary Herald*, October 26, 1984, p. A1 and "Sunday shopping blooms for now in Alberta" *Toronto Star*, November 25, 1984, p. A19.

[13]This information was obtained through personal communication with Randy Markewich, City Clerk with the City of Regina, and Crystal Lowe, Records Administrator in the City Clerk's Office of Saskatoon.

Table 2
The effect of adding an additional Sunday and subtracting a weighted average of the other days of the week on monthly per-capita retail sales before and after Sunday shopping deregulation

	30 Days			31 Days		
	Before	After	Wald	Before	After	Wald
(1) Total retail sales data						
Newfoundland	–10.65	–23.96	2.94*	–12.41	–24.05	2.62
Prince Edward Island	–11.06	–47.76	1.01	–13.92	–40.13	1.42
Nova Scotia	–15.76	–21.46	0.35	–17.75	–21.33	0.15
New Brunswick	–16.65	–16.59	0.00	–17.53	–20.12	0.34
Quebec	–17.17	–11.45	0.77	–19.14	–16.93	0.14
Ontario	–18.75	–14.75	0.94	–17.72	–18.19	0.02
Manitoba	–13.96	–11.32	0.45	–15.77	–14.44	0.14
Saskatchewan	–16.90	–12.50	0.53	–15.30	–14.33	0.03
Alberta	–22.55	–13.49	1.92	–24.13	–15.88	1.97
(2) DSTM sales data						
Newfoundland	–2.05	0.14	0.32	–2.63	–2.17	0.02
Prince Edward Island	–3.17	–25.38	2.24	–4.30	–10.49	0.49
Nova Scotia	–2.68	–2.89	0.00	–3.68	–4.08	0.01
New Brunswick	–4.26	–0.18	4.77**	–5.36	–1.82	4.36**
Quebec	–3.74	–1.83	0.46	–4.05	–2.15	0.54
Ontario	–4.58	–2.04	1.98	–3.91	–3.54	0.05
Manitoba	–3.10	–0.90	3.01*	–3.78	–2.52	1.18
Saskatchewan	–4.67	–2.41	0.99	–5.07	–3.20	0.81
Alberta	–4.77	–2.73	0.46	–5.69	–3.37	0.74
(3) TDS sales data						
Nova Scotia	–0.32	–2.99	6.56**	–1.10	–2.13	1.06
New Brunswick	–0.67	–0.38	0.23	–1.42	–1.02	0.54
Quebec	–0.52	–0.08	0.94	–0.86	–0.56	0.51
Ontario	–1.14	–0.13	3.07*	–1.48	–1.04	0.72
Manitoba	–0.89	–0.37	0.67	–1.50	–1.33	0.09
Saskatchewan	–0.77	–0.20	0.81	–0.70	–0.77	0.02
Alberta	–1.64	–0.18	2.48	–2.46	–0.92	3.39*

Note: The sample period is from January 1981 to December 2001, which gives 252 observations for each province. Standard errors are in parentheses. ** and * indicate significance at the 5 and 10% levels respectively.

to province-wide deregulation in 1992.[14] Finally, it is unclear whether the results for Nova Scotia, Prince Edward Island, and Newfoundland reflect poorly measured deregulation indicators or retailer non-response to deregulation. There is some evidence that Nova Scotia's experiments with Sunday shopping were unpopular

[14]See "Wide-open shopping on Sunday may end" *Montreal Gazette*, March 10, 1984, p. A1, "Sunday shopping laws: a cross-Canada survey" *Toronto Star*, March 2, 1986, p. F1,F4 and "Quebec stores plan to defy Sunday Law" *Financial Post*, November 28, 1992, p. 5.

among retailers and consumers.[15] However, there are also reports of flouting of restrictions in Nova Scotia during the 1980s.[16]

Since retailers are expected to respond quite differently to deregulation if it is only seasonal, the decision was made to restrict the analysis to those provinces that show both a significant increase in Sunday retail activity in Table 2 *and* experienced year-round deregulation—Ontario, Manitoba and Alberta. To the extent that Sunday shopping is unpopular with retailers, the resulting estimates will tend to overstate the unconditional labour demand effects of deregulation. They should therefore be interpreted as either upper bound estimates of the unconditional deregulation effect or as the effect conditional on retailers responding to deregulation by opening on Sundays.

3. Difference-in-differences estimates

Before developing and estimating a system of equations simultaneously determining employment and hours of work, it is worth considering whether a simple difference-in-differences estimator shows any evidence of an employment or hours effect of Sunday shopping. Ideally, retail labour market trends in Ontario, Manitoba, and Alberta could be compared to similar retail sector data from a province or set of provinces that have never deregulated Sunday shopping. Unfortunately, the Canadian context offers no such comparison. Instead, the rest of the service sector in each of the three provinces is used as a control group. As in the trading-day analysis, in addition to the aggregate retail industry data, which includes many establishments not affected by Sunday shopping deregulation, separate specifications are estimated using employment and hours data corresponding to the industrial composition of the DSTM and TDS sales data.[17] When the disaggregated retail data are used, the control group includes all non-retail services, as well as the residual retail industry.[18]

Each row in Table 3 represents a separate pooled OLS regression of the variable of interest (normalized by subtracting the January 1983 value) on the provincial

[15]See "Government retreats on Sunday shopping" *Halifax Chronicle Herald*, January 29, 1991, p. 1, "Sunday store openings not worth it—retailers" *Halifax Chronicle Herald*, November 26, 1993, p. B6 and "Sunday shopping shot down" *Halifax Chronicle Herald*, April 14, 1994, p. A3.

[16]See "Ontario ruling on Sunday shopping may affect Atlantic Canada" *Halifax Chronicle Herald*, December 17, 1986, p. B1.

[17]These series were constructed from data published by Statistics Canada in *Employment, Earnings and Hours* (Catalogue No. 72-002-XIB). The industrial composition of the payroll data are not perfectly matched to that of the DSTM or TDS sales data. The payroll data corresponding to the DSTM sales data exclude drug stores (SIC 641), which are in the DSTM sales data, and include a miscellaneous classification (SIC 659), which are not in the DSTM sales data. The payroll data corresponding to the TDS sales data include department stores as well as smaller, general merchandise stores (SIC 6412 and 6413).

[18]The fact that the estimates in the "All other services" column change little between the All retail, DSTM and TDS specifications, reveals that the results are not sensitive to whether the control group is the residual service sector (which becomes larger as the retail data is more disaggregated) or the non-retail service sector.

Table 3
Difference-in-differences estimates (OLS) of the labour demand effect of Sunday shopping; various levels of retail industry compared to rest of service sector

	All Provinces			Ontario, Manitoba, Alberta		
	Retail	All other services	Difference	Retail	All other services	Difference
(1) Log employment						
Entire retail industry	–0.059*	–0.102*	0.043*	–0.023*	–0.020*	–0.003
	(0.005)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)
DSTM data	–0.030*	–0.098*	0.068*	0.064*	–0.031*	0.095*
	(0.007)	(0.006)	(0.009)	(0.008)	(0.005)	(0.009)
TDS data	0.050*	–0.098*	0.148*	0.250*	–0.034*	0.284*
	(0.013)	(0.005)	(0.014)	(0.016)	(0.006)	(0.019)
(2) Log weekly hours						
Entire retail industry	0.004	–0.002	0.006*	0.005	–0.015*	0.021*
	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.006)
DSTM data	0.007	–0.000	0.007*	–0.018*	–0.007*	–0.011
	(0.004)	(0.002)	(0.003)	(0.005)	(0.003)	(0.006)
TDS data	0.042*	–0.001	0.043*	0.024*	–0.010*	0.034*
	(0.005)	(0.002)	(0.005)	(0.008)	(0.003)	(0.009)

Note: All provinces uses data from all Canadian provinces, except British Columbia, where a provincial deregulation indicator variable is not well defined. Each estimate represents the coefficient on the Sunday shopping deregulation indicator variable from an OLS regression of log employment or log average weekly hours on a full set of province dummies, year dummies and month dummies. This coefficient is compared between specifications where the dependent variable is measured at one of three levels of the retail industry data and where it is measured for the residual service sector. The sample period is from January 1983 to December 2000, which provides 216 observations for each province. Standard errors are shown in parentheses. * indicates significance at the 5% level.

deregulation indicator variable and a full set of year, month and province dummies. Specifications are estimated for the log employment level of hourly paid workers and log average weekly hours of hourly paid workers. Each of the series used cover the period from January 1983 to December 2000. Ideally, data from the late 1970s should have been included, but the payroll data only begin in 1983. This is unfortunate given that Alberta experienced deregulation in November 1984. The difference-in-differences specifications are also estimated using the sample of all provinces in order to compare the estimated effects to those of Burda and Weil (2001).

As expected, the estimated employment and hours effects are larger in the more disaggregated data. The exception is the DSTM hours effect which is essentially zero in both samples. Also as expected, the employment effects are substantially larger when the sample is restricted to provinces where provincial deregulation was concomitant with a significant increase in Sunday opening hours. Most importantly, the estimates suggest that Sunday shopping resulted in both employment gains and higher weekly hours, but the employment effects are substantially larger in all cases suggesting retailers' demands for Sunday labour were disproportionately satisfied through job creation. So, for example, the aggregate retail data for all provinces suggests an increase in the employment level of 4.3% and essentially no change in average weekly hours. Interestingly, this small employment effect is very similar to the difference-in-differences estimate of 2.5% of Burda and Weil (2001), who do not restrict their sample to states where there is evidence of an increase in Sunday store hours. When the data are limited to Ontario, Manitoba, and Alberta the labour demand effects of Sunday shopping appear much larger. It is of course difficult to know whether the difference between the full and selected sample effects reflect measurement error in some of the provincial deregulation indicator variables or non-response to deregulation among retailers in some provinces. The newspaper evidence cited above, however, suggests that the difference, at least partly, reflects flouting of provincial regulations. This implies the results from the sample of all provinces likely underestimate the unconditional effect of Sunday shopping deregulation.

A problem with the difference-in-differences methodology is it hinges entirely on the assumption that the treatment and control group series would have the same employment and hours patterns had deregulation not occurred (Angrist and Krueger, 1999). Fig. 1 plots the seasonally adjusted employment and hours series used to obtain the ‘‘entire retail industry'' estimates in Table 3 (first and fourth row). The vertical lines in each panel indicate the provincial deregulation date, while a tick on the top-axis indicates a return to restrictions. Clearly, there is considerable variation in the patterns of most of these series even before any deregulation occurs. A comparison of the retail series *across* provinces reveals much stronger correlation. Since there are no provinces without Sunday shopping experience, the approach taken here is to use the Ontario, Manitoba, and Alberta retail data and estimate a system of structural equations that can account for unexplained contemporaneous correlations.

A final issue worth addressing before estimating the dynamic empirical model is the assumed exogeneity of the provincial deregulation indicator variables. It is entirely possible that deregulation is driven by underlying economic and cultural trends, such as structural shifts to service sector employment or changing attitudes to female labour force participation. To the extent that these trends are correlated with the outcomes of interest, the estimated policy effects will be contaminated. Both Ferris (1991) and Burda and Weil (2001) use IV estimators to identify deregulation effects using female labour force participation rates and measures of the Christian share of the population as instruments. In the context of a large number of political jurisdictions this first-stage estimation can, at least plausibly, generate some useful exogenous variation in legal regimes. However, the additional stage and the instruments involved are a stretch in the context of variation in legal regimes between three large provinces. This is particularly the case because in two of the provinces, deregulation was motivated by the decisions of courts, who are arguably less influenced by public preferences and therefore underlying economic and social trends than are provincial legislators. The decision of an Ontario court to reverse a decision made nine months earlier by the province's Supreme Court is indicative of this

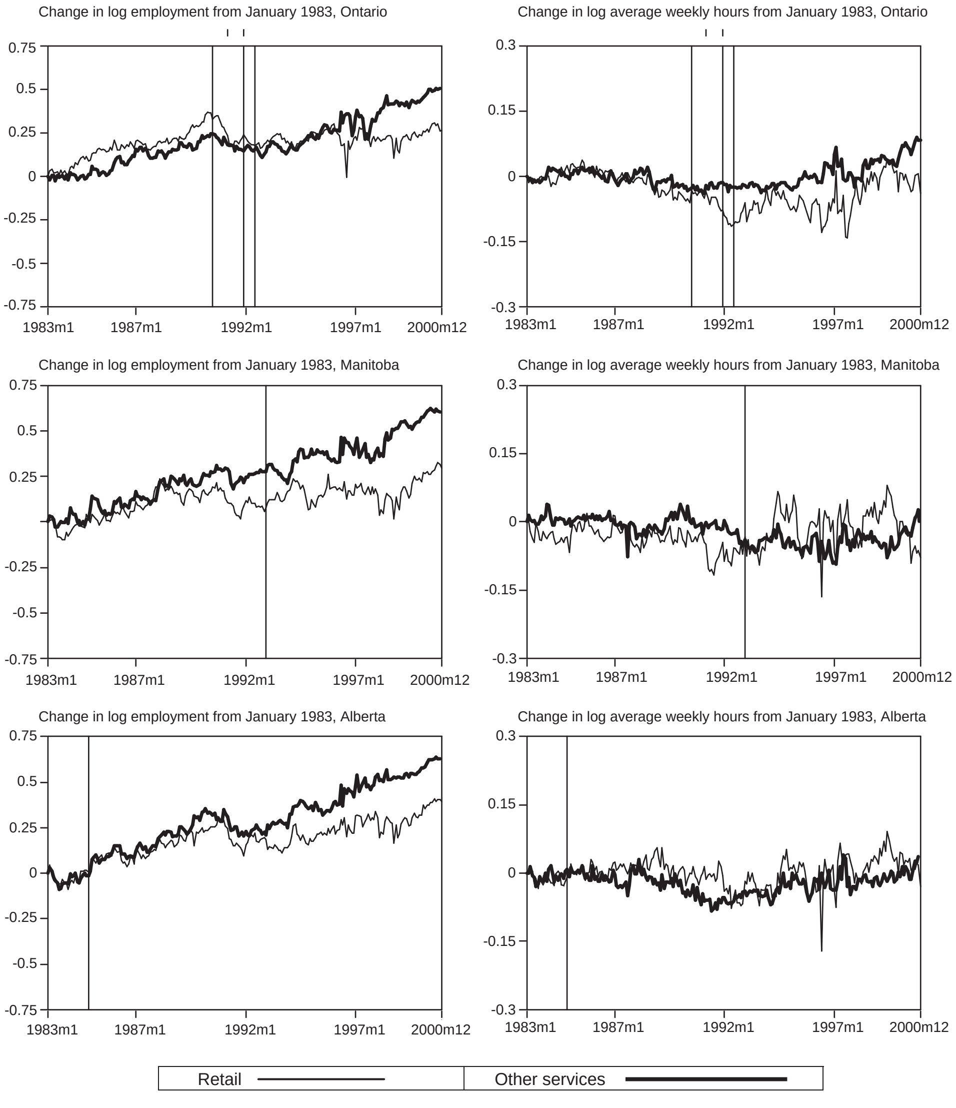

Fig. 1. Changes in employment and average weekly hours, retail and other service industries.
Source: Employment, Earnings and Hours, Statistics Canada, Catalogue No. 72-002, 1983–2000.
Note: Vertical line indicates date of Sunday shopping deregulation. Tick on top-axis indicates return to restriction on Sunday store.

randomness. Also, the influence of underlying economic or cultural trends should be gradual, whereas policy effects should produce discontinuous changes in the variables of interest. By including province-specific quadratic trends in the regression the ‘‘glacial’’ changes in underlying trends can be controlled for, leaving the deregulation indicator variables to capture policy effects.

4. Empirical specification

In his examination of the economic impact of extending shop opening hours, Gradus (1996) distinguishes between three possible labour demand effects. First, to the extent that Sunday shopping leads to an increase in sales there will be an increase in the employment level working through the retail sales production function. The size of this *sales effect* will depend on not only how much Sunday shopping increases total retail activity, but also on the sales elasticity of the labour input and the marginal products of employment and hours of work. Second, even if deregulation has no impact on sales, either because Sunday sales are nil or there is a one-for-one tradeoff with Monday to Saturday sales, increased opening hours implies a necessary *threshold effect* on labour demand as there are more hours in which a store needs to be supervised. Finally, Gradus follows Thurik (1984) and argues that as long as there is some concavity in the production of the daily labour input, extending retail business hours could have a negative *labour productivity effect* by smoothing sales peaks over the days of the week.

It can be shown, from a simple cost-minimization problem, that if the production function for the labour input is multiplicatively separable in employment and hours of work, then only employment will be a function of retail sales (see Appendix B for details). As a result, optimal average weekly hours will be relatively constant over the long run as the data in Fig. 1 suggest they are. This suggests an appropriate linear specification in the logarithms of all the continuous variables given by

$$N_{it}^{*} = \beta_0 + \beta_1\, d_{it} + \beta_2\, Q_{it} + \beta_3(Q_{it} \cdot d_{it}) + \beta_4\, w_{it} + \beta_{5i}\, T_t + \beta_{6i}\, T_t^2 + \mu_{it}, \tag{3}$$

$$h_{it}^{*} = \gamma_0 + \gamma_1\, d_{it} + \gamma_2\, w_{it} + \gamma_{3i}\, T_t + \gamma_{4i}\, T_t^2 + \varepsilon_{it}, \tag{4}$$

where t indexes the month, i the province, N_{it}^{*} is optimal employment, h_{it}^{*} is optimal weekly hours, d_{it} is the provincial deregulation indicator variable defined in Table 1, Q_{it} is log monthly retail sales, w_{it} is the log retail wage and T_t is a linear time trend.

With reference to Eq. (3), it is possible to decompose the long run change in the employment level following deregulation into the threshold, sales, and productivity effects. If the long-run predicted employment level prior to deregulation is given by

$$N_{iB}^{*} = \beta_0 + \beta_2\, Q_{iB} + \beta_4\, w_{iB} + \beta_{5i}\, T_B + \beta_{6i}\, T_B^2 \tag{5}$$

and after deregulation by

$$N_{iA}^{*} = \beta_0 + \beta_1 + (\beta_2 + \beta_3)\, Q_{iA} + \beta_4\, w_{iA} + \beta_{5i}\, T_A + \beta_{6i}\, T_A^2 \tag{6}$$

the employment impact of deregulation is simply the difference

$$\begin{aligned} N_{iA}^{*} - N_{iB}^{*} &= \beta_1 + (\beta_2 + \beta_3)\, Q_{iA} - \beta_2\, Q_{iB} \\ &= \beta_1 + \beta_2(Q_{iA} - Q_{iB}) + \beta_3\, Q_{iA} \end{aligned} \tag{7}$$

if w_{it} and T_t are held constant. The first term in (7) is the threshold effect, the second term is the sales effect, and the productivity effect is captured by the third term. For the estimates to be consistent with the theory we need $\beta_1 > 0$, $\beta_2 > 0$, and $\beta_3 < 0$. Of course, the sales, threshold and productivity effects are partial equilibrium effects.

To the extent that retailers can also adjust their prices, increased total costs may induce higher prices, and in turn lower sales. It will therefore be important to explore the possibility of any price effects of Sunday shopping in the empirical analysis that follows.[19]

The size of the sales effect will in part be determined by β_2, which captures how exogenous shocks to Q_{it} translate into adjustments in the employment level. However, it also depends on the difference $(Q_{iA} - Q_{iB})$. To estimate the sales effect it is then necessary to also obtain an estimate of the deregulation impact on Q_{it}. This is done by estimating

$$Q_{it} = \alpha_0 + \alpha_1\, d_{it} + \alpha_2\, u_{it} + \alpha_3\, Y_{it} + \alpha_4\, r_t + \alpha_5\, MONTH + \alpha_{6i}\, T_t + \alpha_{7i}\, T_t^2 + \omega_{it}. \tag{8}$$

The assumption that Q_{it} is exogenous to the labour demand decision of the firm was tested using an omitted variable version of the Hausman test. When the aggregate retail or TDS sales data are used the test strongly rejects the exogeneity of Q_{it} in Eq. (3). The decision was therefore made to treat Q_{it} as an endogenous variable in the empirical model and to use (8) as its reduced form equation.[20]

In order to distinguish long run from short run firm responses to exogenous shocks it is necessary to add a dynamic element to this empirical model. Following Hart and Sharot (1978), the approach taken here is to assume partial adjustment of workers and instantaneous adjustment of hours. The rationale is that there are quasi-fixed costs of adjusting the employment level, whereas temporary hours adjustments are relatively costless. The partial adjustment process is given by

$$N_{it} = \lambda\, N_{it}^* + (1-\lambda)\, N_{t-1}, \tag{9}$$

where λ provides a measure of the degree of rigidity in the employment level. Since it is now possible that $N_{it}^* \neq N_{it}$, the firm may substitute towards h_t in the short run. Therefore, optimal short run average weekly hours is expected to be increasing in $\left(N_{it}^* - N_{it}\right)$, which can be expressed as

$$h_{it} = \gamma\, h_{it}^* + \pi(N_{it}^* - N_{it}), \quad \pi > 0, \tag{10}$$

where π measures to what extent hours are increased in the short run to accommodate shortfalls in the employment level.

A complication with estimating Eqs. (3) and (4) is that the retail wage is likely to be endogenous. To identify exogenous retail wage fluctuations, monthly provincial data on minimum wages and the average manufacturing wage are used as instruments in a reduced form equation for w_{it}. When this is done and the dynamic structure in (9) and (10) is applied to (3) and (4), the complete empirical empirical

[19] I would like to thank an anonymous referee for emphasizing the possible full-equilibrium effects of deregulation.

[20] The Hausman test statistic is 6.14 in the aggregate data, 10.00 in the TDS data, and 0.59 in the DSTM data (the distribution of the test statistic is $F(2, 632)$). It turns out that the general results are quite robust between specifications. This is true in all three data sources.

model is given by the following equations:

$$N_{it} = \lambda\,\beta_0 + \lambda\,\beta_1\,d_{it} + \lambda\beta_2 Q_{it} + \lambda\beta_3(Q_{it}\cdot d_{it}) + \lambda\beta_4 w_{it} + \lambda\beta_{5i}T_t + \lambda\beta_{6i}T_t^2 + (1-\lambda)N_{i,t-1} + \mu_{it}, \tag{11}$$

$$h_{it} = \gamma_0 + \gamma_1 d_{it} + \gamma_2 w_{it} + \gamma_{3i}T_t + \gamma_{4i}T_t^2 + \pi\left(\frac{1-\lambda}{\lambda}\right)(N_{it} - N_{i,t-1}) + \varepsilon_{it}, \tag{12}$$

$$w_{it} = \delta_0 + \delta_1\,d_{it} + \delta_2\,Q_{it} + \delta_3\,(Q_{it}\cdot d_{it}) + \delta_4\,mw_{it} + \delta_5\,manw_{it} + \delta_{6i}\,T_t + \delta_{7i}\,T_t^2 + \delta_8\,N_{i,t-1} + \eta_{it} \tag{13}$$

and Eq. (8). The presence of the endogenous variable N_{it} in (12) does not present any problems due to the exclusion restrictions on Q_{it} and $(Q_{it}\cdot d_{it})$.

The estimation procedure involves estimating the parameters in Eqs. (8), (11), (12) and (13) using data from the three provinces that experienced significant changes in Sunday retail sales following deregulation. In order to allow province-specific quadratic trends, the four equation system must be estimated province by province, which results in a 12 equation system. All the remaining parameters of Eqs. (8), (11), (12) and (13) are restricted between provinces. In order to identify exogenous fluctuations in Q_{it}, N_{it}, and w_{it} and obtain a single estimate of λ, the system is estimated by 3SLS. This estimator allows us to gain efficiency from contemporaneous correlations as the estimated error-covariance matrix captures all the variances and covariances of the error terms. Thus, common unexplained movements in the sales, employment, hours, and wage data within and between cross-sections are accounted for.

Monthly provincial aggregate data on all the remaining variables of the empirical model were collected which produced two complete seasonally unadjusted, time-series data sets covering the period from January 1983 to December 2000. Descriptions and summary statistics of all the variables are provided in the appendix.

5. Empirical results

The estimates of the parameters of Eqs. (8), (11), (12), and (13) using data from three levels of the retail industry in Ontario, Manitoba and Alberta are presented in Table 4. The implied long-run sales, threshold and productivity employment effects are shown in Table 5 with 95% confidence intervals. The results suggest modest, but significant, increases of between 1 (aggregate data) and 3% (disaggregated data) in retail sales following deregulation. When these estimates of α_1 are combined with the labour intensity estimates, β_2, the results suggest a sales effect on the employment level of about 1–2%.[21] What explains the small estimated increases in retail sales?

[21]In fact, the sales effect is greater in the DSTM data than in the TDS data. The reason is that the estimate of the labour intensity parameter, β_2, is larger in the DSTM data. At least part of this difference probably reflects the superior sales capacity of the larger general merchandise stores relative to the smaller specialized merchandise stores included in the DSTM data.

Table 4
3SLS estimates of the labour demand effect of Sunday shopping in Ontario, Manitoba and Alberta

Q_{it}		N_{it}		h_{it}		w_{it}	
(1) Entire retail industry							
d_{it} (α_1)	0.0138*	d_{it} (β_1)	0.658	d_{it} (γ_1)	0.023*	d_{it} (δ_1)	0.140
	(0.005)		(0.381)		(0.005)		(0.084)
u_{it} (α_2)	−0.022*	Q_{it} (β_2)	0.757*	w_{it} (γ_2)	−0.662*	Q_{it} (δ_2)	−0.021*
	(0.002)		(0.105)		(0.058)		(0.010)
Y_{it} (α_3)	0.629*	$Q_{it} \cdot d_{it}$ (β_3)	−0.029	$N_{it}-N_{i,t-1}$ (π)	0.085*	$Q_{it} \cdot d_{it}$ (δ_3)	−0.006
	(0.059)		(0.018)		(0.021)		(0.004)
r_{it} (α_4)	−0.003*	w_{it} (β_4)	−0.622*			mw_{it} (δ_4)	0.159*
	(0.001)		(0.269)				(0.028)
		$N_{i,t-1}$ (λ)	0.189*			$manw_{it}$ (δ_5)	0.245*
			(0.026)				(0.063)
						$N_{i,t-1}$ (δ_8)	−0.051*
							(0.024)
(2) DSTM data							
d_{it} (α_1)	0.026*	d_{it} (β_1)	0.307	d_{it} (γ_1)	0.015*	d_{it} (δ_1)	0.069
	(0.006)		(0.465)		(0.005)		(0.092)
u_{it} (α_2)	−0.018*	Q_{it} (β_2)	0.615*	w_{it} (γ_2)	-0.480*	Q_{it} (δ_2)	−0.026*
	(0.002)		(0.095)		(0.059)		(0.008)
Y_{it} (α_3)	1.007*	$Q_{it} \cdot d_{it}$ (β_3)	−0.011	$N_{it}-N_{i,t-1}$ (π)	0.056*	$Q_{it} \cdot d_{it}$ (δ_3)	−0.002
	(0.067)		(0.023)		(0.017)		(0.004)
r_{it} (α_4)	−0.004*	w_{it} (β_4)	−0.565			mw_{it} (δ_4)	0.265*
	(0.001)		(0.339)				(0.033)
		$N_{i,t-1}$ (λ)	0.176*			$manw_{it}$ (δ_5)	0.212*
			(0.026)				(0.067)
						$N_{i,t-1}$ (δ_8)	0.110*
							(0.021)
(3) TDS data							
d_{it} (α_1)	0.027*	d_{it} (β_1)	1.773*	d_{it} (γ_1)	0.043*	d_{it} (δ_1)	−0.052
	(0.007)		(0.496)		(0.006)		(0.110)
u_{it} (α_2)	−0.014*	Q_{it} (β_2)	0.257*	w_{it} (γ_2)	-0.355*	Q_{it} (δ_2)	−0.029*
	(0.002)		(0.089)		(0.048)		(0.010)
Y_{it} (α_3)	0.875*	$Q_{it} \cdot d_{it}$ (β_3)	−0.088*	$N_{it}-N_{i,t-1}$ (π)	0.033*	$Q_{it} \cdot d_{it}$ (δ_3)	0.004
	(0.090)		(0.026)		(0.015)		(0.006)
r_{it} (α_4)	−0.001	w_{it} (β_4)	−0.316			mw_{it} (δ_4)	0.196*
	(0.002)		(0.321)				(0.039)
		$N_{i,t-1}$ (λ)	0.188*			$manw_{it}$ (δ_5)	0.280*
			(0.026)				(0.087)
						$N_{i,t-1}$ (δ_8)	0.133*
							(0.019)

Note: Estimates are of the parameters shown in parentheses. All four equations also include province specific time trends and the sales equation includes a full set of month dummies. The sample period is from January 1983 to December 2000, which provides 216 observations for each province. Asymptotic standard errors are in parentheses. * indicates significance at the 5% level.

Table 5
Total long run employment effect of Sunday shopping in Ontario, Manitoba and Alberta

	Estimate	95% confidence interval	
		Lower	Upper
(1) *Entire retail sector*			
Sales effect	0.010	0.002	0.017
Threshold effect	0.658	−0.089	1.405
Productivity effect	−0.618	−1.367	0.131
Total employment effect	0.050	0.008	0.092
(1) *DSTM data*			
Sales effect	0.016	0.008	0.024
Threshold effect	0.307	−0.604	1.218
Productivity effect	−0.222	−1.126	0.682
Total employment effect	0.100	0.043	0.157
(1) *TDS data*			
Sales effect	0.007	0.001	0.013
Threshold effect	1.773	0.800	2.745
Productivity effect	−1.655	−2.613	−0.697
Total employment effect	0.124	0.057	0.191

Note: Estimates represent transformations of the short-run effects shown in the employment equation of Table 4 using the estimates of λ.

The more obvious explanations are pent-up tourist or recreational demands for Sunday shopping. The less obvious explanation is that deregulation serves to increase the price of retail *and* the CPI based on all consumer goods, which is used to deflate the nominal sales data, is an imperfect indicator of this price change for the retail sales series used. In this case, the estimated gain in sales volume may entirely reflect an increase in retail prices. It is therefore worth considering if and to what extent deregulation resulted in higher retail prices. Unfortunately, provincial data on the price of retail (i.e. retail margins) is not available, which explains its absence from Eq. (8). In addition, both the theoretical and empirical literature on the price effect of retail trading hours deregulation is mixed and inconclusive.[22]

[22]Theoretical arguments or models suggesting positive price effects of extending retail business hours include De Meza (1984), Ingene (1986), Kay and Morris (1987), Ferris (1991) and Burda and Weil (2001). In most of these papers this result is driven by increases in operating costs. In contrast, Clemenz (1990) presents a model in which consumers search for prices and trading hours liberalization leads to price reductions, while Tanguay et al. (1995) extend the Morrison and Newman (1983) model and predict, assuming a Cournot equilibrium, higher prices in large stores and lower prices in small stores. Empirical research suggesting positive price effects of deregulation include Burda and Weil (2001) using data on retail value-added by US states and Tanguay et al. (1995) using data from large grocery stores in Quebec, Canada. The empirical analysis in Kay and Morris (1987), on the other hand, suggests lower prices following deregulation.

Table 6
Difference-in-differences estimates (OLS) of the price effects of Sunday shopping

(1)	Goods	0.008	(0.002)
(2)	Services	−0.025	(0.004)
	Difference	0.033	(0.004)
(3)	Personal care supplies	0.011	(0.002)
(4)	Pharmaceutical products	0.041	(0.003)
	Difference	−0.030	(0.003)
(5)	Food from stores	0.038	(0.004)
(6)	Food from restaurants	0.3E-03	(0.003)
	Difference	0.037	(0.004)
(7)	Alcohol from stores	−0.038	(0.006)
(8)	Served alcohol	−0.049	(0.005)
	Difference	0.011	(0.003)

Note: Estimates are from regressions of each CPI, labelled in the first column, on a full set of province dummies, year dummies, month dummies and the Sunday shopping deregulation indicator variable. The sample of provinces is restricted to Ontario, Manitoba and Alberta. Sample period is January 1981 to December 2001, which gives 252 observations per province. Standard errors are shown in parentheses. *Source*: *The consumer price index*, Statistics Canada, Catalogue No. 62-001.

In order to obtain some evidence on whether the estimated sales increase reflects a volume or price change, I estimated simple difference-in-differences specifications using CPI data from the three selected provinces. The results from this analysis are presented in Table 6. It is assumed that price indices of goods that have always been available on Sundays (even-numbered goods) will reveal what would have happened to the price of goods affected by deregulation (odd-numbered goods) if deregulation had not occurred. Unfortunately, the analysis is restricted to published price indices so the goods chosen are more aggregated than is ideal and in all cases probably include some goods that do not satisfy the assumptions of the identification strategy. The food and alcohol comparisons are arguably the most convincing for the Canadian context. In all cases, except the pharmaceutical/personal care comparison, the estimates suggest significant positive price increases following deregulation. The estimates range from about 1–4%. As some assurance of the meaningfulness of these estimates it is worth noting that the estimated increase of about 4% using the food indices is remarkably similar to the Tanguay et al. (1995) estimate of 5% using food price data before and after deregulation of food stores in Quebec and with the Burda and Weil (2001) estimate of 3% using retail value-added data for US states. This raises the possibility that sales volume may have been unaffected by Sunday shopping after all as deregulation instead served to raise the price of retail. The small estimated sales effect on employment of 1–2% should then be zero.[23] However, we

[23]We should still expect a price effect on employment though as price changes signal more profitability. The price effect should then be captured by the threshold effect estimate of β_1.

are of course unable to rule out the possibility of *both* a 3% increase in prices and a 1–3% gain in sales volume.

In contrast to the modest estimated sales effect, the threshold effect estimates of 65.8, 30.7 and 178.1 log points in the aggregate, DSTM and TDS data respectively exceed any reasonable explanation. Similarly, the productivity effect estimates, given by β_3, exceed expectation. From Eq. (7), the magnitude of the productivity effect depends on at what value of Q_{iA} it is evaluated. It is not obvious what that value should be. The approach taken here is to calculate for each province the annual average level of log retail sales in the 12-month period in which deregulation occurs in the 6 month. The average of these values over the three provinces is 21.3 in the aggregate data, 20.3 in the DSTM data and 18.8 in the TDS data, which imply productivity effect estimates of 61.8, 22.2 and 165.5 log points respectively. Although we have no priors regarding the magnitude of the productivity effect, intuition suggests that the amount of sales smoothing needed to reduce the long-run employment level by more than 165 log points could not have resulted from the addition of a single day of shopping. As the large standard errors on the estimates suggest, the problem is that both the threshold and productivity effects are estimated imprecisely. However, quite plausible estimates are obtained when the estimates of the two effects are combined. The aggregate, DSTM and TDS data then imply 4, 9 and 12% increases in the long-run employment level respectively. The DSTM estimate is almost identical to the difference-in-differences estimate using these data in table 3. The estimate using the aggregate data is, however, slightly larger and the TDS estimate is substantially smaller (and certainly more reasonable).

The threshold and productivity effects are poorly identified because the threshold effect is calculated at $Q_{it} = 0$, but there are no data points close to 0. As a result of the linearity imposed on the data, any reduction in labour intensity following deregulation, reflected in a negative estimate of β_3, will tend to imply a corresponding increase in the threshold effect. Since there are no observations when Q_{it} is close to 0, the threshold effect is entirely determined by the change in the slope of the fitted regression line via this tradeoff. The problem is that both estimates are identified from a single source of information—the change in labour intensity following deregulation. It is therefore not surprising that entirely plausible estimates are obtained when the two effects are combined.

The estimates of γ_1 imply *permanent* increases in average weekly hours of between 2 and 4%. These estimates are again not very different from those in Table 3. Once again, they imply that obtaining the desired total labour input following deregulation involved having either some existing employees work Sunday shifts in addition to their regular shifts or having some new employees work more than the pre-deregulation level of average weekly hours.[24] A complication in estimating the

[24]In either case, these results are in contrast to that of Upton (1986) who collected information from five large British retail firms that operated stores in Scotland, where there has never been formal regulation of Sunday shopping, to find out how their needs for Sunday employment were satisfied. He found that among these firms much of the labour was provided by "Sunday-only" part-timers who the firms claimed they had little difficulty in recruiting. Clearly, to the extent that this strategy is dominant in the industry, average weekly hours should fall, not rise, following deregulation.

hours equation is that a Breusch-Godfrey test of serial independence of the errors is easily rejected (for both first and higher order autoregressive processes). This is not true of the employment equation where the lagged employment term removes nearly all autocorrelation in the error terms. Nonetheless, the finding of relatively small hours effects is robust to a first-order timewise autoregressive error structure in all three data sources.[25]

Interestingly, comparison of the estimates at the three levels of the retail industry implies larger employment and hours gains among general merchandise stores than among more specialized retail establishments and relatively modest gains at the aggregate level. This result is not consistent with the Morrison and Newman (1983) prediction that deregulation serves to redistribute sales from small to large stores as the magnitude of the estimated sales effects are essentially identical in the DSTM and TDS data. An alternative explanation for the larger labour demand effects among general merchandise is that, unlike general merchandise stores, establishments with more specialized product lines were more likely to have store owners or managers work Sunday shifts than to hire new employees or raise the hours of existing employees.

Finally, the partial adjustment parameter, λ, estimates reveal some stickiness in the retail industry employment level. At first glance this employment rigidity appears considerable, but it should be emphasized that it is estimated using monthly data so N_{it} will be more than half way to reaching N_{it}^{*} 3 months following a shock. The point here is that the low estimate of λ leads to some short-run dynamics. However, this in turn produces very mild fluctuations in average weekly hours due to the small estimates of π. Specifically, weekly hours increase by 0.3, 0.5 and 0.3% in the first month following deregulation in the aggregate, DSTM and TDS data respectively. As a result, in the short run the total labour input employed, L, falls below its optimal long run level. Given that there were significant increases in Sunday opening hours, as the trading-day regression analysis implies, how did stores overcome this temporary shortfall in the labour input? The lack of substitutability between workers and hours probably reflects the difficulty of adjusting workers' weekly hours of work. This rigidity is likely to be particularly important when retail firms are asking their existing workers, who in some jurisdictions have the legal right to refuse Sunday work, to temporarily work Sunday shifts until new workers can be hired. A possible firm response is for store owners or managers to work Sunday shifts themselves until new employees with low preference for Sunday leisure are recruited. Again, since the hours of store owners and managers do not appear in the data there is no evidence of a short run tradeoff between workers and hours.

[25]For example, when the hours equation is estimated separately with cross-sectionally heteroskedastic and timewise autoregressive errors, the estimated hours effect in the aggregate data is 4.3% when rho = 0 and 3.7% when rho is unrestricted. Allowing AR(1) errors in the disaggregated data results in a similar small decline. For an analysis of the appropriate test for autocorrelation in the context of a system of simultaneous equations with lagged dependent variables see Edgerton and Shukur (1999).

6. Summary

Using data from a sample of provinces where there is evidence that deregulation resulted in significantly more Sunday store openings, a simple dynamic labour demand model was estimated to identify how retailers satisfy their demands for Sunday labour. The results suggest that the increase in labour demand that followed deregulation was disproportionately satisfied through an increase in the employment level. The large estimated employment gains of between 5 and 12% appear to have been driven by an increase in the level of threshold labour that dominated an offsetting gain in labour productivity, and not by an increase in sales volume. The results also suggest that the labour demand increases were larger among general merchandise stores than among more specialized retail establishments and were relatively modest at the level of the entire retail industry. Finally, there is evidence that retail firms were unable to *temporarily* raise the weekly hours of their existing employees to overcome significant rigidities in the employment level. Although these estimated labour demand increases are large in comparison to similar estimates from previous research, it must be emphasized that they are obtained using data from selected provinces where there is evidence that provincial deregulation served to raise opening hours. They should therefore be interpreted as the effect of deregulation conditional on a significant increase in Sunday opening hours.

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Appendix A. Variable descriptions and first and second moments.

Variable	Description	Ontario	Manitoba	Alberta
(1) *Entire retail industry*				
Q_{it}	Real retail sales	22.55	20.19	21.29
		(0.170)	(0.137)	(0.174)
N_{it}	Employment of hourly paid workers	12.81	10.48	11.47
		(0.075)	(0.088)	(0.109)

Variable	Description	Ontario	Manitoba	Alberta
h_{it}	Average weekly hours of hourly paid workers	3.23 (0.044)	3.22 (0.044)	3.26 (0.039)
w_{it}	Average real wage of hourly paid workers	2.32 (0.033)	2.26 (0.076)	2.30 (0.059)
(2) *DSTM data*				
Q_{it}	Real retail sales	21.48 (0.239)	19.04 (0.201)	20.24 (0.194)
N_{it}	Employment of hourly paid workers	12.07 (0.072)	9.70 (0.072)	10.69 (0.085)
h_{it}	Average weekly hours of hourly paid workers	3.19 (0.065)	3.18 (0.056)	3.20 (0.053)
w_{it}	Average real wage of hourly paid workers	2.22 (0.036)	2.12 (0.061)	2.20 (0.069)
(3) *TDS data*				
Q_{it}	Real retail sales	19.98 (0.296)	17.75 (0.297)	18.74 (0.290)
N_{it}	Employment of hourly paid workers	11.18 (0.130)	9.01 (0.169)	9.86 (0.303)
h_{it}	Average weekly hours of hourly paid workers	3.12 (0.085)	3.13 (0.076)	3.18 (0.070)
w_{it}	Average real wage of hourly paid workers	2.27 (0.060)	2.16 (0.067)	2.27 (0.083)
Common				
d_{it}	Sunday shopping deregulation indicator	0.52 (0.501)	0.45 (0.499)	0.90 (0.303)
Y_{it}	Real seasonally adjusted labour income	23.33 (0.115)	20.81 (0.048)	21.90 (0.124)
r_t	National consumer loan rate (Bank of Canada index)	12.12 (2.278)	12.12 (2.278)	12.12 (2.278)
u_{it}	Seasonally adjusted unemployment rate	7.93 (1.926)	7.58 (1.378)	8.13 (1.933)
mw_{it}	Real minimum wage	1.76 (0.087)	1.64 (0.062)	1.58 (0.045)
$manw_{it}$	Average real manufacturing wage	2.78 (0.031)	2.54 (0.019)	2.71 (0.047)

Note: Means with standard deviations in parentheses are shown. Real retail sales are constructed using the provincial CPI (1992 = 100) based on consumer goods. All other real variables are constructed using the all-items provincial CPI (1992 = 100)

Appendix B. Hours of work independence of retail sales

Consider a cost-minimizing optimization problem in which homogeneous retail firms within a province face costs of operation:

$$C_L = w\,h\,N + q\,N, \tag{B.1}$$

where C_L are total weekly labour costs, N is total employment by each firm, h is average weekly hours of those employed, w is the average wage within each firm which is assumed to be independent of average weekly hours, and q are quasi-fixed costs such as hiring, training and benefit costs. Real retail sales per representative firm are given by

$$Q = H(u,\ r,\ Y,\ MONTH), \tag{B.2}$$

where u is the provincial unemployment rate, r is the consumer loan rate, and Y is real provincial labour income.

Assuming that Q is exogenous to the optimization problem of the individual firm, the total labour input employed, L, is constrained by the requirement that

$$L \geqslant G\,(Q), \tag{B.3}$$

where $G' > 0$ and $G'' < 0$. If the production function for units of total labour input is given by

$$L = F(h, N), \tag{B.4}$$

where F_h, $F_N > 0$ and F_{hh}, $F_{NN} < 0$, a retail firm's optimization problem can be expressed as

$$\min_{h,N}\ C_L \text{ subject to } F(h,N) \geqslant G(Q). \tag{B.5}$$

A solution to this problem must satisfy the following first-order conditions:

$$\frac{w\,N}{w\,h + q} = \frac{F_h}{F_N}, \tag{B.6}$$

$$F(h, N) = G(Q). \tag{B.7}$$

In order to derive closed-form solutions for h, it is convenient to assume the following specific functional forms for F:

$$F(h,N) = (h - s)^{\varepsilon} N^{1-\alpha}, \quad 0 < \varepsilon,\ \ \alpha < 1,\ \ h \geqslant s, \tag{B.8}$$

where, following Hart and Fitzroy (1985), (10) recognizes a minimal set-up time, s, per worker. This implies long run weekly hours are given by

$$\begin{aligned} h^* &= \left(\frac{1-\alpha}{1-\alpha-\varepsilon}\right) s + \left(\frac{\varepsilon}{1-\alpha-\varepsilon}\right)\left(\frac{q}{w}\right) \\ &= \beta\, s + \theta\,(q/w). \end{aligned} \tag{B.9}$$

This solution has the attractive result that only the employment level is a function of retail sales so that optimal average weekly hours will be relatively constant over the long run as the data in Fig. 1 suggest they are. This is a consequence of the production function for the total labour input. Indeed, any function of the form $L = g(h)\ N^{1-\alpha}$ where $g' > 0$ and $g'' < 0$ will produce this result. Clearly, there exists a wide range of production functions that are multiplicatively separable in h and N, including the Cobb–Douglas form. This particular form actually follows directly from the fact that the total labour input, L, is the product of the number of workers employed and the average weekly hours of these workers.

References

Angrist, J., Krueger, A., 1999. Empirical strategies in labor economics. In: Ashenfelter, O., Card, D. (Eds.), Handbook of Labor Economics, Vol. 3A Elsevier Science Publishers, New York.

Burda, M., Weil, P., 2001. Blue laws. Paper presented at the Society of Labor Economists (SOLE) meetings in April 2001.

Clemenz, G., 1990. Non-sequential consumer search and the consequences of a deregulation of trading hours. European Economic Review 34, 1323–1337.

De Meza, D., 1984. The Fourth Commandment: Is it Pareto efficient. The Economic Journal 94, 379–383.

Edgerton, D., Shukur, G., 1999. Testing autocorrelation in a system perspective. Econometric Reviews 18 (4), 343–386.

Ferris, J.S., 1991. On the economics of regulated early closing hours: Some evidence from Canada. Applied Economics 23, 1393–1400.

Gradus, R., 1996. The economic effects of extending shop opening hours. Journal of Economics (Zeitschrift für Nationalökonomie) 64, 247–263.

Hart, R.A., Fitzroy, F.R., 1985. Hours, layoffs and unemployment insurance funding: Theory and practice in an international perspective. Economic Journal 95 (379), 700–713.

Hart, R.A., Sharot, T., 1978. The short-run demand for workers and hours: A recursive model. Review of Economic Studies 45, 299–309.

Ingene, C.A., 1986. The effect of "Blue Laws" on consumer expenditures at retail. Journal of Macromarketing 6, 53–71.

Kajalo, S., 1997. Sunday trading, consumer culture, and shopping: Will Europe sacrifice Sunday to recreational shopping? Paper Presented at the Sosiologipäivät 1997 Conference Arranged by The Westermarck Society, Helsinki, March 21–22, 1997.

Kay, J.A., Morris, C.N., Jaffer, S.M., Meadowcroft, S.A., 1984. The Regulation of Retail Trading Hours. The Institute for Fiscal Studies, London.

Kay, J.A., Morris, C.N., 1987. The economic efficiency of Sunday trading restrictions. Journal of Industrial Economics 36 (2), 113–129.

Laband, D.N., Heinbuch, D.H., 1987. Blue Laws: The History Economics and Politics of Sunday-Closing Laws. D.C. Heath & Company Lexington Books, Lexington, MA.

Morrison, S.A., Newman, R.J., 1983. Hours of operation restrictions and competition among retail firms. Economic Inquiry 21, 107–114.

Price, J., Yandle, B., 1987. Labor markets and Sunday closing laws. Journal of Labor Research 8 (4), 407–414.

Tanguay, G.A., Vallée, L., Lanoie, P., 1995. Shopping hours and price levels in the retailing industry: A Theoretical and Empirical Analysis. Economic Inquiry 33, 516–524.

Thurik, A.R., 1984. Labour productivity economies of scale and opening time in large retail establishments. The Services Industries Journal 1, 19–29.

Upton, R., 1986. Coming to terms with Sunday working. Personnel Management 18, 28–32.