An Analysis of Teenage Employment by Firms: 1999/00–2006/07

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Access to the data used in this study was provided by Statistics NZ under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular person or firm. The tables in this paper contain information about groups of people so that the confidentiality of individuals is protected.

The results are based in part on tax data supplied by Inland Revenue to Statistics NZ under the Tax Administration Act 1994. This tax data must be used only for statistical purposes, and no individual information is published or disclosed in any other form, or provided back to Inland Revenue for administrative or regulatory purposes.

Any person who had access to the unit-record data has certified that they have been shown, have read and have understood section 81 of the Tax Administration Act 1994, which relates to privacy and confidentiality. Any discussion of data limitations or weaknesses is in the context of using the Linked Employer-Employee Database (LEED) for statistical purposes, and is not related to the ability of the data to support Inland Revenue's core operational requirements.

Careful consideration has been given to the privacy, security and confidentiality issues associated with using tax data in this project. A full discussion can be found in the LEED Project Privacy Impact Assessment paper (Statistics New Zealand, 2003).

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Abstract

Changes to youth minimum wage legislation in New Zealand together with steady increases in minimum wages since 2001 have contributed to substantial increases in the minimum wages for teenage workers, and significant increases in the number of teen workers earning at or near minimum wages. With these changes as a backdrop, this paper uses data from Statistics New Zealand's Linked Employer-Employee Database (LEED) to document the pattern of firm-level teenage employment over the period 2000–2007, and analyse the responses of firms to the increasing relative wages of teen workers.

First, we describe the distribution of teen-employment across firms and industries, and assess the possible impacts of the minimum wage changes on firms' wage bills. The average teen-employment share across all firms is about 7–8 percent, and about twice that in four main teen-employing industries. The minimum wage increases for teenagers plausibly increased their average wage by 5–10 percent relative to adult workers, although the effect on typical firms' wage bills is likely to be small: about 0.5 percent on average and about 1.5 percent for firms in the main teen-employing industries. However, there is a significant fraction of high teen-employing firms where, in the absence of any employment response by firms, the average impact of such wage increases could be about 5 percent.

Second, we analyse the changing nature of teen employment within continuing firms, focusing on whether firms that had high levels of teen employment before the changes in teenage minimum wages changed their teen-employment patterns relative to other firms. We find mixed evidence on whether high initial teen-employment shares reduced their teen employment over the period. Analysing changes over the period as a whole, we estimate that initial high teen-employing firms tended to reduce their subsequent teen employment: by 2.5–3 percentage points for firms in the main teen-employing industries, and about 1.2 percentage points for firms in other industries. However, analysing annual changes, we estimate small and insignificant effects for firms in the main teen-employing industries and positive effects for firms in other industries.

Third, we analyse the relationship between teen employment and firm entry and exit over the period. We find preliminary evidence of adverse effects on survival for firms that had high levels of teen employment at the beginning of the period. We estimate that firms in the main (other) teen-employing industries with initial teen-employment shares greater than 0.3, had about a 3 percent (10 percent) lower survival rate than other firms. We also estimate that firms entering the main teen-employing industries during the period had about 2 percent higher teen-employment shares in the final year of the period than continuing firms.

These findings highlight the potentially important role played by firm entry and exit in accounting for changes in the teenage labour market. However, it is unclear whether the patterns associated with exit and entry are due to increasing teenage wages over the period, or a reflection of characteristics associated with the dynamics of firm entry and exit.

Keywords

Minimum wage; Linked Employer-Employee Data; Youth employment.

Contents

1. Introduction 5
2. Minimum wage changes and the economy, 1999–2007 6
3. Predicting firms' responses to changing teenage wages 8
4. Data description 10
   4.1. Predicted wage bill effects 12
5. Analysis and results 14
   5.1. Effects on firms' teenage-employment share 15
   5.2. Effects on firms' teenage-wage share 19
   5.3. Effects on firms' survival 19
   5.4. Effects associated with firm entry 21
6. Concluding discussion 21
7. References 23

Tables

Table 1 24
Table 2 25
Table 3 26
Table 4 27
Table 5 28
Table 6 29
Table 7 30
Table 8 31

Appendix Table A1 33
Appendix Table A2 34
Appendix Table A3 35
Appendix Table A4 36

Figures

Figure 1 32

1. Introduction

Changes to youth minimum wage legislation in New Zealand together with steady increases in minimum wages since 1999 have contributed to substantial increases in the minimum wages for teenage workers,[1] and significant increases in the number of teen workers earning at or near minimum wages. Between April 1999 and March 2007, the real value of minimum wages for workers aged 16 to 17 years and 18 to 19 years increased more than 60 percent and 100 percent, respectively.

This paper documents the pattern of firm-level teenage employment over the period, and analyses the responses of firms to the increasing relative wages of teen workers, using data from Statistics New Zealand's Linked Employer-Employee Database (LEED). LEED provides a unique opportunity to examine firm-level patterns of teenage employment over time for all economically significant firms in New Zealand. However, it should be emphasised that although the analysis is motivated by the strong increases in minimum wages for youth workers over this period, which appears to be a primary factor driving the relative increase in teenage wages, these issues are only circumstantially related.

We first document the pattern of firms' teen-employment over this period. Although teenage workers accounted for only 7 to 8 percent of overall employment, they account for about twice that proportion in the four main teen-employing industries: Agriculture, Forestry and Fishing; Construction; Retail Trade; and Accommodation, Cafes and Restaurants.[2] Of total teen employment, 60 percent was concentrated within these four industries, where about 16 percent of firms have teen-employment shares of over 30 percent, accounting for nearly 30 percent of total teen employment.

These characteristics, together with estimates of the increases in teenage workers' relative wages, are used to estimate possible effects on firms' teen wage bills. We find that the average effect for all firms is small and likely to be about 0.5 percent. For firms within the main teenage-employing industries, the estimated effect is also likely to be modest: about 1.5 percent. However, for firms with teen-employment shares of at least 30 percent, the estimated impact on their wage bill may be around 4–5 percent.

We then analyse changes in firms' youth employment patterns as well as their wage bills, both on average and among high teen-employing firms and industries. We first focus on the relative teen-employment share changes for continuously employing firms, and distinguish firms that had high teen-employment shares before 2001 from other firms. We also analyse the relationship between teen employment and firm entry and exit over the period. Our analysis finds mixed evidence of a decline in teenage employment among continuing firms that had high teen employment initially. However, we find that firms with a high initial teen share were less likely to survive throughout the

[1] Throughout the paper we focus on 16 to 19 year olds and the terms 'teenage', 'teen' or 'teenager' used in this paper will refer only to this group. Although younger workers appear in LEED, accounting for about 1.5 percent of monthly jobs and 0.2 percent of earnings, they are not covered by minimum wage legislation.

[2] We measure employment as a simple unweighted count of number of job months in firms. There is no attempt to adjust for part-time versus full-time work, or for workers who hold multiple jobs during the same month. Both of these factors likely overstate youth employment relative to adult employment. An alternative measure of the incidence of teenage employment, which adjusts for part-time work differences as well as relative wage differences, is firms' teenage-wage shares: over the period, the firm employment weighted average wage share is 4.5 percent.

period, while new firms that entered production tended to employ more teenagers than continuing firms.

The next section provides an overview of changes in minimum wages over the period. In section 3, we present a simple model to guide the analysis. Section 4 describes the LEED data that we used, and provides some upper-bound estimates of possible effects of the changing minimum wages on firms' wage bills. Section 5 describes the analysis and associated results, and we conclude with a discussion in section 6.

2. Minimum wage changes and the economy, 1999–2007

Prior to 1999 there was an adult minimum wage that applied to workers aged at least 20 years, and a youth minimum wage set at 60 percent of the adult wage for 16- to 19-year olds.[3] Appendix Table A1 summarises the changes in minimum wage rates over the period observed, both in nominal dollars and in CPI-adjusted constant (2007) dollar values. In April 1999 the adult minimum wage was $7.00 and has increased each year since then, at roughly twice the rate of CPI inflation: between 1999 and (March) 2007, the minimum wage increased 46 percent in nominal terms and 22 percent in real dollar values.

Apart from the increased minimum wages for teenagers and adults, there were also significant changes to the teen-to-adult minimum wage relativities over this period. First, in 2001, the minimum adult age was lowered from 20 to 18 years, providing a substantial increase in the minimum wage for 18- to 19-year olds. The real minimum wage applying to this age group increased 64 percent in 2001, and 103 percent between 1999 and 2007.

Second, the youth-to-adult relativity affecting 16- to 17-year olds increased by two steps from 60 percent to 70 percent in 2001, and then to 80 percent in 2002. These changes and the adult minimum wage increases combined to increase the real value of the minimum wage for 16- to 17-year olds by 62 percent between 1999 and 2007.[4]

Figure 1 presents comparative trends in the CPI-adjusted real value of the minimum wage that applied to workers aged 16 to 17, 18 to 19, and 20 years and over (Figure 1a); the real average wage rate for each of these two teenage groups and for 20- to 24-year old workers (Figure 1b); and the extent to which the minimum wage potentially affected these three age groups, as measured by the fraction of workers in each year with wages less than the next year's minimum wage (Figure 1c).[5] Average real wages

[3] Hyslop and Stillman (2007) provide further details of the history of minimum wages in New Zealand.

[4] Subsequent to these changes, and beyond the current LEED observation period, there have been two further annual increases in the adult minimum wage in April 2007 and 2008 resulting in a greater than one-third real increase in the adult minimum wage since 1999. Also, the youth minimum wage was abolished on 1 April 2008, and replaced by a new entrants' minimum wage set at 80 percent of the minimum wage ($9.60) that applies to 16- to 17-year old workers for their first three months or 200 hours of employment: following this all workers aged 16 years and over are entitled to the adult minimum wage. The abolition of the youth minimum wage resulted in a further substantial increase in the minimum wage for 16- to 17-year olds: the real increase in minimum wage for teenagers since 1999 is 128 percent.

[5] The estimates provided in Figure 1b and c are derived from the 1999–2006 June quarter Household Labour Force Survey, Income Supplements (HLFS-IS). The estimated fractions of workers with wages less than next year's minimum wage include those with wages less than the current minimum wage, which may be due to either exemption from the minimum wage, non-compliance on the part of firms, and/or reporting errors by survey respondents. In

increased steadily for 16- to 17-year old workers over the period, resulting in a combined increase of 24 percent over the period. Surprisingly, the average wage of 18- to 19-year olds increased noticeably only between 2002 and 2003, was roughly flat across other years (in fact falling between 2003 and 2004), and had a combined increase of 8 percent over the period. The average wages of 20- to 24-year old workers grew modestly until the final two years, for a combined increase of 9 percent over the period. Based on a more detailed analysis of the wage distributions of these age groups (and anecdotal reports in the media), we believe that part of the reason for the stronger wage growth for 16- to 17-year olds (compared with 18- to 19-year olds) was because many firms voluntarily treated them as adult workers and paid them at least the adult minimum wage.

Of workers affected by the minimum wage, Figure 1c shows steady increases for both teenage groups between 1999 and 2003. Since 2003, the fraction of 16- to 17-year olds affected was constant at about 30 percent (perhaps reflecting the effects of firms paying adult wages). In contrast, the fractions of 18- to 19-year old workers with wages below the next year's minimum increased strongly over the last two years from 25 percent in 2004 to 51 percent in 2006. Finally, the fraction of 20- to 24-year olds affected by minimum wages was low (4 to 8 percent) until 2004, and increased in the last two years to 21 percent in 2006.

In summary, Figure 1 shows steadily increasing real minimum wages applying to all workers, with additional significant increases for teenage workers. The degree to which minimum wages affected teenage workers appears to have increased steadily, albeit reflected differently for the two subgroups: via strong wage growth for 16- to 17-year olds versus a strong increase in the fraction of affected 18- to 19-year olds. In contrast, adult workers were largely unaffected by the increases, at least until the last couple of years.

Although the magnitude of the minimum wage changes that affected 18- to-19-year olds over the period was larger than that for 16- to 17-year olds, the relative wage changes were larger for the latter group. This reflects either that the youth minimum wage was more constraining on 16- to 17-year olds than the adult minimum wage was on 18- to 19-year olds, or the effect of voluntary compliance to a single (adult) minimum wage for all workers on the part of firms, and/or other secular changes affecting these groups. To emphasise more general patterns in teenage employment, in our subsequent analysis we combine the 16- to 17-year and 18- to 19-year age groups, and focus on their total employment. Furthermore, because the changes in Figure 1 appeared to be gradual, we focus our analysis on changes over the full period, instead of the changes in the youth minimum wages in 2001 and 2002.

Previous analysis of the effects of these minimum wage increases have focused largely on employment outcomes of workers using the Household Labour Force Survey (HLFS) data (see eg Cruickshank and Pacheco, 2007; Hyslop and Stillman, 2007; Pacheco, 2007; Timmins, 2006). Despite the large increases in the prevailing minimum wages,

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addition, even in the absence of a minimum wage increase, some workers with wages in the affected range will receive cost of living wage increases that would lift their wage above the next minimum wage and would not be affected either. These factors suggest the estimated fraction of workers affected by minimum wages may be overstated. However, the fraction of workers earning less than the next minimum wage should provide a sense of the relative impacts across the age groups over time.

this literature has found little evidence of adverse employment effects on teen employment.[6]

In terms of firm-level analysis of minimum wage effects, Naiker and Pacheco (2006) find no evidence of significant impacts on investors' profit expectations for low-wage firms following New Zealand's youth minimum wage changes in 2001 and 2002. In the UK, Draca, Machin, and Van Reenen (2008) find profitability was adversely affected among low-wage firms following the introduction of a national minimum wage in 1999.

Between 1999/2000 and 2006/07 New Zealand experienced an extended period of economic growth, and employment increased by about 20 percent, the labour force participation rate increased from about 65.5 to 68.5 percent, the unemployment rate fell from about 6.5 percent to 3.5 percent, and average hourly wages increased 7.3 percent in CPI-adjusted real value terms. As youth employment is generally considered more cyclical than other age groups, we would expect relatively stronger growth in teenage employment over the period, all else equal.[7] In our analysis below, we focus on the different responses of firms with 'high' versus 'low' teenage-employment shares before 2001. If age-group cyclical employment differences are the same across high and low teen-employing firms this should control for differential cyclical teen employment effects, as well as any secular changes affecting teen employment rates. If relatively more teens tend to be absorbed in higher (lower) teen-employing firms during an upswing our estimates will under (over) state any firm response to teenage relative wage increases. Also, in some of our analysis we compared teenage-employment shares with those of young adult workers who provide a closer comparison group.

3. Predicting firms' responses to changing teenage wages

In this section we use a simple production function framework to derive theoretical predictions about firms' responses to changes in teenage relative wages. The strength of a firm-*i*'s response is summarised by its *elasticity of substitution* (σ_i) of teenage workers for other inputs. This framework provides two useful predictions. First is the standard prediction that firms will use relatively fewer teenage workers as teenagers' wages rise relative to the prices of other inputs into production (perhaps because of minimum wage increases). Second, and more important for our analysis, is that the relative response in terms of either teen-employment or wage shares is greatest for firms with teen-employment shares close to one-half. Given that teen-employment shares are relatively low, in practical terms this implies that firms with higher teen-employment shares are predicted to respond more.

To highlight the relative employment response between teenage and other (adult) employment, we assume the firm's production function consists of two inputs, teenage workers (T) and adult workers (A), and the elasticity of substitution σ_i captures the response of the teenage to adult employment ratio in response to a change in the teenage-adult wage ratio. Further, adopting the common assumption of constant elasticity of substitution (CES), we can write firm-*i*'s production function as:

[6] Earlier analyses of the effects of minimum wages on employment in New Zealand by Maloney (1995) and Chapple (1997) also reached mixed conclusions.

[7] In addition, there has been unusually strong growth in the employment rates of older workers over this period. This was partly in response to increases in the age of eligibility for New Zealand Superannuation to 65 years in 2001, and partly due to other secular and cyclical factors (see Dixon and Hyslop, 2008).

$$Q_i^{\rho_i} = \alpha_i T_i^{\rho_i} + \beta_i A_i^{\rho_i} \quad (1)$$

where Q_i is the firm's output, $\alpha_i+\beta_I = 1$, and $\rho_i = (\sigma_i-1)/\sigma_i<1$. From this equation, we can derive the relationship between the relative teenage/adult employment and teenage/adult wages as:

$$\ln\left(\frac{T_i}{A_i}\right) = \left[\sigma_i \ln\left(\frac{\alpha_i}{\beta_i}\right)\right] - \sigma_i \ln\left(\frac{w_T}{w_A}\right) \quad (2)$$

where $\sigma_i=1/(1-\rho_i)$. Equation (2) implies that, faced with the same wage ratio, firms will choose different mixes of teenage/adult employment according to differences in either the constant term in square brackets or differences in their elasticity of substitution (σ_i). Assuming firms within the same industry have similar elasticities of substitution, the within-industry variation in firms' teenage employment mix is likely to mainly reflect (exogenous) idiosyncratic firm variation in α_i and β_i, while cross-industry variation in firms' teenage employment will reflect a combination of this factor together with industry variation in the elasticity of substitution.

From equation (2), we can derive the responsiveness of the teen-employment share ($\lambda_i = T_i/(T_i+A_i)$) to a change in the relative wage as:

$$\frac{d\lambda_i}{d\ln\left(\frac{w_T}{w_A}\right)} = -\lambda_i(1-\lambda_i)\sigma_i \quad (3)$$

Equation (3) implies that, for a given elasticity of substitution, the degree to which the teenage-employment share is reduced by higher teenage wages is greatest when the teenage-employment share (λ_i) is one-half. Motivated by this result, and the low average teen-employment shares of firms, our empirical analysis estimates the responsiveness of teenage-employment shares for firms with relatively high (greater than 30 percent) teenage-employment shares, and firms with lower shares.[8]

Furthermore, given relative wages, firms with a high teenage-employment share will also have a high teenage-wage share. In some specifications, we investigate whether the responsiveness of employment shares is higher for firms with a high teenage-wage share as opposed to a high employment share.

We are also interested in the responsiveness of firms' teenage-wage shares ($s_i = w_T T_i/(w_T T_i + w_A A_i)$) to changing relative teenage wages. From equation (1), we can derive the relationship as:

$$\frac{ds_i}{d\ln\left(\frac{w_T}{w_A}\right)} = s_i(1-s_i)(1-\sigma_i). \quad (4)$$

The effect of higher relative wages for teenagers will be offset by a decline in the firm's teenage-employment share. Equation (4) implies that the firm's teenage-wage share will rise or fall in response to an increase in teenage relative wages according to whether the elasticity of substitution is less than or greater than 1, and the magnitude of the

[8] Although the predicted response is symmetric around one-half, the incidence of firms with greater than 50 percent teen-employment share is very low.

share response will be larger the closer the firm's wage share is to one-half. In the case σ_i=1 (Cobb-Douglas production), the fall in employment exactly offsets the rise in wages and the teenage-wage share is unchanged. When σ_i>1 (relatively elastic case), the employment share fall outweighs the higher teenage wages and the teenage-wage share declines; and for σ<1, the reverse occurs and the teenage-wage share rises.

The aggregate effect of a change in the relative wage of teenagers will depend on the distribution of teenagers across firms with different elasticities (σ_i) and different intensities of teenage labour use (λ_i and s_i). It is possible that the aggregate impact of changing relative teenage wages is small, even though some firms make significant adjustments in their use of teenage labour. Determining the distribution of impacts and the aggregate response to changing relative teenage wages is an empirical question that we consider below.

4. Data description

This study uses data from Statistics New Zealand's Linked Employer-Employee Database (LEED) covering the eight-year period April 1999–March 2007.[9] LEED uses information from tax and statistical sources to construct a record of paid jobs. Each month all New Zealand employers file an Employer Monthly Schedule (EMS) record with Inland Revenue (IRD), which lists all employees at that firm in the month, the amount of income they received, and the amount of tax that was deducted at source. Two types of recipients are covered by EMS: those who have pay-as-you-earn (PAYE) tax deducted, who are employees, and those who pay withholding tax, who are a subset of self-employed individuals. In addition to employment earnings, LEED also captures and identifies various forms of non-employment PAYE-withheld income; specifically, working-age welfare benefits, New Zealand Superannuation (NZS), earnings-related accident compensation (ACC) income, Paid Parental Leave (PPL) payments, and Student Allowances (SA). Because of the uncertain nature of the selection of self-employed in LEED, we exclude those who pay withholding tax and focus only on PAYE-deducted employment.[10]

Employees are identified by a unique confidentialised identifier derived from their IRD tax numbers. In the EMS data, *employers* appear as the administrative unit to which the EMS return relates, and do not equate to any consistent conception of a firm. We use a version of the LEED data that has allocated EMS returns to geographic units, as defined in the Longitudinal Business Frame (LBF) (Seyb, 2003), and identified by a unique identifier – the Primary Business Number (PBN).

One significant weakness of the LEED data is that it contains no information on hours worked. Because the EMS returns report only monthly earnings for each employee, it is not possible to accurately distinguish changes in hourly wage rates from changes in hours worked. Throughout our analysis we express earnings and incomes in constant, June 2007 quarter dollar values, adjusted using the Consumers Price Index (CPI).

Our analysis here focuses primarily on firms, and we use data on workers' age group employment and earnings aggregated to the firm (PBN) level. Table 1 and Table 2 provide descriptive summaries of the data. Each of these tables contains four panels pertaining to, first, all firms in all industries; second, all firms in the four main teen-

[9] See Kelly (2003) for a more detailed discussion of the LEED data.

[10] Note, however, that there are also some self-employed workers who receive PAYE-deducted earnings, who remain in the data that we use.

employing industries;[11] third, firms in these main teen-employing industries with teen-employment shares of greater than 30 percent; and fourth, the subset of (continuing) firms that employed workers in each year.[12] To take account of different firm sizes and be representative of an employment unit, our analysis is weighted by firms' total employment.

In Table 1 we describe the patterns of firms' average teenage and young adult (workers aged 20 to 24 years) employment and wage shares over the sample period for each of these four samples. The table highlights several findings. First, although the average firm in the economy has relatively limited exposure to teen workers (the average teen employment and wage shares across all firms are 7.7 and 4.5 percent, respectively), firms in the main teen-employing industries are naturally somewhat more exposed (15.5 and 9.7 percent). Furthermore, about 16 percent of firms within these industries have teen employment and wage shares greater than 30 percent (average 43 and 30 percent, respectively), and these firms employ 28 percent of all teen employment.

Second, the average firm teen-employment share actually increased (about 0.5 percentage points) for all firms, perhaps reflecting either cyclical factors that increase relative demand for teen workers and/or secular changes in worker cohort sizes. However, there was a smaller increase (0.1 percentage point) in the average teen-employment share of firms in the main teen-employing industries, while the average share fell among firms in these industries with high teen-employment shares (by 1.5 percentage points among all firms with teen-employment shares greater than 30 percent, and by 2.6 percentage points among the subset of continuing firms). Average wage shares grew more (or fell less) among firms in the main teen-employing industries, reflecting relatively stronger teen wage growth (see Table 2).

Third, although some of the changes in teen-employment shares can be explained by offsetting changes for young adults, this doesn't account for all the change.

Table 2 describes the average monthly earnings and monthly employment levels of jobs held by teenagers, young adults and all workers in LEED over the sample period for the same sample of firms. The descriptions here support and add to those in Table 1. The growth in average monthly real earnings was substantially stronger for teenage jobs than either all jobs or (particularly) young-adult jobs, which may reflect either stronger

[11] We define the main teen-employing industries as those industries that have above average teenage-employment shares and wage shares. The four industries are Accommodation, Cafes and Restaurants; Agriculture, Forestry and Fishing; Retail Trade; and Construction. Individually, the average teen-employment share of firms in each of these industries is higher than the average across all industries, and collectively these four industries account for around 60 percent of teen employment and 30 percent of total employment over the period. Appendix Table A2 presents further details on the teenage employment and earnings patterns across industries.

[12] This descriptive analysis is cross-sectional, so that some firms will not be in the latter two samples in each year if their teen-employment share fluctuates around 30 percent. About 16 percent of firms (weighted by firm employment) in these main teen-employing industries have teen-employment shares greater than 30 percent. Appendix Table A3 describes the characteristics of firms with high and low teenage employment in all industries and the four main teen-employing industries. In Appendix Table A4 we describe the autocorrelation structure over the eight years for firms that employed workers in each year for all industries and the main-teen employing industries. The patterns in this table indicate that, although there is persistence in firms' teen-employment shares over time, there is also a degree of fluidity.

(hourly) wage growth or growth in hours worked among teenage jobs. For all industries, the growth in average teenage earnings was 13.0 percent, compared with 4.3 percent for young-adult jobs and 7.9 percent for all jobs.[13] Growth in average earnings was stronger among all firms in the main teen-employing industries, but similar for high teen-employing firms within these industries.

Table 2 confirms the relatively stronger employment growth for teenagers in all industries over the period. Total employment growth was stronger in the main teen-employing industries than for all industries (30 versus 22 percent) but teenage employment growth was about the same (31 versus 30 percent). Also, among the high teen-employing firms in the main teen-employing industries, total and teen employment growth was slower. In fact, among the continuing subset of firms, total employment fell 4 percent and teen employment fell 10 percent over the period.

4.1. Predicted wage bill effects

Before presenting the empirical analysis of changes in firms' teenage employment over the period, we first provide estimates of the possible impact of a change in teenage wages on firms' wage bills. These are based on simple estimates of possible teenage relative wage changes, under the assumption that firms do not adjust their employment shares (σ=0), so are upper-bound estimates. To the extent that firms use fewer teenage workers when the cost of employing teenagers increases, the increase in the wage bill will be less than that derived here.

We begin by exploring some possible impacts on alternative firms' teen and total wage bills. If a firm employs N workers, of which a fraction e_T are teenage workers at an average (monthly) wage of $\overline{w}_T$ and (1-e_T) adult workers at an average wage of $\overline{w}_A$, its teen and total wage bills are

$$WB_T = e_T \overline{w}_T .N$$

and

$$WB = (e_T \overline{w}_T + (1-e_T) \overline{w}_A).N.$$

Suppose the teen average wage changes by $\Delta\overline{w}_T^M$ between period 0 and 1 (eg 1999/00 and 2006/07, respectively) as a result of the minimum wage changes. Then, assuming firms' employment decisions are unaffected by these changes, we can estimate the relative impacts on firms' teenage and total wage bills respectively as:

$$\text{Relative change in } WB_T = \Delta\overline{w}_T^M \Big/ \overline{w}_T^0$$

and

$$\text{Relative change in } WB = \left(\Delta\overline{w}_T^M \Big/ \overline{w}_T^0 \right).s_T^0$$

[13] Some simple comparisons with measured wage growth reported in the Household Labour Force Survey – Income Supplement (HLFS-IS) over the 1999–2006 period suggest most of the growth in average LEED monthly earnings reflects growth in wages rather than growth in hours. For all industries, the average real teenage wage growth from the HLFS-IS is about 14 percent.

where s_T^0 is the period 0 teenage-wage share – i.e. $s_T^0 = e_T^0 \overline{w}_T^0 \Big/ (e_T^0 \overline{w}_T^0 + (1 - e_T^0)\overline{w}_A^0)$.

To explore the possible impacts on firms' teen and total wage bills, we use estimates of firms' teen-employment shares and relative wage changes presented in Tables 1 and 2, assuming the observed average wages changes are exogenous to firms' employment decisions – ie that firms did not adjust their employment patterns in response to minimum wage or other changes.

We are interested in the impact of changing minimum wage levels on the relative wages of teenagers and hence on the demand for teenage employment. However, it is not clear how much of the observed relative growth in teenage wages is due to the impact of minimum wages, so we derive three estimates which differ in the counterfactual teenage wage growth that is assumed to have occurred in the absence of minimum wage changes. We adopt three alternative assumptions based on the observed monthly earnings changes in LEED: (1) the change in the average teenage wage is wholly due to the minimum wage changes over the period which, given general wage growth, likely overestimates the impact of minimum wages; (2) teenage average wage growth would have been equal to the growth in the young adult (20- to 24-year olds) average wages, in which case the implied minimum wage impact is the difference between the observed change in teenage and young adult (20- to 24-year olds) average wages; and (3) teenage wages would have risen at the same rate as the (all-job) average wage, so that the implied minimum wage impact is equal to the difference between the observed teenage average wage change and the (all-job) average wage change.[14]

Table 3 contains estimates for the four groups of firms described in Tables 1 and 2, using each of these assumptions. The first panel pertains to the all-industries average firm. Assuming the minimum wage changes were entirely responsible for the increase in teenage average wages implies the average firm's teen wage bill increased by this amount (13.0 percent), while its total wage bill increased a more modest 1.0 percent. The implied change in the teenage-wage share is 0.5 percentage points, which is similar to the observed change of 0.4 percentage points shown in Table 1. However, increasing wages of other groups suggests this is likely an overestimate of the impact of minimum wage changes. Based on the alternative assumptions that the minimum wage impact is the difference between the teenage young adult (all-job) average wage increase (8.7 and 5.2 percent, respectively), results in lower estimated average impacts on firms' total wage bill of 0.6 and 0.4 percent, respectively, and a wage share change of 0.4 percentage points.

The second panel repeats this exercise for the four main teen-employing industries. For these industries, the average wages of teen, young adult and all jobs increased more, and the resulting estimated impacts on the average firm's teen wage bill are greater than for all industries. In addition, because firms have higher teen-employment shares in these industries, the estimated impacts on the total wage bill are substantially higher: ranging from 1.2 percent (using the all-job average wage change as the counterfactual for the minimum wage impact on teenage wages) to 3.2 percent assuming the observed 20.6 percent increase in teenage wages is wholly due to minimum wage increases. The implied wage share changes of 0.6–1.6 percentage points is greater than the observed change of 0.2 percentage points, which is consistent with firms responding to higher teenage relative wages by reducing their use of teenage workers. However, Table 1

[14] Note, teenage wage changes are also included in the estimated average wage change across all jobs.

also shows a slight (0.1 percentage points) rise in the teenage-employment share in these industries, suggesting a possible increase in the relative demand for teenage workers and/or compositional changes over the period.

The third and fourth panels present analogous estimates for the average firm among those with teen-employment shares greater than 30 percent for all firms in the main teen-employing industries (panel 3) and restricted to continuing firms across the sample period. Although the average wage increases are lower for these firms than the average across all main-industry firms, their substantially higher teen-employment shares means the simulated total wage bill impacts are generally larger. The main exception is the estimate for the continuing firms' sample using the all-job average wage change as the counterfactual: in fact, because the all-job average wage increased more than the teenage average wage for this group of firms, this estimate is negative.

As these high teen-employing firms are the largest users of teenage workers, they are predicted to be most likely to adjust their employment in response to minimum wage changes that affect teenage wages, as shown in equation (3). For this reason, we have also added estimates of the impact on the total wage bill for these firms, using the observed average wage changes for all firms in these industries. Based on these wage changes, the observed 20.6 percent increase in teen wages is expected to increase the total wage bill of these firms by about 9 percent. Adjusting the observed increase in teen wages for the 10–12 percent increase in young-adult or all-job earnings, suggests the teenage wage increase impact on the total wage bill of these firms is 4–5 percent. Consistent with the higher elasticity of demand for teenage workers in these firms, the observed wage share change of -0.3 percentage points is lower than any of the changes implied by the counterfactuals, and the employment share decline (-1.5 percentage points) is even greater, suggesting a more than offsetting reduction in the demand for teenage workers in response to rising teenage relative wages.

In summary, based on 1999/2000 year employment shares and observed average wage changes over the period, the likely impact on the total wage bill of the average firm across all industries is likely to be low (perhaps 0.5 percent). However, for the average firm in high teen-employing industries, the impact may be 1.2–1.7 percent and, for firms with high levels of teen employment, the impact may be 3.4–4.9 percent. Thus, although the average impact of the rising teenage relative wages on a firm's wage bill across all firms is likely to be low, the impact on the subset of high teen-employing firms may be about 5 percent.

Similarly, the low overall impact conceals potentially stronger labour demand responses by firms with high teenage-employment shares in high teen-employing industries, where rising relative teenage wages are associated with declines in teenage-employment shares large enough to lower the teenage-wage share. We now turn our attention to this issue.

5. Analysis and results

In this section we analyse whether there has been any relative change in outcomes for firms that employed teenagers extensively at the start of the period. For this purpose, our primary definition of a high (initial) teenage-employing firm is one that had a teen-employment share of at least 0.3 in 2000/01 (denoted by the dummy variable Hi_i), which was the year before changes in youth minimum wage policies and subsequent increases in minimum wage rates took effect. In addition, we consider an analogous

measure based on the firm's 2000/01 teen-wage share,[15] and also based on the continuous teen employment or wage share measures.

This analysis focuses on three complementary outcomes: teenage-employment shares and wage shares among firms that employed workers in all eight years of the period; the survival rates of firms that existed in the first two years of the period; and teenage employment and wage shares of firms in the final year (whether or not they started employing workers during the period).

5.1. Effects on firms' teenage-employment share

We first focus on firms' teen-employment share changes after 2000/01. We begin with a simple assumption that firm-*i*'s teenage-employment share in year-*t* (y_{it}) can be adequately expressed by the following regression:

$$y_{it} = \alpha_{0t} + \gamma_1 y_{it-1} + \delta_{1t} Main_i + \beta_{1t}.Hi_i + \beta_{2t} Hi_i.Main_i + X_i'\delta_{2t} + \alpha_i + u_{it};$$

$$i=1,\ldots,N;\ t=2,\ldots,8 \qquad (5)$$

where $Main_i$ is a dummy variable for whether firm-*i* is in one of the four main teen-employing industries, Hi_i is a dummy variable for whether the firm was a high teen-employing firm in 2000/01 (had teen-employment share greater than 0.3), $Hi_i.Main_i$ is an interaction term between these two variables, X_i' is a vector of other control variables (typically time invariant), α_i is a teen-employment share fixed effect for firm-*i*, and u_{it} is assumed to be a random error term. Our primary focus of interest is on the coefficients β_{1t} and β_{2t} which capture the effects of being a high initial teen-employing firm in all and main industries on the firm's subsequent teen-employment share. Note that, with the exception of the coefficient on the lagged variable (y_{it-1}) and the fixed effect, we allow each of the coefficients to vary over time. In particular, a time-varying effect of being an affected firm (β_{1t}) allows the possibility of the increasing minimum wage rates over time to progressively impact on high teen-employing firms.

The results of alternative model specifications for equation (5) are presented in Table 4. We begin with a simple static model in column (1) that ignores the lagged teen-share term, the firm fixed effects, and other covariate controls (X_i). This model includes separate unrestricted time trends for each of the four groups of 'high' and 'other' teen-employing firms in the 'main teen-employing' and 'other' industries. These results, estimated by ordinary least squares (OLS), largely confirm that firms in the main teen-employing industries have higher teen-employment shares than those in other industries, and firms with high initial teen-employment shares have higher teen-employment shares in subsequent years. The estimates suggest that the teen-employment shares of unaffected firms in the non-main teen-employing industries increased about 0.3 percentage points on average over the period (between 2000/01 and 2006/07), while the teen-employment share of non-high teen-employing firms in the main teen-employing industries increased about 1.7 percentage points. Also, around these trends, the average teen-employment share of high teen-employing firms (those with initial teen-employment shares greater than 30 percent) fell by 14 percentage points for firms in the main teen-employing industries, and by 19 percentage points for

[15] A firm's teen wage share may provide a better measure of the (full-time employment) intensity of its teen employment and hence exposure to teen labour market changes. However, high-wage paying firms, who are less likely to be affected by minimum wage changes, may be misclassified using this measure.

firms in other industries. However, the magnitudes of these estimates may be biased upwards if there is random year-to-year variation in firms' teen-employment shares, resulting in patterns of mean-reversion in firms' teen-employment shares over time. Comparing the implied annual changes with the actual seven-year changes reported in Table 1, there does appear to be significant upward bias. For high teen-employing firms in the main teenage-employing industries, the teen-employment share declined by -2.6 percentage points over the seven-year period, an average of -0.4 per annum. This is significantly smaller than the -14 percentage points implied by the OLS estimates. We return to the issue of mean-reversion shortly.

We next add firm fixed effects to the model. Guided by the reasonably steady time profiles of the coefficients in the previous levels specification, we have restricted this profile to be linear in time. To handle the fixed effects, we estimate this model in first-differenced form:

$$\Delta y_{it} = \alpha_0 + \delta_1 Main_i + \beta_1 .Hi_i + \beta_2 Hi_i .Main_i + \Delta X_i^{'}\delta_2 + u_{it};$$

$$i=1,\ldots,N;\ t=3,\ldots,8. \qquad (6)$$

Column (2) contains OLS estimates of the model. If there is random year-to-year variation in firms' teen-employment patterns, using the 2000/01 teen-employment share to determine more versus less affected firms, the Hi_i variable will be measured with error. For this reason, in column (3) we present estimates of this model that instruments for this variable (and its interaction with the main teen-employing industry dummy variable, $Main_i$) using its first year analogue (ie a dummy variable for whether the firm's 1999/00 employment share was at least 0.3) and interaction.[16] The two sets of estimates for this specification are almost identical and suggest the teen-employment share of affected firms fall by around 2.2 percentage points annually after 2000/01 in the main teen-employing industries, and by 2.8 percentage points in other industries.

The similarity of the OLS and IV results suggests either that the year-2 measure of Hi_i is accurate and there is no mean-reversion, or that the attenuation bias associated with mismeasurement is roughly counterbalanced by the mean-reversion effects associated with Hi_i. If there are random year-to-year fluctuations in employment shares, our sample of high teen-employing firms will include those with a transitorily high number of teenage workers and we would expect them to have subsequent declines in their teen-employment share, generating mean reversion in our estimates. To examine this issue, we relax the simple assumption of random year-to-year variation in teen-employment shares and include the firm's lagged teen-employment share to control for possible dynamic patterns unrelated to the minimum wage changes. In first-differenced form:

$$\Delta y_{it} = \alpha_0 + \gamma_1 \Delta y_{it-1} + \delta_1 Main_i + \beta_1 .Hi_i + \beta_2 Hi_i .Main_i + \Delta X_i^{'}\delta_2 + \Delta u_{it}. \qquad (7)$$

Columns (4)–(6) present alternative estimates of these specifications. Column (4) extends the IV specification from column (3) by adding Δy_{it-1}, without additional controls. These estimates are biased by the well-known problem of Δy_{it-1} being (negatively) correlated with Δu_{it} (via u_{it-1} being a component of y_{it-1}). In column (5), we present estimates using the standard IV procedure of instrumenting for Δy_{it-1} using y_{it-2} (which is a valid instrument conditional on the first order of dynamic process being correct). As

[16] That is, suppose Hi_{i^*} is the true (unobserved) indicator for whether firm-i is a high teen-employing firm, and that the year 1 and year 2 measured indicators equal Hi_{i^*} plus classical measurement error (ie $Hi_{it} = Hi_{i^*} + \varepsilon_{it}$ and ε_{it} is a purely random noise term), then Hi_{i1} is a valid instrument for Hi_{i2}.

expected, these estimates indicate positive serial correlation in firms' employment share dynamics and, compared with columns (2) and (3), a now insignificant estimate of the decline in teen-employment shares over the period by high initial teen-employing firms.

Finally, to allow for possibly different teen-share dynamics for high initial teen-employing firms, we include in column (6) an interaction between the affected dummy variable and the lagged change in teen-employment share ($Hi_i.\Delta y_{it-1}$), and also instrument for this variable using the interaction between the first year high-use dummy and y_{it-2}. The estimates in column (6) imply insignificantly positive main high teen-employing firm effects, insignificantly negative effects for firms in the main teen-employing industries, and negative (and approaching statistically significant: t-stat=1.5) dynamic interaction effects. The latter estimate suggests there is a faster dynamic adjustment in the teen-employment share among firms characterised as high teen-employing firms before the 2001 (and beyond) minimum wage changes.

A broadly similar pattern of estimates is obtained when we restrict the sample to continuing firms in the four main teenage-employing industries, presented in the lower panel of Table 4.

Based on this analysis, we treat the specification in column (6) of Table 4 as the base specification, and consider various extensions to this model. The results of these extensions are presented in Table 5. In the first extension (column (1)), we include interactions between the Hi_i variable and year dummies to allow for non-linear time effects (not shown). The estimated main Hi_i effect is slightly larger, reflecting that the time profile show a slight decline, but the only significant interaction effect is -0.011 (se=0.004) associated with the penultimate year (2005/06). Another point to note in this specification is that the interaction effect between the firm's affected dummy and lagged teen-employment share is smaller than in the base model and is insignificant.

In column (2), we control for the firm's changing 20- to 24-year olds' employment share. There is a negative but statistically insignificant relationship between this share and the teen-employment share but, again, this has little effect on the other results. In column (3), to allow for a continuous measure of firms' intensity of teen employment, we replace the dummy variable for whether the firm's 2000/01 teen-employment share is greater than 0.3 with a continuous share measure. In this specification for all industries, both the main effect and its interaction with lagged teen-employment share have the same signs as before and are statistically significant. The results imply that a higher 10-percentage-point difference in the 2000/01 teen-employment share has the *main* effect of raising teen-employment share growth by 0.12 percentage points per year and the lagged teen-employment share *interaction* effect of lowering growth by 0.25 percentage points per year for firms with 10 percentage points higher lagged teen-employment shares.[17]

The specification in column (4) replaces the binary definition of high teen-employing firms with the 2000/01 teen-employment share continuous variable. The results from this specification are qualitatively the same as those reported in the earlier columns, and imply declining teen-employment shares for high teen-employing firms. For example, the estimates imply that for an average firm in the non-main teen-employing industries (teen-employment share = 7.5 percent), the teen-employment share will fall 0.7 percentage points (=0.012-0.254*0.075) in the first year; while for an average main

[17] For example, compared with a firm with a 2000/01 teen-employment share of 0.1, a firm with a 0.3 teen-employment share would have its teen-employment share fall by about 0.26 percentage points per year.

teen-employing industry firm (teen-share = 15.5 percent), the teen-employment share will fall 3.4 percentage points (=0.012-0.007-0.254*0.155) in the first year. Furthermore, the teen-employment share of firms with 10 percent higher initial teen-employment shares will fall 2.5 percentage points (=-0.254*0.1) more on average in the first year.

In the final two extensions, we estimate the 'long-difference' regressions of the change in firms' teen-employment shares between 2000/01 and 2006/07. In column (5) we use an analogous specification to that in the base model, replacing the lagged teen-employment share with the lagged long-difference, and in column (6) we replace the 2000/01 high teen-employing firm dummy by the 1999/2000 equivalent. The estimates of the various high teen-employing firm coefficients in column (5) are typically negative and, although generally not individually statistically significant, are jointly significant (eg F-stat=9.89, p-value<0.001, for all industries). For example, the all-industry main high teen-employing firm estimates in column (5) imply that, on average, firms in the non-main teen-employing industries with 2000/01 teen-employment shares greater than 0.3 will lower their teen-employment shares by 1.2 percent for between 2000/01 and 2006/07, and firms in the main teen-employing industries by 2.9 percentage points. In addition, the interaction term between Hi_j and lagged teen-employment share implies the teen-employment share will fall an additional 0.4 percentage points for affected firms with 10-percentage-point higher teen-employment shares in 2000/01.

The estimates from the long-difference regressions indicate changes in employment shares that are larger than those in the preceding first-difference regressions, and similar in magnitude to the observed changes reported in Table 1. If the dynamic specification shown in equation (7) were correct, the coefficient on lagged teen-employment share should be similar across the first-difference and long-difference specifications. However, the long-difference coefficient (0.505) is significantly smaller than the corresponding coefficient in the main specification (0.632), pointing to possible mis-specification of the short-run dynamics. On balance, the long difference specification is preferred as a more robust summary of the changing patterns of teen-employment shares, and confirms the patterns observed in Table 1, with the most pronounced employment declines observed for firms that are the most intensive users of teenage workers in the main teen-employing industries.

In summary, this analysis of firms' teen-employment share changes provides mixed evidence on whether firms' with high teen-employment shares (before the 2001 changes to youth minimum wages and subsequent minimum wage increases) reduced their teen-employment share more or less than other firms in subsequent years. The long-difference specifications find significantly negative effects of being a high initial teen-employing firm on a firm's subsequent teen-employment share: on the order of 2.5–3 percentage points for main teen-employing industry high teen-employing firms between 2000/01 and 2006/07, which is comparable to the descriptive changes shown in Table 1, and about -1.2 percentage points for high teen-employing firms in other industries. However, after controlling for likely measurement error in the classification of firms as initial high teen-employing firms, the estimates from the annual dynamic specifications imply effects that are very small and insignificantly different from zero for high teen-employing firms in the main teen-employing industries, and positive for other industries. The differences between the long-difference and annual dynamic specifications suggest there may still be mis-specification in the model.

5.2. Effects on firms' teenage-wage share

We now extend the analysis above to examine the impacts on firms' wage share changes. For this purpose, we adopt a base model for wage shares that is analogous to that for teen-employment shares shown in Table 4, and then consider similar extensions. The results of this exercise are presented in Table 6.

The results for the base specification in column (1) show no significant main effect of high 2000/01 teen-employing firms on subsequent teen-wage share changes, or for firms in the main teen-employing industries, but there is a strongly significant interaction effect with lagged wage share: a firm with 10 percent higher initial teen-wage share is estimated to have a 0.6 percent annual decline in its teen-wage share. These results are robust to using 1999/00 to characterise high teen-employing firms, including year interactions to allow for time-varying effects over the period, and controlling for firms' 20–24 wage shares (columns (2)–(4)).

In column (5), we allow firms' teen-employment share in any year to vary continuously with their 2000/01 teen-employment share. The results are qualitatively similar to the base model. Columns (6) and (7) consider long-difference specifications. The results for these models show negative effects of the main high teen-employing variable and stronger effects for such firms in the main teen-employing industries, and positive interaction effects with the lagged teen-wage share. For all industries these estimates are not individually significant, but are jointly significant. The results for the subset of firms in the main teen-employing industries, the high teen-employing firm effect is strongly significant, and implies the teen-wage share falls by 1.8 percent between 2000/01 and 2006/07 for an affected relative to other firms.

As in the analysis of teenage-employment share changes, the difference in the lag share coefficient between the first-difference and long-difference specifications points to possible mis-specification. The long-difference coefficients yield changes that are comparable to the observed patterns in Table 1, and confirm the decline in wage shares for high teen-employing firms in the main teen-employing industries. Furthermore, the implied change in wage shares for this group is smaller in magnitude than the implied employment-share change, consistent with relatively elastic demand for teenage workers.

5.3. Effects on firms' survival

The analysis so far has focused only on firms that continue to exist and employ workers throughout the period. Using a similar approach, we now consider whether there was any effect on firm survival, by examining whether firms' initial teen-employment share was related to the probability that it survived until 2006/07. In particular, for the sample of firms that employed workers during each of the first two years, we model whether or not they *survived* (ie, employed workers in each of the eight years), using linear probability models of the following form

$$Survival_i = \beta_0 + \beta_1 . Hi_i + \beta_2 Hi_i . Main_i + \gamma_1 \log(emp)_i + \sum_j \delta_j . D_{ij} + u_i ; \qquad (8)$$

where $Main_i$ is a dummy variable for whether firm-*i* is in one of the main teen-employing industries, $log(emp)_i$ is the log(Firm-*i* employment) and D_{ij} is a dummy variable for whether firm-*i* is in industry-*j*. On an employment-weighted basis, 83 percent of such

firms survived in all industries, and 79 percent of firms in the main teen-employing industries survived.[18]

Table 7 contains results for various specifications of equation (8). The specifications in columns (1)–(4) vary by the definition of the affected variable, the specification in column (5) replaces the *survival* outcome variable with the number of years the firm survives beyond 2000/01, and columns (6) and (7) relax the industry and firm size controls of the base (column (1)) specification. We again estimate models both for all industries, and for the four main teen-employing industries. The results are qualitatively the same across all these specifications.

The specification in column (1) uses the dummy variable for whether the firm's teen-employment share is greater than 0.3 in 2000/01 (and instrumented using the 1999/2000 analogue). This specification estimates strong negative effects on survival of firms that employ a large fraction of teen workers. For the model estimated for all industries, the effect is -17 percent for firms outside the main teen-employing industries, and a smaller -4 percent for firms in the main teen-employing industries. For the model estimated just for the main teen-employing industry firms, the estimated effect is -6 percent. In column (2), we use the 1999/2000 dated high teen-employment dummy variable, and the resulting estimates are smaller but still statistically significant.

In column (3) we use the 2000/01 firm's continuous teen-employment share measure in place of Hi_i. These results imply that if a non-main teen-employing industry firm's teen-employment share was 10 percent higher it would have about a 2.4 percent lower survival rate. For firms in the main teen-employing industries, the equivalent survival effect is -0.6 percent (from the all-industry estimates) and -1.1 percent from the main-teen employing industry estimates.

In column (4) we use a dummy variable for whether the firm's 2000/01 wage share is at least 0.2 to define *high teen*-employing firms. The estimated effects are larger for non-main teen-employing industry firms, but similar or smaller for main teen-employing industry firms, compared to the base model estimates in column (1). Column (5) presents estimates for the base specification where we use the number of years of survival (beyond 2000/01) as the outcome variable. These estimates suggest that non-main teen-employing industry firms with high teen-employment shares, on average, survive about 0.7 years less than their counterparts with low teen-employment shares; while the effect for main teen-employing industry firms is 0.2–0.27 years less.[19]

Finally, columns (6) and (7) control for detailed (3-digit) industry, while column (7) also relaxes the firm size control and includes a quartic polynomial in log(employment). Each of these changes reduces the magnitudes of the estimated effect of being a high initial teen-employing firm on firm survival, but the coefficients remain negative and significant. For example, compared with the estimated 6 percent lower survival rate for high teen-employing firms among the four main teen-employing industries in column (1), controlling for detailed industry effects (column (6)) and/or a polynomial in log(employment), the estimated effect is about -4 percent. This suggests that some of the earlier estimated effects are associated with high exit rates in some industries that also have high teen-employment levels.

[18] The relative survival rates of firms with 2000/01 teen-employment shares less than and greater than 0.3 was 84 and 78 percent, respectively, in all industries; and 79 and 80 percent in the main teen-employing industries.

[19] Firms that exit are observed after 2000/01 for 2.8 years on average, while the average number of years observed for all firms in this sample is 5.5 years.

5.4. Effects associated with firm entry

The results presented in tables 4–7 provide evidence both that firms with high teen-employment shares at the start of the period and before the minimum wage changes were less likely to exist at the end of the period and, among firms that employed throughout the period, were likely to lower their teen-employment shares. To the extent that these patterns are correct, the absence of any noticeable change in teen-employment shares across all firms suggests that new firms that entered production during the period must have higher teen-employment shares than continuing firms.

The final analysis we present here examines this issue. In particular, we consider regressions of a firm's final year (2006/07) teen-employment (or wage) share on a dummy variable for whether or not the firm entered production during the period, and other control variables.

The results from alternative specifications are presented in Table 8. The first specification includes industry dummy variables and the logarithm of the firm's employment. The estimates imply the 2006/07 teen-employment share of an entering firm is 2.5 percentage points higher than that of a continuing firm. In column (2), we interact the main teen-employing industry dummy and both the firm entry dummy and the firm's log(employment). In this specification, entering firms in the main teen-employing industries have about 3.3 percentage point higher teen-employment shares than continuing firms, and those in other industries have 2.1 percentage point higher teen-employment shares. We next add interaction between the entry dummy and log(employment) (column (3)) and then the three-way interaction between firm entry, main teen-employing industry and log(employment (column (4)). In column (3) the estimated main firm entry effect is insignificantly positive, while the entry interaction effects with main teen-employing industry and log(employment) are significantly positive. In column (4) the main teen-employment entry effect is significantly negative, but there is a strong positive effect of about 6 percent on the teen-employment share in the main teen-employing industries.

Columns (5)–(8) of Table 8 repeat these specifications for firms' teen-employment shares, controlling for detailed (3-digit) industry differences. The resulting estimates of entry on teen-employment shares are generally smaller, although still imply higher teen employment among entering firms. This suggests that at least some of previous estimated entry effects reflect higher firm entry rates in industries with higher teen employment.

The results here suggest that firms that started production during this period employed larger fractions of teenage workers than continuing firms. This may seem counter-intuitive (in the context of rising minimum wage impacts on youth workers) in that start-up firms would, if anything, be expected to face lower fixed costs and have greater flexibility than existing firms in employing fewer teen workers. One possible explanation is that the positive correlation between entry and teen employment reflects within-industry differences in the characteristics of entering versus continuing firms, rather than a direct effect of entry on teen employment over this period. Alternatively, it may be that entering firms are able to use teenage workers more productively than existing firms, and/or that the supply of other aged workers was relatively more constrained for new firms, during this period.

6. Concluding discussion

This paper analyses teen employment patterns across firms over the period 2000–2007, a time of substantial changes to minimum wage rates that have particularly affected

teenage workers. Although this analysis was motivated by the large increases in minimum wages for teenage workers over the period, given that the analysis is largely circumstantial, whether the results we find can be attributed to such minimum wage increases is unclear. Nonetheless, our analysis provides three main contributions.

First, we described the distribution of teen-employment across firms and industries, and assessed the possible impacts of the minimum wage changes on firms' wage bills. Although the minimum wage rates faced by teenagers increased dramatically over this period, which plausibly increased the average wage of teenagers by 5–10 percent relative to adult workers, the effect on typical firms is likely to be small. The average teen-employment share across all firms is about 7–8 percent, and a 10 percent increase in teenage relative wages would increase firm wage bills by about 0.5 percent on average. In the main teen-employing industries, the average teenage employment share is 15 percent, and the increase in firms' average wage bill may up to about 1.5 percent. However, there is a significant fraction of high teen-employing firms where, in the absence of any employment response by firms, the average impact of such wage increases could be about 5 percent.

Second, we analysed the changing nature of teen employment within continuing firms, focusing on whether firms that had high levels of teen employment before the changes in teenage relative wages changed their teen-employment patterns relative to other firms. We found mixed evidence on whether high initial teen-employment shares reduced their teen employment over the period. For employment share changes over the period as a whole, we estimate that initial high teen-employing firms tended to reduce their subsequent teen employment: by 2.5–3 percentage points for firms in the main-teen industries, and about 1.2 percentage points for firms in other industries. On the other hand, based on annual changes, we estimate small and insignificant effects for firms in the main teen-employing industries and positive effects for firms in other industries.

Third, we analysed the relationship between teen-employment shares and firm entry and exit over the period. We find preliminary evidence of possible adverse effects on survival for firms that had high levels of teen employment at the beginning of the period. For example, for firms with initial teen-employment shares greater than 0.3, those in the main teen-employing industries had about a 3 percent lower survival rate; while those in other industries had a 10 percent lower survival rate. However, we also find that firms that entered the main teen-employing industries during the period had about 2 percent higher teen-employment shares than continuing firms in the final year of the period. This latter finding helps reconcile the evidence on exit effects of high teen-employing firms, with the absence of any apparent adverse teen employment effects across firms in aggregate. It is unclear whether the patterns associated with exit and entry are due to higher teenage wages associated with minimum wage increases, or are a reflection of characteristics associated with the entry and exit dynamics of firms.

These findings highlight the potentially important role played by firm entry and exit in accounting for changes in the teenage labour market. The mixed evidence on teen-employment response by continuing firms, together with the low survival rates of firms with high teenage-employment shares, is in contrast to the apparently high propensity of entering firms to employ teenage workers. Reconciling these patterns requires a greater understanding of firm dynamics in teen-intensive industries, and of the characteristics of entering firms.

7. References

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Table 1

Firm Teenage and Young-adult Employment and Wage Shares

	Employment share		Wage share	
	Teenage	Young adult	Teenage	Young adult
1. All industries				
All years	0.077	0.116	0.045	0.095
1999/00	0.074	0.119	0.043	0.099
2006/07	0.079	0.116	0.046	0.095
Change	0.005	-0.002	0.004	-0.004
1999/00 Exiting firms	0.083	0.136	0.054	0.117
2006/07 Entering firms	0.111	0.156	0.073	0.139
2. Four main teen-employing industries[(1)]				
Fraction of age-group total	0.596	0.411	…	…
All years	0.155	0.161	0.097	0.148
1999/00	0.154	0.164	0.094	0.152
2006/07	0.155	0.164	0.096	0.148
Change	0.001	0.000	0.002	-0.004
1999/00 Exiting firms	0.140	0.167	0.097	0.157
2006/07 Entering firms	0.166	0.190	0.112	0.177
3. Main teen-employing industries, teen-employment share > 0.3				
Fraction of age-group total	0.278	0.073	…	…
All years	0.429	0.170	0.295	0.188
1999/00	0.437	0.163	0.291	0.185
2000/07	0.422	0.177	0.288	0.193
Change	-0.015	0.014	-0.003	0.008
4. Main teen-employing industries, balanced panel, teen-employment share > 0.3				
Fraction of age-group total	0.188	0.050	…	…
All years	0.415	0.167	0.269	0.184
1999/00	0.426	0.164	0.269	0.186
2006/07	0.400	0.171	0.257	0.183
Change	-0.026	0.007	-0.012	-0.004

Note: All estimates are weighted by firms' total employment. Teenagers are defined as workers aged 16 to 19 years; young adults are workers aged 20 to 24 years. Employment is measured as monthly job counts; Earnings are measured as monthly employment earnings, expressed in constant 2007 (June quarter) dollar-values, adjusted using the CPI. Each is summed over months in a year.
(1) The four main teen employment industries are Retail Trade; Accommodation, Cafes and Restaurants; Agriculture, Forestry and Fishing; and Construction.
… Not applicable.

Table 2

Changes in Average Monthly Earnings and Monthly Employment, 1999/2000–2006/07

	Average monthly earnings ($)			Total months employment (000)		
	Teenage	Young adult	All jobs	Teenage	Young adult	All jobs
1. All industries						
1999/00	1,190	2,130	2,990	1,393.8	2,235.2	18,800.0
2006/07	1,350	2,220	3,230	1,809.2	2,678.8	23,000.0
Percentage change	13.0	4.3	7.9	29.8	19.8	22.3
2. Four main teen-employing industries						
1999/00	1,010	1,720	2,030	824.2	879.1	5,367.7
2006/07	1,220	1,890	2,290	1,080.1	1,145.8	6,981.6
Percentage change	20.6	9.7	12.6	31.1	30.3	30.1
3. Main teen-employing industries, teen-employment share > 0.3						
1999/00	810	1,480	1,320	424.3	158.5	970.2
2006/07	930	1,530	1,440	494.4	207.5	1,171.1
Percentage change	15.0	3.8	9.6	16.5	30.9	20.7
4. Main teen-employing industries, balanced panel, teen-employment share > 0.3						
1999/00	790	1,510	1,340	322.1	123.7	755.5
2006/07	890	1,550	1,450	289.1	123.4	722.0
Percentage change	12.6	2.9	8.5	-10.2	-0.3	-4.4

Note: Monthly earnings are expressed in constant 2007 (June quarter) dollar-values, adjusted using the CPI, and averages are weighted by firms' total employment.

Table 3

Impacts of Relative Wage Changes on Wage Bill and Wage Shares

	Counterfactual wage change		
	Zero	**Young adult**	**All jobs**
All industries			
1. Teen relative wage change	0.130	0.087	0.052
2. Total wage bill change	0.010	0.006	0.004
Implied change in wage share	0.005	0.004	0.002
Main teen-employing industries			
1. Teen relative wage change	0.206	0.109	0.080
2. Total wage bill change	0.032	0.017	0.012
Implied change in wage share	0.016	0.009	0.006
Main teen-employing industries, teen-employment share > 0.3			
1. Teen relative wage change	0.150	0.112	0.053
2. Total wage bill change	0.065	0.049	0.023
Implied change in wage share	0.023	0.018	0.009
3. Total wage bill change	0.090	0.048	0.035
(Using main industry wage changes)			
Implied change in wage share	0.031	0.017	0.013
Continuing firms, main teen-employing industries, teen-employment share > 0.3			
1. Teen relative wage change	0.126	0.096	0.040
2. Total wage bill change	0.054	0.041	0.017
Implied change in wage share	0.018	0.014	0.006
3. Total wage-bill change	0.088	0.046	0.034
(Using main-industry wage changes)			
Implied change in wage share	0.029	0.016	0.012

Note: The estimated wage bill changes equal the increase in the wage bill that would have occurred if employment shares had not changed and the increase in average teenage wages was as observed between 1999/00 and 2006/07.

Table 4

Regression Estimates – Continuing Firms' Teen-employment Shares

	Levels	Fixed effects (first-differences)				
	OLS	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)
All industries						
Hi	(1)	-0.028	-0.029$^{(IV)}$	-0.037$^{(IV)}$	0.005$^{(IV)}$	0.005$^{(IV)}$
		(.002)	(.003)	(.002)	(.003)	(.003)
Main	(1)	0.003	0.003	0.004	-0.0003	-0.0003
		(.0002)	(.0002)	(.0002)	(.0003)	(.0003)
Hi * *Main*	(1)	0.006	0.006$^{(IV)}$	0.009$^{(IV)}$	-0.005$^{(IV)}$	-0.005$^{(IV)}$
		(.002)	(.003)	(.002)	(.003)	(.003)
lag(teen-emp share)	(1)	...	...	-0.160	0.616$^{(IV)}$	0.632$^{(IV)}$
				(.002)	(.010)	(.014)
Hi * lag(teen-emp share)	(1)	...	...	...	...	-0.058$^{(IV)}$
						(.039)
Main teen-employing industries						
Hi	(1)	-0.022	-0.022	-0.029$^{(IV)}$	0.0003$^{(IV)}$	-0.0001$^{(IV)}$
		(.001)	(.001)	(.001)	(.001)	(.001)
lag(teen-emp share)	(1)	...	...	-0.165	0.610$^{(IV)}$	0.626$^{(IV)}$
				(.003)	(.013)	(.020)
Hi * lag(teen-emp share)	(1)	...	...	...	...	-0.048$^{(IV)}$
						(.047)

Note: Robust standard errors are in parentheses. $^{(IV)}$ denotes that the corresponding variable has been instrumented. All regressions based on the balanced panels of firms in all industries or main teen-employing industries. The OLS-levels regression in column (1) is estimated using outcomes for the seven years 2000/01–2006/07; the first-differences regressions in columns (2)–(6) are estimated using differenced outcomes for the six periods (2001/02–2000/01)—(2006/07–2005/06). The variable *Hi* is a dummy variable for whether the firm's 2000/01 teen employment share was at least 0.3.

$^{(1)}$ The unrestricted time effects implied by column (1) are shown in the following table

	Intercept	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
All industries							
Baseline trends	0.036	0.001	0.002	0.002	0.003	0.003	0.003
(intercept is constant)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Main firms	0.066	0.008	0.011	0.013	0.014	0.014	0.014
(intercept is *MainTeen* coef)	(.001)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Hi firms	0.382	-0.077	-0.133	-0.162	-0.175	-0.184	-0.194
(intercept is *Hi* coef)	(.004)	(.008)	(.010)	(.012)	(.013)	(.014)	(.013)
Hi, *Main* firms	-0.060	0.024	0.041	0.051	0.054	0.052	0.057
(intercept is *Hi*Main* coef)	(.005)	(.009)	(.011)	(.013)	(.014)	(.015)	(.014)
Main teen industries							
Baseline Trends	0.101	0.009	0.013	0.015	0.017	0.018	0.017
(intercept is constant)	(.001)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Hi firms	0.322	-0.053	-0.092	-0.112	-0.122	-0.133	-0.137
(intercept is *Hi* coef)	(.003)	(.004)	(.005)	(.005)	(.005)	(.005)	(.005)

The IV regressions (3) and (4) instrument for the variable *Hi* using as an instrument the corresponding 1999/2000 indicator for whether teen-employment share was at least 0.3. The IV regression (5) also instruments for the lagged first-difference of a firm's teen-employment share variable using the second lagged level of teen-employment share as an instrument. The IV regressions (5) and (6) instrument for these two variables and the interactions between *Hi* and *Main* (column (5)), and between *Hi* and lag(teen-employment share) (column (6)) variables, using these instruments and their corresponding interactions.

… Not applicable.

Table 5

Regression Analysis – Continuing Firms' Teen-employment Shares

	Year interaction effects (1)	Young adult emp'ment share (2)	2000/01 teen wage share (3)	2000/01 teen emp'ment share (4)	Long difference (6-year) (5)	Long-difference 1999/00 *Hi* (6)
All industries						
Hi	0.008	0.004	0.009	0.012	-0.012	-0.005
	(.004)	(.003)	(.004)	(.003)	(.016)	(.009)
Main	-0.0003	-0.0003	-0.0006	-0.001	0.002	0.0003
	(.0003)	(.0003)	(.0003)	(.0004)	(.001)	(.001)
*Hi * Main*	-0.005	-0.005	-0.009	-0.007	-0.019	-0.013
	(.003)	(.003)	(.005)	(.004)	(.014)	(.008)
lag(teen-emp share)	0.630	0.631	0.642	0.697	0.505	0.530
	(.014)	(.015)	(.012)	(.018)	(.021)	(.017)
Hi * lag(teen-emp share)	-0.032	-0.060	-0.096	-0.254	-0.038	-0.034
	(.039)	(.038)	(.038)	(.058)	(.035)	(.027)
Young adult emp-share	…	-0.007	…	…	…	…
		(.008)				
Main teen-employing industries						
Hi	0.002	-0.0001	-0.0001	0.005	-0.027	-0.015
	(.003)	(.001)	(.002)	(.003)	(.007)	(.004)
lag(teen-emp share)	0.625	0.626	0.641	0.695	0.498	0.539
	(.019)	(.021)	(.018)	(.024)	(.029)	(.023)
Hi * lag(teen-emp share)	-0.030	-0.048	-0.090	-0.238	0.001	-0.019
	(.046)	(.047)	(.046)	(.071)	(.041)	(.033)
Young adult emp-share	…	-0.001	…	…	…	…
		(.013)				

Note: Robust standard errors are in parentheses. All regressions based on the balanced panels of firms in all industries or main-teen employing industries, are estimated using outcomes for the six years 2001/02–2006/07, and weighted using firm total employment (except column (3), weighted by firm total wage bill). The variable *Hi* in columns (1), (2) and (5) is an indicator variable for whether the firm's 2000/01 teen-employment share was at least 0.3; in column (3) this variable is an indicator variable for whether the firm's 2000/01 teen-wage share was at least 0.2; in column (4) this variable is the firm's 2000/01 teen-employment share; and in column (6) the variable *Hi* is an indicator for whether the firm's 1999/00 teen employment share is at least 0.3. All models instrument for the lagged change in teen-employment share and the 2000/01-dated variable *Hi* and interactions using second lagged level of teen-employment share and the 1999/2000-dated variable *Hi* analogue and interactions.
… Not applicable.

Table 6

Regression Analysis – Continuing Firms' Teen-wage Shares

	Base model (1)	1999/00 *Hi* (2)	Year Interact effects (3)	Young adult wage share (4)	2000/01 teen wage share (5)	Long Difference (6-year) (6)	Long difference 1999/00 *Hi* (7)
All industries							
Hi	0.001	0.001	0.002	0.001	0.005	-0.011	-0.004
	(.003)	(.001)	(.004)	(.003)	(.003)	(.012)	(.006)
Main	-0.0002	-0.0003	-0.0003	-0.0002	-0.0003	0.002	0.001
	(.0002)	(.0002)	(.0002)	(.0002)	(.0003)	(.001)	(.001)
*Hi * Main*	-0.002	-0.001	-0.002	-0.002	-0.005	-0.010	-0.010
	(.003)	(.002)	(.003)	(.003)	(.003)	(.011)	(.007)
lag(teen-wage share)	0.609	0.610	0.611	0.608	0.684	0.467	0.491
	(.012)	(.012)	(.012)	(.013)	(.023)	(.028)	(.024)
Hi * lag(teen-wage share)	-0.060	-0.060	-0.057	-0.060	-0.316	0.049	0.013
	(.019)	(.019)	(.020)	(.019)	(.067)	(.046)	(.028)
Young adult wage-share	...	...	...	-0.002	...	...	...
				(.006)			
Main teen-employing industries							
Hi	-0.001	-0.001	-0.001	-0.001	0.0002	-0.018	-0.011
	(.001)	(.001)	(.003)	(.001)	(.002)	(.003)	(.002)
lag(teen-wage share)	0.604	0.607	0.606	0.605	0.680	0.493	0.524
	(.015)	(.014)	(.015)	(.015)	(.029)	(.026)	(.022)
*Hi * lag(Teen-wage share)*	-0.051	-0.051	-0.048	-0.051	-0.289	0.034	-0.003
	(.022)	(.022)	(.023)	(.022)	(.081)	(.044)	(.027)
Young adult wage-share	...	...	...	0.002	...	...	...
				(.009)			

Note: Robust standard errors are in parentheses. All regressions based on the balanced panels of firms in all industries or main teen-employing industries, and are estimated using outcomes for the six years 2001/02–2006/07. The variable *Hi* in columns (1), (3), (4) and (6) is an indicator variable for whether the firm's 2000/01 teen employment share was at least 0.3; in columns (2) and (7) this variable is an indicator for whether the firm's 1999/00 teen employment share is at least 0.3; and in column (5) it is the firm's 2000/01 teen employment share. All models instrument for the lagged change in teen-wage share and the 2000/01-dated variable *Hi* and interactions using second lagged level of teen-wage share and the 1999/2000-dated variable *Hi* analogue and interactions.
… Not applicable.

Table 7

Regression Analysis – Firm Survival

	Base model (1)	1999/00 *Hi* (2)	2000/01 emp'ment share (3)	2000/01 Wage share>.2 (4)	Outcome variable: #years (5)	3-digit ANZSIC (6)	+ Quartic in log(emp'ment) (7)
All industries							
Hi	-0.173	-0.097	-0.243	-0.264	-0.717	-0.119	-0.104
	(.030)	(.015)	(.038)	(.038)	(.118)	(.029)	(.029)
*Hi * Main*	0.128	0.066	0.186	0.214	0.501	0.078	0.067
	(.032)	(.017)	(.043)	(.040)	(.125)	(.032)	(.032)
log(emp)	0.049	0.049	0.049	0.042	0.165	0.057	…
	(.002)	(.002)	(.002)	(.002)	(.008)	(.003)	
Main teen-employing industries							
Hi	-0.060	-0.020	-0.112	-0.044	-0.275	-0.042	-0.037
	(.011)	(.008)	(.020)	(.011)	(.040)	(.013)	(.013)
log(emp)	0.071	0.076	0.071	0.061	0.245	0.080	…
	(.003)	(.003)	(.003)	(.004)	(.009)	(.004)	

Note: Robust standard errors are in parentheses. All specifications control for industry effects. Except for column (2) (estimated using OLS) all specification use instrumental variables for the 2000/01 dated estimates of affected firms (and interactions) based on the 1999/2000 dated analogues. Specification (4) is weighted using 2000/01 firm total earnings; other specifications weighted using 2000/01 firm total employment. In columns (6) and (7), we control for detailed (3-digit) industry, and column (7) also controls for a quartic polynomial in log(employment).
… Not applicable.

Table 8

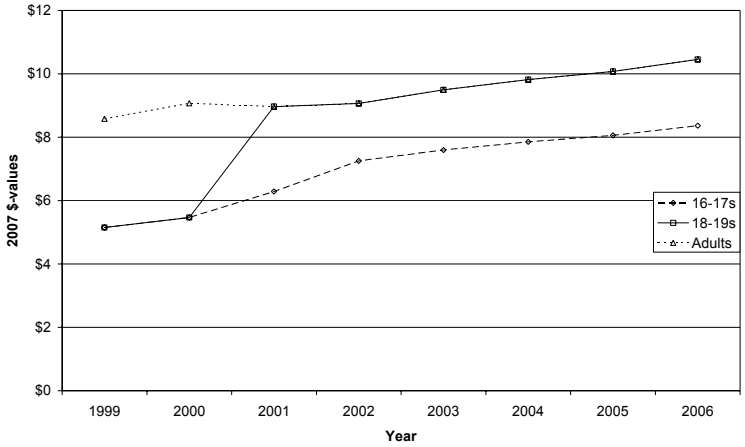
Regression Analysis – Final year Teen-employment Shares

	Teen-employment shares							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
All industries								
Entering firm	0.025	0.021	0.007	-0.015	0.018	0.016	-0.006	0.001
	(.001)	(.002)	(.005)	(.006)	(.001)	(.001)	(.005)	(.005)
Entering**Main*	...	0.012	0.013	0.075	...	0.006	0.007	0.034
		(.003)	(.003)	(.010)		(.002)	(.002)	(.010)
log(emp)	0.003	-0.0004	-0.001	-0.001	0.003	0.001	0.003	-0.0005
	(.0004)	(.0005)	(.0005)	(.0005)	(.0005)	(.001)	(.001)	(.001)
*Main**log(emp)	...	0.015	0.014	0.017	...	0.009	0.008	0.010
		(.001)	(.001)	(.001)		(.001)	(.001)	(.002)
Entering*log(emp)	...	...	0.003	0.007	...	...	0.004	0.006
			(.001)	(.001)			(.001)	(.001)
Entering**Main**logemp	...	...	...	-0.013	...	...	...	-0.005
				(.002)				(.002)
R-squared	0.251	0.259	0.259	0.260	0.353	0.355	0.355	0.355
Main-teen industries								
Entering firm	...	0.033	...	0.061	...	0.021	...	0.019
		(.002)		(.009)		(.002)		(.009)
log(emp)	...	0.014	...	0.016	...	0.010	...	0.010
		(.001)		(.001)		(.001)		(.002)
Entering*log(emp)	...	...	...	-0.006	...	...	...	0.0004
				(.002)				(.002)
R-squared	...	0.107	...	0.108	...	0.231	...	0.231

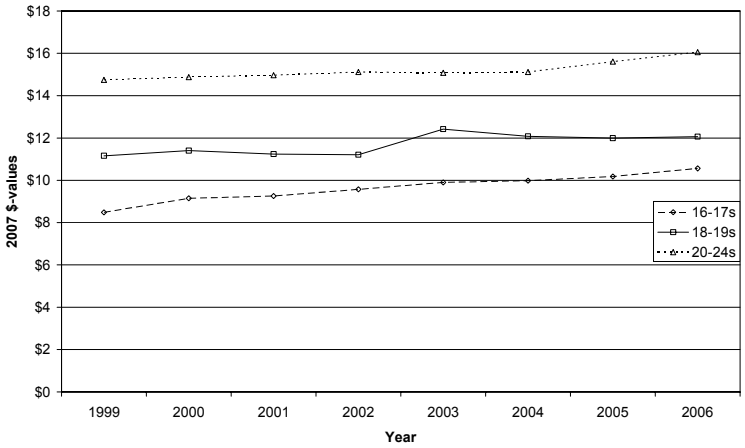
Note: Robust standard errors are in parentheses. Estimation based on 2006/07 firm data. All specifications control for industry effects. Columns (1)–(4) include 1-digit industry controls, and columns (5)–(8) include detailed (3-digit) industry controls.
… Not applicable.

Figure 1

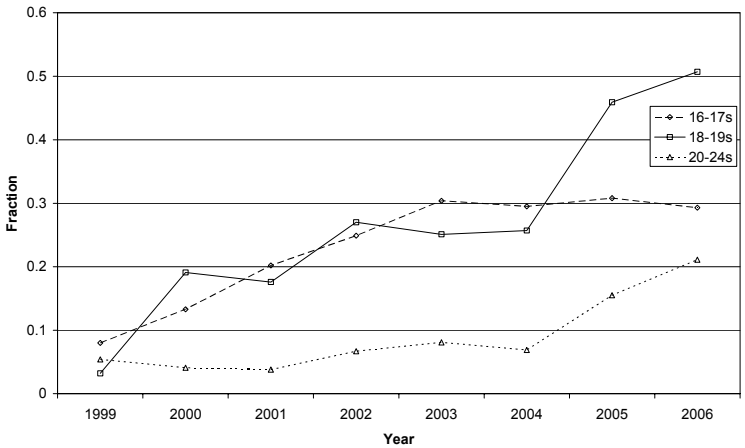
(a) Trends in Real Minimum Wages



(b) Trends in Real Average Wages



(c) Trends in Fractions with Wages less than next Minimum Wage



Appendix Table A1

Minimum Wage Rates, 1999–2008

	Nominal minimum wages ($)			Real minimum wages (2007, $)		
	Age group			Age group		
Effective date	16-17	18-19	Adults	16-17	18-19	Adults
1 March 1997	4.20	4.20	7.00	5.15	5.15	8.58
6 March 2000	4.55	4.55	7.55	5.47	5.47	9.07
5 March 2001	5.40	7.70	7.70	6.29	8.97	8.97
18 March 2002	6.40	8.00	8.00	7.25	9.07	9.07
24 March 2003	6.80	8.50	8.50	7.60	9.50	9.50
1 April 2004	7.20	9.00	9.00	7.85	9.82	9.82
21 March 2005	7.60	9.50	9.50	8.06	10.07	10.07
27 March 2006	8.20	10.25	10.25	8.36	10.46	10.46
Percentage changes: 1 April 1999 – 31 March 2007				62.4	103.0	21.8
1 April 2007	9.00	11.25	11.25	9.00	11.25	11.25
1 April 2008	12.00	12.00	12.00	11.72	11.72	11.72
Percentage changes: 1 April 1999 – 1 April 2008				127.6	127.6	36.6

Source: Department of Labour.
Note: Real minimum wages are adjusted using the CPI and expressed in 2007 (June quarter) dollar values.

Appendix Table A2

Industry Teenage Employment and Wage Share Characteristics

Industry	Share of Total teen employment (%)	Teen-employment share (%)	Teen-wage share (%)	Fraction with employment share>0.3 (%)
Main teen-employing industries				
G Retail Trade	30.1	18.9	8.2	23.9
H Accommodation, Cafes and Restaurants	14.4	18.6	10.1	21.4
A Agriculture, Forestry and Fishing	9.5	12.1	7.5	8.3
E Construction	5.6	8.0	4.2	5.2
Other industries				
P Cultural and Recreational Services	3.1	8.8	2.6	7.5
Q Personal and Other Services	2.6	5.7	2.1	5.5
C Manufacturing	10.1	5.5	2.4	1.0
J Communication Services	1.0	5.4	1.5	1.1
L Property and Business Services	9.5	5.4	1.7	1.9
F Wholesale Trade	4.1	5.2	1.9	1.6
I Transport and Storage	1.8	3.5	1.5	0.7
M Government Administration and Defence	1.5	3.3	1.2	0.1
K Finance and Insurance	0.9	2.7	0.9	0.7
B Mining	0.1	2.7	1.2	0.4
O Health & Community Services	3.2	2.6	0.8	0.6
D Electricity, Gas and Water Supply	0.1	2.2	0.7	0.2
N Education	2.3	2.0	0.5	0.8
All industries	100.0	7.7	2.7	6.0

Note: Main teen-employing industries are defined as those with above average teenage employment and wage shares. In the final column, the fraction of firms with teenage employment share > 0.3 is weighted by firms' total employment.

Appendix Table A3

Characteristics of Low versus High-teen Employment Firms

	All industries		Main teen-employing industries	
	Teen-employment share		Teen-employment share	
	< 0.3	> 0.3	< 0.3	> 0.3
Main teen-employing Industry	0.261	0.820	1	1
Firm employment	2,279.6	659.7	501.1	702.3
FTE employment	1,912.4	424.3	379.6	445.0
Average FTE employment	0.803	0.615	0.742	0.612
Teen-employment share	0.054	0.431	0.099	0.429
Teen-wage share	0.028	0.298	0.056	0.295
Average teen earnings ($)	1,300	910	1,180	890
Average earnings ($)	3,180	1,410	2,300	1,380
Average FTE earnings ($)	3,780	2,240	2,970	2,200

Note: Main teen-employing industries are defined as those with above average teenage employment and wage shares. All estimates are weighted by firms' total employment.

Appendix Table A4

Auto-correlations in Firms' Teen-employment Shares, 1999/2000–2006/07

	Correlation between firm teen-employment shares in year							
And year	**1999/00**	**2000/01**	**2001/02**	**2002/03**	**2003/04**	**2004/05**	**2005/06**	**2006/07**
All industries								
1999/00	1							
2000/01	0.854	1						
2001/02	0.761	0.861	1					
2002/03	0.719	0.772	0.867	1				
2003/04	0.697	0.732	0.780	0.870	1			
2004/05	0.682	0.709	0.739	0.782	0.870	1		
2005/06	0.664	0.691	0.714	0.738	0.780	0.867	1	
2006/07	0.649	0.676	0.697	0.713	0.738	0.779	0.867	1
Main teen-employing industries								
1999/00	1							
2000/01	0.831	1						
2001/02	0.722	0.834	1					
2002/03	0.668	0.728	0.841	1				
2003/04	0.641	0.679	0.735	0.841	1			
2004/05	0.623	0.649	0.684	0.732	0.838	1		
2005/06	0.596	0.625	0.649	0.676	0.724	0.832	1	
2006/07	0.581	0.608	0.629	0.644	0.672	0.723	0.830	1

Note: The correlations are based on the subsamples of firms that employed workers in each of the eight years (i.e. Continuing firms), and are weighted by firms' geometric average total annual employment over the period.