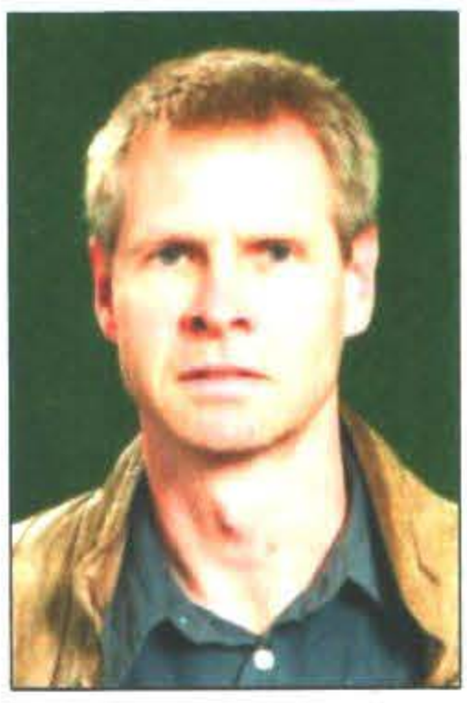
AN ANALYSIS OF TEENAGE EMPLOYMENT BY FIRMS: 1999/00–2006/07[1]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Abstract

This paper uses data from Statistics New Zealand's Linked Employer-Employee Database (LEED) to analyse the teenage employment responses of high teen employment firms in the four main teen employment industries to increasing relative wages of teen workers over the period 2000–2007, against a backdrop of substantial increases in the minimum wages for teenage workers. Among continuing firms, we find mixed evidence whether high teen-employers reduced their teen employment relative to other firms over the period. Analysing changes over the period as a whole, we estimate that initial high teen-employing firms reduced their subsequent teen employment by 2.5–3 percentage points for firms in the main teen-employing industries; however, analysing annual changes, we find small and insignificant effects for these firms. We also find preliminary evidence that high teen employment is associated with firm entry and exit: firms in the main teen-employing industries with high teen-employment at the beginning of the period, had about a 3 percent lower survival rate than other firms; while firms entering the main teen-employing industries during the period had about 2 percent higher teen-employment shares in the final year than continuing firms.

Introduction

Minimum wage increases in New Zealand since 2001, together with changes to youth minimum wage legislation, have contributed to substantial increases for teenage workers,[2] and significant increases in the number of teen workers earning at or near-to minimum wages. Between April 1999 and March 2007, the real value of minimum wages for workers aged 16-17 and 18-19 years increased more than 60 percent and 100 percent, respectively. Average teenage wages increased by 5–10 percent relative to adult wages over this period.

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, 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.

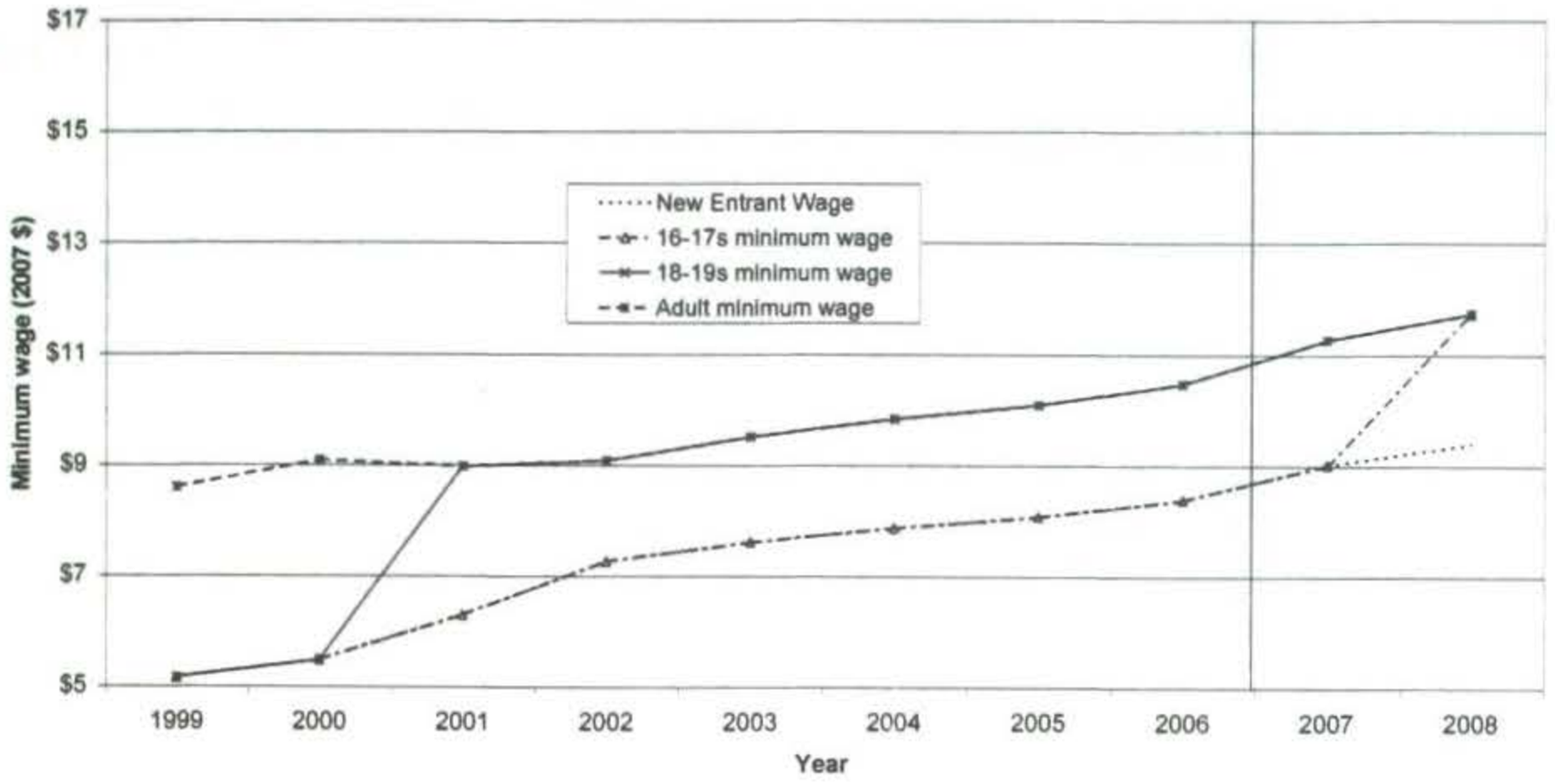
We first document the pattern of firms' teen-employment over this period. Although teenage workers accounted for only 7 to 8 percent of overall employment, they account for about twice that proportion in the four main teen-employing industries: Retail Trade; Accommodation, Cafes and Restaurants; Agriculture, Forestry and Fishing; and Construction.[3] 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.

Our analysis focuses on changes in youth employment patterns of high teen-employing firms within the main teen-employing industries (see Hyslop et al, 2008, for a more extensive analysis). 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 period, while new firms that entered production tended to employ more teenagers than continuing firms.

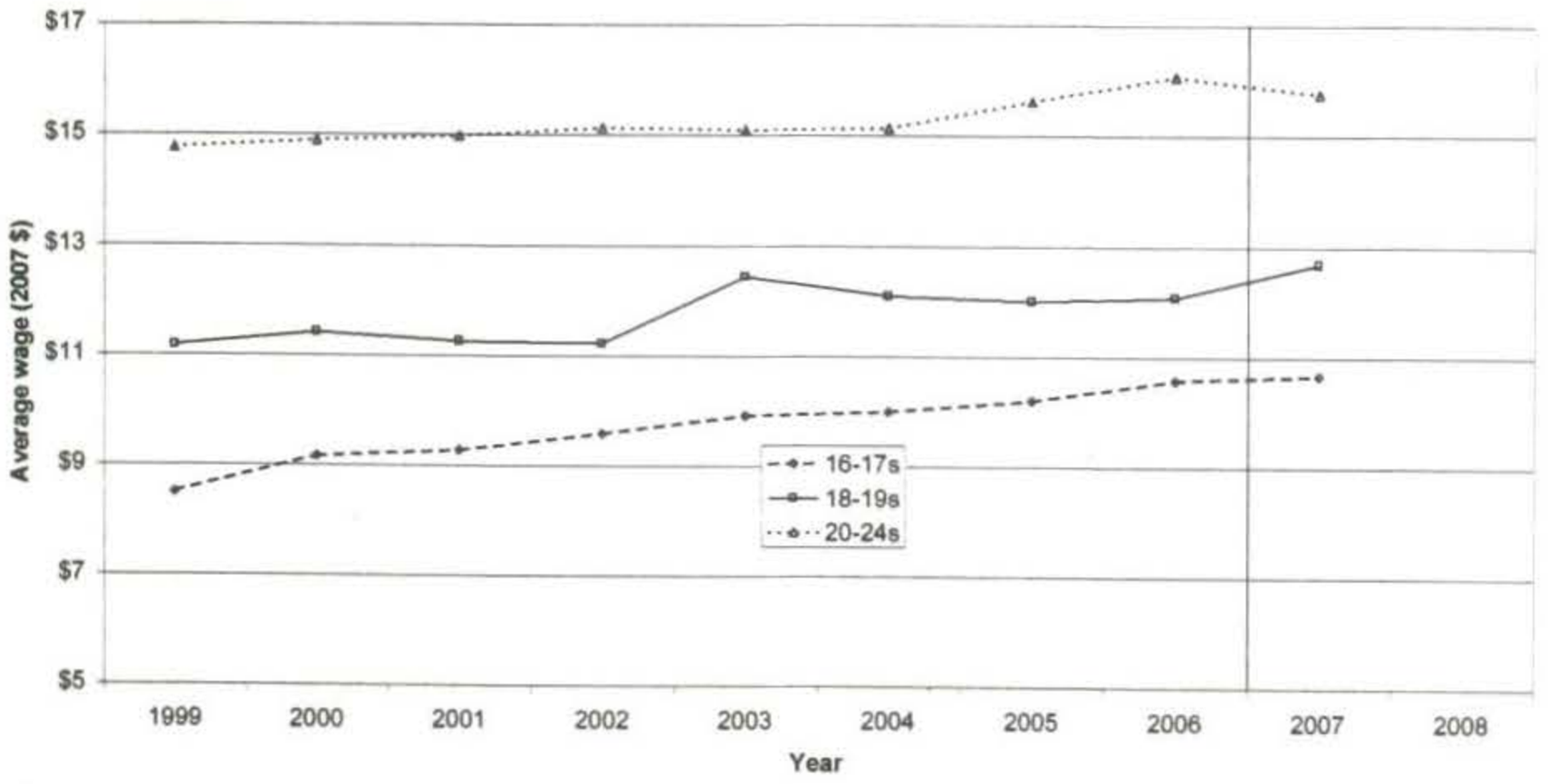
The next section provides an overview of changes in minimum wages over the period. In section 3, we present a simple model to guide the analysis. Section 4 describes the LEED data, section 5 describes the analysis and associated results, and section 6 concludes.

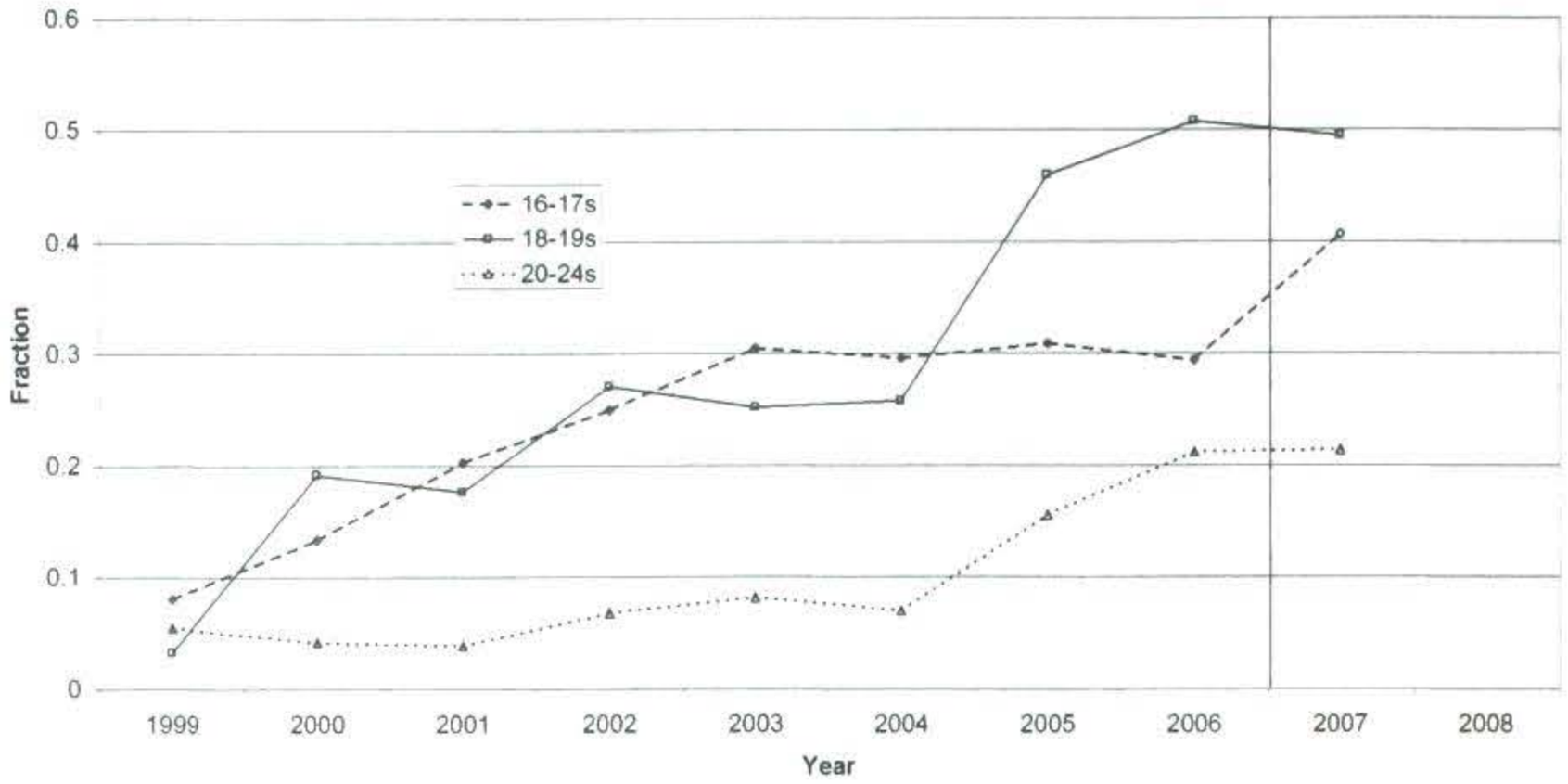
Figure 1: Trends in Minimum wages, Average wages, and Minimum wage *affectedness*

(a) Real Minimum Wages



(b) Real Average Wages





Source: (a) Department of Labour; (b) and (c) Authors' calculations from the 1997—2007 June Quarter Household Labour Force Survey, Income Supplements (HLFS-IS)

Minimum wages 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 16-19 year olds.[4] 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.

As well as increasing adult minimum wages, there were also significant changes to the teen-to-adult minimum wage relativities. First, in 2001, the minimum adult age was lowered from 20 to 18 years, providing a substantial increase in the minimum wage for 18-19 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 16-17 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 16-17 year olds by 62 percent between 1999 and 2007.[5]

Figure 1 presents comparative trends in the CPI-adjusted real value of the minimum wage that applied to workers aged 16-17, 18-19, and 20 years and over (Figure 1a); the real average wage rate for each of these two teenage groups and for 20-24 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).[6] Average real wages increased steadily for 16-17 year old workers over the period, resulting in a combined increase of 24 percent over the period. Surprisingly, the average wage of 18-19 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 20-24 year old workers grew modestly until the final two years, for a combined increase of 9 percent over the period.

Figure 1c shows steady increases in the fractions of teenage workers affected by the minimum wage between 1999 and 2007. The fraction of 16-17 year olds affected was about 30 percent between 2003 and 2006 (perhaps reflecting the effects of firms paying adult wages), and increased to 40 percent in 2007.[7] In contrast, the fraction of 18-19 year old workers with wages below the next year's minimum increased steadily to about 25 percent between 2002 and 2004, and then strongly to 51 percent by 2006. Finally, the fraction of 20-24 year olds affected by minimum wages was low (4 to 8 percent) until 2004, and increased in the next two years to 21 percent in 2006.

Although the magnitude of the minimum wage changes that affected 18-19 year olds over the period was larger than that for 16-17 year olds, the relative wage changes appear to be larger for 16-17 year olds. This reflects either that the youth minimum wage was more constraining on 16-17 year olds than the adult minimum wage was on 18-19 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.[8] In our subsequent analysis we combine the 16-17 year and 18-19 year age groups, to emphasise more general patterns in teenage 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, this literature has found little evidence of adverse employment effects on teen employment.[9]

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 and 2007 New Zealand experienced an extended period of economic growth. 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, all else equal we would expect relatively stronger growth in teenage employment over the period. Our analysis below compares the outcomes of firms with 'high' versus 'low' teenage-employment shares prior to 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 compare teenage-employment shares with those of young adult workers who provide a closer comparison group.

Firm responses to changing teenage wages

In this section we use a simple production function framework to derive predictions about firms' responses to changes in teenage relative wages. 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 importantly for our analysis, the relative teen-employment share response is greatest for firms with teen-employment shares close to 0.5. As the average teen-employment share is 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:

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

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, the relationship between the relative teenage/adult employment and teenage/adult wages can be derived as:

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

where $\sigma_i = 1/(1-\rho_i)$. Equation (2) implies that, faced with the same wage ratio, firms 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 the elasticity of substitution is similar for firms in the same industry, within-industry variation in firms' teenage employment mix will mainly reflect idiosyncratic firm variation in α_i and β_i, while cross-industry variation in firms' teenage employment reflects both this factor and 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:

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

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.[10]

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). 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.

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.[11] LEED uses information from tax and statistical sources to construct a record of paid jobs. In the EMS data, individuals are identified by a unique confidentialised identifier derived from their IRD tax numbers, while *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 has only monthly earnings for each employee and contains no information on hours worked. Thus, it is not possible to accurately distinguish changes in hourly wage rates from changes in hours worked. Throughout our analysis we express earnings in constant, June 2007 quarter dollar values, adjusted using the Consumers Price Index (CPI).

Our analysis focuses on firms, and we use data on workers' age group employment and earnings aggregated to the firm (PBN) level. Table 1 summarises the average teen-employment and wage shares, together with estimates of teenage wage increase relative to young adults' and effects on firms' average wage bill, across four samples: first, all firms in all industries; second, all firms in the four main teen-employing industries;[12] 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.[13] To take account of different firm sizes and be representative of an employment unit, our analysis is weighted by firms' total employment.

Table 1: Firm Teenage Employment and Wages

	Teenage		Relative Wage change	Impact on Wage bill
	Employment share	Wage share		
1. All industries				
All years	0.077	0.045	…	…
Change (1999/00-2006/07)	0.005	0.004	0.087	0.006
2. Four main teen-employing industries[(1)]				
Fraction of Teen-employment	0.596	…	…	…
All years	0.155	0.097	…	…
Change (1999/00-2006/07)	0.001	0.002	0.109	0.017
3. Main teen-employing industries, teen-employment share > 0.3				
Fraction of Teen-employment	0.278	…	…	…
All years	0.429	0.295	…	…
Change (1999/00-2006/07)	-0.015	-0.003	0.112	0.049
4. Main teen-employing industries, continuing firms, teen-employment share > 0.3				
Fraction of Teen-employment	0.188	…	…	…
All years	0.415	0.269	…	…
Change (1999/00-2006/07)	-0.026	-0.012	0.096	0.041

Note: All estimates are weighted by firms' total employment. Teenagers are defined as workers aged 16-19 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. The relative wage change is estimated as the difference between the growth in average monthly LEED earnings of teenage workers and 20-24 year old workers between 1999/2000 and 2006/07. The wage bill impact is calculated as the relative wage change multiplied by the average teen employment share over the period.

(1) The four main teen employment industries are Retail Trade; Accommodation, Cafes and Restaurants; Agriculture, Forestry and Fishing; and Construction.

… Not applicable.

Table 1 highlights several findings. First, although the average exposure to teen workers in the economy is relatively limited (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 (fell less) among firms in the main teen-employing industries, reflecting stronger teen wage growth. 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.

Third, relative to the average monthly earnings of 20-24 year old workers, the earnings of teenage workers grew by around 10 percent over the period. These increases are comparable to wage increases as measured in the HLFS-IS, and we believe that minimum wage changes were a significant contributor to such changes.

Finally, in the absence of any teen employment response by firms, these factors imply that the average impact of the relative teenage wage increases on firms' wage bills across all firms is likely to be low (about 0.6 percent). For firms in the four main teen-employing industries the estimated impact is somewhat higher (about 1.5 percent), and for high teen employing firms within those industries, the average wage bill impact is estimated to be 4-5 percent. Given these findings, our analysis below focuses on firms in the main teen-employing industries, and the relative response of high-teen employers within those industries.

Table 2: Continuing Firms' Teen-employment share changes

	Base Model (1)	2000/01 Teen emp'ment Share (2)	Long Difference (6-year) (3)
Hi	-0.0001	0.005	-0.027
	(.001)	(.003)	(.007)
lag(teen-emp share)	0.626	0.695	0.498
	(.020)	(.024)	(.029)
Hi * lag(teen-emp share)	-0.048	-0.238	0.001
	(.047)	(.071)	(.041)

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. The variable *Hi* in columns (1) and (3) is an indicator variable for whether the firm's 2000/01 teen-employment share was at least 0.3; and in column (2) this variable is the firm's 2000/01 teen-employment share. 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.

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. 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), the year before changes in youth minimum wage policies and subsequent increases in minimum wage rates took effect.[14]

This analysis focuses on three complementary outcomes: teenage-employment shares among continuing firms – ie those that employed workers in all eight years of the period; the survival rates of firms that employed workers during the first two years; and the teenage employment shares of firms in the final year of continuing versus entering firms.

Continuing firms' teenage-employment share

We first focus on firms' teen-employment share changes after 2000/01, and assume that firm-*i*'s teenage-employment share in year-*t* (λ_{it}) can be adequately expressed by the following regression:

$$\lambda_{it} = \alpha_{0t} + \gamma_1 \lambda_{it-1} + \beta_{1t}.Hi_i + X_i'\delta_{2t} + \alpha_i + u_{it}, \text{ t=2,…,8} \quad (4)$$

where 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), 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 coefficient β_{1t} which captures the effect of being a high initial teen-employing firm on the firm's subsequent teen-employment share. Note that, with the exception of the coefficient on the lagged variable (λ_{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. For parsimony, we restrict the time profile to be linear. To deal with the firm fixed effects, we estimate this model in first-differenced form:

$$\Delta\lambda_{it} = \alpha_0 + \gamma_1\Delta\lambda_{it-1} + \beta_1.Hi_i + \Delta X_i'\delta_2 + \Delta u_{it}, \quad t=3,\ldots,8 \qquad (5)$$

OLS estimates of equation (5) are biased by $\Delta\lambda_{it-1}$ being (negatively) correlated with Δu_{it}. We present instrumental variables estimates of equation (5) using λ_{it-2} as an instrument for $\Delta\lambda_{it-1}$ (λ_{it-2} is a valid instrument conditional on the first order of dynamic process and uncorrelated errors being correct). In addition, if there is random year-to-year variation in firms' teen-employment patterns, the variable Hi_i will be measured with error. For this reason, we also instrument for this variable using its first year analogue (ie a dummy variable for whether the firm's 1999/00 employment share was at least 0.3).[15] Finally, to allow for possibly different teen-share dynamics for high initial teen-employing firms, we include an interaction between the affected dummy variable and the lagged change in teen-employment share ($Hi_i.\Delta\lambda_{it-1}$), and also instrument for this variable using the interaction between the first year high-use dummy and λ_{it-2}.

We treat this specification as the base model, and present the estimation results in column (1) of Table 2. The estimates imply 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.

Table 3: Effects on Firm Survival

	Base model (1)	3-digit ANZSIC (2)	+ Quartic in log(emp'ment) (3)
Hi	-0.060	-0.042	-0.037
	(.011)	(.013)	(.013)
log(emp)	0.071	0.080	...
	(.003)	(.004)	

Note: Robust standard errors are in parentheses. All specifications control for industry effects, and estimated using instrumental variables for the 2000/01 dated estimates of affected firms (and interactions) based on the 1999/2000 dated analogues. Specification (2) we control for detailed (3-digit) industry; column (3) additionally controls for a quartic polynomial in log(employment).

... Not applicable

The specification in column (2) replaces the binary definition of high teen-employing firms with the 2000/01 teen-employment share continuous variable. In this specification we estimate insignificantly positive effects of being a high initial teen employer on subsequent teen employment, and a significantly negative dynamic interaction effect. For example, the estimates imply that for an average main teen-employing industry firm (teen-share = 15.5 percent), the teen-employment share will fall 3.2 percentage points (=0.005-0.238*0.155) in the first year. Furthermore, the teen-employment share of firms with 10 percent higher initial teen-employment shares will fall 2.4 percentage points (=-0.238*0.1) more on average in the first year.

The final specification we estimate is a 'long-difference' regression of the change in firms' teen-employment shares between 2000/01 and 2006/07, using an analogous specification to that in the base model, replacing the lagged teen-employment share with the lagged long-difference. The estimates for this model imply a negative and significant fall (of 2.7 percentage points) in teen-employment by initial high teen employers; and this estimate is almost the same as the raw change of 2.6 percentage points in panel 4 of Table 1.

If the dynamic specification shown in equation (5) 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 (0.498) is significantly smaller than the corresponding coefficient in the main specification

(0.626), pointing to possible mis-specification of the short-run dynamics.

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. 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. The differences between the long-difference and annual dynamic specifications suggest there may still be mis-specification in the model.

Effects on firms' survival

Using a similar approach to the analysis for continuing firms' teenage-employment shares, we next 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

$$Survival_i = \beta_0 + \beta_1.Hi_i + \gamma_1 \log(emp)_i + \sum_j \delta_j.D_{ij} + u_i \quad (6)$$

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.[16]

Table 3 contains results for various specifications of equation (6). 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 (instrumented using the 1999/2000 analogue). This specification estimates that high teen employment firms have a 6 percent lower survival rate over the period than other firms in the main teen-employing industries.

Table 4: Entry Effects on Final year Teen-employment Shares

	Teen-employment shares	
	(1)	**(2)**
Entering firm	0.021	0.019
	(.002)	(.009)
log(emp)	0.010	0.010
	(.001)	(.002)
Entering*log(emp)		0.0004
		(.002)
R-squared	0.231	0.231

Note: Robust standard errors are in parentheses. Estimation based on 2006/07 firm data, and weighted using firm total employment. All specifications control for detailed (3-digit) industry effects.

… Not applicable.

In column (2), we control for detailed (3-digit) industry, and column (3) additionally 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, controlling for detailed industry effects 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.

Effects associated with firm entry

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:

$$\lambda_{iT} = \beta_0 + \beta_1 Entry_i + X_{iT}'\beta + u_{iT}. \quad (7)$$

The results from alternative specifications are presented in Table 4. The first specification includes dummy variables for detailed (3-digit) industries and the logarithm of the firm's employment. The estimates imply the 2006/07 teen-employment share of an entering firm is 2.1 percentage points higher than that of a continuing firm. In column (2), we interact the firm entry dummy and the firm's log(employment). In this specification, entering firms in the main teen-employing industries have about 1.9 percentage point higher teen-employment shares than continuing firms.

The results here suggest that firms that started production during this period employed larger fractions of teenage workers than continuing firms. In the context of rising minimum wage impacts on youth workers, this may seem counter-intuitive in that start-up firms would, if anything, be expected to face lower fixed costs and have greater flexibility than continuing firms to employ 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 adult workers was relatively more constrained for new firms, during this period.

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 minimum wage changes for teenage workers, 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 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, and plausibly increased teenage wages by 5–10 percent relative to adults', the effect on a typical firm 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 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 may be 4-5 percent.

Second, we analysed the changing nature of teen employment within the main teen-employing industries, 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. For continuing firms, we found mixed evidence: over the period as a whole, we estimate that initial high teen-employing firms reduced their teen employment by 2.5–3 percentage points; but based on annual changes, we estimate small and insignificant effects.

Third, we analysed the relationship between teen-employment shares and firm entry and exit over the period. We estimate that firms with initial teen-employment shares greater than 0.3 had 4 percent lower survival rates than other firms in the main teen-employing industries. We also find that firms that entered during the period had about 2 percent higher teen-employment shares than continuing firms in the final year of the period. The latter finding helps reconcile the absence of any apparent adverse teen employment effects across firms in aggregate. However, 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.

Future Research

The findings in this paper 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.

Notes

1. This paper was written while the authors were on secondment to Statistics New Zealand and was funded by the Department of Labour. We thank Sylvia Dixon, Sid Durbin, Andrew McLeod, Simon McLoughlin and Dirk Van Seventer for helpful comments and discussions. Any views expressed are those of the authors, and do not purport to represent those of Statistics NZ, the Department of Labour, or Motu, who take no responsibility for any omissions or errors in the information contained here. 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).

2. We use "teenagers" to refer to 16-19 year olds. 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.

3. We measure employment as a simple unweighted count of number of job months in firms, with no attempt to adjust for part-time versus full-time work or multiple job holding, which likely overstate youth 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.

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

5. Subsequent to these changes, and beyond our 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 16-17 year old workers for their first three months or 200 hours of employment. The abolition of the youth minimum wage resulted in a further substantial increase in the minimum wage for 16-17 year olds: the real increase in minimum wage for teenagers since 1999 is 128 percent.

6. The estimated fractions of workers with reported wages less than the next year's minimum wage include those with wages less than the current minimum wage, due to either exemptions, firm non-compliance, and/or reporting errors by survey respondents. In addition, regardless of a minimum wage increase, some workers in the affected range would receive wage increases that lift their wage above the next minimum wage and thus not be affected. These factors suggest the estimated fraction of workers affected by minimum wages may be overstated. However, the measure should provide a sense of the relative impacts across the age groups over time.

7. This 40 percent is the fraction less than the $9.60 "new entrants wage": the fraction less than the $12 adult minimum wage was about three-quarters.

8. Part of the reason for the stronger wage growth for 16-17 year olds (compared with 18-19 year olds) was firms voluntarily applied adult minimum wages to such workers.

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

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

11. See Kelly (2003) or Maré and Hyslop (2008) for more detailed discussion of the LEED data.

12. 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. 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.

13. 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.

14. 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.

15. 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}.

16. The relative survival rates of firms with 2000/01 teen-employment shares less than and greater than 0.3 was 79 and 80 percent in the main teen-employing industries.

References

Chapple, S. (1997). Do minimum wages have an adverse impact on employment? Evidence from New Zealand. *Labour Market Bulletin*, **2**, 25-50.

Cruickshank, A. A. and Pacheco, G. A. (2007). Minimum Wage Effects on Educational Enrolments in New Zealand. *Economics of Education Review*, **26**, 5, 574-587.

Draca, M., Machin, S. and Van Reenen, J. (2008). Minimum Wages and Firm Profitability. NBER Working Paper, No. 13996.

Hyslop, D. R., Maré, D. C., Stillman, S. and J. Timmins. (2008). An Analysis of Teenage Employment by Firms: 1999/00—2006/07. Statistics New Zealand report, available at http://www.stats.govt.nz/leed/reports/analysis-teenage-employment-by-firms.htm.

Hyslop, D. and Stillman, S. (2007). Youth Minimum Wage Reform and the Labour Market in New Zealand. *Labour Economics*, **14**, 2 (April), 201-230.

Kelly, N. (2003). Prototype Outputs Using Linked Employer-Employee Data. Statistics New Zealand report, available at http://www.stats.govt.nz/domino/external/pasfull/pasfull.nsf/e17092639373f80b4c2567ed0009410e/4c2567ef00247c6acc256dbf0015303f?OpenDocument.

Maloney, T. (1995). Does the adult minimum wage affect employment and unemployment in New Zealand? *New Zealand Economic Papers*, **29**, 1, 1-19.

Maré, D. C. and Hyslop, D. R. (2008). Cyclical Earnngs Variation and the Composition of Employment. Statistics New Zealand LEED research report, available at http://www.stats.govt.nz/leed/reports/cyclical-earnings-variation-and-the-composition-of-employment.htm.

Naiker, V. and Pacheco, G. A. (2006). Impact of the Minimum Wage on Expected Profits. *International Review of Applied Economics*, **20**, 4, 469-490.

Pacheco, G. A. (2007). Changing Role of Minimum Wage in New Zealand. *New Zealand Journal of Employment Relations*, **32**, 3, 2-17.

Seyb, A. (2003). The Longitudinal Business Frame. mimeo, Statistics New Zealand, available from www.stats.govt.nz.

Timmins, J. (2006). Minimum Wage Workers in New Zealand: Who are they? *New Zealand Journal of Employment Relations*, **31**, 2, 66-76.

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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	7.54	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
Change: 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

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