# Estimating the impact of changes in employers' National Insurance Contributions on wages, prices and employment

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*This article explains how changes in payroll taxes might affect real wages and employment. It then estimates the responses of relative wages, prices and employment to the changes in employers' National Insurance Contributions (NICs) that occurred in 1999. The empirical evidence is based on industry-level data and exploits valuable variation in the extent to which these changes in the payroll tax affected different industries.*

## Introduction

In the 2002 Budget the Chancellor announced that the NICs of both employers and employees would rise by 1 percentage point in April 2003. Employers' NICs will rise from 10% to 11% on all workers whose weekly pay exceeds the lower earnings limit (LEL) and employee contributions will rise from 11.8% to 12.8%. Unlike previous rises, the increase in the employee rate of 1 percentage point will be levied not only on earnings between the lower and upper earnings limit (UEL), but also on all pay above the lower threshold.[1] There is considerable uncertainty as to what the impact of these changes will be on wages, prices and employment.

This article explores the impact of changes in employers' NICs from a previous episode. The NICs reforms, in 1999, were designed to be revenue neutral. They also had a neutral effect on the aggregate wage bill. Consequently, their implications for aggregate prices and wages are likely to have been negligible; any resulting movements in wages and prices are likely to have been relative changes. In contrast, the 2003 reforms are designed to raise additional revenue. Because most firms will be affected, firms and workers may be more likely to assume that wages and prices can be increased (at least partially) without affecting relative wages and prices. To that extent, evidence from the 1999 changes may not allow us to draw robust inferences about the likely impacts of the 2003 reforms, particularly for the pass-through onto nominal wages and prices. Nevertheless, the 1999 changes are

informative and may provide insight into the mechanisms that are likely to be at work.

## The wage and employment implications of changes in NICs

What are the effects of changes in NICs? Standard public finance theory tells us that it is irrelevant which side of the market a tax is levied on. The ultimate incidence of a payroll tax depends on the elasticities of the supply of and the demand for labour, not on whether the tax is levied on employees or employers. A simple illustration of the impact of a payroll tax on employment and wages is given in Chart 1. The horizontal axis measures the level of employment whereas the vertical axis measures the real consumption wage. The downward-sloping curve, D0 is the initial demand for labour. The chart shows two possible labour

**Chart 1**
**The supply of and demand for labour with payroll taxes**



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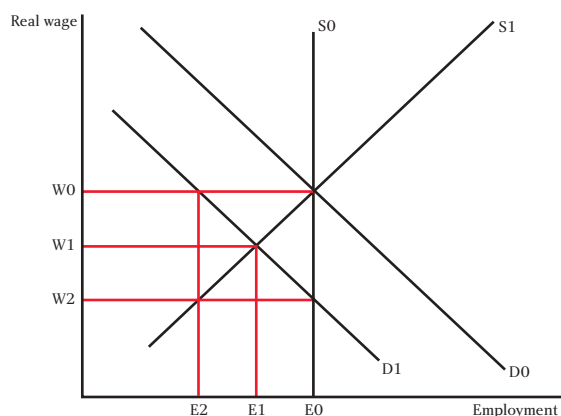
[1] For 2002–03, the LEL is £75 per week and the UEL is £585 per week.

supply curves. S1 is an upward-sloping supply curve implying that more labour is supplied as the real wage rises. In contrast, S0 is a vertical labour supply curve implying that a fixed quantity of labour is supplied irrespective of the real wage.

A payroll tax levied on a firm reduces the demand for labour by raising the after-tax cost of workers. Consequently the demand curve shifts inwards to D1. The resulting impact on real wages and employment depends on the slope of the labour supply curve. If labour supply is inelastic, the real wage falls from W0 to W2, which is equal to the full amount of the tax. In this case employment remains constant and workers bear the full tax burden. In contrast, if supply is somewhat elastic, the real wage only drops from W0 to W1 and employment now falls from E0 to E1. In this case the impact of the tax is shared between workers and firms.

So far we have only considered long-run outcomes. In the short run, it is possible that workers will resist attempts by firms to shift the tax onto them ('real wage resistance'). Suppose workers are initially successful at resisting any reduction in the real wage. While the wage remains at W0, firms will still want employment determined by the new labour demand curve, D1. Hence employment falls to E2. The accompanying rise in unemployment puts downward pressure on real wages, which eventually absorb the full tax rise, and both unemployment and employment move back to their long-run levels.[1]

There has been a sizable body of empirical research into the employment and wage effects of payroll taxes. This literature is summarised by Nickell and Layard (1999). One problem the studies face is that it is very difficult to isolate the causal effect of tax changes on wages and employment because other factors are changing at the same time. Nonetheless, the findings suggest that, in the long run, wages absorb the changes in payroll taxes. Nickell and Layard (1999) conclude that there may be small long-run effects on employment but they emphasise that the results are fragile.

The response of real wages to payroll tax changes can in principle be broken down into nominal wage changes and price changes. Suppose a 1 percentage point increase in payroll taxes is entirely borne by workers, so real wage growth falls by 1 percentage point. This could be achieved by a 1 percentage point drop in nominal wage growth or by a 1 percentage point rise in price increases—or any combination in between. The extent to which nominal wages or prices are used to achieve a given real wage adjustment will depend upon the relative extent of nominal rigidities in wages and prices, worker bargaining power, and the competitive pressures facing the firm.[2] Whereas previous empirical work has explored the effect of changes in payroll taxes in the context of models of nominal wages and prices, these models have generally ignored the relative movements between the two. Moreover, this research has been based on time-series models which are unlikely to provide robust estimates.[3]

## The 1999 NIC changes

This article intends to exploit a previous change in employers' NICs to estimate the response of employment, nominal wages and prices to payroll tax changes. The changes to employers' NICs in 1999 were the most recent reforms of the tax. They were also the first reform of National Insurance since the Bank of England was given operational independence for setting interest rates, which may be relevant to the extent that employer responses to the tax changes depend on how the monetary authority is expected to behave. The main adjustments, which were revenue neutral, were:

● the replacement of a stepped payment schedule (with rates of 3%, 5%, 7% and 10%) with a single contribution rate of 12.2%;

● payments to be levied on employee earnings above the lower earnings limit (LEL), rather than on all earnings, provided the employee earned above the LEL; and

● the effective LEL was raised from £64 per week to £81 per week.[4]

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(1) Although this discussion considers employment in heads, it may also be instructive to think of employment in hours. If firms find it easier to adjust work hours rather than heads then it is possible that hours might be more sensitive to payroll tax changes. This issue is explored in the empirical analysis.

(2) For example, firms in the traded goods sector are more likely to face constraints on their ability to raise prices than those in the non-traded goods sector.

(3) Poterba, Rotemberg and Summers (1986) use the responsiveness of nominal wages and prices to changes in the tax structure as a way of testing for nominal rigidities.

(4) The effective LEL and the actual LEL differ because the first part of earnings above the actual LEL is subject to NICs at a zero rate. In practice this simply moves the effective LEL to a higher starting point.

These reforms were aimed at reducing the cost of employing low-paid workers. During his 1998 Budget speech, the Chancellor argued that 'with these changes, we are cutting the costs to business of employing 13 million of our lower-paid employees'. It was expected that raising the level at which employers would pay no payroll tax on employees to £81 per week would be a particular spur to low-wage job creation, supported by the elimination of payments on the first £81 for higher-paid workers. However, these impacts would have been countered to some extent by the replacement of the stepped payment schedule with a single rate of 12.2%.

## Method and data

This article's approach to estimating the effects of NIC changes on wages, prices and employment broadly follows that of Gruber (1997), who examined the effect of a change in payroll taxes in Chile that reduced the average tax rate from 30% to 5% over a six-year period. Gruber's study used data on a sample of manufacturing plants which allowed him to create payroll tax rates for each firm by dividing total tax payments by wages. He then modelled the change in wages and employment at a given plant following the policy change as a function of the change in the average tax rate for the plant. The findings indicated that payroll taxes affected real consumption wages, with little impact on employment. Unlike Gruber's approach, the analysis here is based upon industry-level data rather than data at plant level, but otherwise the method is the same.

The following regression for industry $i$ at time $t$ is estimated:

$$\Delta y_{it} = \alpha + \beta \Delta NIC_{it} + \varepsilon_{it} \qquad (1)$$

where $\Delta y_{it}$ is the percentage change in the dependent variable (eg average industry employment, average industry wage, and average industry price), $\Delta NIC_{it}$ is the corresponding percentage point change in the NICs share of total wages and salaries and $\varepsilon_{it}$ is an error term. The key idea is that the share of workers whose weekly pay lies below the NIC threshold varies considerably across industries. This variation can be used to identify the movements of wages, prices, and employment following a change in employers' NICs (see the box on page 387).

In estimating equation (1), data from the Annual Business Inquiry (ABI) are used. The ABI is an annual survey that covers around 70,000 UK businesses that are registered for Value Added Tax (VAT) and/or Pay as You Earn (PAYE). In its current form, the ABI has been running since 1998 and covers around 85% of all businesses. Survey variables include turnover, employment (full-time and part-time), labour costs, wages and salaries, and social security contributions. Social security contributions can be split into employer NICs and other costs (mainly contributions to pension schemes). Hence by dividing NIC payments by total wages and salaries, industry-level estimates of the incidence of payroll taxes can be obtained. For the manufacturing sector only, the ABI data can be supplemented with producer price indices obtained from Business Monitor. These are matched at the 2, 3 and the 4-digit level, giving around 200 industries with both price and wage data. To assess the impact of NICs changes on working time, matched data on average working hours across industries are used from the 1998–2000 waves of the New Earnings Survey (NES).

The incidence of NICs differs across industries due to variations in the proportion of workers who are below the LEL. Chart 2 shows the 1998 frequency distribution of NICs incidence as a percentage of the paybill across the 579 industries for which information is available. Those industries in the lower tail of the distribution tend to be those with a relatively high share of part-time workers, such as retail stores, hotels and restaurants. Industries in the upper tail are far more heterogeneous, and include manufacturing sectors with very few part-timers, and professional services such as finance.

**Chart 2**
**NICs incidence across industries in 1998 (pre-1999 reforms)**



Frequency (in per cent)

NICs incidence (as a percentage of wages and salaries)
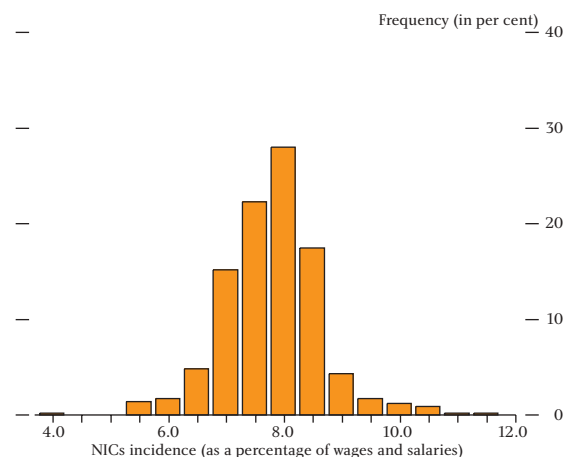
## The difference-in-difference method

Since economics is not a natural science, we are unable to conduct controlled random experiments in order to estimate the impact of policy changes on variables of interest. If payroll tax rates could be randomly distributed across the population, it would be easy to identify the effect on wages and employment, by simply comparing the outcomes for those with different tax rates. As an alternative, the natural experiment approach considers the policy reform itself as an experiment and tries to find a control group that has little or no exposure to the reform. The method, of which the equation in the text is an example, is often called 'difference in differences', as it is estimated by comparing the difference in average behaviour before and after the reform for the eligible group with that for the control group (see Blundell and Costa-Dias (2000)).

Under certain assumptions, this method measures the average effect of the policy reform on those exposed to it. It does so by removing unobservable individual effects and common macro effects. It relies, however, on two crucial assumptions regarding these effects. These are: (i) macro effects are common across groups; and (ii) unobserved temporary individual-specific components are absent. The first assumption requires a macro shock to have similar impacts on both the treatment and control groups.[1] The second assumption requires that, at the time of the policy reform, there are no other events occuring that have different impacts on the treatment and the control groups. The strength of the approach is that it does not require any of the exclusion restrictions commonly adopted when estimating the impact of a policy reform, nor does it require assumptions on the exact data-generating process.

(1) A solution to this problem was proposed by Bell, Blundell and Van Reenen (1999), which requires a differential adjustment of the treatment and control group using a previous macro event.

Chart 3 shows the frequency distribution of the percentage point change in NICs incidence following the 1999 reforms. On average, there was no change in NIC payments as a proportion of wages and salaries, reflecting the fact that the reforms were revenue neutral. But the actual changes ranged from a decline of around 4 percentage points to a rise of 5 points in the NICs share. Around 33% of all industries experienced no change whatsoever.

**Chart 3**
**1998–99 change in NICs incidence**
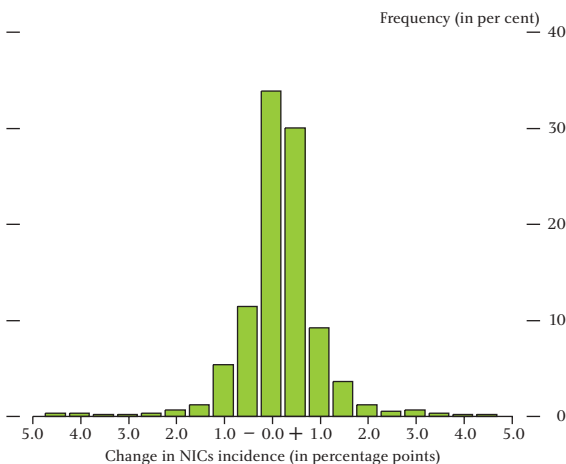


In the wage (price) regressions, the dependent variable in equation **(1)** is the growth rate of the average industry wages (prices) over 1998–99. Employment averages for these years are unavailable, so we use the growth rate of industry employment between December 1998 and December 1999. The ABI employment figures are rounded to the nearest thousand. Consequently, there is considerable scope for measurement error when constructing the employment growth rates. For example, if an industry employed 4,499 workers in December 1998 this would be reported as 4,000. If employment increased to 4,501 in 1999 this would be reported as 5,000, implying employment growth of 25% which would be incorrect. Since the nominal and real wage data are calculated on a per head basis, these would also be contaminated by the same measurement error. To avoid this measurement error, those observations where employment changed by more than ±5% are excluded. Those observations where nominal wages fell by more than 10% or rose by more than 20% are also excluded (Nickell and Quintini (2001)). A similar restriction was imposed in the real wage regressions. Other exclusions did not appreciably affect the results. Charts 4–6 show the distribution of employment, nominal wage and producer price growth between 1998 and 1999.

## Chart 4
## Distribution of 1998–99 employment growth

Frequency (in per cent)
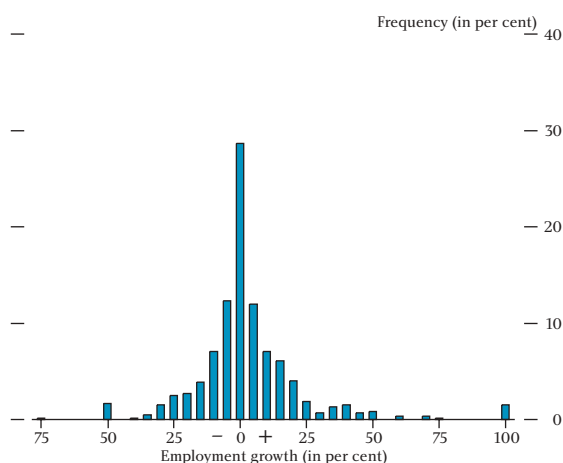
Note: There are three observations where the change in employment exceeds 100%.
These are not shown in the histogram.

## Chart 5
## Distribution of 1998–99 nominal wage growth

Frequency (in per cent)
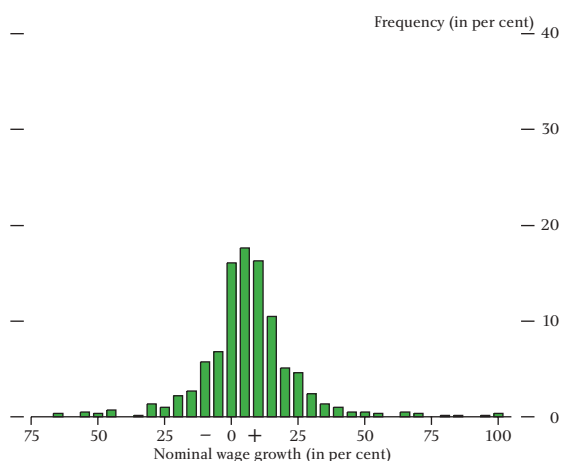
Note: There is one observation where the change in nominal wage exceeds 100%.
This is not shown in the histogram.

## Chart 6
## Distribution of 1998–99 producer price increases

Frequency (in per cent)
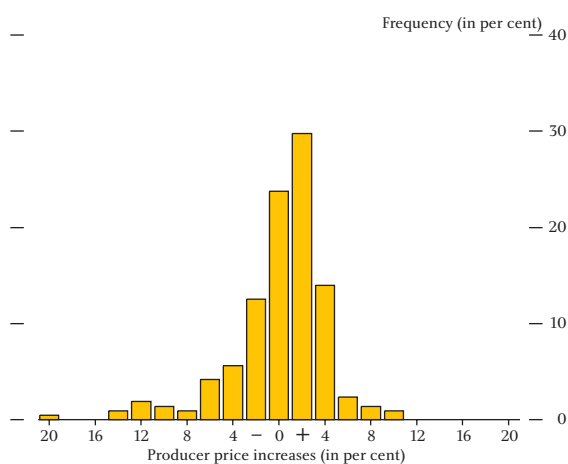
## Results

Table A provides a summary of the main regression results. All the point estimates shown can be interpreted as the percentage point impact of a 1 percentage point change in the share of NICs in total labour costs on the dependent variable in question.

### Table A
### Impact of change in NICs' labour cost share

|  | Impact | Standard error | Sample size |
|---|---|---|---|
| Nominal wage growth | -1.44 | 0.62 | 405 |
| Producer price increases | 1.28 | 0.60 | 209 |
| Real producer wage growth | -1.07 | 1.55 | 156 |
| Employment growth | 0.46 | 0.31 | 222 |
| Average hours | -0.26 | 0.09 | 213 |

The relative wage and price effects of the NICs change are shown in the first and second rows respectively. Both wage and price effects are statistically significant. A 1 percentage point rise in the NICs share is predicted to reduce nominal pay growth by around 1.4 percentage points after a year, while producer prices in the manufacturing sector rise by around 1.3 percentage points.[1]

For the manufacturing sector, the impact on real producer wages can be estimated. The third row shows that real wage growth in manufacturing declines by 1.1 percentage points. While the hypothesis that the tax rise is fully passed on to real wages cannot be rejected, it should be noted that the estimate is very imprecise. Consequently this result is best interpreted as supporting the evidence from the first two rows in Table A that both nominal wages and prices move in the direction of reducing real wages.[2]

The fourth row indicates that, across a range of sectors, a 1 percentage point rise in the NICs share leads to a rise in employment growth of 0.5 percentage points, but the effect is statistically insignificant. There are several possible explanations for the lack of evidence of a decline in employment. If employment reacts quickly to shifts in the structure of labour costs, then the results may be picking up the long-run adjustment of employment back to its initial level. Although it is impossible to test the validity of this hypothesis, some support for full real wage adjustment comes from the evidence (discussed above) suggesting that the full

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(1) Results using NES data on nominal wages per hour to examine the impact of NICs changes on nominal pay growth were similar.
(2) The observant reader will note that the estimated impact on the real wage is not equal to the estimated effect on nominal wages minus the estimated effect on producer prices. This is because the estimated nominal wage response is for all industries, while the effect on producer prices and real wages is for the manufacturing sector only. There is no way of knowing whether non-manufacturing prices behaved in the same way.

pass-through of the tax to lower real wages occurs within a year.

Alternatively, it is possible that employment in hours, rather than heads, bears most of the adjustment. This idea was examined with matched data on average employee working hours from the NES. The final row of Table A indicates that a rise in NICs exposure is associated with a statistically significant decline in industry working time. The results therefore suggest that the rise in employer NICs does not reduce the level of employment but does appear to put downward pressure on employment in hours, possibly by encouraging employers to increase the share of part-timers in the workforce.[1]

## Summary

In the 2002 Budget it was announced that the NIC rate for both employers and employees would rise by 1 percentage point in April 2003. Although such changes might be expected to put downward pressure on both real wages and employment, the precise split between the two is an empirical matter. It is perfectly possible for employment to remain unchanged, with the entire burden of the tax reflected in reduced real wages.

This paper uses industry-level data from the Annual Business Inquiry for 1998 and 1999 to assess the employment, wage and price impacts of the revenue-neutral 1999 reforms of employers' NICs. Although there is no evidence of a significant impact on heads employment, average working hours across industries did appear to decline. This may reflect the fact that working time responds more rapidly to changes in labour costs than heads employment.

However, the effect on hours is quite small and coupled with the evidence that real wages in the manufacturing sector adjust to absorb the tax change, this suggests that real wages respond more than employment in heads and hours to payroll tax changes. One novel feature of the research is that it allows identification of the roles of relative wages and prices in any real wage response. It emerged that real wage adjustment occurred through both reduced nominal wages and higher prices.

To what extent are these findings for the 1999 reforms informative about the likely impacts of the prospective 2003 changes in employers' NICs? Any comparison between the episodes must be tentative for several reasons. In particular, there are important distinctions between the 1999 and 2003 reforms, which mean that the responses of wages, prices and employment are likely to differ. Though the 1999 reforms had a neutral impact on the aggregate wage bill, the 2003 reforms are likely to increase the total wage bill.

The response to the 2003 NIC changes will also depend on the monetary regime and the credibility of monetary policy: inflation is, after all, ultimately a monetary phenomenon. Workers and firms will expect the MPC to continue to aim to hit the inflation target and to adjust interest rates as it judges necessary to do so. In such an environment, it would be difficult for firms to achieve a fall in real wages simply by adjusting their prices. So even NIC changes before 1999 that have increased the total wage bill might not be wholly instructive. More of the adjustment from the 2003 changes might occur through nominal wages than might previously have been the case.

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(1) Around 92% of all employees earning less than the 1999 effective LEL were part-timers.

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