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35 years of reforms: a panel analysis of the incidence of, and employee and employer responses to, social security contributions in the UK

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Paper summary

- Examine hours and earnings responses to changes in employee and employer SSCs in UK

  - Using data from 1978 – 2010 and panel estimation

  - Reforms affecting employee and employer SSCs differently

- Contributions of this paper

  - Careful consideration of behavioural response and incidence

  - More consistent approach to examining immediate and slightly longer run effects

  - Add to limited work on SSCs and in UK

- Key findings:

  - Moderate compensated hours responses to employee SSCs

  - Moderate income effects on hours of work

  - Economic incidence follows statutory incidence, with little shifting (in either direction) after 12-18 months

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Coming up

- Background and related literature

- UK policy context

- Data

- Conceptual framework

- Econometric methodology

- Results

- Summary and future directions

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Behavioural response and incidence intertwined
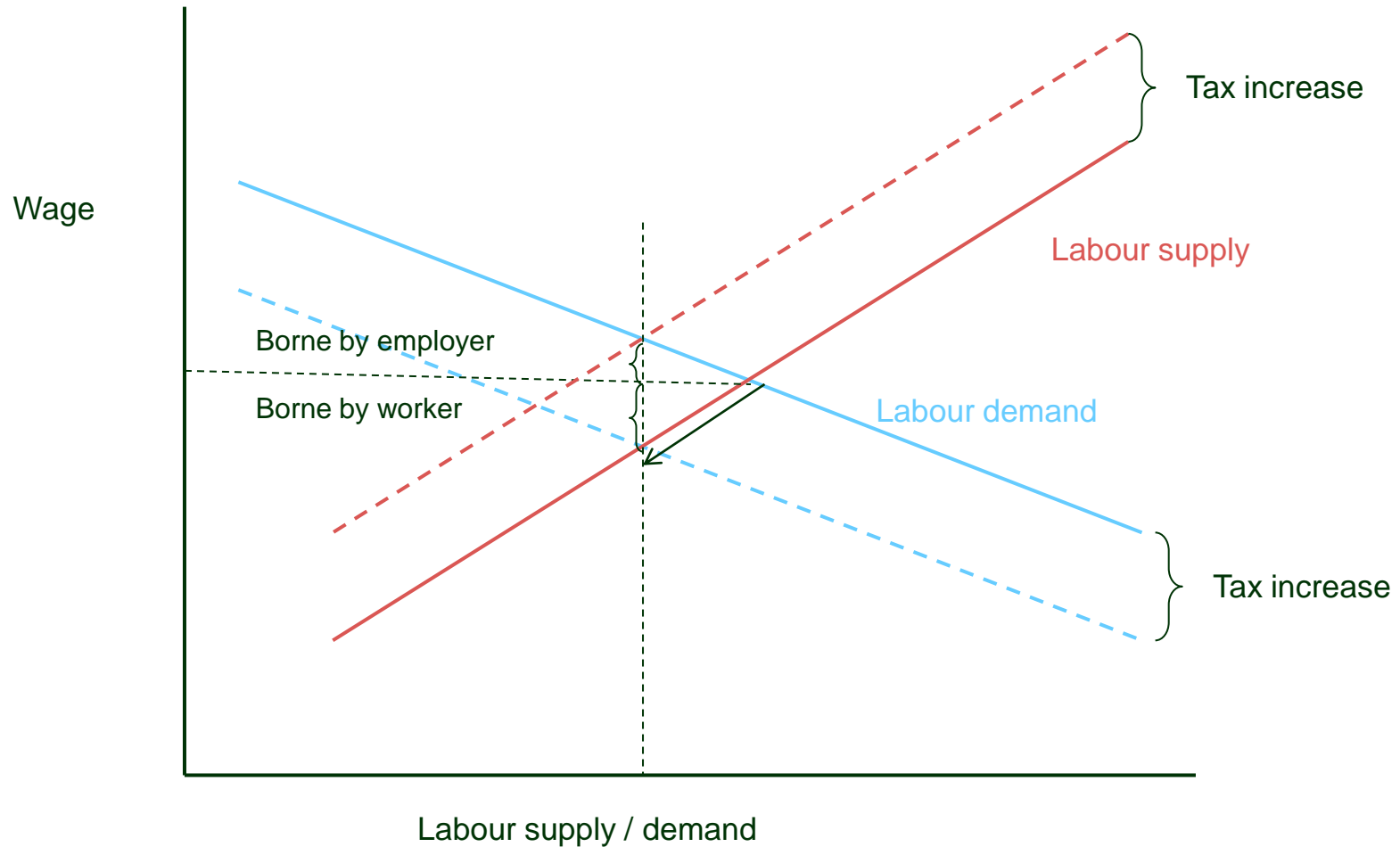
'New Tax Responsiveness' literature

- Implicit assumption of full incidence on workers
  - Reflect focus of NTR literature on income tax rather than SSCs?

- The incidence of a tax not affect its efficiency cost
  - But affects distributional, and potentially revenue, effects
  - Can also affect empirical estimation or interpretation

- E.g. increase in average income tax or employee SSCs rate is associated with an increase in earnings
  - Is that a standard income effect?
  - Or is that shifting of the tax on to employers?

- Some studies rule out income effects and exclude changes in average tax rates (or virtual income) from regressions
  - Also need to assume incidence on workers for this to be valid

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Tax incidence literature

- Focuses more on SSCs than NTR literature

  - Employment/hours as measure of behavioural response

  - Earnings/wages as incidence

- Lack of consensus on incidence:

  - Some studies (Gruber, 1997) find evidence of incidence on worker

  - Others find incidence at least partly on 'employer' (Kubic, 2004, Saez et al, 2012)

- Surprisingly few studies examine whether statutory splitting of incidence of SSCs between employees and employers matters

  - Sticky wages may mean it matters in short run?

  - But supply and demand mean not over longer term?

This paper's contribution

- Examines behavioural responses to and incidence of UK's SSCs: National Insurance contributions (NICs)

  - Set out assumptions required to interpret effects on earnings, hours and hourly earnings as behaviour or incidence

- Separately analyse effects of employee and employer NICs

- Examine very short term (0 – 6 month) and slightly longer term (12 – 18 month) effects

 - Use of lagged changes in NICs rates to examine longer run effects

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The UK's NICs system

- NICs paid by both employers and employees
  - Function of employees gross earnings (including employee but not employer pension contributions)
  - Limited and weakening link between contributions and benefits

- Big changes to rate structure during study period (1978 to 2010)

# Changing structure of NICs, April 2012 prices
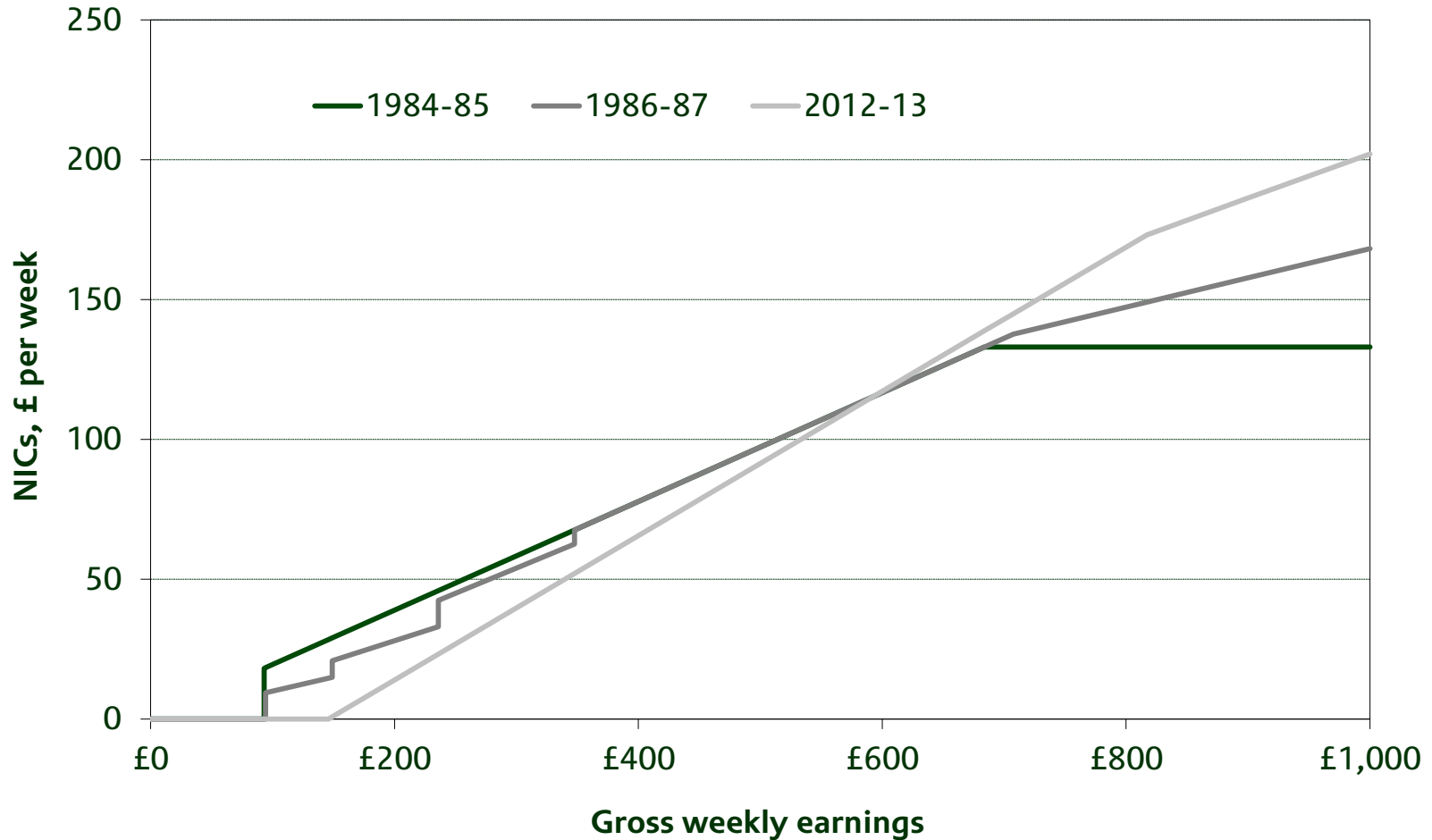
The UK's NICs system

- NICs paid by both employers and employees

  – Function of employees gross earnings (including employee but not employer pension contributions; including some benefits-in-kind)

  – Limited and weakening link between contributions and benefits

- Big changes to rate structure during study period (1978 to 2010)

  – Major reforms in 1985, 1989 and 1999, reforming and then removing a series of 'notches' in NICs liabilities

- These and other reforms affect average and marginal rates differently; and affect employee and employer NICs differently

  – Allow us to estimate effect of each tax rate on earnings, hours, etc.

Making use of 32 years of reforms

- Adopt a panel making use of all 32 years because no single reform allows us to identify effect of each of these parameters

- And 'mean reversion' of earnings, etc, particularly problematic when analysing these individual reforms
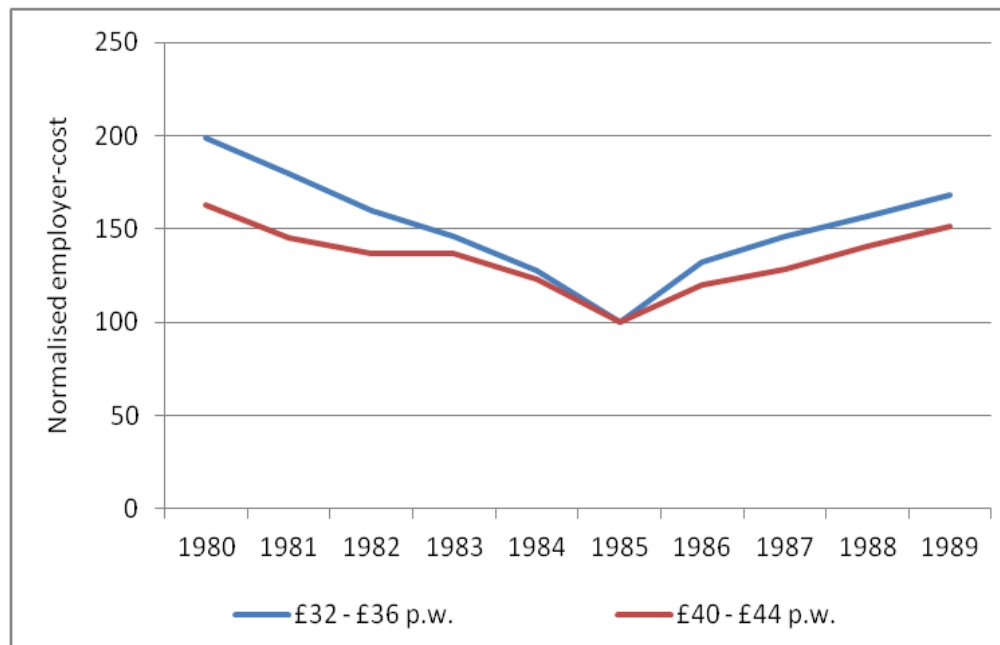
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Data: the NESPD (I)

- New Earnings Survey Panel Dataset (NESPD)
  - Compulsory survey of employers payroll records
  - Report on earnings & hours of employees with NI no. ending in '14'
  - In principle random 1% sample, but achieves circa 0.7%

- Non-random non-response could mean estimated effects not representative of overall labour market
  - But better than other available data in UK

- Further restrict our estimation sample
  - Panel method, use of lags and instrumenting means need to be in NESPD for 3 – 5 consecutive years
  - Drop those around lowest NICs threshold – significant bunching
  - Final sample: 33-40% of overall sample (around 1.5–2 million in total)

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Data: the NESPD (II)

- Calculate NICs rates based on reported earnings and rate structure
  - Very good (but not perfect) measure of NICable earnings

- Do not observe which employees paying lower 'married women's rate' (available to those who started claiming it before 1977), or lower rate for those 'contracting out' from part of state pension
  - Ignore both and apply standard NICs rates
  - Reforms we use for identification affect 'contracting out' the same

- Survey is conducted in April, typically just after NICs reforms
  - But major reforms in 1985 and 1989 in October, and reforms announced at least a few months prior to implementation

- Immediate incidence likely to be close to statutory incidence
  - Examine incidence (and behaviour) in subsequent year, 12 – 18 months after reform

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Conceptual framework: employer cost (I)

- Build on work of Lehmann et al (2013), who show that earnings responses to changes in tax/NICs rates satisfy:

$$\frac{\Delta Z}{Z} = \beta_{Z,\tau}^{R} \frac{\Delta \tau^{R}}{\tau^{R}} + \beta_{Z,\tau}^{E} \frac{\Delta \tau^{E}}{\tau^{RE}} + \beta_{Z,\rho}^{R} \frac{\Delta \rho^{R}|}{\rho^{R}} + \beta_{Z,\tau}^{E} \frac{\Delta \rho^{E}|}{\rho^{E}}$$

Z = employer cost (gross earnings + employer NICs)

τ^{E} and τ^{R} are employee and employer net-of-marginal NICs rates; ρ^{E} and ρ^{R} are employee and employer net-of-average NICs rates

$\beta_{Z,\tau}^{R}$ and $\beta_{Z,\tau}^{E}$ are compensated elasticities of employer cost wrt NICs

- Note that changes in net-of-average NICs rates ($\Delta \rho$I) are calculated holding earnings fixed at pre-reform levels
    - Lehmann (2013) provides a proof showing using standard net-of-average NICs rates ($\Delta \rho$) is inconsistent with underlying behaviour

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Conceptual framework: employer cost (II)

- Usually coefficients on net-of-average NICs rates (e.g. $\beta^R_{Z,P}$) are interpreted as income effects. But also pick up incidence.

- e.g. Employer cost increase when employee NICs increase
  - Income effect?
  - Or shifting of burden on to employers?

- Additional assumptions required & paper uses two approaches
  - Using data on employer cost only
  - Also making use of data on hours of work

- If making use of data on employer cost only, then
  - Assume income effects (e.g. 0) ➔ estimate incidence
  - Assume incidence (e.g. on employees) ➔ estimate income effects

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Conceptual framework: employer cost (III)

Table 2. Coefficient values under various assumptions about incidence and income effects, employer cost

		Net-of-marginal rate coefs.		Net-of-average rate coefs.	
		$\beta_{Z,\tau}^{R}$	$\beta_{Z,\tau}^{E}$	$\beta_{Z,\rho}^{R}$	$\beta_{Z,\rho}^{E}$
(1)	Full incidence on employee[a]	≥ 0	≥ 0	≤ 0	≤ 0
Assuming away income effects:					
(2)	Sharing of incidence[b]	≥ 0	≥ 0	$-1 < \beta < 0$	$-1 < \beta < 0$
(3)	Full incidence on employer[c]	≥ 0	≥ 0	-1	-1
(4)	Statutory incidence[d]	≥ 0	≥ 0	-1	0

Notes: (a) In standard models, furthermore $\beta_{Z,\tau}^{R} = \beta_{Z,\tau}^{E}$ and $\beta_{Z,\rho}^{R} = \beta_{Z,\rho}^{E}$.

(b) In standard models, furthermore $\beta_{Z,\tau}^{R} = \beta_{Z,\tau}^{E}$ and $\beta_{Z,\rho}^{R} = \beta_{Z,\rho}^{E}$.

(c) Unless labour supply was fully elastic, full incidence on employers requires $\beta_{Z,\tau}^{R} = \beta_{Z,\tau}^{E} = 0$.

(d) Statutory incidence requires models with at least temporary gross wage stickiness.

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Conceptual framework: hours and hourly cost (I)

- If make use of data on hours, can estimate effect of NICs on hours and hourly employer cost

- Hours pick up standard substitution and income effects

- If assume away income effects operating via non-hours margins of labour supply like effort, then response of hourly employer cost to changes in net-of-average NICs rates picks up incidence

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Conceptual framework: hourly cost (II)

Table 4. Coefficient values under various assumptions about incidence and income effects, hourly employer cost

	Net-of-marginal rate coefs.		Net-of-average rate coefs.	
	$\beta^R_{Z,\tau}$	$\beta^E_{Z,\tau}$	$\beta^R_{Z,\rho}$	$\beta^E_{Z,\rho}$
With				
(1) Full incidence on employee[a]	≥ 0	≥ 0	≤ 0	≤ 0
Assuming away income effects:				
(2) Sharing of incidence[b]	≥ 0	≥ 0	$-1<\beta<0$	$-1<\beta<0$
(3) Full incidence on employer[c]	≥ 0	≥ 0	-1	-1
(4) Statutory incidence[d]	≥ 0	≥ 0	-1	0
Also assuming away substitution effects:				
(5) Sharing of incidence[b]	0	0	$-1<\beta<0$	$-1<\beta<0$
(6) Full incidence on employer[c]	0	0	-1	-1
(7) Statutory incidence[d]	0	0	-1	0

Notes: (a) In standard models, furthermore $\beta^R_{Z/H,\tau} = \beta^E_{Z/H,\tau}$ and $\beta^R_{Z/H,\rho} = \beta^E_{Z/H,\rho}$.

(b) In standard models, furthermore $\beta^R_{/HZ,\tau} = \beta^E_{Z/H,\tau}$ and $\beta^R_{Z/H,\rho} = \beta^E_{Z/H,\rho}$.

(c) Unless labour supply was fully elastic, full incidence on employers requires $\beta^R_{Z/H,\tau} = \beta^E_{Z/H,\tau} = 0$.

(d) Statutory incidence requires models with at least temporary gross wage stickiness.

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Empirical specification (I)

$$\Delta lnZ_{i,t} = \alpha_Z + \beta_{Z,\tau}^R \Delta ln\tau_{i,t}^R + \beta_{Z,\tau}^E \Delta ln\tau_{i,t}^E + \beta_{Z,\rho}^R \Delta ln\rho_{i,t}^R| + \beta_{Z,\rho}^E \Delta ln\rho_{i,t}^E| + +\gamma_Z X_{i,t} + \varepsilon_{i,t,Z}$$

- Endogeneity problems to be addressed

    – Change in tax rate ➔ change in earnings ➔ change in tax rates

    – Mean reversion and secular trends

- Standard approach in NTR literature is to instrument for, e.g., $\Delta\tau$ using $\Delta\tau|Z_{t-1}$ and then including functions of Z_{t-1} to control for mean reversion and secular trends

    – Critiqued by Caroline Weber (2014)

    – Shows inclusion of such controls cannot properly control for mean reversion and estimates obtained typically very sensitive to specification of controls

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Empirical specification (II)

- Weber (2014) suggests using instruments based on holding earnings fixed at levels in earlier periods (t-1-k)

  - And suggests testing for their 'exogeneity' by difference-in-Sargan test (under assumption instruments based on even earlier earnings, e.g. t-1-k-1, are exogenous)

  - Control for secular trends using functions of Z_{t-1-k}

- We test 'exogeneity' of instruments based on t-2 earnings and find they are exogenous if t-3 and t-4 are exogenous

  - Control for secular trends using (different) functions of Z_{t-2}

  - Also include year dummies to pick up aggregate shocks, inflation

- Instruments based on t-3 used as sensitivity check

  - Main results hold

Lagged NICs changes to examine year-2 effects

- To pick up year-2 effects, include lagged changes in NICs rates

$$\Delta ln Z_{i,t} = \alpha_Z + \sum_{n=0}^{1} (\beta_{Z,\tau}^{R,n} \Delta ln\tau_{i,t-n}^{R} + \beta_{Z,\tau}^{E,n} \Delta ln\tau_{i,t-n}^{E} + \beta_{Z,\rho}^{R,n} \Delta ln\rho_{i,t-n}^{R}| + \beta_{Z,\rho}^{E,n} \Delta ln\rho_{i,t-n}^{E}|) + \gamma_Z X_{i,t}$$
$$+ \varepsilon_{i,t,Z}$$

- Add up coefficients: e.g. $\beta_{Z,\tau}^{R,0} + \beta_{Z,\tau}^{R,1}$

- Examine whether incidence and behavioural effects change over time – e.g. equalisation of effects of employer and employee NICs

- Varying duration of difference. eg. $\Delta ln Z_{i,t} = ln Z_{i,t} - ln Z_{i,t-3}$ does not properly capture difference between short and longer term effects

   - e.g. if tax changes in period t-3, t-2 and t-1, ΔZ will pick up a combination of all effects, but attribute all to overall tax change between period t-3 and period t

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Results: employer cost regressions

	$\Delta lnZ_{i,t}$		
	Cubic	Quintic	Spline
$\beta_{X,\tau}^{E,0}$	0.270*	0.278*	0.299*
	(0.1399)	(0.1399)	(0.1380)
$\beta_{X,\tau}^{E,1}$ (Lag)	-0.060	-0.058	-0.022
	(0.1056)	(0.1048)	(0.1065)
No. of Observations		1,777,732	

- Moderately-sized comp. elasticity for employee NICs

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	(0.1056)	(0.1048)	(0.1065)
$\beta_{X,\tau}^{R,0}$	-0.006	-0.015	-0.009
	(0.0753)	(0.0755)	(0.0739)
$\beta_{X,\tau}^{R,1}$ (Lag)	0.025	0.008	0.033
	(0.0791)	(0.0787)	(0.0807)
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	(0.0791)	(0.0787)	(0.0807)
$\beta_{X,\rho}^{E,0}$	0.010	-0.003	-0.04
	(0.2367)	(0.2369)	(0.2324)
$\beta_{X,\rho}^{E,1}$ (Lag)	-0.132	-0.120	-0.168
	(0.1642)	(0.1636)	(0.1675)
No. of Observations		1,777,732	

- Moderately-sized comp. elasticity for employee NICs

- Zero comp. elasticity for employer NICs

- Coefficients on net-of-av employee NICs rate consistent with zero or low income effects and incidence on workers

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	(0.1642)	(0.1636)	(0.1675)
$\beta_{X,\rho}^{R,0}$	-1.304*†	-1.304*†	-1.334*†
	(0.1408)	(0.1409)	(0.1465)
$\beta_{X,\rho}^{R,1}$ (Lag)	-0.222	-0.212	-0.275
	(0.1546)	(0.1536)	(0.1598)
No. of Observations		1,777,732	

- Moderately-sized comp. elasticity for employee NICs

- Zero comp. elasticity for employer NICs

- Coefficients on net-of-av employee NICs rate consistent with zero or low income effects and incidence on workers

- Coefficients on net-of-av employer rate consistent with income effects and incidence on employer

- Lagged terms insignificant: little evidence of changes between year 1 and 2

Results: hours regressions

	$\Delta ln H_{i,t}$		
	Cubic	Quintic	Spline
$\beta_{X,\tau}^{E,0}$	0.201*	0.209*	0.227*
	(0.0995)	(0.0995)	(0.0982)
$\beta_{X,\tau}^{E,1}$ (Lag)	0.096	0.101	0.105
	(0.0762)	(0.0756)	(0.0768)
$\beta_{X,\tau}^{R,0}$	-0.083	-0.092	-0.073
	(0.0546)	(0.0548)	(0.0535)
$\beta_{X,\tau}^{R,1}$ (Lag)	-0.118	-0.107	-0.156
	(0.0603)	(0.0599)	(0.0616)
$\beta_{X,\rho}^{E,0}$	-0.185	-0.197	-0.235
	(0.1645)	(0.1647)	(0.1609)
$\beta_{X,\rho}^{E,1}$ (Lag)	-0.118	-0.107	-0.156
	(0.1130)	(0.1124)	(0.1157)
$\beta_{X,\rho}^{R,0}$	-0.173	-0.176	-0.219*
	(0.0922)	(0.0920)	(0.0953)
$\beta_{X,\rho}^{R,1}$ (Lag)	-0.139	-0.135	-0.175
	(0.1088)	(0.1077)	(0.1129)
No. of Observations		1,697,556	

- Moderately-sized comp. elasticity for employee NICs

- Zero or slightly negative comp. elasticity for employer NICs

- Moderate sized income effects

- Lagged terms insignificant: little evidence of changes between year 1 and 2

- But year 2 effects reinforce year 1 effects, making them more significant

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- Moderately-sized comp. elasticity for employee NICs
- Zero or slightly negative comp. elasticity for employer NICs
- Moderate sized income effects
- Lagged terms insignificant: little evidence of changes between year 1 and 2
- But year 2 effects reinforce year 1 effects, making them more significant

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Results: hourly employer cost regressions

	$\Delta ln(Z/H)_{i,t}$		
	Cubic	Quintic	Spline
$\beta_{X,\tau}^{E,0}$	0.140	0.142	0.136
	(0.0999)	(0.0999)	(0.0987)
$\beta_{X,\tau}^{E,1}$ (Lag)	-0.193*	-0.186*	-0.172*
	(0.0735)	(0.0730)	(0.0742)
$\beta_{X,\tau}^{R,0}$	0.020	0.020	0.004
	(0.0484)	(0.0486)	(0.0475)
$\beta_{X,\tau}^{R,1}$ (Lag)	0.028	0.027	0.015
	(0.0531)	(0.0528)	(0.0541)
$\beta_{X,\rho}^{E,0}$	0.201	0.194	0.219
	(0.1598)	(0.1601)	(0.1570)
$\beta_{X,\rho}^{E,1}$ (Lag)	0.055	0.053	0.074
	(0.1142)	(0.1138)	(0.1165)
$\beta_{X,\rho}^{R,0}$	-0.986*	-1.000*	-0.951*
	(0.0981)	(0.0981)	(0.1009)
$\beta_{X,\rho}^{R,1}$ (Lag)	0.098	0.087	0.101
	(0.1080)	(0.1074)	(0.1114)
No. of Observations	1,697,556		

- Coefficient ~ -1 for net-of-average employer NICs

- Coefficient ~ 0 for net-of-average employee NICs

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$\beta_{X,\tau}^{E,0}$	0.140	0.142	0.136
	(0.0999)	(0.0999)	(0.0987)
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	(0.0735)	(0.0730)	(0.0742)
$\beta_{X,\tau}^{R,0}$	0.020	0.020	0.004
	(0.0484)	(0.0486)	(0.0475)
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	(0.0531)	(0.0528)	(0.0541)
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	(0.1598)	(0.1601)	(0.1570)
$\beta_{X,\rho}^{E,1}$ (Lag)	0.055	0.053	0.074
	(0.1142)	(0.1138)	(0.1165)
$\beta_{X,\rho}^{R,0}$	-0.986*	-1.000*	-0.951*
	(0.0981)	(0.0981)	(0.1009)
$\beta_{X,\rho}^{R,1}$ (Lag)	0.098	0.087	0.101
	(0.1080)	(0.1074)	(0.1114)
No. of Observations	1,697,556		

- Coefficient ~ -1 for net-of-average employer NICs

- Coefficient ~ 0 for net-of-average employee NICs

- Economic incidence follows statutory

- Lagged terms insignificant: little evidence of moves away from statutory incidence between year 1 and 2

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Coming up

- Background and related literature

- UK policy context

- Data

- Conceptual framework

- Econometric methodology

- Results

- Summary and future directions

Summary of results

- Responses of employer costs and hours to employee and employer NICs differs

  – +ve compensated elasticity for employee NICs

  – -ve income effects for both employees and employer NICs

  – Statutory incidence in the first and second year following reform

- Main results are robust to using instruments based on earlier instruments

  – Although a number of other coefficients more sensitive

- Results are very similar to Lehmann et al (2013) in France

  – We extend by looking at hours as well as employer cost

  – And slightly longer run as well as immediate responses

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Possible extensions

- Disaggregate results according to sex, age, earnings-level, occupation, etc

- Extend number of lagged changes in NICs rates to look at third and fourth year responses

- Extend analysis to look at other labour taxes (e.g. Income tax, or withdrawal of benefits and tax credits)

  – Require alternative data as depend on family income not just earnings

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