Firm productivity growth and skill

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Productivity Hub seminar

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  - Department of Labour, MED

Context

- Study period: 2000/01 – 2011/12
  - Qualifications growth among employed

	2001	2006	2013
% no qual	19%	18%	14%
% degree or above	14%	18%	24%

    - Reflected in official stats 'composition adjustment' of labour input (Szeto & McLaughlin, 2008)
  - 2001-2007: Employment growth
    - Employment increased by 331,000
    - Employment rate rose from 61.8 to 65.8 (4ppt)
  - 2001-2012: +372,000; 2.1ppt
- Questions
  - Skill dilution?
  - Does adjustment depend on entrant firms?

Research steps

- Derive a wage-based skill measure
- Estimate skill-adjusted labour input
- Estimate productivity growth with and without skill adjustment
- Decompose productivity growth into contributions from entering, exiting, continuing firms
- Show how much of the difference in growth (skill adjusted v unadjusted) occurs in entering/ exiting/ continuing firms

A wage-based skill measure

- "Worker and firm fixed effects" approach

$$\ln(w_{nit}) = \underbrace{X'_{\mathrm{nt}}\beta}_{\substack{Worker\\ experience}} + \underbrace{\theta_n}_{\substack{Worker\\ premium}} + \underbrace{\psi_i}_{\substack{Firm\\ premium}} + \underbrace{\tau_t}_{\substack{Year\\ effect}} + \varepsilon_{nit}$$

Abowd et al, 2002

  - Estimates separate wage contribution of:
    - Lifecycle Experience & matching
      - Age-earnings profile
    - Worker wage premium
    - Firm-related pay premiums
    - Average year to year wage change
  - Identification relies on observing workers in multiple jobs
    - Linked employer-employee data

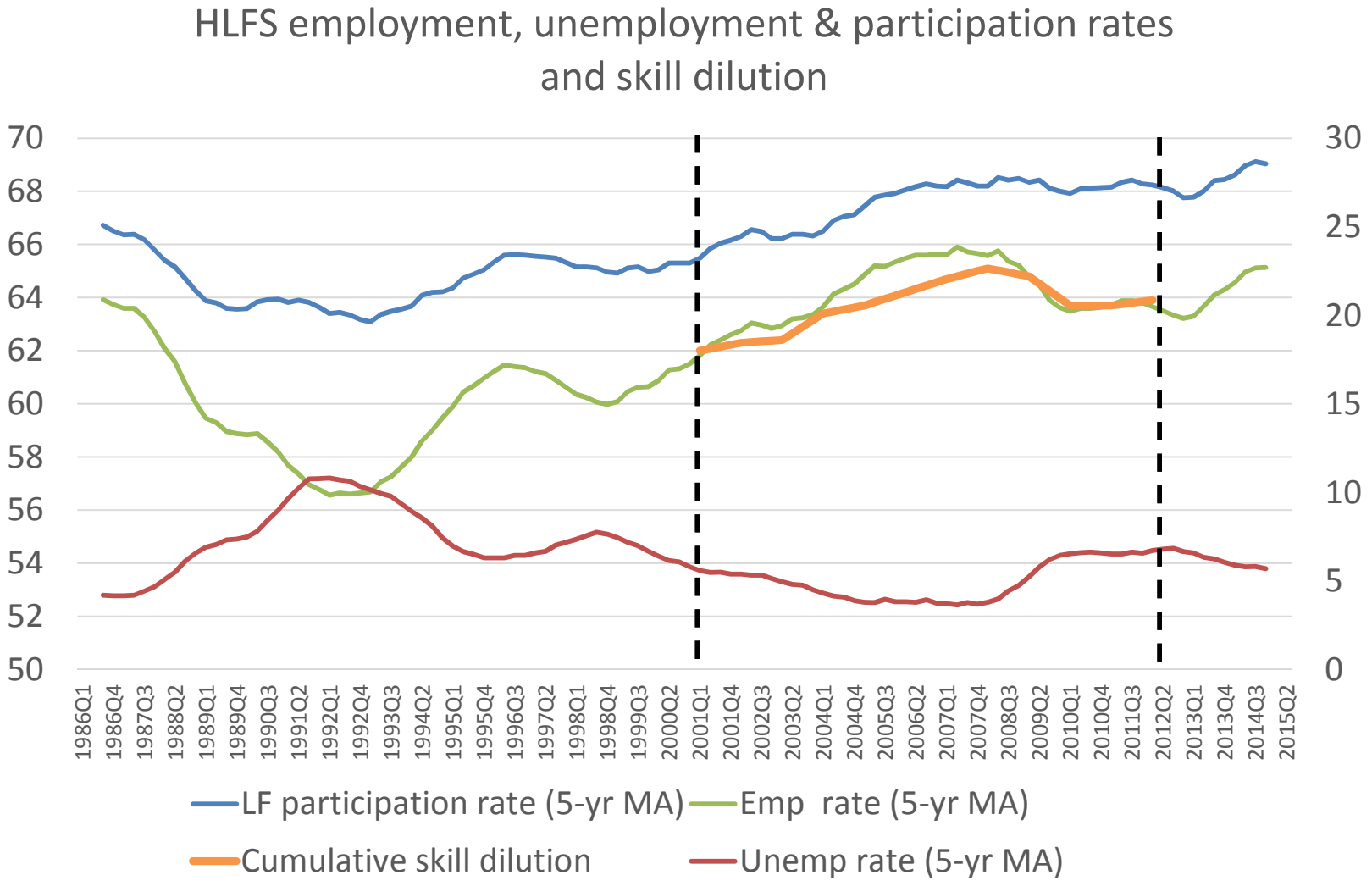
Skill-adjusted labour input

- Worker fixed effect captures:
  - Entry and exit of more/less qualified workers
  - Changes in (wage-based) worker 'quality'
    - misses qualification increases for continuing workers
  - Compositional change is measured relative to baseline change in skill as captured by time and experience effects
- Net effect
  - Previous research shows a 5% net compositional decline in average worker 'quality' between 1999 and 2007, when employment grew by over 20%
    - 60% of decline due to entrants; 40% due to hours increases for low-skilled continuers

Maré & Hyslop (2008)

- Summarised for each firm in each year:
  - FTE-weighted average skill

Employment expansion and skill dilution

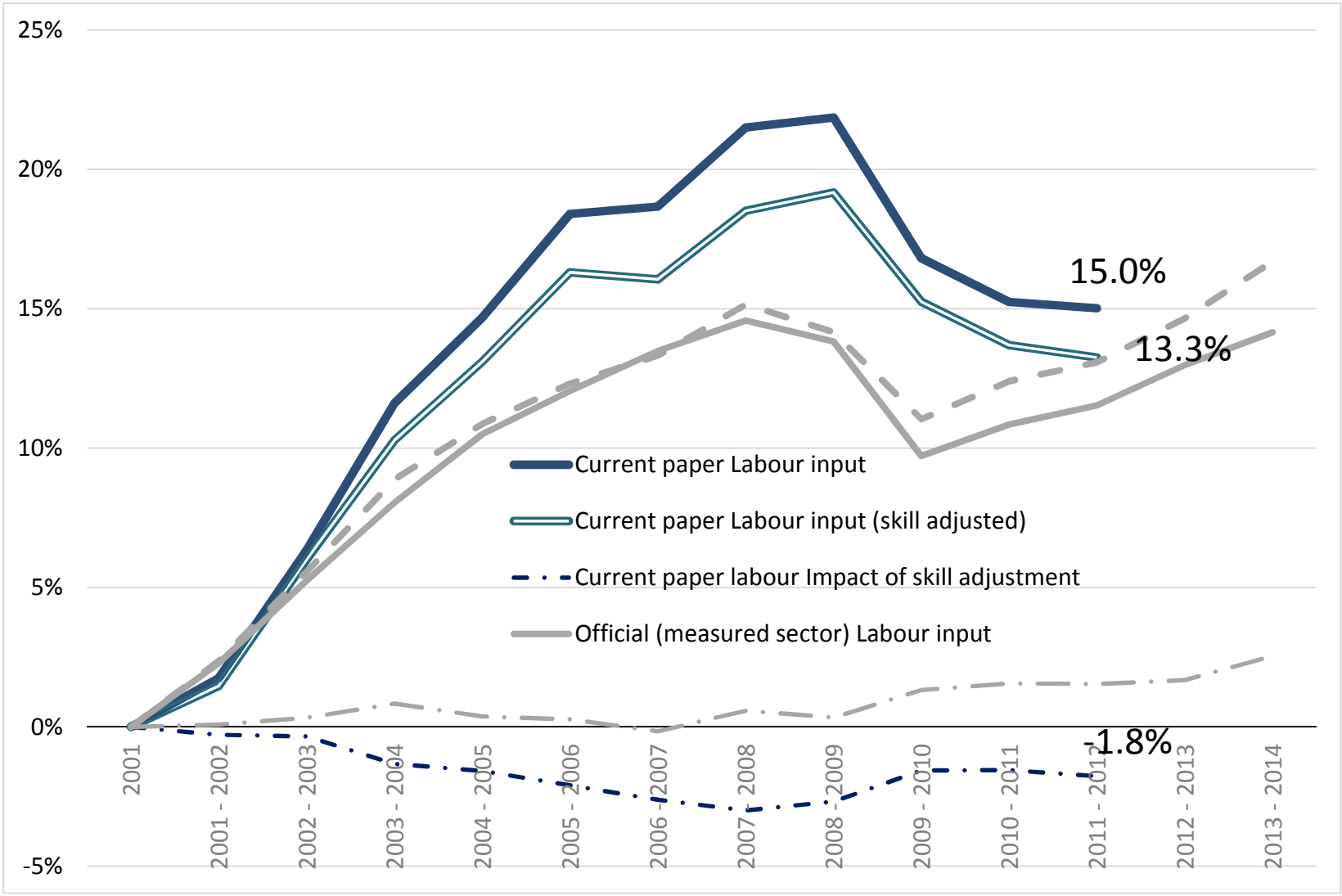


Data

- Integrated Data Infrastructure
  - PAYE (Employer Monthly Schedule)
    - Monthly earnings in each job (worker-firm pair)
    - Adjusted to approximate FT equivalent
- Longitudinal Business Database
  - Sample with production information
    - Output; Employment; Capital services; Intermediate inputs
    - Main sources: Annual Enterprise Survey; IR10
    - Not the same as official statistics

Access to the data presented was managed by Statistics New Zealand under strict micro-data access protocols and in accordance with the security and confidentiality provisions of the Statistics Act 1975. Our findings are not Official Statistics. The opinions, findings, recommendations, and conclusions expressed are those of the authors, not Statistics NZ, or any other agency.

Skill-adjusted labour input cumulative growth



Estimating Productivity

- Within industry

$$ln\,Y_{it} = \{\beta_j^H\, ln\,H_{it} + \beta_j^S S_{it}\} + \beta_j{}^K\, ln\,K_{it} + \beta_j{}^M\, ln\,M_{it} + \lambda_j + \underbrace{\tau_{jt} + e_{it}}_{mfp_{it}}$$

Gross Output *Hours* *Skill per hour* *Capital Services* *Intermediate Consumption*

  - industry-specific coefficients

- Between-industry differences

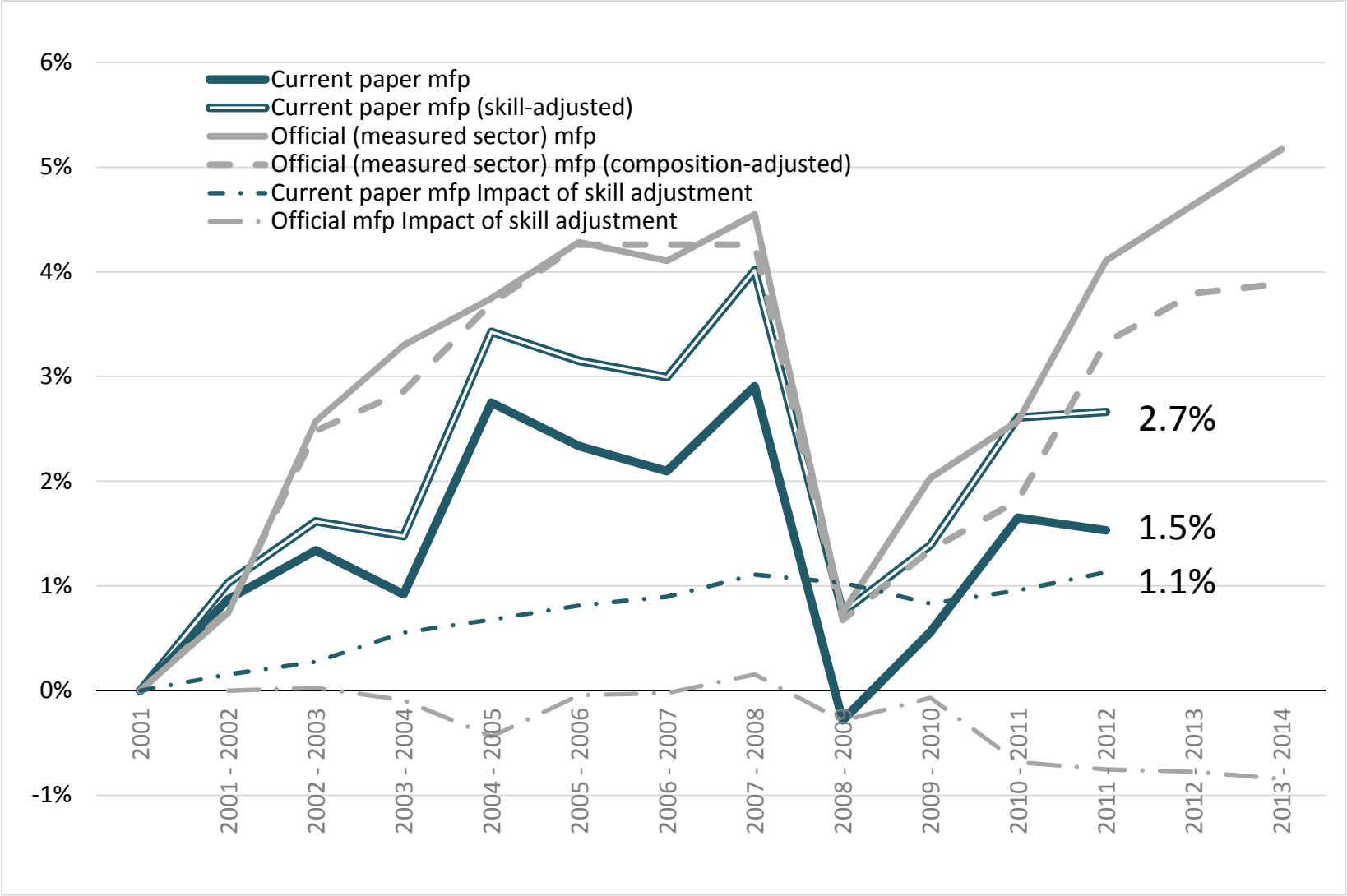
$$ln\,Y_{it} = \underbrace{\{\beta^H\, ln\,H_{it} + \beta^S S_{it}\} + \beta^K\, ln\,K_{it} + \beta^M\, ln\,M_{it}}_{\omega_{it}} + \underbrace{\lambda_j + \tau_t + e_{it}}_{p_{it}}$$

  - Pooled regression with industry intercepts

- Average (input-weighted) mfp

$$A_{jt} = \sum_{i \in j} \omega_{ijt} mfp_{ijt}$$

Productivity (mfp) cumulative growth



Which firms are adjusting?

- Classify firms as continuers, entrants, or exiters
  - Define groups
    - Depends on observation window
    - Have to deal with missing data
  - Estimate each group's contribution to *mfp* growth

Identifying transition groups

- Two issues
  - Choice of observation window
  - Treatment of missing data

11-year transitions	2012 Sample	Continuers	Entrants	Joiners	Exiters	Leavers
Number of firms	93,777	26,625	60,126	7,029	53,784	9,264
	Share of period t				Share of period t-1	
Share of firms	100.0	28.4	64.1	7.5	60.0	10.3
Share of gross output	100.0	60.5	30.9	8.6	34.5	7.3

Single-year transitions	Pooled Sample	Continuers	Entrants	Joiners	Exiters	Leavers
Number of firms	1,076,937	813,360	144,789	118,788	108,621	150,870
	Share of period t				Share of period t-1	
Share of firms	100.0	75.53	13.44	11.03	10.12	14.06
Share of gross output	100.0	90.30	3.13	6.56	2.19	7.85

Decomposition of *mfp* change

– Griliches-Regev decomposition

- Within industry

$$A_{jt} = \sum_{i \in j} \omega_{ijt}\, mfp_{ijt} \qquad \bar{A}_j = \frac{1}{2} * \left(A_{jt} + A_{jt-1}\right)$$

$$\Delta A_{jt} = \underbrace{\sum_{i \in C} \bar{\omega}_{ij}\, \Delta mfp_{ijt}}_{\substack{Continuers: \\ productivity\ growth \\ [Within]}} + \underbrace{\sum_{i \in C} \Delta\omega_{ijt} \left(\overline{mfp}_{ij} - \bar{A}_j\right)}_{\substack{Continuers: \\ input\ shares \\ [Reallocation]}}$$
$$+ \underbrace{\sum_{i \in N} \omega_{ijt} \left(mfp_{ijt} - \bar{A}_j\right)}_{Entering\ firms} - \underbrace{\sum_{i \in X} \omega_{ijt-1} \left(mfp_{ijt-1} - \bar{A}_j\right)}_{Exiting\ firms}$$

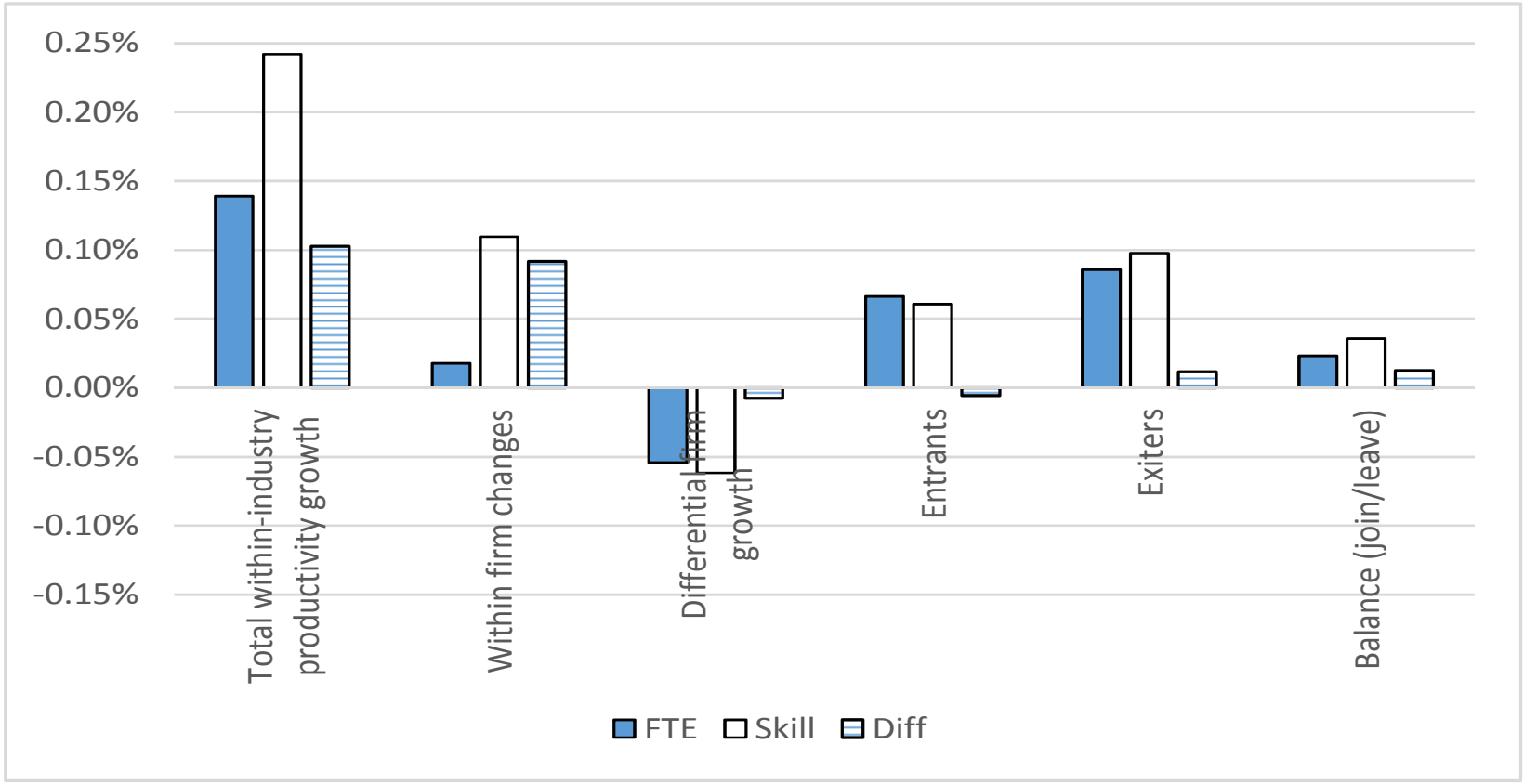
- Between industry

$$\Delta P_t = \underbrace{\sum_j \bar{\omega}_j\, \Delta P_{jt}}_{\substack{within\ industry \\ productivity\ growth}} + \underbrace{\sum_j \Delta\omega_{jt} \left(\bar{P}_j - \bar{P}\right)}_{Industry\ mix}$$

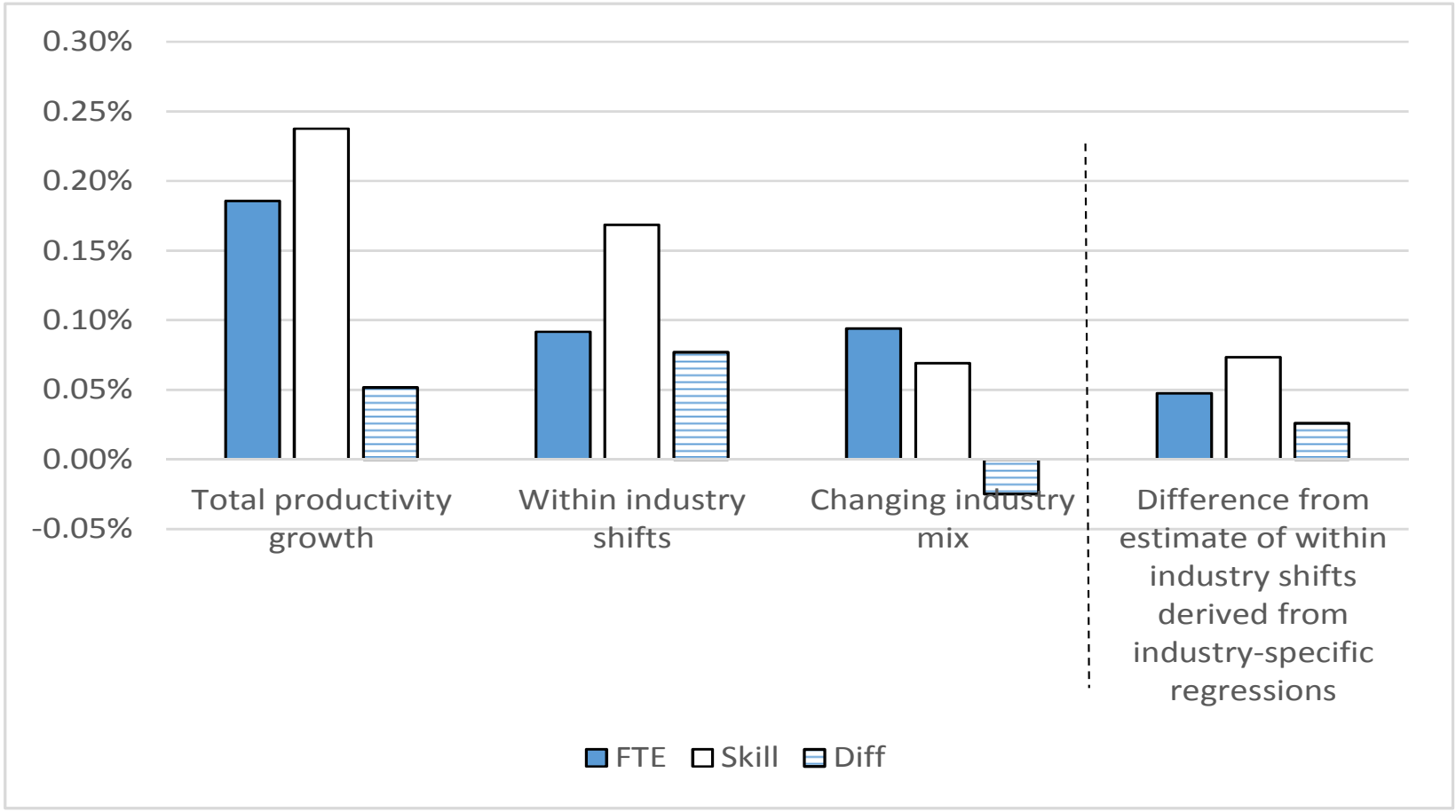
mfp growth decomposition

		Continuers		Entrants		Exiters	
Period: 2001-2012	Average annual within-industry mfp growth	Within-firm change in productivity	due to differential growth of high v low productivity firms	Entrants	Joining sample	Exiters	Leaving sample
	mfp growth contribution						
mfp(FTE)	0.14%	0.02%	-0.05%	0.07%	-0.02%	0.09%	0.04%
mfp(skill adjusted)	0.24%	0.11%	-0.06%	0.06%	-0.02%	0.10%	0.05%

Within-industry *mfp* growth decomposition



Reallocation between industries



Summary of findings

- When employment growth is strong, quantity measures of employment overstate the growth in labour input, because growth draws in lower-earning workers
  - Between 2001 and 2007, skill-adjusted labour input grew by 18.5% (unadjusted FTE growth =21.5%)
- Consequently, productivity growth is understated when employment growth is strong
  - Output has actually been produced with *less* growth in labour input (1.1% higher mfp growth over 11 years)
- The impact of skill-adjustment is confined largely to continuing firms
  - Absorbing workers who differ from the existing workforce does not depend on the entry of firms with new technologies