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Earnings Inequality, Institutions and the Macroeconomy – What Can We Learn from Ireland’s Boom Years?

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Abstract

Rapid economic growth is often expected to lead to increased returns to education and skills and thus to rising wage inequality. Ireland offers a valuable case study, with distinctive wage-setting institutions and exceptional rates of growth in output, employment and incomes in the Celtic Tiger period from 1994 to 2007. We find that dispersion in (hourly) wage inequality fell sharply to 2000, before increasing though much less sharply to 2007. Returns to both education and work experience declined considerable in the earlier period, while the increase in lower earnings relative to the median was associated with the introduction of the minimum wage in 2000, anchoring the bottom of the distribution. For 2000-2007 the faster increase in higher earnings may be associated with the changing pattern of immigration and of the employment growth in the second half of the boom. Further exploration of the factors at work towards the top of the distribution during these years is an important research priority.

Keywords: Earnings dispersion, minimum wage, returns to education

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Earnings Inequality, Institutions and the Macroeconomy – What Can We Learn from Ireland’s Boom Years?

1. Introduction

Increasing earnings dispersion has been the focus of an ever-expanding research literature since the late 1980s, responding initially to the realization that a marked rise in earnings inequality was taking place in the United States. As Lemieux (2008) points out, during the 1990s a consensus emerged that this reflected a shift in demand towards more skilled labour, producing rising returns to education and skills, and that the primary source of this shift was skill-biased technical change (rather than international trade and globalization, the leading alternative explanation). Even then, though, this prevailing view, dominated by US (and to a lesser extent UK) experience, was difficult to reconcile with the fact that some other industrialised countries had experienced much smaller increases in inequality while others had seen no increase. This led to the hypothesis that wage-setting institutions as well as supply and demand trends were important and helped explain such diverging trends.¹ Even in the USA, wage-setting institutions such as the decline in unionization and the fall in the real value of the minimum wage were seen as important factors in rising US earnings dispersion by, for example, Freeman (1993), DiNardo, Fortin and Lemieux (1996), and DiNardo and Lemieux (1997).

More recent US evidence has further undermined the concentration on a straightforward skill-biased technological change explanation for increasing dispersion. While this would predict a continued steep rise in wage inequality across the distribution, in fact the growth in US inequality since about 1988-90 has been concentrated at the top of the distribution (see for example Autor, Katz and Kearney, 2008). Wage-setting institutions including top executive remuneration, unions and minimum wages may have an important part to play in explaining the differing trends in US wage inequality before and after the late 1980s. Such institutions, including the way wages are bargained more generally, may also help to explain why, although a widening in the distribution of earnings has been seen since

1990 in many advanced countries, its extent and nature have varied considerably (see for example the OECD's *Growing Unequal*, 2008, Ch. 3). Demand-side shifts and the role of skill-biased technological change are clearly still of central importance (as argued by Autor, Katz and Kearney, 2008 for example), but the fact that they operate in different institutional settings over time and across countries has to be incorporated into the analysis and explanation of observed trends.

As Lemieux's survey (2008) concludes, one of the most fruitful directions for research on the changing nature of wage inequality is to study the recent experience of countries other than the United States, each with its own institutional setting. Ireland, on which this paper focuses, is a particularly interesting case-study in that respect. This is firstly because of its distinctive wage-setting institutions, including in recent years centralized wage-bargaining unusual in what is otherwise an "Anglo-Saxon" style labour market, and the introduction of a minimum wage. As well as institutional factors, Ireland is also of special interest because during the period we will be examining it experienced quite exceptional economic growth – the "Celtic Tiger" period from the mid-1990s where it had the fastest growth in the OECD, fuelled (at least for a time) by foreign direct investment and the expansion in high-value output and exports. Ireland over this period thus serves as a laboratory for the impact of such growth on wage inequality, incorporating the potential role of wage-setting institutions.

Our analysis builds on and extends several studies of earnings inequality trends before and during the first half of Ireland's economic boom. Barrett, Callan and Nolan (1999) found a sharp increase in (hourly) earnings inequality in the immediate pre-boom years from 1987 to 1994, with increasing returns to university degrees despite a large increase in the number of graduates. Barrett, FitzGerald and Nolan (2002) reported that inequality remained stable from 1994 to 1997, despite the rapid acceleration in economic growth, with estimated returns to university education remaining stable or falling. McGuinness,

¹ The role of institutional versus other factors in producing cross-country variation in the level and trends in earnings dispersion is discussed in for example Freeman and Katz (1995), Blau and Kahn (1996), and Gottschalk and Joyce (1997).

McGinnity and O'Connell (2009) found that the level of wage inequality was markedly lower in 2001 than 1997, with little change in estimated returns to education for men but higher wage growth for women with lower levels of education. Studies to date thus suggest a striking contrast between the pre-boom period 1987-1994 when wage inequality rose markedly, and 1994-2001 when growth surged and wage inequality fell. These studies highlight the strength and pattern of labour demand as economic growth surged, the very substantial numbers of highly-educated young people being produced by the education system at the time, the emergence of substantial in-migration of both skilled and less skilled labour, and the role of centrally bargained wages and the introduction of a national minimum wage.

In this paper we extend the analysis of wage inequality in Ireland in a number of important respects, both substantive and methodological. First, we are able to include both the period from 1994 to 2001 and the second half of Ireland's economic boom in our analysis, with new data up to 2007. This is particularly valuable in that from about 2001 there was a marked shift in the nature of economic growth, from export-led to greater dependence on domestic demand and in particular construction, which might be expected to have consequences for the pattern of labour demand. The latter period also saw the expansion of the European Union in 2004 to include the transition economies of Eastern Europe, with major implications for immigration into the "old" EU-15, and the UK and Ireland in particular. Secondly, whereas previous studies have compared wage dispersion in particular years (1994, 1997 and 2001), here we are able to examine the evolution of wages year-by-year, with a complete annual series from 1994 to 2007 (except for 2002 for which no data are available). This proves to be particularly useful in teasing out the impact of institutional innovations versus shifts in demand and supply of skills. Finally, we employ the decomposition technique using quantile regressions recently developed by Machado and Matta (2005) to distinguish the impact of changes in returns versus changes in workforce composition on overall dispersion (which has advantages over the Juhn-Murphy-Pierce decomposition method used in previous Irish studies by Barrett, FitzGerald and Nolan, 2002 and McGuinness, McGinnity and O'Connell, 2009). We are thus able to draw an in-depth picture of the evolution of wage inequality over the entire

period of Ireland's economic boom and of the factors at work in producing the observed changes.

2. The Economic and Institutional Context

One of the reasons that changes in the pattern of earnings dispersion in Ireland over the period from 1994 to 2007 are of such great interest is that the macroeconomic context was so unusual. The rate of growth in the economy and in the numbers employed was dramatic by any standards, while the substantial net inflow of migrants was also strikingly different from previous Irish experience. Key aspects of the macroeconomic background and labour market trends over the period are summarised in Table 1.

Table 1: Trends in Key Macroeconomic and Labour Market Variables, Ireland 1994-2007

	Growth in real GNP %	Growth in Numbers Employed %	Unemployment Rate %	Employment Rate %	Net Migration '000	Increase in CPI %
1994	6.49	3.17	14.74	52.2	-4.7	2.37
1995	5.62	5.01	12.16	54.0	-1.9	2.52
1996	7.58	3.65	11.87	55.1	8	1.74
1997	10.07	3.87	10.33	56.1	19.2	1.41
1998	7.64	8.27	7.80	59.6	17.4	2.38
1999	8.46	6.37	5.75	62.5	17.3	1.65
2000	9.75	5.18	4.27	64.5	26	5.63
2001	3.78	3.02	3.64	65.2	32.8	4.79
2002	2.93	2.25	4.20	65.0	41.3	4.66
2003	5.74	1.68	4.41	64.9	30.7	3.46
2004	4.33	2.49	4.41	65.4	32	2.23
2005	5.59	5.29	4.29	67.1	55.1	2.41
2006	6.34	4.63	4.39	68.2	71.8	3.95
2007	4.35	3.98	4.56	69.0	67.3	4.90

Growth in GNP was very substantial throughout the second half of the 1990s, having been relatively modest up to that point, and accelerated further in 1997. Real GNP growth was 10% in both 1997 and 2000 and averaged 7% from 1994 to 2000, among the highest in the OECD during these years, giving rise to the “Celtic Tiger” label. Growth was lower in 2001-02 but then returned to 4-6% per annum. By 2007, Ireland’s GNP per capita was among the highest in the EU. That proved to be the high water mark of Ireland’s economic boom, with GNP falling by 3% in 2008 and by considerably more in 2009 in the wake of the global financial crisis and the bursting of a pronounced domestic property bubble. The micro-data required to study the impact the “bust” may have had on earnings is not yet available, so here our focus is on the period of remarkable growth from 1994 to 2007.

As Table 1 also shows, employment growth was also dramatic, particularly in the later 1990s. At the outset in 1994 the total number in employment was 1.2 million, but by 2000 this had increased by half a million, an average rise of 5% per year. The numbers employed continued to grow significantly after 2000, although the average rate of increase slowed somewhat, so that by 2007 there were 2.1 million in employment, a remarkable increase of 75% over the entire period. With the numbers employed growing so strongly unemployment declined very rapidly, from 15% in 1994 to below 4% by 2001, and was about 4.5% each year from then up to 2007. The employment rate also rose very sharply as more married women in particular were drawn into the paid workforce. This meant that whereas just over half of all adults of working age were in the workforce in 1994, by 2007 this had reached 69% (with the rate for women going from 40% to 60%). Migration was also been extremely important in the expansion of the workforce, allowing growth to continue at a rapid pace as the domestic pool of unemployed and inactive shrank. While Ireland has traditionally been a country of outward migration, the scale of economic growth was such that significant net immigration emerged from 1997. It was substantial throughout the period to 2007, but was particularly large in 2005-2007 after the enlargement of the EU to include ten new member states in 2004.

Table 1 also shows that inflation was relatively low in the 1990s despite the pace of economic growth, but the Consumer Price Index rose rapidly, by 5-6%, in the years 2000, 2001 and 2002. It rose less quickly, but much faster than in most other EU countries, from then until 2007. This was accompanied by an important shift in the sectoral distribution of employment. About 60% of the increase in employment from 1994 to 2000 was in production, distribution or finance, with 17% in construction and 15% in public administration, health and education. From 2001 to 2007 only one-third of the increase was in production (where the numbers actually fell), distribution or finance. Over these years one-quarter of the growth in jobs was in construction and one-third was in public administration, health, and education.

This reflects a major shift in the key drivers of economic growth. In the first phase of the Celtic Tiger exports were the key driver of growth, increasing by a remarkable 15- 20% in volume terms from 1997 to 2000 in particular. Foreign direct investment is seen as playing a key role in Ireland's macroeconomic performance, and both FDI internationally and the share coming to Ireland were particularly strong in these years. Export growth was significantly lower in the later period, and in 2005-07 exports grew below the growth rate for the economy in general. Ireland's share of world trade declined from 2003, related to the loss in competitiveness associated with the divergence in inflation rates between Ireland and the rest of the euro-zone. Domestic sources of demand replaced exports as the main driver of growth, and the construction sector in particular – for housing, commercial and infrastructural purposes – grew to an unprecedented extent, accounting for 14% of employment by the end of the period. The number of dwelling units built increased steadily to reach a peak of almost 90,000 in 2006, about three times the more usual level before the boom, while house prices continued to rise very sharply throughout the entire period. This left the economy highly vulnerable to external shocks, with the construction sector collapsing once the impact of the international financial crisis was felt; however, this was only felt in 2008, outside the period on which we are focusing here.

Our aim is to examine how earnings at different education and pay levels evolved over this highly unusual period in the Irish macroeconomy, one that saw unprecedented growth in output and numbers employed but also had marked variation in the nature of growth within it. However, as noted in the introduction, institutional factors affecting wages also need to be taken into account. In the Irish case a number of features are particularly salient: the role of centralised wage bargaining, the way public sector pay was set during the boom, and the minimum wage. Wage bargaining in Ireland has been centralised at the national level since 1987, through a process known as social partnership in which the state, employers, unions and farming interests have concluded agreements on wage levels in both private and public sectors, together with a wide range of economic and social policies including tax reform, welfare payments, and labour law. The contribution of these agreements to Ireland's rapid economic growth, and indeed the extent to which they represent successful social corporatism, is debated,² but wage restraint does seem to have contributed to enhanced competitiveness in the earlier part of the boom. In terms of the pattern of wage increase, though, the centrally bargained increases will in most cases have set a floor on what firms awarded their workers, with more profitable firms – particularly in the multinational sector – then often giving greater increases.

As well as receiving the centrally bargained increases that applied to workers in the private sector, most public sector workers were subject to a separate process whereby the Public Service Benchmarking Body recommended substantial increases in 2002, implemented by government, while senior officials received substantial pay increases recommended by the Review Body on Higher Remuneration in the Public Sector. These reflected a concern that workers in the public sector had fallen behind during the boom, although the extent to which this was actually the case has been hotly contested, with Kelly, McGuinness and O'Connell's (2008) analysis suggesting that the public sector premium grew substantially from 2003 to 2006 and was then greater than in other

² See for example Sexton and O'Connell (1996), Lane (1998), FitzGerald (1999), Allen (2000), O'Donnell and O'Riordan (2002), Baccaro and Simoni (2002), O'Donnell (2008).

industrialized countries. Once again our concern here is not with that contested finding (which underpinned the government's subsequent decision to cut nominal pay rates in the public sector in the face of a yawning fiscal deficit), but with the role that public sector pay-setting may have played in the evolution of the overall earnings distribution.

Finally, the period we are analyzing saw the introduction of a national minimum wage in Ireland for the first time. Before 2000 varying wage minima were set for a limited number of occupations or sectors by Joint Labour Committees, similar to the Wages Councils which operated in the UK for many years. A standardised national minimum applying across all sectors was seen as more effective in protecting low-paid workers, with the UK as an influential example in making a similar transition just a few years earlier, so a national minimum wage was introduced in April 2000. This sets minima for all employees aged 18 or over, with reduced rates payable for younger/inexperienced workers and the full adult rate applying to the bulk of the workforce. These minima have been increased over time since introduction at irregular intervals, apparently broadly in line with the growth in median earnings (insofar as the available statistics allow that median to be estimated). The minimum wage has been set at a relatively high figure compared with other countries, introduced at (the equivalent of) €5.59 per hour and reaching €8.65 by mid-2007, corresponding to about half the median level of earnings at the time. Studies based on specially-designed surveys suggest that about 4-5% of workers in the private sector were earning at or about the minimum wage level in 2000-2002 and in 2005-2006.³ Clearly the potential impact of this institutional innovation on the earnings distribution is of substantial interest.

Having outlined the key features of the macroeconomic and institutional background, we now describe the micro-data to be used in capturing trends in earnings dispersion and exploring the underlying forces at work.

³ See Nolan, Williams and O'Neill (2002), Nolan, Williams and Blackwell (2003), (2006), O'Neill, Nolan and Williams (2006).

3. The Earnings Data

The micro-data on individual employees and their earnings used here come from two sets of large-scale household surveys, the only sources that allow for year-by-year analysis of earnings dispersion in Ireland over the period. The first is the Living in Ireland Survey (LII), a longitudinal household panel survey carried out by the ESRI that formed the Irish component of the European Community Household Panel (ECHP) which ran from 1994 to 2001. In the first wave (fully described in Callan *et al*, 1996), 4,048 households were interviewed with a response rate of 63% of valid addresses contacted. The samples for analysis are reweighted to correct for non-response, on the basis of the number of adults in the household, urban/rural location, age and socio-economic group of household head, using external information. (Here we are not exploiting the panel nature of the survey so cross-sectional rather than longitudinal weights are used.) The overall representativeness of the original sample data was validated by comparison with a range of external information (see for example Callan *et al* 1996). The survey sought detailed information on the earnings, education, labour market experience and other characteristics of the employees in sample households. Over 3,000 employees responded fully to such questions, and they also appeared to represent employees well, in terms of age, sex, occupation and industry, when compared with available external data. By 2000 the overall sample size had declined substantially due to attrition, so 1,500 new households were added. Detailed checks suggested that the overall impact on the sample structure was slight, and the reweighting scheme sought to compensate for any biases to the extent that available external information allowed (for a detailed discussion see Whelan *et al*, 2003, Appendix A.).

Like the broader ECHP of which it was part, the Living in Ireland Survey was discontinued in 2001. At EU level the ECHP was replaced by EU Statistics on Income and Living Conditions (EU-SILC), which is an “output-co-ordinated” framework rather than an input-coordinated harmonised survey, and is now the reference source for common indicators on poverty and social inclusion in the European Community. In Ireland the information required under this framework is obtained via a new household survey, called SILC, conducted by the Central Statistics Office (CSO). This was initiated in 2003, with interviews carried out in the period June to December and a sample of

3,112 households obtained. The survey has been carried out annually since then with a total completed sample size of the order of 5,000 to 6,000 households and 13,000-14,000 adult individuals in each year (see for example CSO, 2005, 2008 on the 2004 and 2007 surveys respectively). The sampling frame and reweighting procedures differ from the Living in Ireland Survey (see for example CSO, 2005 Appendix for a detailed description), but these are similarly designed to ensure the sample is representative of the population using external controls. At a household level, the weights were adjusted on the basis of household composition and region, while at an individual level the age by sex distribution of the population was taken into account.

The questions about earnings included in the two sets of surveys are similar: employees were asked about the gross pay they received in their last pay period, how long this covered (a week, fortnight, month etc.), and the hours worked during that period. They were also asked whether this was the amount they usually receive, and if not what was their usual gross pay and hours usually worked. Here we focus on hourly earnings, derived for most employees as reported last gross pay received divided by hours worked in that pay period; for the small proportion of responding employees (generally about 5%) who stated that their last pay was not usual, we use the usual amount received divided by hours usually worked. We have also harmonised to the greatest extent possible across the surveys the earners who are included in the analysis (excluding those in apprenticeships, state-backed employment schemes or full-time education). The significant effort we have invested into harmonizing the precise earnings variable and coverage we employ across the Living in Ireland and SILC surveys provides for some reassurance that the switch from one survey to another is not introducing a major discontinuity: as we shall see, the similarity in the earnings distributions observed at the end of the Living in Ireland Survey and the beginning of SILC bears this out.

4. The Evolution of Earnings and Earnings Dispersion

In analysing earnings inequality, a variety of alternative populations of earners and concepts of earnings are of substantive interest – notably the distribution among full-time employees versus all workers, and the dispersion of hourly, weekly and annual earnings. The number of hours worked in the week and of weeks worked in the year are clearly

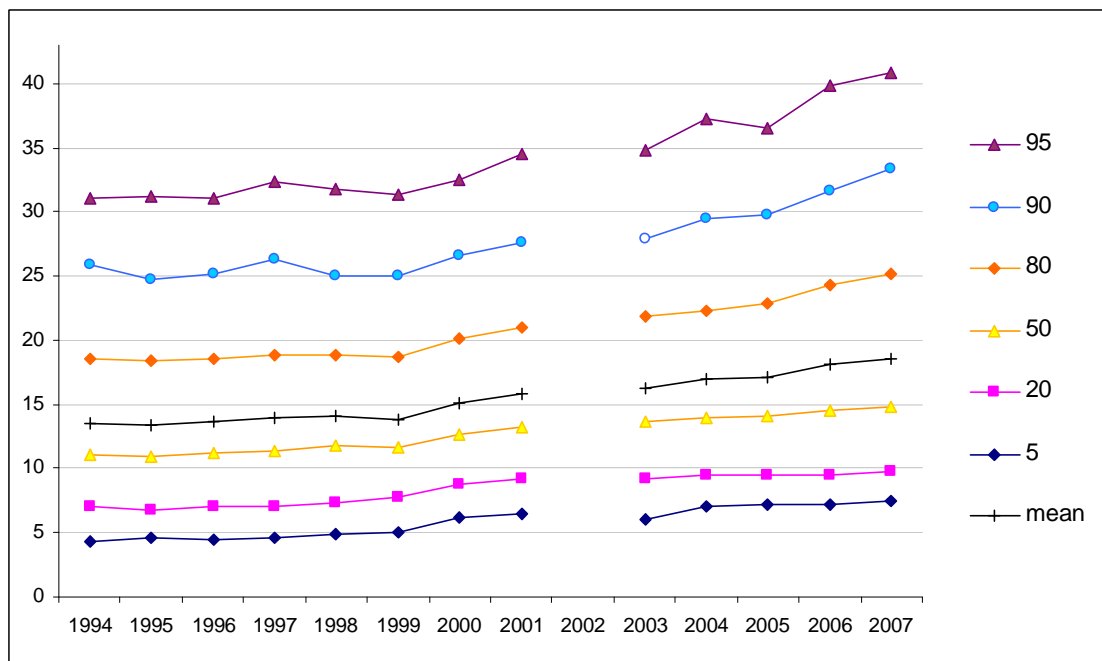
central in determining individual earnings and household income. However, from the point of view of the reward to skills and effort, hourly wages are at the core, and it is on this measure of earnings and its dispersion across all employees that we focus in this paper. We look first at median earnings and how that changed over the period. (The currency in use switched from the Irish pound to the euro in 2000, so we convert all the earlier figures to euro at the conversion rate of IR£0.79 per euro employed at the change-over point.) Table 2 shows that median earnings rose rapidly in nominal terms throughout the period, and by 2007 had reached twice the 1994 figure. Prices also increased relatively rapidly (compared with elsewhere) over the period, as we have seen, so the increase in wages in real terms was a good deal more modest, but median earnings still rose by 33% in real terms over the period. Most years saw positive real earnings growth, with 2000 being exceptionally strong.

Table 2: Median Hourly Earnings, All Employees, 1994-2007

Median	<i>Nominal</i>			<i>In 2007 prices</i>		
	Hourly earnings	% change	Index 1994=100	Hourly earnings	% change	Index 1994=100
1994	7.51		100	11.32		100
1995	7.62	1.45	101.45	11.19	-1.16	98.84
1996	7.98	4.70	106.22	11.53	3.08	101.89
1997	8.19	2.67	109.06	11.66	1.11	103.02
1998	8.73	6.61	116.27	12.12	3.95	107.09
1999	8.73	0.02	116.30	11.95	-1.37	105.62
2000	10.06	15.19	133.97	13.04	9.09	115.22
2001	11.00	9.36	146.51	13.59	4.23	120.09
2002						
2003	12.28	11.65	163.58	14.02	3.10	123.82
2004	12.82	4.38	170.74	14.33	2.22	126.57
2005	13.33	3.98	177.54	14.53	1.44	128.40
2006	14.21	6.60	189.25	14.91	2.57	131.71
2007	15.19	6.85	202.22	15.19	1.86	134.16

Looking beyond the median to other parts of the distribution, Figure 1 shows how the level of earnings in 2007 constant price terms at various percentiles evolved year by year. Broadly speaking, there was little change up to 1997 or 1998 but significant growth across the distribution from then on, with that growth being much more rapid towards the top of the distribution in the latter part of the period.

Figure 1: *Percentiles of Hourly Earnings, All Employees, 1994-2007 (Constant 2007 Prices)*



The implications of these trends across the distribution for the overall shape of the earnings distribution are brought out in Table 3. This shows the level of earnings at the bottom decile, bottom quartile, top quartile and top decile, each expressed as proportions of the median. We see that the entire distribution was rather stable from 1994 to 1997, with little change in these percentile/median ratios. The ratio of the top to the bottom decile, P_{90}/P_{10} , is a widely-used summary measure of earnings dispersion, and we see that this also was little changed. That summary measure then fell markedly from 1997 to 1998; this reflected a fall in the top decile relative to the median, with the bottom decile

rising only marginally faster than the median. However, P_{90}/P_{10} was stable from 1998 to 1999 but then fell sharply again from 1999 to 2000, and this time the driving force was a very marked increase in the bottom decile as a proportion of the median, from 0.51 to 0.59. The bottom quartile rose slightly faster than the median, having risen a good deal more rapidly in the previous year.

Table 3: Distribution of Hourly Earnings, All Employees, 1994-2007

	as proportion of median				top decile/ bottom decile
	Bottom decile	Bottom quartile	Top quartile	Top decile	
1994	0.49	0.69	1.53	2.35	4.77
1995	0.50	0.70	1.54	2.27	4.54
1996	0.49	0.69	1.50	2.24	4.62
1997	0.50	0.71	1.52	2.33	4.64
1998	0.51	0.67	1.45	2.12	4.16
1999	0.51	0.73	1.45	2.15	4.21
2000	0.59	0.75	1.44	2.10	3.56
2001	0.58	0.74	1.44	2.09	3.62
2002	<i>No data available</i>				
2003	0.56	0.73	1.46	2.04	3.67
2004	0.58	0.74	1.46	2.12	3.65
2005	0.57	0.73	1.46	2.11	3.67
2006	0.56	0.71	1.50	2.18	3.92
2007	0.56	0.72	1.50	2.26	4.00

So the net result was that the P_{90}/P_{10} summary dispersion measure fell very sharply indeed from 1997 to 2000, from 4.8 to 3.6 – a quite remarkable scale of change, rarely seen internationally. This came about primarily because the bottom decile rose so rapidly from 1999 to 2000, but the fact that the top decile lagged behind the median after 1997 also made a substantial contribution.

We will come in due course to the range of potential explanations for these changes in overall earnings dispersion to 2000, but first look at what happened subsequently. We see from Table 3 that after 2000 the bottom decile and quartile were relatively stable, both falling back slightly relative to the median but with the bottom decile in particular remaining well above the level seen before 2000 throughout the period to 2007. The pronounced change was now towards the top, where the top quartile but even more the top decile pulled substantially away from the median, coming close to reversing the falls seen in the late 1990s. The net impact was that by 2007 the P_{90}/P_{10} ratio had risen from 3.6 back up to 4, though this was still well short of the figure of 4.8 seen in 1997. (As already noted, despite the switch from Living in Ireland Surveys to SILC between 2001 and 2003, the distributions are very similar in these two years.)

It is of interest to also consider the distribution of earnings among men and women separately. We therefore look at the various percentiles of the distribution among men expressed as a proportion of the male median, and correspondingly for women.⁴ Tables 4 and 5 show that the trends over time in dispersion were broadly similar for men and women, though with some interesting divergences. Overall, for both men and women the summary P_{90}/P_{10} ratio fell sharply to 2000 and then rose somewhat, but was still well below its initial level by 2007. However, while both saw the bottom decile moving a good deal closer to the median from 1999 to 2000, this was much more pronounced for women than men (with men but not women also seeing an increase in the previous year). The top decile fell as a proportion of the median in the late 1990s for both, but the subsequent recovery towards the top was much more pronounced for women than men.

⁴ Median earnings for women were generally about 83-85% of the male median, though they were higher than that in 2005-2006 before falling back in 2007.

Table 4: Distribution of Hourly Earnings, Male Employees, 1994-2007

	as proportion of median				top bottom decile/ decile/
	Bottom decile	Bottom quartile	top quartile	Top decile	
1994	0.48	0.71	1.54	2.26	4.70
1995	0.50	0.71	1.48	2.18	4.32
1996	0.47	0.70	1.48	2.16	4.58
1997	0.50	0.70	1.47	2.26	4.54
1998	0.51	0.70	1.44	2.16	4.22
1999	0.54	0.73	1.43	2.21	5.05
2000	0.58	0.74	1.40	1.98	3.42
2001	0.55	0.75	1.41	1.99	3.65
2002					
2003	0.54	0.76	1.47	2.12	3.92
2004	0.56	0.76	1.44	2.12	3.77
2005	0.54	0.72	1.44	2.13	3.93
2006	0.55	0.72	1.50	2.14	3.90
2007	0.54	0.70	1.45	2.08	3.88

Table 5: Distribution of Hourly Earnings, Female Employees, 1994-2007

	as proportion of median				top decile/ bottom decile
	Bottom decile	Bottom quartile	top quartile	Top decile	
1994	0.52	0.71	1.59	2.39	4.57
1995	0.50	0.68	1.55	2.42	4.84
1996	0.52	0.69	1.50	2.12	4.08
1997	0.52	0.69	1.50	2.35	4.54
1998	0.55	0.70	1.49	2.28	4.16
1999	0.54	0.73	1.38	2.12	3.96
2000	0.63	0.78	1.42	2.25	3.56
2001	0.61	0.76	1.42	2.12	3.50
2002					
2003	0.59	0.75	1.43	2.02	3.41
2004	0.62	0.76	1.50	2.13	3.42
2005	0.60	0.72	1.43	2.09	3.50
2006	0.59	0.72	1.51	2.27	3.87
2007	0.60	0.72	1.52	2.41	4.01

5. Returns to Education and Experience

As noted earlier, one of the key drivers of increasing earnings dispersion in countries such as the USA and the UK has been increasing returns to higher educational attainment, and previous Irish studies of earnings have focused on its potential role. Ireland has seen a sustained and substantial rise in the level of education of those leaving the Irish education system going back to 1970s, with a marked impact on the education profile of different age cohorts in the workforce. The numbers completing full second-level education (to about age 18) rather than leaving earlier fell sharply, and there has a substantial increase in the proportion going on to third-level education, especially over the past two decades. As cohorts containing a high proportion with relatively low levels of education retire and those with relatively high levels enter the labour force, this has produced major changes in the education profile of employees between 1994 and 2007.

In the surveys on which our analysis is based, the percentage of employees not having completed upper secondary education was down from over one-third in 1994 to close to one-quarter by 2007, with the percentage having some third-level education showing a corresponding rise from about one-quarter to over one-third. (Similar trends are shown in data from the Censuses of Population carried out in 1996, 2002 and 2006, though the levels are not identical.)

The returns to different levels of educational attainment in the workforce and how they have changed over time are then of central interest. The educational categories used for this purpose in our analysis are:

- Primary only: left school at the end of primary level, or did some second-level schooling but obtained no qualification.
- Lower secondary: the Group, Intermediate or Junior Certificate obtained at the midway stage of second level education.
- Upper secondary: the Leaving Certificate qualification obtained on completing second-level education, usually at about age 18.⁵
- Non-degree third-level: diplomas and other non-degree qualifications from such institutions as regional technical colleges.
- University primary degree
- University higher degree.

The returns to these different levels of educational attainment can be estimated via standard human capital earnings equations, where (log) hourly earnings is the dependent variable and education plus experience the key explanatory variables. We show the results of estimating such equations for all employees via Ordinary Least Squares for selected years from 1994 to 2007 in Table 6. Apart from educational attainment and experience, gender is also included as a control; inclusion of other control variables such as marital status makes no substantive difference to the returns to education on which we are focusing here.

⁵Also included in this category are a small number of individuals who obtained qualifications under the PLC (Post Leaving Certificate) and VPTP (Vocational Preparation and Training Programmes).

Primary education is the omitted education reference category in these regressions, and we see from Table 6 that relative to that base, higher levels of educational attainment consistently predict (statistically significant) higher levels of hourly earnings throughout. Looking across the period, though, the additional return to completing second-level is a good deal higher in the early part of the period than from 2000 onwards – vis-à-vis primary education only, or in terms of the gap between completing lower versus upper secondary education. While a university primary degree consistently predicts a substantial further addition to earnings, the increment over school-leaving is also rather lower from 2000 onwards than before. The returns to a higher degree also declined from then on, but by less than the basic degree, while the increment attached to a post-school diploma seems to have held up.

Table 6: Estimated Earnings Equations, All Employees, Selected Years 1994 to 2007

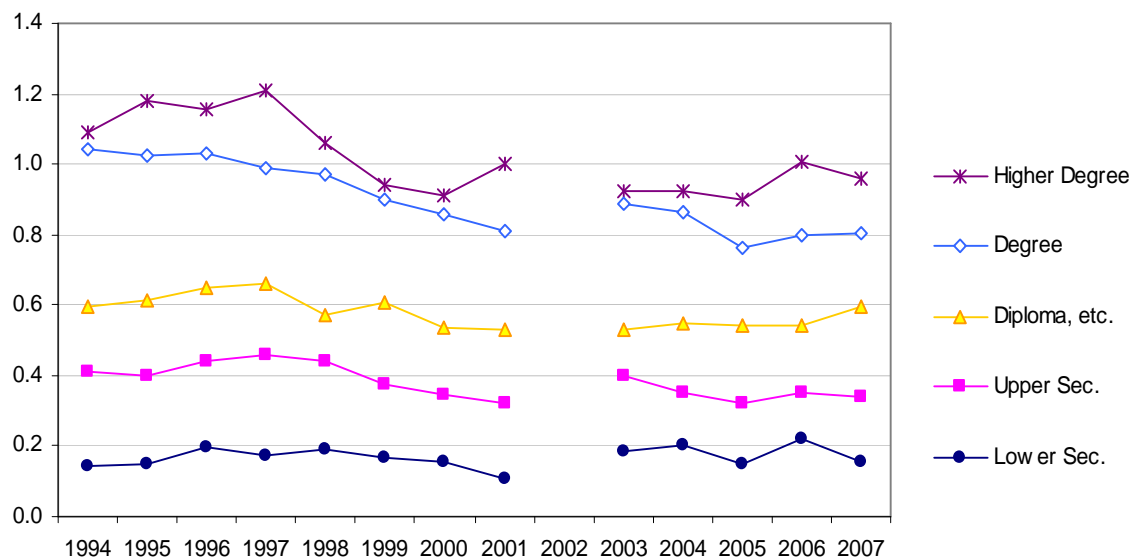
All Employees	1994	1997	2000	2004	2007
Constant	1.463** (0.0348)	1.595** (0.0399)	1.957** (0.0326)	2.005** (0.0290)	2.015** (0.0324)
Lower secondary	0.143** (0.0311)	0.170** (0.0369)	0.155** (0.0311)	0.200** (0.0266)	0.157** (0.0304)
Upper secondary	0.411** (0.0315)	0.457** (0.0368)	0.345** (0.0307)	0.351** (0.0251)	0.339** (0.0285)
Diploma etc.	0.598** (0.0378)	0.663** (0.0425)	0.537** (0.0350)	0.547** (0.0306)	0.594** (0.0333)
Degree	1.040** (0.0361)	0.988** (0.0429)	0.860** (0.0351)	0.863** (0.0306)	0.806** (0.0327)
Higher degree	1.093** (0.0398)	1.210** (0.0475)	0.909** (0.0380)	0.924** (0.0325)	0.960** (0.0342)
Years work	0.0583** (0.00219)	0.0448** (0.00229)	0.0316** (0.00197)	0.0258** (0.00105)	0.0277** (0.00110)
Years work ²	-0.00088** (0.00054)	-0.00055** (6.06e-05)	-0.0004** (5.08e-05)	-0.00024** (1.50e-05)	-0.00023** (1.54e-05)
Female	-0.107** (0.0157)	-0.109** (0.0167)	-0.141** (0.0144)	-0.114** (0.0143)	-0.112** (0.0150)
Observations	3374	2682	3366	3651	3501
Adjusted R-squared	0.493	0.506	0.393	0.355	0.363

Standard errors in parentheses

** p<0.01, * p<0.05

So the pattern of returns for 1994 and 1997 are similar to each other but rather different to those for 2000, while there is then little difference when 2000 is compared with 2004 and 2007. Estimates of the education coefficients for each of the years from 1994 to 2007 (except 2002 for which no data are available) are graphed in Figure 2, and these show that the decline in relative returns to completed schooling and to basic degrees occurred over the period from 1998-2001.

Figure 2: Estimated Returns to Education, 1994-2007



As well as education, experience is the other core predictor of earnings in the human capital model. Returning to the results of the regressions for the entire distribution reported in Table 6, we see that, as well as changes over time in the returns to education, there was a marked downward trend in the return to experience over the period being studied. This was mostly concentrated in the 1994-2000 period, with a relatively small further decline up to 2004 which was partly reversed by 2007. The scale of this decline is

remarkable: the predicted impact of an extra year of work experience on hourly earnings in 2004 or 2007 is only half what it was at the outset in 1994.⁶

The pattern of returns for by gender is also of interest, and Table 7 shows the results of estimating wage equations for male employees over the period. We see that, once again, the most striking features are the decline in the additional returns from completing secondary school or obtaining a third-level qualification from 1997 to 2000, and the declining returns to experience over the period. Corresponding analysis of returns to female employees is more problematic given the need to control adequately for selection into employment, and will not be undertaken here (though see Kelly, McGuinness and O’Connell, 2008, for such an analysis for 1994-2001).

Table 7: Estimated Earnings Equations, Male Employees, Selected Years 1994 to 2007

All Employees	1994	1997	2000	2004	2007
Constant	1.393** (0.0440)	1.586** (0.0520)	1.942** (0.0453)	2.009** (0.0396)	1.974** (0.0428)
Lower secondary	0.166** (0.0378)	0.174** (0.0477)	0.175** (0.0428)	0.176** (0.0363)	0.229** (0.0391)
Upper secondary	0.452** (0.0401)	0.453** (0.0490)	0.340** (0.0438)	0.349** (0.0351)	0.397** (0.0378)
Diploma etc.	0.637** (0.0481)	0.621** (0.0573)	0.483** (0.0515)	0.482** (0.0443)	0.612** (0.0468)
Degree	1.020** (0.0470)	0.990** (0.0574)	0.818** (0.0503)	0.828** (0.0432)	0.827** (0.0440)
Higher degree	1.065** (0.0495)	1.088** (0.0630)	0.962** (0.0530)	0.895** (0.0449)	0.917** (0.0462)
Years work	0.0618** (0.00280)	0.0477** (0.00302)	0.0330** (0.00265)	0.0268** (0.00151)	0.0278** (0.00148)
Years work ²	-0.00090** (6.56e-05)	-0.00062** (7.57e-05)	-0.00042** (6.50e-05)	-0.00025** (2.34e-05)	-0.00023** (1.99e-05)
Observations	1949	1514	1854	1888	1736
Adjusted R-squared	0.490	0.492	0.368	0.334	0.341

Standard errors in parentheses

** p<0.01, * p<0.05

⁶ This takes into account the combined effect of the coefficient on years of work experience and on experience squared.

6. Quantile Regressions

As well as examining returns to education and experience averaged across the entire sample/distribution, in investigating trends in earnings dispersion we are particularly interested in variation in the influences on earnings across different parts of the distribution. This can be explored via the estimation of quantile regressions, whereby quantiles of the conditional distribution of the response variable are expressed as functions of observed covariates (see Koenker and Hallock, 2001). Table 8 shows the results of such regressions, with the same dependent and explanatory variables as before, for the 5 points in the distribution employed earlier – P_{10} , the earnings cut-off below which the bottom 10% fall, P_{25} below which the bottom quarter fall, P_{50} the median, P_{75} above which the top quarter lie, and P_{90} above which the top 10% are found. We concentrate on three years – 1994, 2000 and 2007 – to capture major changes over the period.

Looking across the percentiles in each of the years, we see that the returns to higher levels of education increase as one moves up the distribution, which is the standard pattern found elsewhere. The returns to work experience are also higher further up the distribution in 2000 and 2007, but not in 1994 when the highest return to experience is towards the bottom. The wage “penalty” for women, as captured by the coefficient on the gender dummy, also displays a different pattern in 1994 versus 2000 or 2007, being highest towards the bottom in the first year but not in the other two.

Table 8: Results of Quantile Wage Regressions, 1994, 2000, 2007

a/ 1994	P ₁₀	P ₂₅	P ₅₀	P ₇₅	P ₉₀
Constant	1.008** (0.0965)	1.187** (0.0462)	1.518** (0.0415)	1.687** (0.0441)	1.861** (0.0544)
Lower secondary	-0.00641 (0.0820)	0.129** (0.0394)	0.148** (0.0357)	0.196** (0.0379)	0.332** (0.0428)
Upper secondary	0.296** (0.0846)	0.387** (0.0408)	0.433** (0.0369)	0.450** (0.0391)	0.568** (0.0449)
Diploma etc.	0.452** (0.0950)	0.513** (0.0501)	0.591** (0.0455)	0.717** (0.0492)	0.768** (0.0547)
Degree	0.854** (0.113)	1.096** (0.0501)	1.064** (0.0442)	1.068** (0.0456)	1.167** (0.0528)
Higher degree	1.014** (0.106)	1.090** (0.0520)	1.064** (0.0483)	1.144** (0.0502)	1.275** (0.0589)
years work	0.0692** (0.00530)	0.0647** (0.00285)	0.0549** (0.00259)	0.0576** (0.00287)	0.0475** (0.00379)
years work ²	-0.00121** (0.000137)	-0.0010** (6.78e-05)	-0.00082** (6.27e-05)	-0.00086** (6.89e-05)	-0.00056** (8.64e-05)
Female	-0.136** (0.0440)	-0.115** (0.0217)	-0.111** (0.0192)	-0.0764** (0.0210)	-0.101** (0.0276)
Observations	3374	3374	3374	3374	3374
B/ 2000	P ₁₀	P ₂₅	P ₅₀	P ₇₅	P ₉₀
Constant	1.527** (0.112)	1.739** (0.0505)	1.959** (0.0530)	2.137** (0.0475)	2.301** (0.0731)
Lower secondary	0.189 (0.107)	0.108* (0.0468)	0.163** (0.0490)	0.229** (0.0429)	0.197** (0.0621)
Upper secondary	0.395** (0.109)	0.339** (0.0468)	0.345** (0.0489)	0.424** (0.0428)	0.412** (0.0623)
Diploma etc.	0.513** (0.122)	0.530** (0.0532)	0.549** (0.0572)	0.658** (0.0500)	0.704** (0.0698)
Degree	0.712** (0.130)	0.860** (0.0567)	0.895** (0.0576)	1.025** (0.0499)	0.996** (0.0718)
Higher degree	0.694** (0.145)	0.845** (0.0649)	0.976** (0.0666)	1.041** (0.0598)	1.041** (0.0864)
years work	0.0234** (0.00558)	0.0340** (0.00301)	0.0304** (0.00327)	0.0309** (0.00300)	0.0379** (0.00394)
years work ²	-0.00023 (0.000133)	-0.00045** (7.19e-05)	-0.00035** (7.89e-05)	-0.00038** (7.15e-05)	-0.00054** (9.39e-05)
Female	-0.0968* (0.0417)	-0.139** (0.0227)	-0.165** (0.0243)	-0.164** (0.0226)	-0.159** (0.0337)
Observations	3366	3366	3366	3366	3366

C/ 2007	P₁₀	P₂₅	P₅₀	P₇₅	P₉₀
Constant	1.776** (0.0648)	1.826** (0.0677)	1.944** (0.0487)	2.196** (0.0544)	2.528** (0.0607)
Lower secondary	0.0778 (0.0527)	0.125* (0.0623)	0.177** (0.0440)	0.205** (0.0479)	0.160** (0.0528)
Upper secondary	0.251** (0.0503)	0.335** (0.0583)	0.380** (0.0417)	0.379** (0.0452)	0.274** (0.0512)
Diploma etc.	0.411** (0.0575)	0.535** (0.0655)	0.619** (0.0488)	0.624** (0.0535)	0.511** (0.0578)
Degree	0.441** (0.0712)	0.694** (0.0692)	0.867** (0.0485)	0.931** (0.0532)	0.899** (0.0565)
Higher degree	0.611** (0.0598)	0.861** (0.0695)	1.082** (0.0530)	1.018** (0.0590)	1.006** (0.0705)
years work	0.0158** (0.00243)	0.0238** (0.00221)	0.0302** (0.00165)	0.0308** (0.00198)	0.0299** (0.00208)
years work ²	-0.000119** (2.50e-05)	-0.00020** (2.72e-05)	-0.00025** (2.19e-05)	-0.00026** (3.25e-05)	-0.00026** (2.65e-05)
Female	-0.0807* (0.0315)	-0.107** (0.0299)	-0.127** (0.0231)	-0.103** (0.0261)	-0.122** (0.0289)
Observations	3501	3501	3501	3501	3501

Standard errors in parentheses

** p<0.01, * p<0.05

To help focus on changes in returns over time, we extract the estimated education and work experience coefficients from these quantile regressions for the beginning, middle and end of the period and group them together by percentile in Table 9. The results at the median show the pattern we have already seen, with the return to both secondary school completion and a basic degree rather lower in 2000 and 2007 than they had been in 1994. However, looking at the other percentiles we can now also see that the decline in the return to completing secondary education from 1994 to 2000 is most pronounced for the top decile, and did not occur at the bottom. The decline in returns to a degree, on the other hand, occurred throughout the distribution and, while it was more pronounced from 1994 to 2000, continued in the later period. The return to work experience declined substantially from 1994 to 2000 across the distribution, though the fall was greatest towards the bottom; from 2000 to 2007 it continued falling, though much less rapidly, at P₁₀, P₂₅ and P₉₀ but not for P₅₀ or P₇₅. Note, however, that

Table 9: Quantile Wage Regressions, Key Results, 1994, 2000 and 2007

	1994	2000	2007
<i>P</i> ₁₀			
Lower secondary	-0.006	0.189	0.078
Upper secondary	0.296	0.395	0.251
Diploma etc.	0.452	0.513	0.411
Degree	0.854	0.712	0.441
Higher degree	1.014	0.694	0.611
years work	0.069	0.023	0.016
years work ²	-0.0012	-0.0002	-0.0001
<i>P</i> ₂₅			
Lower secondary	0.129	0.108	0.125
Upper secondary	0.387	0.339	0.335
Diploma etc.	0.513	0.530	0.535
Degree	1.096	0.860	0.694
Higher degree	1.090	0.845	0.861
years work	0.065	0.034	0.024
years work ²	-0.0010	-0.0004	-0.0002
<i>P</i> ₅₀			
Lower secondary	0.148	0.163	0.177
Upper secondary	0.433	0.345	0.380
Diploma etc.	0.591	0.549	0.619
Degree	1.064	0.895	0.867
Higher degree	1.064	0.976	1.082
years work	0.055	0.0304	0.0302
years work ²	-0.0008	-0.000349	-0.00025
<i>P</i> ₇₅			
Lower secondary	0.196	0.229	0.205
Upper secondary	0.450	0.424	0.379
Diploma etc.	0.717	0.658	0.624
Degree	1.068	1.025	0.931
Higher degree	1.144	1.041	1.018
years work	0.058	0.0309	0.0308
years work ²	-0.0009	-0.000379	-0.00026
<i>P</i> ₉₀			
Lower secondary	0.332	0.197	0.160
Upper secondary	0.568	0.412	0.274
Diploma etc.	0.768	0.704	0.511
Degree	1.167	0.996	0.899
Higher degree	1.275	1.041	1.006
years work	0.048	0.0379	0.0299
years work ²	-0.0006	-0.000537	-0.00026

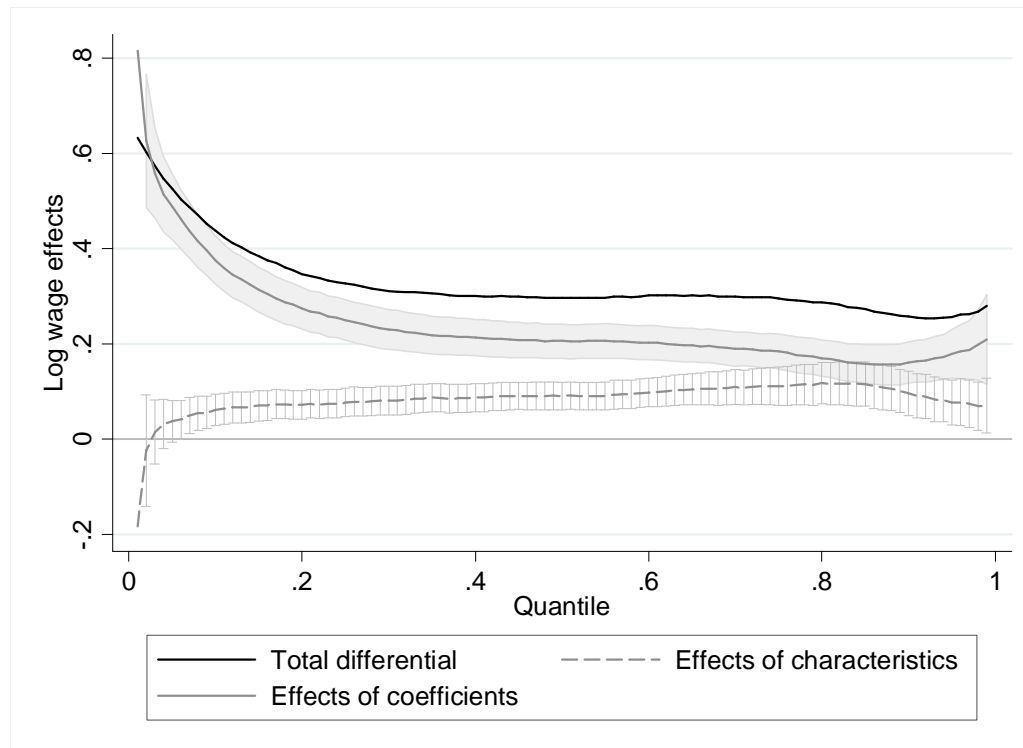
7. Decomposition Analysis

We can now look at the impact on the earnings distribution of changes in the returns to education and experience versus changes in the composition of the workforce in terms of those characteristics, using a decomposition method which allows us to calculate through simulation the impact of each on changes in overall dispersion. Several distinct decomposition approaches have been developed and applied in the literature to the distribution of earnings since the initial procedure employed by Juhn, Murphy and Pierce (1993), which relied on parametric regressions. DiNardo, Fortin and Lemieux (1996) applied a method based on reweighting, extended by Leibbrandt *et al* (2005). Here we employ the approach developed by Machado and Mata (2005), which employs quantile regression and addresses some limitations of those procedures, in particular allowing heteroskedasticity to be taken into account, with the price and quantity terms “adding up” to the observed change. Autor, Katz and Kearney (200?) demonstrate that the Machado-Mata technique nests the other decomposition approaches in use in this literature. A detailed description of the basic procedure is in the original paper by Machado and Mata (2005), and useful discussions are in studies applying extending it such as Autor *et al* (200?), Melly (2007), Azam (2008) and Albrecht, Bjorklund and Vroman (2009).

We now apply this procedure to the earnings micro-data for our Irish samples, using it to decompose the change in earnings from 1994 to 2007. The results for the entire period are presented in graphical form in Figure 3. This shows first of all (in the bold unbroken line) the observed increase over the period in (log) hourly earnings at each percentile of the earnings distribution, where we see the pattern described earlier, earnings increasing most rapidly for those towards the bottom. The figure then shows what that pattern of earnings changes would have been if only returns (the light unbroken line), or only characteristics (the broken line), had changed. The shading around the “returns” and “characteristics” lines represents the 95% confidence interval. The results suggest that towards the bottom of the earnings distribution, where earnings growth was most pronounced, it is changes in the return to characteristics – education and experience – that account for most of the observed changes in earnings. Changes in the composition of the workforce in terms of those characteristics (with returns unchanged) had a positive

impact (except at the very bottom) but played a much smaller role. As we move up the distribution the role of changing characteristics/composition increases but is still less important than changes in returns.

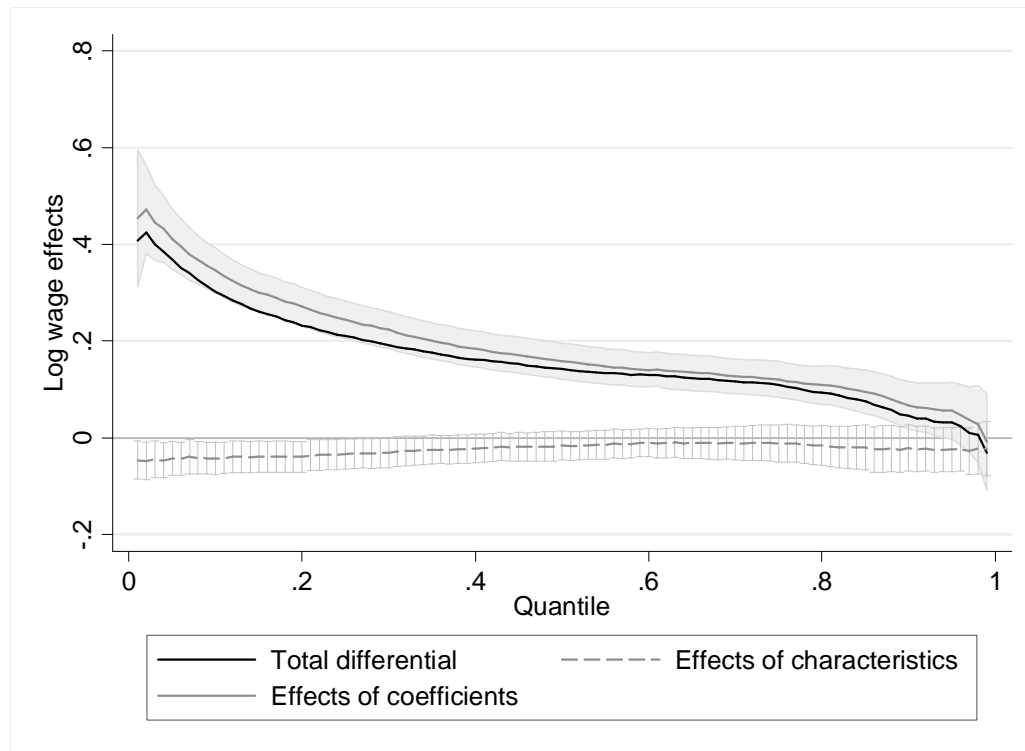
Figure 3: Decomposition of Earnings Change, All Employees 1994-2007



Looking separately at the two sub-periods 1994-2000 and 2000-2007 in these terms then helps to tease out what was happening. Figure 4 shows the decomposition results for the earlier period. The observed increase in earnings now declines steadily as we move up the earnings distribution, and it is this pattern the decomposition seeks to explain or at least account for. We see that it is changes in the return to characteristics that account for almost all of the observed changes in earnings, while changes in the composition of the workforce in terms of those characteristics (with returns unchanged) would have had little impact. Indeed, for the lower parts of the distribution the impact of characteristics may have been negative. Recall, returns to both education and work experience fell markedly over this period, as we saw in Section 6 and 7. This meant that those with higher levels of education and more experience, who tend to be higher up the distribution, saw their

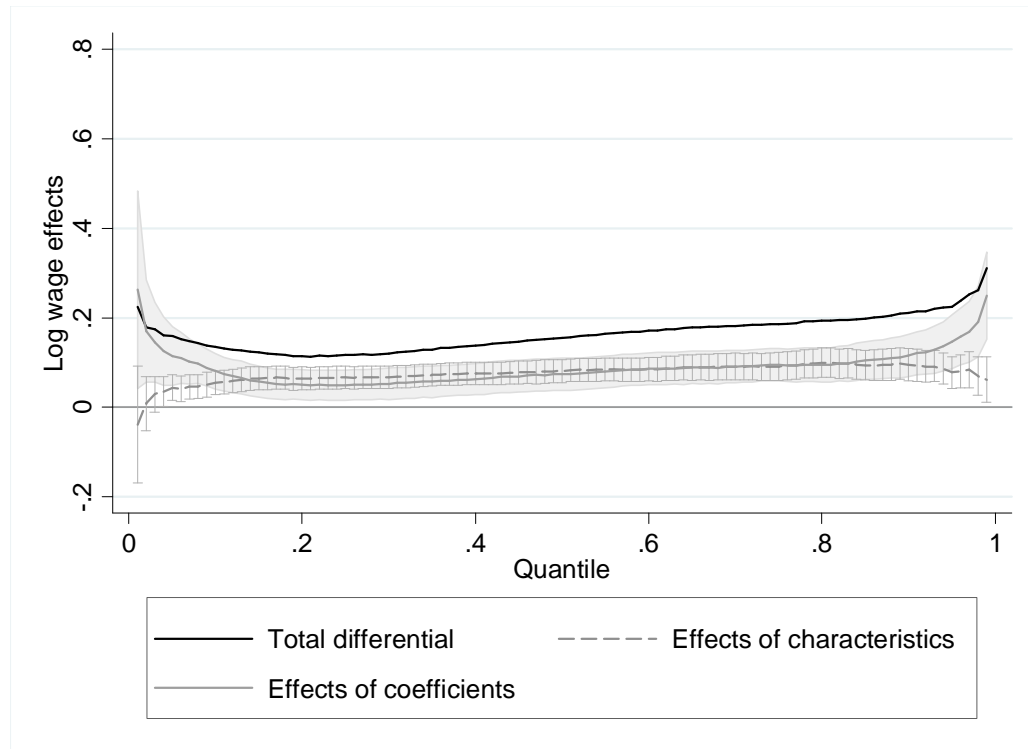
earnings grow less rapidly than would have been the case if those returns had remained unchanged.

Figure 4: Decomposition of Earnings Changes, All Employees 1994-2000 (1994 as base year)



Focusing on 2000-2007, Figure 5 shows the decomposition results. The pattern of earnings change to be accounted for over this sub-period is very different, with the increase in earnings not varying much across the distribution although highest at the very top and bottom. Changes in returns and in characteristics are now equally important across the bulk of the distribution, though changing returns play the larger role at the top and the bottom.

Figure 5: Decomposition of Earnings Changes, All Employees 2000-2007 (2000 as base year)



We can then use these “counterfactual” distributions that would have been produced by a change in returns or in characteristics alone to quantify their impact of the gap between different percentiles in the earnings distribution – for example on the relationship between P90, P50 and P10, which underpin the summary dispersion measures employed earlier. Table 10 shows first the actual values observed for the relevant percentiles and summary measures at the beginning and end of the entire period 1994-2007 and the two sub-periods we have distinguished, and how they changed from the start to the end. It then shows how much they would have changed if only coefficients/returns on education and experience had changed, and the corresponding changes if only the distribution of these characteristics had changed.

Table 10: Decomposition of Wage Inequality Changes into Price and Quantity Components, 1994-2007

Variation between 1994 and 2007					
Percentiles	<i>observed levels (in logs)</i>		<i>Observed difference</i>	<i>coefficient effects</i>	<i>covariate effects</i>
	<i>1994</i>	<i>2007</i>			
10	1.717	2.148	0.431	0.376	0.062
50	2.426	2.720	0.294	0.206	0.091
90	3.280	3.534	0.254	0.161	0.097
90-10	1.563	1.386	-0.177	-0.215	0.035
90-50	0.854	0.814	-0.040	-0.045	0.006
50-10	0.709	0.572	-0.137	-0.169	0.029

Variation between 1994 and 2000					
percentiles	<i>observed levels (in logs)</i>		<i>Observed difference</i>	<i>Coefficient effects</i>	<i>covariate effects</i>
	<i>1994</i>	<i>2000</i>			
10	1.717	2.039	0.322	0.346	-0.043
50	2.426	2.568	0.142	0.158	-0.016
90	3.280	3.308	0.028	0.067	-0.020
90-10	1.563	1.269	-0.294	-0.278	0.023
90-50	0.854	0.740	-0.114	-0.091	-0.004
50-10	0.709	0.529	-0.180	-0.187	0.027

Variation between 2000 and 2007					
percentiles	<i>observed levels (in logs)</i>		<i>Observed difference</i>	<i>Coefficient effects</i>	<i>covariate effects</i>
	<i>2000</i>	<i>2007</i>			
10	2.039	2.148	0.109	0.081	0.054
50	2.568	2.720	0.152	0.074	0.081
90	3.308	3.534	0.226	0.116	0.095
90-10	1.269	1.386	0.117	0.035	0.041
90-50	0.740	0.814	0.074	0.042	0.014
50-10	0.529	0.572	0.043	-0.007	0.027

We see that comparing 2007 with 1994, the change in coefficients/returns which occurred would in itself have produced a very substantial reduction in the gap between P_{10} and P_{90} – indeed, even larger than actually took place. The change in characteristics worked modestly in the opposite direction, but it was the changing pattern of returns that was the

dominant influence. Most of the fall in the gap between P_{10} and P_{90} was between P_{10} and P_{50} , and once again it is the estimated impact of changing returns that accounts for most of this narrowing.

When we compare 2000 rather than 2007 with 1994, the middle panel of the table shows a more pronounced version of the same pattern. The change in returns in itself now produces an even larger narrowing of the gap between P_{10} and P_{90} - and between P_{10} and P_{50} - than over the whole period. The changing distribution of characteristics has an even more modest impact in the opposite direction than over the entire period.

Looking at the later sub-period, from 2000 to 2007, it is an increase rather than a narrowing of these gaps that must be accounted for, dominated by a widening in the top half of the distribution. We see that the change in returns had a very different impact than from 1994 to 2000; in itself it would now have produced some increase in the gap between P_{10} and P_{90} . The impact of changing characteristics was now similar in direction to that of returns, but the widening gap between top and middle predominantly reflecting the effects of changing returns. This may be surprising given the results from the estimated quantile earnings functions presented in Section 6, which showed that the returns to completing schooling, a post-school diploma or university degree, and to experience, all declined from 2000 to 2007 towards the top of the distribution, i.e. at P_{90} . However, note that the intercept in the estimated earnings function for that quantile increased from 2000 to 2007 (see Table 8). The decomposition method attributes the impact of such an increase in the intercept to “prices” rather than composition, although it is the return to some characteristic or set of factors not included in the model – i.e., other than education, experience or gender.

In addition to looking at the two halves of the boom divided at the year 2000, it is also of interest to look within those at the sub-period 199-1997 versus 1997-2000, and 2000-2004 versus 2004-2007, and the results of decompositions these sub-periods using the same methods are given in the Appendix.

8. Key Factors at Work

To reiterate, our analysis of Irish survey data year-by-year from 1994 to 2007 has shown some dramatic changes in the extent and patterning of wage inequality over that period of spectacular economic growth. The widely-used P_{90}/P_{10} summary dispersion measure fell very sharply indeed between 1997 and 2000, from 4.8 to 3.6, a scale of change rarely seen internationally, and had risen back up to 4 by 2007. Distinguishing trends toward the bottom and those towards the top that contributed to these movements is crucial. The key changes that require explanation are then that the bottom decile was stable for much of the period but jumped from 0.51 to 0.59 of the median between 1999 and 2000, whereas the top decile fell from 2.33 to 2.10 times the median between 1997 and 2000, then rose back to 2.26 by 2007. With trends in dispersion up to 2000 so different from those which followed, we can usefully contrast the two halves of the Irish boom and ask why they saw such different wage inequality trends.

Looking first at trends over the earlier part of the boom, this in turn can be broken into two sub-periods, with Section 4 observing a period of stability in earnings dispersion from 1994 to 1997 followed by one of major change, with dispersion narrowing dramatically as both the bottom and the top of the distribution moved markedly closer to the middle by 2000. At the same time, Section 5 found that the returns to higher levels of education were also rather stable from 1994 to 1997 but had fallen by 2000, with a marked downward trend in the return to experience. Economic growth was rapid throughout the years from 1994 to 2000 and the numbers in employment were increasing substantially, with unemployment declining steadily and others previously inactive moving into work. Net out-migration, substantial in the 1980s and into the 1990s, fell away from 1994-96, and a net inflow of people from abroad to work in Ireland then became substantial for the first time.

Previous Irish studies have suggested that immigration of skilled and experienced workers – particularly returning Irish migrants – may help to explain the stability and then decline in the returns to education during these years, rather than the increases one might otherwise expect to accompany rapid economic growth. Studies focused on

migration into Ireland⁷ have shown that immigrants were relatively young and highly educated during this period. The availability of skilled workers from the broader labour pool that included Irish people working in Britain and the USA in particular, together with the substantial and increasing inflow of educated young people coming from the Irish education system, can clearly help to explain the fact that earners towards the top did not pull away from the middle of the distribution. Our decomposition analysis showed clearly that it was the decline in returns to higher education and experience from 1997 to 2000 that accounted fully for the fall in the P90/median ratio over those years rather than any effect of changing workforce composition, consistent with this line of argument. Indeed, for the lower parts of the distribution the impact of composition was if anything negative – consistent with the return to work of relatively inexperienced or uneducated persons previously unemployed or inactive as the labour market tightened.

Looking towards lower earners, the factors that reduced pressure on returns to higher education/skills would also have kept downward pressure on the cost of producing in Ireland, thus helping to fuel economic growth and the demand for unskilled labour. Under this interpretation, the rapidly expanding Irish economy required both high and low-skilled labour, so that skill-biased technological change was not the dominant factor.⁸ Low skilled wages were kept up by the scale of demand as employment increased rapidly across all skill levels. In addition, McGuinness *et al* (2009) have suggested that the introduction of the minimum wage in 2000 could also have contributed, especially for women. In assessing its role, the fact that we are able to track the evolution of earnings year-by-year here (whereas they relied on a comparison between 1997 and 2001) is particularly valuable. Returning to Table 3, we can see that the sharp rise in the bottom decile as a proportion of the median over the 1994-2000 period was in fact almost entirely concentrated in the transition from 1999 to 2000. This certainly supports the

⁷ Barrett, Bergin and Duffy (2006), Barrett and McCarthy (2007), Barrett and Duffy (200?), Barrett, McGuinness and O'Brien, (2008).

⁸ Barrett *et al*, (2002) and McGuinness *et al*, (2009) show this to be consistent with simulation of a simple model distinguishing skilled and unskilled labour but treating them as complements, and comparing outcomes with and without significant immigration.

notion that the introduction of the national minimum wage played a role, but it merits more intensive examination.

The level of hourly earnings cutting off the bottom decile – P_{10} - was (the equivalent of⁹) €4.46 in 1999, whereas in the 2000 sample it had risen to €5.93. The minimum wage was introduced in April of 2000 at €5.59. So it seems reasonable to assign a substantial role to the minimum wage in producing that increase. On the other hand, while the increase in earnings from 1999 to 2000 was highest around that point in the distribution, it was also above-average elsewhere in the bottom half of the distribution. The increase in nominal hourly earnings at P_{10} was 33%, but at P_{10} it was still 20%, and at P_{30} it was 18%, compared with 15% at the median. While the minimum wage could be expected to have some “spill-over” effect, this might not fully account for this above-average increase. So we may conclude that it was a combination of strong demand for low-skilled workers as employment levels rose and the introduction of the minimum wage at a relatively high level that produced the observed rise in low versus median earnings. It is also worth noting that while the sample in the Living in Ireland Survey was substantially supplemented in 2000, the increase in P_{10} relative to the median in the overall sample was also seen in the continuing sample alone, and so was not simply a product of sampling factors.

This combination continues to be critical when we turn to the period from 2000 to 2007. Now, it is stability or marginal decline in the P_{10} /median ratio that is observed. The minimum wage was increased over time broadly in line with median earnings, and as Table 11 shows P_{10} and the minimum wage evolved in a very similar fashion up to 2007. Indeed, if we focus on P_{10} for women, which is below that for men, this moved even more closely in line with the minimum wage, as is clearly seen from Figure 6. So the minimum wage seems to have effectively anchored the bottom of the distribution relative to the median over these years. The importance of the timing of the introduction of the minimum wage in the middle of a boom has to be emphasised: the fact that

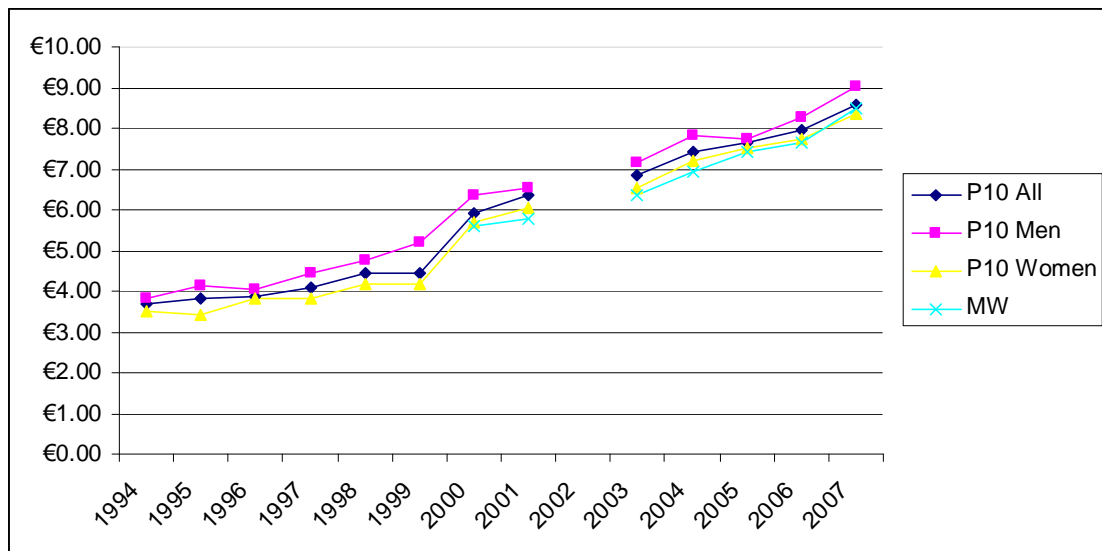
⁹ The IR£ was the currency at the time, but for convenience in looking across the entire period we convert all amounts to euro throughout.

unemployment stayed very low throughout means that strong demand for low-skilled workers allowed this anchoring to be achieved without creating a substantial loss for unemployed “outsiders” to balance the gain for “insiders” in employment.

Table 11: Low Earnings and the Minimum Wage

	Bottom decile cut-off, €			Minimum Wage
	P ₁₀ All	P ₁₀ Men	P ₁₀ Women	
1994	3.69	3.84	3.49	
1995	3.81	4.15	3.41	
1996	3.87	4.06	3.81	
1997	4.10	4.43	3.81	
1998	4.44	4.76	4.18	
1999	4.46	5.19	4.16	
2000	5.93	6.35	5.67	5.59
2001	6.35	6.52	6.06	5.79
2002				
2003	6.85	7.14	6.55	6.35
2004	7.44	7.82	7.18	6.95
2005	7.65	7.75	7.50	7.43
2006	7.98	8.25	7.75	7.65
2007	8.57	9.00	8.34	8.48

Figure 6: Earnings at the Bottom Decile and Level of the Minimum Wage



This is particularly striking in the period from 2004, when immigration reached new heights as substantial numbers came from the new member states of the EU to work in Ireland. These immigrants from the EU-10 had a lower level of educational attainment

than other migrants (though not than natives), and faced particularly large occupational and earnings penalties when compared with similarly-aged and educated natives. Many worked in unskilled and semi-skilled jobs, increasing the supply of labour available for those jobs, and yet only a modest decline in the bottom decile relative to the median was seen in 2005-2007.¹⁰

Over the 2000-2007 period, it is trends in the top half of the distribution that capture the attention, with the top decile rising from 2.10 to 2.26 times the median. This has something in common with the pattern of wage inequality in the USA from the early 1990s as analysed in Lemieux (2005) and Autor, Katz and Kearney (2008): the gap between top and bottom is rising but primarily because of what is happening at the top rather than the bottom. Our decomposition analysis over the whole period 2000-2007 showed that both the evolution of returns to characteristics and the changing composition of the workforce in terms of those characteristics contributed to this pulling away of the top from the middle. However, returns rather than composition were the major contributor, and this is most obvious when we look at the sub-period decomposition for 2004-2007 (see Figure A4 in the Appendix), when most of the increase in the top decile relative to the median took place.

As noted earlier, the quantile regressions showed returns to most education levels and to experience declining from 2000 to 2007 towards the top of the distribution, so this “price” effect reflects an increase in the intercept in the estimated earnings function around P_{90} . A number of possible contributory factors suggest themselves, in the light of the evolution of the macroeconomy over the period. We saw that the employment structure altered significantly in the second versus the first half of the boom, with construction, health and education and public administration becoming more important, and 2004-2007 was the peak of the consumption and property-led phase of the boom. Some support for the notion that the sectoral shift played a role is provided by the finding that when sectoral dummies are included in the estimated P_{90} earnings function, the

¹⁰ See Barrett, Bergin and Duffy (2006), Barrett and McCarthy (2007), Barrett and Duffy (2007), Barrett, McGuinness and O’Brien, (2008).

coefficients on education and experience are more stable and the intercept no longer increases from 2000 to 2007. Occupation also seems to play a more important role by the end of the period, with the estimated return to being an employer or manager or a professional (controlling for education and experience) increasing. With growth in public sector employment so important, the wage-setting processes for the public sector outlined in Section 2 above could also have played a part. Unfortunately public versus private sector employees are not readily distinguished in the SILC dataset for these years; using an imperfect proxy based on reported pension contributions, it does not appear that the evolution of public sector pay played a key role towards the top of the overall distribution. Further exploration of the factors at work towards the top of the distribution during these years, focusing on the evolution of occupational and sectoral differentials as well as the nature of immigration and its impact on higher earnings, is an important priority.

9. Conclusions

Rapid economic growth is often expected to lead to increased returns to education and skills and thus to rising wage inequality. Recent research for the USA has shown that the picture is often more complicated, with institutions as well as shifts in demand for and supply of skills needing to be taken into account, and wage trends towards the bottom and the top needing to be distinguished. Ireland offers a valuable case study in this context, with distinctive wage-setting institutions and exceptional rates of growth in output, employment and incomes in the Celtic Tiger period from 1994 to 2007 studied here. Our key finding with respect to the evolution of (hourly) wage inequality among all employees is dispersion overall fell very sharply indeed to 2000, before rising somewhat up to 2007. The bottom decile was stable 1994-99, rose from 0.51 to 0.59 of the median from 1999 to 2000, and by 2007 was 0.56; the top decile fell from 2.33 to 2.10 times the median from 1997 to 2000, then rose back to 2.26 by 2007.

Over the entire period declining returns to both education and work experience meant that those with higher levels of education and more experience, who tend to be higher up the distribution, saw their earnings grow less rapidly than others. These declining returns

may be associated with the substantial immigration of relatively highly skilled workers attracted by the availability of jobs in a very rapidly expanding economy. The increase in the bottom decile relative to the median was also seen to be related to the introduction of the minimum wage in 2000, anchoring the bottom of the distribution at a higher proportion of the median from then onwards. For 2000-2007 the increase in higher earnings may be associated with the changing pattern of immigration and of the employment growth in the second half of the boom, with further exploration of these factors a priority.

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Appendix: Decomposition Analysis by Sub-Periods 1994-2007

Figure A1: Decomposition of Earnings Changes, All Employees 1994-1997

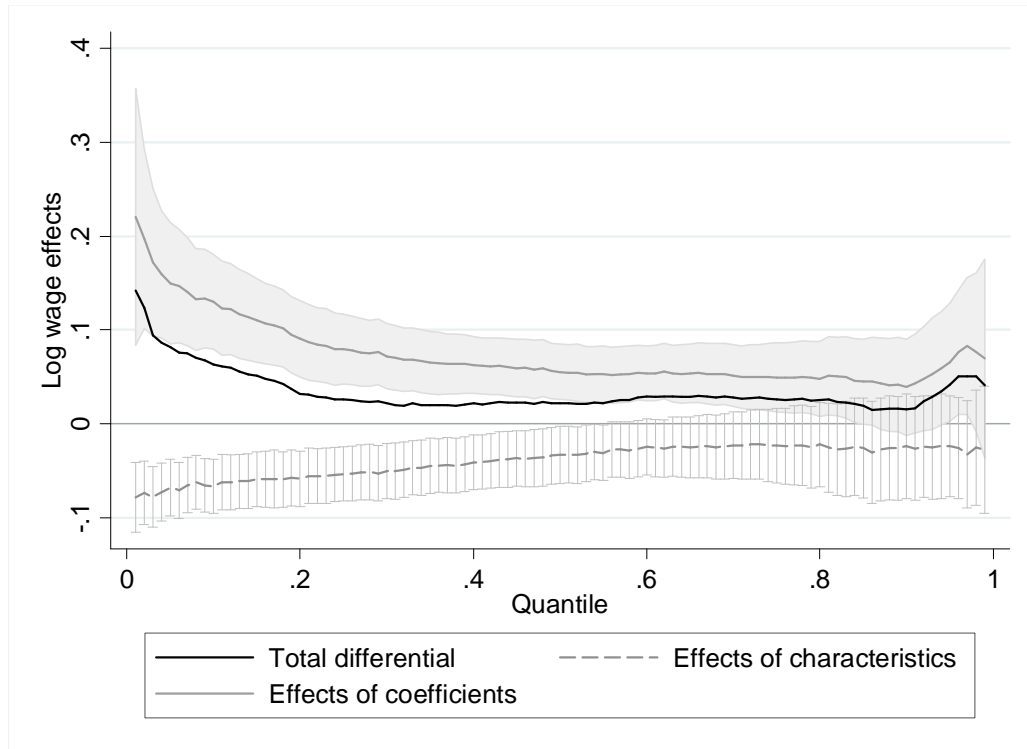


Figure A2: Decomposition of Earnings Changes, All Employees 1997-2000

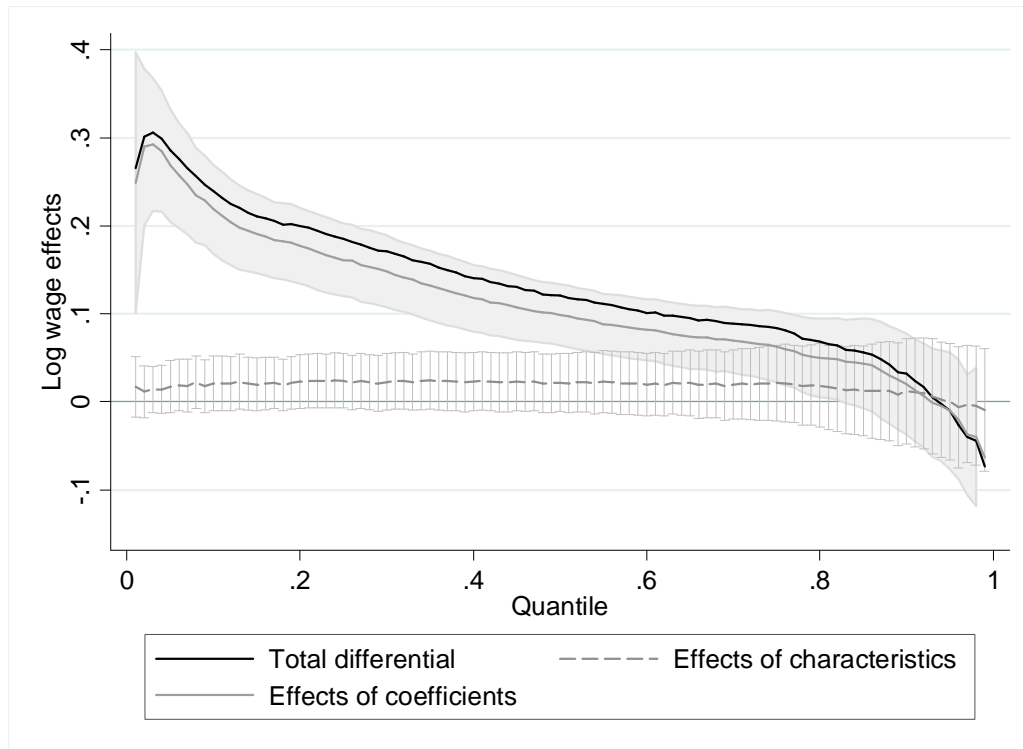


Figure A3: Decomposition of Earnings Changes, All Employees 2000-2004

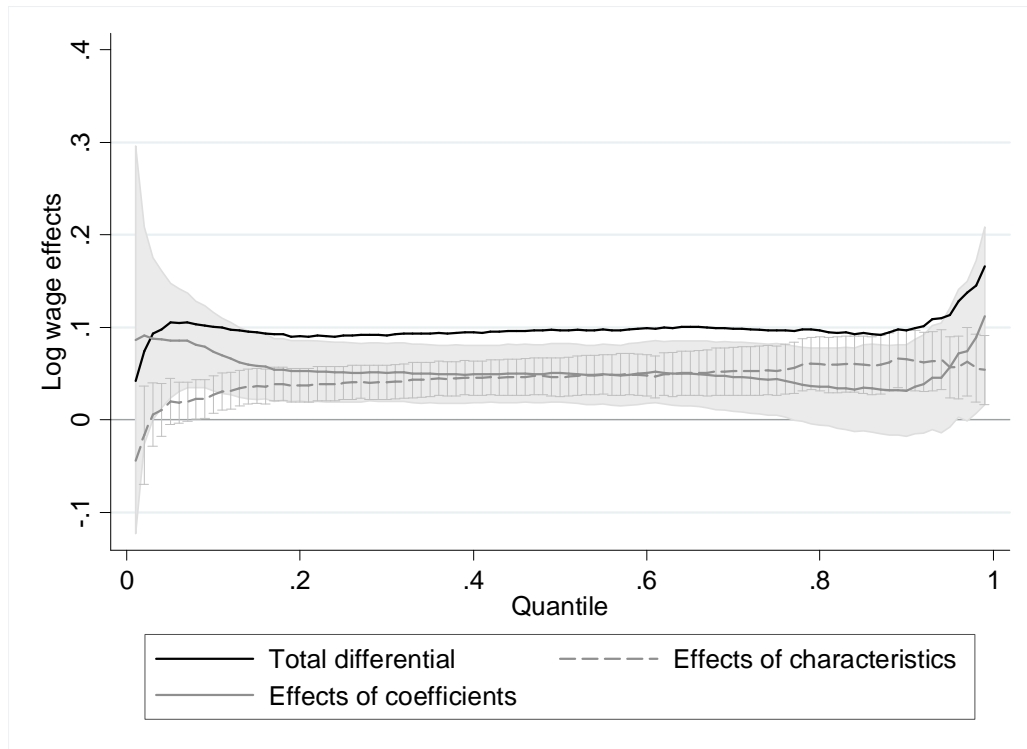


Figure A4: Decomposition of Earnings Changes, All Employees 2004-2007

