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**Working Paper**

## Economic Explanations of Earnings Distribution Trends in the International Literature and Application to New Zealand

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# TREASURY WORKING PAPER

00/16

## **Economic Explanations of Earnings Distribution trends in the International Literature and Application to New Zealand**

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### **ABSTRACT**

This report, commissioned by the Treasury, reviews the international and New Zealand evidence on trends in the distribution of earnings over the past 20 years. It assesses the international evidence on the strength of the various explanations for changes in the earnings distribution. It concludes with suggestions on how the trends in the earnings distribution in New Zealand might be further analysed.

Considerable variation has occurred in trends in the distribution of earnings between industrialised economies, with English speaking countries showing the greatest increases in earnings inequalities, and European countries showing the least. The New Zealand evidence also shows a growth in earnings inequality, and indicates that this has been due to both growth in inequality in wage rates and in weekly hours of work. Trends in earnings inequalities together with changes in the distribution of employment appear to explain much of the movement in income inequality in New Zealand.

The international literature has attributed changes in the distribution of earnings to labour supply side factors (eg, education, age, gender), demand side factors (eg, technological change, international trade), and institutional factors (eg, union effects, labour market regulation). The relative importance of these effects differs between countries. In the United States, where the most detailed analysis has taken place, about one third of the increase in overall earnings inequality can be explained by widening earnings differentials between education/experience groups; and another one-third by institutional factors, primarily declines in the value of minimum wages, and declines in union density. Possible (untested) explanations of the remaining increase include increasing returns to unobserved cognitive or inter-personal skills, and changing social norms. The evidence suggests that the growth in inequality between groups of workers with different levels of educational attainment and experience can be best explained by changes in the demand for and supply of skills. Changes in the relative demand for skill categories appear to be mainly explained by technological change.

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**TABLE OF CONTENTS ..... PAGE**

**ABSTRACT ..... 1**

**EXECUTIVE SUMMARY..... 4**

**1. Introduction..... 9**

**2. Conceptual framework..... 10**

**3. Trends in the distribution of earnings ..... 15**

**a. International evidence..... 15**

        a.i. Overall earnings inequality ..... 15

        a.ii. Between-group inequality ..... 20

        a.iii. Decomposition analysis of the sources of earnings inequality ..... 22

        a.iv. Other aspects of inequality relating to work ..... 23

        a.v. Earnings mobility ..... 23

        a.vi. Effect of earnings inequality on income inequality ..... 24

**b. New Zealand evidence..... 25**

        b.i. Overall earnings inequality ..... 25

        b.ii. Between-group inequality ..... 26

        b.iii. Decomposition analysis of the sources of earnings inequality ..... 27

        b.iv. Earnings mobility ..... 28

        b.v. Effect of earnings inequality on income inequality ..... 28

**4. Causes of changes in the distribution of earnings..... 30**

**a. General framework ..... 31**

**b. Supply-side factors ..... 35**

        b.i. Educational attainment..... 35

        b.ii. Experience/Age cohorts ..... 35

        b.iii. Immigration..... 35

        b.iv. Female labour force participation ..... 36

        b.v. Labour quality ..... 36

**c. Demand-side factors ..... 36**

        c.i. Deindustrialisation ..... 36

        c.ii. International trade ..... 37

        c.iii. Technological change..... 40

        c.iv. Cost of capital..... 43

**d. Institutional factors ..... 43**

        d.i. Union effects ..... 43

        d.ii. Labour market regulation..... 44

        d.iii. Other government regulation and product market rents..... 44

        d.iv. Other institutional factors..... 45

**5. Evidence on causes of changes in the distribution of earnings ..... 46**

**a. General type studies ..... 46**

**b. Supply factors ..... 51**

        b.i. Education/Experience..... 51

        b.ii. Immigration..... 51

        b.iii. Female labour force participation ..... 52

        b.iv. Labour quality ..... 53

**c. Demand factors..... 54**

        c.i. Deindustrialisation ..... 54

        c.ii. International trade ..... 55

        c.iii. Technological change..... 58

<b>d. Institutional factors</b> .....	62
d.i. Union effects .....	62
d.ii. Labour market regulation .....	63
d.iii. Other government regulation .....	64
<b>e. Summary</b> .....	65
<b>6. Future research on New Zealand – A suggested agenda</b> .....	<b>67</b>
<b>a What is known about changes in earnings inequality in New Zealand?</b> .....	67
<b>b. What to do - Introduction</b> .....	68
<b>c. What to do – A possible research strategy</b> .....	69
<b>References</b> .....	<b>73</b>
<b>TABLES</b> .....	<b>83</b>
<b>NOTES ON TABLES:</b> .....	<b>100</b>
<b>FIGURES</b> .....	<b>90</b>

## **EXECUTIVE SUMMARY**

### ***Purpose***

This report reviews the evidence on the trends that have been occurring in the distribution of earnings over the past 20 years – both in New Zealand and internationally. It sets out the possible explanations for these changes in the earnings distribution. The international evidence (principally for the US) on the strength of these various explanations is then summarised. The report concludes with suggestions on how the causes of changes in the earnings distribution in New Zealand might be further analysed.

### ***Focus on Labour Market Earnings***

The distribution of earnings is only one dimension of labour market outcomes, but it is a major determinant of the distribution of income in society. Another dimension is the distribution of employment. Trends in earnings inequalities, together with changes in the distribution of employment, explain much of the movement in income inequality. Generally, the extent to which labour market adjustment occurs through the distribution of earnings or through effects on employment appears to depend critically on the institutions present in a country.

### ***Country Trends***

Considerable variation has occurred in the trends in the distribution of earnings between industrialised economies. There are difficulties in deriving standardised data for making cross-country comparisons. However, English-speaking countries have had the greatest increases in earnings inequalities, while European countries appear to have had the least. There have also been trends in the level of inequality between groups in the labour market. Thus, the gender wage differential has narrowed, although the magnitude and timing of that narrowing has differed between countries. Earnings differentials have also increased between workers with different levels of educational attainment, and between workers in different age and experience groups.

The New Zealand evidence also shows a growth in earnings inequality, particularly in the periods 1986 - 1990 and 1995 – 1997. The evidence indicates that increases in weekly earnings inequality were significantly larger than in hourly wage inequality. This stems from the growth in both the inequality in wage rates and in the weekly hours of work. In terms of trends in inequality between groups, while the gender wage gap has narrowed (from about 16% in 1984 to about 9% in 1997), there is less evidence of increasing earnings differentials by levels of educational attainment or by differences in age/experience than for many other countries.

### ***Factors Influencing the Distribution of Earnings***

The international literature has attributed the causes of these changes in the earnings distribution to three broad groups of factors:

- *labour supply side factors*: The main factors here are educational attainment (an easily measured proxy for worker skill); experience/age (measuring both size of birth cohorts and experience related earnings growth); immigration (and its effect on the wages of affected skill groups); and female labour force participation.
- *demand side factors*: Significant factors here include de-industrialisation (and the shift of labour into the service sector); international trade (particularly the effect of imports from developing countries on the wages of low skilled labour in the importing industrialised countries); and technological change (such as the effect of information technologies on the demand for skilled labour).
- *institutional factors*: Important factors here include union effects (reflecting significant reductions in union density over the period); labour market regulation (particularly the presence of minimum wages and the degree of centralisation in wage bargaining); and the regulation of product markets (and the impact on economic rents).

### *International Evidence on Causes*

The most detailed analysis of the causes of trends in earnings distributions has taken place in the United States. The evidence presented in this report therefore relates mainly to that country. In summary, for the United States:

- about one third of the increase in overall earnings inequality can be explained by widening earnings differentials between groups of workers with different levels of education and experience;
- the growth in inequality between groups of workers with different levels of educational attainment and years of experience is reasonably well explained by changes in the demand for and supply of skills. Institutional factors do not appear to have had a strong role in explaining the changes in between group inequality;
- changes in the relative demand for education/skill categories appear to be mainly explained by technological change, with international trade having a much smaller effect.

International evidence on the causes of changes in the earnings differentials amongst workers with the same level of education and years of experience relates mainly to the role of institutional factors. Studies of the effects of union density (for a range of countries) and the minimum wage (primarily for the United States) explain up to about half of the changes in the within group earnings inequality. The other half is left unexplained. Possible explanations are of two main types: first, changes in the unmeasured distribution of skills not well captured by formal education or experience; and, second, changes in other institutional factors not included in the analysis.

Thus, again for the United States:

- another one-third of the overall earnings inequality is explained by specific institutional factors, primarily declines in the value of minimum wages, and declines in union density; and
- the final third of the overall earnings inequality is unexplained, but thought to be caused by unobserved factors such as cognitive or inter-personal skills or other institutional factors.

The relative importance of these three sets of factors in explaining movements in earnings inequality differs between countries. In Australia, for example, virtually none of the increase in earnings inequality is explained by changes in earnings differentials between education/experience groups. Further, existing explanations can account for only about one fifth of the changes in within group earnings inequality. Thus, only about one fifth of the overall earnings inequality can be explained.

### ***Opportunities for Further Analyses of New Zealand Data***

Research to date into the distribution of earnings in New Zealand has been largely descriptive. Little research appears to exist on the cause of changes in earnings inequality – of the kind that has been undertaken for the US. A possible research strategy is proposed, taking into account both ease of analysis and availability of data.

A first step could be to apply a methodology that would allow an exploration of the role of demand and supply-side factors in causing changes in relative earnings between different groups of workers. This could be done for New Zealand alone or in a cross-country context for both New Zealand and Australia. This work could then be extended to look at the factors influencing changes in the demand for or the supply of labour by skill categories. Such analyses would allow the impacts of the changes in labour force participation between 1986 and 1996 on changes in earnings inequality, or the effects of liberalisation in international trade, to be explored. Approaches also



exist to explore the responsiveness of earnings and employment status to changes in labour demand.

## 1. INTRODUCTION

This report has three main objectives:

- To summarise international evidence on trends in the distribution of earnings over the past twenty years.
- To review possible explanations for changes in the earnings distribution, and assess international evidence on the validity of the alternative explanations.
- To discuss the extent to which factors identified in the international literature might explain changes in the distribution of earnings in New Zealand, and to suggest possible methods for undertaking empirical analysis on this topic.

Section 2 presents a conceptual framework for thinking about the concept of earnings inequality. Specifically, it presents a framework that summarises the main potential determinants of earnings inequality, discusses the relation between earnings inequality and social welfare. Section 3 provides an overview of descriptive evidence on recent changes in earnings inequality for a range of industrialised economies including New Zealand. Section 4 presents a review of the determinants of individual earnings, and uses a taxonomy developed from that review to discuss potential causes of changes in earnings inequality. Section 5 reviews empirical evidence that has attempted to distinguish the relative explanatory power of each potential causal factor. Finally, section 6 presents a range of ideas for how research on the causes of increases in earnings inequality in New Zealand might be undertaken.

## 2. CONCEPTUAL FRAMEWORK

The determinants and consequences of the distribution of labour market earnings in an economy can be understood using a fairly simple analytic framework. A possible framework is presented in Figure 1. In this framework the distribution of earnings is one dimension of what are classified as ‘Labour market outcomes’. The determinants of labour market outcomes are a set of ‘Causal factors’, and labour market outcomes determine ‘Social welfare outcomes’ such as the distribution of income.

Individual agents in the labour market are – on the supply-side - a set of potential workers who can supply labour inputs to production. Considerable heterogeneity is likely to exist between workers in the skills that are embodied in their labour inputs, and their demographic characteristics. On the demand side individual agents are firms that require a set of production tasks to be completed in order to produce final output. Firms will organise the required set of labour inputs into jobs. As workers differ in their skills it is likely that the productivity of individual workers will differ between jobs. Assignment of workers to firms can be thought of as occurring through a matching process whereby workers are allocated to jobs (and some workers and jobs may remain unmatched at any point in time).

Each match between a worker and firm involves those parties agreeing to terms of the employment relation – wages to be paid to the worker; hours of work; tasks to be performed; and job ‘quality’ (other dimensions of the job that affect the worker’s welfare). Aggregating over all matches in the economy at a point in time gives rise to a distribution of earnings between workers; a distribution of jobs across potential workers; and a distribution of job quality.

Three main points from the conceptual framework warrant emphasis and some further discussion:

1. The main determinants (causal factors) of the distribution of earnings can be usefully classified as demand factors, supply factors, and institutions. In this report four main types of institutional factors are identified:

- a) Collective organisation – for example, the role of trade unions in the labour market;
- b) Government regulation of wage setting through minimum wage provisions, and through regulation of the locus of wage bargaining (ie, degree of centralisation);
- c) Other government regulation such as product market regulation, and its role as a producer of public sector output; and
- d) Other institutional factors such as social norms.

2. The distribution of earnings between individual workers is one dimension of what has been defined as labour market outcomes. Other outcomes are the distribution of employment (persons employed, and hours of work), and job quality. These outcomes also constitute the set of adjustment or equilibrating mechanisms in the labour market. Changes in supply or demand conditions will therefore generally cause changes in some or all of the distribution of earnings, distribution of employment, or job quality.

Generally, the extent to which adjustment occurs through changes in the distribution of earnings (prices) or in employment (quantities) has been seen to depend critically on institutions. For example, Freeman and Katz (1994, p.44) argue that:

“In a world in which the labour market is not a bourse, identical shifts in supply and demand will have different wage and employment consequences, depending on the wage-setting institutions or pay-setting norms in a country and on its education and training institutions. The stronger the role of institutions in wage determination, the smaller will be the effect of shifts in supply and demand on relative wages and, as a consequence, the greater will be their effect on relative employment. In addition, education and training institutions also mediate the effect of market forces on wages and employment. They determine the level of workplace skills for the less educated workers and the degree to which more and less skilled workers can be substituted for each other in production. A more egalitarian distribution of skills should dampen the effects of market shifts on wages and employment.”

A range of supporting empirical research that suggests institutions are an important determinant of cross-country differences in earnings inequality and rates of unemployment does exist. For example, studies by Blau and Khan (1996) and OECD

(1997) have shown that the degree of centralisation in wage bargaining is inversely related to earnings inequality; and Nickell (1997) and Blanchard and Wolfers (1999) show that differences in union density, employment protection regulations, and unemployment benefits can explain cross-country differences in the rate of unemployment between OECD countries.

Interestingly however, there is not strong evidence that countries where institutions cause lower earnings dispersion (or smaller changes in earnings dispersion) are the same countries where institutions are causing higher rates (or larger increases in the rate) of unemployment. Although there are not many studies that have sought to address this issue, what studies that do exist tend to conclude that changes in the distribution of earnings and in employment outcomes are not correlated across countries. For example, Card et al. (1996) conclude from an analysis of individual-level data for the 1980s that:

“...the same forces that led to falling real wages for less-skilled workers in the U.S. affected similar workers in Canada and France. Consistent with the view that labor market institutions are more rigid in France [than Canada], and more flexible in the U.S. [than Canada], we find that relative wages of less-skilled workers fell the most in the U.S, fell somewhat less in Canada, and did not fall at all in France. Contrary to expectations, however, we find little evidence that wage inflexibilities generated divergent patterns of relative employment growth across the three countries.”

Similar conclusions are reached in Nickell and Bell (1995), and OECD (1997, chapter 3).

In this report the focus will be on determinants of changes in the distribution of earnings, and the issue of the relative adjustment of earnings and employment to changes in supply and demand conditions will not be addressed further. Nevertheless, this is clearly an important topic that is relevant for understanding the overall role of institutions in the labour market, and for understanding the determinants of unemployment. Therefore in the concluding section some suggestions are made for research on the topic.

3. The distribution of earnings is one determinant of the distribution of income in society, and hence changes in the distribution of earnings have potentially important

consequences for social welfare. Furthermore, where individuals derive some part of their sense of self-worth from job status or relative labour market earnings, the distribution of labour market earnings can affect perceptions of fairness in society.

The distribution of earnings from labour market activity is likely to be an important causal factor underlying changes in the distribution of income. However, it cannot be inferred that over any time period there will a direct relation between changes in the distribution of earnings and changes in the distribution of income.

First, the ideal measure of income for social welfare purposes is lifetime income; by contrast, measures of the distribution of earnings have largely been examined for different time periods using different groups of workers. Increases in cross-section earnings inequality can be consistent with either increasing or decreasing inequality in lifetime earnings depending on the extent of (and changes in) mobility of workers through the distribution of earnings over their lifetimes.

Second, information on the distribution of earnings is usually presented for individual workers; whereas the most appropriate unit for welfare analysis is considered to be the family or household (or some alternative definition of an income unit). Therefore it is the aggregate of labour market earnings (or more generally, income from all sources) for all persons in an income unit that matters for the distribution of income.

Third, studies of the distribution of earnings tend to include only persons who are employed (and most often who are also wage and salary earners); on the other hand, the distribution of income is measured over all persons. Hence, changes in the distribution of employment between income units – that occur in the absence of any changes in the distribution of labour market earnings – can be a source of change in the distribution of income.

Fourth, many factors contribute to an income unit's well-being apart from labour market earnings. Disposable income (total cash payments minus income tax) received by an income unit will depend on other types of market income (for example, income from property), and on government tax and transfer payments. Beyond disposable income, an income unit's well-being may also be affected by non-cash benefits

received from the government (for example, access to a public education system), and by their general living environment (including factors such as levels of crime).

There is also a question of the appropriate time period over which to draw inferences on the welfare consequences of changes in the distribution of earnings. This question arises since changes in the distribution of earnings are likely to affect skill acquisition and labour force participation.

Increased returns to skill will raise incentives for skill acquisition. Hence, short-run changes in the distribution of earnings are likely in the longer run to be offset by changes in the distribution of skill in the workforce (for example, Heckman et al., 1997). Therefore over a short time horizon there may be changes in earnings inequality that would appear to have potentially adverse implications for the distribution of income. Viewed over a longer time horizon, however, such changes in the distribution of earnings may not be apparent. Topel (1997, pp.69-72) presents evidence for the United States and Sweden that is consistent with the hypothesis that rising wage differentials by educational attainment lead to subsequent increases in average educational attainment.

Another example is that where an increase in earnings differentials between skill groups involves a decrease in the returns to skill for some groups then this may decrease incentives of those groups to participate in the labour force. For example, Juhn (1992) suggests that declining participation of older and less skilled males in the United States in the 1970s and 1980s can be attributed to the decline in earnings of those workers. The withdrawal from the labour market of those workers – or in other words, a decrease in the relative supply of less skilled workers – would be expected to exert upward pressure on the wage rate for less skilled workers, and potentially to some reversal of the initial decline in wages.

### **3. TRENDS IN THE DISTRIBUTION OF EARNINGS**

This section summarises recent trends in the distribution of earnings for a range of industrialised economies. Evidence on a variety of aspects of earnings outcomes will be examined:

- Overall distribution of earnings, and changes in real hourly wages and weekly earnings by position in the distribution of earnings.
- Average earnings for dis-aggregated workforce groups (for example, by education attainment, experience, occupation, and gender).
- Distribution of earnings within dis-aggregated workforce groups.
- Earnings mobility.
- Non-wage compensation and job quality.
- Effect of changes in the distribution of earnings on the distribution of household income.

The first sub-section will present international evidence; and in the second sub-section a detailed review of available evidence on the distribution of earnings in New Zealand is undertaken.

#### **a. International evidence**

##### ***a.i. Overall earnings inequality***

Information on changes in the distribution of earnings is presented for a range of industrialised economies in Tables 1 to 4. Table 1 shows ratios of earnings for workers at the 10<sup>th</sup>, 50<sup>th</sup> and 90<sup>th</sup> percentiles of the earnings distribution for selected OECD countries between 1981 and 1993. Table 2 shows the difference in log earnings for workers at the 90<sup>th</sup> and 10<sup>th</sup> percentiles of the earnings distribution for selected OECD countries between 1979 and 1990. Table 3 shows the coefficient of variation of annual earnings for selected OECD countries for a variety of time periods from the 1970s to 1990s. Finally, Table 4 shows changes in inter-percentile log hourly wage differentials for workers in the United States between 1976 and 1996.

In interpreting Tables 1 to 3 it is important to be aware that the data presented for the different countries are not derived using standardised definitions of the sample of



workers, earnings measure, and time period covered. For example, earnings inequality data in Table 1 is derived using hourly wages for some countries, and weekly earnings, monthly earnings or annual earnings for other countries. For some countries the earnings measure is gross and for others it is net earnings. Finally, the samples of employees also differ between countries – for example, in some countries the sample is restricted to full-time full-year employees, whereas in others all full-time employees are included. (An appendix reports more details on the sample of employees and earnings measure for each country in Tables 1 and 2.)

The reason for reporting earnings inequality data that are not standardised between countries is that it can be very difficult (impossible) to obtain from published sources earnings data that are exactly comparable between countries. But to the extent that earnings inequality data for a country are sensitive to choice of data source, measure of earnings, time period covered, and sample of workers, it is necessary to be aware that the findings from a cross-country comparison of earnings inequality are also likely to be sensitive to the way the earnings inequality data have been constructed. This is one reason why several tables of earnings inequality data from alternative sources are reported in this sub-section.

One important example of the difficulties in making cross-country comparisons using earnings measures and samples of employees that are not standardised involves the use of hourly wage or weekly/annual earnings data. Restricting attention to the former means that changes in earnings inequality can be interpreted as reflecting changes in the price of a ‘unit’ (hour) of labour; but with the latter measure changes in earnings inequality could reflect changes in the price of labour or in the distribution of weekly/annual hours of work. That this distinction can be important is illustrated, for example, in the study of earnings inequality for Canada by Doiron and Barrett (1996). They find that most of the increase in annual earnings inequality between 1981 and 1988 is explained by changes in the distribution of annual hours of work rather than in hourly wages. Hence, a comparison of earnings inequality between Canada and another country would be likely to very sensitive to the choice of earnings measure used. (For other countries for which data are available however it appears that changes in inequality in weekly earnings and hourly wages have been very similar

(for the United States, see Juhn et al., 1993, Table 1; and for Australia, see Borland and Kennedy, 1999, Table 5).]

Another measurement related issue in making cross-country comparisons is the possibility that the composition of the sample of employees for whom earnings data are examined changes in a different way across different countries. For example, suppose over the sample period for which earnings data are observed that in one country there is an increase in the number of unemployed persons and that the new entrants to unemployment are drawn exclusively from the bottom decile of the distribution of earnings. In this situation measures of earnings dispersion for the country will incorporate a sample selection effect: such measures will show a decrease in earnings inequality even where real weekly earnings of all persons who remain in employment are unchanged over time. To the extent that unemployment rates change by different amounts in each country then earnings inequality measures will be affected to different degrees by sample selection effects.

Notwithstanding the significant caveats on cross-country data comparability just discussed, most commentators have concluded that one robust finding does emerge from earnings inequality such as is presented in these tables. From the countries for which data are available, the United States and United Kingdom have had the largest increases in earnings inequality. This result appears to hold over any time period from the late 1970s onwards, for any inequality measure, and for any earnings measure.

Beyond identifying that the United Kingdom and United States have had the largest increases in earnings inequality it is somewhat more difficult to classify countries. In their recent survey Gottschalk and Smeeding (1997, p.652) argue that:

“The first [group] consists of countries that experienced at least as large an increase in inequality as in the United States. This group includes only the United Kingdom. A second group which experienced substantial increases in inequality but less than the United States and the United Kingdom includes Canada, Australia, and Israel. France, Japan, the Netherlands, Sweden and Finland form a third group with positive but quite small changes in earnings inequality over the 1980s. Finally, Italy and

Germany form a small group that experienced no measurable increase in earnings inequality during the 1980s.”

A careful reading of single country studies of changes in earnings inequality (for example, United Kingdom – Machin, 1996; Australia – Borland, 1999; Canada – Kuhn, 1995; France – Card et al., 1996; Italy – Eriksson and Ichino, 1995; and Germany - Abraham and Houseman, 1993) suggests that Gottschalk and Smeeding’s classification is probably a reasonable characterisation of cross-country differences. For example, for Australia a ‘consensus’ estimate of changes in earnings inequality since the mid-1970s – drawing on findings from alternative data sources, using different earnings measures – would be that it has had quite large increases in earnings inequality although not quite as large as in the United States or United Kingdom (see Borland, 1999).

Having presented a very general characterisation of the evolution of earnings inequality in a range of countries, it is also necessary to note that in order to really understand the causes of changes in earnings inequality in those countries, a much more detailed understanding of the nature of changes in earnings inequality will be required.

To illustrate this point Table 4 presents some further information on changes in the inter-percentile log hourly 90-50 and 50-10 wage differentials, and on the real hourly wage by percentile, for male and female workers in the United States. Data from two sources – the Current Population (CPS) March survey, and the CPS Outgoing Rotation Group survey – are presented. One point to emerge from this Table is that increases in earnings inequality have not been spread evenly through the distribution of earnings. In the early to mid 1980s the main source of increases in earnings inequality was growth in inequality at below-median wages; whereas from the mid 1980s to mid 1990s the main source appears to have been increasing inequality in above-median wages.

To the extent that different potential causes of changes in earnings inequality impact at different points of the earnings distribution – for example, changes to real wages due to minimum wage laws would not be expected to affect above-median wage

inequality – this more dis-aggregated information on earnings inequality may assist in distinguishing between explanations for changes in earnings inequality.

[Table 4 makes the additional point that – as well as having dis-aggregated information on changes in earnings inequality – it may be useful to know about the actual values of real earnings underlying the earnings inequality data. For example, Table 4 shows that it would be incorrect to infer from Panel A that because there has been little change after the mid-1980s in the 50-10 wage difference, but growth in the 90-50 wage difference, that therefore wages at the bottom of the distribution have been stable and have increased at the top of the distribution. In fact, as Panel B shows, the explanation for these changes for male workers has been a fall in the real value of the hourly wage at the 10<sup>th</sup> percentile and median, while the real wage at the 90<sup>th</sup> has remained relatively stable. This information on the actual value of real wages may also be very important for distinguishing between explanations for changes in earnings inequality. For most countries all groups of workers experienced increases in real earnings in the period between the late 1970s and early 1990s. The exceptions are the United States and Australia where male workers in the bottom half of the distribution of earnings experienced decreases in real earnings (OECD, 1996, Chart 3.3).]

Another issue that it is important to address is whether inferences should be drawn from data on changes in earnings inequality for groups of male and female employees, or only for all employees. Studies of earnings inequality generally have examined outcomes for males and females separately, and have not aggregated those groups to consider whether earnings inequality has changed for all employees. However, recent research by Fortin and Lemieux (1996) has argued that since changes in earnings inequality for males and females may reflect redistribution of male and female employees between different types of jobs in the economy, as well as changes in earnings dispersion between those jobs, therefore it may be more appropriate to study changes in earnings inequality for persons rather than for males and females separately. For example, it is possible that even with an unchanged stock of jobs and wages - and hence unchanged distribution of earnings for the whole economy - redistribution of male and female employees between those jobs could cause an increase in earnings dispersion for each group of workers. Research for the United

States has however shown that aggregating males and females does not significantly affect measures of changes in earnings inequality for the 1970s to 1990s (Bernstein and Mishel, 1997).

#### **a.ii. Between-group inequality**

##### ***Gender***

The gender wage differential has narrowed in most industrialised countries in the period between the late 1960s and late 1980s. However, it is evident from Tables 5 and 6 that the magnitude and timing of changes has differed between countries. For example, the decrease in the gap has been relatively large in countries such as Australia and the United States, but much smaller in countries such as Switzerland. And whereas the decrease in Australia was concentrated in the early 1970s, in the United States most change has occurred during the 1980s.

##### ***Education***

Earnings differentials between workers with different levels of education attainment have displayed considerable variation over time. Table 6 shows relative earnings by years of education for the United States, and Table 7 shows the earnings ratio for selected pairs of education groups for a variety of countries. Hence from Table 6 it is possible to make inferences (for the United States) on the overall structure of earnings by education attainment; whereas for the countries in Table 7 it is only possible to comment on relative earnings between the specified groups rather than the overall structure.

Tables 6 and 7 show that in many industrialised countries earnings differentials by education attainment decreased in the 1970s, before increasing during the 1980s. The largest decreases in the relative earnings of university graduates in the 1970s occurred in Australia and Canada, and the largest increases in the 1980s occurred in the United States and United Kingdom.

##### ***Age/Experience***

Earnings differentials between age and experience groups also appear to have widened in many countries during the 1980s. Table 6 shows that experience-earnings differentials widened in the United States from the early 1970s onwards; and Table 8

shows that age-earnings differentials between prime age and younger workers rose in the entire sample of countries for various periods in the 1980s.

Some caution is however necessary in interpreting evidence on changes in experience or age-earnings differentials. First, what appears to be a change in slope of the experience or age-earnings profile may in fact be a shift in the profile between cohorts. For example, for Canada Beaudry and Green (1997) show by constructing data on 'synthetic cohorts' that what appeared to be a steepening of the age-earnings profile between 1971 and 1993 is in fact a shift down in the profile over successive cohorts of workers. This has important implications for explaining changes in earnings inequality; rather than trying to explain why the return to experience has risen it is necessary to explain why more recent cohorts of workers have lower earnings profiles than older cohorts. (However, the study does not attempt to distinguish between the possible explanations for the existence of cohort effects.) For the United States, by contrast, Juhn et al. (1993) find that cohort effects do not explain any of the changes in earnings inequality that have occurred. A second issue is that changes in age-earnings profiles may occur due to composition effects as well as to changes in the return to experience. For example, Borland and Kennedy (1998) show for Australia that despite quite large increases in differentials between age groups, there was no change in earnings differentials between experience groups from the early 1980s to mid 1990s. The explanation is that changes in relative earnings by age appear to have been driven mainly by changes in the quality of labour in each age group following large increases in high school completion and progression to tertiary study.

### ***Industry***

Changes in inter-industry earnings dispersion appear to have been fairly small amongst industrialised countries during the 1980s (Table 9). For most countries changes in earnings inequality within industries have been far more significant as a source of increases in overall earnings inequality.

### ***Other***

Education attainment and years of experience are proxies for the skills or human capital of workers, but it is generally accepted that neither provides a complete

representation of the set of skills possessed by a worker. Hence, there has been some attention devoted to analysis of whether changes in returns to other dimensions of worker skills have changed. For the United States Murnane et al. (1996) show that the return to cognitive skills (measured by performance on a mathematics aptitude test) increased between 1978 and 1986. And Autor et al. (1999) show that the return to computer use at work increased slightly between 1983 and 1993. (Although there is considerable debate as to whether computer use is a causal factor for earnings or a proxy for unobserved worker ability – see for example, DiNardo and Pischke, 1997.)

***a.iii. Decomposition analysis of the sources of earnings inequality***

Changes in inequality between different groups of workers are only one possible source of changes in overall earnings inequality. Other factors are changes in the distribution of the workforce between those groups, and changes in earnings inequality within each group of workers. Juhn et al. (JMP)(1993) develop a decomposition technique that allows the share of the change in earnings inequality that is due to each of these three components to be estimated.

The JMP method has been applied for the United States in Juhn et al. (1993), and for Australia in Borland and Kennedy (1998). In both cases the ‘observable attributes’ are education attainment and years of potential experience. Some results are summarised in Table 10. For both countries it is evident that the main factor that accounts for increases in earnings inequality is increases in inequality within groups of workers with the same education and years of experience. In both countries change in the distribution of the workforce between education/experience groups accounts for a small part of the increase in earnings inequality. The main difference between the countries is that in the United States changes in the return to education and experience account for about one-third of the increase in earnings inequality, whereas in Australia changes in returns had a slight compressing effect on the distribution of income. This latter finding is consistent with differences in changes in the returns to education and experience in each country over the respective sample periods of the studies (for example, in Australia in the 1980s returns to experience were stable, and earnings differences by education attainment decreased slightly – see Borland and Kennedy, 1998).

***a.iv. Other aspects of inequality relating to work***

Evidence of increases in earnings inequality has raised the question of whether the distribution of non-monetary aspects of work might also have altered. Two recent studies in the United States have examined this question. Hamermesh (1998) has examined changes in the distribution of workplace injuries, and in working evening and nights, from the late 1970s to early 1990s. His main finding is that both types of disamenities were increasingly borne by low wage male workers. Farber and Levy (1998) consider changes in the distribution of employer-provided health insurance between ‘core’ (full time/high tenure) and ‘peripheral’ (other) jobs between 1988 and 1997. An important explanation for the overall decline in employer-sponsored health insurance is found to be a decline in the likelihood that workers in peripheral jobs were offered health insurance. Both studies therefore suggest that changes in earnings inequality have understated absolute changes in inequality in the net return to work.

***a.v. Earnings mobility***

Growth in earnings inequality will not necessarily cause an increase in inequality in the distribution of lifetime labour market earnings. (Where lifetime earnings is generally thought of as a better measure of welfare than earnings at a point in time.) Lifetime earnings for an individual worker depend on both the extent of inequality at each point in time during that worker’s career, and on the extent of earnings mobility of the worker during the worker’s career. Hence, even with an increase in cross-section inequality, there may not be an increase in inequality in lifetime earnings, if there is an offsetting increase in earnings mobility.

As an example suppose that there is a cross-section distribution of earnings with 10 different earnings levels. Suppose that each worker has a career that lasts for ten years – beginning at the lowest earnings level, shifting to the second highest earnings level after one year, shifting to the third highest earnings level after two years, and so on. In this model each worker will end up with the same lifetime income equal to the sum of earnings across the ten levels. Now suppose that the cross-section distribution of earnings widens (in a mean-preserving spread) but that there are still ten levels of



earnings and that workers still progress by one level each year. Then despite the increase in cross-section earnings inequality, there is no change in the distribution of lifetime earnings – each cohort of workers will still receive exactly the same amount of lifetime earnings.

Studies by Gottschalk and Moffitt (1994) for the United States, and by Dickens (1996) for the United Kingdom have examined longitudinal data on earnings from which it is possible to ascertain whether changes in earnings mobility have offset increases in cross-section earnings inequality. Both studies find that there has been some increase in year-to-year earnings instability; however, both also conclude that about one-half of the increase in earnings inequality observed at any point in time is due to permanent factors that imply higher inequality in lifetime earnings.

***a.vi. Effect of earnings inequality on income inequality***

Changes in the distribution of labour market earnings between individual workers are just one factor that can affect the distribution of disposable income between households. Other important factors are – changes in household composition, changes in the distribution of employment between households, changes in the distribution of other types of market income, and changes in government tax/transfer policies.

Gottschalk and Smeeding (1997, Table 4) review international evidence on sources of changes in income inequality. They find that most industrialised countries experienced some increase in inequality in the distributions of market and disposable income in the period from the late 1970s to early 1990s. The main factor accounting for increases in market income inequality was increases in inequality in the distribution of labour market earnings. Other factors such as growth in inequality in the distribution of capital income; household composition changes; and shifts in the distribution of employment between households are found to have some role, but to be less important than changes in earnings inequality. It is concluded that increases in inequality in the distribution of disposable income are fairly highly correlated with increases in market income inequality. (Although there are exceptions to this last conclusion – for example, in Australia where tax/transfer system changes had a

significant equalising effect on the distribution of disposable income – Harding, 1997.)

**b. New Zealand evidence**

***b.i. Overall earnings inequality***

Evidence on changes in overall earnings inequality and in real earnings in New Zealand – from Dixon (1998) and Statistics New Zealand (1999) – is presented in Tables 11 to 13. Several main findings emerge from the tables:

- Earnings inequality in New Zealand increased fairly substantially between the early 1980s and mid 1990s. Much of the increase in inequality was concentrated in the periods between 1986 to 1990, and 1995 to 1997.
- Increases in weekly earnings inequality were significantly larger than in hourly wage inequality. Increases in inequality in the distribution of hours of work appear to have contributed equally with growth in hourly wage inequality to the increase in inequality in the distribution of weekly earnings.
- Median real hourly wages increased strongly from 1984 to 1990, but decreased thereafter to 1997. Over the whole period females at all points of the distribution of hourly wages experienced increases in real hourly wages; whereas male workers below about the 75<sup>th</sup> percentile experienced declines in real hourly wages. However, virtually all workers experienced increases in real weekly earnings between 1984 and 1997. (Martin, 1995a and 1995b, shows that the real value of annual income for actively engaged males and females increased between 1976 and 1981, but then decreased in each intercensal period through to 1996.)

Over the time period for which comparisons can be made (1984 to 1997) increases in inequality in weekly earnings have if anything been slightly larger in New Zealand than in the United States or United Kingdom; however, increases in inequality in hourly wages have been significantly larger in those other countries than New Zealand (Dixon, 1998, Table 3). This difference between the cross-country comparison depending on the choice of earnings measure points to a distinctive aspect of the increase in earnings inequality in New Zealand – that an increase in inequality in hourly wages was accompanied by a large increase in inequality in the distribution of hours worked. It is also important to note that in the period prior to 1984 both the

United States and United Kingdom experienced very rapid increases in earnings inequality. Hence, in terms of the increase in earnings inequality it has experienced it is perhaps most reasonable to classify New Zealand – using the Gottschalk and Smeeding ranking – as one of the countries in the second group with Australia and Canada.

***b.ii. Between-group inequality***  
***Gender***

From the early 1980s onwards the gender wage gap in New Zealand appears to have narrowed. Martin (1997a, Table 6) shows that median female income was fairly constant as a proportion of median male income (for actively engaged males and females) between 1951 and 1981 but has increased since that time. And Dixon's (1998) regression analysis of hourly wages (reported in Table 14) suggests that controlling for other factors the gender wage gap fell from about 16 per cent to about 9 per cent between 1984 and 1997.

***Education***

Earnings differentials by education display some variability over time. Relative to persons with no qualifications earnings of persons with high school completion or a vocational qualification have increased from the early 1980s to mid 1990s. Relative earnings of persons with a bachelor degree increased during the 1980s but then appear to have declined slightly during the 1990s. These patterns are evident from Dixon's regression analysis reported in Table 14, but also emerge from studies using Census income data by Maani (1999) and Winkelmann (1998). For example, Maani (1999, Tables 7 and 11) shows that relative to the no qualification group annual earnings of full-time males with a sixth form certificate increased by about 12 per cent between 1981 and 1996; and annual earnings of males with a bachelor degree increased by about 14 per cent from 1981 to 1991, before falling by 2 per cent to 1996.

***Age/Experience***

There do not appear to have been large changes in earnings differences between workers of different ages. The regression analysis undertaken on hourly earnings by Dixon (1998) finds very little change in age-earnings differentials between 1984 and 1997. From Table 15 the only real variation appears to be a slight decline in earnings

of workers aged 20 years relative to those aged 35 years. Analysis by Martin (1997a) using Census income data for actively engaged persons finds somewhat larger changes over time. He finds that age-earnings differentials narrowed between 1951 and 1981, and then increased in the period to 1991. However, compared for example to the magnitude of changes in earnings differentials between education groups, the magnitude of changes in age-earnings differentials is fairly small.

The magnitude of change in the gender wage gap in New Zealand from the 1980s appears to be fairly large by comparison with other industrialised countries. Increases in earnings differentials between workers without qualifications and with a university degree during the 1980s appear similar to increases between college/university graduates and workers who had not completed high school that occurred in the United States and United Kingdom. (However, differences in the definition of education categories between countries mean that some caution is necessary in undertaking such a comparison.) By contrast, changes in age-earnings differentials do not suggest the same magnitude of increase in earnings differentials by experience that occurred in some other countries (although it is difficult to make direct comparisons between data on age-earnings and experience-earnings profiles).

### ***b.iii. Decomposition analysis of the sources of earnings inequality***

Results from a JMP decomposition analysis of the sources of changes in weekly earnings inequality for New Zealand between 1984 and 1997 (from Dixon, 1998) are presented in Table 16. For each decomposition at least one-half of the increase in inequality is explained by increases in within-group inequality. (In Dixon's analysis a group is a set of workers classified by age, education attainment, ethnicity, and hours worked per week.) For females the other main factor that accounts for the increase in earnings inequality is changes in the distribution of the workforce between groups; whereas for males it is changes in inequality in returns between workforce groups.

These results – although based on a slightly different definition of observable characteristics - seem quite consistent with international evidence. In particular, the finding that the largest fraction of increases in earnings inequality is due to increases in within-group inequality matches with the U.S. and Australian studies.

#### ***b.iv. Earnings mobility***

No direct evidence on earnings mobility in New Zealand is available. However, Hyslop (1999) has undertaken a preliminary analysis of mobility in market and disposable incomes using tax record data. His findings suggest that the extent of income mobility may be slightly higher than in the United States. However, he does note that the results appear to be affected by sample selection, and by a relatively small group of outliers who have large changes in income between sample years. Moreover, as his analysis uses measures of total income rather than earnings, and has not examined changes in mobility over time, it cannot be used to address the question of the extent to which increases in cross-section earnings inequality in New Zealand are likely to translate into increases in inequality in the distribution of lifetime earnings.

#### ***b.v. Effect of earnings inequality on income inequality***

Alternative measures of income inequality for New Zealand - presented in Table 17 - uniformly show an increase in inequality between the early 1980s and mid 1990s. Increases in inequality in the distribution of market income between individuals receiving market income occurred between 1986 to 1991, and 1991 to 1996. Other measures – such as household equivalent market income – show the increase concentrated to a much greater degree between 1986 to 1991. (This is likely to be due to the fact that increases in the rate of unemployment between 1986 to 1991 would have acted in the same direction as increases in market income inequality; whereas decreases in the rate of unemployment between 1991 and 1996 are likely to have partially offset increases in market income inequality.)

The correlation between changes in inequality in market income and household disposable income suggests that increases in inequality in labour market earnings are likely to have been an important determinant of changes in income inequality. However, other existing evidence does not provide strong support for this hypothesis. Podder and Chatterjee (1998) examine inequality in gross income in New Zealand between 1983 and 1995. They conclude that changes in the share of wage and salary

income in total income (due for example, to changes in the rate of unemployment) are much more important than changes in the dispersion of wage and salary income in explaining movements in inequality between 1983-91 to 1991-95. As well, Hyslop and Mare (1999) undertake a decomposition analysis of sources of changes in the distribution of household market income from 1983-86 to 1995-98. It is found in that study (see Table 18) that changes in the distribution of skill and demographic attributes and changes in the returns to attributes explain a very small fraction of the overall increase in household income inequality.

It is difficult on the basis of existing evidence to make definite conclusions on the role of earnings inequality in explaining increases in income inequality in New Zealand. Nevertheless, it does seem that the role of earnings inequality may have been somewhat less, and the role of changes in the distribution of employment somewhat greater, than is suggested to have been the case for other countries by Gottschalk and Smeeding (1997).

#### **4. CAUSES OF CHANGES IN THE DISTRIBUTION OF EARNINGS**

The review of evidence on trends in the distribution of earnings in the preceding section suggests that there are two main questions to be answered:

- a) What explains changes in earnings differentials between workers with different levels of education and years of experience within industrialised countries? (and differences between changes across countries?); and
- b) What explains the increase in earnings inequality within groups of workers with the same education and experience? (and differences in the magnitude of the increase across countries?).

To understand the range of possible answers to these questions the first sub-section presents a general framework for the determinants of labour market earnings. This framework divides potential explanatory factors for changes in the distribution of earnings between supply factors, demand factors, and institutions (hence it is often referred to as the 'SDI' framework). Subsequent sub-sections then discuss in more detail the role of specific types of factors – for example, types of supply-side factors.

In seeking to explain changes in the distribution of earnings across time it is important to keep in mind that existing explanations for differences in earnings between individuals at a point in time do not account for the whole of those differences. In fact, most standard 'human capital' earnings regressions explain only between 40 to 60 per cent of the variation in individual earnings (for example, see Preston, 1997 on Australia). In other words, we are seeking to explain changes in an economic phenomenon for which we do not have an entirely satisfactory set of explanations for the level. Of course, there is no necessary relation that says if our existing explanations for individual differences in wage levels explain 50 per cent of those differences, then the explanations must also explain 50 per cent of changes in wages. (It may be higher or lower.) But it does mean that we should not approach the exercise of seeking to explain changes in earnings inequality assuming that existing theories or explanations of wage determination will necessarily provide the whole explanation for what has occurred.

**a. General framework**

The starting point for the general framework is to assume that an individual worker's wages will be equal to the competitive wage for a worker of that type plus other components that depend on institutional factors. The competitive wage will depend on the complete set of factors that affect the opportunity cost of work – for example, cost of skills acquired by the worker (such as formal education and on-the-job training), and disutility of work (such as risk of injury or locational disamenities). Institutional factors that affect wages can be classified as: a) Role of trade unions and collective bargaining; b) Government regulation of wage-setting (for example, through setting minimum wage levels); and c) Other government regulation that might affect wages (for example, tariff protection against imports that is a source of rents in the domestic industry that competes against those imports).

This can be summarised as:

$$Y_{ijk} = Y_k^c + \lambda_k U_{ijk} + \delta_k R_{ijk} + I_{jk} + F_{ik} + \varepsilon_{ijk} \quad (1)$$

where:

$Y_{ijk}$  = Wage of  $i$ th worker in industry  $j$  with skill/job attributes in group  $k$ ;

$Y_k^c$  = Competitive market wage for a worker in skill/job group  $k$ ;

$\lambda_k$  = Return to worker in skill/job group  $j$  from union membership;

$U_{ijk}$  = Indicator variable for union membership for  $i$ th worker in industry  $j$  and skill/job group  $j$ ;

$\delta_k$  = Return to worker in skill/job group  $j$  from government regulation of wage-setting;

$U_{ijk}$  = Indicator variable for whether  $i$ th worker in industry  $j$  and skill/job group  $j$  is affected by government regulation of wage-setting (for example, by minimum wage regulation);

$I_{jk}$  = Return to worker in industry  $j$  and skill/job group  $k$  from product market rents or government regulation (for example, product market rents from tariff protection);

$F_{ik}$  = Return to worker  $i$  in skill/job group  $k$  from other institutional factors; and



$\varepsilon_{ijk}$  = Unobservable component.

Hence, the average wage of workers in skill/job group k can be expressed as:

$$Y_k = Y_k^c + \lambda_k U_k + \delta_k R_k + \sum_j \phi_{jk} I_{jk} + \sum_i F_{ik} / n \quad (2)$$

where:

$U_k$  = Union density for workers in skill/job group k;

$R_k$  = Proportion of workers in skill/job group k affected by government regulation of wage-setting; and

$\phi_{jk}$  = Proportion of workers in skill/job group k in industry j

In much of the empirical research on trends in the distribution of earnings a distinction is made between between-group and within-group inequality. Using the above framework – where a group is defined as workers with the same set of skill/job attributes – it is possible to decompose overall earnings inequality,  $D(Y_{ijk})$ , as the sum of inequality in average earnings between groups of workers with different attributes,  $B(Y_k)$ , and earnings inequality between workers within each of those groups,  $W(Y_{ijk})$ .

Applying this decomposition, changes in overall earnings inequality therefore can be explained by changes in average earnings between groups of workers with different skill/job attributes, and changes in earnings inequality within each group of workers. Changes in between-group inequality – or the change in average earnings of workers in group k relative to all other workers - can be understood as occurring due to changes in supply, demand or institutional factors (see Bound and Johnson, 1992):

$$dY_k = [(1 - (1/\sigma))d(\ln b_k) - (1/\sigma)d(\ln N_k) + (1/\sigma)d(\ln D_k)] + \sum_j (\phi_{jk} dI_{jk} + d\phi_{jk} I_{jk}) + d\lambda_k U_k + \lambda_k dU_k + d\delta_k R_k + \delta_k dR_k + \sum_i dF_{ik} / n \quad (3)$$

where:

$\sigma$  = Elasticity of supply between workers in skill/job group k and other groups;  
 $d(\ln b_k)$  = Average rate of technical change for workers in skill/job group k relative to all other workers;

$N_k$  = Share of aggregate supply of units of labour in skill/job group k; and

$D_k$  = Share of aggregate demand for units of labour in skill/job group j.

With this framework average earnings of workers in group k relative to all workers will vary with demand and supply factors:

- a) Positively (negatively) where technical change is biased towards (against) workers in group k. (Technical change is generally regarded as a demand-side factor);
- b) Negatively with the share of aggregate labour supply accounted for by workers in group k; and
- c) Positively with the share of aggregate labour demand for workers in group k.

Changes in between-group inequality will also depend on institutional factors.

Average earnings of workers in group k relative to all workers will vary:

- a) Positively with the relative concentration of group k workers in industries with relatively high wage premia, and positively with the level of wage premium in each industry;
- b) Positively with the proportion of group k workers who are union members, and positively with the union wage premium paid to group k workers;
- c) Positively with the proportion of group k workers who are affected by government wage regulation, and positively with the average magnitude of the effect of government wage regulation on wages of workers in group k; and
- d) Positively with average magnitude of the effect of other institutional factors on wages of workers in group k.

Changes in within-group earnings inequality – that is, between workers in group k with the same skill/job attributes – from equation (1) will then depend on:

- a) Changes in union status of individual workers in group k;
- b) Changes in the effect of government regulation of wage-setting on each worker within group k;
- c) Changes in other institutional factors; and

d) Changes in unobservable factors.

Note that the decomposition of overall earnings inequality described in this section does not correspond exactly to the JMP decomposition described in the previous section. In the approach in this section all skill/job attributes that affect competitive wages are used to classify workers between groups; whereas the standard approach using the JMP decomposition method has been to use educational attainment and years of potential work experience as the only skill attributes for classifying groups of workers. Hence in the framework in this section all effects on earnings inequality skill or job differences between workers are incorporated into the between-group effect. By contrast, in the JMP approach, the effect on earnings inequality of some 'unobservable' skill dimensions (any factor apart from educational attainment or experience) will be incorporated into the within-group component.

Another issue relates to the role of firm or company-level effects on wage outcomes. Such effects – found in recent empirical work to be an important influence on wages even after controlling for worker skill and job characteristics and industry (for example, Groshen, 1991, and Crossley, 1998) – are not directly modelled in the framework above. Some part of company effects found in empirical research is likely to represent competitive wage differentials (variation in  $Y_k$ ) not controlled for by the available set of explanatory variables for worker skill or job conditions. The remaining non-competitive component of company wage differentials – for example, due to product market rents or efficiency wage payments – is captured in the above framework by the terms representing the industry wage effect and other institutional factors.

A final point regarding the analysis of causes of changes in earnings inequality undertaken in this report is to note that the main objective is interpreted as being to explain the structural or trend dimension of recent changes in earnings inequality. At some times, changes in earnings inequality and relative earnings between skill groups have been understood more as a cyclical phenomenon (for example, Reder, 1958). However, increases in earnings inequality that have occurred over the past two decades in industrialised economies, have been viewed in almost all research as a

structural change that requires an explanation (or explanations) that draws on longer run changes in the economy.

**b. Supply-side factors**

***b.i. Educational attainment***

Education attainment is usually considered the most easily quantifiable proxy for workers' skills. Changes in the distribution of education attainment – such as the large increases in high school completion and rates of progression to university that have occurred in many industrial economies in the past twenty-five years – can therefore be regarded as altering the distribution of skill in the labour force. The independent effect of changes in labour supply by education attainment on competitive wages should be to decrease (increase) the relative wages of groups whose share of total labour supply has expanded (contracted). To the extent that recent changes in the distribution of education attainment have increased (decreased) relative labour supply of high skill (low skill) groups this would be expected to have reduced between-group earnings inequality.

***b.ii. Experience/Age cohorts***

Where workers of different ages are not perfect substitutes in production then changes in the relative size of successive birth cohorts may cause changes in relative earnings by age. For example, a relatively large birth cohort will, at some future date, increase the relative supply of younger workers, causing their wages to fall compared to wages of older workers. Since earnings increase with experience, such an outcome provides a potential explanation for increases in earnings dispersion between workers by years of experience.

***b.iii. Immigration***

Where the net effect of immigration is to change the relative shares of different skill groups of labour it can affect the competitive wage difference between those groups. For example, in the United States it has been suggested that immigration in the 1970s and 1980s from Latin America and Asia increased the relative supply of low skill labour, and hence was one source of increases in between group wage differences. To

the extent that recent immigrants are concentrated in particular geographic regions wage effects might also be expected to be especially pronounced in those regions.

#### ***b.iv. Female labour force participation***

Comparing earnings distributions for male and female workers in most industrial economies it is found that the female distribution is concentrated at earnings values that represent the lower end of the male distribution. For example, Topel (1997, p.67) reports that the median of the female wage distribution in the United States is at about the 25<sup>th</sup> percentile of the male wage distribution. Hence it could be argued that increases in female labour force participation – and in particular the large group of females who have entered the labour force in the past two decades who tend to have relatively low levels of work experience – have increased the relative aggregate supply of low-skill workers. This could then provide an explanation for increases in earnings differentials between low skill and high skill workers.

#### ***b.v. Labour quality***

Data on changes in relative earnings between different skill groups of workers generally do not seek to correct for changes in the quality of labour inputs supplied by an average worker in each group. Therefore changes in the quality of labour supplied by a group of workers is one potential explanation for changes in the relative earnings of that group. For example, decreases in government expenditure on the university system might lower the average quality of labour supplied by a university graduate, and hence lower the relative earnings of university graduates.

### **c. Demand-side factors**

#### ***c.i. Deindustrialisation***

What has become known as the ‘deindustrialisation hypothesis’ asserts that changes in the industry composition of employment have been an important source of increases in earnings inequality (for example, Bluestone and Harrison, 1988). Specifically, it is argued that changes in industry composition have caused a decrease in the proportion of middle-wage jobs, and an increase in the proportion of low-wage jobs in the economy. For example, Levy and Murnane (1992, p.1347) describe

deindustrialisation as a process whereby “...labor was forced to shift from manufacturing, with many middle class jobs, to the service sector, with a few high paying jobs and many low paying jobs”.

[Deindustrialisation – or changes in industry structure – overlaps somewhat with the explanations of international trade and technical change. This is because both of those phenomena are possible explanations for changes in the industry composition of employment. However, there are also other explanations for changes in industry structure such as changes in the composition of product demand of domestic consumers. Moreover, international trade and technical change can have effects on labour demand apart from on the industry composition of employment – that is, within industries. Hence, there is no exact decomposition where the effect of deindustrialisation can be seen as equivalent to the sum of effects of international trade and technical change.]

### *c.ii, International trade*

In the period since the 1970s many industrialised economies have experienced a significant expansion in the scale of international trade. Table 19 presents data on the shares of imports and exports in GDP for groups of OECD countries. It is apparent that for each group of countries there was a significant expansion in trade between the early 1960s and 1980s. The increase in trade flows, together with the hypothesis that most of the increase in imports to industrial countries are goods intensive in low-skill labour from developing economies with low wages for low skill labour, has meant that international trade has been considered an important potential explanation for changes in the demand for labour by skill level.

There have been two main approaches to thinking about how the expansion in international trade might affect labour demand. The first – trade theoretic – approach has mainly been concerned to examine whether data on prices and employment are consistent with predictions of trade theory, and in particular the Stolper-Samuelson theorem. The second – factor content – approach examines how much of changes in relative wages between skill groups can be explained by changes in labour supply embodied in increased inflows of imports.

A number of core implications of the Heckscher-Ohlin theory of trade are set out in the Stolper-Samuelson theorem. To understand the theorem the following simple model from Lawrence and Slaughter (1993) is presented. Consider a small open economy that produces two products, software and textiles, using two factors of production, high skill and low skill labour. Assume that the software sector uses high skill labour relatively intensively, and the textile sector uses low skill labour relatively intensively. Suppose that the price of textiles decreases relative to the price of software (for example, due to a reduction in tariffs on textiles). The country will then seek to increase output of software and decrease output of textiles. Because of the difference in factor intensities between industries, in order to achieve sufficient reallocation of high skill labour from textiles to software it is necessary for there to be an increase in the high skill/low skill wage ratio. Due to the rise in the wage ratio the proportion of high skill workers employed will decrease within each sector.

The Stolper-Samuelson theorem suggests that there are several empirical propositions that can be examined to test for the role of international trade in explaining changes in relative labour demand by skill category:

- a) Prices of traded goods intensive in low-skill labour should fall relative to prices of traded goods intensive in high skill labour;
- b) The composition of output shifts towards industries intensive in high skill labour;
- c) Within each industry the relative share of total employment of high skill labour declines; and
- d) Wages of high skill labour compared to low skill labour increase.

[Clearly hypothesis (d) has been satisfied. Hence in the assessment of empirical evidence in the next section the focus is on hypotheses (a) to (c).]

A further important implication of the Heckscher-Ohlin trade theory is that there is no necessary relation between trade flows and factor prices. A country's domestic consumption decisions will determine the amount of imports to the country and hence affect its trade deficit. But provided that changes in the trade deficit do not influence output prices, there will be no effect on factor demands or on the returns to factors.

On this point however there has been criticism of the Hechscher-Ohlin model. First, it has been argued that the model depends on an unrealistic set of assumptions. Under a more realistic set of assumptions – for example, allowing countries to specialise in production of output, or allowing capital flows – it is possible that the relative prices of factors of production will depend on the factor content of trade. As Snower (1998, p.83) has for example argued with regard to a situation where there is specialization in production:

“Under these circumstances, the factor content of international trade matters for earnings inequality, for through rising exports some of the country’s domestic labor supplies are, in effect, flowing abroad, reducing the effective supply of skilled labor for domestic production...”. (On the weaknesses of the Heckscher-Ohlin model see also Deardorff and Staiger, 1988, Bhagwati and Dehejia, 1994, and Sachs and Shatz, 1996.) Second, Topel (1997, pp.68-69) argues that evidence that domestic factor supplies do matter for explaining changes in relative wages by skill constitutes an important critique of the Heckscher-Ohlin model.

An alternative critique has been made by Davis (1998). He shows that the basic competitive cost conditions of the Heckscher-Ohlin model make it difficult for the model to explain divergent wage trends in different countries. Davis begins with a two-country model with two types of labour (low skill and high skill) in each country. There is a binding minimum wage in one country (Europe) and flexible wages in the other country (United States). The key finding is that (p.482): “...international trade equalizes factor prices between the flexible-wage and minimum wage economies. The proof is simply that under free and costless trade, competitive producers in the two countries face the same goods prices, have the same technologies, and are (at least weakly) diversified. The equality of factor prices then follows directly from the common competitive cost conditions...this [result] will sharply restrict the nature of shocks that can be appealed to in explaining divergent wage trends between Europe and America.”

The theoretical problems that potentially exist with the Heckscher-Ohlin theorem, and evidence that domestic factor supplies matter for determination of relative wages, suggest that an alternative approach to analysis of the role of international trade may



be to examine how changes in factor supplies implicit in expanded international trade affect relative wages of high skill and low skill workers.

Factor content studies of the effects of international trade involve two main steps (see for example, Borjas et al., 1992 and 1997). The first step is to estimate the implicit supply of each labour skill category embodied in trade flows as a proportion of the total supply of each skill type of labour. The second step is to multiply the estimate of the effect of trade on the relative endowment of the different skill categories of labour by an estimate of the effect of how changes in relative labour supply by skill category affect relative earnings by skill. This can then be compared with the actual change in relative earnings by skill to estimate what proportion of that change can be explained by changes in trade flows.

In addition to inconsistency with the Heckscher-Ohlin theory of trade, other criticisms of the factor content approach have been made. Most importantly, Leamer (1992, and 1994) argues that a country's factor content of trade represents a realised excess demand for factors of production that is jointly determined by domestic and foreign preferences, technology and factor supplies. The fact that changes to any of these determinants – and not just exogenous changes in international trade (due for example, to trade liberalisation) – could cause changes in the factor content of trade means that it is difficult to know how to interpret findings from factor content studies.

### *c.iii. Technological change*

Technological change is a further potential determinant of the relative demand for labour by skill category. Technological change is generally considered to be any change in the production technology for producing output. There are many possible sources of technological change – for example, innovations in types of capital equipment available, or new production processes or ways of organising production tasks.

For the period since the mid-1970s it has been suggested that the introduction of computers and new information technologies into workplaces has been one factor that might explain why demand for high skill workers has increased relative to low skill

workers. Table 20 presents data on changes in computer use at work in the United States. It shows that for the period covered – from the mid 1980s to late 1990s – there has been a significant increase in the proportion of workers who use computers.

To understand how technological change might affect labour demand consider the following model economy from Johnson (1997). There are a variety of jobs involving different tasks that can be ordered from most complex to least complex. There are two skill categories of labour – low skill and high skill – and importantly, the comparative advantage of each type of labour differs between jobs. Suppose that high skill workers have a comparative advantage in performing jobs that are relatively more complex, and low skill workers have a comparative advantage in relatively less complex jobs. Hence each type of labour will be assigned to the type of job in which it has a comparative advantage.

In this framework there are two ways in which technological change might affect the relative demand for low skill and high skill labour. First, the set of jobs in the economy might not change, but the introduction of new technology that is used by a worker in some job might raise the relative productivity of high skill compared to low skill workers in that job. Examples might be the introduction of robotics techniques that complicate many production line tasks that had previously been routine, or the introduction of computers that increases the complexity of tasks such as data processing. Such changes to technology which increase the complexity of particular jobs, would be expected to increase the productivity of high skill compared to low skill workers in those jobs, and hence to cause an increase in demand for high skill relative to low skill labour.

Second, technological change might alter the types of jobs in an economy in a way that raises the relative productivity of high skill compared to low skill workers in more complex jobs, or extends the range of jobs in which high skill workers have a comparative advantage. Again, this would cause an increase in demand for high skill relative to low skill labour. Possible sources of changes in job structure in an economy are the availability of new types of capital equipment, or changes in human resource practices. For example, Lindbeck and Snower (1996) and Snower (1998) have argued that advances in computer and telecommunications technologies are the

main source of an ‘organisational revolution’ that has encompassed changes to the organisation of authority within firms, to the organisation of design, production and marketing activities, and the break down of traditional occupational barriers.

Similarly, Bresnahan (1999) suggests that the main impact of computers has been through ‘organisational complementarity’ between computer systems, changes in work organisation, and high skill workers. As an illustration he uses the case of marketing managers who:

“...now have the opportunity to know much more about customers. Computer databases provide the underpinnings for much analytical marketing thinking. Once research has discovered what customers want, the computerised production process can be changed to deliver it. This is typically not trivial...A wide range of managerial functions now calls for more complex cognitive skills.”

This simple description of how technological change might affect the relative demand for labour by skill category has implicitly taken a partial equilibrium perspective – that is, assuming that the economy consists of a single sector. One criticism of this approach to thinking about technological change has been to argue that it does not carry over to a multi-sector model (for example, Leamer, 1996). For example, consider the case of technological change in a Heckscher-Ohlin model with small open economies and two factors of production (high skill and low skill labour). In that model technological progress in one country within a sector increases profits in that sector at fixed product prices and at initial factor prices. Producers will respond to this profit opportunity by trying to expand production in that sector. This causes an increase in demand for the factor employed relatively intensively in that sector, and an increase in the relative wage of that factor. In the case where technological change occurs in one country but has the same effect in all sectors of the economy, the outcome is different. Now, from the expansion of production in all sectors of the economy with different factor intensities, there will be no effect on relative wages.

In response to this criticism two ways in which technological change might affect relative wages of high skill and low skill labour – even in a multi-sector economy – have been proposed. First, where technological change is sector-biased towards sectors that are intensive in high skill labour, there will be an increase in wages of high skill relative to low skill labour (Haskel and Slaughter, 1998). Second, pervasive

technological change – whereby all countries experience technological change within all sectors – that is biased towards high skill labour should raise wages of high skill relative to low skill labour (Krugman, 1995).

#### *c.iv. Cost of capital*

Changes in the cost of capital may affect the relative demand for different types of labour. How demand is affected will depend on whether each type of labour is a substitute or complement for capital. For example, Griliches (1969) finds that capital is a complement for high skill labour, and a substitute for low skill labour. In this situation a decrease in the price of capital goods used in production increase demand for high skill labour and decrease demand for low skill labour.

#### **d. Institutional factors**

##### *d.i. Union effects*

In the period from the 1970s onwards there have been significant decreases in trade union density and in the proportion of workers covered by trade union wage setting in many industrialised economies. For example, Table 21 presents data on union density for a range of industrialised countries. It is evident that in many countries union density declined during the 1980s. The apparent correlation in timing between declines in union density and increases in earnings inequality has raised the question of whether there might be some causal relation from union density to earnings inequality.

Union coverage of wage bargaining has been identified to have two main effects on wage outcomes. First, workers who are covered by trade union wage-setting tend to have higher earnings than workers who are not covered. Second, within-group earnings inequality tends to be lower amongst a group of workers covered by a trade union than for a group with the same skill and demographic characteristics who are not covered by a trade union. The overall effect of trade unions on earnings inequality – and the effect of changes in union density on changes in earnings inequality - therefore depends on the relative magnitude of these opposing effects. Where the first effect dominates trade unions will tend to increase earnings inequality;

whereas where the second effect dominates the outcome will be to decrease earnings inequality.

***d.ii. Labour market regulation***

Of the range of forms of government regulation of the labour market, attention has centred on two types of regulation as possible explanations for changes in earnings inequality. First, most countries have some type of minimum wage regulation that sets a legal floor on the wage distribution. (In some countries such as the United States there is a single Federal minimum wage. In other countries such as Australia there is a much more extensive set of minimum wages that set different floors for according to a worker's skill and/or occupational classification.) By imposing a floor the minimum wage tends to reduce earnings dispersion. The magnitude of the effect will depend on the level of the minimum wage relative to other wages, and on the proportion of the workforce affected. To the extent that the minimum wage operates to reduce earnings dispersion, increases in earnings inequality might be explained by decreases in the real value of the minimum wage. Second, government regulation often determines the locus of wage bargaining (ie, whether wage bargaining takes place at the enterprise, industry or national level). Usually it would be expected that the higher is the degree of centralisation in wage bargaining, the lower should be the extent of earnings dispersion in an economy. Hence, changes in wage bargaining systems – and specifically, a shift centralised towards decentralised systems – is another potential explanatory factor for increases in earnings inequality.

***d.iii. Other government regulation and product market rents***

As producers and regulators in product markets governments may have a further indirect influence on the distribution of earnings. First, governments are likely to have some role in determining the size of product market rents in various industries (for example, through tariff policy, regulation of entry to some industries such as banking and telecommunications, and through competition policy). Of course, product market rents may arise from other sources such as structural barriers to entry to a market. To the extent that employers share these product market rents with workers, government policy or other sources of product market rents will therefore

have some effect on wages. Hence, for example, programs of reform and deregulation that have been implemented during the 1980s and 1990s in countries such as the United Kingdom, New Zealand, and Australia that alter product market rents would then also be expected to affect wages. What is less obvious is how such an effect on wages might affect earnings inequality.

Second, as a producer and employer the government is likely to have some discretion in wage-setting for public sector employees. In fact, earnings dispersion for public sector workers is usually found to be less than for similar private sector workers (Gregory and Borland, 1999). Hence, for those countries where the share of public sector employment in total employment has declined during the 1980s, this suggests that this might be a potential explanatory factor for increases in earnings inequality. Alternatively, the government might seek to reduce the magnitude of increases in earnings inequality amongst public sector employees relative to outcomes in the private sector.

#### *d.iv. Other institutional factors*

A range of other institutional factors could affect wage outcomes. One example is the use of an efficiency wage policy by a firm to seek to enhance worker's incentives for effort, or as a mechanism for screening between workers with different skills or characteristics (for example, Yellen, 1984). Another possibility is that social norms and fairness criteria may affect wages (for example, Lester, 1952). Hence, changes to social norms, or changes in the groups of workers whose wage-setting is affected by social norms, could affect earnings inequality.

## **5. EVIDENCE ON CAUSES OF CHANGES IN THE DISTRIBUTION OF EARNINGS**

Two main types of studies of the determinants of changes in the distribution of earnings have been undertaken. One type of study has attempted to estimate the relative explanatory power of a set of possible factors that might have caused an increase in earnings inequality. For example, the study by Bound and Johnson (1992) sought to decompose changes in average earnings differences between demographic groups between the effects of changes in demand and supply, technical change, and industry and union wage effects. The other type of study has focused on a particular explanation for increases in earnings inequality, and sought to establish what role that factor might have played. An example of this approach would be the studies of the effects of declining union density on earnings inequality undertaken by Card (1992, and 1998).

Most research on causes of changes in earnings inequality has been undertaken for the United States. Therefore, a review of evidence for the United States provides the most comprehensive understanding of causes of changes in earnings inequality for a country that is available, and the most complete description of available methods of those causes. Therefore this section will mainly focus on evidence for the United States.

There also exist a limited number of cross-country studies and evidence on the role of some potential explanatory factors for other countries, and this evidence will also be surveyed. However, as the evidence is piecemeal, the review will not advance as far as seeking to provide a detailed explanation for the cross-country differences in changes in overall earnings inequality described in section 3.

### **a. General type studies**

Studies that have sought to examine – within a common framework - the role of multiple potential explanatory factors for increases in earnings inequality have adopted two alternative approaches.

One – decomposition-type - approach involves several steps. First, the effect of institutional factors - industry effects, union effects, and minimum wage effects - on earnings is estimated. Second, actual earnings changes are adjusted for the effects of the institutional factors. Third, supply/demand framework is used to assess the determinants of changes in the (remaining) competitive component of earnings. One weakness of the approach is that it relies on an assumption that the effects of institutional factors are independent of each other, and of the effects of competitive factors.

This decomposition approach is followed by Bound and Johnson in their analysis of the determinants of changes in between group wage differences in the United States between 1979 and 1989; by DiNardo et al. (1996) and Fortin and Lemieux (1997) in their studies of the determinants of changes in the overall distribution of earnings in the United States between 1973 and 1992; and by DiNardo and Lemieux (1997) in their analysis of the sources of differences in changes in earnings inequality in Canada and the United States between 1981 and 1988.

Findings from these studies are summarised in Table 22. Bound and Johnson's (1992) study finds that the main factors affecting relative earnings of workers with different education attainment and experience have been demand and supply factors. On the demand-side it is technical change rather than shifts in the industry composition of employment that explain increasing earnings differentials by skill. Institutional factors – represented through industry wage effects – are found to be relatively unimportant. The time-series pattern of the college/high school earnings differential – decreasing in the 1970s and increasing in the 1980s – is explained by acceleration in the effect of technical change.

The studies by DiNardo et al. (1996) and Fortin and Lemieux (1996) find that demand and supply factors, and institutions, are important for explaining increases in overall earnings dispersion. Changes in the skill/demographic characteristics of the workforce, together with supply and demand factors, explain about one-third of the increase. About one-third is also explained by declines in the real value of the minimum wage, and declines in trade union density. Union effects are relatively more important in explaining increases in earnings inequality for males; whereas



minimum wage effects are much more important for females. This reflects the extent to which each group has been affected by changes in trade union density and in the real minimum wage. Over the period studied by these papers (1979 to 1988) union density decreased from 31 per cent to 21 per cent for males and 17 per cent to 13 per cent for females; and the real value of the minimum wage decreased by about 32 per cent. Hence, it seems entirely plausible that the institutional factors of declining union density and a falling real minimum wage should account for one-third of the increase in earnings inequality. Deregulation is found not to be a significant determinant of changes in earnings inequality. This latter finding is not surprising given the relatively small proportion of workers affected by deregulation in the United States.

Finally, the study by DiNardo and Lemieux (1997) finds that about two-thirds of the difference in the increase in earnings inequality between the United States and Canada can be explained by differences in changes in the real value of the minimum wage and in union density. Between 1981 and 1988 the variance of log hourly wages for male employees increased by 0.0495 more in the United States than Canada. Of this amount, 0.0169 is explained by the decline in the real value of the minimum wage in the United States, and 0.0160 is explained by the more rapid decline in union density in the United States than Canada.

The alternative approach has been to apply a supply/demand framework to examine to what extent changes in relative earnings of different skill and demographic groups (between-group changes) are consistent with changes in the relative supplies of and demand for labour inputs of those groups.

The first step in this approach, the 'labour supply test', examines whether data on relative earnings of workers in different skill groups are consistent with the hypothesis of stable factor demand by comparing the directions of change in relative wages and in employment shares of workers in skill groups over a specified time period. With CES technology the relative wage rates of two groups of workers at time  $t$  can be expressed as (Katz and Murphy, 1992, p.68):

$$\log(w_1(t)/w_2(t)) = (1/\sigma)[D(t) - \log(x_1(t)/x_2(t))] \quad (4)$$

where  $w_i(t)$  is the wage rate of group  $i$ ,  $\sigma$  is the elasticity of substitution between the two types of labour,  $D(t)$  is a time-series of relative demand shifts measured in log quantity units, and  $x_i(t)$  is labour supply of group  $i$ . From equation (4), the finding that, for example, the relative pay of low education workers has fallen while their employment share has risen would be consistent with stable factor demand. On the other hand, the opposite finding would imply that – in addition to supply shifts - some change in relative demand for labour must also have occurred.

Where the hypothesis that supply factors alone are sufficient to explain changes in relative earnings is rejected, the second step is to solve for the shift in relative demand using the data on actual wage and labour supply changes. It is straightforward to solve equation (4) for the relative demand shift variable in each time period:

$$D(t) = \sigma[\log(w_1(t)/w_2(t))] + \log(x_1(t)/x_2(t)) \quad (5)$$

The supply/demand approach has been applied by Katz and Murphy (1992) and Murphy and Welch (1992) in their analyses of changes in earnings differences between gender/education/experience groups in the United States between 1963 and 1987, by Murphy et al. (1998) in a comparative study of changes in earnings differences between gender/education/experience groups in the United States and Canada, and by Gottschalk and Joyce (1998) to examine changes in relative earnings by age and education attainment for eight OECD countries.

Some representative findings from supply/demand studies analysing changes in wage differences by educational attainment for the United States are presented in Table 23. These studies reach two main conclusions. First, changes in relative labour supply (by education and/or experience) are not sufficient to explain changes in relative wages. For example, in Table 23 there are many sub-periods where both relative wages and relative supply of more highly educated labour increases – yet if supply factors were able to provide a complete explanation of changes in relative wages the opposite result should hold. Second, supply factors do however seem very important for explaining the time-series pattern of changes in earnings differentials by skill

category. This is particularly the case for changes in relative earnings between workers with different levels of education attainment. For example, Table 23 shows that a decline in the rate of increase in the supply of workers with college qualifications relative to high school completion appears to be the main factor explaining why the college/high school earnings differential declined in the 1970s and then increased in the 1980s and 1990s.

The set of studies that have examined cross-country differences in changes in relative earnings by education or experience suggest that many industrial economies have experienced similar shifts in relative demand for labour by skill category, and that differences in relative earnings outcomes are therefore explained by differences in changes in relative supply.

In the most careful cross-country study Murphy et al. (1998) compare earnings outcomes in Canada and the United States. They find that a model that assumes the same shift in labour demand (towards high skill labour and away from low skill labour) in the United States and Canada, together with actual data on changes in labour supply by education attainment, can explain almost entirely the difference in changes in relative earnings by education attainment in those countries. (During the 1980s the college/high school wage premium grew substantially in the United States but was relatively constant in Canada. At the same time the rate of growth in the relative supply of college to high school labour was three times as rapid in Canada as in the United States – see also Freeman and Needels, 1993).

Gottschalk and Joyce (1998, pp.498-499) from their eight country study conclude in a similar vein that:

“...we find strong evidence that differences across countries in the growth of the age premium are associated with changes in relative factor supplies. Countries which experienced larger increases in the supply of college educated workers also experienced smaller increases in the education premium, though the relationship is not as strong.”

Other cross-country studies by Katz and Revenga (1989) for the United States and Japan, and Katz et al. (1993) for France, Japan, United Kingdom and United States, also find strong support for a role of supply factors in explaining differences in

relative earnings by education attainment. Finally, Card et al. (1995) present descriptive evidence on rates of computer utilisation and changes in import/output ratios to argue that the United States, Canada and France are likely to have experienced similar changes in the relative demand for labour by skill category.

## **b. Supply factors**

### ***b.i. Education/Experience***

Research on the effect on earnings inequality of changes in the relative shares of labour force participants by education attainment and experience has been summarised in the preceding sub-section. The main finding from that research is that changes in relative supply, together with plausible shifts in relative demand, seem able to explain most of the change in earnings differentials between workers with different education attainment and experience. While supply factors alone are not able to explain changes in relative earnings, time-series variation in the rate of change in the relative supply of education groups is important for explaining the pattern of variation in the relative earnings by education.

### ***b.ii. Immigration***

Changes in the supply of different types of labour that occur due to immigration are a subset of the overall changes in labour supply that occur in an economy. Hence the effects of immigration on labour supply are encompassed in the general type of demand/supply studies described in the previous sub-section. For political reasons, however, there has been considerable interest in attempting to separate out the labour supply effects of immigration on earnings inequality.

One type of study has sought to analyse the consequences of immigration for overall changes in relative earnings between skill groups. The methodology in these studies has been to treat immigration of a person in a particular skill category as an exogenous shift in the supply curve for that type of labour. In this framework the effect of immigration on the earnings of workers in a skill category will depend on the size of effect on labour supply and on the elasticity of demand for that skill category of labour (assuming that immigrants and native-born workers in the category are

perfect substitutes). The main studies of this type that have been undertaken (Borjas et al., 1992, and 1997) have considered the effect of immigration on earnings differentials by educational attainment in the United States. The studies find that – first, the main effect of immigration has been to increase the relative supply of workers with less than high school education; and second, although immigration can therefore explain a relatively large fraction of the decline in the relative earnings of high school drop-outs, it is not able to explain a significant proportion of the change in overall earnings dispersion by education category. For example, Borjas et al. (1997, p.62) report that about 45 per cent of the 10.9 per cent increase in the log wage differential between high school graduates and high school drop outs in the United States between 1980 and 1995 can be explained by immigration; but immigration accounts for only 5 per cent of the 19.1 per cent increase in the log wage differential between college graduates and high school graduates.

As immigrants tend to be relatively concentrated in particular geographic regions it is possible – even though wage effects of immigration are not significant at the country-level – that there are large effects within local labour markets. However, this does not seem to be the case. Available evidence for the United States suggests that average wages and wages for workers with different skill levels in local labour markets are not strongly related to the size of immigration into that market (for example, LaLonde and Topel, 1989, and Card, 1990). One explanation for this finding is that labour supply of substitute workers for immigrants is highly mobile – for example, Filer (1992) finds that regional migration of native born workers is increasing with the inflow of immigrants to a region.

### ***b.iii. Female labour force participation***

Analysis of the effect of changes in female labour force participation on wage inequality for males has been undertaken by Topel (1992, and 1993). He uses regional-level data for the United States to estimate the relation between changes in relative wages for low skill males and increases in labour force participation of low skill and high skill females. (Low skill is defined as the bottom third of the earnings distribution and high skill as the top third.) He finds that relative wages of low-skill males are significantly negatively related to participation of high skill females, and

that changes in participation of high skill females are able to explain the whole of the decrease in relative earnings of low skill males between 1971 and 1989. (Other factors such as technical change and changes in male labour supply are also important but have offsetting effects.)

These results appear to suggest an important role for female labour supply in understanding changes in earnings inequality for males. However, Topel (1997, p.67) suggests that caution is necessary in interpreting the findings. First, women who have entered the labour market tend to work in different occupations and industries than males so that it is not clear how the substitution process between males and females would work. Second, more detailed time series analysis reveals differences between the timing of increases in female participation and increases in earnings inequality for males.

#### ***b.iv. Labour quality***

Changes in labour quality have been suggested as an explanation for movements in earnings differentials between education group. One approach – followed by Bishop (1991) - is to seek to correlate the rate of increase in college progression rates with differences in the average ability of high school and college graduates (as measured by the difference in average aptitude test scores), and then to correlate changes in the average ability difference with changes in relative earnings by education.

Undertaking this exercise for the United States between the 1960s and 1980s does provide some evidence in support of the quality hypothesis. First, it is found that changes in the difference in average test score results of high school and college graduates do correlate closely with changes in the college/high school wage premium. Second, changes in the relative average quality of workers in each education group are found to be inversely related (with a lag) to relative changes in the supply of each group of workers.

A second form of the quality hypothesis – presented by Cameron and Heckman (1993) – has been an argument that the average quality of high school graduates has declined since the 1970s due to an increasing proportion of those graduates who attain graduate status by certification (passing the General Education Development (GED)

examination) rather than completing 12 years of formal schooling. Cameron and Heckman (1993) show that the labour market performance of GED graduates is inferior to that of the other category of high school graduates. The increasing proportion of GED graduates within the group of high school graduates is found to explain about 10 per cent of the increase in the college/high school wage premium in the United States between 1979 and 1987.

Available evidence is therefore consistent with some role for changes in labour quality in explaining changes in between group earnings inequality. However, in existing research the effect is examined only for labour quality between education groups, and there has not been an attempt to assess its contribution to changes in overall earnings inequality.

### **c. Demand factors**

#### ***c.i. Deindustrialisation***

The primary methodology that has been applied to test the effects of deindustrialisation has been to undertake a 'shift-share' type analysis to examine what fraction of changes in earnings inequality can be explained by changes in the industry distribution of employment. These studies – for the United States - find uniformly that changes in the industry composition of employment can explain little of the changes in earnings inequality that have occurred. For example, Bound and Johnson (1992) find that less than 10 per cent of the increase in the college/high school wage differential between 1979 and 1988 can be explained by changes in the industry composition of employment; Murphy and Welch (1993) find that shifts in industry composition explain about 15 per cent of changes in demand for college educated workers relative to workers with high school completion between 1968 and 1988; and Juhn et al. (1993) conclude that none of the increase in overall earnings inequality for males between 1969 and 1987 can be explained by changes in the industry composition of employment.

One study that uses an alternative methodology does however find stronger support for the deindustrialisation hypothesis. Bernard and Jensen (1998) undertake a regression analysis of the determinants of state-level changes in the 90-10 percentile

differential in log real weekly earnings. They find that the percentage of state employment in durable manufacturing industry has a significant negative effect on earnings inequality that is highly robust to inclusion of an extensive range of alternative explanatory variables. This result suggests that states where durable manufacturing employment declined most strongly – such as Pennsylvania – are also the states where earnings inequality increased by the largest magnitudes.

***c.ii. International trade  
Factor content studies***

Factor content studies undertaken for the United States have generally found fairly small effects of international trade on the relative demand for labour by skill category (for example, Borjas et al., 1992 and 1997, Katz and Murphy, 1992, and Sachs and Shatz, 1994). Freeman (1995, p.25) concludes that these studies indicate that trade can explain about 10 to 20 of the change in relative demand for labour by level of educational attainment. The most recent study by Borjas et al. (1997) obtains even more conservative conclusions – that at most trade with less developed countries can explain about 10 per cent of the growth in the high school graduate/high school drop out wage differential, and less than 10 per cent of growth in the college graduate/high school graduate wage differential from 1980 to 1995.

Research undertaken by Wood (1994, and 1995) has argued that the type of factor content studies described above have under-estimated the role of international trade in explaining changes in labour demand. The main source of bias identified by Wood relates to an argument that imports within an industry category may not compete with domestic output in that industry. Hence, by using industry-level labour input coefficients from the developed country to calculate the labour skill content of imports the proportion of low skill labour embodied in inputs is likely to be underestimated. This is because imports of goods within an industry category are likely to embody a relatively greater share of low skill labour than domestic production of goods in that industry. By instead using labour input coefficients from developing economies Wood shows that it is possible to approximately double the proportion of changes in relative wages that can be explained by increasing international trade. He further argues that the remainder of the change in relative wages by skill category can



be explained by the effect of international trade on introduction of technological change.

While the consensus appears to be that there is some validity in both points about the standard factor content approach that have been made by Wood, there seems much less acceptance of his methodology for correcting for problems with the approach, and hence with his argument that international trade alone can explain changes in relative wages between skill groups. For example, Wood's methodology (for example, assuming developing economy labour input coefficients) seems likely to over-estimate the effect of trade on the domestic labour market, especially when there has been some question raised about the extent to which domestic output and imports within industry categories should be regard as non-competing (Baldwin, 1995).

### *Stolper-Samuelson studies*

Early research for the United States did not find strong support for the Stolper-Samuelson theorem. In support of the theorem studies for the United States by Sachs and Shatz (1994, and 1996) find some evidence that output price decreases in sectors that are intensive in low skill labour occurred relatively more rapidly in the 1980s than previous time periods. However, another study by Lawrence and Slaughter (1993) finds that prices of import prices increased only marginally less than export prices. As well, the same studies (and other studies by Berman et al., 1994, and Autor et al., 1999) find that between-industry shifts in the composition of employment do not explain a large fraction of the increased employment share of high skill labour, and that contrary to the theory, within the vast majority of industries the composition of employment has shifted towards high skill labour.

There have been two types of responses to the findings from these early studies. First, it has been suggested that intra-industry shifts in the composition of employment towards high skill labour can be explained by international trade. One approach is to argue that foreign out-sourcing of intermediate inputs (production of which is intensive in low skill labour) is responsible for changes in the skill composition of employment. Empirical evidence however indicates that, while out-sourcing can explain some part of the intra-industry changes, it cannot explain the whole of the change (and direct measures for the effects of technological change have greater

explanatory power)(Autor et al., 1999, and Feenstra and Hanson, 1999). An alternative approach has involved analysis of plant-level changes in the skill composition of employment. Bernard and Jensen (1997) find that almost all of the intra-industry increase in demand for skilled labour in manufacturing industry in the United States between 1976 and 1987 can be explained by between-plant shifts in employment towards plants that are involved in export activity. This study provides perhaps the strongest evidence that changes in international trade might be the predominant factor behind changes in the demand for labour by skill category.

The second type of response has been to apply alternative approaches to estimating the relation between changes in output prices and relative wages of labour by skill category. Leamer (1994, and 1996) attempts to correct output prices for effects of technological change, and allows a greater lag between changes in output prices and relative wages. With this methodology it is possible to explain up to 40 per cent of the change in relative wages of production and nonproduction workers in manufacturing industry in the United States between 1961 and 1991.

Two further problems that have been raised with regard to the effect of international trade on labour demand also warrant some discussion. First, it has been argued that the timing of changes in international trade do not match with the periods of most rapid increase in earnings inequality. For example, Snower, 1998, argues that international trade expanded most rapidly in the United States during the 1970s whereas it was in the 1980s that largest increases in earnings inequality occurred. Slaughter (1998) reviews evidence from product price studies and concludes that changes in product prices operated most strongly to affect relative wages in the 1970s. Second, the Stolper-Samuelson theorem predicts that at the same time as there is an increase in the demand for high skill labour in high skill-abundant countries, there should be an increase in demand for low-skill labour in countries abundant in low-skill labour. However, several studies have found increased relative wages of high skill labour in a range of developing economies abundant in low skill labour such as Mexico (for example, Hanson and Harrison, 1995).

### *c.iii. Technological change*

Four main types of evidence have been used to address the question of whether technological change might be a source of changes in the demand for labour by skill. (A fifth approach is to treat technological change as a residual – to argue that since other explanations can't explain all of the shift in demand, therefore technological change must be the answer. As Raymond Chandler's detective Philip Marlowe says in 'Playback':

"There are things that are facts, in a statistical sense, on paper...And there are things that are facts because they have to be facts, because nothing makes any sense otherwise.")

One type of evidence, on changes in the share of high skill and low skill labour within industries, has served mainly as a critique of international trade as an explanation for changes in labour demand. The basic Stolper-Samuelson model predicts that a shift in production towards industries that are intensive in high skill labour will increase wages of high skill relative to low skill labour, and that this change in relative wages will cause an increase in the share of low skill labour and decrease in the share of high skill labour within each industry. However, contrary to the prediction of trade theory, evidence for the United States (Berman et al., 1994, and Autor et al., 1999) and for a range of OECD countries (Berman et al., 1998) shows that within almost all industries (and detailed sub-sectors for manufacturing industry) the share of high skill workers in total employment has increased. (These studies use as measures of skill either the proportion of production and non-production workers, or proportions of workers with different levels of educational attainment.) As further evidence against trade theory these studies also show that most of the overall shift in employment towards high skill labour has been due to within-industry rather than between-industry shifts. Finally, strong cross-country correlations in intra-industry changes in the skill composition of employment (Berman et al., 1998) have been taken as support for the hypothesis of pervasive technological change.

The second (more direct) type of evidence has examined whether there is a cross-section and time-series relation between changes in the skill composition of

employment and the extent of usage of (and changes in usage of) information technology capital. Studies by Bartel and Lichtenberg (1987), Berndt et al. (1992), Berman et al. (1994), and Autor et al. (1999) for the United States, and by Machin and Van Reenen (1998) for seven OECD countries have examined data on the intra-industry skill composition of employment (again, using as measures of skill either the proportion of production and non-production workers, or proportions of workers with different levels of educational attainment.). All studies reach the conclusion that the introduction of information technology such as computers has been an important determinant of the shift in employment towards high skill labour. For example, Autor et al. (1999) find that there exist strong positive correlations between industry-level indicators of technical change (such as computer investments, growth of employee computer use, and R&D expenditures) and within-industry growth in the employment share of workers with higher levels of education attainment and in more skilled occupation groups; and that lagged computer investments and R&D expenditure predict the subsequent rate of change in the relative employment shares of high skill workers (with the latter finding being interpreted as providing a causal link between the rate of technological change and changes in employment). It is also found that the relation between intensity of computer usage and the skill composition of employment is robust to including more general measures of capital utilisation as explanatory variables for the skill composition.

An alternative approach – in studies by Doms et al. (1997) and Bernard and Jensen (1997) for the United States – examines firm-level data on technological change and the skill composition of employment. These studies find similarly strong correlations between contemporaneous skill composition and measures of R&D intensity and investment in information technology capital. However, unlike the intra-industry studies Doms et al. (1997) find mixed evidence of a causal relation – a lagged measure of the number of new automation techniques introduced does not have a significant effect on the skill composition of employment, although lagged computer investment does have a significant effect. Hence Doms et al. (1997) conclude that how technology affects the skill composition of employment is likely to be sensitive to the type of technology.

[One criticism of these types of study is the use of the production/nonproduction worker classification as a proxy for worker skill. It is certainly the case that the classification causes some occupations that would generally be regarded as high skill (such as skilled tradespersons) to be categorised as production workers (and vice-versa). However, studies that have used education attainment as a proxy for skill (usually regarded as more satisfactory) reach similar conclusions to studies using the production/nonproduction worker classification. More generally though it does seem important to recognise that any of the usual proxies for skill – such as education, experience or occupation – are only partial representations of worker skill; and that to explain changes in earnings inequality it may be useful to think more generally about the types of skills embodied in workers and how the returns to those skills might have shifted.]

A third type of evidence has been to examine the relation between technological change, workplace organisation, and the demand for labour by skill level. For example, Bresnahan et al. (1999) examine data from a survey of 400 large firms in the United States including information on workplace organisation and workforce characteristics in the mid-1990s and on information technology investment in the period between the mid 1980s and mid 1990s. They find that use of information technology capital is complementary with types of new workplace organisation such as broader job responsibilities, more decentralised decision-making, and the introduction of self-managing teams. It is further found that both usage of information technology capital and workplace reorganisation are complements with worker skill (using measures such as educational attainment and skill level of occupation). Other case study evidence that is consistent with these findings is presented by Mark (1987) and Levy and Murnane (1996).

The final category of evidence on technological change is a group of studies that use wage data. Allen (1996) examines wages of individual workers in the United States in 1979 and 1989. He finds that wage differentials by industry are strongly related to measures such as R&D intensity and usage of high-tech capital, and that returns to schooling are larger in industries that are intensive in R&D and high-tech capital. Davis and Haltiwanger (1991) examine wage dispersion and the distribution of employment within manufacturing industry in the United States between 1963 and

1986 using plant level data that distinguishes between production and nonproduction workers. They argue that skill-biased technological change appears the potential explanation that is best able to explain their findings – for example, an increase in the firm-size wage differential and a shift in the distribution of hours worked towards small plants, and the significant growth in within-plant wage inequality for nonproduction workers. Finally, Haskel and Slaughter (1998) present evidence for ten OECD countries to show that there is a strong correlation between changes in the wage differential between production and nonproduction workers and constructed measures of the sector bias of technological change. This latter study is particularly important as it provides evidence for sector bias in technological change, and hence that technological change will have affected the demand for labour by skill even in a multi-sector environment.

The mainstream view at present appears to be that the weight of evidence is in favour of technological change as the main factor underpinning changes in relative demand for labour by skill type. Some arguments against this point of view on the role of technological change have, however, also been raised.

First, it has been suggested that the timing of changes to the rate of technological change does not match with the timing of increases in earnings inequality. Earnings inequality increased in the United States most rapidly during the 1980s, and hence it would seem that there should be evidence of an acceleration in technological change in the same period. The slow-down in the rate of growth in labour productivity during the 1980s, and evidence that the degree of capital-skill complementarity remained unchanged in that period, have therefore been used to argue that technological change cannot be the main explanation for changes in labour demand (Mishel and Bernstein, 1996). Against this criticism, Autor et al. (1999) present alternative evidence on changes in the skill composition of employment (by education and occupation) which it is argued does show an acceleration in the increase in demand for high skill relative to low skill labour from the 1970s onwards.

Second, it has been suggested that technological change over the past 25 years may partly reflect increased competitive pressures due to expansion of international trade. Hence, some part of any effect on relative labour demand by skill attributed to

technological change may in fact be due to changes in international trade patterns (for example, Leamer, 1996)

A third (and related) argument is that technological change that has occurred has been caused by changes in the relative supply of labour in different skill categories. An example is the model presented by Beaudry and Green (1998) (see also Acemoglu, 1998). Suppose that there are two methods of organising production – a ‘modern’ organisation and ‘traditional’ organisation. The modern organisation is assumed to use relatively more high skill labour, and less of other factors of production than the traditional organisation. Hence, an increase in the relative supply of high skill labour will favour the growth of the modern organisation since it decreases the price of the input it uses relatively intensively. This will in turn cause capital to flow towards modern organisations and away from traditional organisations. The end result is an increase in the wage differential between high skill and low skill labour.

#### **d. Institutional factors**

##### *d.i. Union effects*

A series of studies have examined the effect of decreases in union density on earnings inequality in the United States for different periods between the early 1970s and early 1990s. These studies have used a variance decomposition approach to identify the effect on the variance of earnings of changes to union density – holding constant other factors such as the union/nonunion earnings premium and earnings inequality within groups of union and nonunion workers. Freeman (1991) adopted a relatively simple approach using data aggregated across the whole population of workers. Subsequent studies by Card (1992, and 1998) have used a methodology that takes account of differences in the union/nonunion wage premium across different points in the wage distribution, and seeks to correct for selection bias and measurement error in the estimate of union wage effects. Despite the differences in methodology (and differences in time periods examined) these studies reach a fairly uniform conclusion – that decreases in union density can explain about 15 to 20 per cent of the increase in overall earnings dispersion for males, but little of the increase for females. The latter finding is attributed to the fact that union density for females did not change appreciably between the 1970s and 1990s. Card (1998) also finds that different trends

in union density can explain 50 to 80 per cent of the slower rise in wage inequality for men in the public than private sector, and 20 to 30 per cent of the slower rise for females.

Studies for other industrialised economies (using the same variance decomposition method) have also reached remarkably similar conclusions on the effect of changes in union density on earnings inequality. Gosling and Machin (1994) find that 15 per cent of the increase in variance of earnings for semi-skilled workers in the United Kingdom between 1980 and 1990 can be explained by decreases in union density. And Borland (1996) finds that decreases in union density in Australia between 1986 and 1994 explain about 25 per cent of the increase in the variance of weekly earnings of full-time employees for males and about 10 per cent for females. Both studies for the United Kingdom and Australia find that the main factor that accounts for increases in earnings inequality is higher inequality within the group of nonunion workers.

#### *d.ii. Labour market regulation*

Research on the effect of the minimum wage on changes in earnings inequality has reached mixed conclusions. Lee (1999) uses inter-state variation in the proportion of workers affected by the minimum wage in the United States to seek to identify how changes in the real value of the minimum wage have affected changes in earnings inequality. He finds that about 70 per cent of growth in the 50-10 percentile earnings difference for males and females can be explained by falls in the relative value of the minimum wage between 1979 and 1989. Another finding is that changes in the value of the minimum wage are not important for explaining changes in differences in average earnings between workers with different levels of education and experience, but account for about 60 to 80 per cent of the increase in earnings inequality within those groups. Another study by Bernard and Jensen (1998) also examines the relation between changes in state-level earnings inequality and the real state-level minimum wage in the United States between 1970 and 1980, and 1980 and 1990. Estimation of a regression equation for the determinants of the changes in state-level 90-10 percentile differences in earnings finds some evidence of an inverse relation with changes in the state-level minimum wage, but the relation is not found to be particularly robust.



Available evidence on the relation between changes in earnings inequality and the degree of centralisation in wage-setting appears to consist of a single study by the OECD (1997). That study – incorporating data for 17 OECD countries between 1980 and 1994 – did not find a significant relation between changes in earnings inequality and changes in the degree of centralisation in wage-setting.

#### *d.iii. Other government regulation*

Apart from the analysis undertaken by Fortin and Lemieux (1997) there does not appear to have been any other study of how changes to government product market regulation have affected the distribution of earnings. Instead research on deregulation has been primarily concerned with how the average wages of particular groups of workers have been affected – for example, Rose (1987) documents a large decline in earnings of trucking industry employees in the United States following deregulation of interstate transport; Card (1986) finds that deregulation of entry to the airline industry in the United States had a modest effect on wages of airline mechanics; and Gaston and Trefler (1994) find evidence that wages of manufacturing industry employees in the United States are related to industry-level effective rates of protection. (For a review see Peoples, 1998). However the implications of these studies for the sources of changes in earnings inequality have not been explored.

The role of government as an employer has also not received much attention in research on earnings inequality. For the United States Card (1998) finds that earnings inequality between 1973-74 and 1993 increased far more rapidly for public sector than private sector employees. However, he also finds that most of this difference can be attributed to differences in changes in union density between those sectors, rather than to any direct effect of government on wages of public sector workers. For Australia Borland and Kennedy (1998) find that earnings inequality between 1982 and 1990 increased by a larger amount for private sector than for public sector employees. Changes in the proportion of public sector employees in total employment are however found to explain a negligible fraction of the overall increase in earnings inequality.

## e. Summary

Several main findings emerge from empirical research on the causes of earnings inequality:

- Inequality between groups of workers with different levels of education attainment and years of potential experience has widened in most industrialised countries. Changes in earnings differentials between education/experience groups (over time within a country and differences between countries) appear to be reasonably well explained by a demand/supply model using actual changes in labour supply inputs and assuming a secular (or slightly increasing over time) rate of increase in demand for high skill relative to low skill workers. (Hence there does not seem to be a strong role for institutional factors in explaining this dimension of changes in between-group inequality.)
- The main sources of the change in relative demand for labour by skill category have been an expansion of international trade and technological change. Although there is not unanimity regarding the effects of trade, a ‘consensus’ estimate for the United States appears to be that trade can explain about 10 to 20 per cent of the growth in earnings differentials between workers by education/experience. Fairly strong evidence on a causal link between technological change and increased earnings differentials by education/experience now exists; however, at present the evidence is probably not sufficiently strong to claim conclusively that technological change can explain the entire change in earnings differentials that is not explained by international trade. (The main caveats to this summary point are firm-level evidence on the effects of international trade, and state-level evidence on the effect of deindustrialisation on earnings inequality.)
- Evidence on the causes of changes in earnings inequality within groups of workers with the same education and years of experience relates mainly to the role of institutional factors. Studies of the effects of changes in union density (for a range of countries) and in the value of the minimum wage (primarily for the United States) suggest that those factors can explain up to about one-half of changes in within-groups earnings inequality.
- Decomposition analyses for the United States suggest that changes in earnings differentials between workers in different education/experience groups explain about

one-third of changes in overall earnings inequality. Interpreting existing evidence as finding that the entire change in between-group inequality can be explained by a demand/supply model, and that one-half of the change in within-group inequality is explained by institutional factors, this means that about one-third of the change in overall earnings inequality in the United States is left unexplained. For other countries, however, the story is somewhat different. For example, in Australia it is found that virtually none of the increase in earnings inequality is explained by changes in earnings differentials between education/experience groups; and that existing explanations can account for only about one-fifth of the change in within-group (and hence overall) earnings inequality.

- Possible explanations for increases in within-group earnings inequality not explained by changes in union density or minimum wages are of two main types. First, changes in the distribution of skills, or increases in the return to skills, not proxied for by education and experience, might have caused increased earnings inequality. An example would be an increase in the return to basic abilities such as cognitive or inter-personal skills. (Changes in the return to unobserved skills can be caused by the same set of factors as for changes in the return to observed skills – for example, international trade and technological change.) Second, changes in institutional factors, apart from those examined in existing empirical research, could be a source of higher earnings inequality. An example might be the erosion of social norms in wage-setting.

## **6. FUTURE RESEARCH ON NEW ZEALAND – A SUGGESTED AGENDA**

### **a What is known about changes in earnings inequality in New Zealand?**

The starting point for suggesting how future research on earnings inequality in New Zealand might proceed has to be an understanding of the current state of knowledge. Existing evidence for New Zealand is primarily in the form of descriptive information on the nature of changes in earnings inequality. That descriptive evidence – reviewed in section 3 of the report – indicates that:

- There was a substantial increase in earnings inequality for wage and salary workers in New Zealand between 1984 and 1997. Increases occurred for both male and female workers, but have been more pronounced using a weekly than hourly earnings measure. The magnitude of increases in earnings inequality have been fairly large by international standards.
- Changes in the distribution of the workforce between groups classified by education, age, industry and hours of work, and changes in the relative earnings of those groups, can together explain about one-third of the increase in overall earnings inequality. The remaining two-thirds of the increase is therefore attributed to ‘unobservable factors’ (changes within the groups of workers).
- The timing of increases in earnings inequality and income inequality suggests that the former might have been an important cause of the latter. However, it appears that changes in the share of wage and salary income in total income have been much more important than changes in the dispersion of wage and salary income as a cause of increases in income inequality.

Little research appears to exist on the causes of changes of earnings inequality in New Zealand. The exception is some research that has been undertaken by Lang (1998), and Deardorff and Lattimore (1999a, 1999b), to examine the relation between international trade and earnings outcomes. Lang (1998) finds a positive relation between industry-level wages and effective protection, and hence, due to the concentration of protection in low-wage industries, it is possible to conclude that decreases in protection would have increased inter-industry earnings dispersion. Deardorff and Lattimore (1999a, 1999b) use a type of factor content approach to

examine the relation between trade and earnings differentials across workers with different education attainment. Their analysis indicates that changes to trade patterns between 1986 and 1996 appear to have had a slight equalising effect on relative average wages across education groups. In particular the wage gap between workers with advanced technical qualifications and no qualifications has narrowed over the period. These results contrast with the hypothesis that the expansion of international trade is an important explanatory factor for increases in earnings inequality in New Zealand.

The existing state of research on earnings inequality in New Zealand – which provides a comprehensive understanding of the nature of changes in earnings inequality but has not provided significant insights into the causes of those changes – clearly suggests that the priority for future research should be to undertake some analysis of the causes of increases in earnings inequality. As well, an important issue (discussed in the introductory section of the report) is the extent to which changes in demand and supply in the labour market cause adjustment through changes in earnings and employment. This is a further issue that might usefully be taken up in future research.

#### **b. What to do - Introduction**

In thinking about how to proceed with analysis of causes of increases in earnings inequality in New Zealand it seems sensible to take into account three main factors:

- What are the existing methodologies that have been applied to study causes of changes in earnings inequality in international research?
- Do recent developments in the New Zealand economy suggest that the role of particular factors should be examined?
- What data are available?

In making suggestions on an exact research strategy that might be followed, tradeoffs are likely to exist between these factors. For example, based on international research declines in union density that occurred in New Zealand seem an important potential candidate for explaining increases in earnings inequality; however, data that could be

applied to examine this relation do not seem to exist. Hence the research strategy that is outlined in the next sub-section attempts to suggest a feasible course of action taking into account each of the three factors.

**c. What to do – A possible research strategy**

A review of existing research on earnings inequality in New Zealand suggests that two useful areas for future research are analysis of causes of increases in earnings inequality, and of the extent of adjustment in earnings and employment in response to demand or supply shocks. Figure 2 provides an outline of specific research that might be undertaken on these topics.

On the first topic of causes of changes in earnings inequality the research strategy makes a distinction between research analysing changes in relative earnings of workers grouped by education/experience, and changes in earnings inequality within those groups. It seems that it would be possible to make progress on understanding the role of demand and supply factors in causing changes in between-group relative earnings using the Katz and Murphy (1992) methodology applied to New Zealand or in a cross-country context to New Zealand and Australia. This would provide a perspective on the extent to which changes in the earnings structure can be thought of as occurring mainly due to changes in demand and supply (as appears to be the case in the United States); and whether the magnitude of shifts in the demand for labour by skill category appear to have been similar in New Zealand and Australia.

It should also be possible to pursue some of the specific factors that might have caused changes in labour supply and labour demand by skill category:

- i) The overall role of labour supply factors would be ascertained through the general analyses described above. Between 1986 and 1996 there were large changes in labour force participation of young adults, prime-age males, and adults without formal education qualifications (Dixon, 1996b). Hence it would be of interest to examine to these changes in labour force participation are related to changes in earnings differentials. Large inflows of low skill immigrants to New Zealand in the early 1990s (Dixon, 1998, p.99) suggest that it might also be of interest to examine the particular effect of immigration

on earnings differentials between skill groups. Such an analysis could be undertaken at an economy-wide level using the factor content approach (for example, Borjas et al., 1997); and

- ii) From the early 1980s onwards there has been considerable liberalisation of international trade to and from New Zealand. For example, average effective rates of assistance on manufactured products fell from 39 per cent to 26 per cent between 1982 and 1988. While the overall share of manufactured imports in domestic consumption remained relatively steady from the mid 1980s to early 1980s there were large increases in imports of good for which rates of protection had declined most significantly (for example, textiles, apparel and leather goods) (Lattimore and Wooding, 1996, pp.334-350). Effects of increases in international trade could be analysed using the two main types of methodology used in international research:

- Factor content approach: Examine effect on earnings differentials by skill of changes in labour supply implicit in changes in trade flows (for example, Borjas et al., 1997).
- Stolper-Samuelson approach: Examine whether prices of goods in industries intensive in low skill labour have decreased relative to prices of goods in industries intensive in high skill labour (for example, Lawrence and Slaughter, 1993).

Unfortunately there are two areas where it would be desirable to undertake research on causes of changes in earnings inequality where data limitations mean that such research does not appear feasible. First, following implementation of the Employment Contracts Act union density has declined from 42 per cent in 1991 to 23 per cent in 1994 (Evans et al., 1996, p.1882); and there is a single minimum wage (different only for adults and youth) rather than the set of awards that had previously specified minimum wages and conditions for workers. Unfortunately, the absence of data on union status of individual workers in unit record data sets in New Zealand, and the difficulties of measuring the impact of wage regulation (for example, matching award wage data to individual workers), mean it is likely to be difficult to say much about the causes of changes in earnings inequality within groups of workers (grouped by education and experience). Second, the lack of data on capital intensity or usage of new technologies (by workplace or industry level) means that it is not

possible to use existing methods for examining whether there is a relation between technological change and shifts in the demand for labour by skill category.

On the second topic of earnings and employment adjustment two empirical approaches seem feasible. First, a cross-country analysis of the relative magnitude of earnings and employment adjustment in response to changes in the demand for labour by skill category (workers grouped by education and experience) could be undertaken (Card et al., 1996). Second, the relation between earnings and employment outcomes for individual workers, and changes in the aggregate demand for labour (proxied for example by the aggregate rate of unemployment), could be undertaken using quasi-cohort data. Such an analysis can provide information on how the labour market adjusts to aggregate shocks. This exercise could be undertaken using data from multiple cross-section data sets for a single country, or for different countries (such as Australia and New Zealand) to obtain a comparative institutional perspective. Understanding the extent to which a country's labour market adjusts through changes in earnings and/or employment can provide a perspective on issues such as the causes of unemployment and trends in earnings.

By way of summary, the research that has been suggested in this sub-section could be organised into three projects as follows (ordered according to ease of implementation):

1. Causes of changes in the earnings structure (analysis for New Zealand and cross-country study with Australia) and the extent of earnings/employment adjustment in the labour market (cross-country study). (The reason for integrating these two pieces of research is that both involve disaggregating the workforce into education/experience groups);
2. Analysis of the effects of immigration and international trade on the earnings structure; and
3. Extent of earnings/employment adjustment in the labour market (Quasi-cohort analysis for New Zealand and cross-country study).

Together these projects would provide useful information on the extent to which changes in the earnings structure can be explained by demand and supply factors, provide insight into some of the factors that might have caused changes in demand



and supply, and provide a perspective on the relative extent of adjustment in earnings and employment in response to demand and supply shocks. What would be missing (due to data limitations) would be an understanding of the role of institutional factors (such as changes in wage regulation or union density) in explaining changes in earnings inequality, and analysis of some types of demand and supply factors (such as technological change).

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**TABLES**

**Table 1: Earnings inequality in selected OECD countries – 1981 to 1993**

	<b>1981</b>	<b>1984</b>	<b>1987</b>	<b>1990</b>	<b>1993</b>	<b>Overall change</b>
<b>Australia</b>						
Male – 90/50	1.74	1.67	1.70	1.62	1.76	+0.02
50/10	1.64	1.64	1.64	1.68	1.64	0
Female – 90/50	1.51	1.59	1.61	1.59	1.59	+0.08
50/10	1.65	1.70	1.64	1.65	1.58	-0.07
<b>Canada</b>						
Male – 90/50	1.67			1.75	1.73	+0.06
50/10	2.07			2.28	2.19	+0.12
Female – 90/50	1.76			1.75	1.84	+0.08
50/10	2.12			2.28	2.10	-0.02
<b>France</b>						
Male – 90/50	2.05	2.06	2.11	2.13	2.13	+0.08
50/10	1.65	1.61	1.61	1.62	1.61	-0.04
Female – 90/50	1.69	1.67	1.69	1.72	1.73	+0.04
50/10	1.63	1.57	1.62	1.66	1.70	+0.07
<b>Germany</b>						
Male – 90/50		1.65	1.63	1.65	1.65	
50/10		1.48	1.41	1.40	1.37	
Female – 90/50		1.60	1.58	1.58	1.57	
50/10		1.67	1.53	1.52	1.48	
<b>Italy</b>						
Male – 90/50	1.46	1.50	1.56		1.65	+0.19
50/10	1.49	1.53	1.45		1.60	+0.11
Female – 90/50	1.46	1.35	1.39		1.49	+0.03
50/10	2.16	1.73	1.65		1.88	-0.28

<b>Japan</b>						
Male – 90/50	1.65	1.68	1.68	1.73	1.71	+0.06
50/10	1.61	1.65	1.65	1.64	1.61	0
Female – 90/50	1.56	1.57	1.65	1.61	1.59	+0.03
50/10	1.40	1.40	1.41	1.43	1.41	+0.01
<b>Sweden</b>						
Male – 90/50	1.56	1.55	1.58	1.56	1.62	+0.06
50/10	1.33	1.31	1.33	1.33	1.36	+0.03
Female – 90/50	1.35	1.35	1.39	1.40	1.40	+0.05
50/10	1.31	1.29	1.33	1.22	1.30	-0.01
<b>United Kingdom</b>						
Male – 90/50	1.68	1.71	1.76	1.81	1.86	+0.18
50/10	1.56	1.62	1.68	1.72	1.74	+0.18
Female – 90/50	1.72	1.66	1.72	1.79	1.82	+0.10
50/10	1.47	1.51	1.56	1.60	1.65	+0.18
<b>United States</b>						
Male – 90/50	1.74	1.86	1.91	1.96	2.00	+0.26
50/10	1.92	1.98	2.06	2.02	2.06	+0.14
Female – 90/50	1.85	1.80	1.87	1.92	1.96	+0.11
50/10	1.62	1.83	1.87	1.91	1.90	+0.28

Source: OECD (1996, Table 3.1).

**Table 2: Wage inequality for full-time workers – Log of ratio of wage of 90<sup>th</sup> to 10<sup>th</sup> percentile wage earner - Selected OECD countries, 1979 to 1990**

	<b>1979</b>	<b>1984</b>	<b>1987</b>	<b>1990</b>	<b>Change</b>
<b>Men</b>					
United Kingdom	0.88	1.04	1.10	1.16	+0.28
United States	1.23	1.36	1.38	1.40	+0.17
Japan	0.95	1.02	1.01	1.04	+0.09
France	1.19	1.18	1.22		
Italy	0.74	0.69	0.73		
Netherlands	0.82	0.77		0.80	-0.02
Germany I	0.78	0.80			
Germany II		0.96	0.91		
Canada	1.23		1.44		
<b>Women</b>					
United States	0.96	1.16	1.23	1.27	+0.31
United Kingdom	0.84	0.98	1.02	1.11	+0.27
Japan	0.78	0.79	0.84	0.83	+0.05
France	0.96	0.93	1.00		
Italy	0.87	0.69	0.69		

Source: Freeman and Katz (1994, Table 2.2)

**Table 3: Coefficient of variation – Annual gross earnings – Males – Selected OECD countries**

<b>Country</b>	<b>Time period</b>	<b>Change per annum</b>
Australia	1981-1985	+0.005
	1985-1989	+0.003
Canada	1987-1991	+0.002
Finland	1987-1991	-0.001
Israel	1979-1986	+0.010
	1986-1992	+0.003
Netherlands	1983-1987	+0.003
Sweden	1981-1987	+0.004
	1987-1992	+0.003
United Kingdom	1979-1986	+0.008
United States	1979-1986	+0.006
	1986-1991	+0.003

Source: Gottschalk and Joyce (1998, Table 1).

**Table 4 – Distribution of hourly wages – All workers – United States – 1976 to 1991**

**A. Change in inter-percentile log hourly wage differential**

	<b>CPS - March</b>			<b>CPS - ORG</b>		
	<b>90-10</b>	<b>90-50</b>	<b>50-10</b>	<b>90-10</b>	<b>90-50</b>	<b>50-10</b>
<b>Male</b>						
Change:						
1976-1981	0.04	-0.01	0.05	0.06	0.06	0.00
1981-1986	0.15	0.06	0.09	0.12	0.04	0.08
1986-1991	0.01	0.07	-0.06	0.00	0.02	-0.02
1991-1996	-0.01	0.03	-0.04	0.07	0.08	-0.01
<b>Female</b>						
Change:						
1976-1981	-0.01	0.03	-0.04	-0.01	0.02	-0.03
1981-1986	0.22	0.04	0.18	0.17	0.08	0.09
1986-1991	0.07	0.04	0.03	0.00	0.01	-0.01
1991-1996	0.04	0.05	-0.01	0.07	0.05	0.02

**B. Real hourly wage by percentile (1996 dollars)**

	<b>CPS - March</b>			<b>CPS - ORG</b>		
	<b>10</b>	<b>50</b>	<b>90</b>	<b>10</b>	<b>50</b>	<b>90</b>
<b>Male</b>						
1976	6.91	13.59	25.13	6.09	14.27	26.89
1981	6.52	13.55	24.70	5.86	13.73	27.54
1986	5.99	13.65	26.42	5.49	13.91	29.06
1991	5.77	12.42	25.69	5.26	13.10	27.91
1996	5.68	11.85	25.27	5.12	12.62	29.00
<b>Female</b>						
1976	5.51	8.62	15.86	4.27	8.52	16.32
1981	5.78	8.71	16.49	4.47	8.73	16.98
1986	5.07	9.14	18.06	4.31	9.19	19.45
1991	5.01	9.31	19.22	4.39	9.47	20.31
1996	4.96	9.19	19.91	4.22	9.56	21.53

Source; Bernstein and Mishel (1997, Tables 4 and 6).

**Table 5: Average female earnings as a percentage of average male earnings – Selected OECD countries – 1968 to 1987**

	<b>1968</b>	<b>1977</b>	<b>1987</b>
Sweden	0.78	0.87	0.90
France	0.86 (1972)	0.86	0.82
Denmark	0.74	0.85	0.82
Australia	0.63	0.82	0.82
Netherlands	0.74	0.81	0.77 (1986)
Norway	0.75	0.80	0.84
United Kingdom	0.54 (1970)	0.65	0.66
Switzerland	0.64	0.68	0.67
Japan	0.43 (1960)	0.56 (1975)	0.52

Source: Gregory (1998, Table 1).

**Table 6: Real weekly wage changes for full-time workers, United States, 1963 to 1987**

**Change in log average real weekly wage (multiplied by 100):**

	<b>1963-1971</b>	<b>1971-1979</b>	<b>1979-1987</b>	<b>Overall</b>
<b>All</b>	19.2	-2.8	-0.3	16.1
<b>Gender:</b>				
Male	19.7	-3.4	-2.4	13.9
Female	17.6	-0.8	6.1	22.9
<b>Education:</b>				
8-11 years	17.1	0.3	-6.6	10.9
12 years	16.7	1.4	-4.0	14.1
13-15 years	16.4	-3.4	1.5	14.4
16+ years	25.5	-10.1	7.7	23.1
<b>Experience (men):</b>				
1-5 years	17.1	-3.5	-6.7	6.8
26-25 years	19.4	-0.6	0	18.8

Source: Katz and Murphy (1992, Table 1).



**Table 7: Changes in earnings differentials between education groups – Selected OECD countries**

**A. 1970s**

<b>Country</b>	<b>Education groups</b>	<b>Base year</b>	<b>Ratio</b>	<b>End year</b>	<b>Ratio</b>	<b>Five year change</b>
United States	College/CHS	1969	1.49	1978	1.35	-0.07
Japan	College/Upper HS	1970	1.33	1979	1.26	-0.04
United Kingdom	University/No qualification	1974	1.64	1980	1.53	-0.06
Canada	University/CHS	1970	1.65	1980	1.40	-0.13
Sweden	University/Post secondary	1968	1.40	1981	1.16	-0.09
Australia	University/Left school 17-18	1968/69	1.89	1978/79	1.54	-0.17

**B. 1980s**

<b>Country</b>	<b>Education groups</b>	<b>Base year</b>	<b>Ratio</b>	<b>End year</b>	<b>Ratio</b>	<b>Five year change</b>
United States	College/CHS	1979	1.37	1987	1.52	+0.11
Japan	College/Upper HS	1979	1.26	1987	1.26	0
United Kingdom	University/No qualification	1980	1.53	1988	1.65	+0.08
Canada	University/CHS	1980	1.40	1985	1.43	+0.05
Sweden	University/Post secondary	1981	1.16	1986	1.19	+0.03
Australia	University/Trade	1982		1990		+0.03
Netherlands	University/CHS	1983	1.43	1987	1.23	-0.25

Source: Davis (1992, Table 3).

**Table 8: Age-earnings differentials – 40-55 years to 25-30 years – Selected OECD countries**

<b>Country</b>	<b>Base year</b>	<b>Ratio</b>	<b>End year</b>	<b>Ratio</b>	<b>Five-year change</b>
United States	1979	1.28	1986	1.46	+0.13
Canada	1981	1.16	1987	1.33	+0.14
West Germany	1981	1.14	1984	1.39	+0.42
Australia	1981	1.20	1985	1.29	+0.09
Sweden	1981	1.20	1987	1.22	+0.01
France	1979	1.25	1984	1.40	+0.15
United Kingdom	1979	1.08	1986	1.17	+0.06
Netherlands	1983	1.30	1987	1.40	+0.12

Source: Davis (1992, Table 2.B).

**Table 9: Changes in inter and intra-industry earnings dispersion – Selected OECD countries**

<b>Country</b>	<b>Years</b>	<b>Total percent change in square of coefficient of variation</b>	<b>Effect of change in industry distribution of employment</b>	<b>Effect of change in inter-industry average earnings</b>	<b>Effect of change in intra-industry earnings dispersion</b>
Canada	1981-1990	25.2	0.8	-1.0	25.4
Japan	1979-1989	9.3	1.6	2.6	5.2
United Kingdom	1984-1991	54.0	-6.9	8.6	52.3
Australia	1981-1985	15.3	1.7	2.4	11.1
Netherlands	1983-1987	9.2	0.3	-2.2	11.0
Sweden	1981-1987	-0.6	-1.4	7.5	5.6
United States	1979-1986	31.0	1.7	1.1	28.1

Source: OECD (1993, Table 5.8).

**Table 10: Sources of changes in earnings inequality – JMP decomposition – 90-10 percentile log earnings difference - United States and Australia**

	<b>Effect of:</b>		
<b>Total change</b>	<b>Change in observable attributes</b>	<b>Change in return to observable attributes</b>	<b>Unobservable factors</b>
A. United States – Males – Hourly wages – 1964-1988			
0.373	0.035	0.128	0.208
B. Australia – Weekly earnings – 1982 to 1994/95			
Males – 0.132	0.021	-0.021	0.132
Females – 0.073	0.028	-0.037	0.082

Sources: a) United States – Juhn et al. (1993, Table 4); and Australia – Borland and Kennedy (1998, Table A2.3).

**Table 11: Changes in earnings inequality – New Zealand – 1984 to 1997**

**A. Males**

	<b>1984</b>	<b>1990</b>	<b>1997</b>	<b>Overall change</b>
<b>I. Weekly</b>				
90-10 log difference	1.00	1.12	1.27	0.267
90-50	0.51	0.56	0.67	0.158
50-10	0.49	0.56	0.60	0.108
Gini coefficient	0.23	0.26	0.29	0.061
<b>II. Hourly</b>				
90-10 log difference	1.07	1.16	1.18	0.110
90-50	0.54	0.57	0.60	0.062
50-10	0.53	0.59	0.58	0.047
Gini coefficient	0.24	0.27	0.28	0.041

**B. Females**

	<b>1984</b>	<b>1990</b>	<b>1997</b>	<b>Overall change</b>
<b>I. Weekly</b>				
90-10 log difference	0.89	1.00	1.04	0.148
90-50	0.43	0.44	0.52	0.086
50-10	0.45	0.55	0.51	0.061
Gini coefficient	0.19	0.22	0.24	0.047
<b>II. Hourly</b>				
90-10 log difference	0.96	0.99	1.02	0.063
90-50	0.51	0.50	0.54	0.034
50-10	0.45	0.49	0.48	0.029
Gini coefficient	0.22	0.24	0.24	0.020

Source: Dixon (1998, Table 2).

**Table 12: Dispersion in wages and salaries by gender – New Zealand – Gini coefficients, 1982 to 1996**

	<b>1982</b>	<b>1986</b>	<b>1990</b>	<b>1994</b>
<b>A. Males</b>				
15-64 years	0.340	0.339	0.408	0.434
15+ years	0.350	0.353	0.415	0.442
<b>B. Females</b>				
15-64 years	0.479	0.459	0.481	0.486
15+ years	0.481	0.463	0.486	0.490

Source: Statistics New Zealand (1999, Figure 2.11).

**Table 13: Changes in aggregate real earnings – New Zealand – 1984 to 1997**

	<b>Per cent change:</b>	
	<b>1984-1990</b>	<b>1990-1997</b>
<b>A. Median weekly earnings</b>		
Males	8.5	-1.1
Females	14.5	4.2
<b>B. Median hourly earnings</b>		
Males	7.7	-6.1
Females	7.0	-8.1

Source: Dixon (1998, Table 1).

**Table 14: Regression of individual characteristics on log hourly wage – New Zealand – 1984 to 1997**

<b>Variable</b>	<b>1984</b>	<b>1990</b>	<b>1997</b>
Constant	1.471*	1.301*	1.226*
Female	-0.162*	-0.146*	-0.093*
Age	0.062*	0.067*	0.065*
(Age) <sup>2</sup> × 1000	-0.692*	-0.751*	-0.724*
No qualification	-0.154*	-0.181*	-0.198*
Vocational qualification	0.056	0.114*	0.086*
University qualification	0.257*	0.344*	0.263*
Maori	-0.032	-0.018	-0.038
Other non-Pakeha ethnicity	-0.022	-0.061	-0.109*
Part-time	-0.117*	-0.095*	-0.119*
Adjusted R-squared	0.313	0.304	0.270
Sample size	3981	3372	3001

Note: Asterik denotes significant at 5 per cent level.

Source: Dixon (1998, Table 6).

**Table 15: Age-log hourly wage ratios – New Zealand – 1984 to 1997**

<b>Age group ratio</b>	<b>1984</b>	<b>1990</b>	<b>1997</b>
20/35 years	0.871	0.858	0.855
25/35 years	0.926	0.919	0.917
30/35 years	0.969	0.966	0.965
40/35 years	1.018	1.019	1.020
45/35 years	1.023	1.025	1.027
50/35 years	1.017	1.017	1.019
55/35 years	0.997	0.995	0.998

Source: Calculated from Table 6 in Dixon (1998).

**Table 16: Sources of changes in weekly earnings inequality – JMP decomposition – New Zealand – 1984 to 1997**

	<b>Effect of:</b>		
<b>Total change</b>	<b>Change in observable attributes</b>	<b>Change in return to observable attributes</b>	<b>Unobservable factors</b>
<b>A. Males</b>			
90-10 difference – 0.246	0.040	0.076	0.131
Standard deviation – 0.129	0.012	0.025	0.091
<b>B. Females</b>			
90-10 difference – 0.184	0.068	-0.021	0.138
Standard deviation – 0.099	0.099	0.027	0.073

Source: Dixon (1998, Table 7).

**Table 17: Income inequality – Gini coefficients – New Zealand – 1982 to 1996**

	<b>1982</b>	<b>1986</b>	<b>1991</b>	<b>1996</b>
Market income recipients (15 years plus)	0.483	0.491	0.534	0.554
All persons (15 years plus)	0.566	0.542	0.611	0.609
Household equivalent market income	0.384	0.395	0.469	0.478
Household equivalent disposable income	0.259	0.253	0.307	0.322

Source: Statistics New Zealand (1999, Tables 2.20 and 5.4).

**Table 18: Sources of changes in distribution of log household income – New Zealand – 1983-86 to 1995-98**

	<b>Gini</b>	<b>90-50 percentile difference</b>	<b>50-10 percentile difference</b>
1983-86	0.347	0.715	1.051
Change in:			
(a) Household types	0.352	0.729	1.039
(b) (a) + Attributes	0.365	0.772	1.138
© (b) + Employment	0.370	0.796	1.104
(d) © + Returns	0.365	0.796	1.011
1995-98	0.398	0.904	1.012

Source: Hyslop and Mare (1999, Table 4b).



**Table 19: Imports and exports as a percentage of nominal GDP – OECD regions – 1962 to 1992**

	1962	1972	1982	1992
<b>Imports</b>				
Europe	3.9	5.4	6.9	7.6
North America	1.8	2.0	2.5	2.1
Other OECD	0.4	0.8	1.1	1.2
<b>Exports</b>				
Europe	4.2	5.5	7.1	7.8
North America	1.4	2.0	2.3	2.3
Other OECD	0.5	0.5	0.7	0.7

Source: OECD (1994, Table 3.1)

**Table 20: Percent of workers who use a computer work – 1984 to 1997 – United States**

	1984	1989	1993	1997
<b>All</b>	24.4	37.3	46.6	50.6
<b>Occupation:</b>				
Professional & technical	38.1	54.4	65.7	73.1
Managers & administrators	42.5	61.8	73.7	78.7
Sales	23.9	35.5	49.8	55.8
Clerical	47.4	66.8	77.4	78.6
Craftspersons	10.1	15.2	23.5	25.3
Operatives	5.8	9.6	15.7	18.6
Laborers	3.2	6.6	11.7	12.8
Service	6.0	9.8	15.1	16.8

Source: Friedberg (1999, Table 4).

**Table 21: Union density (non-agricultural employees) – Selected OECD countries – 1970 to 1986/87**

	<b>1970</b>	<b>1979</b>	<b>1986/87</b>
Australia	52	58	56
Canada	32	36	36
France	22	20	17
Germany	37	42	43
Italy	39	51	45
Japan	35	32	28
Netherlands	39	43	35
New Zealand	43	46	41
Sweden	79	89	96
United Kingdom	51	58	50
United States	31	25	17

Source: Blanchflower and Freeman (1992, Table 1).

**Table 22: Decomposition analyses of sources of changes in earnings inequality in the United States – Summary of findings**

**Panel A: Bound and Johnson (1992) – Change in College/High school wage differential**

	<b>1973-1979</b>		<b>1979-1988</b>	
	<b>Male</b>	<b>Female</b>	<b>Male</b>	<b>Female</b>
Overall change	-0.035	-0.073	0.163	0.118
Effect of:				
Industry wage effects	0.007	-0.002	0.036	0.015
Supply of labour by skill category	-0.117	-0.098	-0.100	-0.191
Demand for labour by industry	-0.008	-0.052	0.013	-0.047
Technical change	0.082	0.122	0.215	0.279
Residual	0.001	-0.043	-0.001	0.062

**B. DiNardo et al. (1996) – Change in standard deviation of hourly wages – 1979 to 1988**

	<b>Male</b>	<b>Female</b>
Overall change	0.072	0.090
Percent contribution of:		
Minimum wage	24.8	30.2
Union effects	14.3	3.2
Distribution of individual characteristics	14.3	25.9
Supply/Demand effects	22.3	19.3
Residual	24.4	21.2

**C. Fortin and Lemieux (1997) – Variance of hourly wages – 1979 to 1988**

	<b>Male</b>	<b>Female</b>
Percent contribution of:		
Minimum wage	24.2	32.1
Union effects	21.3	0
Deregulation	2.6	-1.9

**Table 23: Growth of College/High School Relative Hourly Wage – United States – 1940 to 1998 (Annualized percent changes)**

	<b>Relative wage – Actual</b>	<b>Relative supply – Actual</b>	<b>Relative demand – Constructed</b>
1940-50	-1.86	2.35	-0.25
1950-60	0.83	2.91	4.08
1960-70	0.69	2.55	3.52
1970-80	-0.74	4.99	3.95
1980-90	1.51	2.53	4.65
1990-98	0.36	2.25	2.76

Source: Katz (1999, Table 2).

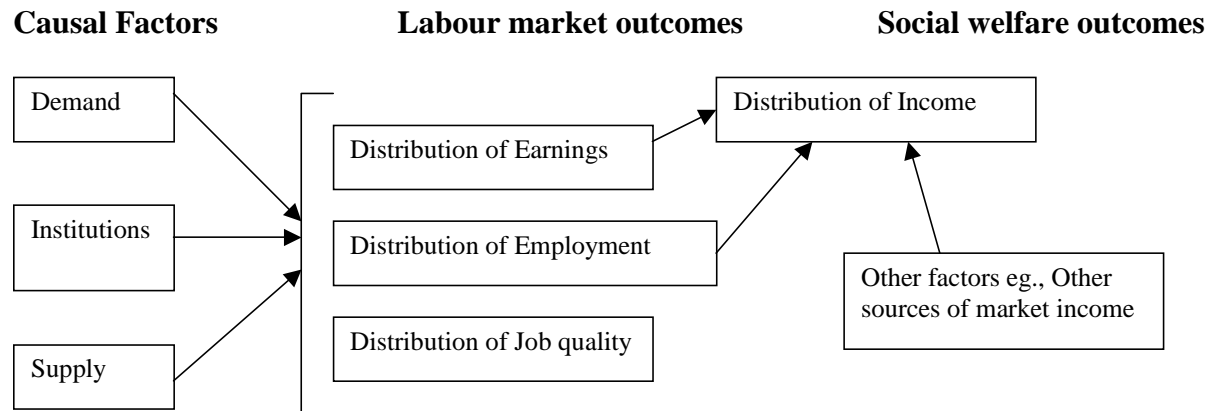
## NOTES ON TABLES:

**Figure 1:** Definition of earnings variables: Australia – Gross weekly earnings of full-time employees in main job; Canada – Gross annual earnings of full-year full-time employees; France – Net monthly earnings of full-time employees; Germany – Gross monthly earnings of full-time workers; Italy – Monthly net earnings of full-time wage and salary earners in main job; Japan – Monthly scheduled earnings of regular employees (excluding part-time employees); Sweden – Gross annual earnings of full-year, full-time employees aged 18 and over; United Kingdom – Gross weekly earnings of full-time employees paid at adult rates; and United States – Gross annual earnings of full-time full-year workers.

**Figure 2:** Samples consist of full-time workers (except for Japan where the sample is regular workers). Wages are measured by hourly wages for the United States, United Kingdom, France and Sweden; weekly earnings for Germany I and gross monthly earnings for Germany II; and gross annual earnings for other countries.

## FIGURES

**Figure 1: The Labour Market – A Simple Analytic Framework**



**Figure 2: Causes of Changes in Earnings Inequality – A Framework for Future Research in New Zealand**

