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Male Pre and Post Tax Wage Inequality: A Six Country Comparison

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Male Pre and Post Tax Wage Inequality: a Six Country Comparison[1]

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Abstract

Are Australian wages relatively equally distributed? This paper examines the distribution of the pre- and post-tax wages of prime-age male workers in Australia, Sweden, West Germany, Canada, the US and the UK in the mid 1980s. The analysis includes an examination of the impact of income taxes and employer and employee social security contributions on the wage distribution. The main conclusion is that Australia does indeed belong to a group of nations with low wage inequality. This conclusion holds irrespective of the wage measure used. The growth in wage inequality in Australia since the mid 1980s however, may require a revision of this conclusion.

1. Introduction

For many years has been a common perception that wages in Australia were more equally distributed than those in other countries. Whilst this view is now fading due to the strong evidence of increasing Australian wage inequality since the late 1970s, this increase in inequality has also been mirrored in other countries.[1] The question of whether Australian wages are more equal, and the role of Australian wage setting institutions in determining this distribution remains open.

Francis Castles (1985) has argued that the historically important role of the Australian institutions of arbitration and conciliation in setting wages was in part a response to the combination of a strong industrial labour movement coupled with a low degree of labour movement involvement in national government. In consequence, he described the Australian welfare state as a "wage earners' welfare state" — one where the labour movement sought redistribution primarily through the wage system, rather than through the programs of the welfare state. If this strategy was successful, we should expect to find a relatively low degree of wage inequality in Australia. This pattern, moreover, should be most marked for those most integrated into the (unionised) work force. The goal of this present paper is to test whether there is prima facie evidence that this strategy was successful in equalising wage outcomes for 'prime age' men.

Previous research has reached varying conclusions about the degree of wage inequality in Australian compared to other countries. Early research by Hughes (1973) suggested that little difference existed between the wage distribution in Australia and the USA or UK, but later studies drawing on a wider range of indicators have indicated that wages in Australia are probably relatively compressed (particularly at the lower end). Norris, for example, in comparing Australia and the UK concludes that, despite data limitations, wage variation appears to be generally lower in Australia. Mitchell (1984) in a comparison with the wage structure of the USA reaches similar conclusions. The weekly earnings of the first quartile of full-time workers were much closer to the median in Australia than in that country. Comparisons with countries other than the USA and UK, however, have been rare, with the only examples known to this author using data from the Luxembourg Income Study (LIS) as employed here.

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1 See King, Rimmer and Rimmer (1991), Gregory (1992) and Borland (1992) for Australia, and Green, Coder and Ryscavage (1992) and Gottschalk and Joyce (1991) for international comparisons.

Looking at male family heads and using several summary measures of inequality, Green, Coder and Ryscavage (1992) find that wage inequality in Australia in the mid 1980s was lower than in the US and Canada, but greater than in West Germany and Sweden.[2] This present paper extends their analysis to look at all males in this age range who worked full-year/full-time, as well to take account of the effects of taxes (including social security contributions) and transfers on net wages. The extension to all males is of interest because the definition of family differs somewhat across the LIS countries, whilst taxes and transfers often produce large 'wedges' between employer and employee wages which will be of relevance to the processes that lead to variations in wage inequality. As well, this paper adds the United Kingdom to the list of countries that they examine.

The paper is in seven sections. In the next section some different concepts of wage inequality are introduced, and causal theories of wage inequality briefly reviewed. Section 3 then introduces the Luxembourg Income Study data used in the study, whilst sections 4, 5 and 6 present the main results. These are summarised and compared in Section 7. Two appendixes address some of the data measurement problems of the study in more detail.

2. Concepts and Determinants of Wage Inequality

Theories explaining variations in wage inequality can be grouped into two categories. First are theories based upon marginal productivity theory. This theory suggests that competitive forces will lead to the wage rate of each category of labour being equated with its marginal revenue product. Differences in wage inequality between countries will thus be determined by variations in human capital, market structure (e.g. the types of industries predominant in each country) and the technology of production. Technology in this sense should be used in its broadest sense, encompassing the structure of work organisation, and the human relations of production (and hence encompasses the concept of 'efficiency wages').

An alternative perspective is given by theories that consider the limitations imposed by institutional structures. Unions or monopsonist employers may be able to extract economic rents, and social institutions such as the Australian arbitration commission, or national minimum wage policies, may influence the wage distribution. Most generally, social

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2 Like the present study, however, they also note that the Lorenz curve for Australia crosses that of West Germany and Sweden, and so no unambiguous dominance conclusion is possible (though they do not stress this). The focus of the Green et al analysis, however, is on changes in wage inequality over time. Because of the significant limitations in the early LIS data files, and the small interval of time between data sets in most countries, this approach is not followed here.

norms as to the acceptability of wage variations may influence either wage setting institutions and even the decision-making of profit maximising firms. The latter might occur via employers' attempts to set within-enterprise wage variation at a level which will maximise employee morale.

Whilst most empirical investigations of the variation in earnings focus on *gross wages*, from the perspective of competitive theory it is the total marginal cost of the employee that must be compared with marginal product. This total cost (described here as the *employer wage*) includes gross wages, employee benefits such as wages 'in-kind', leave and retirement benefits, payroll taxes and employer social security contributions. If these 'on costs' are not proportional to gross wages then the distribution of employer wages will provide a more meaningful picture of the productivity-related determinants of wage inequality.[3] Whilst it is generally difficult to obtain information on all 'on costs' as they apply to each employee, the data source used in this study does contain information on employer social security contributions (where they exist). The contribution rates required under these schemes often have wide variations according to wage level.

From the institutional perspective, on the other hand, the preferred measure of earnings will depend upon the particular institutions being considered. In some cases bargaining may take place over the gross wage — as is ostensibly the case in the Australian Arbitration system. However it is probably reasonable to assume that employers will be most interested in the employer wage defined above, whilst workers and their representatives will be most concerned with the 'net wage' — taking into account income taxation, government transfers received when employed, employee social security contributions and possibly components of the 'social wage'. These net wages are also of prime interest for the consideration of the welfare impact of wage inequality.[4]

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3 Whilst this conclusion will apply irrespective of the economic incidence of employer contributions, knowledge the incidence of these costs is required if we wish to consider the implications of changes to policies such as employer social security contributions. If the competitive model of wage fixing applies and if we assume a fixed supply of each component of labour, then a decrease in employer social security contributions for one group of employees will, in the long run, result in an equal increase in their wage. Whilst the distribution of wages to the employer will thus be unchanged, there will be changes in gross and net wages.

4 If the uncompensated labour supply elasticity is not zero, then the net wage will also be relevant for marginal productivity based theories of wage determination.

3. Data

The data used here comes from the Luxembourg Income Study (LIS). This study includes individual, family and household level data on incomes, taxes and labour market characteristics for a large number of industrialised countries. This data is derived from nation-specific collections, but is adjusted to conform where possible to common definitions. For most countries in the LIS database, income information is recorded on an annual basis (rather than the 'current' basis most commonly used for wage distribution comparisons), and so the present study restricts attention to those countries where it is possible to identify full-year, full-time (FYFT) individual workers. This permits an analysis of wage distributions in Sweden, (West) Germany, Canada, the USA and Australia. These countries are denoted by the mnemonics SW, GE, CA, US and AS respectively. In addition monthly wage data for full-time workers in the UK is also analysed (and compared with similarly defined Australian data). No adjustment is made for variations in hours worked within these full-time categories.

Further detail of the country datasets is given in Table 1, and more information can be found in Coder et al (1988). The surveys were undertaken between 1984-85 and 1987, using a variety of methodologies. The US, AS and CN surveys were generally similar in methodology, all being family income surveys conducted by the national statistical authority.[5] The Swedish dataset includes official income tax data together with survey data on household characteristics. These four surveys all had quite high response rates. The higher response burden associated with the collection of expenditure data in the UK survey, and the non-official nature of the GE survey may explain the relatively low response rate for these surveys. All surveys were designed to be representative of the whole population excluding the institutionalised population and (in some cases) people in remote areas. All the surveys except the UK survey employ sample weights to correct for differential sampling fractions and non-response rates, and these weights are used here.[6]

The goal of this paper is to explore wage inequality among the 'core' work force, and so the population considered is restricted to males aged 25-54, who worked FYFT. (Workers younger than 25 are not included so as to remove the effect of 'training wages' from the analysis.) Unfortunately these datasets do not permit a distinction between weeks worked

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5 The US survey collected information about all household members from a single adult, which might be expected to diminish the quality of the data. The high response rate for the AS survey is because the survey is formally compulsory.

6 The UK survey is designed to be self-weighting, though differential non-response is not controlled for.

full-time for wages or salaries and weeks worked in the persons' own business (though wages and self-employment income are separately recorded). One means of dealing with this problem is to exclude those men whose family had a positive annual income from self-employment, or who were self-employed at the time of the survey. This method is employed by Green, Coder and Ryscavage (1992), and some results for this population are shown in Appendix A. However this population still has many men with implausibly low levels of annual earnings.

Table 1 Country Datasets

Mnemonic	SW	GE	CN	US	AS	UK
Country	Sweden	West Germany	Canada	USA	Australia	United Kingdom
Year	1987	1984-85	1987	1986	1985-86	1986
Type of Collection	merge of survey and tax records	1st wave of household panel survey	household income survey	household income survey	household income survey	household expendit-ure survey
Response Rate[a]	86%	62%	76%	82%	94%	69%
Definition of full-year, full-time employment	worked >=1,872 hours per year	>=48 weeks full-time (defn of ft not known).	worked >=48 weeks, most of which was ft (ft defn unknown).	>=48 weeks full-time (defn of ft not known).	>=48 weeks working 35+ hours.	currently employed ft (defn not known)

Notes: a Where wage questions had a lower response rate than the overall survey, this lower rate is shown.

One possible explanation for these low earnings is that this exclusion does not remove the self-employed whose business made a loss according to the survey income definition,[7] and who had left self-employment at the time of the survey. This appears to be a non-negligible problem (in Australia at least), with many people recorded as having worked some weeks in their own business even though they did not have any self-employment income and were not self employed at the time of the survey. This may include men working most of the time on their loss-making farm, whilst employed part-time in some other job. Whilst their labour market status is thus defined as employed full-time, they are

7 Since income taken in the form of capital gains generally attracts concessional taxation treatment, there are strong incentives for the self-employed to structure their business so as to accrue income in this form (which is not recorded by the surveys).

not receiving a full-time wage, and to include them would severely bias estimates of the distribution of earnings.

This paper deals with this problem in a crude but straightforward way, by simply excluding from the analysis all men whose annual wage fell below 1/3 of the median wage of the prime-age males in their country. For all countries except the US and Canada, this exclusion removed 2 per cent or fewer of cases, whilst in the US 4.2 per cent of cases are removed by this selection. If some of these countries actually do have very low FYFT wages, this will lead to a downwards bias in wage inequality, and reduce the dispersion in wage inequality observed between countries. Nonetheless, the 1/3 median cut-off is still a very low wage level and likely to be below the minimum wage level. Men working FYFT (but not self employed) with such wages will often be receiving other benefits in-kind, in particular training or housing benefits.[8]

In summary, therefore, the population represented in the tables here is *men, aged 25 to 54, working full-year and full-time, not self employed, and with wages above 1/3 median.*[9] Results including low wage men are shown in Appendix A. Finally, at the other end of the income distribution there are also data limitations, though here they are limited to the US data, where wages above US$100,000 per annum are rounded down to this amount. For the present purposes this limitation is less important, as even with this adjustment the US still has the most unequal distribution of wages. The same considerations apply to the relatively high proportion of US cases excluded at the bottom of the wage distribution.

4. Gross Wages

Some basic distributional statistics for gross wages in the study population are shown in Table 2 for each of the six countries. For Australia, two wage distributions are shown. The first is the annual wage distribution (denoted AS), whilst the latter is the wage rate of

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8 Members of religious orders, for example, often fall into the latter category.

9 Men are defined as self-employed if their family received any (positive) income from self employment during the year, or if they were self employed at the time of the survey (for ASc and UK just current employment status is considered). Because of the way in which the LIS files are constructed, in all countries apart from Sweden, a very small number of men in large families or households are also excluded.

full-time men as at the time of the survey (denoted ASc).[10] This is comparable to the wage measure used in the UK survey.

A number of conclusions can be derived from this table. On all measures the US distribution stands out as the most unequal. This is in spite of the truncation of the US wage data. The UK generally follows in second position, with Canada generally third. On most measures Australia is second-most equal, with either Sweden or West Germany having the most equal wage distribution. These conclusions are similar to those of Green et al (1992) who use the same data source, though with a slightly different population. One difference, however, is that they rank Australia as having a consistently more unequal wage distribution than both Sweden and West Germany.[11]

The relative standard deviation and Gini coefficients shown in this table, however, are only two of many indices that can be used to measure inequality. The most general way to measure inequality is with the use of Lorenz curves. These are calculated by ranking individuals by their wage level, and at each percentile of the wage distribution calculating the proportion of total earnings received by those with lower wages. Where the Lorenz curve for one country lies everywhere above (*dominates*) that for another, we can unambiguously say that inequality is lower in the first country (e.g. Lambert, 1986).

Whilst useful as an analytical tool however, the Lorenz curve is limited as a graphical device because the curves of different countries are usually very close. A simple alternative employed here is a 'differential Lorenz curve'. The horizontal axis for this curve is identical to that of the Lorenz curve, whilst the vertical axis is defined as the proportion of total earnings received by each fraction of the population, *less* the corresponding proportion in some reference country. A differential Lorenz curve lying above the axis thus implies that the Lorenz curve for the comparison country lies above that for reference country and so equality is greater. Similarly, inequality between other countries can be compared by examining whether their differential Lorenz curves lie above or below each other.

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10 The ASc data is not from the LIS dataset, but rather comes from the public use sample file from which the LIS AS data is derived. Current wages are generally more variable than annual wages because the annual period smooths out short term wage fluctuations (e.g. through overtime variations), and also because those working FYFT will on average be more likely to be 'core' workers.

11 The relatively equal wages for Australia shown in Table A.1 suggests that this difference does not stem from the exclusion of very low wage cases in the current analysis, but rather from the different population used.

Table 2 Gross Wage Distribution of Men in Study Population

	SW	GE	CN	US	AS	ASc	UK
No. of cases	3010	2401	3461	3559	2583	3289	2337
Weighted No. (000)	1118	8884	3374	28064	1814	2315	2337
Mean	145682	44943	34925	30657	25944	496	11669
Minimum	43500	13700	10820	8740	8310	156	3431
Median	131100	40500	32090	27000	24000	450	10347
Maximum	1774600	236900	257000	100000	170680	2677	97355
Percentiles as % of mean							
1st (inverse rank)	38.9 (3)	45.2 (6)	34.4 (2)	31.0 (1)	44.6 (5)	40.3	35.7 (4)
10th (inverse rank)	66.7 (6)	63.0 (5)	53.8 (3)	45.7 (1)	62.5 (4)	61.1	53.3 (2)
90th (rank)	142.1 (6)	149.5 (3)	148.9 (4)	163.1 (1)	144.0 (5)	151.2	158.6 (2)
99th (rank)	269.0 (4)	230.1 (6)	272.0 (3)	326.2 (1)	235.5 (5)	242.5	293.2 (2)
Relative standard deviation (rank)	0.448 (4)	0.400 (6)	0.483 (3)	0.561 (1)	0.447 (5)	0.431	0.517 (2)
Gini coefficient (rank)	0.194 (6)	0.200 (4)	0.234 (2.5)	0.286 (1)	0.196 (5)	0.209	0.249 (2.5)

Notes: All income amounts are annual amounts in national currencies apart from ASc which is weekly $AU. Ranks exclude ASc. The UK rank is calculated after first multiplying the statistic by the ratio between the AS and ASc samples. The population (for all except ASc and UK) is men aged 25 to 54, employed FYFT, not self employed and with wage greater than 1/3 median wage. For ASc and UK, the population is men aged 25-54, employed full-time, not self employed, and with wage greater than 1/3 median.

In addition, because the slope of the Lorenz curve at percentile p shows the relative wage[12] of men at that percentile, the slope of the differential Lorenz curve shows the difference in relative wages. If the differential Lorenz curve is horizontal at percentile p this means that, at the pth percentile, relative wages are equal in the two countries. Similarly, if the curve is downwards (upwards) sloping this implies that relative wages are lower (higher) in the comparison country.

12 That is, the wage of men at percentile p divided by the overall average wage for that country.

Figure 1 shows the differential Lorenz curves for the gross wage distribution corresponding to Table 2. Since the Australian data is available for both annual (AS) and current wages (ASc), Australia is used as the reference category, with the UK curve being expressed relative to the ASc data, and the other countries relative to the AS data. To compare the UK data with that of the other countries, it is necessary to assume that the relationship between annual UK data and AS data would be the same as between the UK and ASc data.

Figure 1 shows the six countries in this study falling into three groups. The US has by far the most unequal distribution (except at the very top of the income distribution where the data truncation obviously plays a role). The UK and Canada form a middle group with the UK having a more unequal distribution in the top half of the distribution, whilst the two non-English speaking nations have wage distributions that overlap those of Australia. Whilst Swedish relative wages at the very bottom of the wage distribution are slightly lower than in Australia, the wage shares of men from the 4th to 36th percentiles[13] are higher (the differential Lorenz curve is upward sloping). Given the problems of measuring very low wages described above, we might thus conclude that, for the most part, Swedish wage setting mechanisms are better at protecting low wage workers than Australian. However this is offset by the high wage shares of those at the top of the income distribution in Sweden (though relative wages of the very top 2 per cent are equal). It is possible that this may be due to the superior data collection methodology of the Swedish survey (from tax records). In any event, the observed pattern implies that no clear Lorenz dominance ordering can be defined between Australia and Sweden.

This conclusion also applies to a comparison between Australia and West Germany (and between Sweden and Germany). The AS and GE wage shares are essentially the same up to the 40th percentile. From this point to the 70th percentile Australian wage shares are higher (the curve slopes downwards), then German wage shares are higher up to the 96th percentile, whilst Australian wage shares are higher at the very top of the income distribution. This sharp drop in relative wages for the top two per cent of the German distribution is quite out of keeping with the other countries and suggests either that there is a substantial compression in the German wage distribution at the top end, or else that there is under-recording of high German wages (or under-sampling of men with high wages). Given the low response rate of the German survey, this latter explanation must be accorded some weight.

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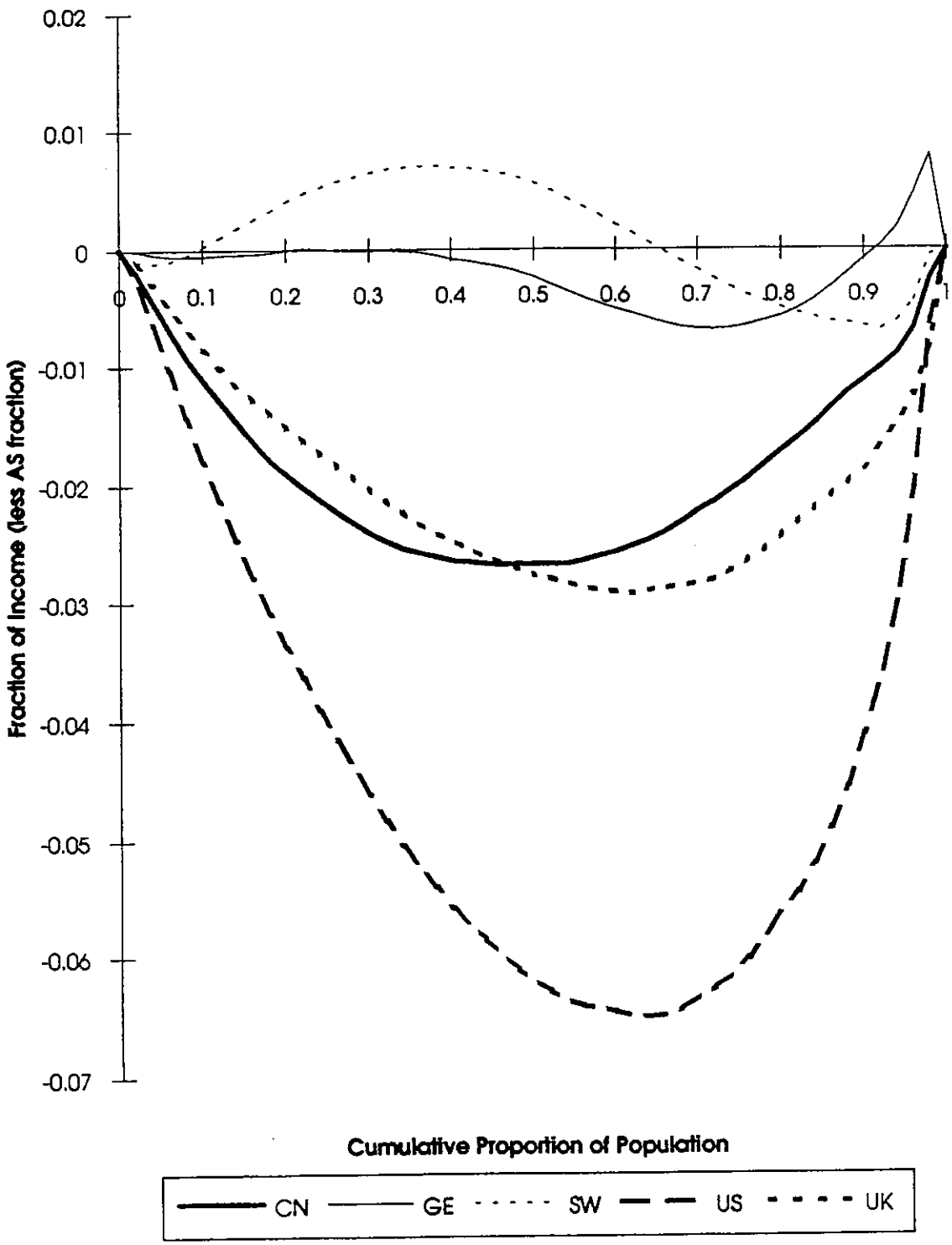
13 The differential Lorenz curves are calculated at two percentile increments.

Figure 1 Gross Wages: Differential Lorenz Curves



The presentation in Figure 1 does, however, allow us to test the effects of some simple modifications to the German data. If for, example, it were assumed that the relative wage of the top two per cent of German men was the same as in Australia, then the end segment of the German curve would be horizontal, and the rest of the curve would have an additional downward slope. (The latter follows because total incomes would be increased by this adjustment, and so relative wages for men below the 98th percentile would fall). This would lead to wages being unambiguously more equal in Australia than West Germany. Whether this adjustment is warranted, however, clearly wage inequality in Australia and West Germany (and Sweden) is relatively similar — particularly in comparison with that of the other English speaking nations examined here.

5. Employer Wages

Whilst there are many factors that lead to a divergence between gross wages and labour costs, one of the most important and variable across countries are social security contributions. In many countries these are both large and vary as a proportion of income.[14] Table 3 summarises the main features of employer social security contributions in the six countries considered here (focussing on features relevant to men working FYFT).

For all the countries where employer (and employee) social security contributions exist, these are available in the LIS dataset (or amenable to simple modelling in the case of Canada), though in some countries not all components are included.[15] Some basic summary statistics on employer wages, defined as the sum of gross wages and social security contributions, are presented in Table 4. For Australia, where there are no employer social security contributions, gross wages alone are used. Figure 2 shows the distribution of these wages in a comparable form to Figure 1. The use of Australia as reference means that Figure 2 can be directly compared with Figure 1 in examining the impact of employer contributions on inequality in each country.

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14 Several countries also have payroll taxes. These however are levied as a proportion of total salary bill, and hence are effectively proportional within the firm. They do however often vary between industry sectors with small firms often exempted.

15 The most important exclusion is probably unemployment insurance contributions in the US (which vary significantly by State). In addition, in no countries are data on employer contributions to private retirement (superannuation) funds available.

Table 3 Main Features of Social Insurance Contributions

Country	Employer Social Insurance Contributions	Employee Contributions	Coverage in Data
Sweden	Pensions, health, injury compensation etc: 37.5 % of payroll. Private pension plans covering 90% of workers of 6-8% of payroll	None	Available, from tax records. Private pensions not included
West Germany	Pensions: 9.25% of earnings up to DM62,400. Health: 5.5%, ceiling DM46,800. Unemployment: 2.3%, ceiling DM62,400	Identical	Survey data
Canada	Pensions: 1.9% of earnings above C$2500 and up to C$25,900. Unemployment: 3.29% of earnings up to C$530 p.w. ($C27,560p.a.). Some reductions for employers with adequate sickness or other benefit plans	Pensions identical, unemployment contribution rate is 2.35%	Modelled as per formula, assuming constant wages over year.
United States	Pensions (OASDI): 5.7% of wage up to US$42,000. Health: 1.45% (same ceiling). Unemployment: national scheme 6.2% up to US$7,000 ceiling. State schemes also exist, some with higher ceilings	Pensions, Health identical to employer. No unemployment contributions in most states.	Pensions and health modelled
Australia	None	Health 1% of wage, though with lower rates for very low income families (varying with family size)	Not separately available (included with income tax).
United Kingdom	Contribution rates: 5% of weekly wages in the range £38.00-60, plus 7% of wages in the range £60-95, plus 9% in range £95-140, plus 10.45% in range £140-285, plus 10.45% of wages over £285. When employees are covered by approved private schemes contribution rates are reduced to 0.9%, 2.9%, 4.9%, 6.35% and 10.45%.	Corresponding contribution rates are 5%, 7%, 9%, 9% and 9% and for those in private schemes 2.85%, 4.85%, 6.85%, 6.85% and 6.85%.	Available from respondents' pay slip.

Source: Luxembourg Income Study, Institutional database. Modelling of Canadian contributions undertaken by author, other data as defined in the LIS variables PMEEC and PMERC.

Figure 2 Employer Wages: Differential Lorenz Curves

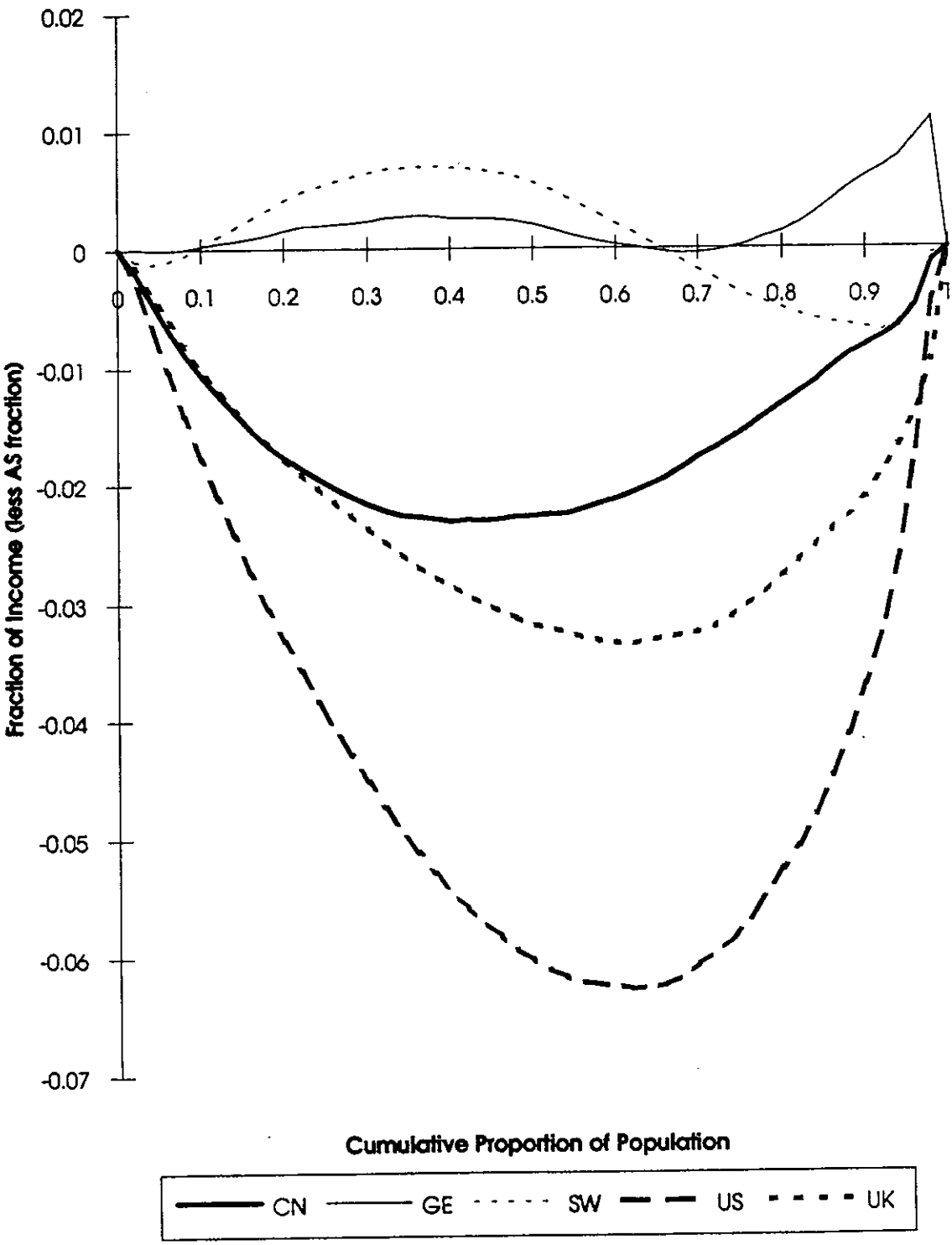

Table 4 Employer Wages

	SW	GE	CN	US	AS	ASc	UK
Mean	199645	52134	36191	32523	25944	3289	12608
Mean as % of gross wage mean	137.0	116.0	103.6	106.1	100.0	100.0	108.0
Gini coefficient (rank)	0.194 (5)	0.192 (6)	0.228 (3)	0.282 (1)	0.196 (4)	0.209	0.256 (2)
Gini as percentage of gross wage Gini	100.0	96.0	97.4	98.6	100.0	100.0	102.8

Notes: Population as for Table 2. The employer wage is defined as the gross wage plus compulsory employer social insurance contributions. The latter do not exist in Australia.

The most obvious fact in Table 4 is the large variation in the magnitude of employer social security contributions, ranging from 37 per cent of wages in Sweden, to zero in Australia. The inclusion of employer social security contributions also has varying impacts upon the Gini coefficient. In Sweden there is no change between Tables 2 and 4, as contributions are a fixed proportion of salary. In Germany, Canada and the US, the contribution ceiling means that employer wages are more equally distributed than gross wages. The effect is larger in Germany because of the higher total contribution rate. It should be noted however, that the US data does not include the (almost lump sum) unemployment contribution. If this were included, the inequality in employer wages would be reduced. In the UK employer wages are more unequal due to a 'progressive' contribution schedule.

In terms of Gini coefficients, only the ranking of the three more equally distributed countries is changed by the inclusion of social security contributions. Examining the differential Lorenz curve in Figure 2, it can be seen that the main change from Figure 1 is that the German distribution is now relatively more equal. Other changes in the distributions mirror the patterns in Gini coefficients in Table 4.

The small differences between the distribution of employer and gross wages in most countries suggest that employer social security contributions usually have only a minor role to play in the generation of international variations in gross wage inequality. The UK and Germany provide a possible exception to this because of the size and non-proportionality of their employer contributions. That is, if employer wages are largely determined by marginal productivity and labour supply is fixed, a constant sum per-worker employer contribution tax would lead to a greater gross wage inequality in that country as this tax was passed back to workers. Following this logic and noting the differences between employer and gross wage inequality described above, we might conclude that a move

towards a proportional employer contribution in the UK and Germany might (in the long run) make their gross wage distribution less and more equal respectively (that is, their gross wage distribution would become like their employer wage distribution). Reversing this argument, we might say that the employer contribution structure in these two countries may be responsible for decreasing (UK) and increasing (GE) the inequality in gross wages. However it is clear from the data presented here that any such effects are only relatively small in magnitude when compared with the range of international variations in wage inequality. Moreover the welfare effects of such changes depend upon the extent to which employer contributions are either a tax or saving for the worker.[16]

6. Net Wages

For the employee, it is net wages that are most important, as a key determinant of living standards and consequently as an object of bargaining. In this section the effect of both income taxation and employee social security contributions are considered. There are two main conceptual problems, however, in calculating a net wage.

The first concerns the appropriate treatment of employee social insurance contributions. These are levied in Germany, the US and the UK at similar rates and conditions to the employer contributions shown in Table 3. However to the extent to which social retirement and unemployment benefits are linked to contributions, employee (and employer) contributions are insurance or saving rather than a tax. Even though social insurance is never actuarially based, there is usually some relationship between relative levels of contribution, and relative entitlements. At the same time, however, there is often a redistributive element built into these schemes — such as minimum entitlements regardless of contributions. The complexity of the relationship between contributions and entitlements means that a full description of the redistributive effects of these schemes is a difficult task for even one country. Consequently the present study simply presents two polar outcomes. The first set of results, entitled *net current wages* are gross wages less income taxation and employee social security contributions. The second set, entitled *net lifetime wages* are gross wages less income tax plus employer social security contributions.

The second problem in estimating net wages is the estimation of income tax. Whilst the LIS database records family income tax payments for all countries and personal income tax

16 The flat rate unemployment benefit compensation in the US (which has not been modelled in this data) could similarly be used as a (very much partial) explanation for the high level of gross wage inequality in the US.

payments for some, these payments are typically a function of other factors than simply gross wages. Other income sources, numbers and age of children, and in the case of family taxation, the incomes of other family members, are all relevant to the determination of income tax payments. Moreover, some government transfers are best treated as negative taxes. For example whilst some countries provide tax concessions to parents others achieve the same goal through universal child benefits. These should be treated identically.

To estimate after-tax wages whilst taking these considerations into account, the following procedure is followed. For the family of person i, disposable income d_i is defined as

$$d_i = (g_i + y_i - t_i) - s_i = a_i - s_i \tag{1}$$

where g_i is the person's gross wages, y_i is other family income, t_i is the taxes paid by the family (including transfers as negative components), a_i is thus 'after tax' income, and s_i is the person's social insurance contributions. (This calculation is relevant to net current wages. For the calculation of net lifetime wages s_i is defined as the negative of employer social security contributions). After tax income, a_i, is then estimated as

$$a_i = f(g_i, y_i, D_i) + \varepsilon_i \tag{2}$$

where D_i is a vector of household characteristics, and ε_i is an error term. Included in D is the number of children (aged under 18), and whether the person is married or single. In order to capture the different tax rates applicable to different income sources, y is defined as a vector of the following income sources: wife's earnings (zero if not married), earnings of other family members, and other market income of the household. The function $f(.)$ is a linear function of these variables, their polynomial transforms, and interactions between them.[17] Equation (2) is then estimated using a stepwise OLS regression procedure. These results are then used to obtain an estimate of *the after-tax income of the family if the subject's gross earnings were the only source of family market income.* This is given by

$$\begin{aligned} a_i^0 &= \hat{f}(g_i, 0, D_i) + \hat{\varepsilon}_i \\ &= a_i - (\hat{f}(g_i, y_i, D_i) - \hat{f}(g_i, 0, D_i)) \end{aligned} \tag{3}$$

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17 Note that non market incomes (transfers) are not included in the regression, as the object is to estimate net transfers as a function of market incomes. Gross own and spouse wages were entered into the equation as fourth order polynomials, and other wages and other market incomes were entered as third order polynomials. The number of children was entered as a quadratic function, and the linear term was also entered in interaction with the first and second order income variables. Interactions between the income variables and marital status were also entered.

where $\hat{f}(g_i, y_i, D_i)$ is the predicted value of $f(.)$, $\hat{f}(g_i, 0, D_i)$ the corresponding predicted value when other family market incomes are zero, and $\hat{\varepsilon}_i$ is the residual from the estimation of equation (2). As the second line of equation (3) makes clear, a_i^0 is measured family after-tax income less the increase in after-tax family income associated with the other sources of market income in the family.[18] Using this estimate and equation (1) net current wages (*nc*) and net lifetime wages (*nl*) are defined as

$$\begin{aligned} nc_i &= a_i^0 - \text{employee social security contributions} \\ nl_i &= a_i^0 + \text{employer social security contributions} \end{aligned} \qquad (4)$$

Results based on these estimates[19] are shown in Table 5 and Figures 3 and 4.

For the population considered here, net current wages range from 75 to 81 per cent of gross wages. Interestingly, despite its reputation for high marginal tax rates, Sweden has one of the lowest tax and employee contribution rates. This is in part due to the inclusion of family transfers here as negative taxes, together with the relatively narrow coverage of the income tax base. (Since 1987 the Swedish income tax system has been substantially altered, with lower tax rates but broader coverage). In all countries, progressive taxation implies a lower Gini coefficient for net current wages than for gross wages. The largest reductions in the Gini coefficient are for Canada and Australia, whilst the smallest reduction is for Germany. The between-country ranking is unchanged however, except that the rank of Australia and Sweden is now tied. If an alternative estimate of Swedish net wages is used (see Appendix B) then Australia has the most equal ly distributed net current wage.

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18 The treatment of the residuals in this process implicitly assumes that the unexplained variation in after-tax income is not associated with the other incomes of the family. As well as changing this assumption, on might also choose to estimate a more intuitively plausible net wage defined as the increase in disposable income associated with the person's wage (holding other family incomes constant at their current value). That is, define $a_i^0 = a_i - \hat{f}(0, y_i, D_i)$ (if the residuals are assumed to be most associated with personal wages). The main practical difficulty with this is that few men have zero wages, and so this estimate will be poorly defined. More generally, the estimation of such a net wage requires assumptions about how other incomes will change when wages are zero. An assumption of entitlement to unemployment benefit, for example, would lead to a much lower net wage than an assumption that transfers would be zero.

19 For the ASc data, net income was estimated by deducting a modelled estimate of personal PAYE taxation (assuming zero spouse earnings) from the gross wage and then adding family allowance transfers.

Table 5 Net Wage Distributions

	SW	GE	CN	US	AS	ASc	UK
Regression R^2	0.94	0.93	0.95	0.92	0.92	n.a.	0.93
Net Current Wages							
Mean	117140	34069	27795	23951	20036	369	9399
Mean as % of gross wage mean	80.4	75.8	79.6	78.1	77.2	74.4	80.5
Gini coefficient (rank)	0.167 (5.5)	0.188 (4)	0.196 (3)	0.256 (1)	0.167 (5.5)	0.151	0.219 (2)
Gini as Percentage of gross wage Gini	87.1	94.0	83.8	89.5	85.2	72.2	88.0
Net Lifetime Wages							
Mean	171057	48453	30042	27678	20036	369	11492
Mean as % of gross wage mean	117.4	107.8	86.0	90.3	77.2	72.2	98.5
Gini coefficient (rank)	0.164 (6)	0.169 (4)	0.185 (3)	0.250 (1)	0.167 (5)	0.151	0.221 (2)
Gini as percentage of gross wage Gini	84.5	84.5	79.1	87.4	85.2	72.2	88.8

Notes: Population and notes as for Table 2.

Similar trends are evident in the differential Lorenz curves shown in Figure 3. Compared to Figure 1, the Canadian distribution is moved upwards, though it still lies below that of Australia for almost the whole distribution. In contrast, the German distribution is moved downwards due to the ceiling on German social insurance contributions.[20]

20 The UK distribution is significantly more equal in this Figure than in Figure 1. However the net wage for the UK is poorly defined as the tax year is annual whilst the survey only covers a small time period. No information is currently available as to how taxes were defined in the LIS database. In the generation of Figures 3 and 4, the UK distribution is compared with the AS distribution rather than the ASc distribution, unlike in Figures 1 and 2 where it is compared with the ASc distribution. This is done because the modelling of taxation in the ASc data implies a much more progressive tax system than does the actual tax data in the AS data. It was decided to not incorporate this on the assumption that this difference is probably not evident in the UK data.

Figure 3 Net Current Wages: Differential Lorenz Curves

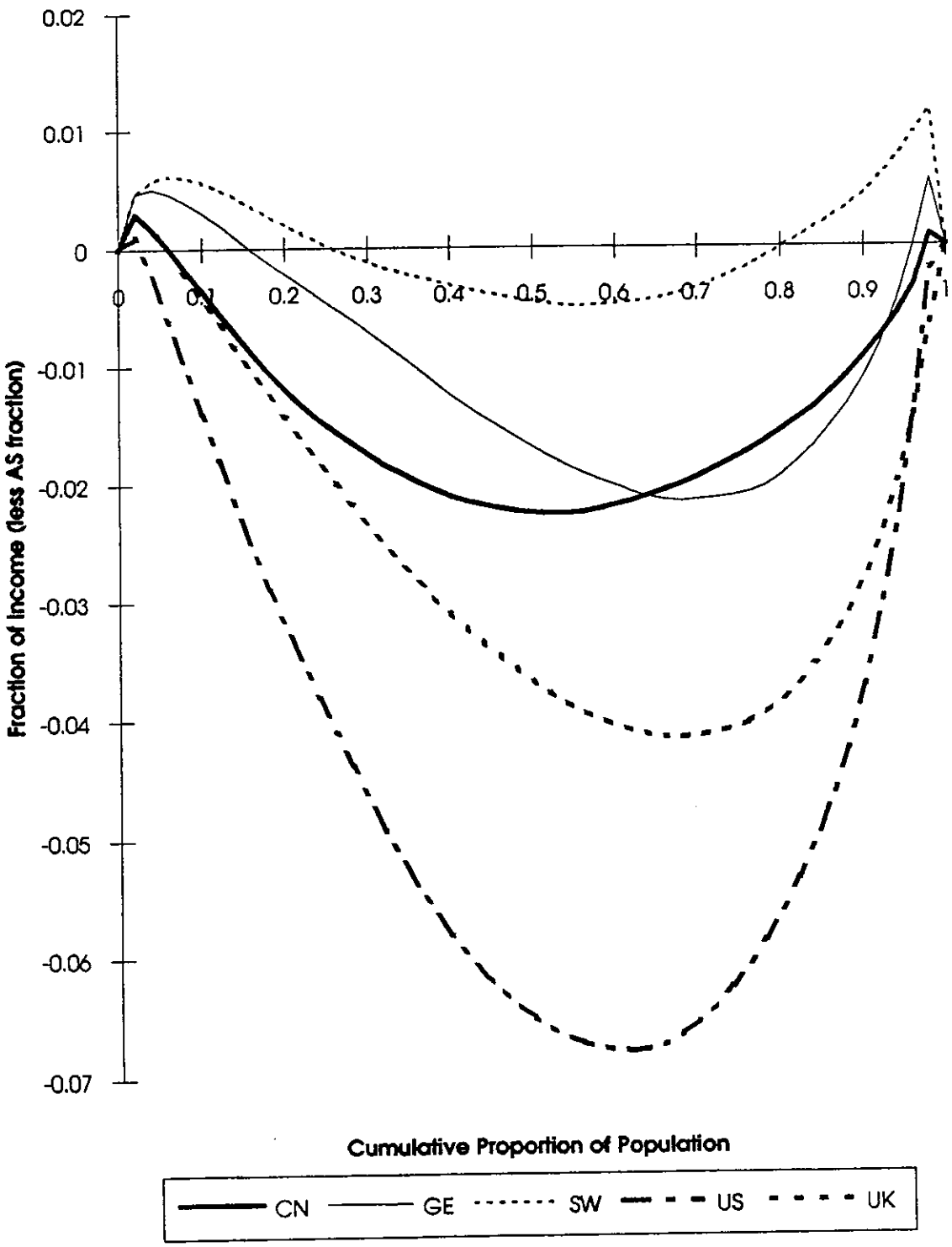
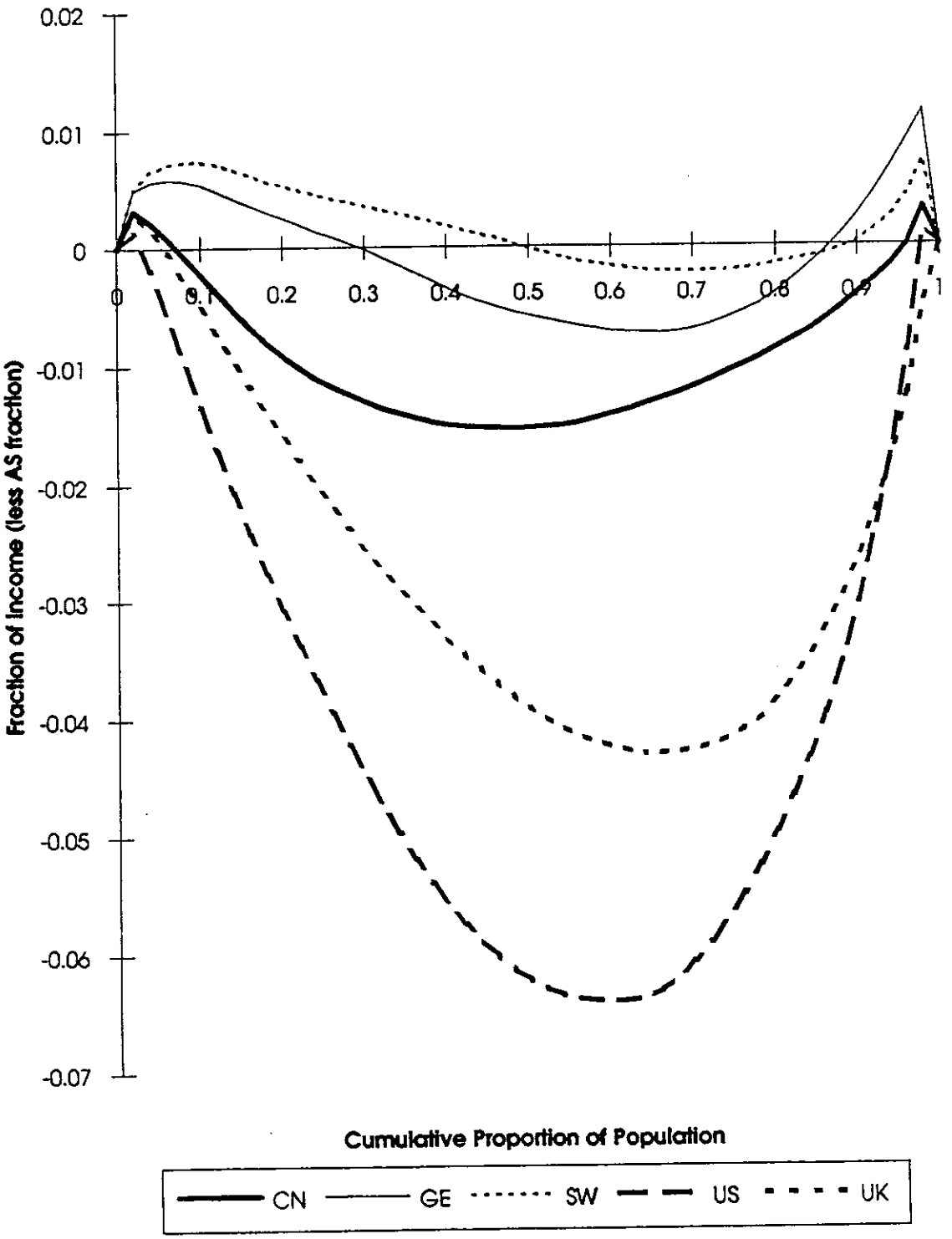


Figure 4 Net Lifetime Wages: Differential Lorenz Curves



If we assume that both employee and employer social security contributions are inputs into lifetime income then the net lifetime wage is more relevant than the net current wage. These wages are shown in the second half of Table 5 and in Figure 4. The high mean net lifetime wage (relative to gross wages) for Sweden reflects the high rate of employer contributions shown in Table 4. Similarly Australia's relative net lifetime wage is the lowest because of the absence of employer social security contributions. As indicated by the Gini coefficient, the ranking of countries is the same under the net lifetime wage measure as for gross wages. The differential Lorenz curves shown in Figure 4 are also quite similar to those of Figures 1 and 3 with two exceptions. First, the German curve shows a much more equal distribution. This is because of the social security contribution ceiling. Whilst employee social security contributions were subtracted in Figure 3, Figure 4 adds employer contributions (which are identical) to after tax wages. The contribution ceiling thus means that high wage workers receive lower social security contributions (as a proportion of their gross wage) from their employer. It is clear therefore that an assessment of the net wage distribution in countries such as Germany that has large and non-proportional social security contributions depends very much on whether these contributions are best viewed as a tax or as saving.

7. Conclusion

The main conclusion of this paper is that the Australian wage distribution is indeed relatively equal—though not necessarily the most equal.[21] Though the present paper has only considered the situation of prime age male workers, for this group this result holds despite the growth in wage inequality in Australia over the decade before 1985. This conclusion also holds no matter which of the four different wage measures are employed. These results are summarised in Table 6.

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21 Of course a low relative dispertion of wages (for one population sub-group) need not imply a low degree of *income*inequality because of factors such as other income sources and the operation of the tax-transfer system. The small volume of transfers in Australia is probably the main reason why other researchers have not found Australian incomes to be particularly equally distributed (e.g. see Saunders and Hobbes, 1988 , and Mitchell, 1991).

Table 6 Gini Coefficients of Alternative Wage Measures: Summary

	SW	GE	CN	US	AS	ASc	UK
Gross wages	0.194 (6)	0.200 (4)	0.234 (2.5)	0.286 (1)	0.196 (5)	0.209	0.249 (2.5)
Employer wages	0.194 (5)	0.192 (6)	0.228 (3)	0.282 (1)	0.196 (4)	0.209	0.256 (2)
Net current wages	0.167 (5.5)	0.188 (4)	0.196 (3)	0.256 (1)	0.167 (5.5)	0.151	0.219 (2)
Net 'lifetime' wages	0.164 (6)	0.169 (4)	0.185 (3)	0.250 (1)	0.167 (5)	0.151	0.221 (2)

Notes: Notes as for Table 2. Source: Tables 2, 4 and 5.

Despite the variations in mean wages as the wage concept is varied, the Gini coefficient ranking among these six countries remains remarkably constant. This should be of some reassurance to those researchers who are restricted to using gross wages alone. The US has by far the most unequal wage distribution, whilst Sweden, Australia and West Germany have relatively equal distributions (though there are some doubts about the quality of the German data).

Within each country, however, the degree of wage inequality varies significantly depending upon the measure employed—even if this variation is usually not enough to change the cross-national ranking. Whilst income taxation systems with some degree of progressivity occur in all the countries considered here, the structures of employer and employee social security contributions vary significantly. Where contributions are large and non-proportional, as in West Germany, their inclusion substantially alters the picture of wage inequality. Which of the resulting wage distributions will be most relevant depends on whether one is trying to describe the welfare outcomes of wage distributions, or examine their causes.

Whilst it has not been the goal of this paper to address the reasons for the observed cross-national wage variations, it is interesting to conclude with a discussion of some correlates with wage inequality. From the institutional perspective, the prevalence and influence of labour unions are often assumed to be important in influencing wage inequality. Union power, it is argued, leads to increases in the wages of low wage workers relative to higher paid non-unionised (e.g. managerial) workers. Moreover, within the unionised workforce, ideologies of solidarity may often lead to lower wage variations.

Whilst union power as such is difficult to measure, a useful proxy is the proportion of the workforce who are unionised. This is shown in the last line of Table 7, where there is a clear negative correlation between unionisation rates and wage inequality. Sweden and the US, in particular, provide outliers on both unionisation and inequality in the expected direction. In comparing Australia with other countries, however, this simple explanation is not satisfactory. Australia has a much lower unionisation rate than Sweden, but a similar degree of wage inequality. Similarly, Australia has a lower unionisation rate than the UK, but also less wage inequality. This last comparison at least may be due to the greater centralisation of wage bargaining in Australia compared to the UK.[22]

In addition more general social norms of inequality may also be important in shaping wage inequality. Even without unions, these norms may influence wage inequality if employers try to maintain a wage distribution that will maximise employee morale. Some data on public perceptions of what degree of wage inequality exists, as well as on what degree of inequality should exist, is also shown in Table 7. This data is derived from the ISSP Social Inequality Surveys, where people were asked to estimate the average wages of people in 11 occupations, and to say what they thought the average wages *should* be. The variations across these occupations are reported in Table 7.

In general, the ranking of countries from the ISSP survey reflects that shown in this paper. An important exception, however, is West Germany, which in the ISSP data has a much greater degree of perceived wage inequality than in the LIS data. Given the earlier discussion, this may point to sampling problems in the LIS data. Another exception is the UK data, where Table 7 shows a perceived wage variation on a par with that in the US.

Whilst one would not want to place too much weight on these subjective indices of wage variation, it is interesting that rankings of legitimate variation closely follow the patterns of actual wage variation. Whether legitimacy just tends to follow experience, or whether these variations in social norms influence wage distributions, remains an unanswered question.

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22 See Kalleberg and Colbjornsen (1990) for further discussion of the importance of wage bargaining structures.

Table 7 Public Perceptions of Wage Inequality, and Unionisation Rates

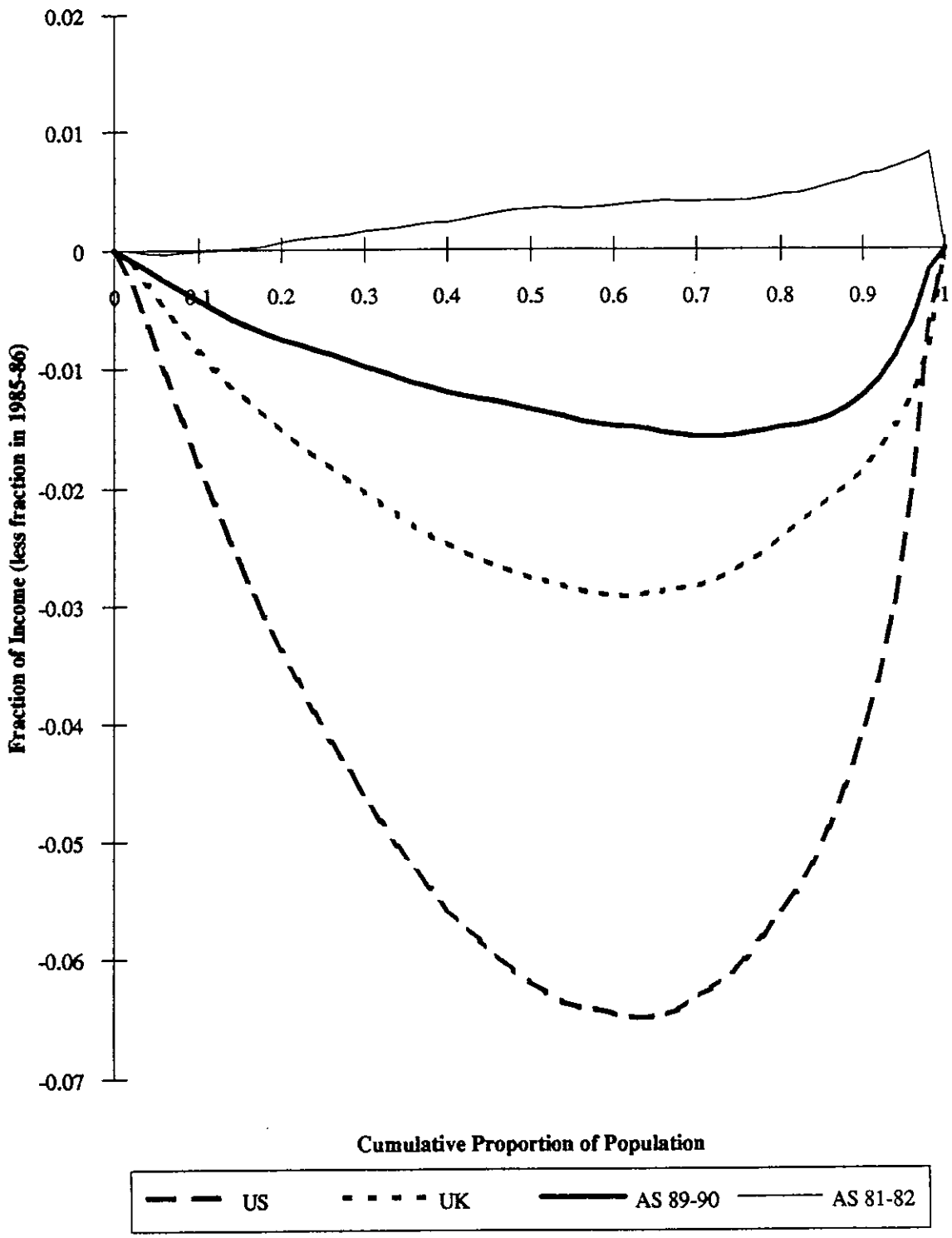
	SW	GE	CN	US	AS	UK
Perceived wage variation						
Relative standard deviation	0.56	1.07	na	1.23	0.61	1.28
(rank)	(5)	(3)		(2)	(4)	(1)
Log deviation	0.47	0.88	na	0.90	0.55	0.85
(rank)	(5)	(2)		(1)	(4)	(3)
Legitimate wage variation						
Relative standard deviation	0.36	0.73	na	0.84	0.48	0.83
(rank)	(5)	(3)		(1)	(4)	(2)
Log deviation	0.32	0.62	na	0.66	0.43	0.62
(rank)	(5)	(2)		(1)	(4)	(3)
Unionisation Rate (1980)	0.79	0.34	0.29	0.18	0.44	0.48
(inverse rank)	(6)	(3)	(2)	(1)	(4)	(5)

Source: Public Perceptions data, Mueller and Uher (1989), Svallfors (1993). Unionisation rate, LIS/North western University aggregates database.

Finally, it is of interest to consider the cross-national variation discussed here in the context of the recent growth in wage inequality in Australia. In Figure 5 the Australian gross wage distributions in 1981-82 and 1989-90 are expressed relative to the distribution in 1985-86. For comparison with Figure 1, the distributions for the US and UK are also included. The increase in Australian wage inequality since 1985-86 is clearly. Men below the 70th percentile lost wage shares, whilst men with higher wages gained. Similarly, wages in 1981-82 are more equal than in 1985-86, though here caution is required, as this difference appears to be wholly confined to the top two per cent of the wage distribution.[23]

23 This figure is calculated so as to compensate for some definitional changes in the surveys. In 1981-82 wages of individuals employed in their own limited liability company were not included as part of wages (but as self-employment income), whilst in 1989-90 FYFT is defined as men working >= 48 weeks, most of which were full-time. Alternative 1985-86 distributions were calculated using each of these definitions in turn. The Gini coefficients are: 1981-82=0.181; 1985-86(1981-82 definition)=0.187; 1985-86(Table 2 definition)=0.196; 1985-86(1989-90 definition)=0.198; 1989-90=0.219.

Figure 5 Australian Gross Wage Distributions, 1981-82 to 1989-90



The increase in inequality over the four years after 1985-86 is also significant in the context of the degree of cross-national variation. In 1989-90 Australia was closer to the mid-range countries (UK and CN) than the low inequality countries of Sweden and Germany (assuming that inequality in these other countries had not changed). Whether this represents a speeding up of the trend towards greater wage inequality, or whether it simply represents a once-off effect due to particularly high wages in the financial services sector in the boom of the late 1980s, remains to be seen.[24]

24 Another explanation is that this growth in wage inequality may be a result of the 'cashing out' of fringe benefits as a result of the introduction of the fringe benefit tax in 1986-87 (though there is anecdotal evidence that large fringe benefits still continue). Such an effect would probably be on-going, but since most other countries do not have such a tax, would imply that it may be inappropriate to compare the 1989-90 distribution with that of other countries.

Appendix A: Low Wages

The analysis presented in the body of the paper excludes men with wages below 1/3 of the median wage for prime age men in their country. For comparison with previous research using the LIS dataset, Table A.1 shows the distribution of gross wages when these men are not excluded. This is similar to the populations considered by Green, Coder and Ryscavage (1992) and by Gottschalk and Joyce (1991), except that: these authors consider only men who were family heads, in some countries they include all men who worked full-time at the time of the survey rather than men who worked full-time during the whole year, and they have used varying definitions of self employment. The (relatively minor) differences in results reflect these definitional differences.

Table A.1 Gross Wage Distribution for Men Aged 25 to 54, Working FYFT, Not Self employed, and with a Positive Wage

	SW	GE	CN	US	AS	ASc	UK
No. of cases	3065	2413	3595	3411	2613	3333	2356
Weighted No. (000)	1139	8928	3495	26920	1833	2343	2356
Mean	143422	44626	33783	29868	25723	491	11596
Minimum	100	1400	250	10	160	10	364
Median	130400	40400	31930	26000	23920	450	10273
Maximum	1774600	236900	257000	100000	170680	2677	97355
Percentiles as % of mean							
1st	20	37	9	20	29	29.5	30.7
99th	270	232	276	335	237	243	294
% of men with wages below 1/3 median	2.0	1.0	4.2	3.1	1.5	1.2	0.8
Relative standard deviation (rank)	0.465 (4)	0.409 (6)	0.517 (3)	0.584 (1)	0.456 (5)	0.441	0.523 (2)
Gini coefficient (rank)	0.205 (4.5)	0.205 (4.5)	0.256 (2)	0.300 (3)	0.202 (6)		0.296 (1)

Note: All income amounts are annual amounts in national currencies apart from ASc which is weekly $AU. Ranks exclude ASc.

Appendix B Alternative Estimates of Swedish Net Wages

For most countries covered by this study there is a significant family based component of personal income tax. Thus the UK, USA and Germany have joint filing options, whilst the Australian system provides a rebate for people with low income spouses. In addition, in these countries enough married men have wives with zero earnings to make the counterfactual regression estimates used here to estimate after tax wages reasonably stable. An exception to this pattern however is Sweden, where the personal income tax system is individual based, and very few wives are not working. Consequently an alternative estimation procedure was also employed for Sweden. This involved defining a_i in equation (2) as disposable income less spouse net wage, and excluding spouse gross wage from y_i. Spouse net wage was approximated as spouse gross wage less income tax paid by spouse. Estimates based on this procedure are shown in Table B.1. Though the R^2 of this equation (0.88) is less than that of the original equation, the standard error of prediction of $\hat{f}(g_i,0,D_i)$ is 20 per cent lower. The mean net current wage is 1.2 per cent lower, whilst the Gini coefficient is 3.5 per cent higher, implying that Australia had the smallest Gini coefficient (rather than the equal smallest). The Gini coefficient rankings for net lifetime wages, however, are not changed.

Table B.1 Alternative Net Wage Distribution for Sweden

	Net Current Wages	*Net Lifetime Wages*
Mean	115684	169630
Mean as % of gross wage mean	79.4	116.4
Gini coefficient (rank)	0.173 (5)	0.164 (6)

Notes: Population and notes as for Table 2.

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