A. INTRODUCTION

In nearly all OECD countries, the share of social security expenditure in national income has been increasing. Among the causes of this have been high unemployment, improving levels of state pensions, and the rising cost of welfare and health care services. In the foreseeable future, growth in the population of retirement age is likely to put further pressure on pension and health expenditure. Most countries finance these and other government expenditures both by personal income tax paid by employees and by social security taxes paid, in large part, by employers: together, these taxes raise more than all other taxes combined. One particular policy concern is that taxes imposed on the wage bill may reduce employment, either through making production unprofitable, or through encouraging the use of more capital-intensive methods of production. This chapter focuses on the particular question of whether a switch between taxes paid by employers and taxes paid by employees will affect employment.

A striking prediction of economic theory is that the final incidence of a tax on any good or service will be the same regardless of whether the tax is paid by the buyer or the seller — an idea that the layman often finds difficult to accept. Applied to the labour market, this theory implies that the replacement of an employer tax by an employee tax of equal magnitude has no effect on the real economy, in that the total after-tax wage received by the employee, which is called the consumption wage, the total after-tax cost of labour to the employer, which is called the product wage, and the level of employment are all unaffected.

This is called the Invariance of Incidence Proposition (IIP), and is illustrated in Chart 6.1. Chart 6.1 shows demand and supply curves in terms of the wage recognised in law as the basis for taxation, which is called here the contractual wage (though in practice non-contractual bonuses, etc., may be taxed similarly). In Chart 6.1, the line $n_s$ shows the amount of labour that will be supplied by employees at various levels of the contractual wage, and $n_d$ shows the amount of labour that will be demanded by employers. The demand and supply curves together determine both the contractual wage $W_0$ and the level of employment $N_0$. If an employee tax is introduced, assuming that employees’ behaviour depends only upon the consumption wage, the supply curve shifts up to $n_s'$ in Chart 6.1, leading to the higher contractual wage $W_1$ and employment $N_1$. If an employer tax is introduced, assuming that employers’ behaviour depends only upon the product wage, the demand curve shifts down to $n_d'$ in Chart 6.1, leading to a lower contractual wage $W_2$ and employment $N_2$.

For a tax of a given size, the upwards shift in the supply curve in Chart 6.1 has the same impact on employment as the downwards shift in the demand curve in Chart 6.1. Only the level of the contractual wage $W$ differs between Chart 6.1 and Chart 6.1. However, a real-world switch between employer and employee taxation will involve many factors that are not taken into account in the simple model of Chart 6.1. Several of these factors are described in the next section of this chapter. Later sections examine selected empirical evidence about the impact of taxation. Section C briefly examines evidence about the behaviour of wages in the long and short run in the face of changes in taxation. Section D examines long-term historical trends in components of the aggregate labour supply, taking the example of Great Britain. Sections E and F examine modern evidence about the relationship of some of the components of labour supply to taxation. Section E considers the impact of the detailed tax schedule upon earnings and hours of part-time workers. Section F presents an international comparison of the relationship between the frequency of female part-time work and the tax treatment of wives’ part-time earnings. Section G summarises and concludes.
B. SOME WAYS IN WHICH INCIDENCES OF EMPLOYER AND EMPLOYEE TAXES MAY DIFFER

The demand and supply curve analysis given above to illustrate the IIP refers to a simple partial equilibrium, where labour demand depends only upon the product wage, labour supply depends only upon the consumption wage, and contractual wages adjust to equate demand and supply. It assumes that all employees are paid the same wage, and that employer and employee taxes are independent of the level of the contractual wage. These assumptions are not realistic, and this section attempts to give a comprehensive list of reasons why, despite the logic of the IIP, a switch from employer to employee taxes may in practice affect employment. Only brief descriptions are given for what have been or could be major research topics, some of them not treated further in this chapter.

1. Inappropriateness of the equilibrium model

Most economists would accept that the IIP holds in simple competitive markets. However, some would object that the competitive model in Chart 6.1 is inappropriate in the labour market because wages are not set competitively, or adjust only slowly towards the level where labour demand would equal labour supply. According to this argument, if the contractual wage is above an equilibrium position (such as \( W_0 \) in Chart 6.1.i), it does not automatically adjust downwards. If this is the case, the contractual wage is also likely not to change when a tax switch causes the demand and supply curves to shift — and yet such a change is necessary for the IIP to hold.

A second objection is that in the context of the entire economy, the demand curve in Chart 6.1 does not adequately represent the relationship between wages and labour demand. According to this argument, if wages are initially above the equilibrium level and then fall, this fall in wages reduces consumers’ income and expenditure and hence their demand for output, and this shifts the firms’ labour demand curve downwards, taking the equilibrium position further away from the actual wage. If such shifts in the demand curve are large enough, they may prevent any equilibrium from being reached through wage adjustment, or may cause the economy to have multiple equilibria.

The *General Theory* [Keynes (1936)] argues that workers strongly resist cuts in nominal contractual wage levels. Because of this, after a shock to the economy which reduces the equilibrium level of nominal contractual wages, the contractual wage remains above
the equilibrium level and unemployment results. Moreover, to the extent that falls in the contractual wage do subsequently occur, they lead to a negative inflation rate, and this makes investment in financial assets more attractive than investment in productive capital equipment. The fall in investment expenditure, added to the effects of falling wages upon consumers’ expenditure, is enough to increase unemployment further.

In the inflationary post-war period, models have been developed to explain the apparent downwards rigidity of real wages in the face of high unemployment rates. In one such model, a fall in demand in the first instance causes firms to lay off union members. Because they are no longer employed, the laid-off workers lose their union membership, and are unable to influence the union to accept a reduction in wages to a level where firms would want to expand employment. In an extreme case of this theory, a fall in demand can leave the wage permanently above its equilibrium level [Blanchard and Summers (1987)].

Most modern econometric models of the economy take into account the fact that contractual wages do not adjust immediately. In these models, a switch from employee to employer taxes temporarily increases the product wage. Changes in prices, profits and consumer incomes result and the effect upon employment depends upon such factors as the subsequent behaviour of wages and the type of monetary policy in force. An initially temporary depression of economic activity may, through its effect upon investment, lead to a lower level of the capital stock, with long-run consequences.

2. Differences in the structure of the social security and income taxes

Employer taxes refer to employer social security or payroll taxes. Employee taxation includes both the employee component of social security taxation and the personal income tax. Although detailed practice varies substantially from country to country, there are always major differences in structure between the social security and personal income taxes which will cause any switch between them to shift the tax burden even if the IIP holds. The main types of difference are discussed below.

i) Taxation of income from capital

Employer taxes apply only to the wage and salary bill. Personal income, company income and value-added or sales taxes apply also to income from capital. Because of such differences in the income base subject to tax, a general shift from income taxes to employer payroll taxation will involve an increase in the overall rate of taxation on employment and a decrease in the rate of taxation on capital, favouring capital-intensive methods of production and industries. This link, which is not investigated further here, is emphasized in a proposal appearing in some European literature that the assessment base for payroll or social security taxation should be widened from the company’s wage bill to its total value-added [see Peeters (1988)].

ii) Other differences in the aggregate subject to taxation

Personal income taxes and social security taxes, even for individuals without capital income, are usually functions of different aggregates. Social security taxes normally apply to weekly or monthly earnings, while income tax applies to annual earnings. Income taxes, in some countries, depend on family or household incomes, or are adjusted according to the taxpayer’s family responsibilities, while social security taxes are nearly always functions of individual earnings. Personal income taxes may also include certain employment benefits (such as a company car) and exclude certain expenses (e.g. mortgage interest payments) from taxable income, whereas employer taxes are based upon the wage and salary with few such adjustments.

iii) Differences in progressivity

Personal income taxes are usually progressive, that is to say, the average tax rate is higher at high income levels than at low income levels. Social security taxes are broadly proportional to earnings, though where there is a lower exemption limit or upper ceiling they can be progressive or regressive at certain earnings levels. These differences alone imply that even a switch between social security and income taxes which is revenue-neutral at the aggregate level will change the total (employer plus employee) tax bill on many employees, unless the schedules of the taxes are adjusted in quite complicated ways. When differences in the income base subject to taxation (as discussed in i and ii above) are also present, a switch between social security and personal income taxes cannot be fully neutral.

Analyses of non-wage labour costs emphasize that many of these costs depend on the firm’s number of employees and are unaffected by changes in hours of work per employee. Research from this perspective has concluded that the relationship between cost structure and employment may be quite complex: for example, a reduction in a proportional tax could encourage substitution towards longer working hours by existing employees rather than an increase in numbers employed [OECD (1986a, p. 83); Hart et al. (1988)].
3. Benefits received

While the benefits an individual receives from government expenditure financed by income tax revenue are generally unrelated to his personal tax payments, compulsory social security contributions usually generate personal rights. In most OECD countries, unemployment benefits are partly related to contributions [OECD (1988a, Chapter 4.B.1)], and the same is often true for sickness benefits. Public pension payments are also generally related to contributions.

However, other major benefits, in particular health care, are little related to individual social security contribution levels. A study in the United Kingdom (Institute for Fiscal Studies (1978), pp. 368-3691 concluded that overall “compulsory national insurance contributions are more nearly akin to a tax than an actuarially balanced insurance premium”. In other countries the judgement might be more equivocal.

Contribution-relatedness of benefits may imply that the incentive to change employment behaviour so as to minimise social security tax is lower than the incentive in respect of a similar amount of income tax. However, the benefit link reinforces, rather than offsets, the general tendency for social security taxes to be less progressive than income taxes. Elsewhere in this chapter, social security contributions will be treated as a component of taxation, and the tax switch analysed is supposed not to have major implications for social security benefits.

4. The excess burden of taxation

In the absence of a tax, a good is sold when its value to the demander exceeds the value or the cost of supplying it to the supplier. Such transactions are mutually profitable. When there is a tax on the transaction, this raises the price paid by the demander relative to the price received by the supplier, which prevents some mutually profitable transactions from taking place. The full economic cost of a tax exceeds the revenue it raises because of this distortion to behaviour. The excess cost is called the “excess burden” of the tax. As a reasonable approximation, the excess burden is proportional to the square of the tax rate and this implies that the total excess burden of two different taxes at a low rate is less than the excess burden from a single tax raising the same revenue.

Social security and income taxes each generates specific changes in economic behaviour which are a function of the particular types of income, income period, exemptions and type of aggregate, etc., that generate liability, and the excess burden of taxation is likely to be lower when the tax burden is split between both types of taxation. This consideration of excess burden, but also a number of other features such as liability to evasion, collection and compliance costs, and equity, are highly relevant to any decision to abolish or introduce a particular tax or change rates of taxation — although they may have relatively minor immediate consequences for employment in the whole economy.

C. THE RESPONSE OF WAGES TO TAXATION

The IIP implies that, after a switch in taxation from employer to employee, the nominal contractual wage or other money prices in the economy will adjust in such a way that the real product wage and real consumption wage and employment are all restored to their initial levels. The IIP is examined here in terms of its predictions concerning the behaviour of wages following a tax switch, on the assumption that if real contractual wages change so as to leave real product and consumption wages unaffected, employment will also be unaffected.

Assuming that the IIP does hold, the response of wages to a change in the overall level of taxation depends upon the way labour supply responds to a change in consumption wages. This is illustrated in Chart 6.2. In the case where labour supply is inelastic (Chart 6.2.ii), a tax has no impact on the real production wage (RPW). The tax acts only to reduce the real consumption wage (RCW). The way this happens is that, if the employer tax is increased unexpectedly and contractual wages cannot immediately change, the real product wage does at first rise, and as a result firms wish to reduce employment. But because labour supply is inelastic, workers’ desire for employment does not change, and in a competitive market wages are driven down. This process continues until wages have fallen to the point workers are effectively paying the whole tax imposed on employers. At any higher level of wages, firms’ demand for labour would remain below its initial level, and thus be below labour supply.5

A simple cross-country illustration of the evidence for shifting of employer taxes at the aggregate level is given in Chart 6.3. This shows, on one axis, the share of contractual wages in GDP and, on the other axis, the rate of social security tax that employers pay on contractual wages. In countries where employer social security contributions are high, the share of contractual wages is low. This was true both in 1974 and 1986. Changes between 1974 and 1986 in the share of contractual wages in GDP also tend to be negatively related to changes in employer contributions. This suggests that increases in those contributions have caused falls in the real contractual wage, either by directly reducing the rate of
Chart 6.2

THE TAX WEDGE AND THE ELASTICITY OF LABOUR SUPPLY

i) Positive elasticity of labour supply

ii) Inelastic labour supply

iii) Backwards-bending labour supply

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a. By contrast with Chart 6.1, the vertical axis in this chart is used to show both the product wage and the consumption wage. Labour demand \( n_d \) is a fixed function of the real product wage \( RPW \) and labour supply \( n_s \) is a fixed function of the real consumption wage \( RCW \). A tax \( TT \), whether on the employer or the employee, is represented by an excess of \( RPW \) over \( RCW \).

b. The elasticity of labour supply is the percentage change in labour supply in response to a one per cent rise in wages.

c. The case shown is zero elasticity of labour supply.

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nominal contractual wage increase, or by increasing the rate of price inflation.

Annex 6.A presents a statistical analysis of the data in Chart 6.3. It also presents an analysis of wage behaviour in time-series data for 16 OECD countries over 30 years. This analysis uses regression techniques to examine the statistical association of movements in real wages with movements in rates of employer, employee and indirect taxes. Results, as regards long-run behaviour, are very weak. The long-run behaviour of real wages is found to be consistent with the IIP, but an alternative hypothesis, that a change in employer taxes arising during a switch of the tax burden will change the product wage, also falls within the margins of statistical error. Because time-series statistics alone do not give definitive findings, the long-run response of wages to taxes in econometric forecasting models of the economy is based largely upon modellers’ theoretical perspectives, which are often in favour of the IIP.

The most obvious reason that short-run behaviour can diverge from the IIP is that wages in nominal terms are intermittently set by contract, and do not adjust immediately to changes in economic circumstances. If monetary policy or other adjustment costs also prevent prices from adjusting immediately, contractual wages in real terms will also be subject to delays in adjustment. In this case, an unanticipated increase in employer taxes will initially be incident on the real product wage (RPW).

The statistical analysis reported in Annex 6.A concerning short-run behaviour indicates that a 1 per cent reduction in employee taxes, accompanied by a 1 per cent increase in employer taxes, initially causes the real product wage to increase by something in the range of 0.22 to over 1 per cent. While the range of estimates is rather wide, it is clear that the IIP does not hold in the short run.

The finding that a taxation switch is likely to have short-run effects is in line with earlier research. Poterba et al. (1986), who treat employer taxes as a component of indirect taxation, analysed the impact of a switch from direct to indirect taxation upon prices, wages and real GDP for the United Kingdom and the United States. They found that in both countries, this tax switch increases prices and reduces output for several years. In a similar vein, Hamermesh (1980) constructed a simulation model which used “the best available estimates of the lags implicit in the adjustment process”, and concluded that it probably takes several years before a majority of any increase in employer tax is shifted to the employee. A model constructed by the OECD Secretariat some years ago [reported in OECD (1986a, p. 95)] suggested that, even using a model where the IIP holds in the long run, a 1 per cent cut in employer taxes could reduce unemployment by about 1/2 per cent for 5
Chart 6.3

THE WAGE SHARE AND THE EMPLOYER SOCIAL SECURITY CONTRIBUTION RATE IN 16 OECD COUNTRIES

1974 to 1986

Country codes:

A = Australia
B = Austria
C = Belgium
D = Canada
F = France
G = Germany
H = Netherlands
I = Ireland
K = United Kingdom
M = Finland
N = Norway
O = Sweden
P = Switzerland
S = United States
U = United States

The corrected wage share is the ratio of wages and salaries to gross domestic product, divided by the ratio of dependent (employee) employment to total employment. The employer social security contribution rate is the ratio of total employer compulsory social security contributions and voluntary pension contributions to total wages and salaries.

Source: See Annex 6 A
to 10 years into the future, and that much of these gains would remain in the presence of offsetting increases in income taxes. Common to these findings is the conclusion that when taxation is switched from the employee to the employer, the product wage increases.

**D. LONG-TERM TRENDS IN LABOUR SUPPLY**

As Chart 6.2 has illustrated, the incidence of tax upon wages is related to labour supply behaviour, and the following sections examine labour supply in more detail. Table 6.1 shows various indicators of labour supply behaviour for Great Britain at census dates. While the overall participation rate (row 1 — labour force as a proportion of population of working age) has changed little since 1901, there have been some marked changes for particular demographic groups which contribute to this aggregate. After 1931, there was a substantial reduction in participation rates of men aged 20-24 and 45-59, and a substantial increase in participation rates of married women (rows 2 to 6). Increased time spent in education and falls in the retirement age have, this suggests, been factors reducing male participation rates almost enough to offset the increase in female participation rates. Hours of work per week fell over the period and holiday entitlements rose (rows 7 to 9). This information, supplemented with estimates of part-time work, has been used to estimate average total hours supplied per week per head of population of working age (row 10), which fell by about 30 per cent between 1901 and 1981. Real income (row 11) rose by 150 per cent. The elasticity of total hours with respect to real income estimated on this basis (regressing row 10 on row 11) is -0.25.

The long-term historical experience of large rises in real incomes, associated with relatively smaller falls in labour supply, is common to many countries. Chart 6.4 illustrates this in terms of the changes in hours worked per head of population over 1950 to 1973. Over this period, real wages were rising rapidly and unemployment was not yet a major factor in most countries. Hours worked per head of population fell in all countries except Japan. The fall in hours worked was much smaller than the rise in incomes, and the statistics in Chart 6.4 lead to estimates of the elasticity of hours worked with respect to income per man-hour in the range of 0.0 to -0.257. As a guide to current behaviour, such estimates can only be approximate: historically, such factors as declines in average family size, more progressive taxation, better state welfare provision for basic needs, and the introduction of household appliances and television, may all have affected the allocation of time between leisure and household and market work.

Rows 12 to 14 of Table 6.1 show an estimate of the weekly hours supplied by married couples with (both) partners aged 25-44. On average, the British married woman in 1981 worked about 11 hours more than she would have in 1901, while her husband worked about 15 hours less. Whether we look at the period since 1901 or since 1951, shifts of labour supply from the husband to the wife within the household have been more important than change in the total labour supply of the household.

This type of evidence shows that certain components of the labour supply have historically changed considerably more than the labour supply in aggregate, and that the growth in female labour supply, which has been the most important single change, may be partly a substitution of wife’s work for husband’s work, rather than a net addition to labour supply. The rest of this chapter attempts to exploit these observations by looking in more detail at women’s part-time earnings and employment.

**E. THE STRUCTURE OF INCOME AND SOCIAL SECURITY TAXES**

Economic theory can be used to analyse the potential impact of social security and personal income tax schedules upon labour supply decisions. Each individual is supposed to have particular (normally undeclared) preferences for all possible combinations of net earnings and leisure time. A line joining points which the individual regards as all having equal levels of utility, or in other words all being equally desirable, is called an “indifference curve”. In Chart 6.5, the curves AA, BB, CC and DD are curves of indifference between various combinations of gross earnings and net earnings for four illustrative individuals. The curves are upwards-sloping, with the slope representing the increase in net earnings that an individual needs to compensate for the additional work that is involved in a higher level of gross earnings. The shape and position of an individual’s indifference curves depend upon his hourly contractual wage rate, but also upon such factors as non-work commitments of time and the availability of income from other sources. Although the curves are drawn for individuals, the indifference curves for an individual may depend upon the earnings options available to other members of the household. As a result of variety in personal situations, the economy may be thought of as containing a continuum of individuals with indifference curves of different slopes and shapes.
CHANGES IN LABOUR SUPPLY AND GDP PER MAN-HOUR IN 16 OECD COUNTRIES, 1950 TO 1973

$a.$ For Japan, the ratio of the 1973 to the 1950 level of gross domestic product per man-hour was 5.92 and the ratio for hours worked per week per head of population was 1.10.

Source: Maddison (1982, Tables B4, C8, C9 and C10)
Chart 6.5

NET AND GROSS EARNINGS,
UNITED KINGDOM, 1984/85

Net earnings £ per week

Gross earnings £ per week

- The thick line represents net earnings. Positive net earnings are shown at zero gross earnings, to represent the saving in travel-to-work time and expenses when not at work. LEL is the lower earnings limit, below which no national insurance is payable. TXT is the tax threshold, above which income tax becomes payable at 30 per cent, and APW is the earnings level of the Average Production Worker. Thin curved lines represent indifference curves. A person with the indifference curve AA chooses not to work, a person with curve BB works part-time with earnings below LEL, a person with curve CC works part-time with earnings above LEL and TXT, and a person with curve DD works full-time with earnings near the APW level.
Table 6.1. Labour data at the census years, 1901-1981, Great Britain

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<tbody>
<tr>
<td>(1) Activity rate, total population of working age</td>
<td>59.0</td>
<td>59.7</td>
<td>58.1</td>
<td>60.7</td>
<td>59.6</td>
<td>60.5</td>
<td>61.1</td>
<td>61.0</td>
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<tr>
<td>(2) Activity rate, all males of working age</td>
<td>86.4</td>
<td>87.8</td>
<td>87.1</td>
<td>90.5</td>
<td>87.6</td>
<td>86.0</td>
<td>81.5</td>
<td>77.8</td>
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<tr>
<td>(3) Activity rate, all females of working age</td>
<td>33.4</td>
<td>33.9</td>
<td>32.3</td>
<td>34.2</td>
<td>34.7</td>
<td>37.4</td>
<td>42.6</td>
<td>45.5</td>
</tr>
<tr>
<td>(4) Activity rate, males 25-44</td>
<td>98.1</td>
<td>98.5</td>
<td>97.9</td>
<td>98.3</td>
<td>98.3</td>
<td>98.2</td>
<td>97.9</td>
<td>97.5</td>
</tr>
<tr>
<td>(5) Activity rate, males 20-24 and 45-64</td>
<td>79.4</td>
<td>80.8</td>
<td>80.9</td>
<td>85.7</td>
<td>80.5</td>
<td>80.5</td>
<td>79.2</td>
<td>73.3</td>
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<tr>
<td>(6) Activity rate, married women 20-64</td>
<td>13.0</td>
<td>10.5</td>
<td>9.4</td>
<td>10.9</td>
<td>23.2</td>
<td>31.6</td>
<td>45.9</td>
<td>54.0</td>
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<tr>
<td>(7) Average hours, full-time male manual</td>
<td>56.6</td>
<td>54.4</td>
<td>49.8</td>
<td>50.5</td>
<td>47.6</td>
<td>47.6</td>
<td>45.5</td>
<td>43.8</td>
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<tr>
<td>(7’) Average normal hours, full-time male manual</td>
<td>53.0</td>
<td>51.0</td>
<td>46.7</td>
<td>47.3</td>
<td>44.6</td>
<td>42.8</td>
<td>40.2</td>
<td>39.7</td>
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<tr>
<td>(8) Average hours, full-time female manual</td>
<td>49.4</td>
<td>47.6</td>
<td>43.6</td>
<td>44.1</td>
<td>41.6</td>
<td>40.0</td>
<td>37.9</td>
<td>37.9</td>
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<tr>
<td>(9) Annual weeks of holiday, manual workers</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1.7</td>
<td>2.0</td>
<td>2.7</td>
<td>4.2</td>
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<tr>
<td>(10) Hours per week per head of adult population</td>
<td>30.9</td>
<td>30.1</td>
<td>26.8</td>
<td>28.4</td>
<td>25.9</td>
<td>25.4</td>
<td>23.4</td>
<td>21.9</td>
</tr>
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<td>(11) GDP per head of population of working age</td>
<td>100</td>
<td>105</td>
<td>88</td>
<td>102</td>
<td>147</td>
<td>182</td>
<td>227</td>
<td>259</td>
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<tr>
<td>(12) Weekly hours of married couple 25-44</td>
<td>58.5</td>
<td>56.5</td>
<td>51.2</td>
<td>53.1</td>
<td>55.5</td>
<td>55.4</td>
<td>55.5</td>
<td>54.4</td>
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<td>of which:</td>
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<tr>
<td>(13) Supplied by wife</td>
<td>4.1</td>
<td>3.9</td>
<td>3.4</td>
<td>4.4</td>
<td>10.3</td>
<td>10.4</td>
<td>13.2</td>
<td>15.1</td>
</tr>
<tr>
<td>(14) Supplied by husband</td>
<td>54.5</td>
<td>52.6</td>
<td>47.8</td>
<td>48.7</td>
<td>45.2</td>
<td>44.9</td>
<td>42.2</td>
<td>39.2</td>
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Sources and definitions: See Annex 6.B.

Chart 6.5 shows, as the thick line, the relationship between gross earnings and net earnings (after income tax and social security payments) in the tax system of the United Kingdom in 1984. For low positive earnings, gross and net earnings are equal (no tax). At £34 per week of gross earnings (shown as LEL, lower earnings limit), net earnings fall because the employee becomes liable to social security tax at an average 9 per cent rate. At £38.42 per week (shown as TXT, tax threshold), income tax becomes payable at a marginal 30 per cent rate. The earnings levels LEL and TXT, in the United Kingdom in 1984, would normally represent part-time work. The case of zero gross earnings is given special treatment in Chart 6.5, with positive net earnings shown in order to represent the saving of travel-to-work time and expenses when an employee reduces his hours of work to zero.

Chart 6.5 shows the indifference curve for the highest utility level that each individual can reach, given the options available in the tax system. The individual with curve AA will choose not to work at all, BB will be a part-time worker earning just below LEL, CC a part-time worker who earns above TXT, and DD a full-time worker with about 75 per cent of the Average Production Worker’s (APW) earnings.

This theoretical analysis suggests insights about how tax structure will influence the frequency of work at various earnings levels. The economy will contain some people whose indifference curves are only slightly curved, at least until earnings representing full-time hours of work are reached. Under a proportional income tax system, these people would mainly choose either to work full-time or not work at all. Under the tax system in Chart 6.5, a larger proportion of them will choose to work part-time, with earnings close to LEL or TXT. However, few will choose to earn between LEL and TXT.

A possible objection to predictions based upon this reasoning is that, since hours of work are usually set by employers, tax incentives are not likely to have much observable effect on behaviour. It is, however, possible that if taxation considerations increase the proportion of people that would like to work part-time, firms will find it profitable to adapt their work schedules to include part-time work, particularly when they find difficulties in recruiting suitable staff. Other institutions (e.g. child care, shopping hours) may also in time adapt to new work patterns. In this perspective, adaptation of observed behaviour to economic factors such as tax structure may be slowed because institutional change is involved, but will not be prevented.
One piece of evidence about the actual work patterns associated with Chart 6.5 comes from the distribution of female part-time earnings for 1984, shown in Chart 6.6. This distribution shows a bunching of earnings just below or at the lower earnings limit (LEL), with a drop in frequency of earnings just above this, as is suggested by the tax considerations. The overall distribution of women’s employment by hours of work — shown in Chart 6.7 — shows distinct modes representing part-time work and full-time work, which again might be expected on the basis of Chart 6.5. Given the wage rates at the time, the peak frequencies of part-time hours appear to represent mainly points slightly above LEL (such as C* in Chart 6.5).

This example shows that an association between the detailed distribution of earnings or hours, and a clear “kink” in the detailed tax and social security contribution schedule, can be fairly easy to demonstrate. By contrast, even if taxation structure (or indeed some other factor) has substantially affected general work patterns. The overall distribution of women’s employment by hours of work — shown in Chart 6.7 — shows distinct modes representing part-time work and full-time work, which again might be expected on the basis of Chart 6.5. Given the wage rates at the time, the peak frequencies of part-time hours appear to represent mainly points slightly above LEL (such as C* in Chart 6.5).

F. TAXATION AND FEMALE PARTICIPATION

There is a range of statistical evidence about the responsiveness of individual labour supply to changes in wage rates, which, combined with simple facts about the degree of variation of tax structure across countries, suggests that taxation structures could account for much of the cross-country variation in labour supply. Estimates in micro-economic data suggest that wives’ hours of work are more responsive to changes in the wage rate than men’s hours. Estimates of the wage elasticity of wives’ labour supply vary greatly, and so can hardly be considered definitive: but they are often of the order of 0.5 to 1 [Beach and Balfour (1983); Killingsworth (1983)]. In negative income tax experiments in the United States, it was found that most of the change in female labour supply was associated with change in labour force status — movements into or out of employment — rather than in hours worked. A review of the available evidence has suggested that taxes and transfer payments may reduce total labour supply in the United States by about 5 per cent [Burtless and Haveman (1985)]. For some other OECD countries where taxation is considerably higher and more progressive than in the United States, the impact of taxation may, if similar relationships hold, be greater.

Table 6.2 focuses on the possible link between female labour supply and the tax structure, using data from the late 1970s. The first two columns show statistics for the female participation rate and the share of part-time working in total employment by women in 1979 for 21 OECD countries. At this time, women’s rates of participation varied from about 30 to 70 per cent, and shares of part-time employment in total female employment varied from about 10 to 50 per cent. The product of these two variables gives an estimate of the rate of female part-time participation, shown in the third column. The fourth to sixth columns summarise the tax liabilities that faced a married couple for some potential earnings patterns in 1974 and 1978. Starting from a situation where only the husband works and where he receives the Average Production Worker level of earnings, columns 4 and 5 show the change in after-tax earnings when total household pre-tax earnings increase by 33 per cent as a result of either an increase in the earnings of the husband (column 4) or an identical increase arising because the wife takes a part-time job (column 5). Column 6 shows the impact on household after-tax earnings of a switch of pre-tax earnings from the husband to the wife.

In the Netherlands and France, the household substituting towards part-time work by the wife suffers a reduction in disposable income of several per cent. At the other extreme, in Sweden the household enjoys an increase of 13.3 per cent. These changes in disposable income are large, given that they result from a switch of only one-quarter of household gross earnings from the husband to the wife. For Sweden the implication is that, if the husband and wife earn the same hourly contractual wage, the husband can reduce his working week by 10 hours and maintain household disposable income unchanged at the cost of approximately 5½ hours’ work by the wife.

The tax treatment of a move from non-employment to part-time work by a married woman depends partly upon the broad principles of income and social security taxation that each country has adopted. Column 7 of Table 6.2 identifies one important characteristic of the income tax system. In 1978, the tax schedule in about half the OECD countries applied to the joint income of a married couple. In the other half, the tax schedule applied separately to each partner’s income. Under joint taxation, the income tax payable at a given earnings level is unaffected by the distribution of earnings between the husband and the wife. Under separate taxation, as long as the husband initially has higher earnings than the wife, the marginal tax rate on his earnings is higher than the marginal tax rate on his wife’s earnings because income tax schedules are progressive. Thus, separate
Chart 6.6

THE FREQUENCY DISTRIBUTION OF LOW EARNINGS, UNITED KINGDOM, 1984

Note: The chart shows the number of persons in each £2 range of earnings (£10–12, £12–14, etc.) recorded in a continuous monthly household sample survey between April and December 1984.

Source: Family Expenditure Survey 1984, this tabulation supplied by Mr. Ian Walker of the University of Keele.
THE FREQUENCY DISTRIBUTION OF FEMALE WEEKLY HOURS,
UNITED KINGDOM, 1984

a. The vertical axis shows estimates of the number of women working at each level of weekly hours.

Table 6.2. Part-time female labour force participation and the tax treatment of husband’s and wife’s earnings in the late 1970s

<table>
<thead>
<tr>
<th>Country</th>
<th>Overall Share of Part-time participation</th>
<th>Change in net income as gross earnings increase by 33 per cent of APW earnings</th>
<th>Tax system (1978)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall participation</td>
<td>Share of part-time</td>
<td>Part-time participation</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Australia</td>
<td>50.3</td>
<td>34.5</td>
<td>17.4</td>
</tr>
<tr>
<td>Austria</td>
<td>49.1</td>
<td>18.0</td>
<td>8.8</td>
</tr>
<tr>
<td>Belgium</td>
<td>47.4</td>
<td>16.5</td>
<td>7.8</td>
</tr>
<tr>
<td>Canada</td>
<td>55.5</td>
<td>23.3</td>
<td>12.9</td>
</tr>
<tr>
<td>Denmark</td>
<td>69.9</td>
<td>46.3</td>
<td>32.4</td>
</tr>
<tr>
<td>Finland</td>
<td>68.9</td>
<td>10.6</td>
<td>7.3</td>
</tr>
<tr>
<td>France</td>
<td>54.2</td>
<td>17.0</td>
<td>9.2</td>
</tr>
<tr>
<td>Germany</td>
<td>49.6</td>
<td>27.6</td>
<td>13.7</td>
</tr>
<tr>
<td>Ireland</td>
<td>35.2</td>
<td>13.1</td>
<td>4.6</td>
</tr>
<tr>
<td>Italy</td>
<td>38.7</td>
<td>10.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Japan</td>
<td>54.7</td>
<td>18.4</td>
<td>10.1</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>39.8</td>
<td>17.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Netherlands</td>
<td>33.4</td>
<td>31.7</td>
<td>10.6</td>
</tr>
<tr>
<td>New Zealand</td>
<td>45.0</td>
<td>26.2</td>
<td>11.8</td>
</tr>
<tr>
<td>Norway</td>
<td>61.7</td>
<td>51.6</td>
<td>31.8</td>
</tr>
<tr>
<td>Portugal</td>
<td>57.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>32.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>72.8</td>
<td>46.2</td>
<td>33.6</td>
</tr>
<tr>
<td>Switzerland</td>
<td>53.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>58.0</td>
<td>39.0</td>
<td>22.6</td>
</tr>
<tr>
<td>United States</td>
<td>58.9</td>
<td>24.1</td>
<td>14.2</td>
</tr>
</tbody>
</table>

Income tax systems create an incentive to switch earnings from the husband to the wife which is not present under joint taxation.

Column 8 identifies an important feature of the social security contribution system. In about half the OECD countries, the average rate of social security taxation declines at around the APW level because certain of the contributions are subject to an upper ceiling. In the other countries, the average rate of social security taxation does not fall as earnings rise. In the former case, if the wife starts working at a low earnings level, her earnings are usually liable to social security contributions at the full rate, while the same earnings received as a pay increase by the husband will pay social security contributions at a lower rate. Consequently, ceilings to social security contributions create a disincentive for substitution of wife’s earnings for husband’s earnings.

While the variables in columns 7 and 8 can explain much of the variation in the incentive for part-time work by wives as measured by the variable SUBST in column 6, other features of the tax structure are also important. In separate taxation systems, the general level and progressivity of the income tax are critical. Arrangements whereby the husband is able to use some part of his wife’s tax allowances only if she has no income in her own right can also enter into the calculation.
Table 6.3. **Regressions of female labour force participation on tax structure’**

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Dependent variable</th>
<th>Female labour force participation rate*</th>
<th>Share of part-timers*</th>
<th>Estimated female part-time participation rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>1. Constant</td>
<td></td>
<td>0.62</td>
<td>0.46</td>
<td>0.36</td>
</tr>
<tr>
<td>1. Constant</td>
<td></td>
<td>(1.7)</td>
<td>(16.2)</td>
<td>(3.7)</td>
</tr>
<tr>
<td>2. <strong>IH (marginal)</strong></td>
<td>disposable income</td>
<td>-1.92</td>
<td>-1.49</td>
<td>-1.61</td>
</tr>
<tr>
<td>2. <strong>IH (marginal)</strong></td>
<td>disposable income</td>
<td>(2.7)</td>
<td>(1.7)</td>
<td>(2.8)</td>
</tr>
<tr>
<td>3. <strong>IW (marginal)</strong></td>
<td>disposable income</td>
<td>1.29</td>
<td>2.04</td>
<td>1.15</td>
</tr>
<tr>
<td>3. <strong>IW (marginal)</strong></td>
<td>disposable income</td>
<td>(1.1)</td>
<td>(1.5)</td>
<td>(1.3)</td>
</tr>
<tr>
<td>4. <strong>SUBST</strong></td>
<td>(increase in disposable income after substitution of part-time work for husband’s earnings)</td>
<td>1.73</td>
<td>1.65</td>
<td>1.59</td>
</tr>
<tr>
<td>4. <strong>SUBST</strong></td>
<td>(increase in disposable income after substitution of part-time work for husband’s earnings)</td>
<td>(3.1)</td>
<td>(2.9)</td>
<td>(2.4)</td>
</tr>
<tr>
<td>5. <strong>LGDP (GDP per capita)</strong></td>
<td></td>
<td>0.07</td>
<td>0.14</td>
<td>0.10</td>
</tr>
<tr>
<td>5. <strong>LGDP (GDP per capita)</strong></td>
<td></td>
<td>(0.8)</td>
<td>(1.0)</td>
<td>(1.0)</td>
</tr>
</tbody>
</table>

a) For definitions and listing of variables, see Table 6.2.
b) Regressions use 21 observations (all OECD countries except Greece, Iceland and Turkey).
c) Regressions use 18 observations (as above less Portugal, Spain and Switzerland).
Sources: See Table 6.2.

As this brief discussion shows, the tax position of part-time work is not, on the whole, a reflection of public policy decisions consciously aimed at part-time work. It emerges from principles of income and social security taxation that countries have adopted usually for unrelated reasons.11

Whatever their origin, the varying financial incentives for splitting work more evenly between husband and wife may help explain cross-country differences in employment behaviour. Table 6.3 presents regressions that test the correlation between tax structure and female participation. The overall female participation rate and the proportion of women who work part-time are, in statistical terms, both related to the tax situation. The specifications examined show that the strongest relationship, in column 8, is obtained when the marginal tax rate upon the husband’s full-time earnings is taken into account as well as the tax on the wife’s part-time earnings. This regression indicates that for each 1 per cent increase in the disposable income offered to the couple that substitutes wife’s part-time work for husband’s work, the rate of female part-time participation rises by 1.46 percentage points. The regression is a simple correlation between columns 3 and 6 of Table 6.2, and is shown in graphical form in Chart 6.8.

A comparison between columns 2 and 8 of Table 6.3 shows that the estimated effect of tax structure upon total participation is rather similar to the estimated effect upon part-time participation. This implies that the effect upon full-time participation is small. Since the explanatory tax variable varies between -3 and +13 per cent from country to country, the coefficient estimates indicate that tax influences on female part-time work are causing cross-country differences of up to 20 percentage points in overall rates of female labour force participation. This, in turn, implies that tax factors are influencing the size of the total labour force by 10 per cent or more.

It is possible that this strong conclusion is mistaken for one of the following reasons:

- The margin of statistical error is considerable;
- The cross-country data on rates of part-time working themselves should be compared only “with extreme caution” because of differences in the definition of part-time work used by countries [OECD (1985, p. 26)];
- The statistics on part-time female participation should ideally refer, but do not, to participation only of married women. A significant part of overall part-time participation in some countries is employment of students, for whom the tax situation of married women is usually irrelevant;
- The statistics on tax structure, based on “typical case” computations, are at most a rough guide to the average of the situations that really exist, which involve a variety of earnings levels, unearned incomes, tax concessions, etc.;
- The “typical case” tax computations treat employee social security contributions as a pure tax, and do not include employer social security contributions at
The variable "change in household disposable income" is the change in the natural logarithm of household disposable income when the husband's gross earnings change from 1.33 to 1.00 of the Average Production Worker level and the wife's earnings change from 0.00 to 0.33 of the Average Production Worker level. Since household gross earnings are unchanged, the change in disposable income reflects solely the change in liability to income tax and employee social security contributions. For further information on the definition of variables, see Table 6.2.

Source: See Table 6.2.
all. For reasons discussed in this chapter these treatments may not be fully appropriate;
— Neither statistics nor theory can determine the exact econometric form of the relationship between participation and taxation;¹²
— Other variables that could be relevant, such as numbers of young children and the availability of child care, are not included in the analysis.¹³

Nevertheless, the general cross-country pattern of tax and participation rates shown in Chart 6.8 seems likely to be fairly robust to further investigation, and it is consistent with the idea that taxation structure has an effect. The results do not support the simple idea that high taxation reduces labour supply. Theoretical and empirical analysis indicate that it is the structure, and not the general level, of taxation that matters. In most countries, the structure encourages female part-time employment. Entries into part-time employment may be accompanied by reductions in the working hours of full-time workers, but this has not been demonstrated directly here.

G. SUMMARY AND CONCLUSIONS

This chapter has considered the impact of taxation on employment and especially the probable impact on employment of switches in the tax burden between employer and employee taxation. The chapter began with an exposition of the Invariance of Incidence Proposition according to which a switch of tax burden from employer to employee or vice versa will have no long-run effect on the economy, and continued with an analysis of the reasons why this simple theoretical prediction is not likely to hold exactly in practice. Several important considerations — including the fact that employer taxes apply to labour income only, while most alternative taxes apply to capital income as well — were noted but have not been investigated further here.

Section C considered evidence about aggregate wage behaviour. Cross-country evidence is consistent with the view that employer taxation is shifted on to contractual wages in the long run. Time-series regression analysis shows clearly that shifting is not complete over short time periods, so that a switch from employee to employer taxation raises the cost of labour to employers, the real product wage. This finding is in line with several earlier studies, which have concluded that a switch from employee to employer taxes or indirect taxes has a depressing effect upon the economy for several years due to lags in the adjustment of prices and contractual wages. To the extent that capital accumulation or skill formation during the adjustment period is affected, longer-term repercussions will also arise.

The simplest type of tax switch that most countries could make would be to increase the employer rate of social security contributions while reducing the employee rate. However, in many countries these rates have been kept equal or near-equal, and in these cases such a switch in the burden of social security contributions is not an option on the policy agenda. In a few countries policy debate has concerned a payroll tax unrelated to social security funding. More often, the significant policy decisions have concerned the extent to which social security spending is financed out of general tax revenues (principally the personal income tax and indirect taxes) rather than earmarked social security contributions. Such decisions affect the structure of taxation regardless of the Invariance of Incidence Proposition.

Later sections of this chapter argued that the structure of taxation may significantly affect employment through changing the structure of the labour supply. Section D reviewed the considerable changes that have occurred in the divisions of total hours worked between men and women; between full-time and part-time work; and between hours worked per week, weeks worked per year, and the level of employment. These changes illustrate why attention needs to be given to particular components of employment. Evidence given in Section F showed that the taxation structure may in some countries be increasing the labour force by as much as 10 per cent, through encouraging higher female participation especially in part-time work. In policy terms, it will always be important to consider which labour market groups and which labour market decisions will be most sharply affected or influenced by a proposed tax change.
NOTES

1. This chapter draws upon a report prepared for the OECD Secretariat by Professor James Symons and Mr. Donald Robertson of the London School of Economics, under a grant from Employment and Immigration Canada which has financed studies on the topic of Payroll Taxes and their Implications for the Level of Employment.

2. See OECD Revenue Statistics 1965-1988. There is a fairly strong tendency for countries with high social security tax rates to have a low personal income tax rate, and vice versa, indicating that in the long term there is a very real choice between these forms of financing. Other significant forms of taxation, not given attention here, include taxes on company profits, taxes on retail sales, and taxes on property and inheritance. Only in three OECD countries (Australia, Austria, Sweden) do non-social-security payroll taxes raise more than 2 per cent of total tax revenue.

3. The case of a switch between one tax and another is relevant not only to policy decisions about such a switch but also to policy when an increase in total tax revenue is required. This is because in all reasonable models the effect of an increase in one tax is equivalent to the effect of an increase in the second tax, plus the effect of a switch between the taxes. If the switch has a positive effect, it follows that an increase in the first tax has a more positive (less negative) impact on the economy than does an increase in the second tax. Knowledge about the tax switch thus answers the policy question about which tax to use when further revenue needs to be raised.

4. The excess burden of a tax is proportional to both the number of mutually profitable trades prevented, and to the average gain from trade foregone per trade prevented. Since both factors increase in line with the tax rate, the principle that excess burden increases as the square of the size of the tax is quite general.

5. Evidence that increases in employer taxes are wholly incident on the consumption wage (i.e. that they leave the real product wage unchanged) may be considered to support both the IIP (because the increase in employer taxes has had the same impact as an increase in employee taxes would have done) and the hypothesis that labour supply is inelastic. However, the two hypotheses are not identical. In particular, micro-economic evidence that the elasticity of labour supply is positive for particular groups such as married women [OECD (1986a, pp. 94-95)] is not evidence against the IIP.

6. Time-series regression techniques give only weak evidence about how wages respond to tax changes, because wages in most OECD countries have shown fairly large and erratic short-term movements at certain times, while tax rates have changed rather slowly. Tax factors have been a relatively minor element in the shorter-term movements in aggregate wages, and this limits the power of time-series equation methods of investigation. Some researchers have used different models of tax incidence: Knoester and van der Windt (1987) claim that employee taxes are between 50 to 100 per cent incident upon employers in most countries, but they do not look at employer taxes.

7. The elasticity of hours worked with respect to income per man-hour can be measured as the ratio of the change in the logarithm of hours worked per head to the change in the logarithm of income per man-hour. This approach leads to elasticity estimates between 0.0 and -0.25, except for Japan where the estimate is positive. If Japan is treated as an exception — and the exceptional character of its labour market is widely recognised — there was during the 1950-1973 period a tendency for the countries that have experienced the most rapid rises in incomes also to experience the greatest falls in hours of work, and the labour supply elasticity as estimated by cross-country regression was -0.25. If Japan is not treated as an exception, there is no significant cross-country relationship.

8. The upper ceiling to the social security tax in the United Kingdom is above the APW level of earnings, and seems not likely much to influence the choice of labour force status.

9. The examination of tax structure in the 1974 to 1978 period is constrained by data availability. Inertia in household and work organisation could plausibly cause tax structure over this period to have a maximum impact on employment patterns a little later.

10. The 0.125 change in the logarithm of disposable income shown for Sweden in Table 6.2 is a 13.3 per cent increase in the level of disposable income. For further discussion of Swedish taxation and female labour force participation, see Gustafsson (1988).

11. A more detailed Secretariat study of the tax situation of women in selected countries has pointed out some
further peculiarities of the situation. Relatively low taxation of part-time earnings is often accompanied by much higher tax rates on the transition from part-time to full-time work, so women may find themselves in a “part-time trap”. For a family dependent upon social transfer income, part-time work by the wife may be very heavily taxed, in the sense that transfer income is reduced in line with the earnings. In such circumstances, an increase in household income may be obtainable only from full-time work, which takes the family above the minimum income level.

12. In regressions with the overall female participation rate as the dependent variable, a slightly stronger correlation can be obtained considering the tax situation when the wife’s income rises from zero to 100 per cent of the APW level (representing entry direct into full-time work) rather than from zero to 33 per cent (representing entry into part-time work). Unfortunately, not enough data are available to allow detailed modelling of the three-way choice between non-work, part-time work, and full-time work.

13. Chapter 5 indicates that child-care subsidies alone often only 0.1 or 0.2 per cent of GDP, which suggests they may be less important factors than the considerations (which, as Table 6.2 shows, involve several per cent of household income). O’Rt (1986), using the proportion of females who work time in cross-section for 19 OECD countries at various dates as a dependent variable, reports that when used as explanatory variables the share of G6 services, a tax structure variable (not considering husband’s marginal rate), GDP per capita, the ratio of female to male earnings, the unemployment rate, the divorce rate, the fertility rate, and the proportion of women who are married, only the first two consistent proved to be statistically significant.
Annex 6.A

REGRESSION ESTIMATES OF THE INFLUENCES OF TAXATION UPON WAGES

Sources of data used in this annex are described in Annex 6.B.

1. Cross-section regressions in changes 1974 to 1986

The cross-country relationships between the corrected wage share (CWS) and the employer tax rate (t1), as shown in Chart 6.3, may be expressed through simple regressions. As can be seen in the chart, the relationship at a single point in time, either 1974 or 1986, is highly statistically significant.

For 1974:
\[ \log(\text{CWS}) = -0.25 - 1.13t_1 \]

(7.5) (6.7)

For 1986:
\[ \log(\text{CWS}) = -0.31 - 0.95t_1 \]

(7.8) (5.5)

(t-statistics in brackets).

As might be expected, the relationship for changes 1974 to 1986 (indicated by d) is weaker, but it remains statistically significant:

\[ \text{dlog}(\text{CWS}) = -0.04 - 0.68dt_1 \]

(2.7) (2.3)

Together these regressions strongly reject the hypothesis of no shifting, and are consistent with the hypothesis of complete shifting (a coefficient of -1.0 on t1).

A more complete analysis is possible taking into account also the employee tax rate, denoted t2, and the indirect tax rate, denoted t3. Using the same data as for Chart 6.3, and defining the change in real wages as national accounts wages and salaries per employee deflated by the GDP deflator, a regression of wage change over 1974 to 1986 (dw) upon corresponding tax changes (dt1, dt2, and dt3) and productivity changes in terms of GDP per person employed (dy-de), across 16 countries, gave

\[ \text{dw} + \text{dt}_1 = -0.05 + 0.19(\text{dt}_1 + \text{dt}_2 + \text{dt}_3) + 1.00(\text{dy-de}) \]

(1.4) (0.8) (6.0)

(R^2 = 0.75, standard error = 0.05).

The restrictions imposed on [4] to obtain [5] are statistically easily acceptable (F-statistic of 0.3). The coefficient on the total tax term is not statistically significantly different from zero, so that this regression is consistent with the case of inelastic labour supply as illustrated in Chart 6.2.

2. A simple model of tax and real wages

Regression analysis of the role of taxation in wage determination needs to take account of such factors as the price level, indirect taxes, and shifts in the demand for labour due to capital accumulation, which are not shown in Charts 6.1 and 6.2. In the neoclassical model of the economy, with a production function where output depends upon capital and labour with constant returns to scale, the real product wage is a function of the capital/labour ratio. Labour demand may be written

\[ k_n(l, \text{RPW}) \]

where \( \text{RPW} = w(1+t_1)/p \)

(6.0)

where k is the stock of physical capital, \( n_0(l) \) is the demand for labour per unit capital, and \( \text{RPW} \) is the real product wage. RPW is defined in terms of \( w \), the contractual wage paid to the employee, \( t_1 \) the rate employer tax, and \( p \), the price of output (which will be measured here by the GDP deflator). Labour supply may similarly be written as a function of the real consumption wage received by the employee as

\[ l_n(l, \text{RCW}) \]

where \( \text{RCW} = w/[p(1+t_2)(1+t_3)] \)

(7.0)

where \( l \) is an index of the population (here, taken as labour force), \( n_0(l) \) is the supply of labour per head, and \( \text{RCW} \) is the real consumption wage. RCW is defined in terms of the contractual wage \( w \), the rate of direct taxation \( t_2 \) (computed for convenience as a proportion of the after-tax wage), the rate of indirect taxation \( t_3 \), and the price of consumption goods net of indirect taxation, \( p \).

Since

\[ \text{RPW} = \text{RCW}\cdot\text{TT} \]

\[ \text{TT} = (1+t_1)(1+t_2)(1+t_3)(p/p_v) \]

(8.0)

labour supply may be written as a function of \( \text{RPW} \) and \( \text{TT} \). The term \( p/p_v \) in the variable \( \text{TT} \) is the proportion by which the
The elasticity of labour supply may be positive or negative, although stability requires that logarithms: a lagged value of the dependent variable was determining variables: and a dummy variable the value 1 in 1970-1976 and zero otherwise, was introduced.

3. Long-run responses in time-series analysis

The general solution [10] is easily evaluated in the case where $n_2$ and $n_4$ are log-linear. Then, with all variables in logs, we have

$$RPW = h(k/l, TT).$$

[10]

The regression results are reported as a simple average of the coefficients, t-statistics, and other parameters obtained in 16 independent ordinary-least squares equations, one for each of 16 OECD countries:

$$RPW = 0.80RPW_{-1} + 0.15(k-l) + 0.087TT + 0.03X$$

[12]

(Duration-Watson statistic 1.78, standard error = 0.021).

An examination of the correlation matrix of the residuals of the 16 individual country equations indicated that the hypothesis of independence across countries was acceptable. On the null hypothesis that a true coefficient is zero, t-statistics on that coefficient have approximately unit variance, and it follows that the average of 16 such t-statistics have a variance of approximately 1/16, i.e., a standard error of 0.25. Thus a 16 country average t-statistic will, on the null hypothesis, fall between -0.5 and +0.5 approximately 19 times out of 20. Thus, the positive average t-statistic of 0.5 on TT in equation [12] is on the borderline of being significant, because it is an average across 16 countries. In qualification, it may be noted that other plausible null hypotheses, for example the hypothesis that true parameters may vary across countries about a mean of zero, might lead to wider confidence intervals.

Equation [12] assumes that the real product wage depends only on total taxes. It does not provide evidence for this assumption. To test the possible impact of a switch of a given tax burden from employee to employer, the equation was re-estimated including a term on the variable $(t_1-t_2)$:

$$RPW = 0.79RPW_{-1} + 0.15(k-l) + 0.077TT + 0.02X - 0.05(t_1-t_2)$$

[13]

(Duration-Watson statistic 1.86, standard error = 0.020).

The hypothesis that the coefficient on $(t_1-t_2)$ is zero, as predicted by the Invariance of Incidence Proposition, is statistically easily accepted. Nevertheless, the coefficient on $(t_1-t_2)$ is not well-determined. A t-statistic testing the hypothesis that the coefficient on $(t_1-t_2)$ is -0.16 averages +0.5 across the 16 countries, and a t-statistic testing the hypothesis that the coefficient is +0.12 averages -0.5. Following the reasoning cited above, according to which a 16-country average t-statistic of 0.5 represents borderline significance, the range -0.16 to +0.12 may be interpreted as a confidence interval (one which takes no account of prior beliefs, such as that the coefficient is unlikely to be negative).

Due to the presence of a lagged dependent variable in equation [13], long-run coefficients are much larger than short-run coefficients. A sustained increase of 1 on the right-hand side of equation [13] causes an increase of 1 in RPW in the first year, but in later years RPW is further increased through the 0.79 coefficient on $RPW_{-1}$. By a standard formula, the long-run effects of the right-hand side variables are $1/(1-0.79)$, i.e. approximately 5 times greater than their first-year effects, so that the confidence interval for the long-run coefficient is roughly -0.8 to +0.6.

A tax switch involving a 0.01 (1 percentage point) fall in the rate of employee taxation and a similar rise in the rate of employer taxation will involve an increase of 0.02 in $(t_1-t_2)$ with TT unchanged. At the upper limit of the confidence interval, this will lead to an increase in the real product wage of 1.2 per cent. Thus, this analysis does not reject the hypothesis that, in the long run, the whole of the increase in the employer tax involved in a tax switch is incident upon the employer.

4. Short-run responses in time-series analysis

Table 6.A shows variants of equation [10] which allow for a short-run impact of tax rates upon real wages, by adding terms in the change in tax rates. The equation in column 1 shows that the change in TT from the previous year has a significant positive impact upon the real product wage. That is, years where the total tax burden (including $t_{pa}$, the import price term) has risen have been associated with a temporary increase in the real cost of labour to employers. Although the effect of tax changes is not permanent, it is quite long-lived: the mean lag is about four years.

The equation in column 2 drops the term in TT, which was of borderline significance, with little effect on the rest of the equation. Equations in columns 3 to 6 add $d_{t1}$, $d_{t2}$ and $d_{t3}$ as separate regressors. Taking into account the fact that these tax changes are already present in the $d_{TT}$ variable, these regressions suggest that an increase in any of the three taxes increases real product wages, but that the increase is relatively low for employee taxes. One way that this tendency might arise
Table 6.A. Product wage regressions
Dependent variable: log product wage (RPW) as defined by text equation [6]

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>t-statistics: averages for individual time-series regressions in 16 OECD countries, 1955-1986</th>
</tr>
</thead>
<tbody>
<tr>
<td>log (product wage)</td>
<td>0.79</td>
<td>0.84 0.84 0.83 0.84 0.84 0.84 (8.7) (10.2) (9.6) (9.9) (9.9) (9.5)</td>
</tr>
<tr>
<td>log (capital/labour)</td>
<td>0.18</td>
<td>0.12 0.12 0.13 0.12 0.11 (2.0) (1.6) (1.4) (1.6) (1.5) (1.5)</td>
</tr>
<tr>
<td>TT (level)</td>
<td>-0.08</td>
<td>- - - - - - (0.6)</td>
</tr>
<tr>
<td>dTT</td>
<td>0.52</td>
<td>0.49 0.46 0.46 0.55 0.51 (2.6) (2.7) (2.3) (2.3) (2.5) (2.5)</td>
</tr>
<tr>
<td>dt, (employer social security tax rate)</td>
<td>-</td>
<td>- 0.07 0.08 - - (0.3) (0.4)</td>
</tr>
<tr>
<td>dt2 (direct tax rate)</td>
<td>-</td>
<td>- -0.07 - -0.26 - (0.1) (0.5)</td>
</tr>
<tr>
<td>dt3 (indirect tax rate)</td>
<td>-</td>
<td>- 0.26 - - 0.12 (0.2) (0.8)</td>
</tr>
<tr>
<td>Equation standard error</td>
<td>0.019</td>
<td>0.020 0.020 0.020 0.020 0.020</td>
</tr>
</tbody>
</table>

Durbin-Watson statistic

Sources: See Annex 6.B.

is that wage claims may more often seek compensation for price rises (induced by increases in indirect taxation) than increases in direct income tax rates. The last equation in Table 6.A introduces the term (dt1-dt2). The average t-statistic on this variable is 0.7, which is sufficient to reject the hypothesis of no effect from a tax switch. A confidence interval for the coefficient on (dt1-dt2), calculated as described earlier, is +0.11 to +0.88.

5. Conclusion

Cross-country comparisons are usually considered to give evidence about long-run behaviour, because changes in the variables from one year to the next do not usually much alter the general pattern. This type of evidence suggests that significant tax shifting does occur, consistent with the IIP holding empirically to a good approximation, although the evidence is also consistent with some increase in real product wages remaining after an increase in employer taxation. Time-series estimation of wage behaviour, however, provided no strong evidence in favour of the IIP in the long run, and provided clear evidence against it in the short run.

Economic theory predicts that increases in real product wages induced by tax changes will cause a fall in the demand for labour. This chapter has not presented estimates of the size of the employment changes. However, estimates derived elsewhere imply that a change in real wages leads to a change in employment which is spread out over a number of years [Newell and Symons (1987)]. In Canada and Ireland, quite sharp changes in terms of trade and taxation are estimated to have had a maximum impact on unemployment of about one percentage point [Keil and Symons (1988); Newell and Symons (1989)].
Annex 6.B

SOURCES OF STATISTICS USED IN SECTIONS C AND D

1. Section C (and Annex 6.A, Table 6.A)

Statistics are taken from a data base for OECD countries kept at the Centre for Labour Economics, London School of Economics. The main source used is current and historical OECD publications: recent publications used include the National Accounts 1974-1986, Volume 2 (Detailed Tables): Labour Force Statistics 1966-1986; and Main Economic Indicators which was used for statistics of average weekly earnings and hours. Where appropriate statistics were not available from OECD publications, the gaps have been as far as possible filled using statistics from national publications: where continuous series were not available, a chaining procedure has generally been used to estimate earlier years on the more recent basis. Further details are given in Moghadom and Newell (1989).

The sixteen countries studied in Section C and Annex 6.A are Australia, Austria, Belgium, Canada, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom and the United States.

The wage variable w used in cross-country regressions is total wages and salaries divided by employee employment, which is an economy-wide statistic. The wage variable w used in time-series regressions is an index of average hourly earnings divided by (weekly hours)²; this statistic generally relates to manufacturing industry. Owing to the operation of overtime premia, actual average hourly earnings increase when weekly hours increase, and the adjustment using weekly hours converts the index into an estimate of the wage paid for straight-time work. The logarithm of the labour force, l, is computed as log(employment) + SUR, where SUR is the OECD’s standardized unemployment rate.

The tax rates t₁, t₂ and t₃ are economy-wide average rates, defined in terms of variables in OECD National Accounts (Tables 1 and 8) as follows:

\[
\begin{align*}
\text{t₁} &= \frac{\text{Employers' contributions for social and private pensions}}{\text{Wages and salaries}} \\
\text{t₂} &= \frac{\text{Direct taxes and employee social security contributions}}{\text{Households' current receipts}} \\
\text{t₃} &= \frac{\text{Indirect taxes minus subsidies}}{\text{CDP at factor cost}}
\end{align*}
\]

The denominator for t₂ is larger than the denominator for t₁. Thus, an increase in t₁ accompanied by an equal reduction in t₂ will reduce overall tax receipts. This reflects the fact that t₂ is assumed to be a tax levied on all household incomes, while t₁ is a tax levied only on wages and salaries. In practice, the tax rate t₂ is not applied uniformly across all types of household receipts, and the method estimates employee tax rates at best approximately.

Another example of the difficulties arising when tax rates are estimated from tax revenue data is that the tax rate t₂ will be partly endogenous (a rise in wage rates will increase the tax rate, due to the progressivity of income taxation). Arguably an ideal measure of tax rates would be based upon detailed study of tax rate structures, but this is difficult to implement, especially on a time-series and multi-country basis. For examples of other researchers’ approaches to constructing summary measures of tax rates, see Hagemann et al. (1988), and McKee et al. (1986), and Poterba et al. (1986).

2. Section D (Table 6.1)

The sources of basic data for Table 6.1 are as follows:

i) Real CDP and total population: Feinstein (1972) and Economic Trends Annual Supplements, Central Statistical Office.

ii) Activity rate and population of males and females aged 20-64, and males and married females aged 25-44: British Labour Statistics Historical Abstract, British Labour Statistics Yearbooks, and Department of Employment Gazettes. For the years 1901 and 1911 the activity rate of under-20 year olds, used in computing the population aged 20-64 from published information, was assumed to be the same as in 1921. For 1901 the activity rate of married females aged 25-44 was assumed to be the same as in 1911.

iii) Activity rate of married women aged 20-64, and the proportion of women aged 20-64 who work part-time: Joshi et al. (1985), Tables 1, 4. The proportion of married women working part-time: Census of Population for the years 1951-1981. The proportions working part-time for the years 1901-1931 were assumed to be the same as in 1951.

iv) Normal weekly working hours, manual workers, all industries and services, the average weekly hours worked by men (21 years and older) and women (18 years and older) in industry, and the basic holiday entitlement of manual workers, 1951-1981: British Labour Statistics Historical Abstract, British Labour Statistics Yearbooks, and Department of Employment Gazettes. Annual weeks of holiday (row 9 of Table 6.2) are calculated as a weighted average of the levels reported. Normal weekly working hours 1901-1931 were taken from the Centre for Labour Economics’ Historical Data Set. It was assumed that movements in average weekly hours 1901-1951 were proportional to movements in normal weekly hours. Although no statistics are shown in row 9, weeks of holiday were assumed at 1 for 1901-1931 for the purpose of estimating household labour supply.
Rows 1 to 9 and row 11 of Table 6.1 are direct from data or direct calculations from data. Later rows use the definitions:

Holiday factor = 1 - annual weeks of holiday/52

Married women’s hours = full-time female weekly hours x proportion of working married women who work full-time + 21.6 x proportion of working married women who work part-time. Thus, the calculations assume that part-time women worked 21.6 hours per week at all dates, calculated as the 1954-68 average hours of part-time women estimated from the *Historical Abstract of British Labour Statistics*, Table 49. For men, full-time hours are used in all calculations. For rows 13 and 14, the cyclical element in weekly hours has been removed by replacing the actual value for the year by the fitted value from a 15-year centered trend regression.

Row 13: Weekly hours of wife = activity rate married women 25-44 x holiday factor x hours factor

Row 14: Weekly hours of husband = activity rate men 25-44 x holiday factor x male weekly hours

Row 12: Weekly hours of couple = row 13 + row 14

Row 10: Hours per week per head of adult population = activity rate of all males x share of males in population of working age x male average weekly hours x holiday factor + ditto for full-time females + ditto for part-time females. For part-time females, it was again assumed that weekly hours were 21.6.

The description given above should make clear some of the principal limitations of Table 6.1. As regards the estimates in row 10, it has been assumed that the average weekly hours and annual holiday of all male workers are the same as for full-time male manual workers; and non-holiday absences from work are not fully taken into account. As regards the estimates in row 12, the weekly hours reported relate to a hypothetical married couple rather than being based upon direct observation. For the years before 1951, no direct data on actual average weekly hours or on the proportion of women (married and total) working part-time were available: thus the estimates are generally more precise from 1951 onwards than they are for earlier years.