IMF Working Paper

The Impact of Tax and Welfare Policies on Employment and Unemployment in OECD Countries

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INTERNATIONAL MONETARY FUND

IMF Working Paper

Fiscal Affairs Department

The Impact of Tax and Welfare Policies on Employment and Unemployment in OECD Countries

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Authorized for distribution by Richard Hemming

October 2000

Abstract

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The paper provides a selective survey of methods and findings concerning the impact of tax and welfare policies on employment, unemployment, and economic growth in OECD countries. The paper examines a number of facets of tax and welfare policy and concludes that cross-country macroeconomic studies shed only limited light on the issue. Analyses of household behavior using microeconometric methods are much more fruitful but the question remains of how to aggregate these results to assess the overall impact of policy.

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I. INTRODUCTION

What has been the impact of tax policy and welfare spending on employment, unemployment, and economic growth in OECD countries? What tax policies and welfare reforms might increase employment and reduce unemployment? There are now a variety of studies that consider this issue, of which the influential Jobs Study (OECD, 1995a) is perhaps the most well known. But it turns out that these studies differ quite sharply in the way that they pose this general question and in the methods used to answer it. This paper provides a selective review of this disparate literature and provides some, perhaps more contentious, interpretations of its conclusions.

Within the general question posed at the beginning, there are in fact three rather more specific issues that have been considered. The first issue is whether high levels of welfare spending and a high *average* tax burden in a country at a point in time reduce economic growth and increase unemployment relative to other countries and time periods. Simple cross-plots of economic performance indicators on aggregate measures of tax and welfare spending generally produce little correlation, but some studies have used multivariate analysis to greater effect. For example:

> "...the tax-financed growth in government expenditure which has occurred in the last 20–25 years has caused unemployment and slowed down the rate of economic growth during the period." (Tullio, 1987)

A second approach is to focus on the *incidence* of taxes: that is, on whether taxes are borne by labor, capital, etc. It is commonly argued that employment has been adversely affected in many European countries by the size of the "wedge": the ratio of nonwage costs (such as payroll tax contributions and taxes on personal income) relative to wages. Although the economic theory underlying this proposition is a little more contentious than might at first appear (we return to it in Section II), this argument too has received some unequivocal support:

> "The observed increase in unemployment and the slowdown in economic growth in Europe are related, both stem from a common cause, an excessively rapid growth of the cost of labour....European labour costs have increased for many reasons, one of which is particularly easy to identify: higher taxes on labour." (Daveri and Tabellini, 2000).

In similar vein, this literature has also focused on the adverse impact on participation in paid work of high *average* replacement rates of out-of-work benefits (whether short term, such as unemployment insurance, or long term, like social security pensions and disability pensions) relative to some measure of average earnings.

The third issue concerns the *progressivity* of tax structure, such as the marginal rate structure of the personal income tax schedule, or the marginal incentive effects associated with the interaction of direct tax systems with schemes of in-work and out-of-work benefits.

Intrinsically, once we focus on the complexity of tax structure as it affects particular groups of taxpayers, the empirical analysis has to shift to the behavior of individual, heterogeneous, households. So this strand of the literature has produced a multiplicity of studies using microeconometric techniques and microsimulation. What is perhaps lacking in such studies, many of which are described here, is the "big picture:" how do all these impacts on disparate types of households combine to generate macroeconomic effects?

Our selective review of these issues and studies proceeds in the following manner. Section II examines, extremely tersely, the theoretical literature that pertains to these issues. Section III provides some rather general empirical comparisons across countries and critically examines the econometric literature that utilizes cross-country comparisons. Section IV shifts the spotlight to the microeconomics of tax policy and welfare benefits: in particular it describes in general terms the diversity of marginal tax rates within countries and empirical methods used to examine impacts on employment and unemployment. Section V examines the impact of marginal tax rates among four household types: among the rich, the working poor, older workers and retired people, and entrants to work. The section suggests that tax structure has a highly significant impact for all these types of households—the issue is whether, combined, these households" behavior have a significant impact on the macroeconomy. Section VI concludes.

II. Basic Theory

A. Levels of Taxation and Welfare Spending in Macroeconomic Models

What is the impact of taxation and welfare spending in the short run? In a Keynesian setting, a tax-financed increase in welfare spending should have a modest expansionary impact on employment and output, so long as there are spare resources. In a static New Classical model, in contrast, such public spending can completely displace private spending. The impact of taxes levied on labor on the "equilibrium" or "natural" rate of output then depends on the within-period elasticity of labor supply and, possibly, the net-of-tax replacement rate of earnings to out-of-work benefits. We return to these issues shortly. An even greater impact of direct taxes on labor supply would occur where there is intertemporal substitutability of labor supply across time periods (Barro, 1997). However the evidence suggests that this elasticity of substitution is rather small in practice, at least in the United States (Altonji, 1982; Mankiw and others, 1985, Ham, 1986).

In the growth setting, there is also a substantial literature. Taxes on factors can affect the optimal level of the capital stock, although not its growth rate in equilibrium, in the standard model (Blanchard and Fischer, 1989). However, in an endogenous growth model, the nature of public spending matters: expenditure on "productive" capital rather than transfers can have a positive long run impact on growth, although taxes will offset this, especially if they distort the relative returns on factors (Barro, 1990). Taxes on labor may also adversely affect the return on investing in *human* capital (Heckman, 1976) but the net return to human capital depends both on the tax on labor and whether the cost of investing in human capital is itself affected by the tax structure (King and Rebelo, 1990).

Few studies have examined the exact theoretical relationship between economic growth and the unemployment rate, and how this is affected by the tax "wedge" and the existence of an unemployment benefit system. In general, growing productivity can destroy jobs and create higher unemployment (Aghion and Howitt, 1994), but also raise vacancies and the outflow from unemployment (Pissarides, 1990) and affect the cost of creating new job slots (Bean and Pissarides, 1993). Clearly tax and welfare policies can impinge on all these mechanisms, by affecting the inflows to, and duration of, unemployment spells. Moreover, if there is any "duration dependence" in unemployment spells, supply or demand shocks that raise unemployment may change the duration structure of the stock of unemployed and thereby change the level of wage pressure, and thus the feasible equilibrium level of economic activity (Layard and others, 1991).

B. Who Bears Taxes on Labor?

Underpinning these arguments are implicit assumptions governing the incidence of labor taxes. However, it is well known that in a competitive labor market with inelastic labor supply, a tax levied on labor is wholly borne by labor through a divergence between the real production wage and the real consumption wage. Indeed, there is some evidence that higher *average* levels of labor taxes across OECD countries are associated with lower shares of wages in output (OECD, 1990, Chart 6.3)—a result consistent with no shifting.

Nickell (1997) takes this one step further. The relevant real wage facing the employer is the real wage at which the employee is willing to work. It is irrelevant to the employee, he argues, as to whether this wage is higher (or lower) because of changes in the "wedge"—the direct tax on labor—or because of changes in taxes on consumption goods. The issue again is whether workers can shift taxes. Nickell believes that capital mobility rules out shifting in the long run and therefore concludes that the evidence for any impact of direct labor taxes on unemployment rates is weak. Not surprisingly, given the earlier quote, Daveri and Tabellini (2000) dispute this conclusion.

In general, therefore, the ability of labor to shift labor taxes onto prices, and ultimately onto consumers, renters or the profit share, requires either that labor or product markets are not competitive, or that labor supply is not completely inelastic. The response of labor supply to tax changes will form a central part of the subsequent analysis of this paper, but it should first be noted that the evidence on the best estimate of the labor supply elasticity of "regular" workers (full-time men) in response to changes in the net wage is indeed zero (Pencavel, 1986). We can of course form a "representative agent" in our macroeconomic models with a hybrid participation/hours elasticity of a composite male/female full-time/part-time single/married person which is nonzero. Some models do this, but it is not a very convincing strategy and it therefore seems best to stick with the inelastic labor supply assumption in the macroeconomic setting.

This leaves the question of labor and product market imperfections. Various partial equilibrium models can be derived that predict some degree of tax-shifting by workers.

Suppose, for example, that wages are set by a monopoly union. Unions set their wage on the basis of the elasticity of demand for labor, an outside option (which can be the level of unemployment insurance—UI) and the marginal tax rate on wages (Schioppa, 1990). Firms set employment conditional on the wage set by the union and thus determine the fraction of union members that are employed. If there is any change in the net-of-tax wage holding UI constant, or *vice versa*, the target wage changes, as does equilibrium employment and unemployment. The progressivity (or otherwise) of the direct tax structure can also have an impact on unemployment, by rotating the wage-employment trade-off (Layard, 1982; Pissarides, 1998).

This analysis can be extended to a wider class of "incentive wage" models (Phelps, 1994) when, for example, after a real tax rise, the wage required to preclude shirking, or quits, rises. Some of these models, as Pissarides (1998) points out, imply that it is the average, rather than the marginal tax rate, which affects employment. A rather general stylized model is contained in Nickell and Layard (1999).

In all these models, there is some unemployment rate which serves to equilibriate the labor market. For example, in Layard and others (1991), the equilibrium levels of unemployment and real wages are given by the interaction between the "target real wage," which is the real wage consistent with wage bargaining for any given level of unemployment and duration structure (see above) and the "feasible real wage" which is, in essence, a dynamic demand curve. In the Layard and others model, as in the Beveridge Curve approach (Blanchard and Diamond, 1989), a high fraction of long term unemployed can lead to a higher level of measured unemployment consistent with long run economic equilibrium. Budd and others (1988) find some support for this proposition in the United Kingdom.

All these models of wage-setting allow workers in part to shift labor taxes, and thereby to affect employment, unemployment, and output. However, there are some problems with this generic approach. First, in any reasonably sophisticated model of wage setting arrangements, it is hard to see why the unemployment rate is the primary labor market disciplining device— the "price" of unemployment (the appropriate replacement rate) should play a greater role in wage-setting than the structure of unemployment.

Second, and more substantively, the model must be extended to a general equilibrium setting. If the union is large enough relative to the size of the economy, or unions coordinate bargaining, the effect is to internalize the overall employment effect of their actions. Thus, economies with coordinated national bargaining may be closer to competitive markets in terms of outcomes than economies with strong unions and decentralized bargaining (Hoel, 1991)—the capacity of workers to pass on labor taxes will be strongest in economies of this last type. This argument is central to the empirical test pursued by most authors in cross-country comparisons.

C. Marginal Tax Rates and Effective Tax Rates

It has long been commonplace in the public finance literature to assert that high marginal tax rates on factors of production induce distortions and deadweight losses, which can be substantial when measured by conventional excess burden methods (see, for example, Feldstein, 1995, 1996). Although the net impact of tax rates on the behavior of the "representative agent" may be approximately zero, given offsetting income and substitution effects, high marginal rates on particular agents induce changes in behavior which may affect measured output and effective employment. These arise not just through changes in labor supply (as conventionally measured by hours of work), but also by adjustments of effort, substitution of alternative activities, tax avoidance, the existence of an informal sector, and so on (Tanzi, 2000).

High marginal rates of direct tax have been a policy concern in OECD countries for some time, which has led to sustained efforts to reduce the highest marginal rates of tax over the last two decades (see Section VA below for examples). But high marginal tax rates are not just simply a product of the combined schedule of income tax and payroll taxes. They arise in other circumstances.

The first case arises in the interaction between tax structures and welfare benefits; when, for example levels of in-work benefits depend on levels of earned income. Examples of these high marginal rates are encountered in Section VB, where the familiar trade-off is discussed between in-work benefits (the "poverty trap") and out-of-work replacement rates (the "unemployment trap"). To generalize this point, consider the relationship between the net-of-tax replacement rate and the effective tax rate. Write the net replacement rate R as:

$$R = b(1 - t_b) / w(1 - t_w - c) \tag{1}$$

where b is the level of benefit, w is the gross wage, t is the tax rate (indexed to the benefit) and c is the payroll tax contribution rate (assumed to be paid only by the worker). The replacement rate is an *average* concept, linking the average income in and out of work, as in a choice of discrete states. However (1) be rearranged and written to derive an Effective Tax Rate (ETR):

$$ETR = 1 - [w(1 - t_w - c) - b(1 - t_b)] / w(1 - t_w - c) \tag{2}$$

We can interpret (2) as a *marginal* tax rate since it asks: what is the return on increasing work on the margin (an hour, a day, or a longer period) relative to receiving benefit? The ETR has a direct inference when an individual faces a nonlinear budget constraint, which is typical of both high income earners and those facing choices between participation in paid work and inactivity, as well as increments in hours worked.

Another example where replacement rates and effective tax rates come into play is the retirement decision: in particular in the implicit effective tax rate on work when judged against alternatives—such as immediate receipt of social security benefits.

By augmenting (2), we can examine decisions such as whether to retire or move on to long term disability benefits, where the marginal effective tax rate has implications for *intertemporal* labor supply decisions. In a static labor supply model, this decision depends only on the current replacement rate of social security relative to earnings. But more insight is obtained by examining the effective tax rate on *continuing* to work when work in turn affects future benefit entitlements.

We follow Gruber and Wise (1999) in assuming that a family or household has accumulated a stock of pension wealth (social security wealth (SSW), in U.S. parlance)) based on past contribution histories, earnings profiles, and so on. By retiring now, the annuitised value of this wealth (the pension) can be compared to current earnings to obtain a static replacement rate, as in (1). But, by continuing to work, individuals will change their prospective value of SSW, according to various parameters: (i) their expected longevity, since deferring retirement by one year reduces the period in which they can expect to receive social security; (ii) any "actuarial" adjustment to benefits, which will increase the *rate* of pension for given earnings; (iii) any adjustment to the earnings base on which pensions are calculated (since an extra year's earnings may change this base, depending on the formula used); and (iv) the change in the number of years" service (there may be a ceiling on eligible years, for example).

Given these four factors, the impact on prospective discounted SSW of one more year's working may be positive or negative. The change in social security wealth, ΔSSW, will almost certainly be negative, for example, if benefits are not actuarially adjusted, if earnings are flat or even declining in later years and if there is a ceiling on years of work.

Write the effective tax rate in this augmented model as:

$$ETR = 1 - [w(1 - t_w)(1 - c) - \Delta SSW(1 - t_b) - SSW(1 - t_b)] / w(1 - t_w - c) \qquad (2a)$$

or as a replacement rate:

$$R = [(SSW - \Delta SSW)(1 - t_b)] / w(1 - t_w - c) \qquad (1a)$$

The inclusion of ΔSSW in the equation converts the decision into a forward-looking one. Ultimately the model can be extended to a fully specified dynamic model of the retirement decision by considering both the evolution of social security wealth *and* of earnings. If the problem of retirement is treated as one of finding the optimal stopping rule, then the prospective effective tax rates now and at each future retirement date will play a central part in the retirement decision (Stock and Wise, 1990). In addition, pension reform, by changing the accrual structure of social security welfare, can also be incorporated into this "effective tax rate" framework (see Disney and Whitehouse, 1999). A final issue, considered in Section VC below, is whether tax policies have in fact played a part in ensuring that retirement is irreversible.

III. MACROECONOMIC FINDINGS ON TAX POLICY AND WELFARE SPENDING

Our investigation of the empirical evidence starts with cross-country comparisons, which we term the "macroeconomic" evidence. Table 1 contains data from OECD (1995a), of the "marginal" tax rate affecting the average worker in a number of countries in two years. The tax rate includes consumption taxes, as in Nickell's (1997) argument; consumption taxes are higher in the Scandinavian countries but most of the other variations across countries and over time comes from variations in the direct rate structure and in the size of social insurance payroll contributions. The percentages are large, and have increased in most countries over time. Canada has a particularly large increase over this period which seems to stem from a restructuring of marginal tax rates and a rise in social insurance contributions. A major factor, of course, in the rise in social insurance contributions has been the growth of payments of social security pensions to elderly people (Disney, 2000).

Table 1. Overall Average Labor Tax Rates in Selected OECD Countries 1978–92

(Percentage of earnings of average production worker)

Country	1978	1991–92	Δ1978 to 91/92
Australia	38.8	43.5	+4.7
Belgium	61.3	66.3	+5.0
Canada	39.8	55.1	+15.3
Denmark	69.7	72.1	+2.4
Finland	64.5	66.1	+1.6
France	57.1	63.4	+6.3
Germany	66.0	63.8	-2.2
Italy	55.7	62.0	+4.3
Japan	18.8	22.2	+3.4
Netherlands	67.4	70.8	+3.4
Norway	70.1	62.9	-7.2
Spain	44.2	53.4	+9.2
Sweden	75.4	62.6	-12.8
United Kingdom	51.6	50.4	-1.2
United States	44.3	38.5	-5.8
Overall average	55.0	56.9	+1.9
OECD Europe	62.1	63.1	+1.0
European Community	59.1	62.8	+3.7
OECD non-Europe	35.4	39.8	+4.4

Source: OECD (1995a) Part II, Table 9.1. The overall average labor tax rate is defined as the sum of employer and employee's social security contributions, personal income taxes *and consumption taxes*. No account is taken of tax reliefs or other nonlabor costs. These rates are the notional marginal rates of combined tax for a worker earning the average production wage (APW).

Some countries have seen falls in the tax burden, notably in Norway, with natural resources, and in Sweden, the United Kingdom and the U.S. which all, in one way or another, embarked on measures to simplify direct tax structures and to reduce rates of income tax in the mid-1980s. Some countries, again including the United Kingdom, have also made some effort to switch from direct to indirect taxation.

There is very little correlation between unemployment rates and employment growth, on the one hand, and measures of average tax rates and tax/GDP ratios on the other (for illustrations, see OECD, 1995a, 1995b). Nevertheless there have been a number of cross-country studies that have investigated the relationship between various measures of tax and welfare policy and unemployment, using econometric methods. A selection of these studies are described in Table 2.

The macroeconomic studies suggest two broad conclusions. First, insofar as labor taxes play a role in raising unemployment or slowing economic growth, they do so in the subset of countries classified as intermediate between competition and coordinated bargaining. In other countries, labor taxes are simply borne by workers (Alesina and Perotti, Daveri and Tabellini). This confirms the argument of the partial equilibrium models described in Section II.

Second, the average replacement rate of unemployment benefits to earnings appears to have a positive impact on unemployment in most of the studies (Layard and others, Nickell, Daveri and Tabellini, Scarpetta), but the magnitude of the effect depend on associated labor market policies (according to the Nickell study).

There are however difficulties in interpreting the results of at least some of the studies. Some studies (for example, Tullio) are so reduced form as to have no properly specified model or covariates. It is likely in these studies that adding additional variables or imposing some structure on the model would quickly reduce the significance of the tax and spending effects on growth and employment. In addition, the possibility of endogeneity (of tax and spending levels to economic performance) is rarely discussed in this macroeconomic literature.

A further key issue in these studies is that much of the cross-country variation in economic performance is country-specific heterogeneity, which one would ideally like to eliminate as a "fixed effect." Conversely, a good deal of the time variation in employment and unemployment arises from common macroeconomic shocks rather than from country-specific tax policy. As Table 2 reveals, there are two strategies for dealing with these issues. First, countries are grouped so that the groups appear to have common characteristics, such as in their degree of (or lack of) coordinated bargaining. Second, a number of the studies use repeated observations of the same countries over time in order to boost sample size and in order to eliminate some "fixed effects" and common shocks.

However, the grouping of countries into categories of "coordination" is intrinsically somewhat arbitrary and of limited use, since there is no real time variation in this crucial

Table 2. Macroeconomic Evidence on Tax and Welfare Policy and Unemployment

Authors	Countries and time period	Method	Main findings
Tullio (1987)	10 OECD countries 1960–83	Variables are averages over three subperiods for each country; estimates are OLS with adjustment for auto-correlation	i) A 1% increase in the tax/GDP ratio reduces economic growth by 0.17% p.a. (for the G/GDP ratio, the reduction is 0.11% p.a.) ii) A 1% increase in the labor tax "wedge" reduces the growth of total employment by 0.03% p.a.
Layard and others (1991)	United Kingdom 1956–87	Quarterly estimates over six subperiods of equilibrium U and actual U, decomposition of variables contributing to ΔU	Between 1956–59 and 1981–87, the rise in the replacement rate of UI benefits to earnings raised U by 1.12 percentage points. Changes in the tax "wedge" *reduced* U by 0.2 percentage points
Alesina and Perotti (1997)	14 OECD countries 1965–90	OLS estimate of balanced panel for each country-time observation. Calmfors-Driffill index of degree of coordinated bargaining; all countries assigned for whole period to one of three values of index.	i) OECD measure of tax "wedge" has positive but insignificant impact on unit labor costs over all countries ii) in "intermediate coordination" countries, a 1% increase in tax "wedge" raises measured labor costs by 0.7%
Nickell (1997)	20 OECD countries 1983–94	Random effects GLS estimate of two pooled time periods. Various "labor market structure" indices used (e.g., degree of employment protection 1–20; degree of coordination 2–6; union coverage index 1–3)	i) A 1% increase in replacement rate raises $logU$ by 0.01% ii) A 10% increase in benefit duration (years) increases long-term $logU$ by 2.5% iii) A 1% increase in the *total* tax rate raises $logU$ by 0.02% iv) labor market structure indices have "large" effects on $logU$
Scarpetta (1996)	17 OECD countries 1983–93	GLS estimate of balanced panel for each country-time observation. Indices (1–3) of employer and union coordination	i) the tax "wedge" has no impact on overall U but a 1% increase in "wedge" raises long term U by 0.1% ii) a 1% increase in the replacement rate raises U by 0.13% iii) greater coordination of bargaining reduces U

variable. Ideally, a good "natural experiment" would have time variation as well as cross-section variation in this coordination variable but only the United Kingdom in the Daveri-Tabellini study performs this function.

More generally, there is unlikely to be a great deal of time variation in many of the key variables over short time periods (other than macroeconomic shocks), so that these studies are basically augmented cross-sections. In particular, the Alesina-Perotti and Scarpetta studies treat each year as a separate, independent, observation in a pooled time series—cross section data set. As Nickell, in the study cited here points out, these data almost certainly violate the assumption of independent random draws and therefore the model should not be estimated by OLS (as Alesina and Perotti do). The other studies circumvent this by using period averages, but the issue of whether we are observing largely cross-country or temporal variation remains. It may be that cross-country analysis with limited time variation in behavioral variables provides too opaque a view to pin down the impacts of tax and welfare policy on unemployment and growth.

IV. MARGINAL TAX RATES AND HOUSEHOLD STRUCTURE

A. Household Heterogeneity

The analysis so far has suggested that there is no strong evidence that aggregate tax and welfare burdens adversely affect employment and unemployment, but that taxes on labor may be passed on by workers and thereby impact on labor costs and on the demand for labor in countries with particular institutional structures. The replacement rate also seemed to play a role in determining the level of unemployment. Consideration of the impact of taxes and welfare spending on labor supply was deferred, on the argument that a "representative agent" was unlikely to respond to tax changes by changing his labor supply.

In the remainder of the paper, the balance is redressed by analyzing labor supply explicitly. It argues that high effective tax rates may have significant effects on the employment and participation of particular types of households. In particular we should search for household types that face high marginal effective tax rates and examine how their behavior is affected. But this inevitably requires a different methodological approach to that of the studies considered in previous sections. This section therefore provides some preliminary illustrations of how marginal and average tax rates differ across different types of households.

One component of the marginal tax rate structure is the rate structure of the personal income tax. In the 1980s, serious efforts were made to reduce top rates of tax in a number of countries. According to the OECD Tax Database, between 1986 and 1995, the top marginal rate of tax fell in 23 of the 24 countries surveyed (the exception being Turkey). For example, in the United Kingdom the top rate fell from 60 percent to 40 percent, in the U.S. from 50 percent to below 40 percent, in France from 65 percent to 57 percent and in Italy from 62 percent to 51 percent. At the same time the number of rate bands fell in most countries. A striking illustration is the experience of Sweden between 1983 and 1991, depicted in

Figure 1. This history suggests that high marginal tax rates affecting top earners may be less of a disincentive than twenty years ago, but also offer good case studies with which to examine the impact of tax rate structure on employment and income.

Figure 1. Structure of Marginal Direct Tax Rates in Sweden 1983–91

Taxable income (thousands of SEK)
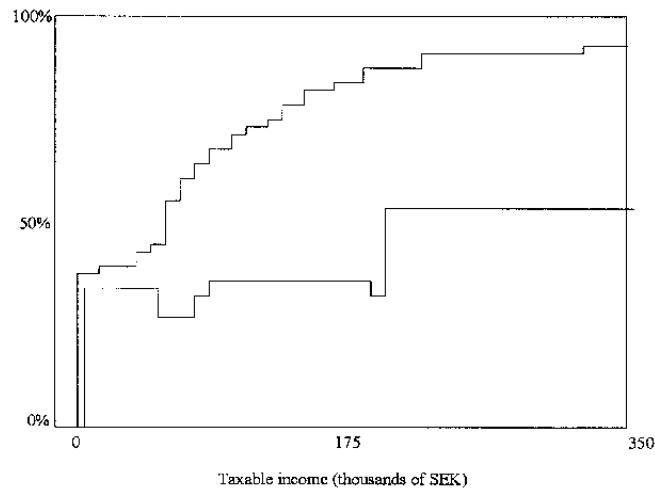
Source: Flood and MaCurdy (1992)

This section provides two other pieces of cross-country evidence on the variation in effective marginal tax rates facing different types of households. Table 3 shows average direct tax rates facing several different family types for nine representative OECD countries. The difference from Table 1 is that Table 3 deducts indirect taxes (which are treated as constant across household types in the absence of exact expenditure data) and includes a measure of average cash benefits for each of the household types.

Table 3. Income Tax Plus Employee and Employer Contributions, Less Cash
Benefits, by Family Type and Wage Level, 1999

(As a percent of labor costs)

Family type	Single	Single	Single	Single	Married	Married	Married	Married
	No children	No children	No children	Two children	Two children	Two children	Two children	No children
Wage level (as a percent of APW)[1]	*67*	*100*	*67*	*67*	*100-0*	*100-33*	*100-67*	*100-33*
Belgium	51.2	57	62.1	34.9	41.3	45	50.1	52.4
Canada	27.1	31.8	35.1	8.3	23	26.1	28.8	28.7
Denmark	40.9	44.3	51.9	14.6	31	36	39	40.9
France	40.4	47.9	49.8	31.5	38.8	38.6	40.5	43.5
Germany	47	51.9	55.9	31.1	34.5	40.9	44.8	47
Italy	44.2	47.3	50.9	28.2	37.4	41.9	44.7	44.7
Japan	18.3	19.3	20.5	14.7	14.7	16.5	17.4	18.4
United Kingdom	26.2	31	33.5	14.2	23.8	20.8	24.8	25.5
United States	29.3	31.1	36.9	12.6	24.5	27.2	28.8	29.8

Source: OECD (1999a), Table 15.

[1] APW = average production wage. For married couples, 100-0 indicates one family member earns the APW, the other does not work; 100-33 implies that the second family member earns one third of the APW, etc.

Again, we observe the cross-country variation in average tax burdens, between Canada, Japan, the United Kingdom, and the U.S. on the one hand, and the continental European countries on the other. Note, however, that a single parent with two children in the United States is taxed at half the rate of a married couple with two children, whereas the rates are almost identical in Germany. In Denmark there are large differences in how childless single people and single parents are treated by the tax system, whereas in France, the difference is much smaller. In some countries, the tax rate on second earners rises progressively, whereas in others the tax burden is almost constant across households with different earnings structures.

Table 4 provides average replacement rates for the same countries, differentiated by whether the hypothetical individual in the household has been unemployed for less than a month, or for five years ("long term"). Although we are still working in a "representative agent" framework for each of the subcategories, it is remarkable how differentiated is the treatment concerning duration of benefits and family type.

Table 4. Net Replacement Rates for Four Unemployed Family Types
at Two Earnings Levels

(After tax and including unemployment benefit)

Panel A. In the First Month of Benefit Receipt

Family type	Single	Married	Married	Single	Single	Married	Married	Single
	No children	No children	Two children	Two children	No children	No children	Two children	No children
Wage level (as a percent of APW)	*100*	*100*	*100*	*100*	*67*	*67*	*67*	*67*
Belgium	64	57	60	65	84	76	75	81
Canada	63	65	69	68	62	65	69	67
Denmark	62	67	77	75	89	94	95	89
France	71	72	74	74	83	82	86	86
Germany	80	60	74	71	69	71	74	78
Italy	36	43	54	48	36	42	52	48
Japan	59	57	56	63	68	65	64	71
United Kingdom	50	61	64	54	73	88	83	69
United States	60	60	61	62	59	59	51	51

Panel B. Long-Term Benefit Recipients

Family type	Single	Married	Married	Single	Single	Married	Married	Single
	No children	No children	Two children	Two children	No children	No children	Two children	No children
Wage level (as a percent of APW)	*100*	*100*	*100*	*100*	*67*	*67*	*67*	*67*
Belgium	46	67	63	69	61	88	79	85
Canada	25	41	59	58	35	57	77	77
Denmark	48	67	97	70	67	94	92	82
France	38	40	50	44	55	56	60	60
Germany	54	60	52	63	75	85	61	82
Italy	28	39	62	51	39	52	75	67
Japan	32	45	65	59	47	66	95	81
United Kingdom	50	61	73	63	73	88	95	81
United States	7	12	48	41	10	18	61	51

Source: OECD (1999b), Tables 3.2 and 3.5.

Countries differ significantly in how they treat the short and long-term unemployed. In Canada, the United States and some continental European countries, the short-term unemployed are treated much more generously than the long-term unemployed. But note that in the United States, for example, the relative disparity of treatment differs across different family types. The United Kingdom treats low income long-term unemployed more generously than low-income short-term unemployed but not recipients on average income (because contributory benefits are replaced by means-tested benefits but, unlike many other countries, the means-tested benefits for long duration inactivity are generally more generous than contributory benefits). Also there are disparities in how families with children are treated, relative to single people or childless couples.

An obvious extension is to suggest that there is a natural correlation between the relative generosity of treatment of the long-term unemployed across countries and the proportion of long-term unemployed in the stock. Even so, looking at all OECD countries for which data are available, there is no such correlation. Although some countries (such as the United States) that have lower benefits for the long-term unemployed also have a lower fraction of long-term unemployed in the stock, others do not (such as Greece). Whereas Japan and Korea, which treat their long-term unemployed more generously, have few long term unemployed. Again, country-specific factors matter and there are no 'simple stories" using country averages.

The overall lesson from this section is that is a great deal of heterogeneity of treatment across household types, which is concealed by the cross-country evidence. If we are to look for evidence for tax and welfare-related labor supply behavior, we have to look at particular household types in particular circumstances. The next section therefore describes four household situations in which we do find evidence of responses to tax and benefit regimes that have impacts on the levels of employment and unemployment.

B. A Note on Methodology

The studies examined in Section V utilize microeconometric methods to examine the impact of tax and welfare policy on labor supply. There is, of course, a vast literature on methodology and estimation which cannot be summarized here (a good modern survey is that by Blundell and MaCurdy, 1999). Nevertheless, a few remarks are useful.

The intrinsic problems in recovering the impact of marginal tax rates and the interaction of tax structure and welfare policies on behavior from microeconomic data sets are twofold. First, high marginal tax rates facing particular households almost always imply that budget constraints are nonlinear—examples will appear in the next section. With nonlinear budget constraints, labor supply, whether hours or participation, depends on the marginal wage, but the marginal wage also depends on hours. This simultaneity has to be resolved somehow. A further problem is that unobservables (such as preferences for work) probably correlate with labor supply and may also therefore correlate with marginal tax rates, for the reason just described.

The second problem is that there has to be variation in tax policy in order to examine the impact of rate changes, benefit changes etc. To do this, we have to find situations in which tax changes affected different groups differently, or else where the same group faced different tax policies at different points of time. If we could estimate elasticities of hours and participation by somehow resolving the problem of endogeneity, it might then be possible to simulate the impact of tax and welfare benefit changes. Alternatively, assuming that we could resolve the first problem, we could use the changes in tax policy over time as a "quasi-experiment" with which to identify the relevant supply elasticities *and* the impact of tax and welfare policies at the same time (Blundell, Duncan and Meghir, 1998).

A number of solutions to the nonlinear budget constraint problem have been adopted. One early solution was to assume that the household faced a *discrete* choice of locating on each segment of the budget constraint (for example, "full time," "part time," "inactive," etc.) and to use an explicit utility function to identify the optimal choice. Tax changes would then involve discrete changes in labor supply across segments. A second traditional approach has been to estimate labor supply response by the "piecewise linear budget constraint" method, by which the group on each nonlinear segment are assumed to face a linearized budget constraint, with the appropriate nonwage income. Some combination of the two methods, for example using discrete choice estimates of location on each segment coupled with this piecewise specification, is possible. Again, however, tax policy responses can only typically be simulated even if underlying estimates of labor supply elasticities can be recovered, without some time variation in tax rates or welfare policy with which to measure actual responses.

A fashionable approach to estimating policy response is to use "differences of differences." A practical example of the method is given in the next section, and there are good surveys by Meyer (1994) and Angrist and Krueger (1999). The intuition, and drawback of the method, is as follows. Suppose we are not interested in the labor supply elasticities ("the structural model") as such, but only the policy responses. A standard approach to policy evaluation is a "before-after" comparison of behavior in which we look for the "difference" in, for example, labor supply or income level before and after a tax change. The weakness of this approach is that "other things are not equal;" other events may have occurred over time (and the policy itself may not be exogenous, which is a tricky, separate, issue). Suppose, however, we could find a comparison group who faced the other events but that was not affected by the policy change (they could be affected by a different policy change). Assuming both groups responded to the other events identically and that the other events were common to both groups (for example, macroeconomic shocks)—these are both strong assumptions—then, by examining the differences in response *between* the groups (i.e., "differences of differences"), we might recover the impact of a given policy change without estimating the structural model.

The difficulty of this approach, other than its strong assumptions, is that without any structural modeling, we merely have the results of any given policy change; we cannot use estimated structural parameters from a model to simulate other policy changes. But if there are enough such studies, we might be able to get an overview of how, in general, such policy

changes affect behavior and perhaps interpolate our simulated effects from this multiplicity of "experiments." In what follows, therefore, results of studies that attempt to derive estimates of responses to policy changes from both 'structural" estimation and from "differences of differences" are cited. Since our interest is in policy changes rather than structure, both procedures yield insights.

V. FOUR CIRCUMSTANCES WHERE MARGINAL TAX AND BENEFIT STRUCTURES MATTER

A. The Labor Supply and Effort of High Income Earners

There has long been an awareness in the public finance literature that, while redistribution may be a wholly justifiable aim of the tax and benefit system, extreme progressivity in the direct tax structure may engender large efficiency losses. High marginal tax rates may reduce labor supply and effort at the upper end of the income distribution and, more pertinently, lower participation in the tax system, through remuneration in nontaxable forms, by sophisticated schemes of tax avoidance and, depending on the risk of getting caught, tax evasion. The well-known "Laffer curve" postulated that, at some high marginal tax rate, government could actually increase tax revenue by reducing the tax rate. The difficulty lies in determining at exactly what degree of progressivity the costs arising from the distortions outweigh the welfare benefits that may accrue from the greater potential for redistribution.

Estimates of the responsiveness of hours of work to changing tax rates have not helped on this issue: first, because most econometric estimates suggest that men in regular work are largely unresponsive to changes in tax rates (Pencavel, 1986) but, second, because the data sets underlying such studies contain very few people at the top end of the earnings distribution with which to test the proposition that high marginal tax rates affect labor supply by econometric methods. This last difficulty arises not just because pretax earnings distributions are bell-shaped, and therefore there are relatively few people at the top end of the distribution to sample, but also because individuals will take measures to avoid facing high marginal tax rates and do not appear in the part of the distribution where their "underlying" earnings would place them. Applying tax elasticities from elsewhere in the distribution or, even more implausibly, by interpolating results from studies of groups where there may be a "tax response" (e.g., the participation of married women), is not sensible. Likewise, attempts to simulate transitions to "flat rate" regimes have not been able to generate strong effects on employment and output (Stokey and Rebelo, 1995).

Some commentators, such as Lindsey (1987) and Feldstein (1995), have started from an alternative framework. They focus on income and revenue-responsiveness to large tax regime changes which involve substantial cuts in marginal rates, rather than estimating labor supply elasticities as such. "Laffer curve"-type effects can be tested directly by looking at revenue responsiveness, and effort/labor supply elasticities are implicit in the estimates of income responsiveness.

The "experiments" most often considered are the big reductions in tax rates on high earners that occurred in a number of countries, notably under the Reagan and Thatcher

administrations in the U.S. and the United Kingdom in the mid-1980s. For example, in the United States, the Tax Reform Act of 1986 reduced the highest marginal rate of personal income tax from 50 percent to 28 percent, whilst in the United Kingdom, the highest rate of income tax fell from 75 percent in 1979 to 60 percent in 1984 and 40 percent in 1988. Recently, Goolsbee (1999) has extended the literature to consider reforms of the direct tax structure in the U.S. over a much longer period. Here we describe some of these results on the income responsiveness of high income earners to major tax changes, and the "differences of differences" method used by the studies. Appendix I gives a simple numerical example of the method in this context.

Following Goolsbee (1999), write a basic equation in which the logarithm of reported tax income, Y, of group A at time t is a function of the net-of-tax share $(1 - \tau)$, with constant elasticity, β. There is a time effect, δ, and a normally distributed error term, e.

$$ln(Y^A_t) = \alpha_A + \beta \, ln(1 - \tau^A_t) + \delta_t + e^A_t \tag{3}$$

Differencing across years gives:

$$ln(Y^A_t) - ln(Y^A_{t-1}) = \beta \, [ln(1 - \tau^A_t) - ln(1 - \tau^A_{t-1})] + \delta_t - \delta_{t-1} + e^A \tag{4}$$

This eliminates the "fixed effect," α, but not any time variation in incomes due to, for example, the business cycle. This "differences" approach is not therefore likely to get a reliable measure of the responsiveness of taxable income to tax changes.

Suppose, however, there is another group, who face a different tax change, but who have the *same* values of β and δ (this is a strong assumption, but is necessary in order to implement the model). Call this group B. We can now write an equation, equivalent to (4), for group B, with the difference that the tax change, τ, differs across the two groups. We can then take the difference between the two equations and write the *differences of differences* estimator as:

$$\Delta ln(Y^A_t) - \Delta ln(Y^B_{t-1}) = \beta \, [\Delta ln(1 - \tau^A_t) - \Delta ln(1 - \tau^B_{t-1})] + \hat{e} \tag{5}$$

Given the assumptions, the other terms cancel out. If the assumptions concerning the constancy of the revenue elasticities and the time effects are invalid, the estimate will be biased. Suppose, for example, that income inequality (the relative size of the various income groups) increases over a period in which higher tax rates are cut more sharply than those for low income earners. Then the measured income elasticity would be biased upwards. This is intuitive, because the higher income share of the higher income group is being misinterpreted as a response to the tax cut.

Table 5 provides a variety of calculated estimates of taxable income responsiveness to tax changes. The studies of the 1980s suggest large positive responses which are indeed in the "Laffer response" range in which tax cuts raise taxable revenue. However Goolsbee's analysis of a number of earlier tax changes, using historical data, suggest lower responses;

indeed some are negative (which is also possible). Generally, the average of these studies suggests that taxable income is positively responsive to tax cuts (which may or may not be a labor supply response), but that the elasticities are not large enough to generate "Laffer curve"-type features.

Table 5. Estimates of Elasticities of Taxable Income to Income Tax Changes
for the United States, Various Tax Reforms, and Control Groups

Tax reform	Author of study	Range of (constant) elasticities
Tax cuts 1982–84	Lindsey (1987)	1.05 to 2.75 (average 1.6)
Tax reform 1986	Feldstein (1995)	1.04 to 3.05 (average 1.3)
Tax reform 1986	Goolsbee (1999)	-0.2 to 2.1 (average 1)
Tax cut 1924–25	Goolsbee (1999)	0.54 to 1.24 (average 0.58)
Tax increase 1932		0.21 to 0.31 (average 0.24)
Tax increase 1935		−0.11 to −0.6 (average −0.52)
Tax increase 1950–51		0.03 to 0.17 (average 0.14)
Tax cut 1964		−0.22 to 0.041 (average 0)

Source: Author's calculations

The results for the 1980s seem out of line with the other calculations. One reason may be that the earlier calculations are based on comparisons of "before" and "after" cross-sections rather than the panel of taxpayers used by Feldstein. Another interpretation is that the 1980s were 'special" because, in fact, the assumptions underlying equation (5) are rejected in that period. For example, Gale (1999) argues that personal income tax rates fell below corporation tax rates after the 1986 Act and that agents therefore shifted their income from a corporate base to a personal tax base. Thus part of the increase in the income tax revenue base was associated with a decline in the corporate tax base. Of course, incentives that induce individuals to shift out of untaxed assets into the tax base under investigation can legitimately be treated as "tax responsiveness" but simple substitution between tax bases with different tax treatments may in fact be associated with an overall fall in tax revenue.

Dilnot and Kell (1988) focus on the large gains in tax revenue from upper income taxpayers occurring in the United Kingdom after the reduction in the highest marginal tax rates that occurred there in the mid-1980s. For example, the *share* of income tax paid by the top 5 percent of taxpayers rose from 24 percent to 27 percent between 1978–79 and 1985–86: a period when top marginal tax rates fell substantially. The study uses a decomposition analysis to examine the *causes* of the rise in income tax revenue between 1978–79 and 1985–86, with a cross-section of data on incomes of taxpayers, coupled with a "tax-benefit" model used to forecast revenues based on actual tax rates in operation. Since they only have one cross section of taxpayer data, they interpolate the distribution of incomes by use of growth factors related to the components of income. Thus their method cannot identify exact individual income transitions nor can a "differences of differences" methodology be applied.

Their results suggest that the change in revenue over the period can be attributed to changes in employment, inflation, and income components. In fact the "residual" in the tax decomposition, which they interpret as the incentive effect on behavior of the change in tax rates, always has the "wrong" sign, in the sense that the decomposition "overexplains" the change in tax revenue as tax rates are reduced. They therefore argue that there is no clear incentive effect.

But this argument involves a much narrower interpretation of the effect of tax changes on incomes than is allowed for in the U.S. evidence. For example, between 1982–83 and 1985–86 the reduction in actual tax receipts in the United Kingdom from the tax reform and the residual (totaling £5 billion) were entirely offset by an increase in real tax receipts from incomes of the employed and self-employed (also £5 billion). By this, overoptimistic interpretation (in the sense that it attributes all the income changes to the tax cuts), the tax cuts "paid for themselves." This inference is too strong, however, and Goolsbee's cautious assessment would seem to be the right one.

B. The Labor Supply of Low Income Families

Whilst attention on top tax earners has focused on the disincentive effect of high marginal rates, the concern at the other end of the income distribution is different. As Table 4 showed, replacement rates for those out of work are high in a number of countries. In addition, levels of other, mean-tested, benefits discourage other social groups, notably single women with children, from participating in the labor market. A number of OECD governments have developed schemes of *in-work benefits* with the express intention of encouraging low income families to participate in paid work, and the objective of reducing rising unemployment and/or rising welfare rolls. A number of studies, particularly in the United States and the United Kingdom, have attempted to evaluate the success of these policies in bringing families with children into work.

The major welfare policy of this type in the United States is the Earned Income Tax Credit (EITC), first introduced in 1975. The EITC is a credit against income tax liability paid to low income families with children (since 1994 there is a very small credit for childless taxpayers). When the credit exceeds the tax liability, the difference is refunded as a cash sum. Reforms in 1986 and 1993 made this the most generous form of in-work benefit provision to low-income households in the United States (Scholz, 1996). The EITC raises the net-of-tax (or credit) wage relative to out-of-work income and by doing so reduces the incentive to stay out of the labor force. However since the credit is reduced as the family's earned income increases, the EITC, like all such programs, serves to *flatten* the budget constraint relative to the original pretax income. There should be a positive effect on the labor force participation of single parents, but, with both income and substitution effects, the impact on hours of low income families with children who are already working, cannot be predicted. The labor supply response is also more complicated in families with more than one potential wage earner.

The United States is not the only country to have such a program. The United Kingdom has, since 1971, provided money to low income working families. Originally paid as a cash payment and termed Family Income Supplement, the program was renamed Family Credit. Family Credit was paid to the woman of the family (if a married couple) above a 16 hours a week threshold as a cash sum, reduced at a rate of 70p in the £ as earnings increased (Walker and Wiseman, 1997). In 1999, the program was replaced by Working Family Tax Credit, which, although similar to Family Credit was conceptually closer to the EITC in being a tax credit against tax liability paid to the worker in the family. Other countries with similar schemes include Ireland, which has a scheme of Family Credit, Canada, which introduced a modest income tax credit in 1993 (with however a high weekly hours threshold at 30 hours a week), and several European countries that offer mixtures of deductions for work-related expenses, child-care costs and other general forms of tax credits (Whitehouse, 1996).

There is an important trade-off in tax policies designed to help low income working families. At one extreme, intervention can be targeted at the very lowest income families with either generous initial levels of credit and/or sharp "tapers" (phase-outs): that is, the rate at which the credit is withdrawn as the earned income increases. This is both more equitable and targets the program efficiently. But it produces a substantial disincentive to increase hours conditional on participation (the "poverty trap"). Alternatively, if the program is less generous in the size of the credit and phases-out the credit at a reduced (slower) rate, it improves the incentives to work more hours conditional on participation, but reduces the positive effect on participation. Moreover, reducing the rate at which the benefit is phased-out incorporates more, relatively higher earners, into the program. For these families, access to the credit acts as a disincentive to work, since the income and substitution effects both induce lower hours of labor supply (Moffitt, 1992). There is no clear-cut answer to program design, and governments have tended to change the generosity and phase-outs frequently. This temporal variation permits researchers to estimate program effects.

How should we think about the impact of these tax and welfare policies on participation and hours supplied? In the EITC, there are three segments: a "phase-in" segment where, as the level of earnings is higher, the credit is added to earnings at a rate of 40 percent (in 1996) for every $ of earnings. There is then an earnings interval where the family retains the maximum credit. The credit is then "phased-out," at a rate of 21.1 percent (in 1996) for every $, so that, ultimately the family is back on the pre-credit budget constraint. The United Kingdom's Family Working Tax Credit is very similar, except that there is no "phase-in" segment; instead there is a minimum hours constraint (16 hours a week) and a further increase in the rate of the credit at 30 hours a week.

There are further complications. First, the credit may affect the wage level, if employers use the existence of the credit as a means of reducing pretax pay. Second, the actual budget constraint is complicated by the presence of other income-tested benefits such as housing benefit, and, in the United States, AFDC and food stamps. Third, there is interstate variation in the local generosity of EITC in the United States (Neumark and Wascher, 2000). Finally, the response must be considered as a family supply response. For a single parent, estimation of the effect is more predictable, as in the work of Eissa and Liebman (1996) and Meyer and

Rosenbaum (1999). For families with more than one actual or potential worker, the increase in hours or participation of one member may be offset by reduced labor supply of another member, if the family can thereby maximize its utility over income (combining earned income and the tax credit) and leisure. This is the scenario explored by Eissa and Hoynes (1998), and Blundell and others (2000) for the United Kingdom.

Figure 2, Panels A and B illustrate recent policy changes for the U.S. and the United Kingdom respectively. In each case, there is a regime I, where we might expect the change to induce greater participation but uncertain effects on labor supply of those already participating; a regime II where the taper has been extended to a level of earnings that were previously above the "breakeven" point at which the EITC/WFTC was fully phased out, and where the labor supply response should be unequivocably a reduction in hours; and regime III where the worker is unaffected.
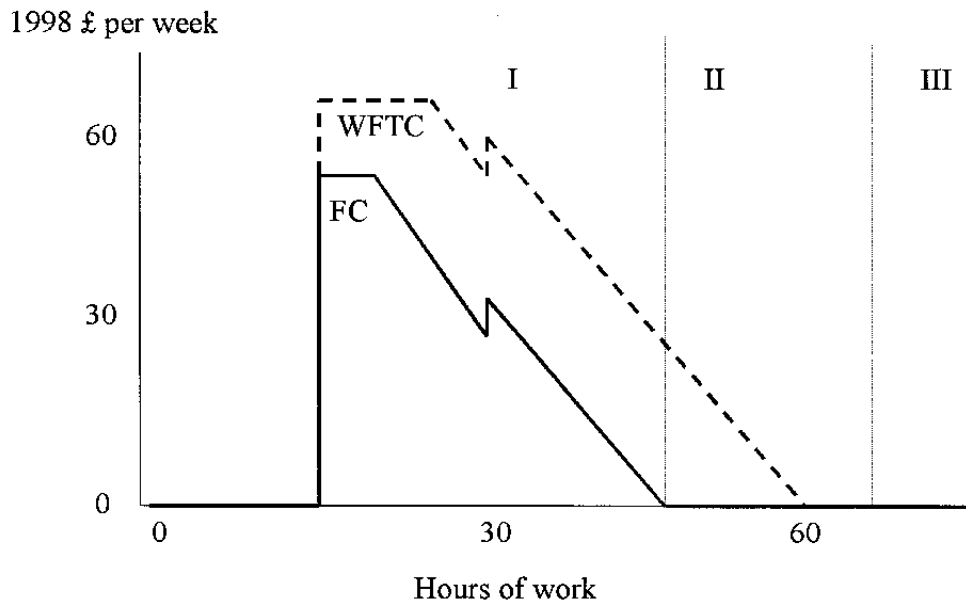
Figure 2. In-Work Benefits in U.S. and United Kingdom: Structures and Reforms

Panel A
US: EITC Reform 1986-88
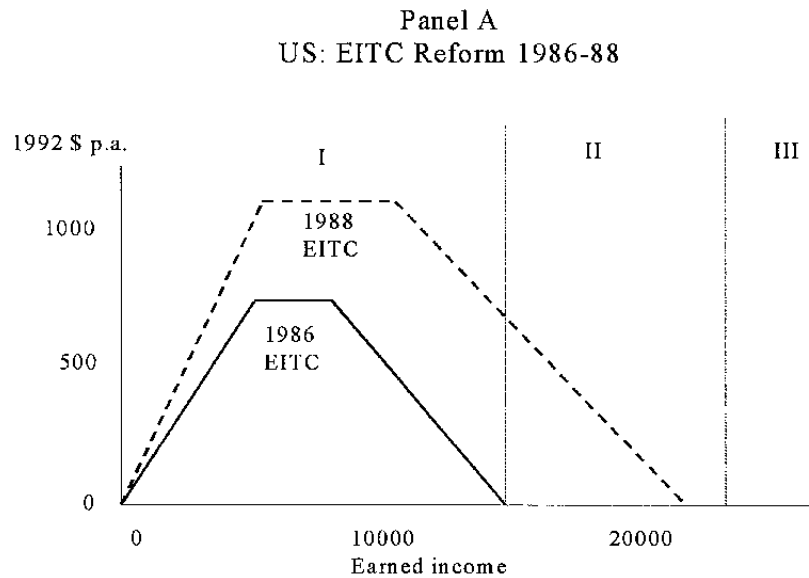
Source: Eissa and Liebman (1986), Figure IV.

Panel B
UK: Family Credit (FC) to Working Family Tax
Credit (WFTC) 1997

Source: Blundell and others (2000), Figure I.

Table 6 describes the main methods and findings used by the various authors to analyze the impact of EITC and other in-work benefits on labor supply. Despite a variety of data sources, time periods and estimation methods, the studies seem to contain a degree of unanimity. First, the Earned Income Tax Credit increases the labor force participation of single parents, relative to other groups, as modeled by improvements in its generosity over time. Second, EITC changes have an equivocal impact on the working *hours* of single parents. This not surprising, given the impact on the budget constraint of EITC reforms (Figure 2, Panel A). Third, the EITC increases labor supply of primary wage earners among low income married couples with children, but this is almost wholly offset by a reduction in labor supply or participation of the secondary earner. Fourth, the levels and withdrawal structures of other welfare benefits generate labor supply responses that are predictable from theory.

These results are confirmed by the studies of the impact of Family Credit, and simulations of the transition to the Family Working Tax Credit, in the United Kingdom. The implied reform arising from the shift from Family Credit is depicted in Figure 2, panel B. Blundell *and others* (2000) use data from the Family Resources Survey and tax microsimulation models to simulate the reform. Labor supply responses are estimated from a discrete choice structural model of family labor supply. Their findings are that, with 100 percent take-up, the

Table 6. Impact of Earned Income Tax Credit and Other Welfare Benefits on Labor Supply:
Results of Selected Studies

Authors	Data	Estimation method	Main findings
Single Parents			
Scholz (1996)	1990 Survey of Income and Program Participation	Econometric; Identification on predictions of marginal tax rates.	i) EITC (1993) raises average wage by +15% and increases probability of working by 6.6%
Eissa and Liebman (1996)	Six rounds of Current Population Survey	"Differences of differences;" exploits changes in 1986 Act; identifies on childless singles	i) Increase in EITC generosity raised participation of single parents by 2% ii) no significant impact on hours, conditional on participation
Keane and Moffitt (1998)	1984 Survey of Income and Program Participation	Estimation of joint model of labor supply and program participation; identification by exclusion restrictions; simulation of policy changes	i) raising EITC maximum and phase-out raises participation and reduces hours worked ii) decreasing withdrawal rate on AFDC increases participation
Meyer and Rosenbaum (1999)	Current Population Surveys 1984–96	Estimating probabilities of participation exploiting temporal program variation; childless women as 'controls'	i) changes in EITC explained 63% of increase in participation of single parents 1984–96 ii) benefit termination limits also important
Neumark and Wascher (2000)	Current Population Surveys 1986–95	Measures "income transitions out of poverty;" exploits interstate variation in EITC; separates families with children from childless	i) interstate variation in EITC generosity has significant impact on income transitions of families with children ii) no impact of federal EITC
Families with Children			
Scholz (1996)	See above	See above	i) EITC in 1993 raises average family wage by 19.6% but participation by only 0.4% ii) secondary family workers reduce labor supply
Eissa and Hoynes (1998)	Current Population Surveys 1985–97	"Differences of differences" on 1993 increase in EITC; identification on childless couples + reduced form estimation	i) EITC increase raised relative participation rate of married men by 0.7% (1 child) or 1.6% (>1 child) ii) EITC increase reduced relative participation of married women by 1.8% (1 child) and 4.3% (>1 child) iii) in econometric results, same signs on participation

participation rate of single parents increases by 2.2 percent and the average hours of workers by 0.2 percent from the switch from Family Credit to FWTC. For married men, there is a small increase in participation (+0.1 percent) and for married women with working partners, a decline (−0.6 percent). For women married to unemployed men, there is a gain in participation (+0.5 percent) and also in hours. These results are in line with those of the U.S. studies of changes in the generosity of EITC.[3]

Gregg, Johnson and Reed (1999) estimate a reduced-form model of individual transitions into work for the United Kingdom. The probability of entering work is determined by the predicted difference between incomes in and out of work and a variety of controls, using the Labour Force Survey. Then tax-benefit simulation based on the Family Resources Survey is used to simulate income gains from various policy experiments, including the replacement of Family Credit by WFTC. The impact of these policy changes on entry to work (participation) can then be calibrated using the reduced form entry to work model. The overall impact of this particular reform (FC to FWTC) is to increase the work entry probability by 0.26 percent for men and 0.09 percent for women. There are no effects for singles without children, a negative impact on married women with working partners (−0.4 percent), but significant positive effects for married men (+0.6 percent), for lone mothers (+1.1 percent) and for married women with partners who are not working (+0.5 percent). Again, this is exactly what theory, and the comparison with the other United Kingdom and U.S. evidence, would predict.

Overall the evidence from low income families is that the tax structure—in this case tax credits and the interaction of the various welfare benefit schemes—does have significant and predictable effects on labor supply, especially among single parents and single earner couples. These findings appear in different countries, and arise from disparate methodologies. None of the measured impacts are "large," because we are typically examining reforms which vary the degree of generosity of tax and benefit policies, rather than situations in which tax credit schemes, or comparable policies, are started "from scratch." However, extrapolating the existing evidence, large changes in participation rates might arise from the introduction of schemes of in-work benefits, which has major revenue implications for the government if the number of people receiving support during inactivity (such as unemployment insurance and social assistance) is thereby reduced.

C. Older Workers and Exit from the Workforce

A feature of many OECD economies in recent years has been the declining participation of older workers (OECD, 1995c, 1998). Reasons for this trend—including early retirement

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[3] Bingley and Walker (1997), in their model of labor force participation of single mothers, argue that take-up should be modeled explicitly, following Keane and Moffitt (1998). In their model of take-up of Family Credit, there are five discrete states: nonparticipation, unemployment (seeking work), part-time work with Family Credit take-up and without, and full-time work. Simulated increases in the generosity of Family Credit lead to increased rates of take-up, as well as smaller increases in seeking work, and in part-time and full-time work.

policies, demand shocks, and the generosity of pension programs, both state-run social security and privately provided—lie outside the focus of the present analysis. Nevertheless, tax and welfare policies have also played a part in this declining participation, and tax policy may play a part in reversing it. As discussed in Section IIC, the effective tax on continued work should play a substantial part in the retirement decision, and subsequent tax policy may make retirement irreversible.

Gruber and Wise (1999), and Blöndal and Scarpetta (1997) both provide measures of average effective tax rates. Although the present paper has suggested that cross-country comparisons of average households should be treated somewhat skeptically, the evidence in Table 7, taken from Gruber and Wise, provides some pervasive evidence that there is indeed a relationship between, on the one hand, the fraction inactive just before the "early retirement age" and the hazard at the early retirement age (that is, the exit rate conditional on still being active) and, on the other hand, the replacement rate, the SSW accrual, and the marginal effective tax rate. There is further, active, research at present on generalizing these results to more heterogeneous households.

Table 7. Retirement Rates, Effective Tax Rates, Social Security Accruals, and
Inactivity: Selected Countries

| (1) Country	(2) Percent of men out of labor force at age 59	(3) "Early retirement age"	(4) Replacement Rate at "early retirement age"	(5) SSW accrual in next year as a percent	(6) Implicit tax on earnings in next year as a percent	(7) Percent leaving activity at "early retirement age"
Belgium	58	'60'	77	-5.6	82	33
France	53	60	91	-7.0	80	65
Italy	53	'55'	75	-5.8	81	10
Netherlands	47	'60'	91	-12.8	141	70
United Kingdom	38	'60'	48	-10.0	75	22
Germany	34	60	62	-4.1	35	55
Spain	36	60	63	4.2	-23	20
Canada	37	60	20	-1.0	8	32
United States	26	62	41	0.2	-1	25
Sweden	26	60	54	-4.1	28	5
Japan	13	60	54	-3.9	47	12

Source: Gruber and Wise (1999), Table 1.

In this section, however, the focus is on the tax treatment of continued work once individuals or households are in receipt of state pension benefits. Taxes conditional on social security receipt, which are often termed "earnings tests" or "earnings rules," penalize work late in life

in a number of countries. The operation of such tax regimes have gained some prominence given the decision of the United States in early 2000 to abolish its earnings test on pensioners aged 65 and over. However such rules continue to operate in a number of OECD countries in various forms, including Austria, Belgium, Denmark, Italy, Japan, and Norway. In Australia the social security pension is completely means-tested, and some countries simply preclude individuals from working while receiving a social security pension (Disney and Whitehouse, 1999). The rules offer pertinent examples of the impact of high effective marginal tax rates on the labor supply of older workers.

Why do countries operate such rules? A simple reason is that it may seem unfair to permit individuals to continue working while receiving a full social security pension. Such individuals are in effect being subsidized by the state to continue to work and thereby to "undercut" the wages of other workers in the workforce. On the other hand, social security rights have usually been acquired from attaining certain eligibility conditions, and operation of tests of this type simply discriminate against those with regular employment histories or with a taste for work. In addition, earnings tests force irreversibility onto the retirement decision and preclude either regret on the individual's part or any attempt by society to sustain employment among older workers as a conscious policy to combat the aging of the workforce and the population.

Figure 3 gives an illustration of the effective budget constraint in such circumstances where benefits are taxed away at 100 percent. This is a classic example of a nonlinear budget constraint described in Section IV.B and suggests that individuals will tend to "bunch" at corners such as nonparticipation and at the kink below which the earnings test comes into operation. As ever, however, there are complications.

Figure 3. Stylized Earnings Test and Alternative Parameters
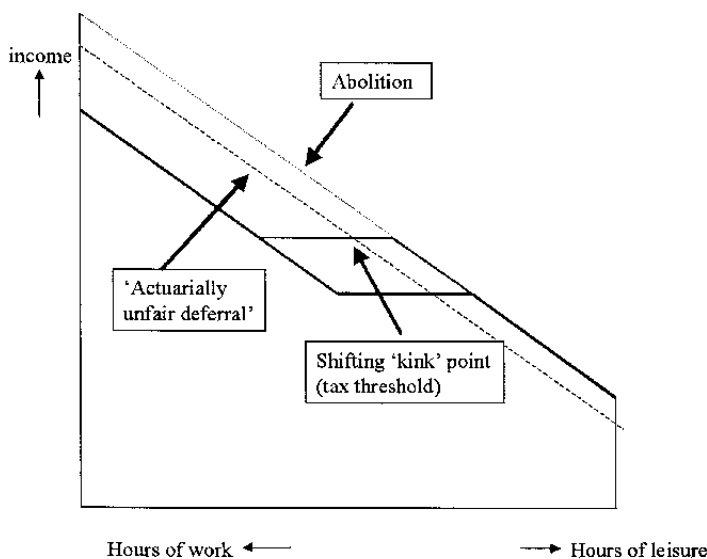
In the first place, some countries permit individuals who would otherwise be subject to the earnings test to avoid its effect by deferring the pension to a later date. If deferral is at least "actuarially fair" (and if individuals are risk-averse, the deferral rate will need to be at least actuarially fair to leave the individual with an incentive to defer) then individuals may prefer to carry on working rather than to take the pension benefit immediately. They may even prefer to do so if the rule is actuarially unfair. In any event there will be self-selection of deferral according to individual preferences and expected longevity, neither of which may be observable to the government. In the United States, accrual of extra social security rights was automatic *even if* the pension benefit was being taxed according to the earnings test; so that any impact of the earnings test on social security rests not just on the structure of the static budget constraint but also on far-sightedness of the individual and on expected longevity.

Second, as with in-work benefits, the earnings test operates differently for a married couple and a single person, if the married couple contains one person below the first age of social security receipt. Thus there will also be an income effect on the household's budget constraint of any decision by the member eligible for the social security benefit to change his or her behavior in the light of the test.

Although these difficulties increase the complexity of the analysis, cases where the rules have been changed permit "quasi-experiments" of the impact of the earnings test. Abolition of the earnings test, as occurred in the United Kingdom in 1989 (Disney and Tanner, 2000; Whitehouse, 1990), and in the Canadian Pension Plan and Quebec Pension Plan between 1975 and 1977 (Baker and Benjamin, 1999) permit investigations of this kind. In addition, quasi-experiments can arise from changes in the level of real earnings which are disregarded from the earnings test and from variations in the real value of the breakeven point. This variation is exploited by Friedberg (1998, 2000) in her simulations of the impact of the U.S. earnings test on labor supply behavior. Figure 3 illustrates these possible changes that can be analyzed.

Table 8 describes the results of various analyses of the earnings test. Some, such as Zabalza and others and Friedberg, are simulations of abolition based on econometric models of labor supply with nonlinear budget constraints. Others, such as Disney and Tanner, and Baker and Benjamin, are "differences of differences" tests based on actual abolition. But again, despite the scope for alternative modeling strategies and procedures, the results are consistent. First, there are large predicted changes in hours of men, especially for workers located at the "kink" below the earnings test threshold. Since many workers are working part-time (average hours in the United Kingdom of workers aged over the state pensionable age are between 20 and 25 hours a week), increases of 3 to 10 hours imply increases of between 15 percent and 50 percent in hours worked. The smallest increase is for the U.S. but this includes a predicted negative response for those above the kink subject to an income effect. The later United Kingdom study gives a lower response than the earlier, but it should be borne in mind that the earlier study derives the result by simulation at a time when average hours were larger, rather than by empirical observation. The Canadian study suggests that the response there takes the form of a switch from part-year to full-year working; indeed all the studies are compatible with a discrete choice model of labor supply of the elderly in which abolition or

Table 8. Impact of Earnings Test on Labor Supply of Elderly: Selected Studies

Authors	Event and data	Methodology	Results
Friedberg (1998, 2000): U.S., older men	Simulate impact of earnings test in U.S. using Current Population Surveys	Piecewise linear budget set econometric modeling; identification from time variation in earnings test rules	i) Earnings test abolition raises hours for people at or above kink by +5.3% ii) earnings at kink from abolition +50%, above kink – 4%. Net effect positive
Baker and Benjamin (1999): Canada, older men	Survey of Consumer Finances 1972–80	"Differences of differences;" identifies from joint "quasi experiment" of abolition of earnings test in CPP 1975 and QPP 1973–77 and from other age groups unaffected by test	i) abolition increases annual weeks worked by +5-6 weeks ii) main source of Δweeks is that people move from part-year to full-year work
Zabalza and others (1980): United Kingdom, older men and women	Retirement Survey, 1977 (cross section)	Explicit CES utility function, estimates discrete choice model; results by simulation	Abolition of earnings test would increase annual hours by: Men: 10.2 Women: 7.0
Disney and Tanner (2000): United Kingdom, older men and women	Family Expenditure Surveys 1984–94	"Differences of differences" on actual abolition 1989; identification of older and younger age groups not directly affected by earnings test	i) Abolition of earnings test increased annual hours of working men in age band by 3–4 hours a week ii) there is not a significant impact on women's hours

amelioration of the earnings test leads to part-time workers reverting to (or remaining in, after social security receipt) full-time work. The discrete model is probably a better simple description of this choice framework.

Since so few individuals are working above age of first receipt of social security pension (see Table 7 for illustrations), the net effect of abolition on aggregate hours is rather small. However, if these studies give a guide to the implications of changing effective tax rates *at or before* retirement age, the implications could be very large indeed. However, the studies suggest that women do not respond in the same way—this exactly parallels the discussion of in-work benefits in the previous section, suggesting that married couples have offsetting response to effective tax changes, with probably reallocation of labor supply such as to minimize the tax burden or maximize the tax credit, depending on the circumstances.

D. Young Workers and Entry to the Workforce

The final area of tax policy considered here is that designed to encourage labor market entry, especially for younger workers without skills. Entry to work may be discouraged by high effective marginal tax rates and high replacement rates. But in addition, lack of skills and structural factors may reduce employment probabilities for particular groups. Features of the tax and benefit system—notably the generosity of unemployment insurance benefits may be a deterrent—and typically measured replacement rates are understated for groups whose initial labor productivity is low—such as the unskilled unemployed. There may also be nonlinearities in the tax structure such as thresholds in the social insurance contribution schedule where the whole of earnings become liable for tax, which deter entry of less skilled workers.

A number of countries have responded to these barriers to work by adopting specific tax and benefit systems designed to facilitate labor market entry. These include in-work benefits, already discussed in Section VB. Other policies include subsidies to potential workers that are triggered if they find a job, and subsidies to employers to take on workers with particular characteristics, such as having been unemployed for more than a certain length of time. Policies which involve explicit tax credits are considered here. Other policies that may be extremely pertinent, such as public-provided or subsidized training programs, although important, are not considered.

A number of programs of wage subsidies have been developed in the United States (Katz, 1996). The New Jobs Tax Credit, which operated from mid-1977 to the end of 1978, offered employers who increased their employment by over 2 percent over the previous year a tax credit of 50 percent of the first $4,200 of wages for each extra hire. A more significant, longer lasting, program was the Targeted Jobs Tax Credit which replaced NJTC in 1978 and lasted until 1994. The TJTC targeted particular groups of individuals such as disadvantaged youths and people on public assistance programs, again providing the employer with a credit of up to 50 percent of the wage in the first year of employment and 25 percent in the second year. However, although the program was long-lasting, eligibility criteria were tightened from the mid-1980s onwards. The changes in eligibility criteria have been used by some researchers as a "quasi-experiment," along the lines of the tax changes discussed previously for other groups.

In the United Kingdom, there have been a number of small programs of this type but the most significant change occurred with the introduction by the incoming New Labour administration in 1997 of a major program known as New Deal (Bell and others, 1999). Under New Deal, all youths (aged 18–24) who have been unemployed for longer than 6 months were given four options: paid work on an Environment Taskforce or in the voluntary sector, entry into full-time education or training, or employment by direct subsidy to the employer for 6 months of £60 per week. The program has now been extended to other age groups, notably those aged 50 and over, but with differences. First, the program is voluntary for other age groups. Second, the employment subsidy for those aged 50 and over is paid to

the participant and not to the employer, and the individual is guaranteed a weekly income of £170 a week.

Other countries have implemented such schemes—for example, Germany has operated limited wage subsidy schemes for targeted groups, although evaluations of such schemes have generally been "in-house." Canada introduced the Self-Sufficiency project as a randomized experiment in two provinces, which is an earnings-supplement program for single parents who have been on welfare for twelve months. It provides a direct supplement to earnings of one half the difference between actual earnings and a target earnings level which is in fact above the level of average earnings for full-time women. Australia has also offered subsidies to employers to take on long-term unemployed workers. Finally, it should be noted that some states in the United States have offered versions of "restart" subsidies in the form of "re-employment bonuses" to individuals who find work quickly. As in Canada some of the state-based programs have used randomized experiments to see which different insurance-tax credit-bonus scheme offers the best prospects for reducing unemployment.

Thus, in one way or another, all these programs offer wage subsidies or tax credits, paid to the employee or the employer, to take jobs. The changes in eligibility over time, and the "pure" randomized basis of some of the programs, permit an analysis of their impact on individual re-employment probabilities and on levels of unemployment and inactivity. The findings of some of the evaluation studies are reported in Table 9. The programs are much more diverse than those previously considered, differ substantially in their generosity, and are often quite small scale. One problem with micro-programs and projects is to translate local effects into economy-wide effects. A particularly interesting program to examine is the Canadian Self-Sufficiency project, because it is both a randomized trial and offers significant changes to the tax incentive to work to participants in the "experiment." The results cited in the table suggest that, not only does this program have large effects on outflows from unemployment and inactivity, but that it may also encourage a small degree of "inflow" into the program (although the twelve month duration before eligibility is permitted seems to be a deterrent to large scale abuse).

Other studies, many of which are not cited in the table, rely on *ad hoc* evaluative procedures. In contrast to the previous evidence, interestingly, only one cited study relies on a "differences of differences" methodology, exploiting program variation over time and over individuals. Overall, however, the broad conclusion is that incentives "work" in the sense that bonuses, tax credits, and subsidies do increase the flow into employment. The questions which are not fully answered are whether, firstly, these effects persist over long periods (for example, five to ten years) and, therefore, whether programs are "cost effective" in the sense of generating resources (such as tax revenues and unemployment insurance savings) to compensate for the payments made to participants.

Table 9. Selected Studies of Impact of Entry-to-Work Tax Credits and Wage Subsidies

Authors	Program and data	Method	Results
Bell and Orr (1994)	Jobs as homemakers and health aides for AFDC recipients—providing training and subsidized employment	Randomized trials in seven U.S. states. Data on participants and "controls" plus post-trial experience	i) post-trial earnings of participants increased in six of seven states ii) welfare dependence fell in the four states with lower AFDC/food stamp benefits
Decker and O'Leary (1995)	Re-employment bonus experiments: *UI* recipients offered bonus to find job quicker	Two states, randomized trials of different bonus levels and durations, on unemployment duration	i) bonus experiments lower duration of unemployment (half a week) and *UI* paid out (by $85) ii) but not cost effective given average size of bonus
Katz (1996)	Targeted Jobs Tax Credit: 1989 change making 23–24 year olds ineligible Data: Current Population Surveys: relevant years	"Differences of differences" using as controls 18–22 (still eligible) and 25–29 (never eligible)	i) 3.4% percentage point decline in employment from removal of eligibility—39k jobs out of 100k jobs for this age group ii) (but relative decline may have started in 1988)
Card and others (1998)	Canadian Self-Sufficiency Project of earnings subsidy for lone mothers who find work	Randomized trials. Test of impact on entry (i.e., whether lone parents defer employment entry to become eligible for tax subsidy)	i) small "entry" effect: i.e. 3% of new applicants for credit have delayed exit from inactivity ii) but no "delayed exit" effect—having obtained eligibility, left into employment as quickly
Blank and others (1999)	Survey of a variety of U.S. local randomized trials of cash and wage subsidies to welfare recipients to take work	Various randomized trials	i) all programs raise employment rates (by 3% to 11%) but depends on design and generosity ii) budgetary effects are mixed—some existing exits are effectively subsidized
Gregg and others (1999)	Simulated impact of tax-benefit reforms in United Kingdom Labour Force Survey and Family Resources Survey	Estimated transitions into work by comparing in-work and out-of-work income from tax and benefit simulation. Data sets merged by household characteristics	i) reducing "entry fee" and raising threshold of social insurance tax raises stock of employees by 20,000 in short run at a cost of £17,000 per job. ii) WFTC (see above) is twice as cost-effective; general cuts in taxation half as effective
Anderton and others (1999)	Simulation of impact of New Deal from initial target areas	Using aggregate transition equations and administrative records	New Deal raised unemployment outflow rate of target young group by 7% to 19%

The Gregg and others (1999) study for the United Kingdom is particularly illuminating in this respect, in suggesting that, at least for the first round of expenditure, in terms of creating jobs per £ spent by the government, the Working Family Tax Credit is twice as effective (in terms of "cost per job") as changes to the National Insurance Scheme thresholds (the payroll tax) which is in turn twice as effective as general cuts in direct tax rates. The lesson of this is that policies focussed on the effective marginal tax incentives and tax rates facing target groups are more likely to obtain an effective employment response than generalized macroeconomic policies designed to stimulate economic activity.

VI. INTERPRETATION AND CONCLUSIONS

This paper has considered three issues concerning the impact of tax and welfare policies on employment and unemployment in OECD countries.

- Does a high average tax burden or share of welfare spending in GDP reduce employment and economic growth, and increase unemployment?

- Does tax incidence matter—in particular do direct taxes on labor disproportionately reduce employment and increase unemployment?

- What groups face high effective marginal tax rates, and how do these marginal tax rates affect labor supply, and therefore participation and employment?

The conclusions can be summarized in the following manner.

- Theories differ as to the impact of higher average tax burdens and levels of welfare spending on employment and growth, although there is a general presumption that the impact would be adverse. However there is no clear cut empirical evidence from cross-country comparisons in support of this general proposition. Moreover, there is a likelihood that average tax and welfare burdens are endogenous to economic performance.

- Theory suggests that direct taxes on labor will only affect employment and unemployment if either labor supply is inelastic or labor markets are not competitive and union-employer bargaining is not coordinated.

- Empirical findings suggest that the labor supply response to tax changes of a regular full-time worker is probably inelastic. There is also evidence that, in general, workers cannot pass on tax changes, since direct tax "wedges" correlate negatively with labor shares. Moreover, wage setting arrangements should be based on wages net of all taxes borne by workers, including consumption taxes.

- There is some evidence for OECD countries that unemployment is higher in countries where bargaining coordination is weak and that high average replacement rates

lengthen spells of unemployment. However adequate tests of the coordination proposition on panels of country data requires some time variation in bargaining arrangements, and also careful econometric procedures that have not always been conducted in the empirical literature.

- High average replacement rates of incomes in and out of work, and high marginal tax rates, taking account not just of direct tax changes but also of welfare benefit withdrawals and the accrual of future benefit entitlements, should affect labor supply—both participation in paid work and effort supplied. The paper identifies four groups where high rates might be a policy issue: those in work with high incomes, those in work with low incomes and eligible for in-work benefits, those nearing retirement, and those considering entering the labor force.

- The paper summarized the main empirical studies concerning these four groups and common features emerged despite the different institutional structures, reforms and countries: there seemed to be significant labor supply responses to policy changes for these groups, and these responses seemed robust to a variety of empirical methods (structural labor supply estimation, a "differences of differences" approach, and actual experimental programs).

The question that remains to be considered, given this last finding, is: how important are these various responses in practice in the macroeconomic context? Our basic finding was that the "representative worker" was unaffected by tax policy but it is apparent that even this worker may be affected at certain periods of his or her life; for example, approaching retirement. The impact of high marginal tax rates for upper income workers has become less of an issue in the last two decades. Nevertheless, an increasing fraction of the actual or potential labor force are affected by tax and welfare policies that generate complex household budget constraints with high effective tax rates over some segments, and for whom we observe significant labor supply responses. This fraction is increasing because of the expansion of in-work benefits, and growing labor force participation of groups previously outside the labor force (such as married women). In addition, government efforts to reduce unemployment and welfare rolls and to change retirement behavior by interventionist policies will have a similar impact.

Poorly designed tax and welfare benefit structures therefore can have significant effects on employment and unemployment in the aggregate. A task for future research is to integrate these common behavioral responses to high effective marginal tax rates in a variety of settings into a macroeconomic model of the labor market and of the economy as a whole.

Measuring Income and Tax Revenue Response to Tax Changes
Using "Differences of Differences": An Illustration

Suppose at time t, there are 1,000 taxpayers earning $20,000 and 200 taxpayers earning $100,000. Assume the following tax structure: all personal income up to $50,000 pays income tax at a rate of 30%, and all income above $50,000 pays income tax at a rate 50%.

Suppose also that at $t+1$, the tax structure is changed: the 'standard' tax rate of 30% is reduced to 25%, and the 'top' rate is reduced to 30%. There are no changes in thresholds. At the end of $t+1$, we observe that 1,000 taxpayers earn $25,000 and 200 taxpayers earn $150,000. So the number of taxpayers in each marginal tax bracket remains unchanged.

According to Feldstein (1995), first define the *net-of-tax rate* (ntr). This is (1-the marginal tax rate). So Δntr for the high earners is $[(1\text{-}tax_t) / (1\text{-}tax_{t+1})] - 1 = [0.7/0.5] - 1 = 40\%$, and, for the low earners, $+7\%$. Δtaxable income is straightforward $= +50\%$ for the high earners and $+20\%$ for the low earners.

Now define *the elasticity of taxable income wrt the tax change* $= (50 - 20) / (40 - 7) = 0.91$

Note that the 'quasi-experiment' is *not* simply a comparison of top earners with the low earners as 'controls', since the tax change has affected both groups (differentially). The implicit 'experiment' is the differential behaviour of the groups before and after the tax change. This 'experiment' therefore assumes that nothing else occurred between t and $t+1$ that might differentially affect the incomes of the two groups.

Is the Laffer conjecture satisfied?

Although the elasticity of taxable income is relatively high in this case, this is not the same as the elasticity of tax *revenue*. But it is easy to calculate tax revenue before and after the tax change to see whether the tax cut was associated with higher revenue, given the parameters assumed here:

> At t, the low earners paid $20,000 \times 1,000 \times 0.3 = \$6$ million
> the high earners paid $[50,000 \times 200 \times 0.3] + [50,000 \times 200 \times 0.5] = \$8$ million

> At $t+1$, the low earners paid $25000 \times 1000 \times 0.25 = \$6.25$ million
> the high earners paid $[50000 \times 200 \times 0.25] + [100000 \times 200 \times 0.3] = \$8.5$ million

The change in tax revenue $= \$14.75$ million $- \$14$ million $= +5.3\%$, so there is a 'Laffer effect.' In this example, therefore, the Laffer conjecture that lower tax rates might increase tax revenues is satisfied.

References

Aghion, Philippe, and Peter Howitt, 1994, "Growth and Unemployment," *Review of Economic Studies*, Vol. 61 (July), pp. 477–94.

Alesina, Alberto, and Roberto Perotti, 1997, "Welfare State and Competitiveness," *American Economic Review*, Vol. 87 (December), pp. 921–39.

Altonji, Joseph G., 1982, "The Intertemporal Substitution Model of Labour Market Fluctuations: An Empirical Analysis," *Review of Economic Studies*, Vol. 49 (Special Issue), pp. 783–824.

Anderton, Bob, Rebecca Riley, and Garry Young, 1999, "An Illustration of the Possible Macroeconomic Effects of the New Deal for Young Unemployed People," Report for the Department of Education and Employment (unpublished; London: National Institute of Economic and Social Research).

Angrist, Joshua D., and Alan B. Krueger, 1999, "Empirical Strategies in Labor Economics," in *Handbook of Labor Economics*, Vol. 3, ed. by Orley Ashenfelter and David Card (Amsterdam: Elsevier Science).

Baker, Michael, and Dwayne Benjamin, 1999, "How do Retirement Tests Affect the Labour Supply of Older Men?" *Journal of Public Economics*, Vol. 71 (January), pp. 27–51.

Barro, Robert J., 1990, "Government Spending in a Simple Model of Endogenous Growth," *Journal of Political Economy*, Vol. 98 (October), pp. 103–25.

———, 1997, *Macroeconomics* (Cambridge, Massachusetts: MIT Press, 5th ed.).

Bean, Charles, and Christopher Pissarides, 1993, "Unemployment, Consumption and Growth," *European Economic Review*, Vol. 37 (May), pp. 837–59.

Bell, Brian, Richard Blundell, and John Van Reenen, 1999, "Getting the Unemployed Back to Work: The Role of Targeted Wage Subsidies," Institute for Fiscal Studies Working Paper 99/12 (London).

Bell, Stephen H., and Larry L. Orr, 1994, "Is Subsidized Employment Cost Effective for Welfare Recipients?" *Journal of Human Resources*, Vol. 29 (Winter), pp. 42–61.

Bingley, Paul, and Ian Walker, 1997, "The Labour Supply, Unemployment and Participation of Lone Mothers in In-Work Transfer Programmes," *Economic Journal: The Journal of the Royal Economic Society*, Vol. 107 (September), 1375–90.

Blanchard, Olivier Jean, Peter Diamond, and Robert E. Hall, 1989, "The Beveridge Curve," *Brookings Papers on Economic Activity: 1*, Brookings Institution.

Blanchard, Olivier, and Stanley Fischer, 1989, *Lectures on Macroeconomics* (Cambridge, Massachusetts: MIT Press).

Blank, Rebecca M., David Card, and Philip K. Robins, 1999, "Financial Incentives for Increasing Work and Income Among Low-Income Families," NBER Working Paper No. 6998 (Cambridge, Massachusetts: National Bureau of Economic Research).

Blöndal, Sveinjörn, and Stefano Scarpetta, 1997, "Early Retirement in OECD Countries: The Role of Social Security Systems," OECD Economic Study No. 29 (Paris: Organisation for Economic Co-Operation and Development).

Blundell, Richard, Alan Duncan, and Costas Meghir, 1998, "Estimating Labor Supply Responses Using Tax Reforms," *Econometrica*, Vol. 66 (July), pp. 827–61.

Blundell, Richard, and Thomas MaCurdy, 1999, "Labor Supply: A Review of Alternative Approaches," in *Handbook of Labor Economics*, Vol. 3, ed. by Orley Ashenfelter and David Card (Amsterdam: Elsevier Science).

Blundell, Richard, Alan Duncan, Julian McCrae, and Costas Meghir, 2000, "The Labour Market Impact of the Working Families' Tax Credit," *Fiscal Studies*, Vol. 21 (March), pp. 75–104.

Budd, Alan, Paul Levine, and Peter Smith, 1988, "Unemployment, Vacancies and the Long-Term Unemployed," *Economic Journal: The Journal of the Royal Economic Society*, Vol. 98 (December), pp. 1071–91.

Card, David, Philip K. Robins, and Winston Lin, 1998, "Would Financial Incentives for Leaving Welfare Lead Some People to Stay on Welfare Longer? An Experimental Evaluation of 'Entry Effects' in the Self-Sufficiency Project," NBER Working Paper No. 6449 (Cambridge, Massachusetts: National Bureau of Economic Research).

Daveri, Francesco, and Guido Tabellini, 2000, "Unemployment, Growth and Taxation in Industrial Countries," *Economic Policy: A European Forum*, Vol. 30 (April), pp. 47–101.

Decker, Paul T. and Christopher J. O'Leary, 1995, "Evaluating Pooled Evidence from the Reemployment Bonus Experiments," *Journal of Human Resources*, Vol. 30 (Summer), pp. 534–50.

Dilnot, Andrew, and Michael Kell, 1988, "Top-Rate Tax Cuts and Incentives: Some Empirical Evidence, *Fiscal Studies*, Vol. 9 (November), pp. 70–92.

Disney, Richard, 2000, "Crises in Public Pension Programmes in OECD: What are the Reform Options?" *Economic Journal: The Journal of the Royal Economic Society*, Vol. 110 (February) pp. 1–23.

————, and Edward Whitehouse, 1999, "Pension Plans and Retirement Incentives," World Bank Social Protection Discussion Paper No. 9924 (Washington).

Disney, Richard, and Sarah Tanner, 2000, "The Abolition of the Earnings Rule for UK Pensioners," Institute for Fiscal Studies Working Paper 00/13 (London).

Eissa, Nada, and Jeffrey B. Liebman, 1996, "Labor Supply Response to the Earned Income Tax Credit," *Quarterly Journal of Economics*, Vol. 111 (May), pp. 605–37.

Eissa, Nada, and Hilary Williamson Hoynes, 1998, "The Earned Income Tax Credit and the Labor Supply of Married Couples," NBER Working Paper No. 6856 (Cambridge, Massachusetts: National Bureau of Economic Research).

Feldstein, Martin, 1995, "The Effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act," *Journal of Political Economy*, Vol. 103 (June), pp. 551–72.

————, 1996, "The Missing Piece in Policy Analysis: Social Security Reform," *American Economic Review*, Vol. 86 (May), pp. 1–14.

Flood, Lennart, and Thomas MaCurdy, 1992, "Work Disincentive Effects of Taxes: An Empirical Analysis of Swedish Men," *Carnegie Rochester Series on Public Policy*, Vol. 37 (December), pp. 239–78.

Friedberg, Leora, 1998, "The Social Security Earnings Test and Labor Supply of Older Men," in *Tax Policy and the Economy*, Vol. 12, ed. by James Poterba (Cambridge, Massachusetts: MIT Press).

————, 2000, "The Labor Supply Effects of the Social Security Earnings Test," *Review of Economics and Statistics*, Vol. 82 (February), pp. 48–63.

Gale, William, 1999, "Comment on 'Evidence on the High-Income Laffer Curve from Six Decades of Tax Reform," *Brookings Papers on Economic Activity: 2*, Brookings Institution.

Goolsbee, Austan, 1999, "Evidence on the High-Income Laffer Curve from Six Decades of Tax Reform," *Brookings Papers on Economic Activity: 2*, Brookings Institution.

Gregg, Paul, Paul Johnson, and Howard Reed, 1999, *Entering Work and the British Tax and Benefit System* (London: Institute for Fiscal Studies)

Gruber, Jonathan, and David A. Wise, eds.,1999, *Social Security and Retirement Around the World*, a NBER Conference Report (Chicago: University of Chicago Press).

Ham, John C., 1986, "Testing Whether Unemployment Represents Intertemporal Labor Supply Behavior," *Review of Economic Studies,* Vol. 53 (August), pp. 559–78.

Heckman, James J., 1976, "A Life-Cycle Model of Earnings, Learning, and Consumption," *Journal of Political Economy,* Vol. 84 (August), pp. 11–44.

Hoel, Michael, 1991, "Union Wage Policy: The Importance of Labour Mobility and the Degree of Centralization, *Economica,* Vol. 58 (May), pp. 139–53.

Katz, Lawrence F., 1996, "Wage Subsidies for the Disadvantaged," NBER Working Paper No. 5679 (Cambridge, Massachusetts: National Bureau of Economic Research).

Keane, Michael, and Robert Moffitt, 1998, "A Structural Model of Multiple Welfare Program Participation and Labor Supply," *International Economic Review,* Vol. 39 (August), pp. 553–89.

King, Robert G., and Sergio Rebelo, 1990, "Public Policy and Economic Growth: Developing Neoclassical Implications," *Journal of Political Economy,* Vol. 98 (October), pp. 126–50.

Layard, Richard, 1982, "Incomes Policy the Answer to Unemployment?" *Economica,* Vol. 49 (August), pp. 219–39.

————, Stephen Nickell, and Richard Jackman, 1991, *Unemployment: Macroeconomic Performance and the Labour Market* (Oxford; New York, New York: Oxford University Press).

Lindsey, Lawrence B., 1987, "Individual Taxpayer Response to Tax Cuts: 1982–1984. With Implications for the Revenue Maximizing Tax Rate," *Journal of Public Economics,* Vol. 33 (July), pp.173–206.

Mankiw, Gregory N., Julio J. Rotemberg, and Lawrence H. Summers, 1985, "Intertemporal Substitution in Macroeconomics, *Quarterly Journal of Economics,* Vol. 100 (February), pp. 225–51.

Meyer, Bruce D., 1994, "Natural and Quasi-Experiments in Economics," NBER Technical Working Paper No. 170 (Cambridge, Massachusetts: National Bureau of Economic Research).

————, and Dan T. Rosenbaum, 1999, "Welfare, the Earned Income Tax Credit, and the Labor Supply of Single Mothers," NBER Working Paper No. 7363 (Cambridge, Massachusetts: National Bureau of Economic Research).

Moffitt, Robert, 1992, "Incentive Effects of the U.S. Welfare System: A Review," *Journal of Economic Literature,* Vol. 30 (March), pp. 1–61.

Neumark, David, and William Wascher, 2000, "Using the EITC to Help Poor Families: New Evidence and a Comparison with the Minimum Wage," NBER Working Paper No. 7599 (Cambridge, Massachusetts: National Bureau of Economic Research).

Nickell, Stephen, 1997, "Unemployment and Labor Market Rigidities: Europe Versus North America," *Journal of Economic Perspectives,* Vol. 11 (Summer), pp. 55–74.

————, and Richard Layard, 1999, "Labor Market Institutions and Economic Performance," in *Handbook of Labor Economics,* Vol. 3c, ed. by Orley Ashenfelter and David Card, (Amsterdam: Elsevier Science).

Organization for Economic Cooperation and Development, 1990, *Employment Outlook,* July (Paris: OECD).

————, 1995a, *The OECD Jobs Study: Evidence and Explanations,* Part II (Paris: OECD).

————, 1995b, *The OECD Jobs Study: Taxation, Employment and Unemployment* (Paris: OECD).

————, 1995c, "The Transition from Work to Retirement," OECD Social Policy Study No. 16 (Paris: OECD).

————, 1998, *Maintaining Prosperity in an Ageing Society* (Paris: OECD).

————, 1999a, *Taxing Wages, 1998–99: Les impôts sur les salaires* (Paris: OECD).

————, 1999b, *Benefit Systems and Work Incentives* (Paris: OECD).

Pencavel, J., 1986, "Labor Supply of Men: A Survey," in *Handbook of Labor Economics,* Vol. 1, ed. by Orley Ashenfelter and Richard Layard (Amsterdam; New York: North-Holland).

Phelps, Edmund S., in collaboration with Hian Teck Hoon, George Kanaginis, and Gylfi Zoega, 1994, *Structural Slumps: The Modern Equilibrium Theory of Unemployment, Interest, and Assets* (Cambridge, Mass: Harvard University Press).

Pissarides, Christopher A., 1990, *Equilibrium Unemployment Theory* (Cambridge, Massachusetts: MIT Press, 2nd ed.).

————, 1998, "The Impact of Employment Tax Cuts on Unemployment and Wages; The Role of Unemployment Benefits and Tax Structure," *European Economic Review,* Vol. 42 (January), pp. 155–83.

Scarpetta, Stefano, 1996, "Assessing the Role of Labour Market Policies and Institutional Settings on Unemployment: A Cross-Country Study," OECD Economic Study, No. 26 (Paris: Organisation for Economic Cooperation and Development).

Schioppa, Fiorella Padoa, 1990, "Union Wage Setting and Taxation," *Oxford Bulletin of Economics and Statistics*, Vol. 52 (May), pp. 143–67.

Scholz, John Karl, 1996, "In-Work Benefits in the United States: The Earned Income Tax Credit," *Economic Journal: The Journal of the Royal Economic Society*, Vol. 106 (January), pp. 156–69.

Stock, James H., and David A. Wise, 1990, "Pensions, the Option Value of Work and Retirement," *Econometrica*, Vol. 58 (September) pp. 1151–1180.

Stokey, Nancy L., and Sergio Rebelo, 1995, "Growth Effects of Flat-Rate Taxes," *Journal of Political Economy*, Vol. 103 (June), pp. 519–50.

Tanzi, Vito, 2000, *Policies, Institutions and the Dark Side of Economics* (Cheltenham, United Kingdom; Northampton; Massachusetts: Edward Elgar).

Tullio, Giuseppe, 1987, "Long Run Implications of the Increase in Taxation and Public Debt for Employment and Economic Growth in Europe," *European Economic Review*, Vol. 31 (April), pp. 741–80.

Walker, Robert, and Michael Wiseman, 1997, "The Possibility of a British Earned Income Tax Credit," *Fiscal Studies*, Vol. 18 (November), pp. 401–25.

Whitehouse, Edward, 1990, "Abolition of the Pensions 'Earnings Rule,'" *Fiscal Studies*, Vol. 11 (August), pp. 54–70.

————, 1996, "Designing and Implementing In-Work Benefits," *Economic Journal: The Journal of the Royal Economic Society*, Vol. 106 (January), pp. 130–41.

Zabalza, A., C. Pissarides, and M. Barton, 1980, "Social Security and the Choice between Full-Time Work, Part-Time Work and Retirement," *Journal of Public Economics*, Vol. 14 (October), pp. 245–76.

Zee, Howell H., 1997, "Taxation and Unemployment," *Tax Notes International*, Vol. 14 (January), pp. 225–54.