Labor Supply Behavior and the Design of Tax and Transfer Policy*

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Abstract

This paper argues that recent empirical evidence on labor supply behavior — showing stronger participation responses than hours-of-work responses — has important implications for the design of tax and transfer policy. Based on a review of recent research in this field, we conclude the following: (*i*) Conventional ways of evaluating the impact of tax-transfer reforms on economic efficiency have to be revised. (*ii*) Optimal redistributional policies may well involve negative marginal tax rates at the bottom of the earnings distribution. (*iii*) The introduction of the Earned Income Tax Credit (EITC) in the United States in the mid-1970s and the large expansions of the credit during the past two decades did not involve a trade-off between efficiency and equality as suggested by previous estimates. Instead, the EITC has improved *both* equality and efficiency. (*iv*) For most European countries, redistribution to the working poor involves a substantially lower trade-off between efficiency and equality than traditional redistributional policies targeted to those out of work.

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1 Introduction

Redistribution to low-income individuals has grown significantly in European countries and in the United States since World War II. Today, most of these countries devote a sizeable amount of public spending to various low-income support programs. These programs include unemployment insurance, social assistance, in-work benefits, health insurance, food programs, housing programs, child care support, and disability benefits for the disabled.

These transfer programs have been motivated by a desire to alleviate poverty and to make the income distribution more equal. However, the presence of generous low-income support provided by the government may have adverse effects on the labor market. In particular, since eligibility in most welfare programs is directly related to the size of income, individuals have an incentive to reduce or under-report earnings so as to qualify for welfare payments. For example, some people may want to reduce hours of work or effort on the job, or they may choose to opt out of the labor market entirely. There is convincing empirical evidence that welfare programs do in fact induce labor supply responses of this sort (Moffitt, 2002). Moreover, taxes collected from middle- and high-income earners to finance low-income support leads to additional negative effects on labor supply and employment (Blundell and MaCurdy, 1999).

The negative effects on labor supply implied by taxes and transfers create a loss of efficiency in the economy. In other words, policy makers face a trade-off between efficiency and equality, since more distributional equity generated by government programs implies lower efficiency. The size of this trade-off depends on the generosity and on the design of welfare programs. If the programs are inappropriately designed, they will be costly in terms of lost efficiency implying that the feasible amount of redistribution is lower. By contrast, if the programs are designed to minimize the adverse effects on labor supply, then we can redistribute more.

An important choice in the design of low-income support is whether it should apply to the poor or to the working poor. This policy choice has varied over time and across countries. In continental Europe and in Scandinavia, welfare programs tend to be aimed at guaranteeing a minimum level of consumption for all individuals, including those without a job (redistribution to the poor). By contrast, Anglo-Saxon countries tend to spend large amounts on in-work benefit programs targeted to the working poor. In the United States, for example, the so-called Earned Income Tax Credit (EITC) has become the single largest cash transfer program for lower-income

families at the federal level. Eligibility for the EITC is conditional on having a low income *and* on having a job. The program attempts to achieve the dual goal of redistributing income to low-income earners and avoiding some of the adverse effects on the labor market mentioned above. In particular, by making the transfer conditional on employment, the EITC aims at increasing labor market participation for the eligible population.

A program similar to the EITC was introduced in the United Kingdom in the 1988 and expanded substantially in the late 1990's. Moreover, a number of continental European countries (including Denmark) have recently experimented with in-work benefit programs, although on a very small scale. In other words, the introduction and further expansion of in-work benefits targeted to the working poor is high on the agenda when discussing welfare reform in Europe. Since the expansion of such programs — at the expense of traditional welfare programs — would represent a fundamental change in the approach to income redistribution, it is important to understand their implications for distribution and the labor market.

In this paper, we provide an overview of some of the central issues in the evaluation of welfare and tax reform, and we discuss the appropriate design of redistributional policies. The paper pays special attention to the importance of modelling labor supply decisions correctly when considering policy reforms affecting the labor market. Until recently, a common feature of the public finance literature was an almost exclusive focus on hours of work for those who are working (the intensive margin of labor supply). However, an emerging consensus in the empirical labor market literature is that most of the observed variation in labor supply reflects changes in labor force participation (the extensive margin of labor supply), whereas changes in hours worked are much smaller (Heckman, 1993; Blundell and MaCurdy, 1999). Consistent with these findings, we outline a simple theoretical framework accounting for both the intensive and extensive margins of labor supply response, and we review a number of recent empirical applications showing that the composition of the response on the two margins is crucial for the evaluation of tax and transfer policy.

Considerable space will be devoted to discussing the desirability of policies targeted at the working poor versus traditional welfare policies aimed at the poorest (non-employed) segments of the population. Based in part on the experience in the US and the UK, we argue that there is a promising scope for in-work benefit reform in continental Europe. In fact, in-work benefit reform seems to be particularly desirable in a country such as Denmark where effective tax

rates are very high at the bottom of the income distribution resulting from generous support to those out of work combined with high tax rates on the working population.

In Scandinavia, policy proposals of this sort are usually met by two critiques. First, it is pointed out that in-work benefit reform tends to be less desirable in a country characterized by a highly compressed earnings distribution. We discuss this argument and find that it is not strong enough to overturn the case for in-work benefit reform in Denmark. Second, it is pointed out that most of the evidence on strong participation responses has been based on countries characterized by relatively low female labor force participation rates. While this argument is not without merit, we argue that working poor policies will be desirable in Denmark even at participation elasticities far below those estimated for the United States and the United Kingdom. This is because the design of the Danish welfare and tax system creates exceptionally high effective tax rates at the bottom, implying that even very small elasticities involves substantial efficiency losses on the margin.

The paper is organized as follows. Section 2 provides a short review of the empirical labor supply literature and discusses the appropriate theoretical modelling of labor supply behavior. Section 3 provides a simple introduction to the measurement of the welfare costs of taxation. Section 4 shows theoretically and empirically why it is important to distinguish explicitly between intensive and extensive labor supply responses when evaluating the impact of tax reforms. Section 5 discusses different issues involved in the optimal design of redistributional policy and provides empirical estimates of the trade-off between equality and efficiency for 15 European countries. Section 6 concludes.

2 Labor supply behavior at the intensive and extensive margins

2.1 A brief review of the empirical literature

A central finding in the empirical literature is that labor supply elasticities are low at the intensive margin (Heckman, 1993; Blundell and MaCurdy, 1999). It is notable that this finding is consistent across different methods and different samples, and that it holds for both males and females. The old findings of high elasticities for women (married women and single mothers) were based on censored specifications including non-participating individuals, thereby conflating extensive and intensive responses in the estimated elasticity. Once labor supply is estimated

conditional on labor force participation, it turns out that the female hours-of-work elasticity is close to that of males (Mroz, 1987; Triest, 1990; Blundell *et al.*, 1992).

Hence, a strong degree of labor supply responsiveness would have to come from the margin of entry and exit in the labor market. Indeed, there is an emerging consensus that extensive labor supply responses may be much stronger than intensive responses (Heckman, 1993). In particular, participation elasticities seem to be very high for certain subgroups of the population, typically people in the lower end of the earnings distribution. Let us briefly review some evidence from both the United States and Europe.

One body of empirical work exploits evidence from recent tax reforms and expansions to tax-based transfers in the United States and the United Kingdom. In particular, a number of in-work benefit reforms targeted at lower-income families with kids has provided an ideal opportunity to estimate labor supply behavior. For the United States, Eissa and Liebman (1996) use a quasi-experimental approach to show that the 1986 expansion of the Earned Income Tax Credit (EITC) had large effects on the labor force participation of single mothers. This was especially the case for single mothers with low education, where the Eissa-Liebman study implies an elasticity around 0.6. Meyer and Rosenbaum (2001) use a more structural approach and data from 1985 to 1997, a period of time where three large tax reforms were enacted in the US (in 1986, 1990, and 1993). Their finding that the EITC accounts for about 60 percent of the increase in the employment of single mothers over the period implies a participation elasticity of about 0.7. A study by Blundell *et al.* (2000) considers the labor market impact of the recently implemented Working Families Tax Credit (WFTC) in the UK. Like the EITC, this program was designed to induce low-income people with kids, typically lone mothers, from welfare into work. Their results indicate that the reform was quite effective in achieving this goal, increasing the participation rate of single women with children by 2.2 percentage points (5 percent).

While the literature on labor supply in Anglo-Saxon countries is extensive, there are fewer studies for continental European and Scandinavian countries. One might expect that labor supply elasticities are smaller in the more rigid labor markets of continental Europe and Scandinavia. However, several recent studies suggest that this is not the case. A number of structural studies of female labor supply are surveyed in Blundell and MaCurdy (1999). These studies found high elasticities — typically between 0.5 and 1 — across a number of European countries

such as Germany, Netherlands, France, Italy, Sweden, and the UK.[1] Since these results were based on samples containing non-employed individuals, the participation response is included in the estimated elasticities. Indeed, the results probably reflect an underlying labor supply curve where elasticities are large around the point of participation but fall off rapidly with increases in working hours (Blundell, 1995).

The finding that tax incentives may have substantial effects on labor force participation is consistent with another stream of empirical literature estimating the effect of out-of-work benefits on unemployment. Krueger and Meyer (2002) surveys the evidence from a number of OECD countries. They conclude that benefits raise the incidence and the duration of unemployment, and that the elasticity of lost work time with respect to benefits tend to be around one. Since the risk of unemployment is largest among low-skilled workers, this evidence also indicates that strong participation responses tend to be concentrated at the bottom of the wage distribution.

2.2 Modelling entry-exit behavior in the labor market

Having established that extensive labor supply responses are empirically important, we wish to explore their implications for the welfare evaluation of tax and transfer policy. In order to do so, we have to think about how to model participation behavior. As emphasized by Eissa *et al.* (2004), a realistic model must be consistent with empirical distributions of hours worked showing almost no workers at low annual or weekly hours of work. In other words, if individuals decide to work at all, they tend to work a substantial number of hours (say, 30 or 40 hours per week). To explain this discreteness of participation behavior, we need a framework featuring non-convexities in preferences and/or budget sets. The observed discrete responses along the extensive margin cannot be captured within a standard convex labor supply model.[2]

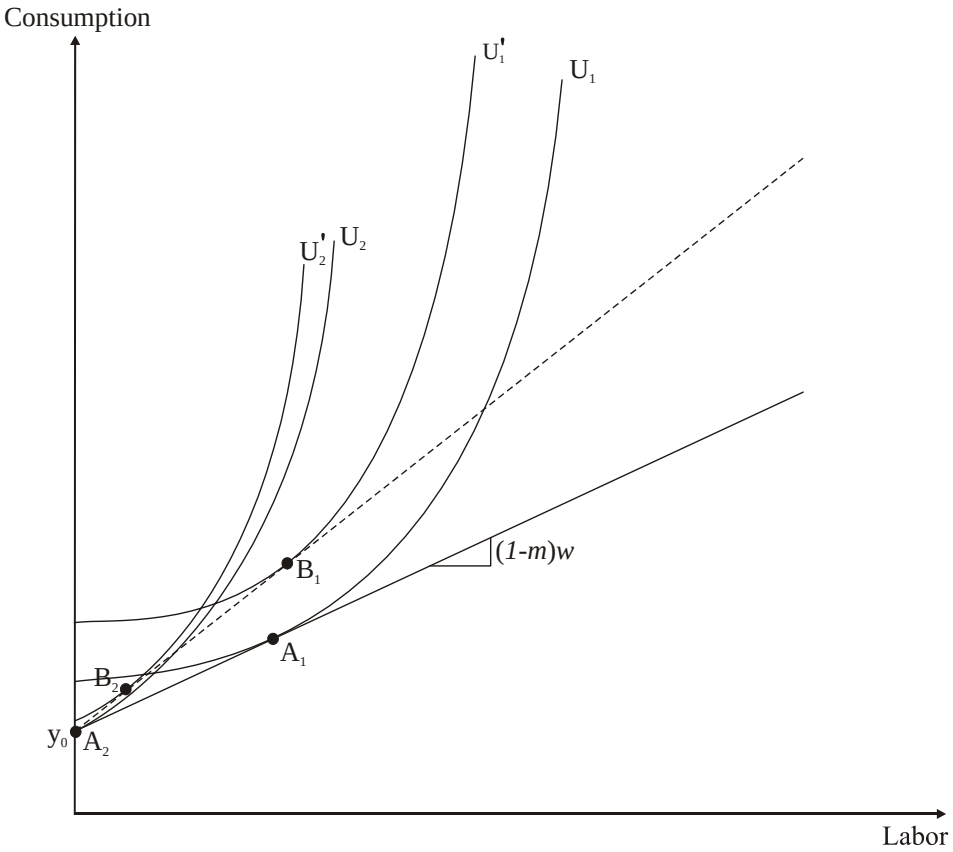
To see the point, Figure 1 illustrates the choice of labor supply in the standard convex model. In the figure, we consider two individuals facing the same budget constraint, where y_0 is non-labor income, w is the wage rate, and $(1-m)\,w$ is the marginal net-of-tax wage. The indifference curves of the two individuals are drawn such that individual 1 has a relatively low valuation of leisure, while individual 2 has a relatively high valuation of leisure. Consequently,

[1] We are not aware of studies estimating the elasticity of labor force participation with respect to taxes for Denmark. While the results for Sweden may give some indication of labor supply behavior in Denmark, it would be interesting and important to carry out econometric studies based on Danish data and reforms in order to discuss the design of future tax and welfare reform in this country.

[2] See Eissa, Kleven and Kreiner (2005) for a more detailed discussion of the modelling of labor supply.

it is optimal for the first individual to work many hours (at point $\mathbf{A}_1$), whereas the second individual chooses to stay outside the labor market (at point $\mathbf{A}_2$) since there is no point of tangency at positive hours. As we have drawn the figure, the point of tangency for individual 2 is exactly at zero hours worked.

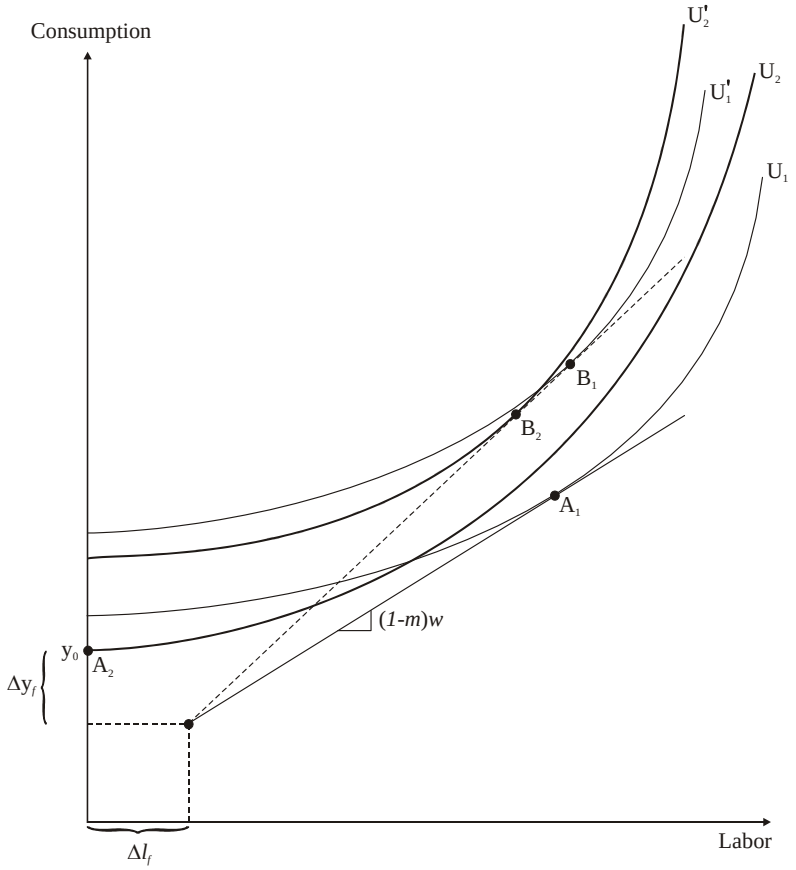
Figure 1: Intensive versus Extensive Responses in the Convex Model



Consider now a small reduction in the tax rate increasing the slope of the budget line a little bit. In principle, we want to consider a marginal (infinitessimal) tax change, but we have exaggerated the size of the change in the figure for the point of illustration. The increased slope of the budget line induces individual 1 to increase his hours of work a little bit from point $\mathbf{A}_1$ to point $\mathbf{B}_1$ (an intensive response). For individual 2, on the other hand, the higher net wage gives rise to an interior solution so that he decides to enter the labor market at point $\mathbf{B}_2$ (an extensive response). Notice that this extensive response involves a change in labor supply from zero hours to some small (infinitessimal) number of hours. Hence, the type of participation

response predicted by this framework is a marginal one, just like the change in hours of work for those who are working. This conflicts with the empirical evidence described above showing that people do not enter the labor market at infinitesimal hours of work but that they do so at, say, 30 or 40 hours. Therefore, to be able to capture participation behavior in a realistic way, we need to adopt a framework incorporating some type of non-convexity making very low hours of work non-optimal.

Figure 2: Intensive versus Extensive Responses with Fixed Costs of Working



In the empirical literature, non-convexities are typically introduced by way of fixed work costs (e.g. Cogan, 1981; Blundell *et al.*, 1987). In Cogan's (1981) analysis, the fixed costs may be monetary costs (say child care and transportation expenses) or they may take the form of a loss of time (e.g., commuting time). In Figure 2, we extend the analysis of labor supply choice along these lines. An individual who chooses to stay outside the labor market receives non-labor income y_0. If he decides to enter the labor market, he looses Δy_f in income and Δl_f in leisure

time upon entry, thereby creating a discontinuity in the budget set. In the initial situation, it is still the case that individual 1 works relatively long hours (at point $\mathbf{A}_1$), while individual 2 does not work at all (at point $\mathbf{A}_2$). Now, if we reduce the tax rate a little bit, individual 1 responds again with a marginal change in working hours from $\mathbf{A}_1$ to $\mathbf{B}_1$. By contrast, individual 2 now reacts by making a discrete jump from not working at all to working nearly as many hours as individual 1 (at point $\mathbf{B}_2$). This discreteness of the participation choice is consistent with empirical distributions of hours worked. Hence, the incorporation of fixed work costs allows for a more realistic model of participation behavior.[3]

To summarize, we note that tax reforms entail intensive as well as extensive labor supply responses, and to account for the observed discreteness of extensive responses, they have to be modelled by introducing non-convexities into the standard framework.

3 The excess burden of taxation

In general, the tax system affects labor supply along both the intensive and extensive margins. These distortionary effects on labor supply affect government revenue and give rise to a loss of economic efficiency. This is what we call the excess burden or the deadweight loss of taxation. The aim of this section is to explain why it is important to distinguish explicitly between the intensive margin and the extensive margin when trying to measure the excess burden of taxation. Notice that it is not obvious a priori that we need to distinguish between the two margins in order to quantify the efficiency cost of the tax system. Taxes distort labor supply along both dimensions but maybe this could be captured simply by looking at the aggregate labor supply curve thereby incorporating both the intensive margin effect and the extensive margin effect in a single relationship. Although this reasoning may sound plausible, it turns out to be wrong, as we will show below.

3.1 The excess burden of taxation with intensive labor supply responses

We start with a review of the standard deadweight loss of taxation which focuses only on the intensive labor supply margin. Consider an individual with an hourly productivity/wage of

[3] In addition to fixed work costs, the presence of low-income support programs featuring gradual phase-out and possibly discrete earnings and work tests create non-convexities making low hours of work very unattractive. In fact, Figure 2 can easily be reinterpreted to illustrate the case of non-convex tax-transfer programs by thinking of the cost Δy_f as an out-of-work welfare benefit which is lost upon entry.

w. For simplicity, assume that the individual faces a simple proportional tax scheme where m denotes the marginal tax rate. The individual is willing to work more hours at a higher after-tax wage rate thereby giving rise to the upward-sloping labor supply curve illustrated in Figure 3a. With no taxes, the labor market would be at point **A**. The impact of the tax system is to reduce the hourly take-home wage from w to $(1-m)\,w$ thereby giving rise to an equilibrium at point **B**.

Figure 3a: Welfare cost of taxation with intensive labor supply responses

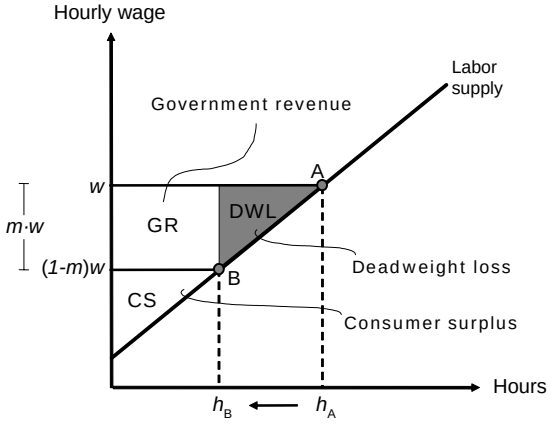
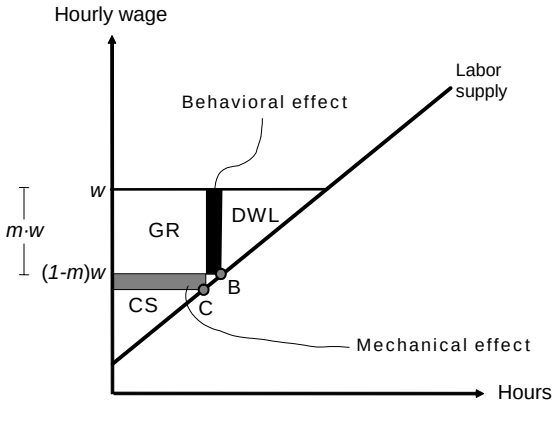


Figure 3b: Marginal welfare cost of taxation with intensive labor supply responses



At point **B**, the individual obtains a consumer surplus given by the area **CS**, the government revenue is given by the area labelled **GR**, while the triangle **DWL** captures the deadweight loss from the tax. The deadweight loss measures the amount that is lost in excess of what the governments collects. If the same tax revenue were to be collected by a lump sum tax — a tax which is independent of earnings — the individual would continue to supply labor at point **A**, and obtain a consumer surplus equal to $\mathbf{CS}+\mathbf{DWL}$.[4] Hence, the difference between the income tax and the lump sum tax is exactly equal to the area **DWL**. This area therefore measures the efficiency cost of having a tax system that depends on income.

Formally, the deadweight loss may be derived by first calculating the area $\mathbf{GR}+\mathbf{DWL}$ using integration and afterwards subtracting the rectangle **GR**. This gives

$$\mathbf{DWL}=\int_{(1-m)w}^{w} h\left(x\right)dx-m\cdot w\cdot h\left(\left(1-m\right)w\right), \tag{1}$$

[4]The tax system influences hours worked through a substitution effect and an income effects. The income effect is, however, irrelevant for the measurement of excess burden. Notice that the excess burden is derived by comparing a given tax system with a lump sum tax system that generates the same tax revenue. Accordingly, the net-income of the individual does not change when going from one system to the other.

where $h(\cdot)$ is the labor supply function of the individual, while $h((1-m)w)$ denotes hours worked at point **B** in Figure 3a.

Equation (1) reflects the *total* deadweight loss of the income tax system, but this is typically not very interesting for tax policy. The reason is that practical tax reforms tend to involve relatively small changes within the existing tax schedule rather than abolishing income taxation altogether. For tax policy analysis, it is therefore more interesting to look at the efficiency impact of small adjustments in the existing system, i.e. the *marginal* deadweight loss.

Figure 3b illustrates the impact of a small increase in the marginal tax rate m. Point **B** is the choice of the individual at the pre-reform tax system (equivalent to point **B** in Figure 3a). The reform reduces the marginal net-of-tax wage and moves the optimal choice from **B** to **C**. It can be seen in the figure that the increase in the deadweight loss triangle following the reform is given (approximately) by the black rectangle.[5] To understand the source of this efficiency loss, it is useful to relate it to the effects on government revenue. In general, tax reforms affect government revenue through two channels — the mechanical effect and the behavioral effect. The mechanical revenue effect reflects the impact of the increase in the tax rate at given behavior, and it corresponds to the gray rectangle in the figure. This effect reflects a transfer of income from the individual to the government (the consumer surplus is reduced by the same area), and it has no consequences for efficiency. In other words, although the mechanical effect represents a welfare loss to the tax payer (a loss of income), it entails no loss of ressources for the economy and hence no efficiency loss.

The behavioral revenue effect reflects the impact of changed behavior at the given tax rate. Because the increase in the marginal tax rate reduces hours worked from point **B** to **C**, taxable earnings goes down leading to a negative feed-back effect on government revenue. This behavioral revenue effect from the tax reform — given by the black area in the figure — is exactly identical to the marginal deadweight loss of taxation. The insight that the marginal deadweight burden is equivalent to the behavioral revenue effect is not specific to the model adopted here. It is an insigt which follows from any model where individuals optimize and markets are efficient, a point which we come back to below.

From the graph, or by differentiation of expression (1), we see that the change in the

[5] This is only approximately true, since the black rectangle does not include the small white triangle immediately below it. However, this triangle is a second-order effect arising because the reform in the figure is not exactly marginal (infinitessimal). For a marginal reform, this effect is zero.

deadweight loss becomes[6]

$$\Delta\mathbf{DWL} = m \cdot w \cdot h'\left(\left(1-m\right)w\right) \cdot w \cdot \Delta m, \tag{2}$$

where $h'(\cdot)$ denotes the derivative of the individual labor supply with respect to the after-tax wage rate. A small increase in the tax rate, Δm, induces the individual to reduce the number of hours by $h'(\cdot) \cdot w \cdot \Delta m$. Since a one-hour reduction in labor supply reduces the tax payment by $m \cdot w$, it follows that the change in the deadweight loss is exactly equal to the behavioral feed-back effect on government revenue. This insight, that the welfare loss is given by the revenue loss created by changed behavior, is not related to the specific model adopted here but holds in general for tax policy analysis.

For empirical applications, it is useful to rewrite the above result. Let ε denote the elasticity of hours worked with respect to the net-of-tax wage rate.[7] Then the change in the deadweight loss in proportion to the aggregate wage income may be written as

$$\frac{\Delta\mathbf{DWL}}{wh} = \frac{m}{1-m} \cdot \varepsilon \cdot \Delta m. \tag{3}$$

This expression is a classic Harberger-type formula for the marginal deadweight burden of taxation.[8] It shows that the marginal welfare cost depends on the initial level of the marginal tax rate, the increase in the marginal tax rate, and the hours-of-work elasticity. Notice that the marginal loss is equal to zero when the marginal tax rate is zero. That is, initially the welfare cost of raising tax revenue is zero. As the tax rate is increased, the marginal welfare cost of taxation also increases at a given labor supply elasticity. In other words, it becomes more and more costly to raise additional government revenue as the tax rate goes up. In fact, welfare effects can be substantial even for very small labor supply elasticities provided that initial marginal tax rates are high. Finally, since the empirical evidence does not give any indication of large, significant differences in hours-of-work responses across individuals (conditional on labor

[6] Notice that the marginal tax rate also enters in the lower limit of the integral in equation (1). Using Leibnitz's rule, the derivative of this term with respect to m becomes $w \cdot h\left(\left(1-m\right)w\right)$.

[7] To be precise, ε is the compensated hours-of-work elasticity. As described in footnote 3, income effects are irrelevant for the measurement of the excess burden of taxation.

[8] The result is more general than it appears. Specifically, the result is not restricted to a proportional tax scheme although this is the case for Figure 3a,b and for expression (1). The relationship in (3) holds for any tax system as long as the marginal tax rate is locally constant. The result also holds for other definitions of the dead-weight loss. Here, we have derived expression (3) from a simple Marshalian definition but the result may also be derived from dead-weight loss measures based on compensating variation, equivalent variation, or compensating surplus.

force participation), we may conclude that the largest efficiency gains of tax rate reductions are to be found where marginal tax rates are relatively high.

3.2 The excess burden of taxation with extensive labor supply responses

The modelling of tax distortions along the extensive margin is a bit more complicated. As noted in Section 2, an appropriate theory requires some type of non-convexity in order to account for the observed discreteness in labor supply behavior.[9] In addition, the theory has to incorporate heterogeneity across individuals. With no heterogeneity in preferences or productivity, either everybody participates or nobody participates in the labor market. In reality, some fraction of those in their working age participate, and small changes in labor market incentives will typically create small adjustments in the number of employed workers. The combination of non-convexities and heterogeneity enables us to explain discrete entry-exit behavior at the individual level together with smooth changes in employment at the macro level. Here we present a very simple framework which illuminates the main insights. A more general analysis is presented in Eissa *et al.* (2004).

Consider a group of individuals who all have the same hourly productivity/wage w. For simplification, we disregard intensive labor supply responses and assume that all individuals work some fixed number of hours, $\bar{h}$, if they work at all. Those who are working receive the same pre-tax earnings denoted by $Y \equiv w\bar{h}$. The individuals face fixed work costs which may reflect monetary costs, time costs or simply a fixed disutility of working. These work costs are assumed to vary (smoothly) across individuals, thereby giving rise to the upward sloping labor supply curve in Figure 4a. This curve displays the number of employed individuals as a function of the net income gain of working (i.e., earnings net of taxes paid and transfers lost). At a low net income gain, many individuals stay outside the labor market because their work costs outweigh the gain from entry. As the net income gain increases, more and more individuals find it worthwhile to enter the labor market so as to generate a positively sloped extensive labor supply curve.

[9] A general framework for analyzing welfare effects with discrete choice is provided by Small and Rosen (1981).

Figure 4a: Welfare cost of taxation with extensive labor supply responses

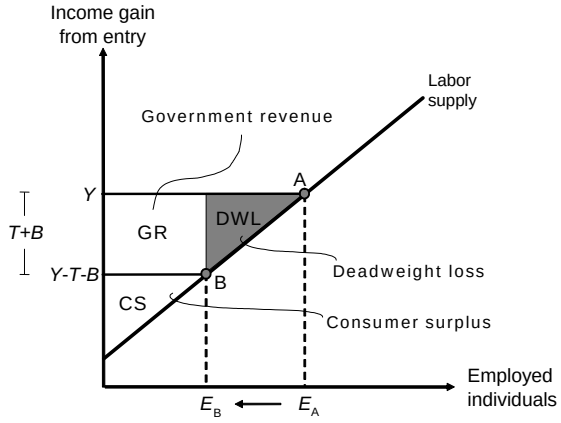
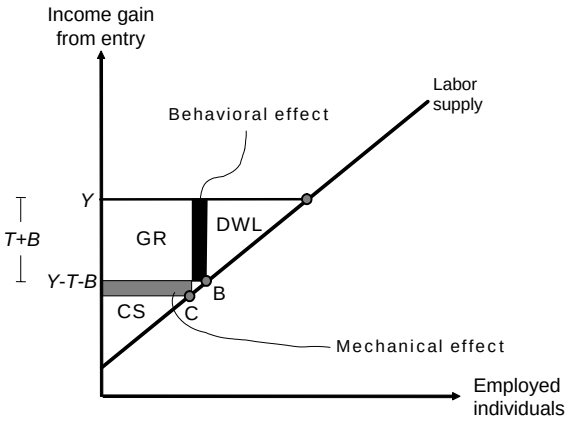


Figure 4b: Marginal welfare cost of taxation with extensive labor supply responses



With no tax-transfer system, the equilibrium would be at point **A**. Assume now that an employed who is earning Y has to pay an amount T in taxes (net of any benefits), while a non-employed individual receives the amount B in welfare benefits (net of any taxes). This implies that the net income gain of working equals $Y - T - B$, thereby moving the equilibrium number of employed from point **A** to point **B**. Those who work at point **B** obtain consumer surplus **CS** and generate a government revenue (taxes paid plus benefits saved) equal to **GR**. The tax-transfer system drives a wedge, $T + B$, in between the social return to work and the private return, thereby creating a deadweight loss equal to the area **DWL**.

Formally, the deadweight loss may be written as

$$\mathbf{DWL} = \int_{Y-T-B}^{Y} E(x)\, dx - (T+B) \cdot E(Y-T-B), \tag{4}$$

where $E(\cdot)$ denotes the number of employed people as function of the net income gain of working. The first term measures the size of the area $\mathbf{GR} + \mathbf{DWL}$ in Figure 4a, while the second term equals the area **GR**.

Let us now consider the impact of a reform making a small adjustment to the existing tax system. Figure 4b displays the consequences of a small increase in the tax burden on the employed, which moves the equilibrium from point **B** to point **C**. As in the previous model, it is useful to distinguish between the mechanical effect and the behavioral effect on government revenue. The mechanical effect is the increase in government revenue at given labor market participation, and it is shown by the gray area in Figure 4b. This effect corresponds to a redistribution of income from the employed to the government and involves no deadweight

loss. The distortionary effect of the tax change comes entirely from the behavioral effect on government revenue. The tax change reduces the number of employed individuals and this reduces the net-payment to the government by $\mathbf{T} + \mathbf{B}$ per person. Accordingly, the change in the deadweight loss becomes

$$\Delta\mathbf{DWL} = (T + B) \cdot E'(Y - T - B) \cdot \Delta T, \tag{5}$$

where $E'(\cdot)$ denotes the derivative of the employment function. This result may also be derived from differentiation of expression (4).

The sensitivity of employment with respect to changes in the net income gain from entry may be measured by the extensive labor supply elasticity $\eta \equiv \frac{E'(\cdot)}{E} \cdot (Y - T - B)$. In addition, we define an average tax rate $a \equiv T/Y$ and a benefit rate $b \equiv B/Y$. With these definitions, expression (5) may be rewritten to

$$\frac{\Delta\mathbf{DWL}}{Y \cdot E} = \frac{a + b}{1 - a - b} \cdot \eta \cdot \Delta a, \tag{6}$$

where $\Delta a = \Delta T/Y$ denotes the reform-induced change in the average tax rate. This deadweight-loss formula reflects the same basic form as the traditional one in eq. (3), but it is related to different policy parameters and a different elasticity. In particular, the welfare cost is no longer related to the marginal tax rate. It is instead related to the tax rate applying at the extensive margin — the *participation* tax rate — calculated as the sum of the average tax rate and the out-of-work benefit rate, $a + b$. The participation tax rate measures the fraction of earnings that is lost in taxes and forgone benefits upon labor market entry. Finally, the welfare effect depends on the sensitivity of entry-exit behavior as measured by the elasticity of labor force participation with respect to the net-of-tax income gain from entry, η.

In general, tax reform affects labor supply along both the intensive margin and the extensive margin. The strength of the responses are determined by the sensitivity of each margin with respect to economic incentives, captured by the two elasticities ε and η. The intensive and extensive adjustments create a change in aggregate labor supply, defined as the total number of hours worked of all employed people ($E \cdot h$). It is therefore natural to ask if it is possible to construct a measure of the deadweight burden which relies only on the sensitivity of aggregate labor supply with respect to economic incentives. The above analysis demonstrates that, in general, it is not feasible to construct such a measure, since labor force participation is related to a different tax wedge than are working hours.

Having said that, it should be noted there is one special case where tax rates on the two labor supply margins are identical. This is the case where the entire tax-transfer system is characterized by a *linear* Negative Income Tax (NIT). This type of system provides a guaranteed minimum income B to all individuals in the economy (participants and non-participants) financed by a constant marginal tax rate m on earnings. In this special case, the participation tax rate $a+b$ is exactly identical to the marginal tax rate m.[10] We may then sum the right-hand sides of eqs (3) and (6) so as to obtain the total welfare effect in proportion to aggregate labor income as

$$\frac{\mathbf{\Delta DWL}}{Y \cdot E} = \frac{m}{1-m} \cdot (\varepsilon + \eta) \cdot \Delta m, \tag{7}$$

where $\varepsilon + \eta$ is the aggregate labor supply elasticity. Notice, that the only difference between this formula and the pure intensive welfare effect in formula (3) is the presence of the aggregate labor supply elasticity instead of the hours-of-work elasticity.

An approach based on (7) would be simple and has been used in some empirical work, but it is unlikely to yield accurate results. It requires that the entire welfare system is a linear NIT, which is far from being true in empirical applications. Public benefits tend to be non-universal, targeted to low and middle income classes through earnings or work tests (creating discontinuities) or through gradual phase-outs. Consider as examples low-income support, in-work benefits, housing- and education subsidies, child benefits, medical aid, food stamps, and public pensions. While some benefits may be universal in some countries, never are they collectively so. Moreover, income tax systems are generally characterized by increasing marginal tax rates further conflicting with the NIT assumption.[11] In Section 4, we demonstrate the potential large errors from not accounting properly from the welfare effects along the extensive margin.

3.3 Excess burden, government revenue, and other dimensions of behavioral response

In the previous sections, we set up two simple models to derive formal expressions for the marginal excess burden of taxation with intensive and extensive responses, respectively. We emphasized the equivalence of the marginal excess burden with the impact of behavioral responses on government revenue. The insight that the efficiency effect of policy reform is given

[10] To see this, notice that the net tax payment of each individual under a linear NIT is given by $T = -B + mY$. By dividing this relationship with earnings Y, we obtain $a + b = m$.

[11] A description of the actual tax-transfer systems prevailing in a number of European countries is provided by Immervoll *et al.* (2005), while the US tax-transfer system is described in Eissa *et al.* (2004).

simply by the behavioral revenue effect is not specific to the simple models adopted above. It is an insight which follows from any model where individuals optimize and markets are efficient, i.e., except for the inefficiencies introduced by the existence of distortionary taxation.

To see that the result holds in general, consider a small (marginal) tax reform changing government revenue by ΔGR. In general, this change in government revenue reflects a mechanical revenue effect, ΔM, and a behavioral revenue effect, ΔB, such that $\Delta GR = \Delta M + \Delta B$. In any model where agents optimize and markets are efficient, the total utility loss (in monetary units) on individuals will be exactly equal to the mechanical tax increase ΔM. To see this, start by noticing that — in the absence of behavioral responses — a higher tax burden involves a transfer of income from individuals to the government given by ΔM, creating a utility loss for the individual equal to ΔM. But of course behavioral responses are not absent: the individual has an incentive to re-optimize behavior so as to avoid some of the tax increase. However, as long as the reform is small, this behavioral adjustment entails no first-order effect on utility, since individuals were initially in their optimum. This is an application of the envelope theorem.

The marginal deadweight loss from the reform, ΔDWL, is defined as the marginal utility loss to individuals in excess of the additional revenue collected. By exploiting the above relationships, we immediately obtain $\Delta DWL = \Delta M - \Delta R = -\Delta B$, showing that the marginal deadweight loss is exactly identical to the behavioral revenue loss. Notice that, under the assumptions of rational individuals and efficient markets, the result relies simply on an application of the envelope theorem and the definition of the deadweight loss. In particular, it does not rely on the form of preferences and technology, nor does it depend on the framework being one of continuous choice. For example, the result encompasses the case of discrete participation behavior due to non-convexities in budget sets or preferences.

There are several points to make in relation to this result. First, behavioral responses are central to the creation of efficiency losses, even though these responses entail no first-order utility effects on individuals due to the envelope theorem. The point is that behavioral responses create efficiency losses indirectly in the form of an externality operating through the government budget. For example, although a marginal labor supply reduction involves no first-order effect on the optimizing worker (envelope theorem), it implies a loss of government revenue and therefore less money for the financing of, say, public goods, creating a negative externality on everybody else.

Second, the derivation did not specify the type of behavioral response we are considering. Following most of the literature, this paper has focused on labor supply behavior in its standard dimensions: hours worked and labor force participation. But there are many other dimensions of labor supply that may be responsive to taxation. For example, higher taxes may lead to lower effort on the job, and they can have adverse effects on the incentives to improve skills by taking education or engaging in on-the-job training. Taxation can also affect the type of jobs that people take (in terms of profession, geographical location, etc.) and it may affect search and labor mobility. All of these different types of labor supply responses can affect taxable earnings and government revenue, thereby creating efficiency losses in the economy. Although there has been a tremendous focus in the empirical literature on hours worked, the other dimensions of labor supply response are just as important from the point of view of economic efficiency.

Third, the relationship between excess burden and behavioral revenue effects implies that we should go beyond thinking just about labor supply in its various dimensions. Instead, we should be thinking about changes in taxable income more generally. Taxable earnings may respond to taxation through several other margins than labor supply. For example, individuals may be able to change change the form of payment for labor services into something which is more leniently taxed. This includes fringe benefits such as corporate cars, in-house sports facilities, free lunch and dining, laptop computers, etc. It also includes turning labor income into capital income (typically carrying a lower rate of tax) by being paid in stock options instead of a traditional wage income. Alternatively, taxable income can respond if higher taxes lead to a more aggressive interpretation of tax rules (e.g., claiming questionable deductions) or tax evasion (understating income, claiming unjustified deductions). Tax-induced changes in avoidance or evasion affect government revenue, hence creating efficiency losses in the same way that labor supply responses do.

This type of reasoning underlies the recent literature on the elasticity of taxable income, starting with the important paper by Feldstein (1995). While taxation may affect behavior in a myriad of ways — as suggested by the above comments — the responses matter for efficiency only to the extent that they change taxable income. While it may be extremely difficult to estimate each of the responses separately, it is possible to estimate the elasticity of taxable income based data from individual tax returns. A focus on this parameter might make intensive responses more important than portrayed in our review of the empirical labor supply literature.

Indeed, for the United States, the literature has shown that the (intensive) elasticity of taxable income can be very high at the top of the income distribution (see Saez, 2004 for a recent survey). However, this is a phenomenon ocurring only at the extreme top of the income distribution (top 1%). We are not aware of studies estimating the elasticity of taxable income for European countries.

Finally, based on the discussion in this section, one might be tempted to conclude that we do not need to distinguish between different margins of behavioral response. To estimate the revenue (and hence efficiency) effects, it seems that all we need to know is the elasticity of taxable income and then apply a marginal tax wedge. However, this is not entirely correct. An obvious point is that the tax system may involve several different bases subject to selective tax rates. In this case, different margins of response can relate to different bases and tax rates, and we then have to distinguish between different taxable income elasticities to get the revenue and efficiency effects right. A more subtle point is that, under non-linear tax systems, marginal and discrete changes in taxable income are taxed differently. As shown in the previous sections on intensive and extensive labor supply effects, it is important to distinguish between marginal and discrete effects in the measurement of excess burden. Hence, the discussion in this section is entirely consistent with the previous conclusions.

4 The evaluation of tax and transfer reform

Following Harberger (1964), a large numerical literature has attempted to evaluate the distortions to the labor-leisure choice induced by labor income taxation and the impact of different tax reforms. The evaluation methods include simple deadweight loss calculations (Browning, 1987, 1995), Computable General Equilibrium models (Ballard *et al.*, 1985; Ballard, 1988), and microsimulations (Browning and Johnson, 1984; Triest, 1994). A common feature of this literature is the assumption of a standard convex labor supply model, ruling out discrete participation responses. Although the models applied are typically more sophisticated than the theory presented above, the basic forces driving the results are the same as those underlying formula (3). Extensive labor supply responses are either ignored, or included implicitly by substituting the elasticity of aggregate labor supply for the hours-of-work elasticity.[12] Ignoring extensive

[12]Indeed, it is not uncommon that simulation studies based on the standard convex model employ total elasticities in their calibration. For example, this seems to be the case in Browning and Johnson (1984), Ballard

responses corresponds to completely disregarding the welfare effects in formula (6). The second approach corresponds to applying a formula like (7), thereby approximating the participation tax rate $(a + b)$ and the change in this rate (Δa) with the level and change, respectively, in the marginal tax rate (i.e. m and Δm). In this section, we demonstrate that these approaches, based on the traditional labor supply model, may be seriously misleading. As a case in point, we examine the welfare effects for single women with dependent children in the United States following four tax acts passed in 1986, 1990, 1993 and 2001.

The welfare effects of these reforms on single mothers are particular interesting to study. The group of single mothers experienced large tax cuts from the reforms due to expansions of the Earned Income Tax Credit (EITC), and because of increases in the standard deduction, personal exemptions, and a more favorable tax rate schedule. The combination of all these elements implied substantial improvements in the incentive to supply labor along both the intensive and extensive margin. The labor supply responses to these changes in incentives have been studied extensively and, not surprisingly, all the evidence point to strong participation responses (cf. the discussion in Section 2). On the other hand, hours-of-work responses (conditional on participation) were very small.

4.1 Effects on labor supply and efficiency of an Earned Income Tax Credit

Let us first discuss theoretically how an EITC influences labor supply and economic efficiency. Figure 5 illustrates the impact on labor supply of introducing an EITC. The straight line represents the relationship between disposable income and earnings before the introduction of the EITC (assuming a linear tax system for simplicity). We assume that the individuals face a fixed cost of working implying that each person will have to work a certain number of hours before consumption is raised above the non-working level. The impact of the EITC depends on the earnings level of the individual. The credit is first phased in at low earnings, then stays constant, and is finally phased out at higher earnings.[13] The consequence for the relationship

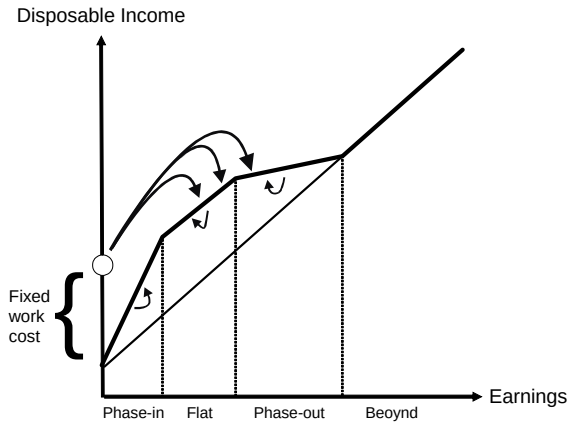
et al. (1985), Ballard (1988), Browning (1995), and Bourguignon and Spadaro (2002a, 2002b). In all these studies, high female labor supply elasticities (around $0.5 - 1.0$) are used in the calibration, although elasticity estimates of this magnitude tend to be based on censored specifications including observations with zero hours of work (Mroz, 1987; Triest, 1990). By implication, the above studies are lumping together extensive and intensive responses in the simulations.

[13] Notice that the EITC recently introduced in Denmark is different. The Danish EITC is given to everyone participating in the labor market, while the EITC in the United States is phased-out at high earnings. In addition, the size of the EITC in the US is related to the number of dependent kids and, if married, on the income of the spouse.

between disposable income and earnings is shown in Figure 5. The total tax burden on labor income is reduced in all three intervals of the EITC. The impact on the marginal tax rate depends on the initial earnings level of the person. In the phase-in interval, the marginal tax rate is reduced, in the plateau range it is unchanged, while in the phase-out range it is increased.

The labor supply responses along the intensive margin, illustrated by the small arrows in Figure 5, depends on substitution and income effects. In the phase-out range both of these effects reduce labor supply. In the flat range only the income effect is present which leads to a reduction in labor supply. Finally, in the phase-in range the substitution effect and income effect have opposite signs, so that hours increase as long as the substitution effect is stronger than the income effect. This is equivalent to the so-called uncompensated hours-of-work elasticity being positive in this range.

Figure 5: Impact of an Earned Income Tax Credit



The sign of the intensive margin welfare effect depends on the direction of the change in the marginal tax rate (cf. formula (3)).[14] An individual in the phase-in region experiences a lower marginal tax rate ($\Delta m < 0$), yielding a positive welfare effect. On the other hand, the welfare effect is zero for individuals in the plateau region (where $\Delta m = 0$), while the welfare effect is negative for individuals in the phase-out region (where $\Delta m > 0$). The total effect on economic efficiency from intensive responses may go either way but, in practise, it is quite likely that the negative effects will dominate. The reason is that the welfare effects have to be weighted by the aggregate labor income in the respective income segments (observe that the deadweight loss in

[14] Notice that ε in formula (3) is the compensated hours-of-work elasticity. Thus, only the substitution effects matter for welfare.

eq. 3 is measured in proportion to the earnings of the individual). Since earnings are higher in the phase-out range this gives, ceteris paribus, a reason to expect an overall welfare loss.

The welfare effects created along the extensive margin are unambiguously positive in all income ranges of the EITC. In all ranges, the total tax burden decrease (i.e. $\Delta a < 0$ in all intervals), which yields a positive behavioral response on government revenue (cf. formula (6)).

The total welfare effect of introducing the EITC depends in the end on the strength of the different effects. However, if the tax wedge on participation is non-negligible it is reasonable to expect a positive total effect since participation elasticities are very large compared to hours-of-work elasticities for the group of single mothers.

The potential errors of basing the evaluation on the standard, convex framework is now easy to see. A welfare analysis disregarding extensive responses is biased downwards, and the error may be substantial if participation elasticities are large. If we try to include extensive responses by substituting the aggregate labor supply elasticity for the hours-of-work elasticity in the traditional formula, the error may very well become even bigger. Assume, for example, that the intensive welfare effect is negative when calculated using the hours-of-work elasticity, while the total effect is positive after accounting for extensive effects in the proper way. If we now try to modify the standard approach by substituting a large aggregate labor supply elasticity for a small hours-of-work elasticity then the measured welfare effect becomes even more negative, thereby getting futher away from the correct positive effect. This type of error seems to underlie the pessimistic results in Browning (1995) concerning the EITC. In the next subsection, we try to quantify these errors in an empirical application.

4.2 Welfare effects on single mothers of four tax reforms in the United States

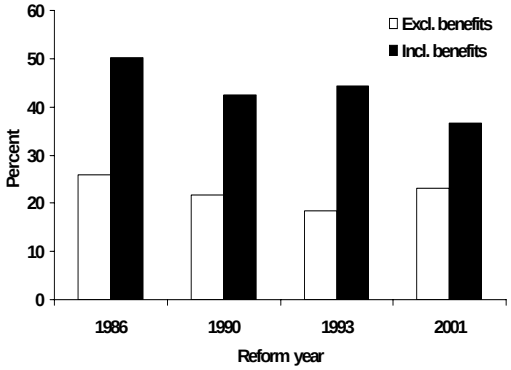
In Eissa, Kleven and Kreiner (2004), we estimate the welfare effects on single mothers of a series of tax acts passed in the United States in 1986, 1990, 1993 and 2001. Our estimation is based on a microsimulation approach using a general theoretical framework which incorporates intensive and extensive labor supply behavior as well as individual heterogeneity in productivities and preferences. The empirical implementation requires information about labor supply elasticities as well as various tax/transfer parameters and wage income shares. In order to get unbiased results, it is particular important that we account for all elements in the tax and benefits system that drive a wedge in between the social return and the private return of supplying labor.

The labor supply elasticities are based on the empirical literature reviewed in Section 2. To generate the tax/transfer parameters, we estimate individual effective tax rates (m and a) on a representative sample of single women with dependent children in the United States. The tax parameters are calculated using the Tax Simulation Model (TAXSIM) of the National Bureau of Economic Research (NBER). These tax rates include the federal, state and payroll tax components but do not include the transfer component.

In the United States, lower-income families are eligible to receive cash assistance from the Temporary Assistance to Needy Families (TANF) program, previously Aid to Families with Dependent Children (AFDC). In addition, families may be eligible for in-kind benefits in the form of food vouchers (Food Stamps) and health insurance (Medicaid). Since most single mothers are eligible for these types of programs, it is important to incorporate the benefit side in the calculation of effective tax rates. Accordingly, we develop a benefit calculator accounting for the differences in eligibility and benefit structures at the federal and state levels.

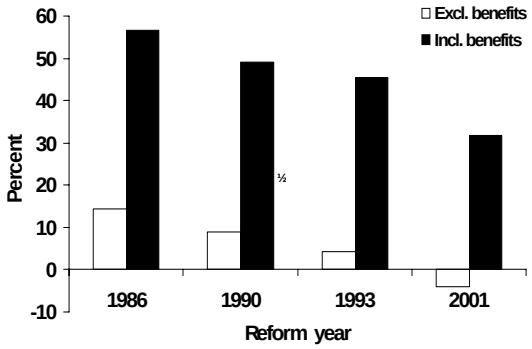
Figure 6a,b display tax rates along the intensive and extensive margins in the four pre-reform years. The graphs illustrate the dramatic changes in the taxation of single mothers over the period. Most notable is the decline in the effective tax rate on labor market participation going from 57 percent in 1986 to 32 percent in 2000. The marginal tax rate shows a more moderate and less systematic decline than the participation tax rate, which is not surprising given the large expansions of the EITC during this period. As discussed above, an EITC reduces unambiguously the tax burden, whereas its impact on the marginal tax rate depends on the distribution of individuals on the different income intervals of the EITC (phase-in, flat and phase-out). The two graphs also highlight the importance of accounting for the benefit system when calculating the relevant tax wedges along the two margins. Excluding benefits would seriously underestimate tax wedges. For example, the mean of the participation tax rates would be reduced with more than 35 percentage points if we did not account for the benefit system.

Figure 6a: Marginal tax rate



Source: Eissa *et al.* (2004)

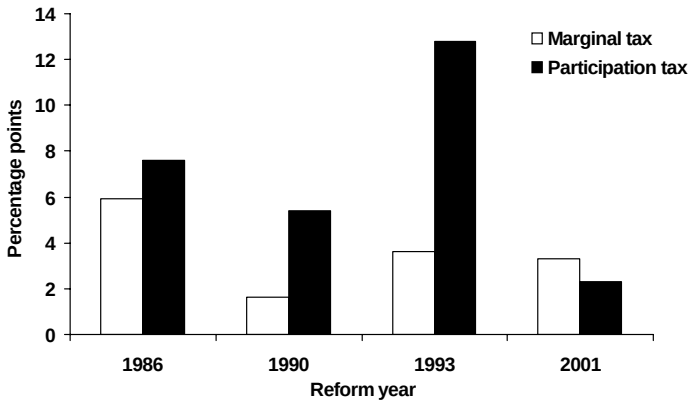
Figure 6b: Participation tax rate



Source: Eissa *et al.* (2004)

In Figure 6a,b, the changes in tax rates across the different pre-reform years reflect all changes in the tax and welfare system taking place at the federal and state levels over the period, and they incorporate as well any behavioral responses to these tax and benefit changes along with macro/time effects on income and demographic variables. To isolate the direct impact of federal tax reform, we calculate the changes in the tax rates that are attributed to the reforms alone. The results are illustrated in Figure 7 which confirms that the decrease in effective tax rates over the 15-year period has been driven to a large extent by tax changes at the federal level. This was particularly the case for the 1986 and 1993 reforms, which reduced the participation tax rate by 8 and 13 percentage points, respectively.

Figure 7: Reform-induced reductions in tax rates



Source: Eissa *et al.* (2004)

There is a substantial variation in wage income and tax rates across the single mothers in the data. This heterogeneity highlights the need for using micro-simulations to evaluate

the tax reforms. Large errors may occur in more aggregate studies because of the correlation between earnings, tax rates and tax changes. In Eissa, Kleven and Kreiner (2004), we carry out a number of simulations assuming different elasticity scenarios. The simulations point to substantial welfare gains for all the reforms. In particular, this is the case for the tax reform act of 1986. In our baseline scenario with a participation elasticity equal to 0.4 and a (compensated) hours-of-work elasticity equal to 0.1, we obtain a welfare gain for this reform equal to 7.3 percent of labor income.[15] The welfare effects are also high for the 1993 reform (2.3 percent of labor income), which contained the single largest expansion of the EITC. For the 1990 and 2001 reforms, the welfare gains are not quite as large.

For all four reforms, most of the total welfare gain is generated on the extensive margin. While 3/4 of the gain from the 1986 tax act is created by labor market entry, essentially all of the positive effect from the 1990 reform is driven by labor force participation. For this reform, the intensive welfare effect is around zero because negative effects in the phase-out region cancel out positive effects in the phase-in region of the EITC. For the 1993 reform, the large welfare gain is a result of the extensive margin strongly dominating welfare losses created on the intensive margin. Finally, for the recently enacted 2001 reform, the difference between the intensive and extensive welfare effects is less pronounced. This occurs for two reasons: First, the 2001 tax cuts reduced participation tax rates only slightly and, second, by year 2000 the previous reforms had already eliminated much of the inefficiency along the extensive margin.[16]

Our finding that extensive responses drive almost all of the welfare effects created by the four reforms underpins the importance of accounting for this margin of labor supply. A simulation based on the traditional, convex labor supply model with only intensive responses would seriously underestimate the welfare effects. For the 1993 reform, even the sign would be wrong. Here, the intensive welfare effect in our baseline scenario equals -0.38, whereas the welfare

[15] For this reform, it is interesting to note that a total labor supply elasticity of 0.6 – certainly not out of bound of the empirical estimates – would imply Laffer curve effects. In this scenario, the large tax reductions granted to single mothers are recouped entirely from the labor supply responses created by the reform.

[16] One might argue that our findings regarding the relative sizes of the extensive and intensive welfare effects were to be expected under the assumed elasticity scenario. Notice, however, that the difference between extensive and intensive welfare effects cannot be explained exclusively by elasticities, since the two kinds of welfare effects are related in different ways to the tax-transfer system. For example, for the tax act of 1990, increasing the hours-of-work elasticity would leave the intensive welfare effect more or less unchanged since the losses in the phase-out region would continue to cancel out the gains created in the phase-in region. For the 1993 reform, increasing the intensive elasticity would simply exacerbate the welfare loss along that margin, thereby reinforcing the point regarding the difference of welfare effects along the two margins.

effect equals 2.30 when including the extensive welfare effect. We may instead try to estimate the welfare effect from the traditional, convex model by substituting the aggregate labor supply elasticity for the hours-of-work elasticity, i.e., apply expression (7). This gives a welfare estimate of -1.88 which should be contrasted with the 2.30 obtained when accounting properly for the extensive welfare effect. These numbers demonstrate clearly the large errors that may arise from basing the evaluating of tax reforms on the traditional, convex labor supply model.

The errors reflect that the two margins of labor supply response depend on taxes and transfers in different ways. While the intensive margin depends on the effective marginal tax rate, the extensive margin is related to the average tax rate and the benefit rate. By implication, the size of the error depends crucially on the properties of the tax-transfer programs being analyzed.

5 The optimal design of redistributional policies

The proper amount of redistribution and the design of transfer programs is an important and controversial issue in the political sphere. As is well known from the theory of optimal income taxation, redistribution gives rise to a trade-off between equity and efficiency. Redistribution from middle and high incomes to low incomes is desirable for equity reasons. On the other hand, redistributive programs tend to reduce labor supply incentives, thereby creating efficiency costs.

In this section, we first discuss the implications of the recent evidence on labor supply behavior for the theory of optimal income taxation. Secondly, we analyse empirically the trade-off between equity and efficiency in redistribution policy across different EU countries. Thirdly, we discuss some implications for the tax treatment of married couples.

5.1 The optimal income tax

Following the seminal contribution by James A. Mirrlees (1971) most of the literature exploring the optimal income tax structure have applied the standard, convex labor supply model. One of the lessons from this literature is that marginal tax rates should be positive at all earnings levels.[17] By implication, a tax-transfer system involving an EITC creating negative tax rates at the bottom of the earnings distribution is never optimal. In a recent interesting contribution,

[17] Kleven and Kreiner (2004a) provides a short review of the standard results in the theory of optimal income taxation.

Saez (2002) shows theoretically that this result breaks down if all (or most) of the variation in labor supply occurs along the extensive margin rather than on the intensive margin. His calibration of a general discrete model featuring both intensive and extensive responses indicates that an EITC is in fact optimal for the United States.

It is possible to understand the gist of these results based on simple heuristic arguments. Let us start by discussing the original Mirrlees result based on the convex labor supply model. The theory takes as its point of departure that taxes and transfers must be observed income – abilities are private information and unobservable for the tax authorities. It is further assumed that society puts a higher value on the marginal consumption of those with low abilities/incomes than on the marginal consumption of the well-off. The society therefore wishes to have a relatively high taxation at the top of the earnings distribution and low net taxes (maybe even negative) at the bottom of the distribution. The drawback of this redistribution policy is that it involves positive marginal tax rates, leading to lower hours worked and generating an efficiency loss (cf. Section 3.1). If the hours-of-work elasticity is large, the efficiency cost will be high which, ceteris paribus, calls for less redistribution and lower marginal tax rates. But the effect can never be so strong that it calls for negative tax rates in some range. To see why this is so, consider for a moment a negative tax rate in some small earnings range $[Y^*, Y^* + \Delta Y]$. The negative marginal tax rate implies that an individual with income $Y^* + \Delta Y$ pays less in taxes than an individual with income Y^*. Suppose now that a revenue-neutral tax reform increases the marginal tax rate a little bit in the interval $[Y^*, Y^* + \Delta Y]$ while leaving marginal tax rates unchanged everywhere else. This small marginal tax rate increase allows the government to raise more money from all individuals with income above $Y^* + \Delta Y$. If the proceeds are then distributed uniformly to all individuals in the population, the reform clearly improves equity. But what about efficiency? Recall from Section 3.1 that the effect on economic efficiency is determined by the change in the marginal tax rate and that the effect is given by the behavioral effect on government revenue. Only individuals in the interval $[Y^*, Y^* + \Delta Y]$ experience a change in the marginal tax rate. These individuals face a higher marginal tax rate and respond by reducing labor supply. This would normally reduce efficiency. However, since the marginal tax rate is initially negative in this interval, the behavioral response actually generates a positive effect on government revenue and thereby an efficiency gain. To conclude, if marginal tax rates are negative then it is possible to increase the tax rate and thereby improve both equity and efficiency, thus contradicting that

negative tax rates can be part of an optimal policy.

In the standard theory described above, labor supply responds only along the intensive margin: hours of work change a little bit when the marginal tax rate is changed a little bit. This stands in contrast to the labor supply evidence reviewed in Section 2.1. In particular, this is the case at the bottom of the income distribution where the variation in labor supply is dominated by entry/exit behavior. Saez (2002) is the first paper to incorporate entry/exit decisions into the theory of optimal income taxation. Below we explain his main result, namely that negative marginal tax rates may be optimal at the bottom of the income distribution.

Consider for a moment the opposite case where the marginal tax rate is positive at the bottom of the earnings distribution. Individuals outside the labor market pays $T(0)$ in net-taxes (presumably a negative number due to out-of-work transfers), while working individuals with very low earnings pay $T(Y^*) > T(0)$. Suppose now that a reform increases the net-tax payment of all individuals in society by a small fixed amount and gives the proceeds to individuals at Y^*. This reduces the tax payment for the low-skilled, while the tax payment for everybody else goes up. If the social welfare weight of the low-skilled individuals at Y^* is higher than the average welfare weight of all individuals in the population, this redistributional scheme increases equity. In addition, the lower tax payment at the earnings level Y^* compared to the zero-earnings situation induces some low-skilled unemployed to enter the labor force at Y^*. Since $T(Y^*) > T(0)$, this behavioral response raises government revenue and thereby economic efficiency.[18] The suggested reform therefore improves both equity and efficiency. As a consequence, it cannot be optimal to have a positive marginal tax rate at the bottom of the earnings distribution. Instead, the tax-welfare system should subsidize labor market entry for low-skilled individuals.

5.2 The trade-off between efficiency and equality in European countries

The traditional theory of optimal income taxation emphasized a simple trade-off between the distribution of income/welfare and the size of aggregate income/welfare. The more we redistribute from rich to poor, the higher are marginal tax rates, and the lower is labor supply,

[18] Notice that the economic incentive to enter/exit is unchanged for individuals with potential earnings above Y^*. The reform has increased their tax payment if they work, but the tax payment for those outside the labor market is increased by the same amount. Hence, the difference in tax payment between working and not working is not changed for individuals with potential earnings above Y^*.

employment and the size of aggregate income. If hours-of-work elasticities are large, this trade-off tends to be very unfavorable. Following this literature, the old debate on redistribution was a classical left-right debate, with the left arguing that redistribution is desirable and the right arguing that labor supply responses are large. By contrast, following Saez (2002) and others, the new debate on redistributional policies focuses to a smaller extent on the size of welfare programs and to a larger extent on the shape of tax-transfer programs and the incentive they create in the decision to enter or exit the labor market. The new debate asks if it is desirable to increase the incentives to work at the bottom by redistributing from the middle- and high-income earners to the working poor, rather than to non-workers as in the old debate.

In Immervoll *et al.* (2004) we try to cast light on the welfare reform debates, both the old debate on traditional welfare programs and the new debate on redistribution towards the working poor. We construct a simple and fully explicit model encompassing labor supply responses along both the intensive and extensive margins and we then apply the model to the analysis of welfare reform for 15 European Union countries using the EUROMOD micro-simulation model that has recently become available.

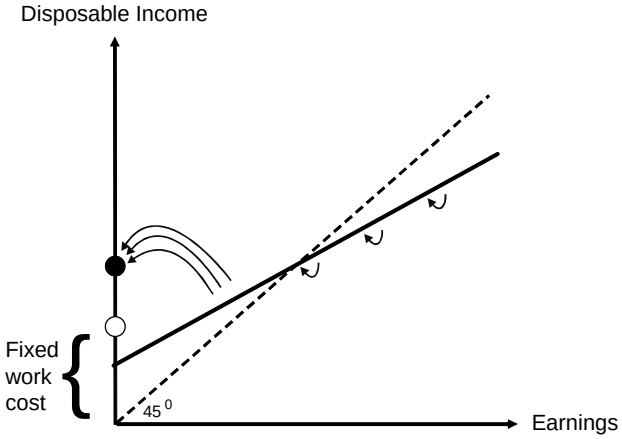
The EUROMOD micro-simulation model combines a tax and benefits calculator with detailed country-specific, but partly harmonised, micro data on income, earnings, labor force participation, as well as many demographic variables. For any set of household characteristics and country, EUROMOD is able to calculate the amount of benefits the household is entitled to and the taxes it should pay. EUROMOD has been constructed to incorporate all relevant tax and transfer programs in place in all countries that were members of the European Union prior to May 1, 2004. It is therefore a unique tool to obtain a complete picture of the incentives to work generated by these programs as well as the analysis of welfare reform.[19]

We consider two types of redistributional reform: a traditional welfare policy with universal transfers and a working poor policy with transfers targeted to the working poor. The traditional welfare policy raises the tax rate on all units of income by 1 percentage point and returns the collected revenue as a lump sum to all individuals in the economy. The concequence on labor supply incentives is illustrated in Figure 8. The linear dashed curve represents the relationship between disposable income and earnings prior to the reform, while the solid curve illustrates

[19] Detailed information on EUROMOD is provided by Sutherland (2001) and on the Internet at http://www.econ.cam.ac.uk/dae/mu/emod.htm.

the relationship after the reform. The reform raises the tax burden on high-income individuals and reduces the tax burden (net of transfers) on low-income workers as well as on non-workers. The marginal tax rate is increased at all earninge levels, implying that workers reduce hours worked (illustrated by the small arrows in Figure 8). Since transfers are universal, non-workers gain more from the reform than workers do. The reform therefore increases the participation tax rate, leading to a reduction in the population wanting to participate in the labor market (illustrated by the large arrows in Figure 8).

Figure 8: Traditional redistribution policy



The working poor policy differs from the traditional policy in one important aspect: the tax proceeds now finance a transfer given only to those who work. The policy therefore improves the standard-of-living for low-skilled individuals participating in the labor market compared to those out of work. By implication, non-participating individuals are induced to enter the labor market at low-earnings occupations.

The desirability of each type of welfare reform depends on several factors. In general, as discussed extensively above, the efficiency effects of tax-transfer reform depends on the size of elasticities along each margin of labor supply response (hours-of-work and participation elasticities), and on the size of tax rates along each margin (marginal and participation tax rates). If effective marginal tax rates are initially high, the increase in taxes create large distortions along the intensive margin. For both policies, this gives an unfavorable trade-off between equity and efficiency. By contrast, the tax on labor force participation affects the impact of the two policies in opposite directions. The presence of high participation tax rates

makes the traditional welfare policy more costly, whereas the working poor policy tend to become more desirable. The reason is that the traditional policy reduces participation, while the working poor policy stimulates it. In particular, the working poor policy will be attractive when participation tax rates are high at the bottom of the earnings distribution, because this is where the additional entry takes place.

In addition to elasticities and tax rates, the distribution of earnings in the population will be important. For example, if the degree of earnings equality is already very high, the gain of additional redistribution will be relatively low. To see this, recall that tax and transfer payments for each individual are functions of earned income. If the income distribution is strongly compressed, the taxes paid and the benefits received tend to be of a relatively similar size for most individuals in the population. Hence, a reform that increases tax rates and benefits generates relatively little redistribution per dollar of deadweight burden, thereby creating an unfavorable equity-efficiency trade-off. Indeed, the presence of a high earnings equality in Scandinavian countries is often mentioned as an argument against introducing working poor policies in this region. It is important to notice, however, that high income inequality tends to make both the working poor policy and the traditional welfare policy costly. If the presence of a high earnings equality is used as an argument against working poor policies, it may also be used as an argument for rolling back traditional welfare programs targeted at those out of work. Still, the effect is somewhat less pronounced for the traditional welfare policy because it also gives transfers to those with zero earned income. We will come back to the implications of a high earnings equality for the design of welfare reform below.

The EUROMOD calculations in Immervoll *et al.* (2004) provide detailed information on the distribution of earnings along with effective tax-benefit rates applying on the two margins of labor supply for the pre-2004-enlargement countries of the European Union. In Table I, we briefly summarize some of the results from these calculations.

[Table I]

The upper panel in the table ranks countries according to the equality of pre-tax earnings as measured by income at the 80th percentile relative to income at the 20th percentile in the distribution. As one would expect, Nordic countries have the highest equality of earnings while Anglo-saxon countries have the lowest. In the United Kingdom, earnings at the 80th percentile

is more than 3 times as large as earnings at the 20th percentile, while the ratio in Sweden is only around 1.5. Moreover, the countries with a high degree of pre-tax earnings equality tend to be those with very high tax rates.[20] Marginal tax rates tend to be highest in the Nordic countries, somewhat lower in central/continental Europe,[21] and lowest in Anglo-saxon and Southern European countries. The variation in tax rates is substantial. At the low end, we have Spain where the average effective marginal tax rate is only 36 percent. At the other end, Belgium has a tax rate that is close to 70 percent.

The Nordic countries also have some of the highest tax burdens on labor force participation for the low-skilled. In countries such as Denmark and Sweden, participation tax rates are largest at the bottom because the implicit tax on working created by generous earnings- and work-tested benefits weigh more heavily on low-income people. Moreover, unemployment insurance benefits can be subject to a floor so that replacement rates for low-wage earners can be very high in some cases. By contrast, countries such as Greece, Luxembourg, Spain, and the United Kingdom have relatively lower tax rates at the bottom because minimum income programs do not exist or are modest relative to earnings, because tax rates on earned income tend to be small and/or because they operate in-work benefits which partly offset the loss of social assistance or unemployment benefits at the point of entry. Notice, finally, that Ireland and France have relatively high participation tax rates compared to their marginal tax rates.

Table II shows estimates of the equity-efficiency trade-off for the two kinds of welfare policy. We define this trade-off as the Euro value of the welfare loss for those who lose from the reform (the rich) in proportion to the Euro value of the welfare gain for those who gain (the poor or working poor). In other words, the trade-off gives the welfare cost to the rich from the transfer of one additional dollar of welfare to the poor. If a given redistributional reform reduces economic

[20] This is contrary to the policy recommendation in the optimal tax literature. In this literature, a high degree of equality in abilities/productivities tend to make redistribution more costly, so that optimal marginal tax rates are lower. Of course, the pre-tax earnings distribution is in itself affected by the tax system, and does not measure the ability distribution relevant for optimal taxation. However, the presence of high marginal tax rates would normally lead to labor supply responses making the pre-tax earnings distribution (with the tax system in place) *more* unequal than the ability distribution without a tax system. Hence, this point serves to reinforce the contradiction between optimal and practical policy. Of course, this gap between optimality and practice might be explained by other differences across countries such as different social preferences for distributional equity. It should also be kept in mind that the optimal tax model is not really a model to explain actual government behavior, but one to analyze to best possible behavior under a given set of government preferences.

[21] Luxembourg is an exception. As other smaller and very wealthy European countries or principalities such as Liechtenstein or Switzerland, tax rates are significantly lower in Luxembourg than in other larger continental European countries.

efficiency, the welfare cost on the rich from transferring an additional Euro to the poor will be larger than one Euro. That is, in the process of redistributing income from rich to poor something is lost due to behavioral responses, giving rise to a trade-off larger than one.[22] The benchmark case where the trade-off is equal to 1, so that the welfare gain of the poor is exactly equal to the welfare loss of the rich, reflects the situation where a reforms involves no efficiency cost (or gain). Finally, if the trade-off were to be less than one, there is no conflict between distributional equity and economic efficiency for the reform under consideration. The trade-off measure used here was originally proposed by Browning and Johnson (1984).

Redistributing income to the poor by increasing the level of universal transfers leads to efficiency losses in all countries, implying a trade-off larger than one. For most European countries, expanding the generosity of traditional welfare programs creates large efficiency costs: for 11 out of 15 countries, redistributing one additional Euro to low-income individuals requires a reduction in the welfare of high-income individuals by 2 Euros or more. This is due to the fact that most European countries already impose quite large marginal tax rates on earnings. The largest trade-offs are found in the Nordic and Continental European countries where taxes and benefits are high. In fact, the 6 countries with the highest trade-off between equity and efficiency are identical to the countries having the highest marginal tax rates in Table I. Likewise, the lowest trade-offs are associated with the countries with the lowest marginal tax rates.

[Table II]

A completely different picture emerges once we turn to the working poor policy. For all countries, the equity-efficiency trade-off is substantially lower for this type of reform. In fact, for Denmark, France, Ireland, Portugal, and Spain, the policy would create an aggregate welfare gain such that the trade-off is lower than 1. Hence, in these countries it would cost less than 1 Euro for the rich to transfer 1 Euro to the working poor. In the case of Denmark, the trade-off is very close to zero – it costs close to nothing for the rich to give money to the working poor – implying the the reform is (almost) Pareto improving. For a number of other countries, the working poor policy creates very small efficiency losses such that the trade-off is quite close to one. This applies to countries such as Austria, Greece, Luxembourg, the Netherlands, and

[22] Okun (1975) used the metaphor of a *leaky bucket* to illustrate the efficienly loss taking place in income redistribution.

the United Kingdom. In these countries there is no significant trade-off between efficiency and equality when we consider redistribution from the rich to the working poor. Only in the case of Finland and Sweden does the working poor policy involve an unfavorable equity-efficiency trade-off, which reflects in part the extremely equal earnings distribution in these two countries.

A comparison of Table I and Table II reveals that countries with relatively high participation tax rates at the bottom of the earnings distribution, such as Denmark, Ireland and France, tend to gain more by choosing a working poor policy rather than a traditional welfare policy. The working poor policy creates higher incentives for participation in the labor force. Moreover, participation rises mainly at the bottom deciles where participation elasticities are large. If participation tax rates are very large at the bottom deciles, the increase in labor market participation creates a large increase in government revenue (through reduced benefit expenditures and a higher tax take) and hence in economic efficiency.

Ceteris paribus, the presence of a highly equal pre-tax earnings distribution tends to make redistribution very costly. This applies to redistributional policies in general, and to the working poor policy in particular because it attempts to redistribute only within the group of workers who are more equal than the entire population of workers and non-workers. The presense of strongly compressed wage distributions in Scandinavian countries (cf. Table I) are often mentioned as an argument against pursuing in-work benefit reform in this region. It is therefore interesting that the working poor policy seems to be extremely desirable in Denmark, more so than in any other country. The explanation is that participation tax rates are very high in Denmark, especially in the bottom deciles where participation elasticities are also high. In the simulations, this effect strongly dominates the effect of a compressed earnings distribution. On the other hand, the working poor policy is less desirable in Finland and Sweden, because participation tax rates at the bottom are somewhat lower there and because the earnings distribution is even more equal than in Denmark. It is important to realize, however, that the equity-efficiency trade-off is even worse for the traditional welfare policy in Finland and Sweden. The bottom line is that both kinds of redistribution are very costly in these two countries, at least on the margin, due to the combination of an already equal distribution and high tax rates.

Besides the presence of an equal earnings distribution, a potential argument against working poor policies in Scandinavia is that participation elasticities might be significantly lower in this region than in, say, Anglo-Saxon countries. It is true that most of the estimates of high

participation elasticities were based on the United States and the United Kingdom where female labor force participation rates have been lagging behind those of Scandinavia, creating more room to increase participation through in-work benefits targeted at low-income females. This argument is potentially important and points to the need for good empirical studies on the responsiveness of labor market participation. Still, there are several counter-arguments that one can make at this point. Firstly, as mentioned in Section 2.1, there are some empirical studies suggesting that female participation elasticities may be high even in Nothern European countries (Germany, Sweden, and the Netherlands). Secondly, while female labor force participation is relatively high in Scandinavia, there is in fact substantial non-participation among a number of demographic subgroups (e.g. immigrants, single mothers, and the young). In Denmark, around 1/4 of those in the working age (15-64) is outside the labor market. Thirdly, and perhaps most importantly, even if participation elasticities were to be substantially lower in Scandinavian countries, a working poor policy may still be desirable due to the fact that the existing welfare system is a lot more distortionary. This argument is very important for Denmark where participation tax rates, in an international perspective, are extremely high at the bottom of the income distribution. In Immervoll *et al.* (2005), we find that the equity-efficiency trade-off for the working poor policy is exactly equal to 1 in Denmark – implying no efficiency loss for this type of redistribution – at an average participation elasticity for the population equal to 0.13, a number far below the existing international estimates.

To conclude this section, expanding traditional welfare programs have very different implications than introducing in-work benefits. Increasing redistribution through traditional welfare can lead to significant negative labor supply responses along both the intensive and the extensive margins. By contrast, in-work benefit reform generates positive labor supply responses along the extensive margin (along with a negative response along the intensive margin). As a result, the efficiency cost of redistribution through this type of reform is much smaller.[23]

[23] It needs to be emphasized, however, that the groups who benefit from redistribution in the two reforms are different. In the traditional welfare case, those who benefit the most are people with no earnings at all, presumably those who are the most in need of support. In the in-work benefit case, people with no earnings receive no additional support and redistribution benefits only the working poor. Finally, notice that the implementation of one policy does not exclude the other policy. Hence, the two policies should be seen as complements rather than substitutes in the design of redistribution policy.

6 Discussion

In this survey, we discussed some recent research on the effects and design of redistributional policies, emphasizing the distortionary effects of taxes and transfers on labor supply behavior, employment and economic efficiency. We paid special attention to the modern labor market literature showing that labor force participation is more responsive to taxes and transfers than is hours worked. It was shown that the presence of significant participation responses tend to make in-work benefit reform inducing individuals from welfare into work a desirable policy option. By contrast, traditional welfare policies providing either universal or earnings-tested benefits are very costly in terms of government revenue and efficiency resulting from adverse effects on labor force participation. This point is reinforced by the fact that earnings- and work-tested benefits generate the highest effective tax rates on labor force particiaption at the bottom of the earnings distribution where participation elasticities are particularly high.

It needs to be emphasized, however, that the individuals who gain from in-work benefit reform are different from those gaining from traditional welfare policies. In the latter case, those who benefit the most are people who are not working and have zero earned income, presumably those in the strongest need of support. With in-work benefit policies, people with no earnings receive no additional support and redistribution helps only the working poor. As a result, if the government has extremely strong redistributive tastes and put a much higher welfare weight on those with no earnings than on the working poor (such as in the case of a Rawlsian welfare criterion), it is possible that expanding traditional welfare would be more desirable than introducing in-work benefits. By contrast, if the government puts lower welfare weights on those with no earnings than on the working poor, the case for in-work benefits would be even stronger. It seems that conservative governments (especially in Anglo-Saxon societies) tend to hold the latter view: those not working are seen as "lazy", whereas the working poor are seen as "deserving".

While the implementation of benefits targeted to the working poor was pioneered by the United States (starting in the 1970s), in-work benefit reform has recently been high on the agenda in political discussions of welfare reform in Europe. The first European countries to introduce in-work benefit programs were the United Kingdom (in 1988, subsequently expanded in 1999) and Ireland (in the early 1990s). In the past 10 years, a number of other European

countries have introduced programs of a similar kind. France introduced an in-work benefit program as of 2001 ("Prime Pour l'Emploi" or premium for employment). The Netherlands introduced an Employment Tax Credit in 2001, while Belgium has been phasing-in an Earned Income Tax Credit program from 2002 to 2004. Germany introduced the so-called "Mainzer Modell" program in 2002 which, more recently, has been replaced by SSC reductions available to low-wage earners. Finland has recently introduced and then expanded an Earned Income Tax Allowance, and Denmark introduced a similar type of program on a small scale in 2004. Finally, while the Italian family benefit has not normally been considered an in-work benefit, it increases with the number of days worked. However, with the exception of Ireland and the United Kingdom, the European in-work benefit programs are still modest in size with maximum annual benefits between 300 and 1000 Euros (see OECD, 2004, for the most recent and systematic description of these programs). Therefore, the "small reform" methodology adopted in this paper would seem to provide a good approximation of the effect of introducing these programs. Our results lends support to the conjecture that these policies constitute a very efficient type of redistribution, and that the expansion of such policies should perhaps be part of future welfare reform.

The simple labor supply model underlying the analysis in this paper abstracts from a number of issues which we would like to discuss briefly. First, and perhaps most importantly, we have assumed that the labor market is perfectly competitive. This might be a poor approximation to European labor markets, where minimum wages tend to be substantial, and where wage rates are often the result of bargaining between unions and employers. Minimum wages prevent employers from paying wages which are below a defined minimum, thereby eliminating jobs with very low productivities and potentially creating involuntary unemployment among the low-skilled. Likewise, union bargaining models, efficiency wage models, and search models imply that a fraction of individuals become involuntary unemployed.

The effects of taxation in imperfect labor markets have been explored in a number of papers (see, e.g., Hansen *et al.*, 1996). The introduction of imperfections will not change the most important mechanisms at work in our analysis. Firstly, variation in aggregate employment is still the result of behavioral responses along the intensive and the extensive margins. For example, Sørensen (1999) considers optimal taxation in three different models of involuntary employment (unions, efficiency wages, and search) where both intensive and extensive responses

are present. Secondly, in all imperfect labor market models, a reduction of average tax rates leads to higher employment, where the effect is channelled through lower equilibrium wages. Accordingly, a working poor policy would lead to increased job opportunities, while a demogrant policy would reduce the chances of finding a job.[24]

While the most important employment effects would survive the introduction of labor market imperfections, the welfare implications of changed labor force participation would be affected by the presence of involuntary unemployment. Following the introduction of in-work benefits, those who obtain jobs would experience a discrete (as opposed to an infinitesimal) increase in utility because some of them were previously involuntarily unemployed. This reinforces the positive effect of the working poor policy on welfare. Increasing traditional welfare programs, on the other hand, creates higher unemployment. To the extent that people lose their jobs involuntarily, the welfare loss is exacerbated relative to the case of voluntary unemployment. In conclusion, a model with labor market imperfections generating involuntary unemployment would most likely increase the attractiveness of redistributing to the working poor and reduce the attractiveness of increasing traditional welfare programs, thereby reinforcing the main conclusion of this paper.

Second, there might be issues related to the presence of segmented labor markets. A well-known hypothesis is that labor markets tend to have a dual structure, being segmented into a perfectly competitive sector offering low-paying, low-productivity jobs and an imperfectly competitive sector offering high-paying, high-productivity jobs. Indeed, labor economists have gathered considerable evidence in favor of the dual labor market hypothesis (see, e.g., the survey by Saint-Paul, 1996, pp. 62-68). In the dual labor market model, there is a distortion in the allocation of employment in favor of the perfectly competitive sector offering low-paying jobs. As pointed out by Bulow and Summers (1986), this implies that the government ought to use industrial policy to shift resources away from the low-productivity sector. In the context of tax reform, Kleven and Sørensen (2003) show that such sectoral distortions tend to make policies aimed at the working poor less attractive, because they promote bad jobs at the expense of

[24] In one respect the imperfect labor market models do involve different comparative statics than the competitive model. This difference relates to the effect of changes in the marginal tax rate. A higher marginal tax rate (for a given value of the average tax rate) may lead to a lower equilibrium wage rate which, ceteris paribus, imply higher employment. At the same time, higher marginal tax rates give rise to lower working hours for those who are working as in the standard competitive model. However, the important point to note is that these effects would apply to both the demogrant and the working poor policies, since both types of reforms increase the marginal tax rate. The main difference between the reforms lies in their implications for the average effective tax rates at the bottom of the earnings distribution.

good jobs. A policy which succeeds in increasing aggregate employment by promoting low-paying jobs may, in theory, reduce welfare as it creates a deterioration in the sectoral mix of employment. It seems unlikely, however, that a composition effect of this sort would be able to dominate the large gains from a higher level of employment at the bottom of the distribution. Even with segmented labor markets, it remains the case that higher employment at the bottom create large effects on government revenue (and hence efficiency) as participation tax rates are particularly high at the bottom

Labor force participation may also generate externalities. Positive externalities of working would make the introduction of in-work benefits even more attractive relative to traditional welfare, while negative externalities would make in-work benefits less attractive. Some of these externalities take the form of fiscal externalities, where higher employment rates affect the demand for certain commodities that are initially taxed or subsidized by the government. For example, higher employment may generate more demand for child care, which would then create positive or negative externalities depending on whether this commodity carries a positive or negative tax rate (in the Nordic countries, for example, child care is heavily subsidized). Externalities could also come in the form of social externalities. Positive social externalities would be reduced crime (as working individuals have less need and time to resort to criminal activities), newly employed parents being better role models for their children (which could increase the incentives of children to do well at school, etc.). Negative externalities are also a possibility if working reduces the time that parents can devote to their children and therefore worsen the quality of parental education.

Finally, a large body of work in behavioral economics has shown that individuals are not always able to make the best decisions for themselves, especially when those decisions involve intertemporal trade-offs. In the case of labor supply, it is conceivable that some individuals may not perceive the full future benefits of starting to work, or procrastinate in the decision to leave welfare and start working. Such models with inconsistent time preferences generate so-called internalities (Herrnstein *et al.*, 1993) that are conceptually close to externalities: an individual may not internalize fully the utility of future selves and hence decide to work too little today. As a result, in-work benefits may be desirable to induce people to work more and help correcting such internalities.

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TABLE I

Ranking of 15 EU countries according to earnings inequality and tax rates

Equality of pre-tax earnings

Low ……...……...…….. High
UK IR LU SP AT NL BE GE PT FR GR IT DK FI SW

Average effective marginal tax rate on labor income

Low ……...……...…….. High
SP GR UK LU PT IR NL AU IT FR GE SW DK FI BE

Relative tax burden on labor market participation of low-skilled individuals

Low ……...……...…….. High
GR LU AT UK GE SP IT NL BE PT FI FR SW IR DK

Source: Authors' own calculations based on EUROMOD simulations reported in Immervoll *et al.* (2005).

Note: The calculations are based on a sample of individuals aged 18 to 59 who have been working the whole year. The tax and benefit rules we consider are those that were in place in 1998. The earnings equality is measured as earnings in the lowest quintile relative to earnings in the highest quintile. The average effective marginal tax rate equals the sample population average of the individual tax rates. The relative taxation on labor market participation of low-skilled individuals is calculated as the average tax rate on participation for those in the first 3 deciles of the earnings distribution relative to the sample average.

TABLE II

Trade-off between equity and efficiency across 15 EU countries

Traditional welfare policy

Trade-off	Countries
1.5 - 2	GR LU SP UK
2 - 4	AT IR IT NL PT
4 - 25	BE DK FI FR GE SW

Working poor policy

Trade-off	Countries
0 - 1	DK FR IR PT SP
1 - 1.5	AT GR LU NL UK
1.5 - 5	BE FI GE IT SW

Source: Table 2 in Immervoll *et al.* (2005).

Note: Trade-off denotes the ratio of the welfare loss of losers to the welfare gains of gainers from the reform. We report the results from the baseline elasticity scenario considered in Immervoll *et al.* (2005). In this scenario the hours-of-work elasticity equals 0.1, while the participation elasticity for the aggregate economy is equal to 0.2. The calculations are based on tax and benefit rules that were in place in 1998.