The 2001 Belgian Tax Reform: Equity and Efficiency

by

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Abstract

During last decade, improved macroeconomic and budgetary conditions have allowed for fiscal reforms in several EU countries. The main aim behind personal income tax reforms across Europe has been to reduce the tax burden on labour and to encourage work - especially for less productive workers. In this context, Anglo Saxon countries and more recently Continental European Countries, including Belgium, have shown increasing interest in tax-benefit instruments awarding monetary transfers or tax reductions, conditional on employment. Using a discrete hours labour supply model, this paper assesses the impact of the 2001 Belgian Tax Reform on female labour supply. Results suggest that labour supply responses are moderate but significant by international standards. Yet, due to an uneven calibration of tax rebates and in-work benefits, the potential labour supply responses are rather dispersed over the whole range of the income distribution. Consequently, the gains from the reform do not appear to be evenly distributed across taxpayers.

Key Words: Micro-Simulation, Tax-benefit System, In-work Benefits, Fiscal Reform, Household Labour Supply, Multinomial Logit.

JEL Classification: D31, H21, H23, H24, H31, J22.

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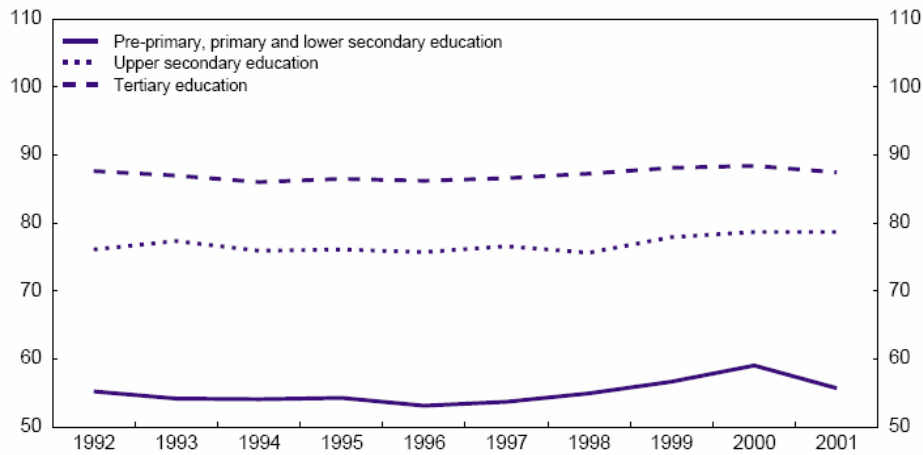
Figure 1: Employment rates by educational level in Belgium. Source: Carey (2003), LFS data.

1   Introduction

Boosting public spending between the early 70s and the mid 80s rapidly deteriorated Belgium's public finance. Efficient budgetary measures taken in the early 90s in order to meet the Maastricht criteria have recently brought primary outlays back in line with the average EU level, yet total government outlays remain high, due to high debt servicing costs. At the same time the tax burden, and especially the tax burden on labour, is amongst the highest in Europe (Carey,2003).

Recently, cross-country empirical studies on the potential negative effects of the tax burden on employment have been surveyed by De Haan et al. (2002). They conclude that, although the overall effect of the tax wedge is probably smaller than earlier estimates, its effects are greater in continental European countries, due to an intermediate level of labour market centralization.

Particularly harmful are the effects of heavy taxation on the employment level of low skilled workers (Layard and Nickell, 1999). High tax wedges and high replacement rates[1] are the main causes of persistent lower employment rates in the less skilled population. Fig. 1 shows the evolution of employment rates for low skilled, medium skilled and high skilled workers. Obviously efforts to raise the employment rate should be directed towards the less skilled, for whom financial gains from taking up work are significantly lower.

The picture is even more dramatic if we break down employment rates by sex. Fig.2 decomposes the employment rate of men, single women and married

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[1]Replacement rates are usually defined as the ratio of disposable income when unemployed or inactive to disposable income in employment. For an analysis of replacement rates across EU countries see Immervoll and O'Donughue (2003).

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	Education			
Sex	Low	Medium	High	*Total*
Men	70.0%	87.0%	91.0%	*82.0%*
Women	39.5%	68.0%	83.3%	*62.0%*
- Single	41.0%	70.5%	85.4%	*65.9%*
- Married	38.9%	66.8%	82.1%	*60.2%*

Source: Author's calculations based on LFS (2001)

Figure 2: Employment rates (males and females aged between 25 and 59)

women[2]. In particular, it is the group of married women[3] that shows the lowest employment rates (just about 60%), of which more than half is represented by atypical part time (5 to 15 hours of work per week) and part time.

A significant tax reform was introduced in Belgium over the period 1988-1993 (Decoster and Al., 2002). The reform implied a shift from a joint family taxation (which is known to be a strong disincentive to married women's labour supply) towards a broadly individualized system. Other aspects of the reform were (i) the broadening of the tax base, (ii) the abolition of the highest marginal tax rates (the highest marginal tax rate was as high as 70.8%), (iii) the collapse from 14 tax brackets into 7, the abolition of the zero tax bracket and of several deductible expenses and the introduction of new tax credits. Unfortunately, no study has yet focused on the potential labour supply responses to such deep reform.

Historically, more attention has been devoted in Belgium to demand side measures, probably due to the high structural unemployment level. The reduction of employers' Social Security Contributions (SSC) for low paid workers has been promoted as early as 1988 by a group of economists known as *"the group of the seventy-two"* as a means to increase low skilled employment. At that time the proposed reduction was in the order of 22500 BEF per year, i.e. approximately 65 EUR per month in 2004 values. Using the macro-model HERMES, Van der Linden (1991) estimated that such reform would reduce unemployment by around 25000 units. SSC reductions have indeed characterised most of the 90s, first following a rather scattered pattern. Since 1994, however, the reduction of SSC has been generalized to all low paid workers, while additional reductions have been granted to employers hiring youngsters, long-term unemployed and other disadvantaged groups. The effects of the recent reduction of employers' social security contributions have been estimated in a recent IMF

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[2] The figures unfortunately refer to official marital status and may give a partially biased view of the reality as employment rates in de facto couples are very similar to those of married couples.

[3] According to recent statistics, there are approximately 1,700,000 married women of working age in Belgium in 2001. The corresponding figure for single women is 783,000. This figure, however, also includes females living in de facto couples.

analysis (IMF, 2001). Using a demand driven aggregated model and reasonable hypotheses of labour demand elasticity, IMF economists have estimated that the forecasted reduction in the tax wedge will bring about an increase in the employment rate of 1 percentage point, which is in line with previous estimations based on HERMES.

In recent years, however, important reforms have tried to tackle the inactivity trap from a labour supply perspective. Starting from 1999 the federal socialist-liberal government (the green party which was part of the first government coalition is no longer in power in the second mandate) has taken major steps towards further reduction of the tax burden on labour.

The first measure was the introduction of substantial reductions in employees' Social Security Contributions (SSC) for low paid workers. In a second step the government has passed a bill for the progressive abolition of the Contribution Complémentaire de Crise (CCC), an additional surcharge that had been introduced during the tough budgetary crisis of the early 90s. The employees' SSC reduction has increased steadily in the period 2001-2004, reaching 104 EUR per month, but it is targeted at low skilled workers and phased out for higher earnings.

Notwithstanding the large stock of public debt, the Belgian government decided that by 2001 the macroeconomic conditions and the status of public finance allowed for a second reform of the personal income tax[4], which, amongst other purposes, included a positive effect on labour supply. The reform was estimated to have a budgetary cost of 3.33 billion EUR, corresponding to a decrease in tax revenue by almost 10%.

This paper assesses the impact of the 2001 Belgian tax reform on the labour market, focusing on the labour supply of females living in couples: arguably the group with the highest labour supply potential. Using a methodology largely exploited in the recent economic literature on ex ante evaluation of tax benefit reforms, this paper significantly extends previous static analyses, such as those performed in Decoster et al. (2002) and Valenduc (2002) for the 1988 and 2001 Belgian tax reform respectively. Employment dynamics, so far analysed in the framework of partial equilibrium macro-models, such as in Saintrain (2002), are hence integrated into our welfare analysis of the tax reform, using a fully structural supply-driven micro-economic approach.

2 Recent tax-benefit reforms in the EU

Major welfare state developments were achieved in Europe between the end of the 60s and the early 70s. In the fast growing European economies of the post-war era, the main concerns were to assure income protection against labour market risks as well as to guarantee fair income distribution and minimum standards of living, through a sophisticated tax benefit system and tight labour

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[4] De Callataÿ (2002) argues that the term 'tax reform' is partially misleading given the substantial continuity of the new tax code with the previous one, and prefers the term 'tax reduction'.

market legislation. Some 30 years later, in a profoundly changed economic environment, the same instruments that were once viewed as the foundations of the European welfare state, are increasingly seen as one of the causes of Europe's persistently low employment performance. On the one hand generous income assistance and unemployment benefits reduce the financial distress of inactivity, whilst on the other hand heavy tax burdens reduce the financial incentives to take up work, especially for less productive workers. Potential financial gains to taking up a job are hence very limited, if not negative, generating inactivity and poverty traps[5].

The situation is particularly dramatic in continental Europe, which heavily depends on a high wage strategy for its labour contribution financed and insurance based Bismarkian welfare state, with generous passive work-related transfers, and relatively sticky labour markets characterized by rigidly structured industrial relations (Esping-Andersen, 1990). The fact that labour market performance of less skilled workers has been particularly poor in these countries is confirmed by a recent study of Davieri and Tabellini (2000). The authors argue that the heavy burden in terms of labour costs, combined with an intermediate degree of labour market centralization is the main cause of persisting poor performances.

The driving forces behind these trends are well known: exactly at the time when the architecture of the western welfare state was finalized, the economic and social environment that had fostered its growth started to deteriorate. The dynamic industrial production, based on ever increasing economies of scale and on the abundance of raw materials, started to slow down, while at the same time household demand for industrial goods showed the first signs of saturation; changing gender roles significantly increased family instability and the poverty risk and growing female labour supply boosted unemployment rates; technological change and globalization favoured industrial delocalization; lower labour productivity in the service sector coupled with high labour costs designed to finance the welfare state did not allow for a rapid absorption of less productive workers, trapping them in poverty.

The perceived failure of the social model built throughout the 60-70s and the growing budgetary costs of the welfare state prompted neo-liberal tax reforms in many EU countries. After the budgetary efforts connected to the Maastricht criteria, the last 5 years have witnessed many EU countries paying back the dividend of the financial restrictiveness of the early 90s through more or less extensive tax cuts. The reforms that have recently interested EU countries have been seen by some as pragmatic responses to growing pressures coming from globalization, the need to reduce the tax burden on labour and the constraints imposed by the Maastricht treaty, rather than the consequences of an ideological swing (Bernardi and Profeta, 2004). In this respect it should be noted that reforms have been carried forward by both left and right wing majorities. On the other hand, the role of *workfare* as the dominating paradigm of recent tax-

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[5] For a detailed discussion of inactivity and poverty traps at the European level, see Périvier (2003).

benefit reforms clearly marks the distance with respect to more traditional left wing values: equity and income redistribution are less of a political priority than they used to be. In other words, the recent reforms witness the softening of ideological resistance to workfare policies [6] and passive compensation for the low skilled is being complemented by more or less generous transfers aimed at making work pay, through low wage subsidies.

In this section we will review the most significant recent tax reforms in the EU, paying particular attention to the different schemes of in-work benefits (IWB) put in place.

2.1 Recent tax reforms in the EU

This section will describe the most significant reforms recently implemented (or planned) in the EU. We will focus on the experience of Germany, the Netherlands and Italy. Other significant reforms were introduced in Scandinavian countries (namely Sweden and Denmark) almost 10 years ago, and minor reforms were implemented in France, Austria and Spain. For a detailed review of these reforms, see Sterdyniak (2003) and Bernardi and Profeta (2004).

2.1.1 Germany

As part of the Agenda 2010, a comprehensive package of measures to re-launch the German economy, in 2001 the German parliament has adopted a large reform of the income tax system raising the basic personal allowance and significantly lowering tax rates (Bundesregierung, 2004). The official objective of the reform is to decrease the overall tax burden, especially on low-paid workers, in order to stimulate employment. The reform is progressively being phased in over the 2000-2005 period. By 2005, the tax rate in the first tax bracket should have fallen to 15% (from 22.9% in 2000) while the top rate should have been cut to 42% (from 51% in 2000) in accordance with international standards. The personal income tax allowance will be increased from 6,902 up to 7,664 EUR in 2005, but will continue to be non-refundable. Hence, the maximum net gain obtained in the first tax bracket will be around 1,115 EUR per year.

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[6] The key element behind the introduction of workfare policies, notably the EITC in the US, was conservative Americans' long standing phobia for a state fostering welfare dependency instead of self sufficiency and responsibility. Workfare, instead of welfare became the ideological notion behind welfare reforms promoted by the new conservative administrations that came in force in the US and a few years later in the UK (Peck, 1998).

Given such an uncomfortable "ideological inheritance", it is not surprising that workfare policies have long been discredited by the European socialist parties and left wing intellectuals as concealed strategies to scale back the welfare state or to govern social conflicts by subordinating social policy to the needs of flexible labour markets (Jessop, 1996).

Welfare to work, nevertheless, was successfully integrated in Clinton's welfare reform act and is one of the key elements of Blair's New Labour's pragmatic view of modern welfare states (Giddens, 1998). As the original ideological background fades away, several governments in continental Europe have also started to view workfare policies as a necessary evolution for a welfare state that faces multiple pressures due to deindustrialisation, globalisation, and family instability.

In addition, several proposals have been made to subsidize low-wage earners through extended exemptions from social contribution payments. Three of them have ranked high on the German political agenda and have been reviewed by Bonin, Kempe and Schneider (2002). Interestingly enough, with respect to the previous discussion on individual vs. family-based policies, two of these proposals employ subsidy schemes based on individual earnings whereas the third subsidy derives from a joint income assessment in the couple. The CSU (resp. SPD) proposal consists in exempting monthly earnings below 400 EUR (resp. 510) from contributions to social insurance, which raises the 2002 income bound by 75 EUR, and in phasing out the exemption until gross earnings reach 800 EUR (resp. 1280). Under the other policy model (the so-called Mainzer model), entitlement to the reduction depends on a joint assessment of household labour income and the lower and upper bounds of the phase-out region are respectively 650 and 1590 EUR for singles and twice these amounts for couples. This way, the policy covers a wider range of earnings, including a large share of one-earner couples. Bonin, Kempe and Schneider find very small estimates for the wage elasticities and conclude that these subsidy policies will not be very effective. Indeed, although the 400 and 800 EUR bounds have been applied since April 2003, new orientations tend to privilege workfare concepts, that is, to make social benefits conditional on atypical part-time work ('mini-jobs').

2.1.2 The Netherlands

The Netherlands has also introduced an important tax reform in 2001 (Ministerie van Financiën, 2001). The reform implied a modular structure according to which incomes are taxed separately according to their source. The new tax system explicitly recognizes the difference between more and less mobile productive factors: income from labour, pensions and imputed rents from owner occupied dwellings are globally taxed under one taxing regime. Income from capital on the other hand is imputed from total wealth (an effective interest rate of 4% is assumed), irrespective of the composition of the portfolio, and taxed at a flat rate of 30%. Finally, the new system aligns the tax burden on different forms of capital income, thus reducing tax induced distortions in the capital markets, but continues to differently tax different sources of income. At the same time, however, the reform has significantly decreased the tax burden on labour income, by increasing tax credits for children and reducing marginal tax rates: new minimum and maximum marginal tax rates are 33 and 52% (prior to the 2001 reform the highest marginal tax rate was at 60%). A feature that was particularly discouraging to female employment was the existence of a transferable personal tax deduction. If one of the partners did not work, the credit could be transferred to the other partner. Given that females are more often the secondary earner in a couple, the measure introduced a significant disincentive for women to work over a certain threshold (which, according to Das and Van Soest (2000) partially explains the widespread diffusion of very short working hours in the Netherlands).

Another significant change was the alignment of the personal deduction for

one-earner and two-earner families. The new reform has limited the scope for tax credit transfers between spouses and has introduced an individualized tax credit. The latter will be analyzed in greater detail in the following section.

2.1.3 Italy

The reform of the tax system that is being studied by the Italian government is also of interest to the present paper (although the tax bill has not yet been approved by parliament) as it arguably represents the most neo-liberal tax reform that any country in continental Europe is currently planning to introduce. The reform of the tax system was one of the major pre-electoral engagements of the Berlusconi government. Despite the business cycle dynamics, the considerable deterioration of public finance in the first years of the mandate and the recent resignation of the finance minister, the governing coalition seems determined to undertake the considerable reduction in the tax burden. It is still difficult to have a definite picture of the shape of the tax reform. The last relevant parliamentary act dates back to the 21st December 2001. Parliament adopted a so called "framework law", by which it charged the government with elaborating a reform proposal within the general framework conditions dictated by parliament itself. Baldini and Bosi (2002), relying on the text of the framework law and the parliamentary text to introduce the bill, describe the most likely features of the new tax system and estimate its distributional impact. The reform is clearly inspired by the Flat Rate Tax (FRT) model, yet it is different from the most basic model on several aspects. In the first place, existing tax schedules will collapse into two tax brackets: the marginal tax rate will be at 23% between 0 and 100,000 EUR and at 33% thereafter[7].

The progressivity of the tax system will be assured by a series of (non-refundable) tax credits. Differently from the standard FRT model, however, the tax credits will vary in accordance with personal labour market status (i.e. inactive, employee or self-employed) and family conditions (number of dependents). The maximum individual tax credit (or no-tax area, NTA hereafter) could thus vary from 3,000 EUR for an inactive single to around 11,000 EUR for an employee with dependent partner and one dependent child (3,000 EUR as a basic tax credit plus 4,000 EUR as a tax credit on employment income and 2,000 EUR for each dependent family member). Beyond the NTA, the tax credit will be tapered away at a rate of probably 40-50%, meaning that no tax credit will be available for a tax payer with taxable income around 35-40,000 EUR (the figure refers to an employee with two dependent family members).

The authors conclude that the tax reform will be a Pareto improvement, also due to a clause that will make the old system applicable, should the latter be more advantageous for the taxpayer. Yet, the benefits of the reform will be concentrated on the lower and upper part of the distribution, with particular benefits delivered to the self-employed and two-earner families with few or no

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[7] According to Baldini and Bosi (2002) taxes in the new system will be flat-rate for about 99% of taxpayers.

children[8]. The gains, on the contrary, will be particularly limited for the wide range of households in the middle of the distribution. However, the dynamic effects of the reform remain unexplored, but it seems likely that it will have a positive impact on labour supply of secondary earners.

2.2 In-work benefits: towards a European Model?

In-work benefits (IWB) are in-work conditional transfers aimed at increasing the financial incentive to take up work, while maintaining a socially acceptable distribution of income. IWBs are a key element of supply-side workfare policies, which aim at promoting self-sufficiency. More in general, IWBs may be seen as hybrid instruments designed to reshape the link between employment, solidarity and social justice in the new century's welfare state. Given their hybrid nature, it should not come as a surprise that at least two broad motivations may be put forward to justify their implementation (Pearson, 2002):

(i) economic inclusion: i.e. the economic mainstreaming of society's most vulnerable individuals, with positive feedbacks coming from decreased spending on income maintenance and poverty related social problems like poor health or crime;

(ii) redistribution: i.e. increasing the financial resources of the weakest fraction of the population, with positive feedbacks coming from increased social cohesion.

Nevertheless, the eligibility conditions, the overall design, the generosity and the relative importance attached to employment per se and redistribution vary significantly across countries that have implemented such benefits. In particular, there is a substantial difference between a first generation of IWB (implemented in Anglo-Saxon countries) and a second generation of IWB recently implemented in Continental European countries.

It may be argued that IWB in Continental Europe have been differently "tailored" to respond to national differences in the framework conditions[9]. However, political constraints and social acceptance of reforms also differ profoundly across countries, so that it should not come as a surprise that IWB have had varying degrees of success across the countries which have implemented them. In particular, IWB in Continental Europe tend to be individualized and universal measures reflecting a widespread distate for means-tested measures. The main drawback is of course that the amount of the benefit tends to be much lower.

In the following paragraphs we briefly analyze some of the instruments recently implemented or reformed in EU countries, such as the Working Family Tax Credit (WFTC) in the UK and the *Prime Pour l'Emploi* (PPE) in France, while the appendix presents information on the Earned Income Tax Credit (EITC) in the US and on the Canadian experimental Self-Sufficiency

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[8] It should be noted that Italy already presents the lowest level of social support for children: most of the benefits are delivered through the tax system as there is no universal child benefit.

[9] Pearson (2002) mentions amongst other factors a more compact income and wage distribution and relatively higher Effective Marginal Tax Rates.

Programme (SSP). The EITC, in particular, is a measure which has largely inspired the WFTC and indeed all existing in-work tax credits. A short overview of these measures aims at showing the differences between Anglo-Saxon measures and the IWBs recently implemented in Europe, in order to better understand the originality of the Belgian measure contained in the 2001 Tax Reform package.

2.2.1 The British Working Family Tax Credit

In the late 90s, the WFTC replaced the FC which had been introduced in 1986 as a form of support for low-income working parents. The WFTC which, relative to the FC, substantially increased the amount of the benefit, is conditional on working at least 16 hours per week, and not 24 as was the rule before 1992. In 2003, the WFTC was redesigned: social assistance for children (which is added to the universal child benefit) was made means tested and not conditional on the employment status of parents, whereas the in-work benefit was extended to people without children. The WFTC was therefore split into a Child Tax Credit (CTC) and a Working Tax Credit (WTC), which entails a clearer separation of anti-poverty and Making-Work-Pay (MWP) measures.

The new WTC is available to both singles and couples with or without children, although amounts vary according to family situation. Couples and lone parents are entitled to a maximum refundable credit of £3,025 per year, plus a bonus of £620 per year for those working 30 hours or more or more a week. Moreover, families with children in which all adults work, care or are disabled may receive help to cover costs of approved child care. The child care tax credit element of the working tax credit, which also characterized the WFTC, covers 70% of approved child-care costs below a generous maximum fee (£135 a week for those with one child under 16). The focus on child care cost is an interesting distinctive feature of the British in-work benefit, since it tackles one of the biggest impediments to women to taking up work.

Families with annual incomes below £5,060 are entitled to the full amount; at income levels above this threshold a taper of 37% reduces entitlement. The latter is exhausted at around £14,911 for a lone parent or a couple with or without children working full-time and at slightly less for singles. The crucial element of the WFTC and similar measures in the US and Canada is the income assessment at the household level. As we shall see, the latter tends to discourage secondary earners in couples, i.e. mostly females.

2.2.2 The French Prime Pour l'Emploi

In continental Europe and in Scandinavian countries, disincentives to take up paid work may be even stronger, due to the relative generosity of the welfare state. Up to 1998, France, for example, found itself in a paradoxical situation: an inactive person receiving the Revenu Minimum d'Insertion (RMI) was receiving more than a worker working half time at minimum wage.

Working full-time at the minimum wage, on the other hand, brought about

a financial gain of about €230. Hardly a significant incentive to take up work, especially if we consider the fixed costs a worker incurs when taking up a job. Such an inactivity trap was due to the fact that earned income was taken into account in the income test to compute housing allowance eligibility, whereas the RMI was disregarded (Périvier, 2003). In 2000, the French government reformed the housing allowance and introduced an in-work benefit, the *Prime Pour l'Emploi.*

To be eligible, at least one member of the household must be employed, taxable income must be lower than a certain amount (€30,050for a couple with two children) and individual earnings must be between €3,265 and €23,207 per year.

An interesting feature of the PPE is that it is strictly connected to the number of hours worked: earnings are in fact recomputed in full time equivalent, so that only unskilled workers with low hourly earnings are targeted, clearly distinguishing between low skills and low efforts. A full-time worker may therefore be eligible to a maximum benefit of €443 per year, whereas a part-time worker has the right to a maximum of €322 per year.

In addition, the French PPE presents some hybrid features: it is means tested on household income, but at the same time it is individualized in the sense that it is also conditional on individual earnings and more than one person in the household may be eligible.

2.2.3 The Dutch Arbeidskorting and the Italian No-Tax Area

The dislike for means-testing is more evident in the reform introduced in the Netherlands in 2001. Up to the introduction of the reform, taxpayers could benefit from a tax allowance of 12% of taxable income (up to a maximum of €1,465). Such a tax allowance was more generous for taxpayers with high earning capacity, and has hence been replaced by a more generous non refundable employment tax credit: the *arbeidskorting*. The maximum amount of the tax credit is €920, which is reached, with a progressive phase-in, at €15,117, i.e. the full-year equivalent of a full-time at minimum wage. One of the characteristics of the Dutch tax credit is the lack of phase-out: all people in employment are eligible for the tax credit.

The tax reform proposal currently elaborated by the Italian government is quite similar. The *No-Tax Area* (NTA) will be a non refundable tax credit which is phased out after attaining a certain maximum value[10]. Moreover, the size of the tax credit will change according to the employment situation, with an additional no tax zone for employment income of about €2,000. The NTA, however, will also consider the number of dependants - thus partially reintroducing the family dimension. Such additional employment disregard may well be considered, just like the *arbeidskorting,* an in-work benefit.

Differently from IWB in traditional terms, however, the tax credits are not refundable, so that employees and self-employed workers can only benefit up

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[10]Technically speaking the credit is not phased in, but since the credit is not refundable, the amount of the actual credit increases with income before attaining a maximum.

to the amount of tax paid. As we will see this represents the main innovative aspect of the Belgian measure, which is not only totally individualized, but also refundable.

3 Assessing fiscal and welfare reforms from a labour supply perspective: methodological frameworks and empirical findings

The deep fiscal reforms that have been implemented in the US and EU countries in the last decades have fostered a growing literature on the impact of changes in the budget constraint on labour market performance. Techniques based on microdata not only allow for a full costs and benefits assessment of economic reforms, but also for better estimates of potential labour supply effects. The main alternative is represented by aggregated models of labour supply and demand which often provide forecasts based on average elasticity estimations. The relative magnitude of substitution and income effects are different across the distribution of incomes, and even small aggregate variations in labour supply could correspond to significant movements in and out of the labour force and, to a smaller extent, between part time and full time employment. Since those opposite movements typically concern different types of workers, simply capturing aggregated shifts in the employment rate risks not being very informative on the welfare impact of a reform. Moreover, as most reforms are not concerned with increasing the employment rate per se, but mainly with tackling situations of welfare dependency and poverty traps, as well as increasing employment in particularly disfavoured groups (women, youngsters or older-aged workers), the micro approach allows for a deeper understanding of movements into and out of the labour market and thus permits a full assessment of policy instruments with respect to objectives pursued.

In recent years a variety of methodological approaches have been used for in-depth analysis of the labour supply impact of tax reforms. Such studies have been of crucial importance to evaluate policy measures in terms of costs and benefits and potential distortions on the behaviour of different social groups, both in an ex-ante and ex-post perspective. Following Blundell and MaCurdy (1999), at least three different approaches have been used in the literature for the estimation of the effects of tax reforms on labour supply: the experimental approach, the natural experiment approach and the structural approach. Before providing an overview of the results, it may be useful to briefly describe these methodologies and discuss their advantages as well as their drawbacks.

3.1 Experimental Approach

The experimental approach starts out from an arrangement of conditions or procedures defined to the purpose of testing some hypotheses. The design of the experiment focuses on the prior conditions themselves and on the outcome

or results of the experiment. The outcome is measured as the difference in the ex-ante and ex-post status of the group participating in the experiment and of the control group. In order to isolate all external effects and the effect of participating in the experiment, the control group differs from the experiment group as regards the participation in the procedure, but otherwise it presents identical measurable characteristics.

Although fairly common in exact sciences and indeed in medicine to test the effectiveness of medicaments, the use of the experimental approach is rather limited in social sciences, principally due to the huge costs of setting up such experiments on a statistically significant scale. The most significant exeptions are represented by the New Jersey negative income tax experiment and eventually by the Seattle and Denver Income Mantainance Experiments (SIME/DIME) in the late 70s.

In more recent years Canada introduced the experimental Self Sufficiency Programme (see appendix). The experimental approach allowed to closely follow the panel of the preselected treated and control groups, thus facilitating the estimation of the impact. According to Card and Robins (1996), the adjusted impact of the SSP on full employment probability was in the order of 11% after the third quarter. Such an astonishing result must nevertheless be interpreted cautiously: on the one, hand the Canadian SSP offered an extremely generous benefit which is unlikely to be set up on a non-experimental basis, on the other hand, "it appears that recipients are taking jobs that pay relatively low wages, within $1.00 and $3.00 per hour above the minimum wage. Thus, unless significant wage progression occurs during the three-year period of eligibility, it is possible that many recipients will return to welfare when the supplement ends" (Card and Robins, 1996).

3.2   Natural Experiment Approach

The natural experiment approach (NEA) shares with the EA the characteristic that estimation is based on comparison between a participating group and a control group. Differently from the pure EA, however, the control group is not pre-selected and the experiment is not set up ex-ante, but results "naturally" follow from some variation of the status (a fiscal or a welfare reform, for example) of the environment that affects one group, but not the control group. It follows that the control group is never exactly identical to the experimental group, but may be selected in order to maximize its resemblance to the participating group. The effect of the reform is estimated by comparing the differences between the initial and terminal conditions (i.e. respectively in t=1 and t=2) of both the experiment and the control group; therefore the methodology is sometimes referred to as "difference in differences". To be more specific, let us suppose that a population of N individuals is divided into two sub-populations A and C which are respectively the group affected by the reform and the control group. The estimated effect of the reform is then simply:

$$(E\{A,1\} - E\{A,2\}) - (E\{C,1\} - E\{C,2\})$$

i.e. the difference in ex-ante and ex-post employment rates (or e.g. poverty rates if we were to assess redistribution), net of the variation in employment rate which is not due to the reform.

The NEA is a fairly common methodology in economic analysis: changes in the status of the environment that differently affect groups of people are indeed rather frequent in fiscal, social and employment policy. Successive series of cross-section data or panel data are also largely available, so that the NEA allows for a widely accessible estimation technique, provided that a valid control group may be identified. Indeed, the approach heavily relies on two restrictive assumptions: (i) common time effect and (ii) no composition changes.

Another shortcoming of such an approach is the impossibility of generalizing results to measures that have not yet been introduced, and hence to provide ex-ante estimations of potential labour market effects.

Eissa (1995) estimates the labour supply effect of the 1986 Tax Reform Act (TRA-86) on a sub-sample of married women. Her analysis is based on a comparison of labour market responses of earners in the 99th percentile – the most affected by the tax rebates – to those of the almost unaffected 75th percentile earners. Eissa and Liebman (1996) more specifically analyse the labour supply responses of women with children to the EITC, using women without children as a control group. The method of the difference in differences is applied for several subgroups of women: low skilled women, medium skilled women and high skilled women. In both cases, results using the NEA approach compare well with results based on different methodologies (infra).

3.3 Structural approach

The development of a structural model is needed to produce reliable econometric estimations of behavioral responses in situations when post-reform effects are not observable.

Simple "reduced-form models", widely used in the past, are biased, as they do not consider the more complex nature of income and substitution effects in sophisticated tax benefit environments which cause non-convexities, concavities and discontinuities in budget sets (Hausman, 1985a). Moreover, the parameters of "reduced-form" equations are typically influenced by the existing "tax benefit" environment and they may not be used to predict behavioral responses to policy reforms (Heckman, 1993).

The application of a progressive tax schedule to earned income is a typical example of the methodological problem that may be encountered. As explained in Hausman (1985b), traditional Slutsky relationships do not hold in a situation in which the net wage changes with the amount of labour offered and average and marginal wages differ.

Moreover, in several OECD countries the simultaneous existence of income maintenance programmes and progressive taxation produce non-convexities and concavities in the budget set that are responsible for discontinuities in the labour supply curve.

The structural approach relies on a labour supply model and optimizing behaviour assumption, subject to a household budget constraint. Rational behaviour by the household implies that the household determines the labour supply level that maximizes utility given the available working opportunities and the budget constraint. Within such a utility maximizing framework, households' preferences may be estimated based on observed behaviour through a maximum likelihood procedure. Once the parameters that characterize taste for income and leisure are recovered, it is possible to estimate the magnitude of behavioral responses to a variation in the budget constraint that is triggered by a change in the tax and benefit legislation, by simply comparing the observed ex-ante labour supply to the labour supply that would maximize household utility after the reform has been introduced.

The advantage of the structural model approach is that it allows for the simulation of behavioral responses to a very wide set of potential reforms with relatively low computational costs: it therefore represents a flexible and inexpensive tool for ex-ante policy analysis. Using a fully structural approach, MaCurdy et al. (1990) propose two different methodologies for estimating a continuous labour supply function: the piecewise linearization of the budget constraint – already proposed by Burtless and Hausman (1987) – and the approximation of the budget constraint through a differentiable function. Both methodologies provide comparable results, but the approximation of the budget constraint is more straightforward, since the piecewise linearization relies on a N-tuple ML Tobit estimation depending on the number of segments with which the budget constraint is approximated (N). Nevertheless, both methodologies are computationally cumbersome even in the simplest case, let alone in the more complex cases in which multiple welfare programme participation, the social stigma of benefit take-up and the fixed cost of labour supply are considered.

Recently, however, *a priori* analysis of the effects of tax and benefit reforms has witnessed an increase in the use of discrete choice labour supply functions. Such models explicitly recognise the institutional constraints on labour supply which result in a limited set of working time alternatives (normally, part-time, $\frac{3}{4}$ full-time and full-time). Most importantly, however, the computational burden of estimating labour supply functions boils down to ML estimation of a more or less articulated conditional logit function, after the disposable income of different working time options have been computed through a tax-benefit simulation model. The econometric model underlying the discrete hours labour supply approach is further detailed in section 4. The following section will explore in some detail recent empirical findings related to the effects of the aforementioned tax and benefit reforms on labour supply.

3.4 Survey of empirical results

Since the pioneering work of Marvin Koster (Koster, 1967), empirical analysis of the effects of tax legislation on labour supply have become a solid tradition in economic literature. Much of the US literature assesses the effect of the TRA-86 in general and of the EITC in particular. Hausman and Poterba (1987),

for example, provide an estimate of the reaction of household savings behavior and labour supply following the 1986 TRA. Applying preference parameters estimated in previous work (Hausman, 1981), the authors predict an elasticity of 0.9 for the average married man. The labour supply elasticity is significantly larger for married women (2.64), but most of the variation is due to the change in participation decision, rather than to variations at the margin.

Compared to Hausman and Poterba (1987), Eissa (1995) finds more modest labour supply responses for married women (0.8). Using the same methodology Eissa (1996) finds almost no response in the sub-sample of married men[11].

In the aforementioned study of Eissa and Liebman (1996) the labour supply impact of the EITC is estimated at 2.8%, witch matches closely the estimate by Hausman and Poterba for married women.

Scholz (1996) focuses on the analysis of the participation choice. Using a tax benefit microsimulation model, he estimates through a probit model the relative importance of the net wage to explain the change in activity status. The comparison of the effect of the coefficients on pre and post 1993 EITC expansion, leads Scholz to conclude that the EITC reform increased the odds of being in activity by 6.6 points for single primary earners, 0.4 ponts for primary earners in two-parent families and a decreases of the odds by 5.0 percentage points for secondary earners.

Scholz's analysis also uses the labour supply elasticity estimates of Hausman (1981), Triest (1990) and MaCurdy et al. (1990) to approximate the effect of the EITC alone on hours worked. He concludes that although the EITC expansion has a negative effect on hours worked by earners already in employment, it will be more than compensated by the participation effect.

The study by Scholz is crucial as it clearly sets out the advantages and disadvantages of most in-work benefits: whereas the substitution effect for inactive people tends to increase financial incentives to take up employment under the EITC or similar measures, the combined working of substitution and income effect may have negative effects both on participation of secondary workers and on hours worked, depending on the distribution of earners over the phase-in, flat and phase-out regions.

Concerning the Canadian SSP, several interesting results were recently drawn, although information collection is still going on and more information about the long term effects of the measure is yet to be made available. For preliminary results, see to the aforementioned analysis by Card and Robins (1996).

For the British experience, conclusions on the WFTC closely match those on the EITC. Focusing on the sub-sample of lone mothers, Bingley and Walker (1997) study the impact on labour supply of the Family Credit using a multinomial model which estimates utility variations associated to moves across the employment statuses (non-participation, part-time and full-time). The authors estimate that a £10 increase in the level of weekly benefit (which was previously

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[11] Both studies, however, measure the impact of the reform on labour supply of high income groups, who are not likely to significantly further increase their labour supply. In this respect, the results of the analysis should be interpreted cautiously, as pointed out by Blundell and MaCurdy (1999).

conditional on working at least 24 hours) would increase participation by 1.3 percentage points, whilst leaving the percentage of full-time workers unchanged.

Finally, several recent papers, adopt a discrete hours labour supply model, very similar to the one proposed in the present paper. Based on Van Soest (1995), Keane and Moffit (1998) and Hoynes (1996) critically assess the impact of welfare programme participation on labour supply of American mothers. For the UK, Blundell et al. (2000) also develop a full structural model of discrete-hours labour supply and estimate the impact of the transition from the FC to the WFTC. In their analysis they use a ML multinomial probit model to estimate preference parameters for consumption and leisure of households supplying labour at discrete levels (0, 10, 20, 30, 40, 50). They find evidence of an increase in labour market participation of lone parents (+2.2 percentage points) and to a lesser extent of men, although it is partially offset by a reduction in the hours supplied (0.2% of the sample was predicted to move from full-time to part-time employment). Similarly to Scholz, they also estimate that females in couples are likely to reduce their work efforts:0.57% of the sub-sample would move into inactivity, whereas the number of hours worked is estimated to decrease by 0.18%.

For the Netherlands, Das and Van Soest (2000) apply the same methodology to estimate the labour market impact of the tax reform bill eventually passed by parliament and described above. They conclude that the tax reform will have a significant impact on female labour supply: average working hours will increase by over 4%, although much of the increase will be driven by a change in the participation rate (1.48%).

Bargain and Terraz (2003) and Bargain (2004) estimate the impact of the French PPE and alternative benefit designs on the employment of women living in de facto couples and predict relatively small effects (about 20,000 females, i.e. 0.45% of potentially active females in couples).

Concerning Germany, discrete hours labour supply and multinomial logit models are again used in the aforementioned analysis by Bonin, Kempe and Schneider (2002) of the impact of different low wage subsidy proposals on the German labour market, and by Haan and Steiner (2004) to evaluate the dynamic effects of the Agenda 2010 tax reform. The latter estimate that the reduction of the tax burden on labour is likely to increase total labour supply by around 160,000 units, more or less evenly shared between men and women.

Remarkably, in the case of Italy, the impact of a revenue-neutral FRT tax reform (with and without negative income tax) on female labour supply was estimated by Aaberge et al. (1997), almost 4 years before such a proposal begun to be discussed. The revenue neutral reform analyzed by Aaberge et al. (1997) implied an equivalent tax rate of 23.3% - based on the 1992 tax benefit legislation. The microsimulation results suggest that participation is likely to decrease, but the total amount of hours is likely to increase. The latter result is probably due to the fact that average tax rates increase, especially for households with the lowest earning capacity, but the marginal tax rate decreases for most households. Aaberge et al (1997), moreover, do not use a discrete hours approach: labour supply may vary almost continuously, but the finite set of

available options is represented through a distribution of working typologies characterised by the working time, wage and other characteristics. The opportunity set, moreover, also includes the probability of being involuntarily unemployed, which represents a significant evolution of the pure supply side model.

Concerning Belgium, few studies have addressed the potential effects of the 2001 tax reform. Valenduc (2002) analyses the reform in purely static terms and focuses on the change in marginal and effective tax rates as well as changes in replacement rates, concluding that the reform is likely to have a positive impact on labour supply (although the increase in replacement rates is not concentrated where poverty traps are most significant). Saintrain (2002), on the other hand, uses a macro model to estimate the impact of the reform. The model he uses is almost totally demand-driven (although the author concedes that the tax reform could bring about a slight increase in labour supply, and thus a decrease in the NAIRU[12]). The author argues that the reform could bring about a partial decrease in the wage wedge, thus increasing the demand for labour[13]. According to estimates using the macro model of the Federal Planning Bureau (HERMES), potential additional employment could be at around 20,000 units. We are not aware of any micro-based assessment of potential labour supply effects of the reform.

4   The 2001 Belgian Tax Reform

In August 2001 the Belgian Parliament passed a Tax Reform bill (*Loi du 10 août 2001*), which implemented the fiscal reform announced by the federal government in its Federal Policy Plan of 17th October 2000. The reform is structured into four main pillars (or axes) corresponding to the following policy objectives:

1. to reduce the fiscal burden on labour income

2. to design a fiscal legislation that is neutral with respect to marital status

3. to improve the way dependent children are taken into account by the tax system

4. to promote sustainable development through an environmentally sound taxation.

The reform is being phased in progressively between 2001 and 2005. Of particular interest to the present study are the measures contained in the first two pillars, namely: (1) the earned income tax credit - *crédit d'impôt pour les bas revenus d'activité profesionnelle* (CIBRAP hereafter); (2) the increase in deductions for working expenses; (3) the broadening of the central tax brackets; (4) the abolition of the highest marginal tax rates and (5) the alignment of the tax exempt income quotas for singles and married couples. These measures,

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[12] Non-accelerating inflation rate of unemployment.

[13] Note that this approach is totally different from our framework. After estimating a labour supply model (infra), we estimate the impact of the fiscal shock, assuming that all the decrease in income tax will correspond to an increase in the net wage that leaves the gross wage unaffected.

representing together around 85% of the cost of the reform, will be examined in depth in the following sections. For details on the other measures, as well as on the reform of corporate taxation, implemented through a second tax bill in 2002 (*Loi du 24 décembre 2002*) see Ministère de Finances (2002a), Ministère de Finances (2003), Caray (2003) and Valenduc (2002).

4.0.1 The CIBRAP

The CIBRAP was introduced with the explicit aim of making employment financially more attractive, especially to youngsters and women, and - at the same time - redistributing income in an effort to reduce the poverty risk of less productive workers[14]. Most remarkable are the words of the Finance Minister himself:

"The idea behind the earned income tax credit is that the organization of solidarity must go beyond the simple passive compensation for people out of employment and extend to low-paid workers. Such an instrument aims at both promoting employment and fighting poverty. Below a certain income threshold, the tax credit becomes a complementary income transfer. It is therefore similar to other negative tax systems, such as the Working Family Tax Credit (WFTC), implemented in Great Britain by the Blair Government" (Reynders, 2001, p.7) – [translated from French].

In fact, the Belgian CIBRAP turns out to be very different from the WFTC and the EITC, and is more similar to the Dutch *arbeidskorting* introduced in 2001. Like the latter, the CIBRAP is fully individualized and not means-tested, but, similarly to the Anglo-Saxon measures, it is refundable. Individualization of the benefit implies - for example - that both members of a couple are potentially eligible and more importantly - the income of one partner has no effect on the eligibility of the other. The main drawback of the family based IWBs is therefore avoided. On the other hand, the broad eligibility conditions imply that the amount of the benefit is much lower than the WFTC. Also, differently from the WFTC and the PPE, the CIBRAP is not scaled according to family conditions, so that the number of dependants is not taken into account. Such a feature may cause the benefit to be quite ineffective in tackling inactivity traps, as means-tested benefits like the MINIMEX are scaled on household size. The net replacement rate of inactivity by employment will therefore be higher for single women on social assistance than for single mothers.

Other characteristics of the new IWB closely match the characteristics of the instruments that already exist in other countries: the benefit is phased-in and phased-out with a relatively low taper, it is conditional on working at least 13 hours and it is administered by the fiscal authorities.

Fig. 3 shows the structure and the progressive implementation of the tax credit. Eligibility starts when net earned income (i.e. gross earned income net of SSCs and professional expenses) is above €3,750. Between this lower threshold and €5,000 the benefit will be phased in very sharply at a rate of 40.5% (i.e. the

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[14]Ministère des Finances, 2002a, p.25.
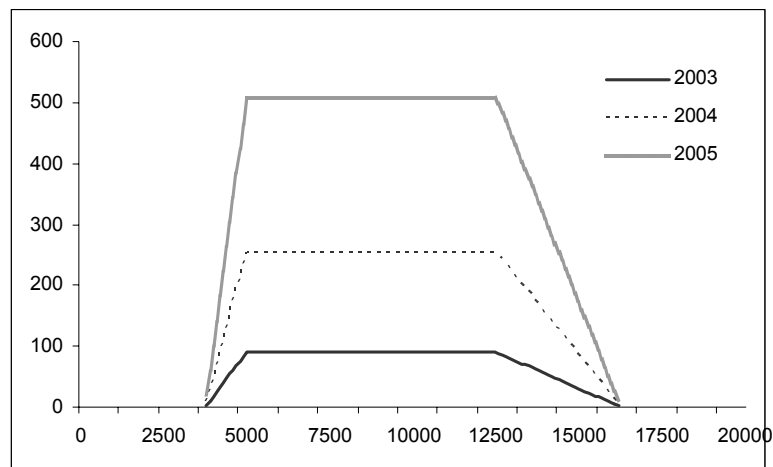
Figure 3: CIBRAP-Crédit d'Impôt sur les Bas Revenus d'Activité Professionnelle

benefit increases by €40.5 for every €100 earned between €3,750 and €5,000). Between €5,000 and €12,530 EUR the benefit amounts to €506 and between €12,530 and €16,280 the benefit is phased out at a rate of 13.5%, meaning that €13.5 of benefit are lost for every additional €100 earned. In 2003 (respectively 2004), the phase-in rate will be 7.2% (20%) and the phase-out rate will be 2.4% (6.7%) while the maximum amount of the benefit will be €90 (€253).

The CIBRAP applies to both the employees and the self-employed, but its total amount is limited to the fraction of professional income (i.e. employment and self-employment incomes) in total earned income (which also includes replacement incomes).

The working tax credit is a measure that will mostly benefit households in the lower part of the income distribution, although the lack of a targeting framework (like means-testing on household income) implies that a substantial share of entitled individuals might be found in the upper middle part of the income distribution.

4.0.2 Increasing deductions for work expenses

According to Belgian tax law, deductions for work expenses are computed using a progressive earning brackets system. The tax reform will increase deductions for low salaries by increasing the deduction rate in the first income bracket. Fig. 4 shows the progressive increase of the deduction rate in the first bracket. Earnings in the range between 0 and €4,320 will benefit from an additional deduction of 5% in 2005 (as a transitory measure the additional deduction will be 3% in 2003 and 2004).

The increase in the deductions for work expenses deduction is a measure

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	Marginal rate of deduction		
Gross earnings	2001	2003	2005
0 - 4,320	20%	**23%**	**25%**
4,320 - 8,580	10%	10%	10%
8,580 - 14,280	5%	5%	5%
more than 14,280	3%	3%	3%

Source: Ministère des Finances (2002b)

Figure 4: Increased deductions for work expenses

	Income brackets							
Marginal tax rate	2001			2003			2005	
25%	0	-	6,570	0	-	6,570	0	- 6,570
30%	6,570	-	8,710	6,570	-	**9,350**	6,570	**9,350**
40%	8,710	-	12,420	**9,350**	**-**	**13,950**	9,350	**15,580**
45%	12,420	-	28,540	**13,950**	-	28,540	**15,580**	28,540

Source: Ministère des Finances (2002b)

Figure 5: Broader central tax brackets

which will benefit all taxpayers, yet its impact on household disposable income is not likely to be very significant. Very low earnings, in fact, are already almost completely exempt due to the combined effects of the basic personal tax deduction and - now - the CIBRAP. For medium and higher earnings, on the other hand, the increase in the total deduction is quite marginal.

4.0.3   Broadening of the central tax brackets

Although the overall inflation level was significantly lower than in previous decades, the suspension of indexation of tax brackets during the 90s increased the overall progressivity of the tax system. The fiscal drag resulted in an increased tax burden even on low and medium incomes. The improvement of the main macroeconomic indicators has allowed for the reintroduction of a full indexation of the tax brackets starting from tax year 2001. Moreover, the tax reform will stepwise reshape progressivity in the middle tax brackets by broadening the middle-lower brackets and narrowing the middle-upper brackets.

Fig. **??** shows how the 30 and 40% marginal tax rate brackets will progressively be expanded at the expense of the 45% tax bracket. The reform will concentrate on the middle to lower part of the distribution in the first phase, and it will be extended to higher earnings in 2005. The broadening of the central tax bracket is the most expensive measure of the tax reform as it substantially increases the disposable income of a wide range of taxpayers (83% of taxpayers according to Reynders, 2001), with more substantial increases concentrated in the middle of the distribution.

		Marginal tax rates		
Income brackets		2001	2003	2005
28,540 - 42,810		50%	50%	50%
42,810 - 62,790		52.5%	**52%**	**50%**
more than 62,790		55%	**52%**	**50%**

Source: Ministère des Finances (2002b)

Figure 6: Collapsing highest marginal tax brackets

4.0.4 Abolition of the highest marginal tax rates

The fourth measure in the first pillar is clearly targeted at higher incomes: the two highest marginal tax rate brackets (55 and 52.5% respectively) are collapsed and - in a second step - merged with the third highest tax bracket. As shown in fig. 6, the highest marginal tax rate will drop to 50%. This corresponds to a drop of 5% in the highest bracket and of 2.5% in the second highest bracket.

4.0.5 Alignment of tax exempt basic personal allowance for couples and singles

The last measure that will be considered, and that is likely to have a significant effect on female labour supply choices, is the alignment of tax exempt basic personal allowance of singles and married couples. The basic personal tax deduction for married couples increases in two steps from €4,350 to €4,540 and in 2005 from €4,540 to €5,480. This measure implies increased tax deductions by almost 25%, although the benefits are likely to be concentrated on households in the middle of the distribution. The personal tax deduction is in fact not refundable, so only households whose pre-deduction tax liability is higher than the full amount of the credit will fully benefit from the new measure.

4.1 The impact of the reform: costs and benefits

Fig. 7 summarizes the timetable for the implementation of all the measures of the reform (i.e. all 4 pillars). In the present study we have focused only on the first 5 measures (i.e. pillar 1 and part of pillar 2). As previously mentioned these measures represent the core of the new tax reform (as they absorb around 85% of the estimated budgetary cost). The choice to focus on these measures, however, has also been pragmatic as they could more readily be integrated into the tax-benefit simulation model Modété (for more information see the appendix). In our analysis we do not model the transitory measures, but instead we simulate the final effects of the reform, had it been instantaneously implemented in 2001.

Fig. 8 compares the official estimated budgetary cost of the tax reform and the estimates produced by our tax benefit model. Results are indeed very similar, which confirms the validity of our simulation model. Estimations in

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	2002	2003	2004	2005
Reduction in the tax burden on labour		p	p	f
CIBRAP		p	f	f
Increase in the deductions for working expenses			p	f
Broadening of the central tax brackets		p	f	f
Abolition of highest marginal tax rates				
Neutrality with respect to lifestyle choices				
Alignment of the tax exempt income quotas			p	f
Individualisation of tax reductions for replacement incomes				f
Generalisation of separate taxation to unarned income				f
Improvement in the way that dependent children are taen into account				
Making tax reduction refundable		f	f	f
Increase in the single parent means-test limit	f	f	f	f
Generalisation of tax exempt for all single parents with dependent children		f	f	f
More environmentally sound taxation				
Deduction for non-car transport costs	f	f	f	f
Energy saving deductions			f	f

p= partial implementation f=full implementation

Source: Valenduc (2002)

Figure 7: Timetable for the implementation of the reform

	(a) Modété	(b) Reynders (2001)	Ratio (a)/(b)
	Millions of Euros	Millions of Euros	%
Increased deductions for working expenses	312	248	125.7%
Broadening of the central tax brackets	872	768	113.5%
Abolition of highest marginal tax rates	469	174	270.5%
CIBRAP	384	446	86.0%
Alignment of the tax exempt income quotas	1,135	1,091	104.1%
Overall effect[†]	3,168	2,727	116.18%

Source: Author's calculations using Modété, Reynders (2001)

† Overall effect may differ from sum of components due to interactions between instruments

Figure 8: Estimated budgetary costs of the tax reform (2001 values)

Reynders (2001) are based on a database of tax-files and the microsimulation model SIRe. Part of the discrepancies is due to the fact that tax files data usually report significantly lower incomes than data from income surveys. Moreover, our estimates are based on 1998 microdata (monetary variables have been inflated to 2001). The single most significant discrepancy is represented by the estimated cost of the reduction of the highest marginal tax rates. On the one hand, it is well-known that tax files underreport sources of income that are partially captured in income distribution surveys and on the other hand, households in the middle to upper part of the income distribution are usually able to deduct significant expenses (pension savings, health care, investments) which are not simulated by the tax benefit model. Yet the size of the discrepancy is larger than expected and would justify further research.

As stated in the introduction, the budgetary cost of the reform will imply a

		Millions Euros	% of 2001 GDP	Source
Generalized reduction of tax burden				
Netherlands		7,000	1.648	Ministerie van Financiën (2000)
Germany		32,000	1.551	Bundesfinanzministerium (2003)
Italy	(lower boundary)	20,000	1.644	Baldini and Bosi (2002)
	(upper boundary)	45,000	3.699	Baldini and Bosi (2002)
Belgium	(net of CIBRAP)	2,280	0.889	Reynders (2001)
		2,784	1.085	Own estimates
In work benefits				
France	PPE	2,102	0.144	Legendre et al. (2002)
UK	WFTC	8,465	0.532	Inland Revenue (2001)
Belgium	CIBRAP	446	0.174	Reynders (2001)
		384	0.150	Own estimates

Figure 9: Tax and benefit reforms in Europe: a comparison

loss of tax revenue of around 10% (the progressive implementation of the reform is nevertheless likely to reduce this cost). This corresponds to about 1-1,15% of the 2001 GDP.

The most expensive measure is - as could easily be predicted - the increase in the exempted quota for married couples (around 35% of the total budget). The second most expensive measure is the broadening of the central tax brackets. Again this is not surprising, as the effect of this measure is expected to cover more than 80% of all taxpayers. According to official estimations the refundable tax credit will be the third most important measure, but according to own estimations it comes fourth only. The underestimation of the cost of the CIBRAP is, again, probably due to the different databases used. Tax files are likely to underestimate earnings thus inflating the number of eligible earners. Also, as shown in fig. 1, the employment rate of the low skilled has significantly increased between 1998 and 2000, due to favourable macroeconomic conditions.

Fig. 9 compares the budgetary cost of the reforms in Belgium and in reference countries, using a variety of sources. The cost of the reform is comparable to that of recent reforms implemented in other European countries. The generalized reduction of taxes is somewhat lower in Belgium than in the Netherlands and in Germany (and than forecasted for Italy). Yet, it must be noted that significant reforms in the reduction of employees' and employers' social security contributions had already been implemented in previous years. With respect to in-work benefits, the Belgian reform appears to be much more in line with the French benefit than with the UK benefit. These results should be kept in mind when assessing the relative efficiency of the reform in an international perspective.

A fully static analysis of the gains from the Belgian tax reform is beyond the scope of the present paper which concentrates on behavioral responses. For a detailed static analysis on the equity and the efficiency of the reform, see Valenduc (2002). In the present section we simply concentrate on some measures of the impact of the reform on household disposable income, in order to

	Total gain (billions EUR)		Average gain (EUR/year)		% of total gain	
Income decile	Modété	SIRe	Modété	SIRe	Modété	SIRe
1	19.37	66.93	44.63	391.75	0.61	2.00
2	71.39	135.85	165.39	388.57	2.25	4.10
3	139.81	145.27	323.19	360.78	4.42	4.40
4	214.18	182.20	493.00	426.72	6.76	5.50
5	264.75	233.52	614.45	526.53	8.36	7.10
6	345.07	311.35	795.29	685.60	10.90	9.90
7	356.97	409.52	826.78	897.50	11.27	12.40
8	416.46	502.73	962.12	1094.45	13.15	15.20
9	446.21	573.38	1032.21	1245.07	14.09	17.40
10	892.42	738.47	2063.58	1605.01	28.18	22.40
All	**3166.62**	**3299.21**	**731.88**	**807.90**	**100.00**	**100.00**

Source: Author's calculations and Valenduc (2002)

Figure 10: Distribution of the gains from the reform by income decile (total and average amounts)

clearly distinguish between first-round static effects and second-round effects that consider the gains induced by potential behavioral responses.

Fig. 10 shows the distribution of total and average gains over the range of the income distribution. The figures are compared with those obtained by Valenduc (2002) using the Ministry of finance microsimulation software SIRe. Overall, the official statistics seem to be confirmed by the results drawn from Modété. The discrepancies are due to the fact that (a) Valenduc (2002) considers all four axes of the reform and (b) the SIRe microsimulation concerns only a sample of taxpayers, whereas our data set contains information on the whole population, including the inactive part. This explains why most differences are concentrated in lower income deciles.

Fig. 11 shows the distribution of the gains from the reform in terms of the percentage increase in household disposable income. As in the previous figure, household income is adjusted to account for household size using an equivalence scale corresponding to the squared root of household size. The reform is clearly a reform for the middle class mainly, with most substantial gains concentrated in the upper income deciles. It is important to notice, however, that the reform dominates in Pareto terms the pre-reform baseline, as no household is made worse off by the reform[15]. Average effective tax rates either remain unchanged or decrease for the whole population.

Finally, we will consider some distributional indicators (fig. 12). The post-

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[15]The above statement obviously does not take into account the effects of lost tax revenue or the decrease in social expenditures needed to meet the cost of the reform.

decile	Percentage increase in disposable income				
	[0-1%]	[1%-2.5%]	[2.5-5%]	[5-7.5%]	[>7.5%]
1	**79.3%**	1.9%	12.1%	5.3%	1.4%
2	**46.7%**	15.5%	26.9%	7.1%	3.7%
3	15.2%	23.8%	**47.0%**	12.4%	1.5%
4	8.6%	29.5%	**44.0%**	17.5%	0.4%
5	4.8%	23.7%	**59.9%**	11.1%	0.5%
6	4.4%	23.8%	**64.9%**	6.8%	0.0%
7	5.1%	25.0%	**66.1%**	3.8%	0.0%
8	4.0%	27.2%	**68.3%**	0.6%	0.0%
9	1.4%	**47.5%**	51.0%	0.2%	0.0%
10	4.3%	**42.9%**	**46.1%**	4.8%	1.9%

Source: Author's calculations

Figure 11: Distribution of the gains from the reform by income decile

	Before reform	After reform
Poverty		
50% of median disposable income	9.39	8.87
60% of median disposable income	15.66	14.98
Inequality		
Gini	0.2764	0.2772

Source: Author's calculations

Figure 12: Pre- and post-reform inequality and poverty indicators

reform poverty remains at the pre-reform level. Household disposable income is adjusted using the squared root of household size as an equivalence scale. Poverty rates estimated using Modété are broadly in line with estimates based on the ECHP and other data sets[16].

Poverty rates (head count ratios) decrease by about .7 percentage points if we refer to the 60% baseline and by around .5 if we consider the 50% baseline. On the other hand, inequality increases as witnesed by the increase in the Gini index.

Fig. 13 and fig. 14 show the impact of the reform on a single-earner and two-earner household working at the minimum wage (with two children). The upper dotted line shows total disposable income after the reform, while the lower solid line shows disposable income before the reform. The two figures are informative with respect to the potential gains of working before and after the reform, although they refer to hypothetical household structures. It is evident that the

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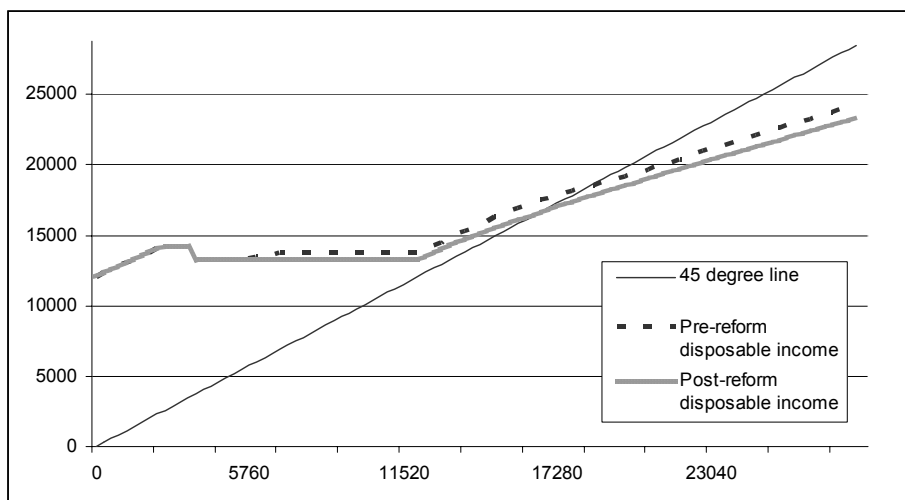[16] See Orsini (2004a) and Orsini (2004b).

Figure 13: Budget constraint for a single earner household (earnings increasing from 0 to 200% of minimum wage) with two children (EUR/year)

reform has no impact whatsoever on the first segment of the budget curve. This is also pointed out in Valenduc (2002), according to whom the reform has not tackled poverty traps where these are most insidious[17]. This analysis, however, must be refined. The analysis of incentives to take up work cannot be limited to ex-ante and ex-post comparison of hypothetical household typologies, but must be evaluated with respect to the actual distribution of household income and characteristics. We now turn to the analysis of the impact of the reform on labour supply. Before introducing the main result, the following section details the econometric model.

4.2 A discrete hours labour supply model

In the following section we will explore in further detail the methodology behind the discrete hours labour supply approach which will eventually be used to estimate labour supply responses to the 2001 Belgian tax reform. The estimation methodology requires three components:

1) a sufficiently large sample of households with sufficient information on demographic variables, income and labour market status;

2) a microsimulation model, i.e. a series of algorithms capable of replicating the budget constraint faced by workers before and after the 2001 tax reform;

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[17] "*The improvements in financial incentives to take up work appear much more dispersed than the inactivity traps and the most significant effects, both in terms of increased disposable income and decreased marginal effective tax rates are not concentrated where inactivity traps are most insidious*"(Valenduc, 2002, p. 181).

45000
40000
35000
30000
25000
20000
15000
10000
5000
0

14400   20160   25920   31680   37440   43200

— 45 degree line

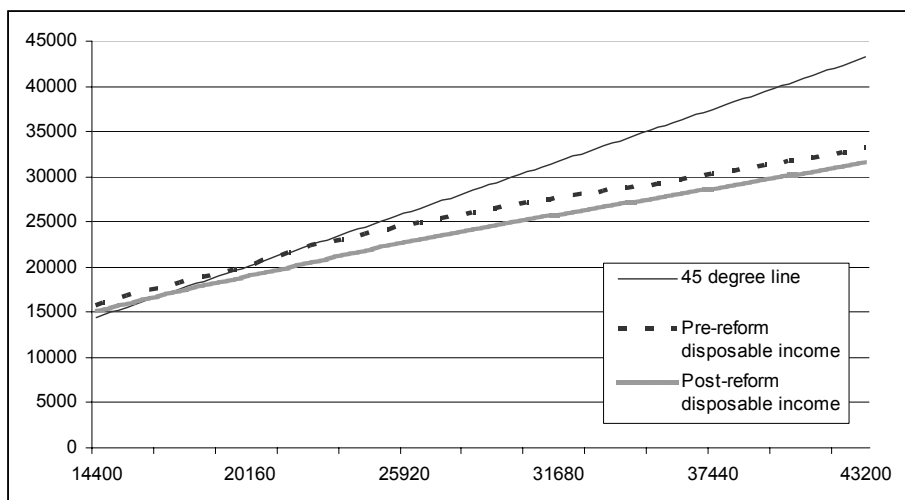- - Pre-reform disposable income

— Post-reform disposable income

Figure 14: Budget constraint for a two-earner household (one partner with fixed earnings at 100% minimum wage, the other with increasing earnings from 0 to 200% of minimum wage) with two children (EUR/year)

3) a behavioral model capable of explaining observed labour supply and predict changes brought about by shocks to the budget constraint.

These components will be analysed in detail in the following sections.

4.2.1 Data: The Panel Survey of Belgian Households (PSBH)

Belgium does not have a history of high-quality data collection. Few micro data sets are available and most are quite limited in size and scope. In 1989 the Universities of Liège and of Antwerp were charged by the Federal Scientific Research Office (SSTC/DWTC) to undertake a systematic collection of relevant social, economic and demographic information on a panel of households representative of the country. The first round of interviews started in 1992 and included information on current as well as previous year's incomes and labour market conditions. Recently the 10th wave of the panel has been made available.

Although the panel fills an important gap (the PSBH data are also used in the European Community Household Panel – ECHP), it is relatively small in size compared to other countries. At the start of the project 4,438 households and approximately 10,000 people (adults and children) were interviewed, and by the 8th wave – the one used for this study – attrition had reduced the number of households to 3,773 and the number of people to 9,262. The data set has been weighted using the GROSS programme developed by Johanna Gomulka in Cambridge (Gomulka, 1992). Several controls where used to weight the data: demographic structure, regional population and labour force status.

	Women	Men
Working time (hours/week)/pop. in employment	31.7	42.0
Working time (hours/week)/total pop.	23.3	39.1
Gross wage rate (EUR/hour)/ pop. in employment	11.1	13.0
Gross wage rate (EUR/hour)/potentially active population	11.0	-
Age	40.18	41.94
Primary education	7.31%	6.59%
Secondary education	54.25%	54.61%
Tertiary education	38.45%	38.80%
# of children	1.40	
Presence of a child 0-3	18.78%	
Presence of a child 3-6	19.28%	
Selected sample of households	1259	
Corresponding population		
# of households	1,296,623	
# of persons	4,408,518	

Source: Author's calculations

Figure 15: Subsample used for LS estimates - descriptive statistics

The estimation of the labour supply model was restricted to couples with both the household head and the spouse aged between 25 and 60, i.e. the active and potentially active population. Self-employed workers were excluded from the selection (due to unreliable information about hours worked and income), as well as people not likely to modify their labour supply: pensioners, students and the disabled. The unemployed were also excluded from the sample. Since the latter are supposed to be constrained from labour demand, no incentive is assumed to have a potential effect on their labour market status. In order to increase the homogeneity of the sample, we excluded three generation households and households with more than three children, the latter being defined as persons under the age of 18 or 25 when in full-time education. Finally, households with significant additional self-employment income (more than €500 per month) where also excluded.

After the selection process, the database contained 1,259 couples. Fig. 15 reports descriptive statistics for the estimation sub-sample. Estimated female gross wage is also reported in the table. Estimation procedure and results are reported in the appendix.

4.2.2 Microsimulation software: Modété

A microsimulation software is a series of algorithms that allow to simulate the tax and benefits in a certain country at a given time. Typically, tax and benefit legislation is translated into parameters read by the algorithms. The software runs on an input database containing relevant information to determine eligibil-

ity and liability conditions, as well as the amount of benefits to be awarded and the extent of the liability. Modété is a microsimulation software developed by Dulbéa-ETE in the framework of the EU project EUROMOD. It runs on PSBH data and it allows to simulate income assistance, child benefits, taxes and social security contributions. Pensions and unemployment benefits are not simulated as the PSBH does not collect all necessary information on past employment records. Yet, this is not a major problem for the present study as we focus only on potentially active people[18].

4.2.3 The Labour Supply model

Following most recent studies on labour supply effects of tax and welfare system reforms, labor supply modelling in this paper relies on a discrete choice multinomial/conditional logit model and on a traditional specification in terms of consumption-leisure preferences[19]. If a household i is offered to choose one among J work durations for the female adult, it is assumed that the utility the household V may derive from alternative j ($= 1, ..J$) is given by:

$$V_{ij} = U(H_j, C_{ij} - f_{ij}, Z_i) + \epsilon_{ij},$$

where $U()$ is a conventional utility function which depends on female work duration (H_j) and consumption (C_{ij}) as well as on a vector Z_i of household characteristics. Note that in this static framework all income is assumed to be transformed in consumption. Following the bulk of the literature, labour supply of men is supposed to be constant whereas women are assumed to choose between non-participation ($H_1 = 0$), part-time ($H_2 = 20$ hours/week) and full-time ($H_3 = 40$ hours per week). This discrete approach is particularly appropriate when institutional and demand-side rigidities are strong and imply concentration around a limited number of hours choices (see Van Soest, 1995). Although the distribution of working hours is indeed continuous, the high densities around these three peaks justify such a discrete approach (see appendix for more details on working hours).

Following Blundell et al. (2000) we also allow for fixed costs of labour supply. These are fully integrated into the model. Fixed costs are modelled as the sum of a fixed term and a variable term which depends on household characteristics and the labour supply choice. It should be noted that we have no information about fixed costs which are treated as latent unobservable variables. Also note that fixed costs capture various effects that may have an impact on labour supply decisions: child care costs, commuting costs, job search activity and distaste for labour[20].

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[18] For more information on Modété, see the appendix.

[19] See Van Soest (1995), Keane and Moffit (1998) and Hoynes (1996), Blundell et al. (2000), Van Soest and Das (2000), Bonin, Kempe and Schneider (2002), Bargain (2003) and Haan and Steiner (2004).

[20] See Das and Van Soest (2000).

The actual utility derived from alternative j for household i, V_{ij}, also includes an error term ϵ_{ij} that is assumed to be identically and independently distributed across alternatives and households according to a type I-extreme value (Weibull) distribution. Under this distributional assumption, McFadden (1973) proves that the probability P that alternative k is chosen by household i is given by:

$$P_{ik} = \Pr(V_{ik} \geq V_{ij}, \forall j = 1, ...J) = \frac{\exp U(H_k, C_{ik} - f_{ik}, Z_i)}{\sum_{j=1}^{J} \exp U(H_j, C_{ij} - f_{ij}, Z_i)}.$$

The likelihood of a sample of observed choices can be derived from that expression as a function of the preference parameters of function $U()$. Estimates of these parameters may be obtained by maximum likelihood techniques. As in Blundell et al. (2000), we choose a quadratic functional form so that, for choice $j = 1, ...J$, the deterministic part of the utility is written as follows:

$$U_{ij} = \alpha_{ch}(C_{ij} - f_{ij})H_j + \alpha_{ci}(C_{ij} - f_{ij}) + \alpha_{hi}H_j + \alpha_{cc}(C_{ij} - f_{ij})^2 + \alpha_{hh}H_j{}^2,$$

with heterogeneity:

$$
\begin{aligned}
\alpha_{ci} &= \alpha_c + \alpha(age) + \beta(age^2) \\
\alpha_{hi} &= \alpha_h + \alpha(age) + \beta(age^2) + \gamma(low\ education) + \delta(\#\ of\ children) \\
f_{ij}^h &= f_f^h + \alpha_f^h(\#\ of\ children \leq 3) + \beta_f^h(\#\ of\ children \leq 6),\ h = 20, 40
\end{aligned}
$$

Fixed costs are assumed to be different when working full-time or part time, i.e. when h=40 or h=20.

The log-likelihood function:

$$\log L = \sum_{i=1}^{N} \sum_{j=1}^{k} \log(\Pr[H_i = H_{ij}|Z_i]^{I(H_i = H_j)})$$

was maximized with the econometric software STATA, version 8.0.

Regularity conditions were checked ex-post rather than being imposed in the maximization process. In particular, C-monotonicity and quasi-concavity are natural minimum requirements for positive and normative analysis of tax reforms. Positive monotonicity is written as:

$$\frac{\partial U_{ij}}{\partial C_{ij}} = 2\alpha_{cc}(C_{ij} - F_{ij}) + \alpha_{ch}H_j + \alpha_{cir} > 0$$

whereas quasi-concavity is assured by the negativity of the squared consumption coefficient, i.e.

$$\frac{\partial^2 U_{ij}}{\partial C_{ij}^2} = 2\alpha_{cc} \leq 0$$

Both conditions were checked *a posteriori*, thus avoiding the MaCurdy critique (MaCurdy, 1992) that elasticities are largely determined *a priori*.

For workers with observed wages, gross income across different labour supply alternatives was computed assuming a constant hourly wage rate[21]. Since potential hourly wages for inactive females are not observable, these were estimated using a standard Heckman two-step procedure (Heckman, 1979). The wage equation was estimated using human capital variables and the selection bias was accounted for through a vector of household and individual characteristics. The identification of the model is secured by controlling for at least one different covariate in the selection model. The results of the wage estimations are presented in the appendix.

Once real and predicted hourly wages have been obtained for all adult females in the sample, we construct household gross income related to the three alternatives and, using the microsimulation model, the set of net incomes corresponding to the three labour market statuses.

4.2.4   Structural model of labour supply: some drawbacks

The recent widespread use of discrete labour supply models proves their suitability to a priori evaluate the behavioural impact of shocks in the budget constraint driven by reforms in the tax and benefit system. Yet this approach suffers from several drawbacks which must be kept in mind when interpreting the results. First, such models are totally supply-driven; very few studies include demand-side constraints. A reform's impact on employment rates might be substantially overestimated if the extra potential labour offer is constrained by an insufficient labour demand. To our knowledge, Boeters et al. (2004) is the only study that includes discrete labour supply in the framework of a general equilibrium model[22]. However, the authors conclude that provided that labour supply effects are not substantial, a pure supply-side framework still provides reasonable results. In a general equilibrium model with endogenous wage formation, tax and benefit reforms could indeed bring about variations in gross wage as well as a balanced increase in labour demand and supply which would automatically affect the unemployed as well as the inactive population.

Moreover, the utilitarian framework used is completely static: disposable income corresponds to total consumption and all life cycle considerations are excluded. It is well-known that in a life cycle perspective, labour supply responses to permanent shocks are rather limited (Blundell and MaCurdy, 1999), so that our static framework might overestimate labour supply responsiveness.

Finally, the present study adopts a unitary utility function[23]. Moreover, we assume a *"male chauvinist,,* labour supply model, where the male partner makes his labour supply choice and the female partner maximizes household utility subject to the labour supply strategy of the male. Although such an

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[21] This assumption is standard in most recent labour supply litterature, although there are some exeptions, such as Moffit (1984) and Tummers and Woittiez (1991).

[22] An alternative to the complex CGE approach is the framework proposed in the aforementioned study by Aaberge et al. (1997).

[23] In a unitary framework it is assumed that household members pool their resources and choose amongst alternative strategies in order to maximize a common household utility function.

approach is more than justifiable on sociological as well as empirical observations, it is increasingly being questioned by economic theory, which argues that unitary models are not compatible with the individualism that is at the heart of microeconomic theory. Beninger et al. (2003) have extended the above labour supply model to joint labour supply decisions and intra household welfare allocation, within a collective setting. In applied microeconomic analysis, there is still no consensus as regards bargaining models of labour supply in a collective setting.

5   Main Results

Parameter estimates for the behavioural model are shown in fig. 16. The results are in line with theoretical predictions and recent empirical findings. The coefficients of income and squared female hours are negative, indicating the marginally decreasing utility of consumption and leisure. Together with the interaction terms, these coefficients determine the elasticity of labour supply. The taste for labour decreases (more than proportionally) with women's age. Preference for labour also decreases with the number of children and when education level is low. On the contrary, the taste for consumption depends positively on age and age squared. Fixed costs of labour supply are higher than expected: 57,000 BEF i.e. approximately the level of the full-time minimum wage in 2001. Yet, this result is only partially surprising: on the one hand, fixed costs of labour supply measure distaste for work for several different reasons (Das and Van Soest, 2000), on the other, it is possible that some women would prefer to work a different amount of hours, but are constrained by institutional rigidities (Bourgignon and Magnac, 1990)[24]. Note, finally, that the variable part of the costs of labour supply appears to have reasonable values: the presence of children under the age of three is significant when working part-time and full-time and the associated costs when working full-time are around 20,000 BEF, i.e. the average price of a full-time month in day care. Older children do not have a significant impact on the cost of labour supply.

Overall, the fit of the model was relatively good. Fig. 17 shows the number and percentage of correctly predicted cases, a classical measure of the goodness of fit. Slightly more than 50% of the cases appears to be correctly placed. Few studies report such a measure of goodness of fit. Compared to Bargain (2003), who also focuses on descrete choices of feamels in couples, our model performs relatively well, especially concerning the prediction of part-time, which is usually underestimated[25].

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[24]Bourguignon and Magnac (1990) obtain extremely high fixed costs of labour supply for France: around 2.5 times average earnings.

Based on a british sample, Blundell et al (2000) obtain more reasonble estimates (around €300 per month. Bargain (2003) obtains estimates of around €600 for 1998.

[25]Underestimation of part-time is usually explained through institutional rigidities and labour demand constraints (Van Soest, 1995). The better fit produced by our model could be interpreted as a sign that part-time work in Belgium is more related to actual preferences than to demand-side constraints.

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Income / 10000						
(age of female - 40)/10	0.082263	0.035376	2.33	0.020	0.012927	0.151599
((age of female - 40)/10)^2	0.091739	0.028047	3.27	0.001	0.036768	0.14671
constant	0.275115	0.074645	3.69	0.000	0.128813	0.421417
Female hours						
(age of female - 40)/10	-1.00529	0.190871	-5.27	0.000	-1.37939	-0.63119
((age of female - 40)/10)^2	-0.13524	0.198641	-0.68	0.496	-0.52457	0.254092
Female has low education	-0.42563	0.158465	-2.69	0.007	-0.73621	-0.11504
# of children	-0.4429	0.09222	-4.8	0.000	-0.62364	-0.26215
constant	5.486056	1.874646	2.93	0.003	1.811816	9.160295
(Income / 10000)^2						
constant	-0.00364	0.001093	-3.34	0.001	-0.00579	-0.0015
Female hours^2						
constant	-3.83683	1.329043	-2.89	0.004	-6.4417	-1.23195
Female hours x income						
constant	0.00733	0.023073	0.32	0.751	-0.03789	0.052552
Fixed cost of labour supply / 10000						
constant	5.726184	1.935859	2.96	0.003	1.931969	9.520399
Variable costs of labour supply (part time)						
# children 0-3	1.443501	0.864267	1.67	0.095	-0.25043	3.137432
# children 3-6	0.045997	0.779548	0.06	0.953	-1.48189	1.573884
Variable costs of labour supply (full time)						
# children 0-3	1.951273	0.893286	2.18	0.029	0.200465	3.70208
# children 3-6	1.407677	0.968496	1.45	0.146	-0.49054	3.305895
Log likelihood		-1235				
Number of observations		1259				

Source: author's calculations

Figure 16: Discrete model of female labour supply - estimation results

	Predictions			
	Inactive	Part-time	Full-time	Total
Inactive	**141**	117	75	333
%	*0.42*	*0.35*	*0.23*	
Part-time	46	**157**	170	373
%	*0.12*	*0.42*	*0.46*	
Full-time	63	162	**328**	553
%	*0.11*	*0.29*	*0.59*	
Total	250	436	573	1,259

Source: author's calculations

Figure 17: Predicted and observed frequencies

	Observed frequencies	Average predicted probabilities
Inactive	0.280	0.280
Part-time	0.337	0.337
Full-time	0.383	0.383

Source: Author's calculations

Figure 18: Predicted probabilities and observed frequencies

Finally, several studies[26] present, as a measure of goodness of fit, a comparison of observed frequencies and of the averages of predicted probabilities[27]. As shown by fig. 18 the model performs very well with respect to this measure as well.

5.0.5 Model calibration

Once preference parameters have been estimated, they may be used to predict post reform labour supply behaviour. A common strategy to analyze labour supply responses is to calibrate the labour supply model in the baseline scenario, before analysing the impact of the reform. In order to produce a 100% fit of the observed data we have drawn a set of unobserved random terms which may be interpreted as unobserved heterogeneity. Triplets of random heterogeneity terms (one for each discrete choice) were drawn from a type I-extreme value (Weibull) distribution until the sum estimated deterministic utility and the stochastic heterogeneity component yielded the observed choice for each household in the sample. This procedure was repeated 200 times in order to interpret post-reform behavioral responses in probabilistic terms rather than in deterministic terms. For more details on the calibration procedure, see Creedy and Duncan (2002) or Creedy and Kalb (2003).

5.0.6 Labour supply elasticities

Potential behavioural responses to an external shock to the budget constraint depend on the size of the shock and on the size of elasticities. In many studies, elasticities are evaluated at the sample mean or for a representative household. As pointed out by Van Soest and Das (2000), this is not very informative - in a highly nonlinear model like ours - as regards the consequence of wage changes in

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[26]See, for example, Van Soest (1995) and Bonin, Kempe and Schneider (2002).

[27]Note the difference between the predicted frequencies and the average of predicted frequencies: in the first case the prediction for each individual simply corresponds to the choice which maximizes utility amongst possible alternatives; in the second case we compute individual probabilities for each individual, defined as the ratio of the utility in each status over the sum of utilities in all possible statuses.

Hours worked	Participation
0.639	0.452
[0.233-1.016]	[0.374-1.273]

Source: Author's calculations

Figure 19: Female labour supply gross wage elasticity

a heterogeneous population. Instead, wage-elasticities can be computed numerically (following an increase of 10% of gross wage), and averaged over the whole sample[28]. Fig.19 shows estimated labour supply elasticities for the selected sample of women in couples. We are not aware of recent studies on female labour supply elasticity for Belgium that use a similar methodology. The results are nevertheless in line with recent international empirical findings: elasticity appears to be relatively small and mostly driven by changes in the participation rate rather than by changes at the extensive margin. Confidence intervals were computed by bootstrapping 1000 times from the asymptotic distribution of the labour supply model's parameter estimates and averaging responses over the whole sample. Compared to other studies, the size of the bootstrap confidence interval is much larger, probably owing to the limited sample size. It is interesting to note, however, that both the lower and upper bound of the confidence interval are within the range of estimates provided in other recent empirical analyses.

For the sake of comparison, fig. 20 shows recent estimates of labour supply elasticities for females in couples. Unfortunately, not all studies on impact of tax and benefit reforms previously cited report estimations of labour supply elasticities. We have therefore exploited all sources available in order to provide a picture of the range of variation of elasticity estimates in the selected countries. The somewhat higher estimations encountered for the Netherlands are probably due to a greater variation in working hours, and a high share of very short part-time. Female employment on the other hand is known to be higher in the UK than in most other countries in contninental Europe, which explains the somewhat lower elasticities. Hence, like in the case of France and Germany, Belgian estimates appear to be contained between the Dutch and the British estimates[29].

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[28] To do so, we increase female wage rates uniformly by 10% and simulate the corresponding disposable incomes. Preference parameters are hence used to obtain the deterministic utility associated to the three alternatives. We then add to the deterministic utility, the pseudo-residual we have been drawing to calibrate the model, and predict, for each draw, the new preferred labour market status. The probabilities associated to each status are then averaged over the whole sample and compared to the baseline.

[29] It should be noted that Blundell et al. (1995) use a different methodology for their estimates, namely a natural experiment. Choné, Le Blanc and Robert-Bobée (2003) focus on a sub-sample of mothers with young children. The difference in the sample is likely to explain the higher value of their estimates.

Country	Data	Methodology	Overall change in hours worked	Change in participation	Remarks
France	French Household Budget Survey (EBF), 1994. 2,744 in employment and 860 non-employed	Standard discrete hours LS model (quadratic utility)	0.20	0.18	-
		Flexible LS model with income dependent variables (quadratic utility)	0.38	0.40	-
France	LFS-Tax return matched dataset, 1997. Couples with children under the age of 6: 2,363 in employment and 2,012 non-employed	Simultaneous model of discrete hours LS and childcare (quadratic utility)	1.05	0.38	-
Germany	German Socio Economic Panel (GSOEP), 2000. Labour supply estimates based on 3,702 couples (1,112 females in employment)	Simultaneous discrete hours LS model for males and females (translog utility)	0.27	0.20	-
Germany	German Socio Economic Panel (GSOEP), 2002. Labour supply estimates based on 7,494 households	Simultaneous discrete hours LS model for males and females (translog utility)	0.39	0.15	-
The Netherlands	Dutch Socio-Economic Panel (SEP), 1987. 1,421 in employment and 1,438 non employed	Simultaneous discrete hours LS model for males and females (translog utility)	0.52	-	Change in hours mostly driven by change in participation
The Netherlands	Dutch Socio-Economic Panel (SEP), 1995. 1,150 in employment and 919 non employed	Simultaneous discrete hours LS model for males and females (translog utility)	0.71	-	Change in hours mostly driven by change in participation
Italy	Turin Survey of Couples, 1979. 338 employed and 494 non employed	Continuous LS (piecewise linear budget constraint)	1.18	0.64	-
Italy	Bank of Italy Survey of Income and Wealth, 1993. 2160 couples aged betwen 18-64	Continuous distribution of working hours	0.66	0.51	-
UK	British Family Expenditure Survey (FES) and LFS, 1983. 11,535 employed and 13,200 non-emplyed	Continuous LS (piecewise linear budget constraint)	0.29	-	Pre-school children
			0.71	-	School children
UK	British General Household Survey, 1974. 2,002 in mployment and 1,494 non-employed	Continuous LS (piecewise linear budget constraint)	2.03	1.41	
UK	Lfamily Expenditure Survey (FES), 1978-1992. 16,781 in employment and 7,845 non-employed	Conditional difference in difference	0.21	-	Young children
			0.14	-	No children

Figure 20: Recent labour supply elasticity estimates (females in couples)

	predictions		
	inactivity	part time	full-time
inactivity	26.318	0.754	0.965
part-time	0.011	33.479	0.257
full-time	0.031	0.066	38.120

Source: Author's calculations

Figure 21: Pre and Post-reform transition matrix (percentage points)

5.0.7 Labour supply responses

Low elasticities of labour supply sugest a modest effect of the reform on female labour supply. Indeed, fig. 21 shows the matrix of transitions following the reform. These have been computed using the same methodology as for the elasticities. Following the reform, about 1% of selected women are likely to move into full-time employment, and a modest share is likely to move into part-time employment (+0.75%). Moreover, about one quarter of a percentage point will move from part-time employment to full-time employment. There appear to be very few movements out of employment: the net effect is therefore an increase in the female employment rate. It is worth noting that the movement from full-time employment to part-time employment is particularly small, despite the fact that, as pointed out by De Callataÿ (2002), the CIBRAP is essentially a "gift" to part-time workers.

These figures refer to the reform as a whole. In the appendix, we report transition matrices for each of the measures contained in the reform. Remarkably, the measure that appears to contribute most in encouraging females to take up a job is the broadening of the fiscal brackets, followed by the alignment of the personal deduction for singles and couples. The refundable tax credit has only a limited role in promoting increased labour supply.

Net increases in employment and work hours (in absolute figures) are shown in fig.22. After the reform female labour supply is estimated to increase by around 20,000 units. Interestingly, this result is pretty much in line with the estimates of the Federal Planning Bureau (Saintrain, 2002), although the latter adopts a completely different framework[30]. Confidence intervals were obtained using the same methodology described above for computing confidence intervals for elasticities. The size of the confidence interval is very large, probably owing to the limited size of the estimation sample (as compared to the average sample size in the studies reviewed above). Nevertheless, it is possible to conclude that the reform will have a significant *positive* impact on female labour supply and on hours worked.

It is interesting to compare the estimated impact of the other reforms re-

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[30] In fact the FPB uses an aggregated model in which employment is driven by demand, and assumes that the decrease in the tax burden will partially benefit the dynamics of labour demand, although a slight decrease in the NAIRU is assumed.

	Before reform	After reform	% increase	90 % confidence interval
Hours (1000 hours/month)	27821.03	28528.83	2.33	[0.07-5.32]
Population in employment (1000 units)	908.56	929.74	2.54	[0.28-6.03]

Source: Author's calculations

Figure 22: Net increase in employment and hours worked

viewed in the present paper. Fig. 23 shows the estimates for the German and the Dutch tax reform, as well as an estimate of the labour supply effect of a FTR reform for Italy (indeed quite similar to the one currently under examination by the Italian government). The increase in hours worked is highest in Italy. It must be noted, however, that Aaberge et al. (2002) estimate labour supply responses using a "pseudo-continuous" framework: the fact that workers are not constrained in their choice of hours allows for a marginal increase in hours worked (the intensive margin) with a simultaneous decrease in the participation rate (the extensive margin). The second greatest effect in terms of hours comes from the Dutch reform. This is not surprising as the Dutch labour market is characterized by significant dispersion in work hours and one of the main characteristics of the reform is to increase incentives to work full-time for secondary earners (Das and Van Soest, 2000). The increase in employment rate (and not in hours worked) is most relevant in the Belgian reform. Another source of difference, however, is the fact that the reviewed studies, excluding Bargain (2003), model both partners' choices simultaneously (in a unitary setting), while we assumed an unchanged male labour supply strategy. It is likely that some of the increased participation predicted by our model would disappear if we allowed for male labour supply to change as well.

Haan and Steiner (2004), however, provide some unexpected findings in that respect. Labour supply responses are estimated for both men and women using both flexible models where both partners are allowed to change working hours and fixed models where the spouse's working time is assumed to be fixed. They find that estimated labour supply responses are higher for men when women's labour supply is fixed, but the contrary is true for women, whose labour supply responses are larger when male labour supply is allowed to change. Such empirical findings should encourage further research to see whether they extend beyond the German case. Nevertheless, in both models, female labour supply elasticities are quite low, which explains the limited behavioural reactions.

The results regarding the in-work benefit component of the Belgian tax reform should be compared with the French experience only, since the design of the WFTC is not comparable to the CIBRAP. The results for the WFTC are

		% increase in participation	% increase in hours worked
Das and Van Soest (2000)	Dutch Tax Reform	1.48%	4.01%
Haan and Steiner (2004)	German Tax Reform	0.50%	1.03%
Aaberge et Al. (2000)	Italian Tax Reform*	-1.80%	5.81%
	Belgian Tax Reform	2.33%	2.54%
Blundell et al. (2000)	WFTC		
- married		-0.57%	-0.18
- singles		2.20%	0.75%
Bargain (2004)	PPE	0.45%	0.59%
	CIBRAP	0.21%	0.30%

*Simulated reform is a 23.3% flat rate tax; continuous LS model

Figure 23: Effects of selected reforms on the labour supply of females in couples

presented here just to stress again the difference between IWB, and the potential negative incentives on secondary earners of a means-tested IWB. The French PPE appears to have a larger impact on female labour supply; almost double. This is partially due to the different design of the measure despite a similar budgetary effort (in percentage of GDP): the PPE is in fact higher when working full-time than when working part-time and, more importantly, the benefits is scaled on the number of dependant children, which is not the case for the CIBRAP.

If the CIBRAP performs relatively poorly with respect to the PPE, the global tax reform appears to have quite a substantial impact on female labour supply. Our analysis of the gains of the reform should therefore be extended to consider dynamic effects derived from increased labour market participation.

5.1 Distributional impact

Behavioural responses do not significantly modify the distributional impact of the reform as described in the static analysis. Labour supply responses are in fact distributed over the whole range of the income distribution. Fig. 24 shows the average percentage gain per income decile. Not surprisingly, in percentage terms, the gains are more concentrated in the second and in the middle-lower income deciles. Average incomes are lower at the bottom of the distribution, so that a dispersed increase in labour supply generates higher percentage gains than in higher income deciles.

Fig. 25 shows income distribution indicators before and after labour supply responses. Again the picture is not significantly modified by second-round effects. Contrary to first-round effects, poverty decreases only slightly. Interestingly, however, inequality is reduced both at the bottom of the distribution

Income decile	Before LS adjustment	After LS adjustment
1	0.905	1.357
2	2.102	2.703
3	3.299	4.315
4	3.146	3.596
5	3.550	3.748
6	3.393	3.571
7	3.210	3.371
8	2.869	3.013
9	2.586	2.833
10	3.175	3.175

Source: Author's calculations

Figure 24: Percentage gain before and after LS responses

	Before reform	After reform, no LS adjustment	After reform, after LS adjustment
Poverty			
50% of median disposable income	9.39	8.87	8.81
60% of median disposable income	15.66	14.98	14.92
Inequality			
Gini	0.2764	0.2772	0.2767

Source: Author's calculations

Figure 25: Income distribution indicators, before reform, after reform and after LS adjustment

and in the middle range.

Finally, second-round effects will have an effect on the budgetary efforts, as tax revenue will increase. The increase, however, is rather modest: less than 120 million EUR, i.e. between 4% and 6% of the total cost of the tax reform (depending on official or own estimates).

6   Conclusions

Reforms in the tax and benefit system have been implemented by several EU countries in recent years. This paper evaluates the impact of the Belgian 2001 tax reform, as if the reform had been instantaneously fully implemented. It therefore neglects the complex rule connected with the progressive implementation of the reform. The reform is assessed considering both its redistributional impact (equity) and its effect on potential labour supply (efficiency) - although

the latter evaluation is restricted to females living in couples only.

The *static* effects of the reform in terms of increase in disposable income appear to be strongest for the middle to upper class - although all income deciles benefit to some extent from the tax cuts. In this concern, we may agree with De Callataÿ (2002) who argues that the 2001 tax bill did not bring about a true reform of the tax system, but merely a generalized reduction of the fiscal burden that does not alter the existing structure of the tax system. To assess the potential medium term effects of the reform, we have used a discrete hours labour supply model, to describe behaviour of women in couples. The *dynamic* effects of the labour supply were quite significant indeed. The size of the effects appears to be in the range of the effects related to similar tax reduction in other EU countries. The distribution of incentives appears to be quite dispersed over the whole range of the income distribution, and particularly low at the bottom of the distribution. As a consequence, second-round effects modify the first round effects only slightly. To this extent, we also agree with the analysis of Valenduc (2002) who argues that the potential benefits of the reform are not concentrated in the range where inactivity traps are most significant.

Interestingly, the most celebrated innovation of the reform, i.e. the CIBRAP, is found to have a small impact as a labour supply incentive. this conclusion, however, could be altered should the analysis be extended to male labour supply behaviour and to single-adult households. At the same time, it seems that the negative impact on full time employment suggested by De Callataÿ (2002) is not very significant, as witnessed by the moderate share of workers shifting from full time to part time (see annex).

Yet, it is likely that a different calibration of tax cuts and in-work benefits could have concentrated labour supply incentives in the range where inactivity traps are most significant. This issue is left for further research.

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7 Appendix

7.0.1 In-work benefits in North America: The Earned Income Tax Credit (EITC) and the Self Sufficiency Program (SSF)

In the US, the *Earned Income Tax Credit* was introduced as early as 1975, wheras the Self-Sufficiency Programme was introduced in the beginning of the 90s as a massive experimental programme in two Canadian provinces.

Following 1975, the Earned Income Tax Credit was kept at relatively modest levels for the first ten years, and was expanded with the 1986 Tax Reform Act (TRA-86) of the Reagan administration, and again in 1990. The EITC, however, gained most importance after the 1993 Tax Act of the Clinton administration, which brought about an increase of the benefit by over 150%. In order to qualify for the EITC, a taxpayer must have a positive earned income (defined as earnings or self-employment income) below a certain amount varying in relation to his family situation ($29,666 in 2003, for a taxpayer with a qualifying child), at least a dependent child and must meet some residence criteria . The maximum amount of the tax credit for 2003 incomes is $4,202 for a taxpayer with two children with income between $10,500 and $14,750, and it may be claimed as lump sum or on a monthly basis; the credit for such a unit is phased in at a rate of 40% and it is phased out at a rate of 21%.

The Self Sufficiency Program was introduced in Canada on a purely experimental basis in 1992 and data on participants were collected for a period of 10 years up to 2002. Up to now it is probably the biggest research experiment in social science ever to be set up. In order to have a valid control group, participation in the programme was randomly offered to 50% of a pre-selected sample of more than 6,000 lone mothers living in British Columbia or New Brunswick. Lone mothers needed to be inactive, aged at least 19 and on income assistance during the past 11 months. Women who were offered participation in the programme had a window of 12 months to get into full time employment (at least 30 hours a week). Conditional on participants being in full employment, a substantial benefit was paid which would reduce the disincentive of the withdrawing of social assistance once in employment (Card and Robins, 1996). The income supplement corresponded to half the difference between a participant's earnings from employment and an "earnings benchmark" which varied across provinces in accordance with the level of IA payments. The benchmark was $37,000 in British Columbia and $30,000 in New Brunswick. Unearned income (such as child support) or earnings of other family members did not affect the amount of the supplement. When tax obligations and tax credits were taken into account,

most families had incomes from \$3,000 to \$7,000 per year higher than if they had remained on income assistance.

7.0.2 The microsimulation model: Modété

Modété is a static tax-benefit computer microsimulation model, i.e. a series of algorithms capable of computing benefit eligibility and tax liability based on relevant individual and household characteristics. Modété was constructed at DULBEA – ETE, at the Free University of Brussels (ULB), by Joyeux in the framework of the EU financed project EUROMOD, which aimed at the development of a European level microsimulation model (Joyeux ,1998). The model originally used data from the third wave of the PSBH (spring 1994) and simulated the 1998 tax benefit environment, but has been updated for the purpose of the present study to simulate 1998 and 2001 tax and benefit rules on the 1998 wave of the PSBH[31].

Technically, Modété operates on an input database – the PSBH – and through algorithms written in C++ generates an output database where certain components of household disposable incomes have been simulated. Since some income transfers depend on the past record of labour market activity, not all benefits may be simulated. Unemployment compensations and pension incomes correspond to amounts reported in the interviews. Other allowances, like family benefits, MINIMEX and minimum old age pension are exlusively based on current demographic characteristics, labour market status and income, and are therefore fully simulated.

As far as liabilities are concerned, all taxes and social security contributions are fully taken into account by the model, with the only exception of property tax and deductions for self-employment income (the latter are imputed). Such limitations, however, do not represent a major drawback for the purpose of the present study, given that estimations and labour supply forecasts are based on a sub sample of active and potentially active persons in working age.

Another point of concern is that the PSBH does not report gross incomes: these have been imputed by reversing the microsimulation model.

7.0.3 The Belgian Tax Reform

Fig. 26 shows all the components of the Belgian Tax Reform and the corresponding budgetary effort. Globally, the measures analysed in the present paper represent around 85% of the total cost of the reform. The remaining measures may not be easily simulated, given the lack of relevant information in the dataset.

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[31] See Orsini, 2004a and Orsini 2004b for further details on simulation and validation of the model output with respect to monetary aggregates and income distribution statistics.

	Bilions EUROS	Billions BEF
Reduction in the tax burden on labour		
CIBRAP	0.446	18
Increase in the deductions for working expenses	0.248	10
Broadening of the central tax brackets	0.768	31
Abolition of highest marginal tax rates	0.174	7
Neutrality with respect to marital status		
Alignment of the tax exempt income quotas	1.091	44
Individualisation of tax reductions for replacement incomes	0.397	16
Generalisation of separate taxation to unearned income	0.050	2
Improvement in the way that dependent children are taken into account		
Making tax reduction refundable	0.074	3
Increase in the single parent means-test limit	-	-
Generalisation of tax exempt for all single parents with dependent children	0.050	2
More environmentally sound taxation		
Deduction for non-car transport costs	0.074	3
Energy saving deductions	0.037	1.5
Total	3.334	134.5

Source: Reynders (2001)

Figure 26: Estimated cost of the reform

7.0.4 Hours worked and wage equation

Institutional constraints do not allow for a continuous distribution of working hours. These are usually fixed by the terms of an employment contract and vary only slightly around the typical contract hours. This is especially true for countries where labour market regulation is particularly tight. Part of the variation around the full-time and part-time peaks is usually due to measurement error and/or atypical working time in the reference period. Fig. 27 shows the actual distribution of working hours of females in couples for the estimation sub-sample. The concentration around 0, 20 and 40 hours is particularly evident.

Fig. 28 reports the distribution of hours after discretization and compares it with LFS (2001) statistics. The following rule was applied to discretize working time:

$$H = 0 \text{ if } (h \leq 15)$$
$$H = 20 \text{ if } (30 \leq h > 15)$$
$$H = 40 \text{ if } (h \geq 30)$$

The share of women in atypical part-time is relatively small, so the approximation to part-time is not very significant. Female population in part-time employment is underestimated, whereas full-time employment is slightly overestimated in the PSBH. Part of these differences are probably due to the different year (PSBH data refer to 1998) and sampling design. The inactive population is much larger according to the LFS than to the PSBH. Such difference is entirely
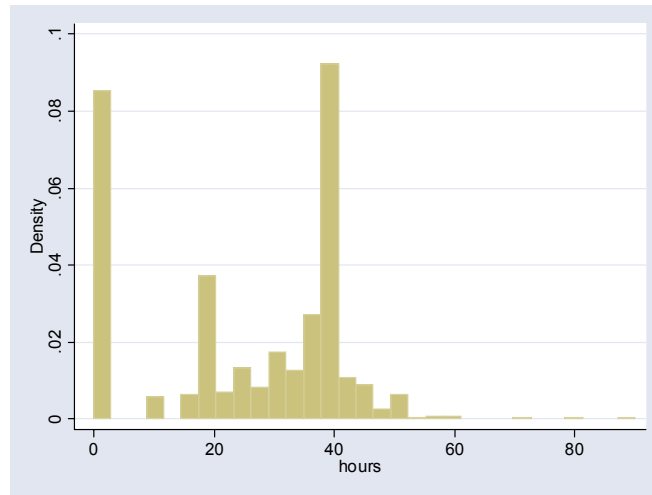
49

Figure 27: Distribution of hours worked by females in couples

	LFS (2001)		PSBH	
inactive	614248	36.84	363600	27.98
atypical part time	146178	8.77	-	-
part-time	438992	26.33	439230	33.80
full-time	468091	28.07	496668	38.22
total	1667509	100.00	1299498	100.00

Source: Author's calculations based on LFS (2001)

Figure 28: Distribution of working hours - females in couples 25-60 years old

due to differences in total population. We consider only potentially active females (thus excluding the retired, the unemployed, students and the disabled), which explains why the two totals differ.

Fig. 29 shows the result for the wage equation. All coefficients are strongly significant and signs and magnitude are as expected: wages increase less than proportionally with potential experience (defined as age minus 6, minus years of schooling) and with each additional educational level. In particular females with master or Ph.D. are paid on average almost twice as much as less educated women - other things being equal. Estimates of the participation equation also shows expected results: being married and having children reduces the probability of being in employment, whereas additional education increases it. Moreover, the odds of being in employment increase with age, but decrease after a certain age level. Regional unemployment level decreases the odds of being in employment. The Wald test for independent equations, nevertheless, was

						Number of obs	2020
						Censored obs	673
						Uncensored obs	1383
						Wald(6)	369.86
						Chi2	0
		Coef.	Std. Error	z	P>|z|	[95% Conf. Interval]	
Hourly wage							
	potential experience	0.0275	0.0037	7.50	0.000	0.0203	0.0347
	(potential experience)^2	-0.0003	0.0001	-3.48	0.001	-0.0005	-0.0001
educational dummies	- lower secondary	0.1396	0.0682	2.05	0.041	0.0058	0.2733
	- upper secondary	0.3291	0.0687	4.79	0.000	0.1944	0.4639
	- university degree	0.6874	0.0718	9.57	0.000	0.5467	0.8282
	- master or ph. D.	0.8869	0.0777	11.42	0.000	0.7347	1.0392
	constant	5.2536	0.0760	69.17	0.000	5.1048	5.4025
Participation							
	married	-0.3220	0.1045	-3.08	0.002	-0.5268	-0.1172
	# children under 6	-0.3076	0.0975	-3.16	0.002	-0.4987	-0.1166
	age	0.1520	0.0256	5.93	0.000	0.1017	0.2022
	(age)^2	-0.0023	0.0003	-7.80	0.000	-0.0029	-0.0017
educational dummies	- upper secondary	0.4591	0.0849	5.41	0.000	0.2927	0.6255
	- university degree	1.0829	0.0994	10.89	0.000	0.8880	1.2778
	- master or ph. D.	1.6235	0.2090	7.77	0.000	1.2139	2.0331
	regional unemployment	-0.6932	0.3001	-2.31	0.021	-1.2814	-0.1049
	constant	-1.6200	0.5491	-2.95	0.003	-2.6962	-0.5438
	/athrho	0.1280	0.1150	1.11	0.266	-0.0975	0.3534
	/lnsigma	-1.0125	0.0352	-28.79	0.000	-1.0814	-0.9436
	rho	0.1273	0.11			-0.097	0.3394
	sigma	0.3633	0.01			0.339	0.3892
	lambda	0.0462	0.04			-0.035	0.1276
Wald test of independent equations (rho=0)		1.24		Chi2	0.266		

Author's estimations based on the PSBH

Figure 29: Female wage rate - Heckman two steps estimation

rejected, meaning that the hypothesis of the lack of selection bias could not be rejected.

Fig. 30 shows the kernel density distributions of predicted and reported hourly wages for the estimation sub-sample. The distribution of the predicted wages follows closely that of reported hourly wage, although the former is more concentrated.

7.0.5 Relative impacte of single measures

Fig. 31 shows the predicted impact of each measure of the tax reform. It shows that the least effect comes from the lowering of highest marginal tax rates, whereas the largest effects come from the broadening of the central tax brackets and the increase in the tax exempt quotas for married couples.
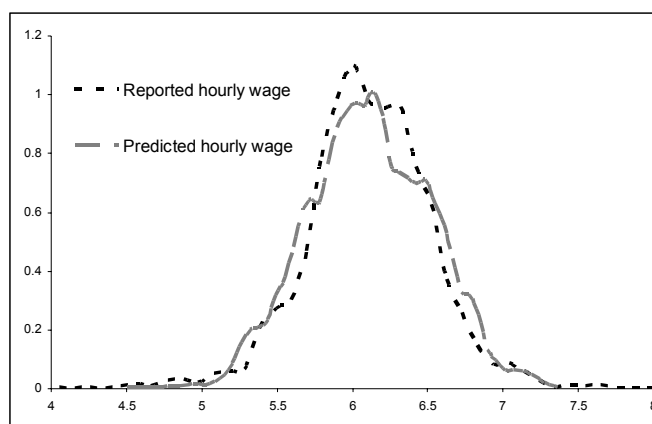
Figure 30: Reported and predicted wage distribution (logarithm of hourly wage)

Broadening of central tax brackets			
	inactivity	part-time	full-time	pre-reform
inactivity	27.12	0.37	0.54	28.04
part-time	0.01	33.44	0.30	33.75
full-time	0.04	0.04	38.15	38.23
post reform	27.18	33.85	38.99	

Lowering highest marginal tax rates			
	inactivity	part-time	full-time	pre-reform
inactivity	27.69	0.13	0.01	27.83
part-time	0.01	33.63	0.11	33.75
full-time	0.05	0.04	38.13	38.22
post reform	27.75	33.79	38.25	

CIBRAP			
	inactivity	part-time	full-time	pre-reform
inactivity	27.76	0.11	0.17	28.04
part-time	0.01	33.68	0.05	33.75
full-time	0.05	0.05	38.15	38.25
post reform	27.83	33.84	38.37	

Increasing tax exempt quota for coupples			
	inactivity	part-time	full-time	
inactivity	27.41	0.28	0.35	28.04
part-time	0.01	33.71	0.03	33.75
full-time	0.04	0.09	38.09	38.22
post reform	27.46	34.08	38.46	

Source: Author's calculations

Figure 31: Labour market effect of single measures of the 2001 tax reform