Is Belgium 'Making Work Pay'?*

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Working Paper
This Draft: March 22, 2006

Abstract

In the period 2001-2004 two major reforms followed in Belgium: a personal income tax reform (2001) and a reform of social security contributions for low skilled employees (2004). Using a discrete hours labor supply model, this paper assesses the impact of these reforms on aggregate labor supply of males and females in couples. Results suggest that the reforms had a positive (but moderate) effect on both participation and hours worked. Targeted reductions in social security contributions, however, proved to be more effective than the newly introduced tax credit on low earnings.

Keywords: Tax-benefit Systems – Microsimulation – Household Labour Supply – Multinomial Logit.
JEL Classification: D31, H21, H23, H24, H31, J22.

*The author thanks Olivier Bargain, André Decoster, Jérôme Dehenau, Peter Haan, Sile O'Dorchai, Christian Valenduc, Arthur Van Soest, Katharina Wrohlich, as well as participants of the BENA, CES and DULBEA seminars for helpful comments and suggestions. This paper was written as part of the MICRESA (Micro Analysis of the European Social Agenda) project, financed by the Improving Human Potential programme of the European Commission (SERD-2001-00099). I am grateful to the PSBH teams at the University of Liége and University of Antwerpen for support with the PSBH data. The usual disclaimer applies. Correspondence: Kristian Orsini, CES-KUL, Naamsestraat 69, Leuven, 3000 Belgium. Email: kristian.orsini@econ.kuleuven.be

1 Introduction

Recently cross-country empirical studies on the potential negative effects of the tax burden on employment have been surveyed by De Haan, Sturm, and Volkerink (2003). 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 labor 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.

This holds also for Belgium, where low skilled employment rate lies just above 55%. In the case of women, and even more so married women, the picture is particularly dramatic. According to recent Labour Force Survey statistics, slightly less than 40% of married women with less than secondary education are in employment.

A significant tax reform was already introduced in Belgium over the period 1988-1993 (Decoster, Standaert, Valenduc, and Van Camp, 2002). The reform implied a shift from a joint family taxation (which is known to have strong disincentive effects on married women's labor 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 labor supply responses to such deep reform.

Traditionally, employment policy in Belgium has focused on demand side measures, probably due to the high level of structural unemployment, mainly linked to the heavy industrial restructuring process. 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 22,500 BEF per year, i.e. approximately 65 EUR per month in current values. Using the macro-model HERMES, Van der Linden (1991) estimated that such reform would have reduced unemployment by around 25,000 units. SSC reductions have indeed characterized 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. Using a demand driven aggregated model and reasonable hypotheses of labor demand elasticity, IMF economists (IMF, 2001) have estimated that the 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.

Recent reforms have tried to tackle the inactivity trap from a supply perspective. Starting from 1999 the federal government has taken major steps to reduce the tax burden on labor. The first measure was the introduction of substantial reductions in employees' SSC for low paid workers.

[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'Donoghue (2003)

In a second step the government 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.

In 2001 the Belgian parliament voted a law for a new reform of the personal income tax,[2] which, amongst other purposes, included a supposed positive effect on labor supply. The reform was estimated to have a budgetary cost of 3.33 billion EUR, which corresponded to a decrease in tax revenue by almost 10%.

In year 2004, a year before full implementation of the tax reform, a second reform amended some aspects of the tax regime. In particular the newly introduced tax credit on low earnings was replaced by a substantial increase in low skilled employees' SSC.

This paper assesses the impact of the last two reforms on the labor market, focusing on the subpopulation of households where both spouses are in working age and have flexible labor supply (i.e. not in full time education, not disabled and not retired).[3] Using a methodology largely exploited in the recent economic literature on ex-ante evaluations of tax benefit reforms, this paper significantly extends previous static analysis, such as those performed in Vallenduc (2002). Employment dynamics, so far only analyzed in the framework of partial equilibrium macro-models, such as in Saintrain (2002), are hence analysed taking into account the heterogeneity of the population in working age, using a structural supply-driven microeconomic model.

In the following we assume that there are no feedback effects due to the interaction of labor supply and demand, nor do we consider the potential effects of involuntary unemployment. Neglecting the latter may indeed lead to severe bias in the estimate of labor supply elasticities, while aggregated behavioral effects tend to be overestimated, (Bargain, Caliendo, Haan, and Orsini, 2005). It might be argued, however, that neglecting involuntary unemployment as well as potential feedback effects will lead to an upper bound estimate of the behavioral adjustments. The analysis will therefore provide an optimistic - or upper bound estimate of the impact of the reforms.

The structure of the paper is as follows: section 2 describes both reforms in detail and show the impact of the reform on two typical households; section 3 presents the data and the econometric framework; section 4 analyzes the budgetary impact of the reforms and section 5 describes potential behavioral adjustments. Conclusions are drawn in section 6.

2 The 2001 Tax Reform and the Employment Bonus

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 being phased in progressively between 2001 and 2005. One interesting feature of the reform is that it includes both a generalized tax reduction and the introduction of a refundable earned income tax credit. The principal axes of the reform are:

[2] 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'.

[3] Self employed have also a flexible labor supply. The information on hours worked, however is often incomplete, and even gross earnings are frequently reported with a high degree of approximation.

1. the introduction of an earned income tax credit - CIBRAP hereafter[4] ;
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,
5. and the alignment of the tax exempt income quotas for singles and married couples.

In 2004, however, the CIBRAP was replaced by the 'Bonus à l'emploi' - Employment Bonus, BE hereafter - an additional reduction of low wage employees' SSC.

These measures, representing together around 85% of the total 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 (2002), Ministère de Finances (2003), Carey (2003) and Vallenduc (2002). The following sections explain in some detail the content of the reform. An overview of the reform is summarized in table 1.

2.1 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 (Ministère de Finances, 2002). 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 Families' Tax Credit', implemented in Great Britain by the Blair Government' (Reynders, 2001, p.7) – [translated from French].

In fact, the Belgian CIBRAP turned out to be very different from the WFTC and the EITC, and is more similar to the Dutch 'arbeidskorting' introduced with the 2001 tax reform. Like the latter, the CIBRAP is fully individualized and not means-tested on household income, but, similarly to the Anglo-Saxon measures, it is refundable.[5]

[4] Crédit d'Impôt pour les Bas Revenus d'Activité Profesionnelle.

[5] 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 tax credit 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.

Eligibility starts when net earned income (i.e. gross earned income net of SSCs and imputed professional expenses) is above EUR 3,750. Between this lower threshold and EUR 5,000 the benefit will be phased in very sharply at a rate of 40.5% (i.e. the benefit increases by EUR 40.5 for every EUR 100 earned between EUR 3,750 and EUR 5,000). Between EUR 5,000 and EUR 12,530 EUR the benefit amounts to EUR 506 and between EUR 12,530 and EUR 16,280 the benefit is phased out at a rate of 13.5%, meaning that EUR 13.5 of benefit are lost for every additional EUR 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 EUR 90 (EUR 253).

One year before its full implementation, however, the CIBRAP was replaced by the EB: an increased reduction on SSC of low wage employees. The credit is however still working for self-employed, as the latter do not benefit from the reductions in social security contributions.

2.2 Employment Bonus

The term 'Employment Bonus' is somewhat misleading, and has generated some confusion in the public debate. The bonus is indeed a structural reduction on quarterly SSC paid by low wage employees. The first reduction had been introduced in 1999. In 2001 it consisted of 81.8 EUR per month, for full time equivalent gross employment incomes between 877 and 1,147 EUR.[6] The benefit was then phased out with a rather sharp taper rate of 36.5%, to be fully exhausted at 1,367 EUR. Following the introduction of the new bonus, the base reduction will reach 140 EUR in 2006. The minimum income threshold has been abolished, while the upper threshold was brought to 1,210 EUR per month. After this level the reduction is phased out with a taper of 17.8%, to be fully exhausted at an equivalent monthly full time gross income of 2,000 EUR. In principle, a minimum wage legislation applies in Belgium. In 2001 full time minimum wage was 1,140 EUR per month. This implies that the bonus should never exceeds SSC due. In some minor cases (mostly for young apprentices) the minimum wage legislation does not apply. In this case the bonus may even become refundable.

The appealing feature of the bonus is its link with equivalent full time earnings: gross earnings are first transformed in full time equivalent, then the maximum reduction to which a worker might be entitled is scaled to the amount of hours worked. This way, employees working full time are entitled to the full reduction, while part time employees will only have half of the maximum reduction. This feature is indeed an improvement with respect to the previous CIBRAP: the EB clearly distinguish between low productivity and low effort (thus avoiding the part-time premium implicit in the CIBRAP), and low wage workers benefit from the increase in net income immediately (instead of having to anticipate next year's tax reimbursement).

[6] This figures refer to white collar workers. For blue collars workers the maximum amount and the income limits are slightly higher due to differences in the social security regime.

2.3 Tax allowance for professional expenses

According to Belgian tax law, lump sum deductions for work-related 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. Earnings in the range between 0 and EUR 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).

2.4 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 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. The 30 and 40% marginal tax rate brackets will 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.

2.5 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 (at 50%). This corresponds to a drop of 5% in the highest bracket and of 2.5% in the second highest bracket.

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

The most expensive measure is the alignment of the lump sum tax exemption of singles and married couples. The basic personal tax deduction for married couples increases in two steps from EUR 4,350 to EUR 4,540 and in 2005 from EUR 4,540 to EUR 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. This measure is likely to have a significant impact on the labor supply of secondary earners in couples, most often women.

2.7 Pre and post reform budget lines

The effect of the reform may best be represented by comparing pre and post reform budget sets. In figure 1 this is done for a single breadwinner household and for a two earner household. Both households also have two young dependent children (aged 4 and 6). The pictures show the increase in disposable income, as working hours increase from 0 to 80 hours per week. In the first case, gross earnings start from zero, while in the second case initial gross earnings correspond to full time gross earnings of one of the spouses. The hourly wage is 6.6 EUR, which correspond to the 2001 minimum wage.[7]

In the case of the single breadwinner household, the most striking feature is the flat segment that goes up to almost 32 hours worked per week. Indeed the minimum income scheme, as it is means tested on net household income, imposes an implicit 100% tax rate on labour market income.[8]

This pictures clearly shows that in complex tax and benefit environments, characterized by generous income support schemes, reductions in the tax burden are not per se sufficient to modify the unskilled's financial incentives to take up work.

Following the reform, the disposable income when working part time (or 3/4 of a full time) is exactly the same as before the reform, which in turn is almost the same as the disposable income when not working at all. The reform however clearly increases disposable income when working full time. In the case of the first reform, however, there is a small peak in disposable income when working 38 hours per week. After this threshold disposable income increases at a lower rate as the CIBRAP is tapered away. By hourly wages slightly higher than the minimum wage, this peak comes even before. This 'part time premium', on the other hand, is not present in the second reform. Given that the reduction is social security contributions is proportional to working hours, the benefit increases the net wage of the low skilled. The second reform therefore clearly distinguishes between low skill and low effort.

The difference between the two reforms is even clearer in the case of two earner households. Between 24 and 38 hours worked, disposable income is higher under the first reform. The two reforms are almost equivalent when working full time, while the second reform is clearly more advantageous when working over time. Again the picture refers to a couple where both spouses work at the minimum wage. For hourly wages above the minimum wage, the CIBRAP creates an unambiguous advantage in working less than full time (indeed the incentive to work part time is stronger the higher the hourly wage - at least until a certain threshold).

The two pictures give already an idea of the possible effects of the reforms: in both cases there is a clear incentives for the less skilled population too take up work. The CIBRAP, however, may push secondary earners to take up a part time job, while the EB does not preset an implicit part time premium. For the medium and highly skilled population, disposable income in work increases

[7] Budget sets for higher hourly wages were also produced and are available upon request.

[8] Increased family benefits for dependent children are also tapered away as gross earnings increase. The double means testing of minimum income and additional family benefits lead to a poverty trap in the very first part of the budget set.

even more (in percentage terms). However, the labour supply adjustments will depend crucially on the interaction between substitution and income effects. In order to consistently account for these effects in a heterogeneous population, we need to set up a methodological framework that allows us to recover the preference structure of the working population. This is done in the next section.

3 Tax-benefit reforms and labor supply: a methodological framework

The importance of the reforms implemented in the US and in the EU in the last decades has fostered a rich literature on the impact of changes in the budget constraint on labor supply. Techniques based on microdata, allow for a full analysis of the distribution of costs and benefits of economic reforms and provide better estimates of potential labor supply effects.

A variety of methodological approaches have been used for in-depth analysis of the labor 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 behavior of different social groups. Most approaches nevertheless are ex-post. Given the time delay in the availability of data such analysis are mostly of historical interest.

Ex-ante evaluations however are also possible. The latter rely on fully structural models of labor supply, on a detailed microsimulation model and on a sufficiently large database. The microsimulation model allows to reproduce the budget constraint for each household, i.e. the latent set of working time and consumption alternatives, while the structural model rationalizes observed behavior.

3.1 The data

This study relies on the most recent wave of the PSBH, i.e. the 11th wave collected in 2001 and containing information on the incomes of year 2000. The survey covers about 7,000 individual living in approximately 3,000 households. Unfortunately the 11th wave was the last wave of the survey, so that it will not be possible to assess the reform ex-post using techniques based on microdata (e.g. difference in differences). Descriptive statistics of the adult population are presented in table 2.

3.2 Modété

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. For more details, see Joyeux (1999).

3.3 Behavioral model and econometric framework

Traditional approaches, based on the estimation of continuous labor supply functions, have proven 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 labor supply are considered. Recently, however, the analysis has been greatly simplified by the discrete approach proposed by van Soest (1995). Such models explicitly recognize the institutional constraints on labor supply which result in a limited set of working time alternatives (inactivity, some part-time categories, full-time and over-time).

Most importantly, however, the computational burden of estimating labor supply functions boils down to ML estimation of a more or less articulated conditional logit function.

Once preference parameter are estimated, optimal behavior conditional to the post reform budget constraints is used to predict post reform participation and working time decisions.[9]

Discrete choice models of labor supply are based on the assumption that a household can choose among a finite number $J+1$ of working hours (J positive hours and non-participation); each hour j=0,...,J corresponds to a given level of disposable income C_{ij} (we suppose here that choice j=0 corresponds to non-participation) and each discrete bundle of leisure and income provides a different level of utility. The approach has become standard practice as it provides a straightforward way to account for taxes and benefits, hence nonlinear and nonconvex budget sets, and the joint labor supply of spouses. In effect, choices j=0,...,J in a couple correspond simply to all the combinations of the spouses' discrete hours. We assume that females may choose between working 0, 20, 40 or 50 hours, while men may work 0, 40 or 50 hours,[10] the database contained almost no case of males in couples working part-time. The interaction of the two choice generates 12 alternative characterized by triplets of disposable income, leisure of the female spouse and leisure of the male spouse. It should be noted here that the term leisure should be intended as non labor market time. Household's utility V_{ij} derived by household i from making choice j, correspond to the sum of the deterministic part of the utility U_{ij}, which is assumed to depend on a function of spouses' leisures Lf_{ij}, Lm_{ij}, disposable income C_{ij} (equivalent to aggregate household consumption in a static framework) and household characteristics Z_i, and of a random term ϵ_{ij}, interpretable as an optimisation error:

$$V_{ij} = U(Hf_{ij}, Hm_{ij}, C_{ij}, Z_i) + \epsilon_{ij}. \tag{2}$$

[9] See van Soest (1995), Keane and Moffit (1998), Hoynes (1996), Blundell, Duncan, McCrae, and Meghir (2000), Van Soest and Das (2000), Bonin, Kempe, and Schneider (2002), Bargain (2004) and Haan and Steiner (2004).

[10] Hours worked were censored at 80 hours per week and discretized according to the following rule:

$$\begin{aligned} H = 0, \forall h \in [0, 10] \\ H = 20, \forall h \in [11, 34] \\ H = 40, \forall h \in [35, 44] \\ H = 50, \forall h \in [45, 80] \end{aligned} \tag{1}$$

When the error term ϵ_{ij} is assumed to be identically and independently distributed across alternatives and households according to a $EV-I$ distribution, McFadden (1973) proves that the probability that alternative k is chosen by household i is given by:

$$P_{ik} = \Pr(V_{ik} \geq V_{ij}, \forall j = 0, ..., J) = \frac{\exp U(Hf_{ik}, Hf_{ik}, C_{ik}, Z_i)}{\sum_{j=0}^{J} \exp U(Lf_{ij}, Lf_{ij}, C_{ij}, Z_i)}.$$

The likelihood for a sample of observed choices can be derived from that expression and maximized to estimate the parameters of function U. When actual working hours are used, the econometrician assumes that individuals choose freely their working hours and face no demand-side constraints.

In the following, we assume a quadratic specification of the utility function as in Blundell, Duncan, McCrae, and Meghir (2000). Hence, the utility function of a couples household has the following form:

$$\begin{aligned} U_{ij} = \alpha_c C_{ij} + \alpha_{cc} C_{ij}^2 + \alpha_{hf} Hf_{ij} + \alpha_{hhf} Hf_{ij}^2 + \alpha_{hm} Hm_{ij} + \alpha_{hhm} Hm_{ij}^2 \\ + \alpha_{chf} C_{ij} Hf_{ij} + \alpha_{chm} C_{ij} Hm_{ij} + \alpha_{hmhf} Hf_{ij} Hm_{ij}. \end{aligned} \tag{3}$$

We assume that preferences vary across households through taste-shifter: (age, number of small children) on income and leisure coefficients:

$$\begin{aligned} \alpha_c &= \alpha_{c0} + \alpha_{c1} X_1 \\ \alpha_{hf} &= \alpha_{lf0} + \alpha_{lf1} X_2 \\ \alpha_{hm} &= \alpha_{lm0} + \alpha_{lm1} X_3. \end{aligned} \tag{4}$$

We follow van Soest (1995) and introduce a dummy variable for the part time β_{pt}. Dummy variable may capture different aspects not explicitly treated in the model: search costs, rationing effect and dynamic maximization.

For workers with observed wages, gross income across different labor supply alternatives was computed assuming a constant hourly wage rate. For inactive and unemployed workers hourly wage is not observed. The latter was therefore estimated on the whole sample of individuals in working age (either employed, unemployed or inactive)and imputed for males and females supplying zero hours. For females, where the censoring effect is likely to be more significant, we have used a Heckman correction model. In the case of males the hypothesis of null correlation between the residuals of the labor supply and the wage equation could not be rejected, so we used a standard regression model estimated on the sample of employees. Estimates of the wage equations are presented in table 3. Coefficients all have the expected sign, and the inverse Mill's ratio (lambda) hints at a significant selection bias for females. In particular the constant for female wage is somewhat lower than that of males, while the effects of schooling and potential experience have a similar order of magnitude. The prediction error is given by the RSME, and - as expected - is

slightly larger for females than for males. The error are nevertheless in the order of magnitude of other recent studies (Laroque and Salanie, 2002).

Once real and predicted hourly wages have been obtained for all adult in the sample, we impute the household gross income corresponding to the different working time alternatives and, using the microsimulation model, we are able to compute the corresponding set of disposable incomes. These are summarized in table 4.

Parameter estimates for the behavioral model are shown in table 5. The results are in line with theoretical predictions and recent empirical findings. The coefficients imply marginally decreasing utility of consumption and leisure. Together with the interaction terms, these coefficients determine the elasticity of labor supply. The preference for leisure displays a clear pattern with respect to age and number of small children. Observed heterogeneity on the other hand does not seem to explain the preference for income. The derivatives with respect to leisure show that for a significant share of the population positive monotonicity in leisure is not respected. As stressed by Euwals and van Soest (1999), there is no necessity to restrict preferences relative to the taste for leisure. With respect to income, however, preferences are well behaved, and no restriction had to be imposed in the estimation.

The quality of the model's predicting power may be best judged by comparing the observed and predicted frequencies for each alternative. The predicted frequencies, reported in table 6 are obtained by averaging up, over the whole sample, each household's probability of choosing a given regime.

4 Budgetary cost

The measures simulated in the present study represent the core of the tax reform (and they absorb around 85% of the estimated budgetary cost). Minor aspects of the reform, as well as transitory measures, will not be considered. We simply simulate the final effects of the reform, as if it had been instantaneously implemented in 2001. Table 7 compares the official estimated budgetary cost of the planned personal income tax reform with the estimates produced by the tax benefit model Modété. It also shows the estimated cost of the EB and of the final reform. The EB is estimated to have a budgetary cost of around 600 EUR millions per year. This is not too far from the figure of 621 EUR millions budgeted by the Minister of Employment. As a result of the subsidy on SSC, however, taxable income increases. As a consequence of all interactions in the tax benefit system, the two reform are comparable in terms of direct budgetary cost: the total simulated cost of the first version of the tax reform is 3,146 EUR billions per year, while the final reform should cost 3,149 EUR billions per year.

With respect to the personal income tax reform only, the estimate produced via Modété exceeds the 'official' predicted budgetary cost by around 25%. Official costs were estimated through SIRe, a microsimulation model developed by the Ministry of Finance, which is based on around 22,000 tax files. This difference is hardly surprising as the distribution of incomes in tax files and the distribution of income according to income surveys are often different. Moreover, Modété

is probably not fully suited for computing aggregated effects, given the small sample size of the database on which it relies. The estimated cost of the CIBRAP is nevertheless very close. 90% of the tax credit would have accrued to employees. Indeed in the second version of the reform, the cost of the tax credit for self employment income is down just 46 EUR billions. The biggest discrepancy, in relative terms, was due to the cost of the abolition of the highest marginal tax rates. This discrepancy might be explained by a mix of underreporting and approximation in Modété's simulation of taxable income. On the one hand, tax files may indeed 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) that are captured by the microsimulation model SIRe, but not by Modété.

As stated in the introduction, the budgetary cost of the reform will imply a loss of tax revenue of around 10% (the progressive implementation of the reform is nevertheless likely will reduce this cost). This corresponds to about 1.3-1.6% of the 2001 GDP(according to official and own estimates respectively). The most expensive measure is 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. The CIBRAP and the EB (plus the CIBRAP for self employed) represent the third most important measures in terms of budgetary efforts.

5 Labor supply responses

In the present non-linear model, labor supply elasticities cannot be derived analytically but it is still possible to simulate numerically the impact of a marginal increase in gross hourly wages on hours of work and participation. Instead of the aggregating frequencies - as done in table 6, we follow the calibration method which is consistent with the probabilistic nature of the model at the individual level.[11] Mean elasticities presented in table 8; bootstrapped confidence intervals are obtained by drawing 100 times from the asymptotic distribution of the estimators and re-calibrating for each draw.

Female and male labour supply elasticities where estimated at .20 and .18 respectively. Although on average female elasticities seem to be somewhat higher than male elasticities, the confidence interval partially overlap - meaning that the null hypothesis that elasticities are equal may not be rejected. Few Belgian recent studies on labor supply elasticity that use a similar methodology. Orsini (2005) estimates labour supply elasticities for female in couples. The estimated elasticity is slightly higher (.27), but the model is partially different as the author models female labour supply according to a male chauvinist framework, assuming male labour supply as fixed.

[11] It simply consists in drawing all random utility terms from the relevant distribution (i.e. $EV - I$) and for each observations until a perfect match between predicted and observed situations is obtained for each household. These draws are used for predicting labor supply responses to a shock on wages or a tax reform (i.e. in the deterministic part of the utility function), and averaging over a large number of draws provide robust transition matrices (Creedy and Kalb, 2005).

Overall, elasticities are small and mostly driven by changes in the participation rate (both for males and for females) rather than by changes at the intensive margin. It is however likely that some of the inactive people are indeed rationed, i.e. their labour supply is positive although they are observed to supply zero hours. Bargain, Caliendo, Haan, and Orsini (2005) analyse the impact of labour market rationing on labour supply elasticities. They conclude that labour supply elasticities tend to be smaller when accounting for rationing from the demand side. Indeed labour supply elasticities are driven by the participation decision and involuntary unemployed are already supplying positive hours, so the margin for positive participation decisions becomes much smaller in a rationed labour market. Moreover, since the effect of rationing tends to be stronger for males than for females, labour supply elasticities of males in couples tend to be more biased (overestimated) than those for female in couples, since a larger share of the latter is indeed voluntary unemployed.

Net increases in employment and working hours (in Full Time Equivalent - FTE) are shown in table 9. If the first reform had been fully implemented, labor supply would have increased by around 28,000 units. The increase in hours, expressed in FTE is in the same range of 24.000 units. This result is pretty much in line with the estimates of the Federal Planning Bureau (Saintrain, 2002). FPB, however, adopts a demand driven macro framework. What is most of interest, however, is the decomposition of the employment and hours effect, by measure. We then see that the CIBRAP has indeed a positive participation effect, but the latter is partially outweighed by the negative impact on hours worked of those males and especially females who are already in employment. For some of them at least the CIBRAP entails an incentive to shorten working times.

In the second version of the reform, the same does not happen. The reduction in working time of those already in employment is virtually zero for females and slightly higher for males. [12] The incentive to take up work, on the other hand, is much stronger: almost 7,000 units are likely to take up work following the reform of the EB. All other instruments, on the other hand, have a similar impact in both reforms. The broadening of the central tax bracket and the alignment of the tax exempt income quota on the level of single households both have a considerable impact. The latter is especially strong in the case of males (+6,000 FTE units).

The abolition of the highest marginal tax rate, on the other hand, has the smallest participation effect. The latter was indeed expected as those who are most likely to benefit from this reform are indeed likely to already be economically active. What is quite striking, however, is the negative effect on hours worked of those who are already in employment. Indeed labour supply elasticities tend to decrease as income increases, and for some households in higher income decile the income effects outweighs the substitution effect, giving rise to negative labour supply elasticities.

Considering all the interactions between the different instruments, the combination of the EB and the tax reform (net of the CIBRAP for employees) has a stronger incentive effect than the reform of the personal income tax alone. In the second scenario the labour supply effect is about 11,000 units FTE higher than in the first scenario (more or less equally shared between males and females).

[12] Let us here recall that there is a higher share of males working over time and that the BE is computed in terms of equivalent full time income, so that the BE does not entail an incentive to work over time.

6 Conclusion

This paper evaluates the impact of the Belgian 2001 tax reform. The reform has been implemented gradually and will be fully operational in tax year 2005. In 2004, moreover, the Employment Bonus partially replaced CIBRAP. The Employment Bonus reform will be fully operational in 2006. Both reforms have been simulated as if they were instantaneously fully implemented. The analysis therefore neglects the complex rule connected with the progressive implementation of the reform.

The reforms are assessed considering its potential impact on the labor supply of couples. The main features of the tax system, however, were not modified, and little was done to boost incentives to take up work for people working at a minimum wage. 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 incentives structure.

For hourly wages above the minimum level, the reform has unambiguous positive effects on the incentives to take up work. At least for singles. In two earner households, the effects of the reforms are more difficult to assess without a structural model of labour supply, but the analysis of the budget constraints allows us to anticipate that the Employment Bonus clearly avoids the part time trap implicit in the CIBRAP (and already denounced by De Callataÿ (2002)).

To quantify the potential effects on employment, we rely on a discrete hours labor supply model. The dynamic effects of the labor supply are quite small, but statistically significant. In particular the econometric analysis confirmed the initial intuition based on the analysis of the budget constraints. While both the tax credit and the employment bonus has positive effects on participation, the latter measure avoids the negative effects on the incentives of the population already at work. The difference between the two measures is indeed very important.

The analysis also confirms the evidence that labour supply elasticities differ significantly in the different segments of the income distribution. While on average the substitution effect dominates the income effects in the bottom of the distribution, this does not always hold in the top of the distribution. As a consequence not all the instruments appear to be equally effective in stimulating labour supply. In particular, the abolition of the highest marginal tax rates has an ambiguous effect (at least on female labour supply).

It seems at least likely that a different calibration of tax cuts and in-work benefits could have concentrated labor supply incentives in the range where inactivity traps are most significant, generating higher employment effects. This issue is left for further research.

Tab. 1: The Belgian tax reform and the employment bonus

	Pre-reform		Post-reform	
CIBRAP (earned income tax credit)[1]				
	n/a		Gross yearly earnings[2]	Tax credit
			0-3,750	**0**
			3,750-5,000	**506(Y-3,750)/(5,000-3,750)**
			5,000-12,530	**506**
			12,530-16,280	**506(16,280-Y)/(16,280-12,530)**
			more than 16,280	**0**
Subsidized SSCs for low earners[3]				
	Gross full time monthly earnings	Monthly subsidy	Gross full time monthly earnings	Monthly subsidy
	0-876.90	**0**		
	876.90-1,147.70	**81.80**	**0-1,210**	**140.00**
	1,147.70-1,366.91	**81.80-(.3732(E-1,147.70))**	**1,210-1,996**	**140-(.1781(E-1,210))**
	more than 1,366.91	**0**	**more than 1,996**	**0**
Increase of deductible work related expenses[5]	**20%**		**25%**	
Basic deduction for married couples	**3.250**		**4.095**	
Tax bracket and marginal tax rates	Income bracket	Tax rate	Income bracket	Tax rate
I	0-6.570	25.0	0-6.570	25.0
II	6.570-8.710	30.0	6.570-9.350	30.0
III	**8.710-12.420**	40.0	**9.350-15.580**	40.0
IV	12.420-28.540	45.0	15.580-28.540	45.0
V	28.540-42.810	50.0	28.540-42.810	50.0
VI	42.810-62.790	**52.5**	42.810-62.790	**50.0**
VII	more than 62.790	**55.0**	more than 62.790	**50.0**

[1] Since 2004 only applicable to self-employment income.
[2] Net of professional expenses and SSCs.
[3] Eligibility is computed on the basis of full time equivalent employment income. The subsidy is then scaled back in proportion of hours actually worked. The figures apply to white collar employees. The corresponding amount for blue collar are slightly higher as they compensate for the slightly higher SSCs paid by blue collar workers.
[4] Up to a maximum of 250 EUR per child.
[5] Work related expenses for employees are computed as a share of employment income (net of SSCs). The reform modifies the share of imputable expenses on gross earnings between 0 and 4,329 EUR.

Tab. 2: Descriptive statistics, population in working age[1]

	Females		Males	
	Mean	Std. Dev.	Mean	Std. Dev.
Demographical variables				
Age	40.901	12.497	40.799	12.557
Married	0.696	0.460	0.695	0.461
Children <3	0.082	0.274	0.078	0.269
Children >3 and <6	0.111	0.314	0.103	0.305
Educational variables				
Primary education	0.181	0.385	0.216	0.412
Secondary education	0.361	0.480	0.346	0.476
Tertiary education	0.262	0.440	0.230	0.421
Master or Ph.D.	0.100	0.300	0.115	0.319
Labour market status				
Retired	0.063	0.242	0.063	0.244
Disabled	0.037	0.190	0.035	0.183
On maternity leave	0.014	0.116	-	-
Student	0.084	0.277	0.087	0.282
Self employed	0.039	0.194	0.064	0.244
Employee	0.539	0.499	0.648	0.478
Unemployed	0.081	0.272	0.051	0.220
Inactive	0.185	0.389	0.084	0.277
Hours worked and wages				
Hours worked	17.243	18.020	26.164	20.926
Conditional hours worked [2]	32.871	10.263	41.237	8.279
Hourly wage [2]	6.239	0.182	6.374	0.234
Predicted hourly wage [3]	6.170	0.196	6.261	0.299
Observations (unweighted)	2,271		2,194	
Observations (weighted)	3,466,225		3,025,657	

[1] All females and males aged between 18 and 65.
[2] Conditional on being in employment.
[3] Conditional on being either unemployed or inactive.

Tab. 3: Wage equation for females (with Heckman correction) and males[1]

	Females		Males	
	Coef.	Std. Err.	Coef.	Std. Err.
Hourly wage rate (ln)				
Primary educ.	**0.1934**	0.0697	**0.2465**	0.0475
Secondary educ.	**0.4306**	0.0698	**0.4331**	0.0475
Tertiary educ.	**0.6498**	0.0728	**0.6595**	0.0486
Master or Ph.D.	**0.8382**	0.0782	**0.8915**	0.0530
Potential exp.[2]	**0.2382**	0.0520	**0.1485**	0.0325
Potential exp. sq.	*-0.0348*	0.0149	-0.0015	0.0078
Constant	**5.3810**	0.0890	**5.5857**	0.0526
Employment (1=in employment)				
Partner is emploed	**0.4803**	0.0814		
nb. children <6	**-0.2623**	0.1004		
Age	**1.2263**	0.2584		
Age sq.	**-0.1761**	0.0309		
Primary educ.	**0.4118**	0.1474		
Secondary educ.	**0.7453**	0.1356		
Tertiary educ. or more	**1.2719**	0.1397		
Regional unempl. Rate	-0.4371	1.0344		
Constant	**-2.1878**	0.5292		
Rho	0.4546	0.1948		
Lambda	0.1893	0.0915		
Number of obs.		1,645		1,391
Censored		455		-
Uncensored		1,190		-
Log-likelihood		-1,487.19		-573.86
Wald test: joint significance (Chi2,5)		238.47		-
Wald test: joint significance (F,6,1384)		-		90.7
Wald test: independent eqns (Chi2,1)		3.99		-
RMSE[3]		0.400		0.366

Bold letters indicate significance at the 1%-level, *italic* letters refer to the 5%-level and underlined letters to the 10%-level.

[1] Females and males aged between 18 and 65 either employed, unemployed or inactive.

[2] Potential experience is defined as current age net of years of schooling and the age when schooling starts(6).

[3] Root of mean squared prediction errors.

Tab. 4: Descriptive statistics, couples with flexible labor supply[1]

	Mean	Std. Dev.
Demographical variables		
Age female	40.613	9.164
Age female sq.	17.333	7.629
Age male	42.531	9.078
Age male sq.	18.912	7.858
Children <6	0.381	0.685
Disposable income by hours worked [2]		
H_f=0;H_m=0	1072.815	988.584
H_f=0;H_m=40	2450.014	1487.849
H_f=0;H_m=50	2803.433	1632.742
H_f=20;H_m=0	1513.229	1103.360
H_f=20;H_m=40	3047.134	1578.469
H_f=20;H_m=50	3389.332	1722.605
H_f=40;H_m=0	2138.294	1284.268
H_f=40;H_m=40	3609.060	1718.882
H_f=40;H_m=50	3943.635	1854.593
H_f=50;H_m=0	2429.082	1388.929
H_f=50;H_m=40	3878.045	1806.201
H_f=50;H_m=50	4211.422	1936.650
Number of households (unweighted)	1,152	
Number of households (weighted)	1,951,289	

[1] Couples where both members are either employed, inactive or unemployed.

[2] Net household monthly income (EUR). H_f and H_m refer to hours worked by female and male respectively.

Tab. 5: Conditional Logit: Preference Structure

		Coef.	Std. Err.
α_c	Age female	-0.1230	0.0665
	Age female sq.	0.1380	0.0756
	Age male	-0.0113	0.0702
	Age male sq.	0.0307	0.0776
	Constant	*3.2636*	1.4393
α_{cc}		**-0.0199**	0.0051
α_{hf}	Age female	-0.0036	0.0021
	Age female sq.	*0.0064*	0.0026
	Children < 6	*0.0064*	0.0027
	Constant	**0.4310**	0.0547
α_{hhf}		**-0.0033**	0.0003
α_{hm}	Age male	**-0.0068**	0.0025
	Age male sq.	**0.0091**	0.0028
	Constant	**0.3551**	0.0564
α_{hhm}		**-0.0023**	0.0002
α_{chf}		-0.0006	0.0019
α_{chm}		0.0012	0.0014
α_{hfhm}		**0.0005**	0.0001
β_{pt}		**1.6801**	0.1409
$\partial U/\partial C$ <0			0.00
$\partial U/\partial L_f$ <0			0.53
$\partial U/\partial L_m$ <0			0.16
Number of obs.			1151
Log-likelihood			-2439.42
Wald test: joint significance (Chi2,4)			8.08

Bold letters indicate significance at the 1%-level, *italic* letters refer to the 5%-level and underlined letters to the 10%-level.

Tab. 6: Observed and predicted frequencies

Weekly working hours		Observed	Predicted
Females	Males	frequencies	frequencies[1]
0	0	9.9	9.01
0	40	19.55	21.44
0	50	9.9	8.91
20	0	2.35	3.50
20	40	15.38	13.93
20	50	5.99	6.29
40	0	3.13	3.31
40	40	19.64	18.69
40	50	8.43	9.18
50	0	0.96	0.51
50	40	2.95	3.45
50	50	1.82	1.77

[1] Predicted frequencies are computed by averaging up over the whole sample, each household's probability to chose a given regime.

Tab. 7: Budgetary Cost of Personal Income Tax Reform and Subsidized SSC for Low Skilled Employees

	SIRe[1]	Modété [2]	
	Reform I	Reform I	Reform II
CIBRAP (earned income tax credit)	446	423	46
EB (low skilled employees' SSC reduction)	-	-	599
Increase in flat-rate deduction for working expenses	248	395	163
Broadening of the central tax brackets	769	870	879
Abolition of the highest marginal tax rates	174	327	327
Alignment of tax exempt income quotas	1,091	1,401	1,404
Total	2,727	3,416	3,419

EURO Billion per year.
[1] Source: Reynders (2001).
[2] Source: Own computations using Modété.

Tab. 8: Labor supply elasticities

	Females		Males	
	Hours	Part.	Hours	Part.
Own wage elasticity	**0.1967**	**0.1271**	**0.1753**	**0.163**
	(.1799 , .2688)	(.1208 , .1829)	(.1535 , .1979)	(.1456 , .1896)
Cross wage elasticity	**-0.0327**	-0.0239	0.0162	**0.0159**
	(-.07377 , -.0571)	(-0.0459 , 0.0381)	(-.0011 , .0028)	(.0019 , .0066)

Elasticities have been computed numerically by increasing by 1% the gross wage of males and females and recomputing optimal labour supply. Labour supply responses are averaged up over the whole sample. The figures in brackets give the bootstrapped 95% confidence interval obtained by drawing 100 independent draws of the parameters from the estimated asymptotic distribution of their estimator, calibrating and computing elasticities for each draw. Figures in **bold** are significantly different from 0.

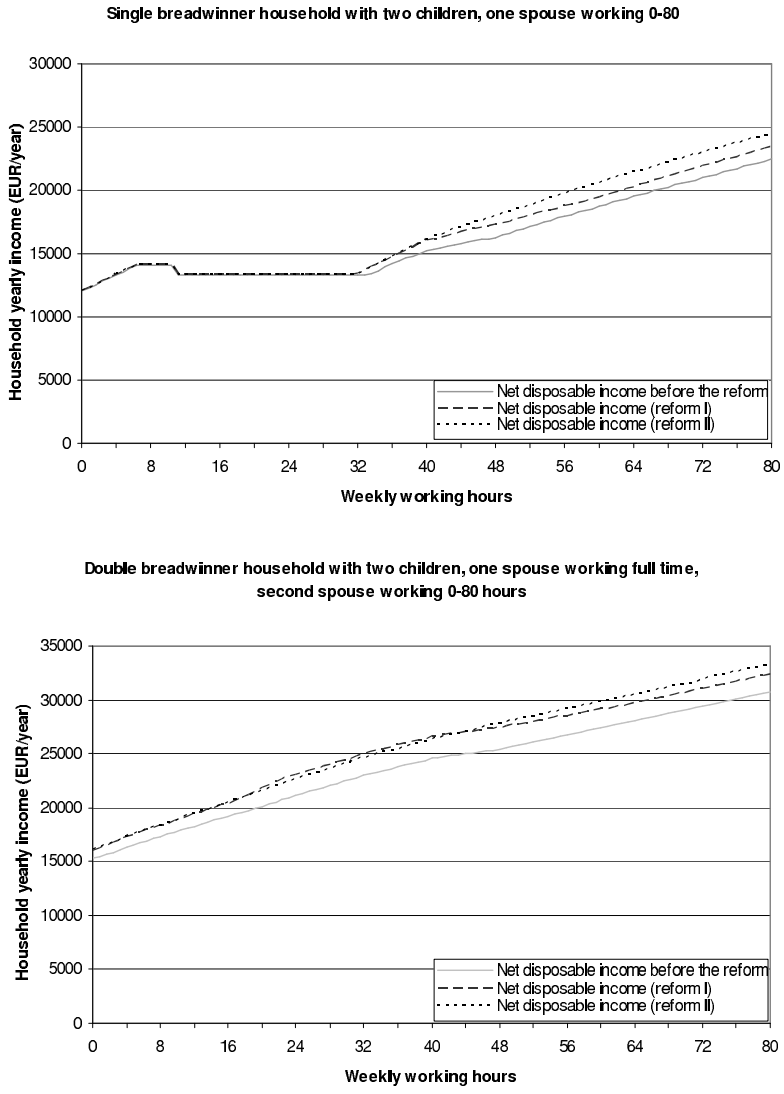
Tab. 9: Employment and hours effect of planned and actual reforms recently implemented in Belgium

	Females				Males			
	Employment	Hours (FTE)	Hours conditional on being inactive (FTE)	Hours conditional on being in employment (FTE)	Employment	Hours (FTE)	Hours conditional on being inactive (FTE)	Hours conditional on being in employment (FTE)
Reform I								
CIBRAP (earned income tax credit)	**5111**	**1463**	**3014**	**-1551**	**1309**	**1112**	**2068**	**-956**
	(3988 , 5450)	(926 , 1708)	(2414 , 3249)	(-1488 , -1541)	(1261 , 1466)	(1065 , 1261)	(1939 , 2238)	(-873 , -977)
Increase in flat-rate deduction for working expenses	**2335**	**1882**	**1857**	**25**	**2057**	**2149**	**2108**	**40**
	(1208 , 3109)	(1220 , 2517)	(1113 , 2495)	(21 , 106)	(1672 , 2135)	(1827 , 2267)	(1618 , 2202)	(32 , 208)
Broadening of the central tax brackets	**3480**	**3268**	**3150**	**118**	**3380**	**3667**	**3405**	**262**
	(2279 , 4834)	(2423 , 4293)	(2251 , 4091)	(112 , 202)	(2930 , 4388)	(3228 , 4682)	(2870 , 4554)	(127 , 358)
Abolition of the highest marginal tax rates	491	180	**1057**	**-877**	**1950**	**2607**	**3553**	**-946**
	(-916 , 1782)	(-853 , 1233)	(142 , 1839)	(-996 , -606)	(547 , 2602)	(1021 , 3202)	(1940 , 4214)	(-919 , -1011)
Alignment of tax exempt income quotas	**2299**	**1722**	**2068**	**-346**	**5364**	**5787**	**5720**	**67**
	(1386 , 4168)	(833 , 3117)	(1618 , 3305)	(-785 , -187)	(3381 , 6831)	(3699 , 7425)	(3619 , 7325)	(53 , 99)
Total	**13716**	**8514**	**11145**	**-2631**	**14059**	**15322**	**16854**	**-1533**
	(12255 , 15036)	(7567 , 9851)	(10417 , 12104)	(-2850 , -2252)	(11883 , 15333)	(12977 , 16703)	(14409 , 18115)	(-1431 , -1612)
Reform II								
BE (reduction for low wage employees) + CIBRAP	**6199**	**6550**	**6589**	**-39**	**5442**	**6024**	**6755**	**-731**
	(5438 , 6592)	(5726 , 7262)	(6200 , 6820)	(-473 , 442)	(5294 , 6245)	(5818 , 6933)	(6018 , 7892)	-400 , -959
Increase in flat-rate deduction for working expenses	**2079**	**1742**	**1685**	57	**2230**	**2350**	**2288**	62
	(1220 , 3222)	(644 , 2914)	(990 , 2375)	(-346 , 538)	(1396 , 2591)	(1497 , 2747)	(1061 , 2900)	(-152 , 435)
Broadening of the central tax brackets	**3546**	**3759**	**3293**	467	**3333**	**3666**	**3470**	196
	(2026 , 4918)	(2031 , 5256)	(2112 , 4381)	(-81 , 875)	(2533 , 4676)	(2889 , 5142)	(2535 , 5184)	(-42 , 353)
Abolition of the highest marginal tax rates	723	316	1113	**-797**	**1983**	**2616**	**3609**	**-993**
	(-902 , 1991)	(-1346 , 2019)	(-86 , 2085)	(-1260 , -65)	(131 , 2903)	(502 , 3558)	(1384 , 4720)	(-1161 , -881)
Alignment of tax exempt income quotas	**2277**	**1646**	**2143**	-497	**5703**	**6151**	**6029**	**122**
	(1176 , 4138)	(305 , 3630)	(1170 , 3377)	(-865 , 252)	(3338 , 6507)	(3650 , 7056)	(3221 , 6875)	(181 , 429)
Total	**14824**	**14013**	**14823**	-810	**18691**	**20807**	**22151**	**-1343**
	(13430 , 16392)	(12559 , 15885)	(13610 , 15817)	(-1050 , 67)	(16525 , 19693)	(18595 , 22001)	(19570 , 23224)	(-974 , -1422)
Reform II - Reform I	1109	**5499**	**3678**	**1821**	**4631**	**5486**	**5296**	189

Change in hours are expressed in Full Time Equivalent (FTE) by dividing total weekly hours worked by 40. The figures in brackets give the bootstrapped 90% confidence interval obtained by drawing 100 independent draws of the parameters from the estimated asymptotic distribution of their estimator, calibrating and computing employment and hours effect for each draw. Figures in **bold** are significantly different from 0.

[1] In the new reform, the tax credit for low earnings still applies to self employment income.

Fig. 1: Budget lines for two hypothetical households[1]



[1] Remark: Households with two dependent children (aged 4 and 6), working at the 2001 minimum wage rate (6.6 EUR/hour)

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