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FINANCIAL WORK INCENTIVES AND THE LONG-TERM UNEMPLOYED: THE CASE OF BELGIUM

Diego Collado *

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* Herman Deleeck Centre for Social Policy, University of Antwerp
Corresponding author: diego.collado@uantwerpen.be

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HIVA RESEARCH INSTITUTE FOR WORK AND SOCIETY
Parkstraat 47 box 5300, 3000 LEUVEN, Belgium
hiva@kuleuven.be
http://hiva.kuleuven.be

ABSTRACT

There is an abundant body of research studying the effect of financial work incentives on employment. Most studies exploit variation within groups over time or across employed and unemployed people, while little research has studied individual changes over time and focused on the long-term unemployed (LTU). In Belgium the long-term unemployment rate is high and the household incomes of many LTU are below the at-risk-of-poverty threshold. Policy proposals aiming to improve this situation might benefit from knowing whether changes in work incentives affect the likelihood of taking up work. Thus, we study whether changes in work incentives, measured by the participation tax rate (PTR), affected the likelihood of going from long-term unemployment to more than half a year of employment. We examine the seven two-year episodes that took place between 2005 and 2012 in Belgium. During these years there were policy changes that affected work incentives and thus contribute to the identification of behavioural effects. We also study whether changes in effective marginal tax rates (EMTRs) affected the hours worked by people already in the labour market working part-time. Increasing out-of-work incomes while maintaining how much work pays would require increasing in-work compensations. As this would probably raise EMTRs, studying the intensive margin is also warranted. We calculate work incentives using the tax-benefit microsimulation model EUROMOD, adapting it to utilise longitudinal data. Results from regression analysis show that a 10 percentage point increase in the PTR (i.e. if work paid less) had a negative average marginal effect of around 4 percentage points on the probability of taking up work. This effect is sizable considering that the baseline probability of transitioning to more than half a year of employment was 9 per cent. Changes in EMTRs did not have a statistically significant effect on hours worked by part-timers. This might leave some room to compensate increases in out-of-work transfers with changes in in-work transfers.

Keywords: labour force participation – work incentives – long-term unemployment – hours of work

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Introduction

Whereas high out-of-work incomes can help people to avoid social exclusion, they can also affect their decisions to join the labour market. In this way, social inclusion and employment, two of the core objectives of governments, can be in conflict with each other (Adam, Brewer, & Shephard, 2006; Blundell, 2002). If governments wanted to increase the often inadequate out-of-work transfers for the long-term unemployed (LTU) – defined as at least 12 months unemployed – it becomes relevant to know whether changes in financial work incentives affect their likelihood of taking up work. In this paper we study whether changes in work incentives have affected the likelihood of going from long-term unemployment to more than half a year of employment. We do so in Belgium during the seven two-year episodes that took place between 2005 and 2012.

Binary changes between unemployment and employment are often referred to as the extensive margin of the labour market, whereas the intensity of work supplied by those in work is referred to as the intensive margin. In the presence of substitution effects[1] at the extensive margin, increasing out-of-work incomes of LTU would require augmenting in-work transfers if governments do not want to reduce the likelihood of taking up work. To offset these surges in expenditure, the targeting of current social contribution (SC) rebates based on full-time equivalent earnings[2] could be increased, or progressive tax credits based on actual earnings – as they exist in other developed countries – could be raised. Making up for increasing out-of-work incomes in either of these ways would raise current effective marginal tax rates for some people already in the labour market (Collado, Cantillon, Van den Bosch, Goedemé, & Vandelannoote, 2017). For this reason, we also study whether changes in financial incentives have affected the number of hours worked by people working part-time. We focus on part-timers because relevant policy changes tended to increase the financial reward to work more hours.

While most research studying labour supply decisions in the extensive margin exploits variation within groups over time or across employed and unemployed people, very little research has studied individual changes over time and focused on the long-term unemployed. To the best of our knowledge, the only study that has done so and presented effects as a function of changes in financial work incentives is the research of Bartels and Pestel (2016) on Germany. Our paper builds on this research, focusing now on another country, studying simultaneously the intensive margin, and including income effects.

Compared to other North-western EU welfare states, Belgium presents one of the highest long-term unemployment rates. For many households with LTU members, incomes are below the at-risk-of-poverty threshold and if those members came back to the labour market, work would pay relatively little compared to staying unemployed. During the last two decades in Belgium and most North-western EU countries, 'make work pay' policies generally increased the take-home pay of low wage workers (see e.g. Immervoll, 2007; Marx, Marchal, & Nolan, 2013). In relation to out-of-work incomes, benefits for unemployed Belgians remained rather stable or even increased for some categories. These events have affected financial work incentives (Decoster, Perelman, Vandelannoote, Vanheukelom, & Verbist, 2015; Kalíšková, 2015) and potentially also employment decisions.

[1] In this context, substitution effects refer to changing the probability of substituting work for leisure (or not work) when how much work pays changes (or the relative prices of these two goods). In contrast, income effects refer to absolute (price) changes.

[2] This means that they do not distort financial incentives to work more hours but do distort incentives to work more than full-time (as the rebate does not increase beyond that) and incentives to increase hourly wages.

We operationalise (substitution) work incentives utilising Participation Tax Rates (PTRs) and Effective Marginal Tax Rates (EMTR). PTRs measure the proportion of household earnings taken in (effective) tax and withdrawn benefits if a household member moved from unemployment to employment. This means that an increase in the PTR reflects a reduction in how much work pays. EMTR measure the same but when a household member increases her hours of work.

In the next section we review previous related work. In section 2 we describe the data, methods and variation used. In section 3 we present descriptive information and results from regression analysis. Section 4 concludes.

1 Previous related research

Most research studying labour supply responses in the extensive margin exploits cross-sectional variation in budget constraints between employed and unemployed people. Among these studies we can distinguish structural and non-fully structural approaches. Within the structural literature, the current dominant methodology is the Random Utility Maximisation (RUM) Approach (Aaberge & Colombino, 2014). The RUM approach is based on a flexible but structural representation of utility maximisation, e.g. choosing a combination of work and leisure subject to a budget constrain. This type of research thus corresponds to ex-ante evaluations of what could happen if constraints were changed. Non-fully structural approaches present simpler or reduced-form models and combine quasi-experimental approaches by exploiting exogenous policy variation over time for identification, thus improving the tractability of the models (Meyer & Rosenbaum, 2001).

Regarding the RUM approach, the substitution elasticities obtained are commonly presented not as a function of changes in PTRs or EMTRs but of changes in net wage rates. There is of course a relationship between the two types of indicator: changes in net wage rates affect in-work budget constraints which modify the amount of earnings lost when changing employment status or hours worked. Numerous ex-post studies focusing on the intensive margin have already studied elasticities as functions of changes in marginal tax rates, whereas only Kalíšková (2015: cross-sectionally), Bartels and Pestel (2016) and Selin (2014) (both longitudinally) have focused on the extensive margin and presented effects as functions of changes in PTRs. We adhere to the latter way of presenting results as these effects have a more direct policy interpretation[3]. Coming back to the results from the RUM approach, Bargain, Orsini, and Peichl (2014, using 2001 data for Belgium) present an extensive cross-country study including 17 EU countries and the US. These authors found three consistent findings across countries: the extensive margin dominates the intensive one; for singles, effects are generally stronger for low-income people; and income effects are extremely small.

In particular for Belgium, Bargain et al. (2014) also found that women and married people were more responsive, men were practically non-responsive in the intensive margin, and effects were stronger also for low-income married men. The RUM approach has also been used in Belgium to estimate the effect of recent policy changes. For example, Orsini (2007) evaluated a tax reduction in 2001 and the implementation in 2004 of a Federal social contribution (SC) rebate - the so called *Work Bonus* -, Dagsvik, Jia, Orsini, and Van Camp (2011) evaluated the increase in 2006 of that same SC rebate, and Decoster and Vanleenhove (2012) evaluated the implementation in 2007 of a Flemish in-work tax credit known as the *Jobkorting*. All these studies found positive effects on labour supply. On the one hand, by changing budget constraints following

[3] As it will be explained, percentage point changes in PTRs can be seen as equivalent changes in replacement rates or in (effective) tax rates.

a reform, the RUM approach has the advantage of attributing the calculated labour supply responses to those reforms, which as it will be shown, is challenging in ex-post studies. On the other hand, the flexible but structural nature of RUM models might influence the results and, as Orsini (2007) mentioned, with panel data one could control for fixed effects in preferences. Moreover, whereas the cited evaluations calculated the effects of specific reforms, we will exploit the exogenous variation that these types of reforms produce in work incentives to study average responses to these and other reforms combined.

In relation to cross-sectional studies using 'non-fully structural' models to study employment decisions in the extensive margin, our research resembles the work of Meyer and Rosenbaum (2001) and Eissa and Hoynes (2004) which exploited several reforms in the US (mainly related to the expansion of the Earned Income Tax Credit). Instead of presenting effects as a function of a synthetic indicator as the PTR, the first study broke down the effects by in- and out-of-work programs, while the second presented them as function of net wage rates. Kalíšková (2015) exploited similar cross-sectional variation during the period 2005-10 in 26 EU countries which allowed her to control for unobserved country-level factors. Moreover, the author expressed effects as a function of changes in PTRs, finding that a 10 percentage point increase in the PTR decreases the female employment probability by 2 percentage points.

While studies using the RUM approach rely on their flexible but structural representation of utility maximisation for identification, Kalíšková (2015) utilised a group-level simulated instrumental variable[4]. Still these approaches can suffer the problem of unobserved individual characteristics that influence work preferences and other variables in the models. This warrants the usage of ex-post evaluations based on actual employment changes and individual longitudinal data so as to control for individual time-invariant unobserved characteristics. To the best of our knowledge, the only study focusing on long-term unemployed, exploiting individual variation over time and presenting substitution effects as a function of changes in PTRs is the recent work of Bartels and Pestel (2016)[5]. Focusing on Germany between the years 1993 and 2010 – a period that, for example, included the Hartz reforms – the authors found that a 10 percentage point decrease in the PTR increased the employment probability between 0.8 and 1.3 percentage points. The work of Selin (2014) on married women in Sweden also studied the effect of PTRs on employment and used individual longitudinal data. By studying two points in time before and after the change from joint to individual taxation in 1971, the author was also able to instrument PTRs. The author studied income effects as well, although he declared that it is difficult to estimate more than one behavioural parameter with one reform (Blundell, Duncan, & Meghir, 1998) and that large reductions in PTRs occurred simultaneously with changes in non-labour income. Evaluated at the (geometric) mean PTR in 1969, the author's findings imply that a 10 percentage point decrease in the PTR of married women increased their employment probability between 8 and 15 percentage points[6].

The research of De Lathouwer and Bogaerts (2004) studying more local effects of the suspension of unemployment benefits (UB) in Belgium in 1998 is also connected to our work. This research is related to the quasi-experimental literature exploiting *group* variation over time caused by policy change and using difference-in-difference estimators. This literature contrasts the responses in the extensive margin of groups

[4] The research of Jäntti, Pirttilä, and Selin (2015) is similar except that – among others – the former used semi-parametric methods instead of a micro-simulation model to calculate counterfactual budget constraints in the non-observed (un)employment state.

[5] Dockery, Ong, and Wood (2008) studied similar employment transitions; however, they analysed the impact of the level of PTRs and not of their changes.

[6] Besides the fact that the author evaluated the effects after four years, Bastani, Moberg, and Selin (2017) explain that the pre-reform share of employed married women was only 67 per cent and that therefore the strong effect is consistent with their finding regarding the relationship between the participation elasticity and employment level. In addition, elasticities estimated from large policy changes might be larger than elasticities estimated from small changes (Chetty, 2009) which may be relevant here as PTRs of some women married to very high-income husbands dropped up to 40 percentage points. The research of Bastani et al. (2017) is closely related to Selin (2014) except that – among others – the former exploited household type variation (instead of individual) and did not control for income effects.

that are supposedly comparable except by the fact that one is not eligible for a policy change e.g. due to income level or having children (e.g. Eissa, 1995; Eissa & Hoynes, 2004; Eissa & Liebman, 1996; Meyer & Rosenbaum, 2001)[7]. The suspension meant that the unlimited UB of a cohabitee could be interrupted if she/he was out of work for more than 1.5 times the average unemployment period according to age, sex and region. As a control group the authors used a somewhat comparable set of non-suspended women. The authors found that the suspension increased the likelihood of re-entry by 9 percentage points 15 months after. In terms of percentage point changes in a PTR, a suspension of benefits represents a drop equivalent to the gross replacement rate of those benefits[8].

In relation to responses to changes in marginal tax rates in the intensive margin, the literature exploiting actual changes over time is much richer (e.g. Gruber & Saez, 2002; Kleven & Schultz, 2014; and for a review, Saez, Slemrod, & Giertz, 2012). Responses in the intensive margin can include changes in hours of work and also changes in hourly wages, tax compliance, etc. We are interested in responses to possible changes in in-work transfer that affect mainly the bottom and part of the middle of the income distribution. Accordingly, the specific response that we study is hours of work, as we believe that in the short term it is the most common reaction in this part of the distribution. Focusing on changes in hours of work, Moffitt and Wilhelm (1998) examined the 1986 tax reform in the US which reduced marginal tax rates for the highest incomes by 22 percentage points. The authors concluded that hours of work were inelastic for males. Klevmarken (2000) studied the period 1986-1993 in Sweden which included important changes in the progressivity of the tax benefit system that, for example, amounted to a reduction in marginal tax rates of 30 percentage points for the highest incomes. This author established that men were inelastic as well, but he also found that for women a 10 percentage point decrease in the marginal tax rate increased yearly hours of work by 168 (roughly equivalent to 3.2 weekly hours). Lastly, Thoresen and Vattø (2015) studied the reactions after three years of a reform in 2006 in Norway that, for example, cut marginal tax rates of the top tercile by around 4 percentage points. Evaluated at the pre-reform means, their findings imply that a 10 percentage point decrease in the marginal tax rate increased weekly hours of work by just 0.2 hours on average for both genders (women being more sensitive).[9]

2 Data and method

2.1 Data

We utilise the European Union Statistics on Income and Living Conditions (EU-SILC) data which consists of a four-year rotational panel. This means that each year a quarter of the sample is replaced. It can thus be used as a cross-sectional survey or a longitudinal survey for a maximum of four years. We use the longitudinal component. As the long-term unemployed (LTU) represent a small portion of the population, in each wave we only use the last three of the four years, which implies that we have roughly 50 per cent of the cross-sectional samples. Then, although we utilise people present in three years, we only study their

[7] The research of Bargain and Doorley (2016) uses the same principle but in a cross-sectional regression discontinuity design. They exploit the discontinuity provoked by an age eligibility rule for social assistance in France.

[8] For instance, if in relation to gross earnings a benefit has a 40 per cent replacement rate – around the Belgian average at that time – the suspension implies a decrease in 40 percentage points in the PTR. Thus, this result is comparable to others presented previously. Extrapolating linearly, a 10 percentage point decrease in the PTR increased the probability of re-entry in 2.3 percentage points.

[9] This literature review focused on non-experimental studies of labour supply. Examples of experimental studies are the evaluation of negative income tax experiments in Robins (1985) and of full-time work subsidies in Card and Hyslop (2005), both finding positive effects on labour supply.

transitions in the last two years. The first of the three years is used only to obtain important retrospective information for the following purposes. First, unemployment benefits (UBs) are constant for most categories after 12 months of unemployment. This means that we are able to simulate them more accurately by looking at the employment status in the last previous 12 months. Second, by looking at this we will also be able to distinguish in our models people that had been unemployed from even longer than that. Third, income and employment information refer to the year before the interview, while weekly hours worked to the year of the interview. To make these variables consistent when studying the intensive margin, we recover the hours declared from the previous year as well. Variance estimations take into account the sample design of the survey (Goedemé, 2011).

To calculate financial incentive measures in the extensive margin, for each person we need to know how much would be her household income when she is in and out of work, while we can observe it only in one of the two states. The same occurs when comparing the incomes of a person working at her current and increased hours of work. We predict earnings for LTU and increase them for part-times to subsequently simulate net income in these hypothetical states with the tax-benefit micro-simulation model EUROMOD G3.0+ (Figari, Paulus, & Sutherland, 2015; Sutherland & Figari, 2013). With EUROMOD it is possible to calculate net incomes, given gross incomes and personal/household characteristics. Originally EUROMOD runs on the cross-sectional component of the Belgian version of SILC. As we wish to follow incentive measures over time, we create instead EUROMOD input files based on the longitudinal component of EU-SILC. This component has fewer variables than the cross-sectional component. As a consequence, there are a few variables which are required for the simulations that are not available; this means that we have to make some assumptions about them[10]. To follow incentive measures over time, we also add to EUROMOD the simulation UBs in the second year of unemployment (for details on the simulation of UBs and social assistance see the Appendix A). Our analysis starts in the first year with available data, and stops in 2012 because later UBs became so tightly linked to work history that their simulation became even more challenging.

In relation to the LTU, we study persons who were available for the labour market[11], unemployed during one year and in the following year either remained in this status for the whole year or switched to employment for more than half a year. When studying the intensive margin, we focus on people working the whole year and who declared in the first year of observation to be working part-time, defining part-time as 36 or less hours of work (the vast majority works 38 or more hours). We only consider households composed by either couples or singles, with or without (non-working) children. We do not include people whose partner left the household, who started having a partner or changed household during the transitions analysed. We apply a 99 per cent winsorisation based on changes in incentive measures, and when studying income effects we do it additionally based on income changes.

[10] For Belgium, EUROMOD started using EU-SILC (instead of the more detailed Belgian version of SILC) since the data year 2015 when income variables became more disaggregated. We use the same assumptions as in the latter file except for the following variables that were missing in longitudinal files from previous years: firm size and leave benefits. We assume that everybody worked in a firm of 10 people which was the average size in 2007 (this impacts slightly social contributions). Although we do not study persons receiving maternity leave, we do include their partners. To calculate maternity leave benefits, we simulate child benefits and subtract them from the variable including all the observed family benefits.

[11] Hereby including people aged between 19 and 65 years old and excluding self-employed (due to the limited quality of their income data (Immervoll, 2004)), (early) retired, students, disabled or other inactive. The replacement benefits of these inactive categories and (the very few) housing benefits are not simulated in EUROMOD. While we do not include people receiving housing benefits, we do calculate incentive indicators of people whose partners receive the other type of non-simulated benefits, assuming that those benefits would not change much when partner's wages are modified.

2.2 Measuring financial work incentives

We utilise Participation Tax Rates (PTRs) and Effective Marginal Tax Rates (EMTRs) to measure the distortion of taxes and benefits on financial incentives to work at all and to work more hours, respectively. Due to data limitations, we focus on changes in taxes and benefits in cash. First in relation to PTRs, they measure the proportion of household earnings taken in tax and withdrawn benefits when a household member moves from unemployment to employment. This is depicted in equation 1 where i corresponds to the person for whom the PTR is being calculated, j to all household earners, w_j to hourly wages, h_j to hours of work and $T\left(\sum_j (w_j h_j) + I\,, Z\right)$ to the tax-benefit function that depends on the sum of household earnings $w_j h_j$, household non-labour income I, and other household characteristics Z[12]. $w_i 0$ corresponds to the situation in which individual i does not work. Note that e.g. for a jobless household with one potential earner, $T(0, Z)$ is negative when out-of-work benefits are higher than the taxes paid in that state. In the non-observed state, household incomes are simulated changing individual i into this state, and it is assumed that other household members do not change their behaviour. PTRs take into account household incomes but represent an individual measure. For this reason, we calculate them separately for each (working) partner in a couple: one time modifying the earnings of one partner, keeping constant the income sources of the other, and then vice versa. More details about the calculation of PTRs and the prediction of potential earnings for LTU can be found in Appendix B. We utilise predicted earnings regardless of whether a LTU transitioned or not to employment so as to treat evenly these two groups that we will compare. To not introduce exogenous estimation errors, we only use the earnings prediction from the first year and inflate it for the second year using the wage index of EUROMOD.

$$PTR_i = \frac{T\left(\sum_j (w_j h_j) + I\,, Z\right) - T(\sum_{j \neq i} (w_j h_j) + w_i 0 + I, Z)}{\sum_j (w_j h_j) - (\sum_{j \neq i} (w_j h_j) + w_i 0)} = \frac{T\left(\sum_j (w_j h_j) + I\,, Z\right) - T(\sum_{j \neq i} (w_j h_j) + I, Z)}{w_i h_i} \quad (1)$$

EMTRs follow the same logic as PTRs: they measure the proportion of household earnings taken in tax and withdrawn benefits when a household member increases her hours of work by five per cent. This is described in equation 2. Relevant assumptions of PTRs also apply to EMTRs.

$$EMTR_i = \frac{T(\sum_{j \neq i} (w_j h_j) + w_i h_j^{+5\%} + I, Z) - T(\sum_{j \neq i} (w_j h_j) + w_i h_j + I, Z)}{w_i h_j^{+5\%} - w_i h_j} \quad (2)$$

2.3 Empirical strategy

2.3.1 Specification

To define the main variables of the regression models we utilise as a starting point the basic micro-economic framework with two goods: consumption and leisure. In the intensive margin, utility maximisation results in a labour supply function that depends on the slope of the budget line and on virtual income[13]. Analogously, choosing between working and not working depends on the difference between the

[12] An equivalent and sometimes useful interpretation of this equation is one minus the difference between in- and out-of-work household net incomes in relation to individual gross earnings.

[13] The piece-wise linear budget line defines the mechanical transformation of gross earnings into net incomes. Virtual income is the level at which the projection of a linear segment would intercept the income axis if the tax payer worked zero hours.

consumptions available in each state, and in the level of the consumption when not working. This means that changes in labour supply can be decomposed in substitution and income effects. Following Gruber and Saez (2002: who studied only the intensive margin), in the regressions we capture substitution effects using changes in PTRs and EMTRs, and income effects using log income changes[14]. We use other variables (X_j) in the model to attempt controlling for time-variant elements or their initial levels. To study the effect of changes in PTRs (ΔPTRs) on the likelihood of taking up work we utilise a first difference logit model. The binary dependant variable is whether or not a LTU (U) transitioned to more than half a year of employment (E) over two consecutive years. The model we use is described in equation 3.

$$P(U_{it-1} \rightarrow E_{it}) = \Lambda(\gamma \Delta PTR_{it} + \boldsymbol{X'}_{itj}\boldsymbol{\beta}_j + \mu_t + \epsilon_{it}) \quad (3)$$

By using a first difference model we are able to control for unobserved time-invariant heterogeneity such as individual characteristics influencing employment status or different preferences for work and leisure. This is the main reason to use longitudinal micro data. Transition fixed effects μ_t are added to control for common business cycles affecting labour demand. Regional changes in employment rates broken down by broad age categories and education are included to control for more specific changes in demand. We introduce a dummy variable for people unemployed the 12 months previous to the years studied to control for state dependency and study possible interaction effects. Region and age are included to account for common cleavages in the Belgian labour market. We also include interactions between changes in PTRs and variables that the literature has focused on such as gender, cohabitation and the initial level of (observed) equivalised household income. Lastly, we include log equivalised income changes to control for income effects. This variable has to be instrumented which is explained below together with other variables instrumented when studying the intensive margin.

To study the effect of ΔEMTRs on weekly hours of work we utilise a similar first difference linear regression. The model is the same as for ΔPTRs except that, similarly to Auten and Carroll (1999), we add the tercile in the initial hours distribution and instrument ΔEMTRs. We add the tercile in the hours distribution to control for mean reversion. We instrument ΔEMTRs because for people who change their hours of work the tax rate can increase mechanically due to progressivity. Likewise, changes in worked hours or employment status can imply a mechanical change in income as well; therefore, we also instrument this variable. We test two type of instrumental variables (IV): ΔEMTRs and incomes changes assuming that i) the person analysed does not change her behaviour which we refer to as IV1s, and ii) the whole household does not change its behaviour which we refer to as IV2s. Thus, IV1s take care of possible endogenous changes of the persons analysed, while the remaining source of variation comes from exogenous policy reforms and changes in the behaviour of other household members. IV2s in addition take care of those changes of other household members. We test both types of variables because as it will be seen, some of them are weak instruments. For ΔPTRs we are already doing something similar to IV1 by using only the earnings prediction from the first year of observation, while we will also test an IV2 for this variable. In all cases we inflate (the 'frozen') earnings using EUROMOD's wage index.

2.3.2 Sources of variation

The sources of variation in ΔPTRs, ΔEMTRs and income changes can be divided in two: exogenous changes in tax-benefit policies and (possibly endogenous) changes in individual/household characteristics. In relation to policy changes, the source of identification comes from the fact that we compare different transitions which have somewhat dissimilar policy parameters and that some changes affected only certain

[14] When controlling for income effects in the intensive margin, we will be estimating substitution *compensated* effects (and not uncompensated effects as e.g. Kleven and Schultz (2014) did by controlling for virtual incomes).

groups (e.g. by family type or income level). The policies that during the period analysed had more changes in their amounts and eligibility rules were UBs and social contribution (SC) rebates.

The main changes in the parameters of UBs and SC rebates are detailed in Table 1 and illustrated for SC rebates in Figure 1. Table 1 expresses parameter changes in relation to changes in the EUROMOD's wage index. Replacement rate and wage index changes are compared in terms of percentage points, while for monetary parameters (e.g. the SC base reduction), their growth is compared to the wage index. In this way no change means that the evolution in the numerators of equations 1 and 2 would be – ceteris paribus – equal as in the denominators. The central characteristics of UBs in Belgium is that they replace a percentage of lost earnings within certain limits, are contributory, (conditionally) unlimited and depend on family situation[15]. UBs generally do not change over time for heads of household, and decline from the first to the second year of unemployment for singles and people cohabitating, remaining at the same level thereafter (flat zone) for singles and possibly also for cohabitees indefinitely or for a given number of months depending on their work history, after which they switch to a flat lump sum benefit[16]. For this reason we present separately the evolution of parameters that change from the first to the second year of a spell and of parameters that do not change from the second year onwards. The first set of parameters is applicable to people unemployed for less than two years, while the second set to people unemployed for longer. In relation to SC rebates, as it is shown in Figure 1, they start from a basic amount which remains constant until a certain level of *full-time equivalent* (FTE) monthly earnings, after which the rebate is withdrawn at a certain rate. That the rebate is based on FTE earnings imply that the withdrawal rate does not affect work incentives to work more hours; however, people working more than full-time do not receive a higher rebate; therefore, there is a kink at this point of the budget constraint[17].

In Table 1 it can be seen that, for instance, during the last three transitions there was a sharp decline in maximum UBs from the first to the second year of a spell for all categories. This included head of households who until then did not have larger automatic decreases in their maximum UBs. The drops in replacement rates of cohabitants during the second half of the period analysed also became much steeper. For people unemployed for more than two years, i.e. already in the flat zone, we see that the maximum UB for singles was strongly increased in 2008. With respect to SC rebates, they increased in all years except in 2010 and 2012. In 2006 there was an important increase in the base reduction, together with a large expansion in the people covered by the rebate. In 2009 the increase in the base was even larger; however, it was targeted at low FTE earnings where there are very few earners (see Figure 1).

[15] For UBs, heads of households are defined as people not living alone and whose partners or dependent children contribute nothing or very little to household income. Singles correspond to people who live alone or dependent children earning above a threshold.

[16] In addition, for workers older than 50 who have been employed for more than 20 years, from the second year onwards their replacement rates drop less steeply (or not at all) according to defined age categories. There are also few cases of people cohabitating who are subject to an increase in UBs due to having a partner whose sole source of income is a low UB. There are as well a couple of cases of young people receiving UBs and not having any work experience, which we simulate as belonging to the special category of UBs after studies (see Appendix A for more details).

[17] Our linear model assumes that people behave as if they were located in the interior of segments of the piece-wise linear budget constraint and therefore it is less suitable to study kinks where people bunch at (Kleven & Schultz, 2014). For this reason, even if we had policy changes increasing marginal tax rates and we would therefore be able to also study the phenomenon of full-timers possibly becoming part-timers, our modelling would not be suitable.

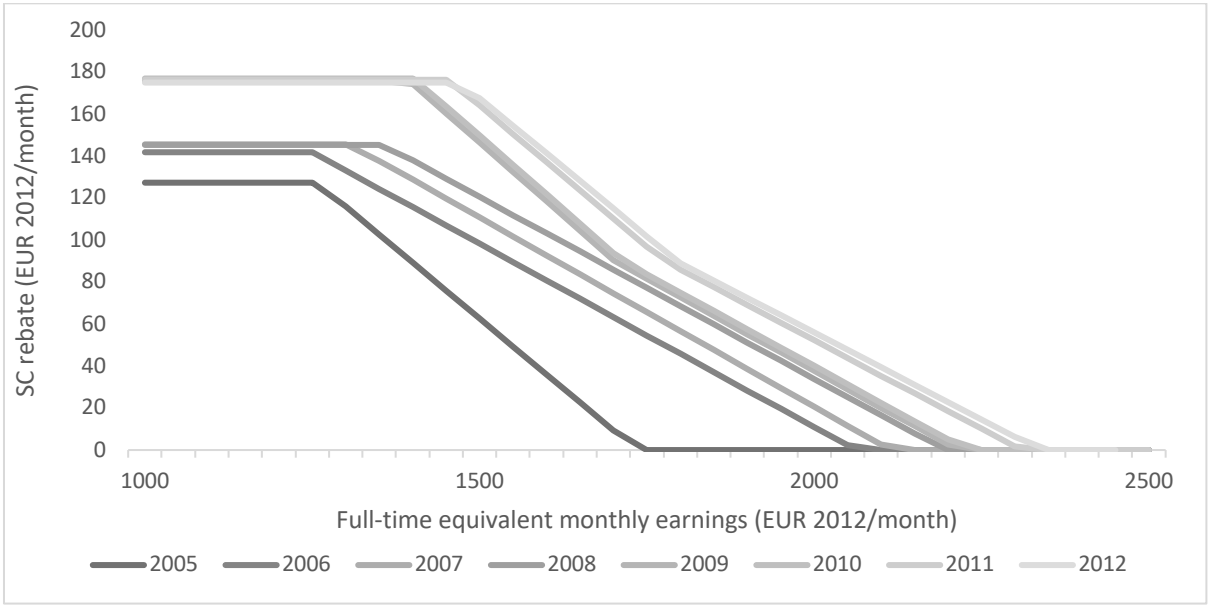
Table 1. Percentage point change in UB and SC rebate parameters in relation to changes in EUROMOD's wage index

	05-06	06-07	07-08	08-09	09-10	10-11	11-12
Parameters of UBs that are the same since the 1st year of a spell							
Min earnings to declare	1.25	2.35	3.99	5.31	0.60	4.27	1.61
Max earnings to declare	1.25	2.35	1.90				
Replacement rate head	-0.55	0.49	-0.18	-1.10	0.60	-0.35	-0.77
Min UB	1.46	2.50	3.89	2.94	4.61	1.64	3.27
Difference between the parameters of the 1st and 2nd year of a spell							
Max earnings to declare single				3.77	-12.31	-11.51	-13.86
Max earnings to declare head & cohabitating				3.77	-12.31	-8.61	-11.93
Replacement rate single	-10.55	-9.51	-7.18	-7.30	-5.60	-5.35	-5.77
Replacement rate cohabitating	-15.55	-14.51	-15.18	-19.10	-19.40	-20.35	-20.77
Max UB single	-15.53	-14.50	-9.19	-8.48	-19.75	-19.70	-21.11
Max UB head	1.45	2.50	2.84	3.77	-10.57	-10.42	-11.94
Max UB cohabitating	-26.37	-25.32	-31.51	-28.79	-40.17	-40.40	-41.54
Parameters of UBs that are the same since the 2nd year of a spell							
Max earnings to declare head & cohabitating					0.60	5.06	1.26
Replacement rate single	-0.55	0.49	2.82	-0.30	0.60	0.85	-0.77
Replacement rate cohabitating	-0.55	0.49	-0.18	-1.10	0.60	-0.35	-0.77
Max UB single	1.46	2.49	9.00	3.77	4.15	2.93	1.24
Max UB head and cohabitating	1.45	2.50	2.84	3.77	2.58	2.92	1.24
SC rebate parameters							
Base reduction	11.45	2.89	-0.18	24.50	0.60	-0.35	-0.77
Max reduction	18.97	2.88	4.74	1.44	0.60	3.74	1.26

Note: Changes are expressed in relation to changes in EUROMOD's wage index. Replacement rate and wage index changes are compared in terms of percentage points, while for monetary parameters their growth is compared.

Source: EUROMOD, and the UB parameters in the second year are obtained from the Office National de l'Emploi.

Figure 1. Main changes in social contribution rebates



Source: EUROMOD

In relation to changes in characteristics or circumstances of the persons analysed, two relevant ones are the automatic decrease of UBs for recent LTU of some categories and the fact that work incentive measures and income changes can be endogenous. The fact that the UBs of singles and cohabitees decrease for relatively new LTU and generally remain flat for *very* LTU and head of households, can imply different

ΔPTRs within the first two groups and compared to those head of households. Thus this represents a source of identification (seniority and other complements as well).

Regarding possible endogeneity, indicators of relevance of our instrumental variables and tests of exogeneity of the variables instrumented are presented in Table 2. First we test the IV2s, i.e. 'freezing' the behaviour of all household members. For ΔPTRs we find that its IV2 is relevant but the exogeneity test is not rejected. This means that it does not make a big difference for the point estimate to use the IV2, while using it would probably come at the cost of larger standard errors (Bartels & Pestel, 2016 did not use an IV either). The IV2 for income changes in the extensive margin was also relevant and its exogeneity test rejected; therefore, we do utilise this IV2. IV2s in the intensive margin were not very relevant, whereas IV1s were relevant and their tests of exogeneity rejected; therefore, we utilise the IV1s in this margin. These IV1s 'freeze' the behaviour of the person analysed, leaving as a source of variation both exogenous policy reforms and changes made by other household member[18].

Table 2. Relevance of IVs and tests of exogeneity of independent variables

Margin	Variable	Type of IV	Relevance		Test of exogeneity
			Partial R-sq.	F	p-value
Extensive	ΔPTR	IV2	0.216	23.58	0.275
	ΔEq. hh. income	IV2	0.072	25.87	0.005
		IV1	0.692	393.16	0.000
Intensive	ΔEMTR	IV2	0.021	12.69	
		IV1	0.145	110.77	0.013
	ΔEq. hh. income	IV2	0.002	1.92	
		IV1	0.643	2,151.79	0.002

Note: To estimate relevance we use the Stata command ivregress, including for the binary outcome as the command ivprobit does not perform this (and there is no ivlogit command). These commands are able to accommodate the survey's sample design except the strata. Results were obtained entering these independent variables one at the time and using all control variables (without interactions).

The standard deviation of our main independent variables is presented in Table 3. We also present the mean of these variables broken down by the categories that defined the main changes in parameters shown in Table 1. We see that, for instance, in 2006 there was one of the largest decreases in PTRs for people potentially eligible for the SC rebate which is consistent with its largest expansion as after the reform work paid more (the decrease in 2012 is mainly due to composition effects[19]). As, there are other policies affecting the means – besides composition effects and non-policy factors –, we decompose them in terms of changes in the different tax-benefit components (this is a simple arithmetic decomposition, as e.g. in Decoster et al., 2015, equation 7)[20]. By looking at this decomposition, we see that the increases in SC rebates indeed contributed to making work pay more in all years but 2010 and 2012 when there were no increases, and that

[18] IV2s in the intensive margin perhaps are not very relevant because policy changes might be relatively small in relation to behavioural changes of the whole household. Regarding changes made by other household members, they are mostly cancelled out in incentives measures as they are present in both terms of equations 1 and 2, which reduces possible endogeneity. This is supported by the rejection of the exogeneity test of IV2 for PTRs. However, changes of other household members are not cancelled out for income changes, and as tax benefits are not completely linear nor individually based, there is still some room for those changes to affect EMTRs as well.

[19] First, in this year there are less observations; therefore, each one is somewhat more influential. Second, we checked and saw that some people stopped receiving out-of-work benefits while staying unemployed and there were several cohabitants within their first two years of unemployment, which implied large drops in PTRs.

[20] E.g. if taxes are 40 percent of gross earnings in the in-work state (or when working 5 per cent more) and 30 per cent in the out-work state (or when working current hours), the contribution of taxes to the PTR (EMTR) is 10 percentage points as this is the amount taken in taxes when moving to employment (or working more). In the case of an UB with 40 percent replacement rate in relation to earnings, the contribution of the UB are those 40 percentage points as this is withdrawn when moving to employment. The mean change over time of these differences gives the contribution of each component.

the largest contribution occurred in 2006 when many more people became (potentially) entitled to the rebate. A similar situation occurred in the intensive margin where SC rebates generally contributed to increasing the marginal gain from work. The difference between the mean incentive measures and the contribution of SC rebates is due to other factors, the automatic response of some policies, and other policy changes. An important automatic response was the one from taxes as decreases in SCs increase taxable income, which means that 'net' SC rebates are somewhat smaller. Non-automatic changes in taxes also contributed since although the tax brackets cut-offs did not move very differently in relation to the evolution of taxable incomes, for the few households that actually changed tax-bracket, this can imply a considerable change in tax liability.

Table 3. Standard deviation of main independent variables and means by the groups defined by main policy changes (in percentage points)

		05-06	06-07	07-08	08-09	09-10	10-11	11-12
SD ΔPTR		6.6	4.7	4.2	4.9	5.8	7.1	9.0
Mean ΔPTR non-elig. for SC rebate		-0.2	-0.1	0.4	-0.4	-0.1	1.0	-1.8
Mean ΔPTR elig. for SC rebate		-2.5	2.7	0.4	1.9	1.9	-1.1	-12.6
Mean ΔPTR single		-2.8	0.0	1.6	-2.8	-3.3	-2.2	-4.2
Mean ΔPTR head	U<=2	-0.8	6.5	2.5	5.8	0.2	1.8	-4.7
Mean ΔPTR cohabitee		-7.3	-6.9	-4.0	-7.9	-14.3	-1.2	-8.8
Mean ΔPTR single U		0.3	0.5	0.8	0.3	2.1	0.6	-5.4
Mean ΔPTR head U	U>2	0.3	1.3	0.6	1.2	3.2	2.2	1.2
Mean ΔPTR cohabitee		-1.4	-0.1	1.3	0.0	-1.4	0.3	-1.5
ΔSC component non-elig. for SC rebate		0.1	0.0	0.0	-0.1	0.0	0.1	0.0
ΔSC component elig. for SC rebate		-1.9	-0.8	-0.5	-0.5	-0.1	-0.6	0.2
ΔUB component single		-1.6	0.7	-0.1	-2.4	-6.0	-4.0	-5.3
ΔUB component head	U<=2	2.2	6.7	7.6	8.0	-0.4	-0.2	-2.9
ΔUB component cohabitee		-7.3	-5.9	-6.0	-7.4	-17.4	-0.6	-10.6
ΔUB component single		1.0	1.1	1.5	1.5	1.3	0.9	0.8
ΔUB component head	U> 2	1.1	1.8	1.3	1.5	2.9	2.7	2.3
ΔUB component cohabitee		-1.0	0.5	0.3	1.0	-2.3	0.1	-1.5
N subsample		107	106	102	85	79	80	75
SD IV1 ΔEMTR		3.7	6.6	4.8	4.4	5.0	5.0	5.4
Mean IV1 ΔEMTR non-elig. for SC rebate		0.1	0.1	0.1	-0.4	0.5	-0.6	-0.7
Mean IV1 ΔEMTR elig. for SC rebate		-1.8	-2.1	-1.4	-0.6	-0.4	-1.9	2.0
ΔSC component non-elig. for SC rebate		0.1	0.0	-0.1	-0.1	0.2	0.0	-0.1
ΔSC component elig. for SC rebate		-2.1	-0.8	-0.3	0.1	0.4	-0.6	-0.3
N subsample		308	375	362	354	309	307	310

Note: U<=2 and U>2: unemployed for less and more than two years at the end of the first year of observation, respectively. Elig. = eligible.

With respect to UBs, we see that the automatic drops in benefits for people unemployed for less than two years at the end of the first year of observation, are the largest for cohabitees, then for singles and lastly for head of households. Besides composition effects and non-policy factors, changes to the parameters of UBs are harder to distinguish because sometimes different parameters were changed simultaneously and some changes apply to people only affected by the (discrete) minima or maxima. That being said, for people unemployed for less than two years, the contributions of UBs in reducing their PTRs was generally the largest in the last three transition which coincides with the general reduction in maximum benefits. For people unemployed for more than two years, the sharp increase in the maximum UB for singles in 2008 coincides with one of the largest contributions of UBs to increasing PTRs.

In the extensive margin, substitution and income effects can be identified separately because changes in in-work policies tend to only affect PTRs, people with similar changes in PTRs can have different incomes changes and vice versa, and there were some changes in policies that do not depend on employment status. Regarding the latter, a universal back-to-school premium was introduced together with a supplement to low

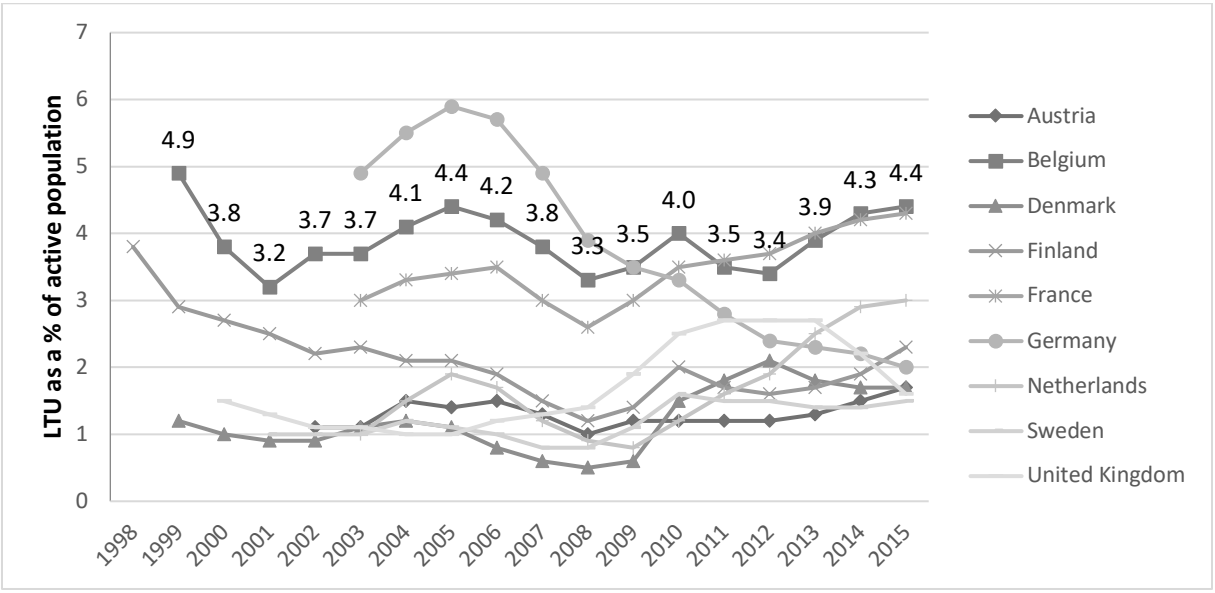
and middle income single parents, and it could also be the case that compensations between in- and out-of-work incomes changed the level of incomes but not how much work pays. In the intensive margin, besides the latter type of changes, adjustments in the slopes of budget constraints involve in the same way all those on a segment subject to a similar EMTR, but the income effect differs by how distant one is from a kink (Gruber & Saez, 2002). In any case, as the sources of identification could still be closely related, we do not include income effects in our main specifications.

3 Results

3.1 Descriptive statistics

Among North-western EU welfare states, Belgium presents one of the highest long-term unemployment rates (Figure 2). The long-term unemployment rate is the number of persons unemployed for 12 months or longer as a percentage of the economically active population. In addition, the incomes of many household with long-term unemployed (LTU) members are below the at-risk-of-poverty threshold, defined as 60 percent of median equivalised household income. Among households with people unemployed at least 12 months, the at-risk-of-poverty rate during the period we study was around 37 per cent according to our own calculations based on EU-SILC, compared to 15 per cent in the whole population (Eurostat, 2017). Moreover, if unemployed members returned to the labour market, work would pay relatively little compared to staying unemployed. Cross-country studies using microdata to calculate PTRs usually rank Belgium among the highest (Collado et al., 2017; Immervoll, Kleven, Kreiner, & Saez, 2007, using 1998 data; Jara Tamayo, Gasior, & Makovec, 2017).

Figure 2. LTU in North-western EU's welfare states



Source: EUROSTAT

Table 4 presents descriptive statistics of our sub-samples. First, with respect to the LTU, we see that the baseline probability of transitioning from unemployment to more than half a year of employment was 9 percent. In addition to the variables that enter the models, we include the initial level of work incentives. The level of PTRs shows that when moving to employment, on average 76 per cent of the potential earnings realised would have been taken in (effective) taxes and withdrawn benefits. We also observe that a large

majority of the LTU were unemployed for 12 or more months previous to the two-year transitions analysed. When we compare the sub-sample of LTU to the larger sub-sample of part-timers studied in the intensive margin, we see that people at the bottom tercile, elderly and from Brussels and Wallonia are overrepresented among the LTU. There are also more females and cohabitants among part-timers, which to a large extent is probably related to the greater prevalence of this type of work among these groups. Second, regarding the sub-sample of working people, the level of EMTRs shows that if a household member had worked five per cent more hours, on average 53 per cent of the potential earnings realised would have been taken in taxes and withdrawn benefits.

Third, in relation to other descriptive statistics, 93 per cent of LTU relied on unemployment benefits (UBs), whereas the rest relied on social assistance, both benefits or none. Fourth, in the descriptive statistics of the LTU we added an extra column showing the means for the people who transitioned to more than six months of employment. This is an unconditional way of anticipating what we might find in the next section. Here we see that people who transitioned tended to perceive a larger decrease in PTRs and (equivalised) household income. As these drops are correlated with the length of unemployment spells, it is important to compare people with somewhat similar lengths as we do in the next section. The groups that were overrepresented among the LTU transitioning were: people not unemployed for the whole previous year to the transitions analysed, from higher terciles and Flanders, cohabitating and not elderly.

Lastly, we also checked whether changes in PTRs and EMTRs were different across some categories. In the intensive margin, the only statically significant difference was non-cohabitants having larger average decreases in EMTRs. In the extensive margin, the groups that had larger average decreases in PTRs were: people who were not unemployed the whole previous year, from higher terciles and not elderly. At the same time, within the categories with smaller average changes, the variances of changes in incentives measures were not much smaller than the variances in the categories with larger average changes. That people not unemployed the whole previous year had larger decreases in PTRs is consistent with the reduction in UBs for some people with relatively shorter spells. With respect to income levels, some policy changes were indeed progressive such as the augmentation of SC rebates. This was sometimes also the case for UBs, although this can have different effects on changes in how much work pays from one year to the next depending on the length of unemployment spells[21]. For their part, some elderly people are eligible for seniority supplements which tends to soften the reduction of their unemployment benefits over time.

[21] E.g. an increase in minima can raise the starting point for people unemployed for relatively shorter periods inducing subsequent larger drop in PTRs, while it can imply the opposite for people unemployed for longer if it reduced those drops.

Table 4. Descriptive statistics of the sub-samples studied

	Obs	Weighted obs.	Mean	SD	Min	Max	Mean U_E=1
	Extensive margin (LTU)						
Transition U -> E	634	1,321,174	0.09	0.28	0.00	1.00	1.00
ΔPTR (pp)	634	1,321,174	-0.47	6.41	-35.70	30.36	-4.62
T1 PTR (pp)	634	1,321,174	75.50	15.20	28.19	194.82	73.50
U whole previous year	634	1,321,174	0.78	0.41	0.00	1.00	0.41
Female	634	1,321,174	0.50	0.50	0.00	1.00	0.50
Cohabitating	634	1,321,174	0.45	0.50	0.00	1.00	0.67
T1 tercile 1	634	1,321,174	0.78	0.41	0.00	1.00	0.64
ΔEmp. reg-age-edu (pp)	634	1,321,174	0.14	1.71	-8.00	9.20	0.08
20-35	634	1,321,174	0.19	0.39	0.00	1.00	0.35
33-50	634	1,321,174	0.33	0.47	0.00	1.00	0.54
50-64	634	1,321,174	0.48	0.50	0.00	1.00	0.10
Brussels	634	1,321,174	0.17	0.38	0.00	1.00	0.10
Flanders	634	1,321,174	0.36	0.48	0.00	1.00	0.56
Wallonia	634	1,321,174	0.47	0.50	0.00	1.00	0.34
IV2 ΔEq.inc. (monthly € 2012)	621	1,295,702	-10.47	51.05	-257.99	364.45	-61.10
	Intensive margin (part-timers during the whole year in both periods)						
ΔWeekly hours	2,325	4,356,634	1.57	5.66	-29.00	44.00	
IV1 ΔEMTR (pp)	2,325	4,356,634	-0.27	5.08	-36.11	31.73	
T1 EMTR (pp)	2,325	4,356,634	52.77	7.26	-0.00	88.65	
Female	2,325	4,356,634	0.72	0.45	0.00	1.00	
Cohabitating	2,325	4,356,634	0.83	0.38	0.00	1.00	
T1 tercile 1	2,325	4,356,634	0.11	0.31	0.00	1.00	
ΔEmp. reg-age-edu (pp)	2,325	4,356,634	0.08	1.32	-11.40	20.30	
20-35	2,325	4,356,634	0.19	0.39	0.00	1.00	
33-50	2,325	4,356,634	0.56	0.50	0.00	1.00	
50-64	2,325	4,356,634	0.25	0.43	0.00	1.00	
Brussels	2,325	4,356,634	0.07	0.26	0.00	1.00	
Flanders	2,325	4,356,634	0.60	0.49	0.00	1.00	
Wallonia	2,325	4,356,634	0.33	0.47	0.00	1.00	
T1 weekly hours	2,325	4,356,634	27.53	6.88	2.00	36.00	
IV1 ΔEq. inc. (monthly € 2012)	2,272	4,271,277	-2.78	131.60	-717.30	805.60	

Note: T1=first period of observation, U_E = 1 refer to LTU who transitioned to more than six months of employment, terciles are based on non-simulated equivalised household income.

3.2 Regression analysis

Table 5 presents results of the effect of changes in PTRs on the likelihood of taking up work. In the model of column 1 all variables are included, while the preferred specification in column 2 removes the interaction between cohabitation and ΔPTRs as this does not imply a decrease in log-likelihood. The result of the average marginal effects (AME) of the preferred specification in column 3 is that a 10 percentage points

increase in the PTR reduced the likelihood of transitioning to more than half a year of employment by 3.7 percentage points. This is sizable taking into account that the baseline probability of transitioning from unemployment to more than half a year of employment was nine percent (and 13 when including transitions to six or less months). For the categories of the interacted variables, column 3 also shows the difference in the AME of increasing 10 percentage points the PTR, while column 4 presents the level of the AME of those categories. We see that the effects are mainly driven by people not unemployed the whole year before the transitions analysed and not from Brussels. And although we are not able to detect statistically significant differences across the categories of some variables, the levels of the AME of increasing 10 percentage points the PTR are statistically significant for categories such as males and people not in the first tercile. The last model in column 5 adds (log equivalised) income changes finding no significant income effects nor a large change in the magnitude of the effect of ΔPTRs (for simplicity we only present these two AME). In relation to other control variables in the models and with respect to their reference categories: people not unemployed the whole previous year and from Flanders were more likely to change employment status, while elderly people less. We also checked whether the main result changed when increasing and decreasing by two months of employment the period to which people transitioned, finding that the AME of increasing 10 percentage points the PTR did not decrease more than 1.5 percentage points. Similarly, we did not find either statistically significant income effects when using the IV1 (i.e. besides policy change, also including variation caused by household members[22]) instead of the IV2 and the point estimates were very similar.

Table 6 presents results of the effect of changes in EMTRs on weekly hours worked by people already in the labour market working part-time (at least the first year of observation). The models are similar to the ones we utilised when studying PTRs. A difference is that we first include models in column 1 and 2 with the observed ΔEMTRs as subsequent models use an instrument for this variable. Another difference is that all models include the tercile in the distribution of hours among part-timers in the first periods of observation. We select the specification of the model in column 2 because by removing some variables, the explanatory power does not decrease. In relation to instrumenting changes in EMTRs, this is necessary because people who increased their hours could have had a mechanical surge in their EMTRs due to progressivity. Accordingly, once we remove this possible reverse causality using the IV1 in the model of column 3, the sign of the effect is reversed and more aligned with previous findings in the literature. However, the effect is not statistically significant. No interactions are statistically significant either, nor income effects in the model of column 4. The coefficients of hours terciles were all statistically significant and their signs and magnitudes aligned with the presence of mean reversion. Regarding other control variables in the model of column 3, females, people in the first income tercile, older and not from Brussels reduced more or increased less their hours of work.

[22] For this IV1, we decided to use the non-simulated (or observed) UBs of other people living in the households to approximate better the income changes. This comes at the cost of not simulating changes in those benefits when 'freezing' the behaviour of the few people analysed who transitioned to employment.

Table 5. Results of regression analysis in the extensive margin

	(1)	(2)	(3)	(4)	(5)
	DV: U->E	DV: U->E	DV: U->E	DV: U->E	DV: U->E
	logit	logit	logit	logit	ivprobit
VARIABLES	odds	odds	AME (contrasts)	AME (levels)	AME
Change in PTR (10 pp)	0.139	0.136***	-0.037**		-0.055
	[0.015 - 1.270]	[0.054 - 0.339]	[-0.061 - -0.013]		[-0.159 - 0.048]
Unemployed whole previous year	0.419*	0.420**	-0.069**		
	[0.200 - 0.877]	[0.214 - 0.822]	[-0.118 - -0.020]		
Change in PTR * U whole previous year = 0	1.000	1.000		-0.078***	
	[1.000 - 1.000]	[1.000 - 1.000]		[-0.120 - -0.036]	
Change in PTR * U whole previous year = 1	1.747	1.761	0.061**	-0.017	
	[0.645 - 4.732]	[0.886 - 3.503]	[0.013,0.109]	[-0.046 - 0.012]	
Female	0.996	0.996	-0.014		
	[0.548 - 1.812]	[0.548 - 1.810]	[-0.047 - 0.020]		
Change in PTR * Female = 0	1.000	1.000		-0.057***	
	[1.000 - 1.000]	[1.000 - 1.000]		[-0.093 - -0.021]	
Change in PTR * Female = 1	1.924	1.927	0.040	-0.017	
	[0.955 - 3.878]	[0.955 - 3.886]	[-0.000,0.081]	[-0.044 - 0.011]	
Cohabitating	1.411	1.413	0.021		
	[0.711 - 2.798]	[0.716 - 2.787]	[-0.020 - 0.061]		
Change in PTR * Cohabitating = 0	1.000				
	[1.000 - 1.000]				
Change in PTR * Cohabitating = 1	0.980				
	[0.227 - 4.236]				
1st Eq. hh income tercile	0.807	0.807	-0.023		
	[0.413 - 1.576]	[0.413 - 1.579]	[-0.060 - 0.015]		
Change in PTR * 1st eq. hh income tercile = 0	1.000	1.000		-0.061***	
	[1.000 - 1.000]	[1.000 - 1.000]		[-0.096 - -0.026]	
Change in PTR * 1st eq. hh income tercile = 1	1.606	1.611	0.033	-0.028	
	[0.641 - 4.022]	[0.656 - 3.954]	[-0.017,0.083]	[-0.060 - 0.005]	

	(1)	(2)	(3)	(4)	(5)
20-35	1.512	1.513	0.043		
	[0.727 - 3.147]	[0.728 - 3.145]	[-0.038 - 0.125]		
50-64	0.084***	0.084***	-0.124***		
	[0.030 - 0.234]	[0.030 - 0.234]	[-0.169 - - 0.079]		
Change in PTR * 35-50	1.000	1.000		-0.052	
	[1.000 - 1.000]	[1.000 - 1.000]		[-0.123 - 0.018]	
Change in PTR * 20-35	1.277	1.281	0.021	-0.031	
	[0.486 - 3.355]	[0.507 - 3.238]	[-0.075,0.117]	[-0.092 - 0.030]	
Change in PTR * 50-64	0.721	0.719	0.032	-0.020	
	[0.217 - 2.394]	[0.222 - 2.329]	[-0.041,0.106]	[-0.047 - 0.007]	
Brussels	0.875	0.875	-0.021		
	[0.360 - 2.130]	[0.360 - 2.126]	[-0.053 - 0.012]		
Flanders	6.088***	6.092***	0.123***		
	[3.173 - 11.683]	[3.154 - 11.769]	[0.072 - 0.175]		
Change in PTR * Wallonia	1.000	1.000		-0.045***	
	[1.000 - 1.000]	[1.000 - 1.000]		[-0.072 - - 0.017]	
Change in PTR * Brussels	3.030	3.042*	0.048*	0.003	
	[0.985 - 9.323]	[1.043 - 8.869]	[0.006,0.089]	[-0.027 - 0.032]	
Change in PTR * Flanders	1.597	1.605	-0.004	-0.048	
	[0.622 - 4.102]	[0.698 - 3.689]	[-0.067,0.060]	[-0.111 - 0.015]	
Change reg-edu-age emp (pp)	1.154	1.154	0.008		
	[0.845 - 1.575]	[0.848 - 1.570]	[-0.009 - 0.026]		
Change in IV2 log eq. hh income (Euro 2012)					-0.156
					[-1.271 - 0.958]
Pseudo-R2	0.295	0.295			
Log-likelihood	-275689	-275690			
AIC	551428	551428			
N_sub	634	634	634	634	620

Note: *** p<0.01 ** p<0.05 * p<0.1. 90% confidence intervals in brackets. Models include transition dummies with base category 2005-06. AME=average marginal effects. In column 3, AME refer to contrasting between the categories of the interacted variables the effect of increasing the PTRs in 10 percentage points, while in column 4 they refer to the level of this effect for those categories. For simplicity column 5 omits other AME. Unemployed whole previous year refers to the year before the two-year transitions analysed. Information criteria and the command *ivprobit* are able to accommodate the survey's sample design except the strata.

Table 6. Results of regression analysis in the intensive margin

	(1)	(2)	(3)	(4)
	DV: hours change	DV: hours change	DV: hours change	DV: hours change
VARIABLES	OLS	OLS	2SLS	2SLS
Change in observed/IV1 EMTR (10 pp)	1.438*	1.638***	-2.297	-2.002
	[0.198 - 2.679]	[0.829 - 2.446]	[-6.452 - 1.859]	[-5.912 - 1.907]
Change in IV1 EMTR * Female	0.283			
	[-0.531 - 1.098]			
Change in IV1 EMTR * Cohabitating	-0.989**	-0.977**	2.216	1.554
	[-1.806 - -0.172]	[-1.747 - -0.207]	[-1.741 - 6.172]	[-2.054 - 5.161]
Change in IV1 EMTR * 1st eq. hh income tercile	-0.056			
	[-0.942 - 0.830]			
Change in IV1 EMTR * 20-35	-0.224	-0.221	0.662	-0.047
	[-1.081 - 0.633]	[-1.080 - 0.639]	[-2.177 - 3.501]	[-2.848 - 2.754]
Change in IV1 EMTR * 50-64	-0.950**	-0.978**	1.319	1.189
	[-1.728 - -0.173]	[-1.755 - -0.201]	[-0.811 - 3.449]	[-0.957 - 3.335]
Change in IV1 EMTR * Brussels	2.075***	1.971***	-0.646	-0.343
	[0.884 - 3.266]	[0.803 - 3.140]	[-3.228 - 1.936]	[-2.574 - 1.888]
Change in IV1 EMTR * Flanders	-0.249	-0.237	-0.911	-0.325
	[-0.930 - 0.432]	[-0.930 - 0.455]	[-3.140 - 1.317]	[-2.444 - 1.795]
Female	-2.165***	-2.160***	-2.137***	-2.176***
	[-2.749 - -1.580]	[-2.739 - -1.580]	[-2.710 - -1.565]	[-2.773 - -1.580]
Cohabitating	-0.582	-0.583	-0.613	-0.614*
	[-1.197 - 0.034]	[-1.205 - 0.038]	[-1.252 - 0.027]	[-1.221 - -0.006]
1st eq. hh income tercile	-1.579***	-1.558***	-1.197**	-1.439***
	[-2.231 - -0.927]	[-2.207 - -0.908]	[-2.020 - -0.374]	[-2.234 - -0.644]
20-35	1.302***	1.308***	1.353***	1.365***
	[0.674 - 1.931]	[0.677 - 1.939]	[0.692 - 2.013]	[0.680 - 2.050]
50-64	-1.292***	-1.301***	-1.358***	-1.328***
	[-1.746 - -0.837]	[-1.756 - -0.847]	[-1.829 - -0.887]	[-1.796 - -0.861]
Brussels	1.198**	1.228**	1.557***	1.641***
	[0.361 - 2.035]	[0.392 - 2.065]	[0.647 - 2.466]	[0.700 - 2.581]
Flanders	0.173	0.181	0.206	0.105
	[-0.282 - 0.628]	[-0.269 - 0.631]	[-0.263 - 0.674]	[-0.364 - 0.575]

	(1)	(2)	(3)	(4)
Hours tercile = 1	1.708***	1.705***	1.725***	1.722***
	[1.057 - 2.360]	[1.058 - 2.352]	[1.056 - 2.394]	[1.015 - 2.429]
Hours tercile = 3	-2.190***	-2.189***	-2.122***	-2.128***
	[-2.674 - -1.706]	[-2.675 - -1.704]	[-2.612 - -1.632]	[-2.632 - -1.623]
Change reg-edu-age emp (pp)	-0.042			
	[-0.229 - 0.146]			
Change in IV1 log eq. hh income (Euro 2012)				-1.362
				[-3.338 - 0.614]
R-squared	0.117	0.117	0.053	0.054
Adjusted-R2	0.108	0.109	0.044	0.044
N_sub	2325	2325	2325	2272

Note: *** p<0.01 ** p<0.05 * p<0.1. 90% confidence intervals in brackets. Models include transition dummies with base category 2005-06. Base categories are male, single, not 1st income tercile, age 35-50, Wallonia, 2nd hours quintile among part-timers. Adjusted-R2 takes into the survey's sample design except the strata.

4 Conclusion

Although many of the household incomes of long-term unemployed (LTU) people in Belgium are below the at-risk-of-poverty threshold, their potential in-work incomes may limit the room for increasing their often inadequate out-of-work benefits. The reason is that in the presence of substitution effects, changes in the difference between the incomes obtained when working and not working may affect the likelihood of taking up work. To study whether this is the case, we analysed the effect of changes in participation tax-rates (PTRs) on the likelihood of transitioning from long-term unemployment to more than half a year of employment during the seven two-year episodes that took place between 2005 and 2012. PTRs operationalise substitution incentives by measuring the proportion of household earnings taken in (effective) tax and withdrawn benefits when a household member moves from unemployment to employment. We found that a 10 percentage point increase in the PTR (e.g. due to an equivalent decrease in replacement rates or increase in tax rates) decreased the likelihood of transitioning by around four percentage points. This effect is sizable taking into account that the baseline probability of taking up work for more than half a year was nine per cent (it was 13 per cent when including transitions to six or less months). We also studied the heterogeneity of substitution effects finding that they were more driven by males, people not unemployed the whole year before the transitions analysed, from higher income terciles and not from Brussels.

The substitution effects found in the extensive margin imply that increasing out-of-work incomes would require augmenting in-work compensations if governments do not want to reduce the likelihood of some groups taking up work. To offset these surges in expenditure, the targeting of current in-work compensations based on full-time equivalent earnings could be increased, or progressive tax credits based on actual earnings could be raised. In either case the current effective marginal tax rates (EMTRs) of some people would rise. For this reason, we also studied whether changes in EMTRs affected the number of hours worked by people already in the labour market working part-time, finding no statistically significant effects. This might leave some room to compensate increases in out-of-work transfers with changes in in-work transfers. For example, future research could study making individually-based social contribution rebates more targeted to low income households. This would require taking into account the trade-off with respect to incentives for (potential) second earners (Vandelannoote & Verbist, 2016). At the same time, it is relevant to mention that the policy variation used was not large and that it tended to reduce marginal tax rates. Effects could be bigger with larger policy changes (Chetty, 2009) and different if reforms tended to increase marginal tax rates, which could, for example, induce some full-timers to reduce their hours of work.

As avenue for further research, longitudinal register data could be used to increase sample sizes and have more accurate income and employment data. This would require combining this type of data with tax-benefit microsimulations models. Another avenue for further research would be taking advantage of the harmonised tax-benefit model EUROMOD to study more countries simultaneously, especially those with large changes in policy which would also enhance the identification of behavioural responses. Lastly, including changes in in-kind services such as childcare and active labour market policies would allow extending and improving the results.

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Appendix

Appendix A – Simulating unemployment benefits and social assistance

EUROMOD is programmed to use cross-sectional data and does not have information of the length of unemployment spells. This means that by default UBs are programmed only for the first year of unemployment assuming that the spells started that year[23]. We improve on this by looking at the employment status during the last 12 months. Singles and heads of household unemployed at least 12

[23] There are two other assumptions. First, assuming that all people who used to work part-time declared to do so involuntarily. In reality, those working part-time voluntarily would have received a "halved" UB. As a reference, we can say that we predicted that only around ¼ of LTU women would have come back to the labour market as part-timers, and according to our own calculations based on EU-SILC, only around ¼ of people working less than 30 hours did so because they did "not want to work more". That being said, we overestimate the UBs of the few (previously) voluntary part-timers and therefore also their PTRs and household incomes. Part of this is cancelled out in incentives measures and first differences. Second, the other assumption is that people is not in the category "temporary unemployed". This category is for unemployed still bounded by a contract of which the work is temporarily suspended (e.g. because of economic circumstances). Replacement rates are slightly higher and do not decrease over time. According to the EUROMOD country report, among the categories that we should simulate, temporary unemployed represented around 20 per cent during the period studied. Nonetheless, we expect that the majority of LTU are not in this category, while misestimation for 'other household members' are also partially cancelled out.

months are already in the flat part of their benefits, while when these groups were unemployed for less, we simulate their decreasing benefits accordingly. People cohabitating have a flexible limit to start the flat part of their benefits. After 12 months of unemployment, cohabitees are entitled to three months at a lower replacement rate and later to a lump sum benefit. This limit of three months is extended for three more months for every year worked, and indefinitely for people who were more than 20 years employed. For people employed for less, we assume that the observed spell is their first which we accordingly calculate as the difference between the years since first joining the labour market and their current work experience.

In terms of eligibility, benefits are always simulated for people observed as recipient. When calculating in the second year the counterfactual out-of-work incomes of people who transitioned to 12 months of work, we simulate their benefits only if they were recipients in the first year. Regarding the calculation of benefit amounts, they depend on previous wages. When people were unemployed during the last months of the first year of observation, we modify EUROMOD to use that year's reference earnings to keep simulating the benefit in the second year. This corresponds to predicted earnings for individuals analysed in the extensive margin (see Appendix B), while for 'other household members' we used observed earnings when we can and otherwise predicted ones[24].

The few people who are not entitled to UBs may be entitled to social assistance (SA). By default, EUROMOD simulates this benefit for everybody who would be entitled, assuming either full take-up or introducing random non-take-up. We modify EUROMOD to simulate SA only for those households that are indicated as recipients in the data. As in the case of UBs, for people analysed who transitioned to 12 months of work in the second year of observation, we simulate SA only if they were recipients in the first year.

When people work, under certain circumstances they could still receive SA, and if they worked involuntarily part-time, they could receive an income guarantee connected to their UBs. EUROMOD allows combining earnings and SA but does not simulate the UB income guarantee. As a reference, the EUROMOD country report shows that part-time employees with income guarantee only amounted to around six per cent among the categories that we should simulate. To somewhat improve this, for LTU that in the counterfactual situation of working are eligible for SA, we also allow them to receive it if they are recipients of UBs (in the non-counterfactual situation). For people receiving the UB income guarantee in a non-counterfactual situation, we overestimate it by applying the same rules as for regular UBs. Part of this is cancelled out in incentives measures and by using first differences.

Appendix B – Calculating PTR's and predicting earnings

For the individuals for which PTRs are being calculated, some additional assumptions and calculations must be made in each labour market state. Incomes in both states must be made comparable. We achieve this by estimating earnings and out-of-work benefits in a full-year basis. To estimate hypothetical hourly wages and hours of work, we construct regression models (available upon request) based on employed people. Previous studies analysing the relationship between PTRs and employment have either predicted earnings for the unemployed (Kalíšková, 2015) or assumed a fixed number of hours of work and predicted hourly wages (Bartels & Pestel, 2016 calculated an scenario where everybody works 20 hours per week and another where everybody works 40; Selin, 2014 also included 30 hours)[25]. We cannot rely on the former as some tax-benefit

[24] For the very few 'other household members' that are not employed or unemployed and do not have observed earnings, we do not predict them ourselves. For them we utilise the prediction of hourly wages in-built in EUROMOD and assume that they worked 38 hours per week.

[25] Predicting wages assuming a fixed number of hours is also the most common assumption in the descriptive literature on participation incentives (e.g. Callan, Keane, Savage, Walsh, & Timoney, 2012; Decoster et al., 2015; Immervoll & O'Donoghue, 2002). An exception is Adam

calculations require specific numbers of hours (e.g. social contribution rebates in Belgium are based on full-time equivalent income). In relation to the second option, we utilise a similar method to predict hourly wages. Regarding the hours assumption of this option however, it can have an effect on PTRs. For this reason, we do not assume a fixed number of hours but match unemployed people to their most likely hours.

We predict hourly wages using a Heckman selection model. This model controls for sample selection bias given that those currently in work might have unobserved characteristics different from those currently out of work. The variables that we use for the wage equation are education, age and experience (including squared terms), and for women also region. The extra variables necessary for the selection equation are the number of children younger than three years old, between four and six and between seven and 12, and for men also region. To improve our estimations we do not include people with too high/low hours (e.g. full-timer working more than 70 hours). We predict log hourly wages separately for men and women.

In relation to matching unemployed people to their most likely hours of work, first we observe the distribution of hours of work by gender. If there is one clear most common option, we assume that one. If there is more than one common option, we predict the probability of choosing those options using a multinomial logistic model. This results in choosing 39 hours for men as more than 50 per cent of them works between 38 and 40 hours and no other options is above 10 percent. For women the most common options are around 19, 30 and 39 hours. For the women's model we use the same variables as the selection equation of our Heckman model and match unemployed women to the hour option for which they have the highest predicted probability.

and Browne (2010). As the UK tax-benefit system does not depend on exact hours but on bands, the latter authors could predict earnings at different hour bands, evaluate PTRs at those different predictions and weight these PTRs by the predicted probability of each hour band.