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Making Disability Work?
The Effect of Financial Incentives on Partially Disabled Workers

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ABSTRACT

This study provides insight in the responsiveness of disabled workers to financial incentives, using administrative individual data from the Netherlands from 2006 to 2013. We focus on workers receiving partial DI benefits and with substantial residual work capacities that can be exploited. After the first phase of benefit entitlement, workers that do not use their residual income capacity experience a large drop in benefit income. In effect, this implies a substantial increase in incentives to resume work. With entitlement periods in the first phase of DI benefits varying across individuals, we use a difference-in-difference approach to analyze the effects on the incidence of work, the wage earnings and full work resumption of disabled workers. Based on the effect estimate on work incidence, we infer a labor elasticity rate of 0.12. Elasticity estimates are highest among younger DI recipients, as well as individuals with mental impairments. The incentive change has only a limited impact on wage earnings of partially disabled workers and no significant impact on work resumption rates.

1. Introduction

In recent years, more attention has been devoted to the design of work incentives of disabled workers (OECD, 2010). Several studies point at the presence of residual work capacities among disability insurance (DI) recipients, see e.g. Bound (1999) and Maestas et al. (2014). At the same time, there is a common belief that disabled workers are discouraged from using these capacities by a lack of financial incentives. Workers that increase their working hours are faced with high implicit tax rates or may even loose their (full) DI benefits. This may explain why outflow rates of DI recipients are typically low, even if their impairments are expected to be temporary (Koning and Lindeboom, 2015). Related to this point, low take-up rates of Ticket-to-Work vouchers in the US Social Security Disability Insurance (SSDI) illustrate that the impact of wage subsidies – as a complement to partial DI benefits – do not compensate for perverse incentives (Autor and Duggan, 2006).[1]

The success of reforms that aim at enhancing the implicit tax rates on work critically hinges on the responsiveness of disabled workers to changes in work incentives. In particular, labor elasticities may vary with respect to the severity of impairments and their evolution – as well as the general loss of work capabilities – over time. One of the key empirical questions in the design of DI benefit schemes thus is how impairments affect the ability of workers to respond to – and benefit from

[1] Likewise, Bütler et al. (2014) find low take up rates for a randomized group of disabled workes in Switzerland that received the offer to claim a payment ("seed capital") of up to USD 71,000 if they take up or expand employment and reduce DI claims.

– incentives. In this context, possible responses are twofold: workers may increase their work effort to complement DI benefits, or leave the DI scheme if benefit conditions become less generous.

This study provides insight in the responsiveness of disabled workers to financial incentives, using administrative individual data from the Netherlands from 2006 to 2013. We focus on workers that receive partial DI benefits and have substantial residual work capacities that can be exploited. In the first phase of benefit entitlement – the so called ‘wage-related period’ – DI benefits are supplemented with Unemployment Insurance (UI) benefits if the residual income capacity is left unused. In principle, this ensures the payment of benefits of at least 70% of the individual’s pre-disability wage. When the wage related period ends and the UI benefit period is exhausted, however, workers that do not use their residual income capacity receive DI benefits that are based on the statutory minimum wage instead of their pre-disability wage. This induces a large drop in the income from benefits for most workers. However, workers that use their residual work capacity receive benefit levels that are (still) related to their pre-disability wage. In effect, most partially disabled workers experience a strong increase in work incentives – with large potential drops in benefits – at the moment the wage-related DI benefit period has been exhausted.

< INSERT FIGURE 1 HERE >

The Dutch DI system, which has been plagued by substantial moral hazard problems for several decades, provides an interesting setting for the current analysis

(Koning and Lindeboom, 2015). As Figure 1 shows, the share of workers in the Netherlands who received DI benefits tripled from 4 percent of those who were insured in the late 1960s to about 12 percent of those who were insured in the mid-1980s. It then remained more or less constant until the early 2000s. To counteract moral hazard problems in the use of DI benefits, policies initially aimed at increasing the incentives of employers to prevent the inflow of workers into disability, as well as increased gatekeeping in the sickness period that precedes the application of DI benefits. In 2006, as a final piece of the reform series, the old DI scheme was replaced by a new DI one with two distinct schemes for permanently and fully disabled workers (IVA) and the partially and/or temporarily fully disabled workers (WGA). Overall, the reforms since the early 2000s have been successful in reducing the inflow into DI, with estimates of over 60% (Van Sonsbeek and Gradus, 2013). Still, there is no evidence on the effect of work incentive enhancements that have been introduced for the WGA scheme in 2006, which is the focus of the current paper.

One key feature of the partial DI scheme that we exploit in our analysis concerns the length of the wage-related period for DI benefits for which benefit conditions are relatively generous. The entitlement period is determined by the work history of individuals, which induces substantial variation in the timing of individual changes in work incentives. This variation allows us to use a Difference-in-Difference (DiD) approach that analyzes the effects on the incidence of work, the wage earnings and the exit rate into (full) employment of disabled workers. Similar to recent work by Kostol and Mogstad (2014), the information on labor supply responses on the incentive enables us to infer the size of labor supply elasticities of disabled workers.

Here, the setup with multiple treatment groups – that is, with different moments of the incentive change – allows us to broaden our scope in several ways. First, we estimate elasticities that vary with respect to the length of entitlement to the wage-related period of DI benefits, enabling us to assess changes in the responsiveness of workers over the DI benefit spell. Second, variation in the timing of incentive changes ensures the identification of incentive effects, as there is no need to impose any functional form assumptions on benefit duration dependence in our outcome variables. Third, and related to the second point, individual variation in the timing of changes in incentives allows us to specify flexible duration dependency functions that differ with respect to age categories in our sample. We thus take account of the possibility that health recovery patterns and the process of loosing job skills may differ between age groups of disabled workers.

This paper is related to an increasing strand of literature that studies the incentive effects of DI benefits. Part of this literature compares applicants that are awarded with DI benefits with rejected applicants (see e.g. Bound 1999; Maestas et al. 2013; Chen and van der Klaauw 2008; Moore 2015; Autor et al., 2014). Other studies in this field exploit variation in DI benefits over time and regional variation in benefit conditions to examine effects on DI enrolment or DI return to work rates (Gruber 2000; Autor and Duggan 2003; Campolieti 2004; Fevang et al 2013). In particular, using a policy change in Canada in 1987, Gruber (2000) comes to an elasticity estimate of 0.3 that is measured as the change in non-participation due to a change in DI benefit levels.[2] Up to date, this is probably the most well known result in this field of research.

Similar to recent studies of Kostol and Mogstad (2014), Campolieti and Riddell (2012) and Weathers and Hemmeter (2011), our primary focus is on work incentives for workers that are allowed to retain their DI benefits if (part of) their work capacity is used. In this literature, a key issue concerns the presence of cash cliffs that deter disabled workers to fully resume work. Kostol and Mogstad (2014) use a Regression-Discontinuity design that exploits a cutoff date for DI entry to get access to a return-to-work program in Norway. DI recipients in the treatment group – those who entered the scheme prior to January 2005 – were exempted from DI benefit cuts to a much higher level than the control group. Kostol and Mogstad find elasticity estimates of the prevalence of work of disabled workers that range between 0.1 and 0.3. These effect estimates are sufficiently large to compensate for entry effects in the DI scheme – that is, program conditions that may encourage workers to apply for benefits.[3] Using a DiD design that exploits SSDI program differentials in Canadian provinces, Campolieti and Riddell (2012) find income exemptions to increase the propensity of disability recipients that work with about 25%, but no significant changes in the inflow in of outflow out of SSDI. Finally, Weathers and Hemmeter (2011) analyse the outcome of a field experiment on earnings disregards for SSDI

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[2] As to the same DI scheme in Canada, Campolieti (2004) finds insignificant elasticity effects for a reform that was enacted in 1973. He argues that eligibility requirements and the stringency of the medical screening were much tougher in the early 1970s than in the 1980s.

[3] Using calibrated models that take into account incentive and entry effects of work incentives, Hoynes and Moffitt (1999) and Benítez-Silva et al. (2010) however find mixed evidence on the overall effect on work participation of (potential) DI recipients.

recipients in the US. Like Campolieti and Riddell, they conclude that the policy led to substantial employment effects for SSDI recipients, rather than changes in the number of benefit payments.

A common observation in the literature is that DI recipients that are targeted with incentives typically have low (a priori) participation rates. For instance, Kostol and Mogstad (2014) analyze the impact of incentives on DI recipients with participation rates that are well below 10%. In the DI scheme that is studied in our paper, however, we focus on workers that are classified as partially disabled, having relatively high (a priori) participation rates and substantial residual work capacities. The pertaining question for this group is whether incentives induce workers to exploit their work capacities or whether other factors are dominant in explaining employment. In the Dutch system of sick pay, one obvious alternative candidate that explains labor participation is the continuation of wage payments by the employer during the period of sickness that precedes DI benefit claims. If employers and workers succeed in finding work adaptations in this period, it is likely that these partially disabled workers continue to work during the DI spell.

From our analysis, we find work effect estimates of the full sample to be equal to 2.5 percentage-points. This corresponds to a labor supply elasticity estimate that is equal to 0.12. The size of the labor supply elasticity declines with respect to the age of workers, rather than the elapsed duration until the incentive change. We also find the incentive change has a limited impact on the earnings of DI recipients that work. This effect is confined to workers with wage earnings below their residual earnings capacity that has been determined at the start of the DI benefit spell. Finally, there is no evidence of incentive effects on the exit rate out of DI benefits. This suggests that the degree of disability of DI recipients was probably too large to be able to engage in substantial work activities to lose DI benefits all together. It is also likely that employed workers preferred partial DI benefits to be supplemented by a wage subsidy and wage earnings, rather than being fully employed while receiving wage earnings only. This points at the presence of cash-cliffs that deter workers from leaving DI benefits.

The remainder of this paper now proceeds as follows. Section 2 explains the institutional background of the Dutch DI scheme for partially disabled workers, as well as the expected impact of the wage subsidy on work, wage earnings and the likelihood of leaving the scheme. Section 3 presents data descriptives, Section 4 discusses the empirical strategy and Section 5 presents and discusses our estimation results. Finally, Section 6 concludes.

2. Institutional background

2.1 Partial disability

Since its inception in 1967, the Disability Insurance (DI) program in the Netherlands is a public scheme that is mandatory for all workers. In principle, DI benefits provide insurance for 70 percent of the loss of income due to these impairments, regardless the cause of the impairments. Workers apply for DI benefits after two years of sickness absence. DI claims are assessed and premiums are set by the public Employee Insurance Agency called UWV. UWV determines the presence of impairments, the consequences for the earnings potential of an applicant, the degree of disability as a percentage of the worker's pre-disability wage, as well as the corresponding disability benefit level. Workers may thus receive benefits for partial disability that are supplemented by UI benefits and subsequently, after UI benefit exhaustion, by social assistance benefits – if the residual earnings potential is not used to its full extent.

In order to assess the individuals' degree of disability, the Employment Insurance Agency first determines the earnings capacity of workers. The earnings capacity follows from an assessment that is made by an insurance doctor and a labor market expert, who select a set of (at least nine) regular jobs that meet the worker's physical and mental impairments. The earnings capacity equals the median value of average wage rates of these jobs. Thus, the degree of disability is calculated as the loss of earnings capacity as a percentage the pre-disability wage. Individual workers are subsequently assigned to six disability classes, with the following degree intervals: 0-35% , 35%-45%, 45% -55%, 55%-65%, 65%-80%, and 80%-100%. If the degree of disability is lower than 35%, the worker is not entitled to any DI benefits. Workers are classified as fully disabled if their degree of disability exceeds 80% of their pre-disability wage. This group, that constitutes about 75% of the inflow into the DI scheme, receives a full benefit of 70% of the pre-disability wage.[4] Workers with disability degrees between 35% and 80% receive partial DI benefits.

With DI benefits that are based on pre-disability wages, disabled individuals with similar earnings capacities can have different disability degrees. This means that

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[4] Note that fully disabled workers with permanent impairments (in the IVA scheme) receive a benefit level that is equal to 75% of their pre-disability wage.

workers with high pre-disability wages are more likely to have higher degrees of disability. Still, full disability is more common for workers with low pre-disability wages that are close to the minimum wage, as alternative job possibilities are less numerous for them.

2.2 Work incentives in the partial DI scheme

Partially disabled workers receive DI benefit levels with two distinctive phases. The first phase of DI benefit entitlement is referred to as the 'wage-related period'. In the wage-related period, partial DI benefits are supplemented with UI benefits[5] if workers do not have sufficient wage earnings; this ensures a total benefit income that equals 70% of the pre-disability wage at minimum. As the length of the wage-related period corresponds to the UI benefit exhaustion period, it is determined by the employment history of an individual (see Figure 2). Until 2007, the length of the wage-related period could be characterized as a step function of the individual employment history of workers, with 60 months as the maximum entitlement length. Since 2008, however, the length of the wage-related period has become a linear function of work history, with one additional year of work history resulting in one additional month of benefit entitlement of the first phase. At the same time, the maximum duration of the wage-related period has been shortened to 38 months.

< INSERT FIGURE 2 HERE >

[5] In practice, partially disabled workers without work receive a single DI benefit that consists of a DI component and an UI component.

When the wage-related period has ended, there is no more entitlement to UI benefits. Also, DI benefits are no longer calculated as the a percentage of the pre-disability wage, but related to the statutory minimum wage. To compensate for this drop in benefits, however, workers may qualify for a wage subsidy if they succeed in using more than 50% of their residual earnings capacity. This wage subsidy then supplements the DI benefit to the level that was received in the wage-related period. This means that disabled workers that exploit more than half of their residual earnings capacity do not experience a drop in their income at the end of the wage-related period of DI benefits. Those who do not meet the wage subsidy condition, however, will have a substantial decrease in their income. In effect, all workers will face a large increase in work incentives if they move from the first to the second phase of DI benefits.

To assess the impact of work incentives in the partial DI scheme, it is instructive to define the 'conditional replacement rate' as a measure of work incentives. In this context, 'conditional' refers to the presence of partial disability and the receipt of partial DI benefits. The conditional replacement rate thus equals the sum of benefits that would be received if one would not work, divided by the sum of benefits and wage earnings that would be received if one would fully exploit his/her residual earnings capacity. The derivation of conditional replacement rate in both phases of benefit receipt requires information on the pre-disability wage W_p, the current wage earnings of partially disabled workers W_c, the degree of disability d, and the statutory minimum wage W_m. Moreover, it should be noted that DI benefits can increase with respect to pre-disability wages until the ‘maximum premium wage’, $\overline{W}$, is reached. With this information, the conditional replacement rate in the first phase of DI benefit receipt, CRR^1, equals

$$CRR^1 = \frac{0.7\, W_p^*}{0.7d\, W_p^* + (1-d)\, W_p^*} = \frac{0.7}{1-0.3d} \qquad [1]$$

with

$$W_p^* = \min(W_p, \overline{W}).$$

Equation [1] shows that unemployed DI recipients receive 70% of their pre-disability wage in the wage-related period, up to the maximum premium wage. DI benefits can be supplemented with wage earnings, but with an implicit tax rate – or ‘taper-rate’ – of 0.7. This results in parameter values of CRR^1 that vary between 0.7 and 1.

The conditional replacement in the second phase of DI benefits, CRR^2, can be derived as follows:

$$CRR^2 = \frac{0.7\, d\, W_m}{0.7d\, W_p^* + (1-d)\, W_p^*} = \frac{0.7\, d\left(\frac{W_m}{W_p^*}\right)}{1-0.3d} \qquad [2]$$

The numerator of this expression shows that the benefit generally decreases in the second phase if one does not work, as entitlement to UI benefits has ended and benefits are no longer based on the pre-disability earnings but the minimum wage,

W_m. The denominator shows that DI benefits continue to be based on pre-disability earnings if the individuals residual earnings capacity is (sufficiently) used. Thus, the conditional replacement rate will decrease substantially, particularly for workers with high pre-disability earnings and a low degree of disability.[6] We will explain the consequences of this in more detail in Section 3.

3. Data

3.1 Data setup

For our analysis we use individual worker information from the Employee Insurance Agency (UWV). Our data consist of monthly observations of all partially disabled workers that entered the partial DI scheme (WGA) between January 2006 and June 2010. These recipients are followed as long as they remain in the scheme up till December 2013. Overall, our sample consists of almost 700,000 monthly records and 13,063 unique individuals for whom we observe several individual characteristics, as well as the length of the wage-related period od DI benefits, the degree of disability, the residuals earnings capacity, the type of impairments, the pre-disability wage and current wage earnings.

In principle, information on individual pre-disability wages and the degree of disability can be used as inputs to derive the conditional replacement rates that are explained in equations [1] and [2] in the previous section. To calculate conditional

[6] It should be noted that equations [1] and [2] abstract from some additional benefit rules that apply to workers without work in the second phase of DI benefits. If these workers do not have a partner with income, these workers are entitled to social assistance supplements. We will return to this issue in the next section.

replacement rates for the second phase of DI benefits, however, closing assumptions are needed on the receipt of supplementary benefits. In particular, partially disabled workers that do not work in the second phase will receive DI benefits that are below the minimum income level in the Netherlands. This minimum amounts to 70% of the minimum wage (€ 12,400 in 2013) for single households and 100% of the minimum wage (€ 17,700 in 2013) for couples, respectively. Workers may therefore qualify for supplementary social assistance benefits if they do not have a partner with sufficient income and do not own sizeable assets. For these individuals, the conditional replacement rate in the second phase of DI benefits is underestimated if supplementary benefits would be ignored.

Unfortunately, our data do not contain information on partner income or assets that are owned. For those individuals that do not work or do not work sufficiently to receive the wage subsidy, however, we observe whether they receive income supplements from social assistance, or not. With this information, we derive two rules of thumb to construct the conditional replacement rates. To avoid any biases in the construction of our data, these rules of thumb apply to all individuals – so also to those without employment for whom income supplements are actually observed. The first one is that *none* of the individuals that are married receive income supplements. This assumption stems from the observation that only 18% of the married individuals without wage earnings received income supplements in the second phase of DI benefits. The second assumption is that *all* unmarried individuals receive income supplements from social assistance, up to 70% of the statutory minimum wage. With 58% of the individuals that are not married and have no wage earnings receiving income supplements in the second phase of DI benefits, this assumption is more restrictive than the first one. In our analysis, we therefore will test the robustness of elasticity estimates with respect to measurement errors. We return to this issue in Section 4.

< INSERT TABLE 1 HERE >

3.2 Data description

Table 1 provides sample statistics of the variables of partially disabled workers in our sample. We measure these statistics at four time points per individual at maximum: (i) the first month of DI benefit receipt; (ii) the last month of DI benefit receipt (for uncensored DI benefit spells); (iii) the last month of the first phase of DI benefit receipt; (iv) the first month of DI benefit receipt in the second phase. Observed variables include gender, age, marital status, pre-disability earnings, the degree of disability, the length of (maximum) entitlement to the wage-related period, the residual earnings capacity, the type of impairments and the current wage earnings. Unfortunately, we do not observe the employment history of workers that determines the maximum entitlement length to the wage-related DI benefit period. In the absence of employment records before 1998, however, the Employee Insurance Agency sets the employment years before 1998 equal to the age of workers on January 1 in 1998, minus 18. In practice, this means that registered employment histories can well be approximated by the age of workers at the time of inflow into DI.[7] In addition, it should be noticed that the residual earnings capacity of workers is measured initially at the start of the DI benefit. When wage earnings are found to exceed the initial residual earnings capacity for a longer period of time, the casemanager may decide to adapt the residual earnings capacity that is registered over time.

At the start of the DI benefit spell, 53.5% of the partially disabled workers in our sample received wages earnings. For these workers, the average wage earnings are equal to 68.6 euros per day, which is 55% of the average of daily pre-disability wages. For individuals that leave DI benefits over time, constituting about one third of our sample, we also observe their outflow destination (recovery, pension, deceased, or other). About half of these individuals are no longer entitled due to their recovery; this typically occurs if they find a job with wage earnings that become too high to meet the threshold of earning more than 65% of pre-disability wages. More generally, any wage earnings that exceed the residual earnings capacity for some months will lead to the adaptation of the assessed individual's earnings capacity.

When comparing the second and third column in Table 1, we infer that individuals leaving the DI scheme tend to be male, older, single and have higher pre-disability wage earnings. This reflects the fact that older workers – with more work history – have a higher probability of retirement or mortality. We also find the work

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[7] Obviously, we cannot separate age differences and differences in entitlement effects if entitlement to the wage-related period would be determined by age only. However, with the dependency between UI benefit entitlement and employment histories changing in the time period under investigation, separate identification is possible if we assume calendar time effects to affect age groups equally. We return to this issue in Sections 4.3 and 4.4.

incidence and wage earnings to be substantially higher at the end of DI benefits than at the start, which mirrors the fact that the probability of (partial) work resumption increases over the DI benefit spell. Finally, the comparison of sample statistics just before and after the start of the second phase of DI benefit receipt – which are presented in the third and fourth column of Table 1 – suggests that there is only an increase in work incentives at that time. We will investigate this impact in more detail in the next subsection.

< INSERT FIGURE 3 HERE >

Essentially, there are two sources of information we use to assess the impact of financial incentives on the labor market behavior of partially disabled workers. First, we exploit variation in the length of the wage-related period of DI benefit receipt. As Figure 3 shows, the distribution of these entitlement periods has changed substantially since 2008. Recall from Figure 2 that the wage-related period followed from a step function until 2007, when it was replaced by a linear function that is capped by a maximum. Accordingly, we observe peaks at periods of 12, 18, 24, 36, 48 and 60 months of entitlement to the wage-related period.[8] Since 2008, however, we observe a continuous distribution of periods of benefit entitlement, with peaks at 0 months (if there is no wage-related benefit entitlement) and 38 months (the maximum length of benefit entitlement) only.

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[8] In addition, the small group of entitlement periods with other wage-related benefits lengths stem from the fact that workers may have experienced benefit periods.

< INSERT FIGURE 4 HERE >

The second source of variation in incentives originates from differences in individual (changes in) conditional replacement rates. We argued earlier that these changes vary with respect to the level of pre-disability wages, the degree of disability and the household status of workers. Figure 4 shows that this variation expands in the second phase of DI benefits. We already showed in Section 2 that conditional replacement rates in the wage-related period have a lower bound of 0.70. When taking into account that some workers received part-time pre-disability wages below the statutory minimum wage, their conditional replacement rate in this period may be equal to 1 at maximum. In the second phase, however, the range of values of the conditional replacement rates increases substantially, down to values as low as 0.1.[9]

< INSERT FIGURES 5, 6 AND 7 HERE >

To shed more light on the labor market behavior of individuals, Figure 5, 6, and 7 portray the evolution of employment, wage earnings (for employed workers) and work resumption rates of workers over the DI benefit spells. The figures stratify according to the age of workers, with four age categories as measured at the start of

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[9] To determine the minimum value of the conditional replacement rate in the second phase of DI benefits, suppose we have a worker with a degree of disability that is equal to 40%, and with pre-disability wage that is equal to the maximum premium wage. Without supplementary benefits, the conditional replacement rate would be equal to 0.11.

the DI spell. Figures 5 and 6 show that the work incidence and wage earnings increase over the benefit spell for all age groups; this ends after about two years of DI benefit receipt. A large share of workers is already employed at the start of DI benefit receipt – usually with the same employer as they had prior to the onset of disability in all groups. In addition, a smaller group succeeds in finding employment during the benefit spell. We also observe marked differences in the size of these increases across age groups. Particularly workers below the age of 35 have low employment rates at the start of the DI benefit spell, but experience an increase by about 15% percentage-point after two years. Likewise, wage earnings of employed DI recipients below the age of 35 start at relatively low levels, but increase at a much higher pace than those for older workers.

Figure 7 shows that workers below the age of 45 have substantially higher work resumption rates than those who are 45 or older in the first two years of DI benefit receipt. It thus seems that age groups do not only differ with respect to employment rates at the start of the DI benefit spell, but also with respect to increases in work resumption rates over the benefit spell. When exploiting individual variation in incentives and outcome variables over time, we thus should take proper account of the fact that duration dependence patterns may vary between age groups.

The appendix to this paper also shows additional figures that reveal heterogeneity in the labor market behavior (see Figures A.1-A.7). Regarding gender differences, we see that women have higher work incidence levels than men and are more likely to resume work than men at the start of DI benefit receipt (Figures A.1 and A.3, respectively). Still, the work incidence of men increases at a higher rate than for women, yielding higher employment levels after three years of DI benefit receipt. We also observe marked differences in work incidence rates across impairment types, with rates that range from 30% for workers with mental disorders to almost 80% for workers with neoplasms (Figure A.4). This suggests that employers are more inclined to keep workers with neoplasms on board and more likely to dismiss workers with mental diagnoses. Finally, and in line with expectations, we find wage earnings to be highest among workers with the lowest disability degrees (Figure A.7).

3.3 Eyeball tests

When graphically exploring the impact of the incentive change at the end of the wage-related period, account should be taken of the continuous nature of wage-related periods. It is therefore instructive to analyze the evolution of work incidence and wage earnings in the months before and after exhaustion of the first phase of DI benefits (see Figures 8 and 9, respectively).[10] To calculate monthly averages, we only include workers with entitlement to the wage-related period.

< INSERT FIGURES 8 AND 9 HERE >

Figure 8 shows that the fraction of workers that are employed remains more or less stable until the start of the second phase of DI benefit receipt, at a level between

[10] Note that we use a time window of 24 months prior and after the incentive change. For the sample of workers that are younger than 45 at the start of their DI spell, however, this time interval is reduced to 12 months prior to the incentive change. For this group of workers, the maximum entitlement to wage-related benefits is usually smaller than 24 months, so we would loose too many observations.

57 and 58% (see Panel A). We next observe an increase in the average work incidence in the year thereafter, up to a level of about 61%. Thus, the eyeball test suggests that workers responded to the incentive without sizeable anticipatory effects. Panel B shows that these effects are confined to workers below the age of 45.

As to the evolution of wage earnings of employed workers around the incentive change, however, the picture is less clear-cut. In particular, Panel A of Figure 9 indicates a modest increase in wage earnings that starts 12 months before the incentive change and ends 9 months after the incentive change. Again, these effects are largely confined to workers below the age of 45 (Panel B). It may be that workers with insufficient wage earnings – i.e. less than 50% of their residual earnings capacity – anticipate the incentive change in the preceding year. But another argument may be that wage earnings increase over the DI benefit spell for most workers in the relevant time interval. This particularly applies to younger workers, with short DI entitlement to wage-related benefits and experiencing substantial increases in wage earnings during the benefit spell.

< INSERT FIGURE 10 HERE >

Using a similar strategy as for work incidence and wage earnings, Figure 10 portrays the evolution of work resumption rates around the time of the incentive change for workers that are younger than 45 and 45 or older, respectively. To keep sufficient individual observations, we reduce the time interval up to the incentive change to 12 months. Remarkably, the figure shows a strong decrease in the work resumption rates after the incentive change, particularly for workers that are younger than 45. If workers would respond to the incentive change, one would not expect anticipatory effects to exceed the effects after the actual start of the incentive change. Rather than that, however, it is likely that recovery patterns of individual workers are correlated with the length of the entitlement period to wage-related benefits.

In sum, the eyeball tests suggest that particularly younger DI recipients with shorter wage-related entitlement periods become more likely to work and earn somewhat higher wages after the incentive change. As for the evolution of work resumption rates, the picture seems less clear-cut. We thus need formal analyses that control for the potential impact of genuine duration dependency effects.

4. Empirical implementation

4.1 Theoretical considerations

The primary goal of the incentive change was to increase the share of partially disabled workers that use their residual earnings capacities. For those receiving UI benefits that complement DI benefits, the large drop in income from benefits at the start of the second phase benefits may thus have induced workers to start working. In addition, employed workers with wage earnings below their residual earnings capacity also experience an increased incentive to work additional hours when they start the second phase of DI benefits. Taking in mind that most workers that work have wage earnings that are equal to, close to or even exceed their residual earning capacity, the size of the incentive effect on wages is likely to be limited.

Next to the intended increase of work and wage earnings, the reform of 2006 aimed at increasing the full recovery and work resumption of workers with partial benefits. There are however strong reasons to believe that the impact of the reform on work resumption has been limited. As explained earlier, the benefit reduction in the second phase of DI benefits only applies to workers that do not exploit 50% or more of their residual earnings capacity and therefore are not entitled to wage subsidies. It is unlikely that this group – that has not succeeded in finding substantial employment so far – would now succeed in earning 65% or more of their pre-disability wage.

At the same time, workers that sufficiently exploit their residual earnings capacities do not benefit from work resumption after the incentive change. For them, full work resumption would imply the loss of DI benefits and wage subsidies. This phenomenon is often referred to as 'cash cliffs': with wage earnings that can be lower than pre-disability wages, full work resumption may even lead to a decrease in total income.[11]

4.2 Identification and specification of work incidence and wages

In our analysis, the research design we follow essentially comprises two steps. First, we use a difference-in-difference (DiD) strategy to estimate the size of the effect of the incentive change at the start of the second phase of DI benefits on the prevalence of work, the wage earnings, and the (full) work resumption rates of DI recipients

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[11] Using ex ante calculations on the new disability law in 2006, Van Sonsbeek and Gradus (2006) show that the increased work incentive will not lower the toal number of DI benefit recipients, but only increase the likelihood of employment of this group. They also argue that cash cliffs deter employed DI recipients to leave the scheme.

which are partially disabled. Second, we derive the implied labor supply elasticity of workers at the extensive margin. For this purpose, we will also extend our work incidence model by allowing the cutoff effect to vary with respect to the size of the incentive change. This increase in incentives is measured as the change in the conditional replacement rate at that moment.

For all outcome measures, the key challenge is to disentangle duration dependence from incentive effects that occur during the DI benefit spell. With entitlement periods to wage-related DI benefits that vary across individuals, we can identify both effects without imposing functional form assumptions on the pattern of duration dependence. More specifically, the DiD approach allows for unobserved a priori differences across groups of individuals that experience different moments at which the incentive change kicks in. As such, we can identify the ex-post effect of the incentive change, together with anticipation and adaptation effects in the months preceding and after the incentive change (Van den Berg et al., 2014).

DiD estimates usually require the assumption that calendar time and duration dependence baselines are similar for all individuals. Recall from Section 3 however that the evolution of work incidence, wage earnings and work resumption rates over the benefit spell may differ between age categories in our sample. When taking in mind that the length of the wage-related benefit period also strongly varies with respect to the age of workers, the common baseline assumption may thus lead to inconsistent effects of the incentive change. We therefore will use baselines that differ across age categories. Loosely speaking, our approach can thus be characterized as ‘triple-differencing’.

With this in mind, we now specify the work prevalence, Y, and wage earnings W of an individual i (i = 1,..N) that enters into DI at calendar time τ . This person has an age a , a maximum wage-related period T_i, and is observed with an elapsed DI benefit duration t . This yields the following equations for the full sample of partially disabled individuals,

$$Y_{it,\tau}\left(a_{i,}, T_i\right) \;=\; \alpha_i^Y \;+\; \boldsymbol{\beta}_\tau^Y \;+\sum_{k=1}^{K} I_k\left(\underline{a}_k < a_i \leq \overline{a}_k\right) \psi_k^Y(t_i) +$$
$$\gamma^{Y,S} I(\, T_i - \Delta T < \; t_i \leq \; T_i + \Delta T \,) + \; \gamma^{Y,L} \; I\;(t_i > T_i + \Delta T \,) + \; \varepsilon_{it}^Y \quad [3]$$

and, for the sample of partially disabled individuals that are employed,

$$W_{it,\tau}\left(a_{i,}, T_i\right) \;=\; \alpha_i^W \;+\; \boldsymbol{\beta}_\tau^W \;+\sum_{k=1}^{K} I_k\left(\underline{a}_k < a_i \leq \overline{a}_k\right) \psi_k^W(t_i) +$$
$$\gamma^{W,S} I(\, T_i - \Delta T < \; t_i \leq \; T_i + \Delta T \,) + \gamma^{W,L} \; I\;(t_i > T_i + \Delta T \,) + \; \varepsilon_{it}^W \quad [4]$$

The successive parts in equations [3] and [4] can be explained as follows. First, individual fixed effects are denoted by α^Y and α^W, respectively. With individual fixed effects, the identification of incentive effects on employment and wage earnings essentially follows from individuals that experience a change in incentives. We thus effectively exclude disabled workers without any entitlement to the wage-related period and those who exit the DI scheme prior to the incentive change. For these worker groups, there is no ‘within-variation’ in incentives that can be isolated with fixed effects estimation. As an alternative, one way to exploit ‘between-variation’ would be to estimate the model without fixed effects, but then controlling for possible correlation between individual effects and the length of the wage-related benefit period. As a first robustness check, we will follow this strategy by including dummies for all possible outcomes of the wage-related benefit period as a control variables.

Second, the vectors $\boldsymbol{\beta}^{Y}$ and $\boldsymbol{\beta}^{W}$ denote the effect of calendar time τ; these are specified as year dummies. Also, both equations allow for the effect of duration dependence, which is included as polynomial functions of elapsed durations ψ_k^Y and ψ_k^W, to vary with respect to age categories that are indexed by *k* (*k* = 1,..,*K*).[12] More specifically, we allow duration patterns to differ between age intervals of five years, with $\underline{a}$ and $\overline{a}$ as lower and upper bounds, respectively. With duration dependency patterns that may differ between age groups and age as the key determinant of the wage-related benefit period of individual workers, allowing for different baselines for age categories helps us to obtain consistent estimates of the incentive effect. When following this strategy, we will vary the width of the age intervals in our sample, so as to assess the robustness of our results.

Third, the structural incentive effects on work incidence and wages are denoted as $\gamma^{Y,L}$ and $\gamma^{W,L}$, whereas the effects in the months around the incentive change are denoted as $\gamma^{Y,S}$ and $\gamma^{W,S}$, respectively. Modeling the effect of incentives in this way takes account of anticipation and adaptation effects. Partially disabled workers may anticipate the incentive change in the preceding months and that it may take time for workers that change their employment status or work more hours. The time window

[12] As we will argue later on, duration dependence patterns can also be estimated non-parametrically, as a step function of the number of weeks that have passed with DI benefits. Regarding the goodness-of-fit of our model, this yields model outcomes that are virtually equivalent to the semi-parametric method that we employ.

around the incentive change, $2\Delta T$, is set equal to 6 months in our benchmark model, but we will also present analyses for different values to analyse the robustness of our results.

Finally, ε_{it}^{W} and ε_{it}^{W} denote error terms that are assumed to be I.I.D. Equations [3] and [4] can be estimated by standard Fixed Effects estimation, allowing for clustering effects at the individual level.

4.3 Modeling work resumption

The conventional way of modeling durations is by the use of proportional hazard models. This would, however, require strong semi-parametric assumptions, both on the proportionality of coefficient effects as well as on the interdependence of observed and unobserved effects (Van den Berg et al., 2015). As an alternative, we therefore specify a linear model that requires less functional form assumptions and that can be estimated by standard linear estimation techniques. Similar to De Groot and Van der Klaauw (2014), we take advantage of the fact that the length of wage-related benefits was shortened in 2008, with changes that varied between groups and were highest for workers with long employment histories (see Figure 2). Again, this also enables us to follow a DiD strategy, now using controls that represent the employment history of workers.

When following this approach, the registered employment history is unobserved, but we argued earlier that it can be approximated by the age of workers at the moment of inflow into DI. We thus specify the probability of leaving DI benefits for work resumption within *M* months after the start of the spell for an individual *i* with age *a* that starts at calendar time τ as follows:

$$\Pr(\, \tilde{t}_{i,\tau} < M \,|\, d_i = 0, X_i \,, h_i) = \alpha^R + \boldsymbol{\beta}_\tau^R + \sum_a \varphi_k \, I(\, a_i = a) + \gamma^R \, T_i + X_i \delta + \varepsilon_{i,\tau}^R \quad [5]$$

with $\tilde{t}$ as the elapsed DI benefit duration that is observed for individual *i*. *d* denotes a censoring dummy which is equal to one only if the DI benefit duration $\tilde{t}$ > *M* and if the DI benefit duration is right-censored (and zero otherwise). For *d* = 1, duration observations are not included in the estimation.

Equation [5] allows for calendar time effects ($\boldsymbol{\beta}_\tau^R$) that apply to the year of inflow in the DI scheme. It also includes dummy values for all possible values of the age in our sample; the effect of these dummies is denoted by φ. As such, we control for endogeneity with respect to the incentive effect γ^R, which denotes the effect of a one-month-delay in the incentive change on the probability of work resumption. We also include individual controls that are in matrix ***X***. These include gender, household status and the age of individuals. Finally, the error term, ε^R, is assumed to be I.I.D.

With probability measures that are estimated to assess the effects of benefit entitlement in equation [5], we cannot explain the underlying dynamics in exit rates of disabled workers. In this respect, one would be interested in the size of anticipation effects that occur prior to the incentive change or spikes in work resumption rates at the incentive change. Still, we can estimate equation [5] for different values of the time frame *M*. For shorter time frames, when most individuals are still receiving wage-related benefits, the value estimate of γ^R will largely be driven by anticipation effects. When increasing *M* to a period that exceeds the maximum period of entitlement to the wage-related benefit period, however, such ex ante effects will disappear.

4.4 Derivation and estimation of labor supply elasticities

In order to compare labor supply responses with changes in financial incentives, it is instructive to derive labor supply elasticities of disabled workers. In the current analysis, such estimates can either be obtained from direct inference on equation [3] that describes the employment effects, or indirectly, by extending and re-estimating the model. As to the labor supply effects at the intensive margin (i.e., in working hours), however, we cannot infer accurate elasticity effects.[13]

As to the first method, the effect estimates of the incentive change can simply be related to the relative average change in relevant taper rates, respectively. To derive the implied elasticity value of the prevalence of work – i.e., at the extensive margin – we thus divide the relative effect estimate by the change in the conditional replacement rate (see also Section 3):

$$e = \frac{\gamma^{Y,L}/(1-\overline{Y}_c)}{\Delta CR/\overline{CR}_c} \qquad [6]$$

with $\overline{Y}_c$ and $\overline{CR}_c$ that denote the average work incidence and average conditional

[13] We argued earlier that the implicit tax rate on additional working hours decreases substantially at the start of the second phase of DI benefits, but only as long as the residual work capacity is not fully employed. This renders the effect of additional working hours on implicit tax rates highly non-linear.

replacement rate of workers prior to the incentive change, respectively. In addition, ΔCR represents the change in the conditional replacement rate at the moment of the incentive change.

Second, we can also infer the labor supply elasticity by extending and re-estimating equation [3] with an incentive effect that is proportional to the change in the log conditional replacement rate, $\Delta\log(CR)$. This means we re-specify the incentive effect in equation [3] as

$$\gamma^{Y,S} I(T_i - \Delta T < t_i \leq T_i + \Delta T) + \gamma^{Y,L} I(t_i > T_i + \Delta T) + \eta^Y \log(CR_i) \quad [7]$$

In this expression, η^Y displays the incentive response that is proportional to the change in the log conditional replacement rate at time T_i, respectively. The labor supply elasticity *e* then equals

$$e = \frac{\eta^Y}{1 - \overline{Y}_c} \quad [8]$$

Interestingly, the parameter estimate of γ^Y can be used as a test on two assumptions. First, we test the assumption that the labor supply response of individuals is proportional to the change in incentives. More specifically, our null hypothesis is that the response effect is fully explained by the increase in incentives, yielding an estimate for the remaining effect that is equal to zero ($\gamma^Y = 0$). Second, recall from

Section 3 that the conditional replacement rate can be susceptive to measurement errors, particularly for the group of unmarried workers that are assumed to receive income supplements from social assistance. If these measurement errors are substantial, one may expect the estimate of η^Y to be biased to zero (i.e., attenuation bias). Thus, if $\gamma^Y = 0$, we cannot reject the hypothesis that there are no measurement errors, lending credence to the implied labor supply elasticity value.

5. Estimation results

5.1 Employment effects

Table 2 presents the estimates for our fixed effects (FE) models on the employment probability of DI recipients with partial benefits. The columns of the table show the different model variants that were explained in the previous section. Model variant (i), which is our benchmark model, uses a time window around the incentive change of six months and allows for separate five-year intervals for the DI duration dependency profiles. This yields a statistically significant structural effect estimate of the incentive change of 2.6 percentage-point. This corresponds to a labor supply elasticity value of 0.12. We obtain similar results if the incentive effect is estimated by OLS, while using dummy values for all possible values of the length of the wage-related benefit period as controls – see model variant (ii). Also, the results of model variants (iii) and (iv) show that the structural effect estimates are fairly robust with respect to the length of the time window around the incentive change that is imposed. We also find that our estimation results do not change if we use age-intervals for DI duration dependency profiles that are equal to 2.5 years or 10 years (i.e., model variants (v) and (vi), respectively). Assuming a common duration dependency profile for all age categories leads to a slight overestimation of the effect (i.e., model variant (vii)).

< INSERT TABLE 2 HERE >

We argued earlier that the labor elasticity rate can also be obtained by inserting the log of the conditional replacement rate as an additional control in the regression. As the estimation results of model variant (viii) show, the incentive effect is fully captured by the log value of the conditional replacement rate. The implied labor elasticity is 0.10, which is close to the elasticity that follows from our benchmark model. This lends credence to the hypothesis that effects are proportional to the incentive increase and the incentive change is well approximated by the change in the conditional replacement rate.[14]

The implied labor supply elasticity we find is comparable to estimates that are obtained by Kostol and Mogstad (2014). It should be stressed however that the a priori employment rates in the analysis of Kostol and Mogstad are only 2 to 3%. In contrast, in our sample 57.7% of the workers was employed at the time the incentive change occurred. This indicates that the incidence of employment can be explained by incentives to a limited extent only. In light of the already high a priori

[14] As some married individuals will receive benefit supplements in our sample in the second phase of DI benefits, the implied labor supply elasticity estimate of 0.10 can be interpreted as a lower bound. Under the assumption that all married individuals are entitled to benefit supplements to meet the social minimum, the implied estimate would be 0.17.

employment rates in our sample, it appears that many workers continue to work for one and the same employer, mostly part-time and possibly with some work adaptations.

5.2 Wage effects

Table 3 reports the estimation result for the incentive effect on wage earnings for employed DI benefit recipients. When following the settings for the benchmark model (i.e., model variant (i)), we find the incentive increase to result in a significant increase of wage earnings per day of 0.971 euro only. This effect corresponds to percentage increase of 1.3% of the average wage. Again, this result is fairly robust with respect to changes with respect to the estimation method, the time window around the incentive changes and changes in the classification of age groups with distinct duration dependency profiles. As an exception to this, we only find effect estimates that are higher if one common baseline for the elapsed DI benefit duration is assumed (i.e., model variant (vii)). Again, this underlines the importance of using flexible duration baselines that vary with respect to age categories.

< INSERT TABLE 3 HERE >

We argued earlier that only workers with wage earnings that are below their residual earnings capacity will, at the margin, experience an increased incentive to work more hours – with a taper-rate on gross earnings that is effectively reduced to 0% – if the wage-related period of DI benefits has ended. For workers that do meet t the wage subsidy criterion, however, there is a risk of medical re-assessments and, ultimately, lower DI benefits. With this in mind, it is not surprising that the impact estimate on wage earnings is limited. This finding complements other studies that also find that disability recipients avoid to exceed income thresholds (Campolieti and Riddell, 2012; Weathers and Hemmeter, 2011; Bütler et al., 2014).

5.3 Work resumption effects

Table 4 presents the estimation results of the linear probability model for work resumption. Incentive effects are measured after 6, 12 and 24 months of DI benefit receipt for the complete sample of disabled workers and separately for those with and without employment at the start of the DI spell. The effect estimates that are shown display the percentage point effect of a one-month-increase in the entitlement period to wage-related benefits.

< INSERT TABLE 4 HERE >

Table 4 shows that the impact of the length of the entitlement period to wage-related benefits is small and insignificant for the full sample of DI recipients and for the samples of employed and unemployed DI recipients. For instance, when assessing the impact of a standard deviation in the entitlement periods of about 12 months, the return to work probability for the full sample of DI recipients after 12 months would decrease with 0.027*12 = 0.3 percentage point only. Our findings are robust with respect to the inclusion of various individual controls and a flexible specification of year effects that allows these to vary between age categories – see columns (ii) and (iii), respectively.[15] Overall, these findings suggest that DI recipients avoided loosing their benefits by resuming work or were incapable of bridging the gap to full work resumption.[16]

5.4 Heterogeneity

To shed more light on heterogeneity effects in our estimation results, Table 5 displays the effects of the incentive change on the incidence of employment and wage earnings for different genders, age categories, household statuses, impairment types, disability degrees, pre-disability wages and classes of the length of entitlement to the wage-related period. Generally, the table shows that implied labor supply elasticities are most substantial for individuals that are female, young, non-married and have low pre-disability earnings and shorter wage-related benefit periods. More strikingly, there is evidence that DI recipients with mental and behavioral disorders respond strongly to the incentive change, with an implied labor elasticity value of 0.197. This contrasts e.g. to Kostol and Mogstad (2014), who find an elasticity coefficient that is lower than that for DI recipients with somatic disorders. Again, however, one should

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[15] We also estimated a Cox proportional hazard model on DI benefit spells to investigate the effect of the incentive change, using a dummy variable that for the period after the incentive change. When allowing for baselines to differ between age categories with intervals of five years, we find insignificant effects of the incentive dummy. The results of this model of are vailable upon request.

[16] Here, one also should take in mind that incentive effects on work resumption are identified from relative changes in entitlement periods to the wage-related period. With changes in entitlement that primarily took place among the older workers, local average treatment effects predominantly apply to this group as well.

take in mind here that our sample consists of individuals with substantial residual earnings capacities. Due to medical treatments and the temporary nature of e.g. burnouts, some of the individuals with mental disorders may show increased health conditions over time (Moore, 2015). This process may in turn increase the responsiveness to incentives. Mental impairments may also be more difficult to verify, causing a higher share of moral hazard in this group.

< INSERT TABLE 5 HERE >

Remarkably, the effect estimate of the incentive change on employment increases with the degree of disability of DI recipients. With larger residual earnings capacities, one would expect that partial work resumption becomes more likely. At the same time, however, disabled workers with a degree of disability that is close to the threshold value of 35% face a higher risk of loosing DI benefits all together.

Albeit small, the relative effect of the incentive change on wage earnings of employed workers appears to be stronger for individuals that are female, relatively young, non-married, and with low pre-disability earnings. Wage earning effects of the incentive change are most substantial among workers that have wage earnings that are below the individuals' residual earnings capacity that has been registered. For this group, we find an increase in wage earnings of 5.8%. This suggests that behavioral effects for employed are confined to disabled workers with room to expand their earnings without the risk of medical re-assessments that lead to lower DI benefits. In line with our findings on employment effects, this group seems less likely to be confronted with cash cliffs that discourage them to work more hours.[17]

We further explored the importance of heterogeneity effects by allowing for incentive effects that interact with multiple control variables at the same time; these included age categories, gender, household status, impairment type, disability degree, benefit entitlement durations and pre-disability wages. Interestingly, age is then found to be the only significant and dominant explanatory variable for the size of the employment incentive effect.[18] This means that there is no innate impact of the length of the wage-related period.

As a final robustness test, we exploited the heterogeneity in our sample to use flexible specifications of duration dependence in the employment and wage earnings model. In particular, we allowed for distinct duration dependence patterns for all possible combinations of (four) age categories, gender and (five) impairment types. This yielded outcomes that were virtually equivalent to those that were obtained for the benchmark model for employment and wage earnings.

[17] We also tested whether the residual earnings capacity in itself responded to the incentive change. This yielded insignificant coefficient estimates. Again, this lends credence to the idea that cash cliffs discouraged workers to increase their wage earnings.

[18] For expositional reasons, the outcomes of estimations of the employment model with interacted incentive effects are not included in this paper, but are available upon request.

6. Summary and policy implications

This paper provides insight in the responsiveness of disabled workers to financial incentives, using administrative individual data from the Netherlands. We focus on workers receiving partial DI benefits and with substantial residual work capacity that can be exploited. After the first phase of DI benefit entitlement, workers that do not use their residual income capacity experience a large drop in their benefit income. As entitlement periods in the first phase of DI benefits vary across individuals, we can use a DiD approach to analyze the effects of this incentive change on the incidence of work, the wage earnings and (full) work resumption of disabled workers. Based on the effect estimate on work incidence, we infer a labor elasticity rate of 0.12. The incentive change has only a limited impact on wage earnings of partially disabled workers and no significant impact on work resumption rates. Further, labor supply effects are largest among younger workers and those with mental impairments.

From a policy perspective, there are least three lessons that can be drawn from our analysis. First, our results stress the importance of work continuation in the sickness period that precedes entitlement to DI benefits. Most employed individuals in our sample succeeded in maintaining employment until the DI claims assessment. Albeit significant, the additional impact of financial incentives among workers without employment at the start of DI benefit receipt is relatively small.

Second, our results confirm earlier work that disabled worker respond to earnings disregards and wage subsidies that complement DI benefits, rather than inducing individuals to leave the DI scheme (Campolieti and Riddell 2012; Weathers and Hemmeter 2011). In the context of the Dutch DI scheme, partially disabled workers had an interest in exploiting their residual earnings capacity but avoided the imposition of medical assessments that would lower their DI benefits. As a result, increases in wage earnings of already employed individuals were limited. In the time period under investigation, DI recipients were typically scheduled to have medical reassessments only if they had experienced substantial increases in wage earnings. With this in mind, one may consider a more frequent and focused use of medical reassessments, so as to prevent the occurrence of cash cliffs (see also Moore, 2015). Alternatively, one may opt to design incentive schemes that also reward full work resumption or allow for temporary extensions of benefit entitlement if wage earnings exceed the maximum level for eligibility to DI benefits.

Finally, we find high response effects of financial incentives are confined to younger workers. This explains why younger workers with low DI benefit entitlement to the more generous wage-related period are more responsive to the incentive change. When controlling for such age effects, there is no evidence that the incentive change also decreases with respect to the length of DI benefit entitlement. Thus, employment effects of shortening DI benefit entitlement are probably limited.

References

Autor, D. and M. Duggan, M. G., 2003, The rise in the disability rolls and the decline in unemployment, *Quarterly Journal of Economics*, 118(1):157-205.

Autor, D. and M. Duggan, 2006, The growth in the social security disability rolls: A fiscal crisis unfolding, *Journal of Economic Perspectives*, 20(3):71-96.

Autor, D., M. Duggan, K. Greenberg, and D. Lyle, 2014, The impact of disability benefits on labor supply: Evidence for the VA's Disability Compensation Program, SIEPR Discussion Paper No. 14-010.

Benitez-Silva, H., M. Buchinsky, and J. Rust, 2010, Induced entry effects of a $1 for $2 offset in SSDI benefits. Working Paper SUNY-Stony Brook.

Berg, G.J. van den, A. Bozio and M. Costas Dias, 2014, Policy Discontinuity and Duration Outcomes, IZA Discussion paper 8450. Institute for the Study of Labor (IZA).

Bound, J., 1989, The health and earnings of rejected disability insurance applicants. *American Economic Review*, 79(3):482-503.

Bütler, M., E. Deuchert, M. Lechner, S. Staubli, and P. Thiemann, 2014, Financial work incentives for disability benefit recipients: Lessons from a randomized field experiment, " Economics Working Paper Series 1406, University of St. Gallen, School of Economics and Political Science.

Campolieti, M., 2004, Disability Insurance Benefits and Labor Supply: Some Additional Evidence, *Journal of Labor Economics*, 22(4): 863-889.

Campolieti, M., and C. Riddell, 2012, Disability policy and the labor market: Evidence from a natural experiment in Canada 1998-2006, *Journal of Public Economics*, 96: 306-316.

Chen, S. and W. van der Klaauw, 2008, The work disincentive effects of the disability insurance program in the 1990s, *Journal of Econometrics*, 142(2):757-784.

Fevang, E., I. Hardoy, and K. Røed, 2013. Getting Disabled Workers Back to Work: How Important Are Economic Incentives?, IZA Discussion Papers 7137, Institute for the Study of Labor (IZA).

Groot, N. de, and B. van der Klaauw, 2014, The Effects of Reducing the Entitlement Period to Unemployment Insurance Benefits, IZA Discussion Paper 8336.

Gruber, D., 2000, Disability insurance benefits and labor supply, *Journal of Political Economy*, 108(6):1162-1183.

Hoynes, H.W. and R. Moffitt, 1999, Tax rates and work incentives in the social security disability insurance program: Current law and alternative reforms, *National Tax Journal*, 52(4): 623-654.

Koning, P. and M. Lindeboom, 2015, The Rise and Fall of Disability Insurance Enrolment in the Netherlands, *Journal of Economic Perspectives*, forthcoming.

Kostol, A.R., and M. Mogstad, 2014, How Financial Incentives Induce Disability Insurance Recipients to Return to Work, *American Economic Review*, 104(2): 624:655.

Maestas, N., K.J. Mullen, and A. Strand, 2013, Does Disability Insurance Receipt Discourage Work? Using Examiner Assignment to Estimate Causal Effects of SSDI Receipt, *American Economic Review*, 103(5): 1797-1829.

Moore, T., 2015, The employment effect of terminating disability benefits, *Journal of Public Economics*, 124: 30-43.

OECD, 2010, Sickness, Disability and Work: Breaking the Barriers. A Synthesis of Findings across OECD Countries , OECD: Paris.

Van Sonsbeek, J.-M. and R. Gradus, 2013, Estimating the effects of recent disability reforms in the Netherlands, *Oxford Economic Papers*, 65(4): 832-855.

Weathers, R.R., and J. Hemmeter, 2011, The Impact of Changing Financial Work Incentives on the Earnings of Social Security Disability Insurance (SSDI) beneficiaries, *Journal of Policy Analysis and Management*, 30(4): 708-728.

TABLES AND FIGURES

Table 1: Sample statistics of the inflow of partially disabled benefit recipients (2006-2013).

	Start of benefit	End of benefit[a]	Close to incentive change at t = T:	
			t = T-1	t = T+1
Number of individual observations	13,063	3,758	11,385	11,385
Male (%)	54.1	56.2	53.1	53.1
Age	46.8	51.1	48.4	48.5
Married (%)	54.5	56.0	53.9	53.9
Grade of disability (%)				
35-45%	33.3	34.6	32.3	31.9
46-55%	30.4	28.6	30.5	30.6
56-65%	18.7	19.5	18.9	19.1
65-80%	17.7	17.3	18.2	18.3
Impairment types (%)				
Neoplasms	7.7	11.1	7.2	7.6
Mental and behavioral disorders	34.9	32.7	35.0	35.0
Diseases of the circulatory system	16.0	16.9	15.6	15.9
Diseases of musculoskeletal system	15.6	15.5	15.7	15.5
Other	25.8	23.8	26.5	25.9
Pre-disability wage, euros per day	125.3	131.8	131.6	131.8
Working status (%)	53.5	60.9	57.7	58.7
Working, more than 50% of earnings capacity (%)	44.7	53.4	54.1	52.8
Earnings, euros per day	31.8	56.2	42.2	43.2
Earnings, euros per day (if working)	68.6	98.7	74.2	74.7
Residual earnings capacity, euros per day	60.0	60.5	60.5	60.2
Conditional replacement rate (%)	82.9	53.2	84.1	36.7
Length wage-related period (months)	24.3	23.3	28.0	28.0
Outflow destination				
Recovery		50.2		
Retirement		28.5		
Deceased		9.0		
Other		12.3		

[a] Note the sample statistics that are measured in the last month of DI benefit receipt are based on uncensored DI benefit spells only.

Table 2: Estimation results for employment probability model. Standard errors are in parentheses. */ indicate significance at 5%/1%, respectively.**

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Estimation method	Individual FE	OLS [a]	Individual FE	Individual FE	Individual FE	Individual FE	Individual FE	Individual FE
Time window around incentive change	6 months	6 months	0 months	12 months	6 months	6 months	6 months	6 months
Age intervals for flexible baseline specification [b]	5 years	5 years	5 years	5 years	2.5 years	10 years	all	5 years
Short term effect incentive	0.014** (0.0029)	0.012** (0.0033)		0.015** (0.0033)	0.014** (0.0029)	0.014** (0.0029)	0.010** (0.0029)	0.0021 (0.0035)
Structural effect incentive	0.026** (0.0044)	0.026** (0.0054)	0.021** (0.0034)	0.026** (0.0052)	0.025** (0.0044)	0.025** (0.0043)	0.032** (0.0041)	0.0069 (0.0053)
Conditional replacement rate, log value								-0.043** (0.0076)
Time constant controls [c]		X						
Year dummies	X	X	X	X	X	X	X	X
R-squared (within)	0.034		0.034	0.034	0.035	0.034	0.028	0.035
R-squared		0.050						
# Observations	688,915	634,390	688,915	688,915	688,916	688,916	688,975	688,915
# Individuals	13,051	11,340	13,051	13,051	13,051	13,054	13,054	13,051
Implied labor supply elasticity	0.123	0.121	0.100	0.124	0.116	0.116	0.151	0.101

[a] Note that OLS estimates are obtained only from the sample of individuals with benefit entitlement to the wage-related period.
[b] For each baseline per age category, we use four polynomial values of the elapsed DI duration. This yields outcomes that are virtually equivalent to a specification with dummy values for all possible values of elapsed duration.
[c] Time constant controls include gender, household status, the degree of disability, impairment types and all possible values of the length of entitlement to the wage-related benefit period.

Table 3: Estimation results for wages of employed DI recipients (euros per day). Standard errors are in parentheses. */ indicate significance at 5%/1%, respectively.**

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Estimation method	Individual FE	OLS [a]	Individual FE	Individual FE	Individual FE	Individual FE	Individual FE
Time window around incentive change	6 months	6 months	0 months	12 months	6 months	6 months	6 months
Age intervals for flexible baseline specification [b]	5 years	5 years	5 years	5 years	2.5 years	10 years	all
Short term effect incentive	0.681** (0.242)	1.393** (0.364)		0.663** (0.284)	0.673** (0.242)	0.686** (0.246)	0.531* (0.228)
Structural effect incentive	0.971** (0.369)	0.828 (0.618)	0.775** (0.276)	0.994* (0.447)	0.926** (0.375)	1.011** (0.369)	1.634** (0.319)
Time constant controls [c]		X					
Year dummies	X	X	X	X	X	X	X
R-squared (within)	0.078		0.078	0.078	0.079	0.078	0.071
R-squared		0.070					
# Observations	393,342	371,034	393,342	393,342	393,342	393,342	393,383
# Individuals	9,209	8,282	9,209	9,209	9,209	9,209	9,211

[a] Note that OLS estimates are obtained only from the sample of individuals with benefit entitlement to the wage-related period.
[b] For each baseline per age category, we use four polynomial values of the elapsed DI duration. This yields outcomes that are virtually equivalent to a specification with dummy values for all possible values of elapsed duration.
[c] Time constant controls include gender, household status, the degree of disability, impairment types and all possible values of the length of entitlement to the wage-relate d benefit period.

Table 4: Estimation results for model of work resumption of DI benefit recipients, measured in percentage point. Standard errors in parentheses. */ indicate significance at 5%/1%, respectively. 12,558 observations.**

	(i)	(ii)	(iii)
Effect length wage-related benefit period : all individuals (months)			
- Within 6 months	-0.014 (0.013)	-0.014 (0.013)	-0.007 (0.014)
- Within 12 months	-0.027 (0.021)	-0.027 (0.021)	-0.011 (0.022)
- Within 24 months	-0.003 (0.027)	-0.002 (0.027)	0.034 (0.028)
Effect of length wage-related benefit period: employed individuals (months)			
- Within 6 months	-0.027 (0.032)	-0.025 (0.032)	-0.047 (0.041)
- Within 12 months	0.037 (0.046)	0.040 (0.047)	0.019 (0.054)
- Within 24 months	-0.029 (0.071)	-0.027 (0.071)	0.005 (0.081)
Effect of length wage-related benefit period: unemployed individuals (months)			
- Within 6 months	-0.021 (0.015)	-0.020 (0.015)	-0.008 (0.016)
- Within 12 months	-0.047* (0.024)	-0.045 (0.024)	-0.016 (0.024)
- Within 24 months	-0.027 (0.030)	-0.023 (0.030)	0.024 (0.031)
Age dummies	X	X	X
Other individual controls [a]		X	X
Year effects	X	X	X
Year effects x age categories (5-years)			X

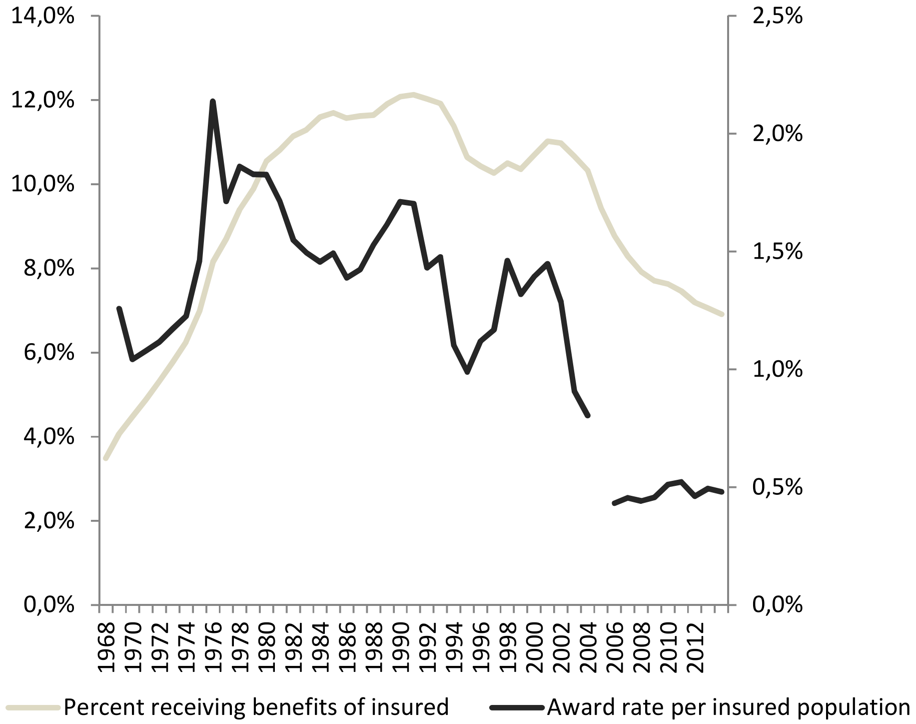
[a] The other time constant controls that are used include gender, household status, the degree of disability and impairment types.

Table 5: Heterogeneity effects in employment and wage responses. Standard errors in parentheses. */ indicate significance at 5%/1%, respectively.**

	Effect on Employment indicidence			**Effect on conditional wages (euros)**		
	Coefficient estimate		**Implied elasticity**	**Coefficient estimate**		**Fraction of average wage**
All	0.026**	(0.0044)	0.123	0.971**	(0.369)	0.013
Male	0.024**	(0.0046)	0.144	0.497	(0.386)	0.0062
Female	0.019**	(0.0050)	0.198	1.086**	(0.392)	0.016
Age categories						
age < 35	0.050**	(0.010)	0.513	1.552	(0.845)	0.026
35 < age ≤ 45	0.039**	(0.0093)	0.294	1.316*	(0.526)	0.017
45 < age ≤ 55	0.0058	(0.0055)	0.046	0.379	(0.501)	0.0049
55 < age ≤ 65	0.0084	(0.0056)	0.050	0.428	(0.416)	0.0055
Married	0.016**	(0.0045)	0.122	0.630	(0.344)	0.0082
Non-married	0.027**	(0.0051)	0.200	0.981*	(0.451)	0.014
Impairment types						
Neoplasms	0.015	(0.012)	0.254	0.592	(0.974)	0.0078
Mental / behavioral disorders	0.032**	(0.0063)	0.197	0.279	(0.607)	0.0038
Diseases circulatory system	0.015*	(0.0074)	0.113	1.136**	(0.495)	0.015
Diseases musculoskeletal	0.019*	(0.0089)	0.128	1.366*	(0.639)	0.019
Other	0.015*	(0.0061)	0.140	0.852*	(0.499)	0.013
Disability degree						
35-45%	0.0077	(0.0058)	0.066	1.186*	(0.501)	0.015
46-55%	0.017**	(0.0058)	0.142	0.306	(0.444)	0.0042
56-65%	0.030**	(0.0079)	0.204	1.010	(0.576)	0.015
66-80%	0.034**	(0.0079)	0.178	1.067	(0.750)	0.015
Residual earnings capacity usage[a]						
Wage < earnings capacity				2.895**	(0.890)	0.058
Wage ≥ earnings capacity				0.554	(0.402)	0.0067
Pre-disability wages						
< 125 euro per day	0.018**	(0.0048)	0.286	0.783**	(0.301)	0.015
≥ 125 euro per day	0.023**	(0.0047)	0.116	0.743	(0.436)	0.008
Length wage- related period						
< 13 months	0.039**	(0.011)	0.258	-0.847	(1.395)	-0.014
12-24 months	0.024**	(0.0062)	0.171	1.133*	(0.505)	0.016
25-36 months	0.0081	(0.0044)	0.063	0.668*	(0.317)	0.0088
> 36 months	0.0078	(0.0053)	0.055	1.553**	(0.416)	0.020

[a] Note that residual earnings capacity usage is measured at the start of the DI spell, thus avoiding endogeneity problems that would occur if wages would not be measured with delay.

Figure 1: Disability Insurance award and enrolment rate per insured worker in the Netherlands, 1968-2012. Source: UWV(2012).[a]

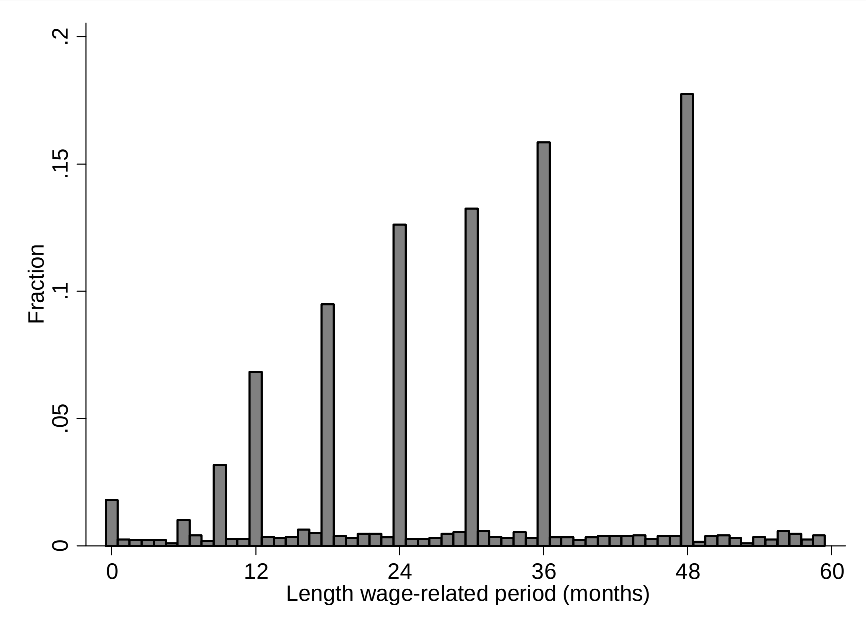


[a] Due to the extension of the sickness waiting period from one to two years in 2004, the yearly DI award rate was almost equal to zero in 2005. This point observation is therefore excluded in the figure.

Figure 2: Employment history (years) and months of DI benefit entitlement in the wage-related period

Figure 3: Distribution of wage-related DI benefit entitlement periods of partially disabled workers, until 2008 (Panel A) and since 2008 (Panel B)

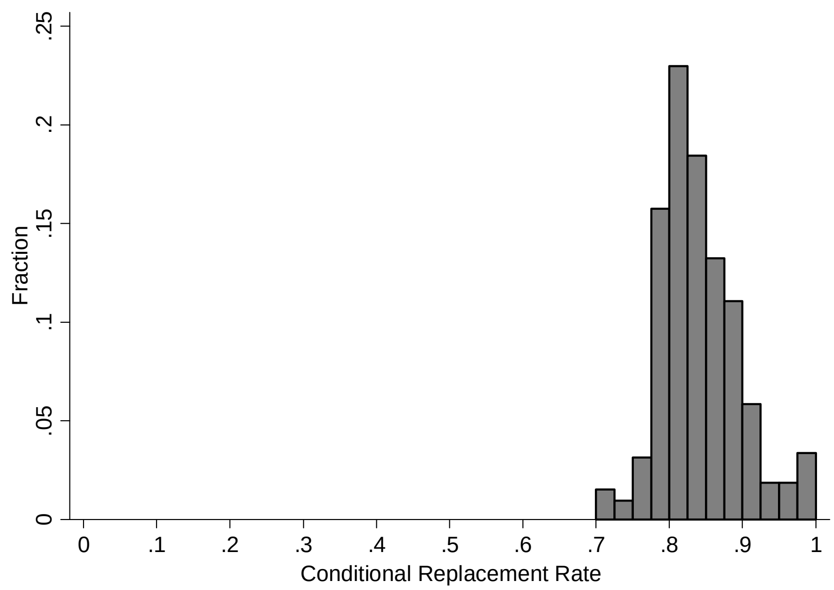
Panel A



Panel B

Figure 4: Distribution of conditional replacement rates in first and second phase of DI benefit receipt (Panel A and Panel B, respectively); Sample of disabled workers that are observed in both DI benefit phases

Panel A



Panel B

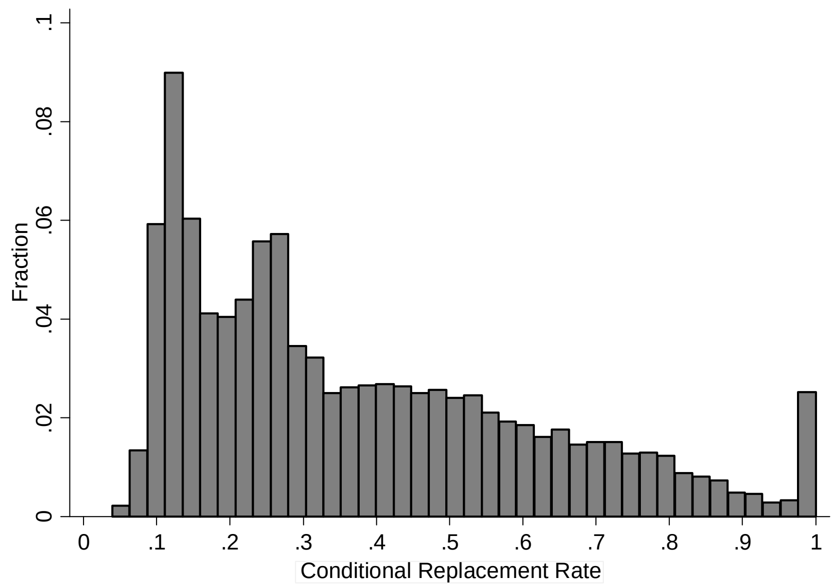


Figure 5: Average work incidence of partially disabled workers, measured over the DI spell and stratified over age categories (age measured at the start of DI spell)

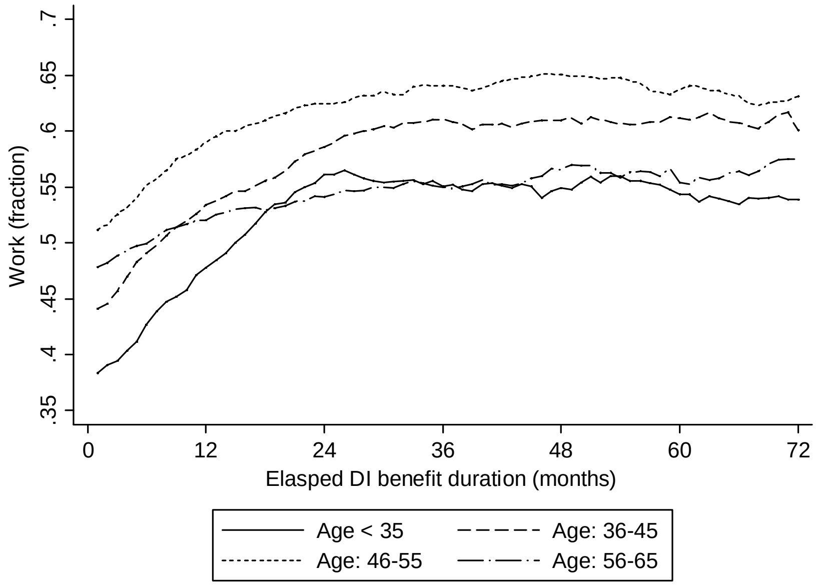


Figure 6: Average wage earnings of partially disabled workers with work, measured over the DI spell and stratified over age categories (wage earnings in eurocents per day; age measured at the start of DI spell)

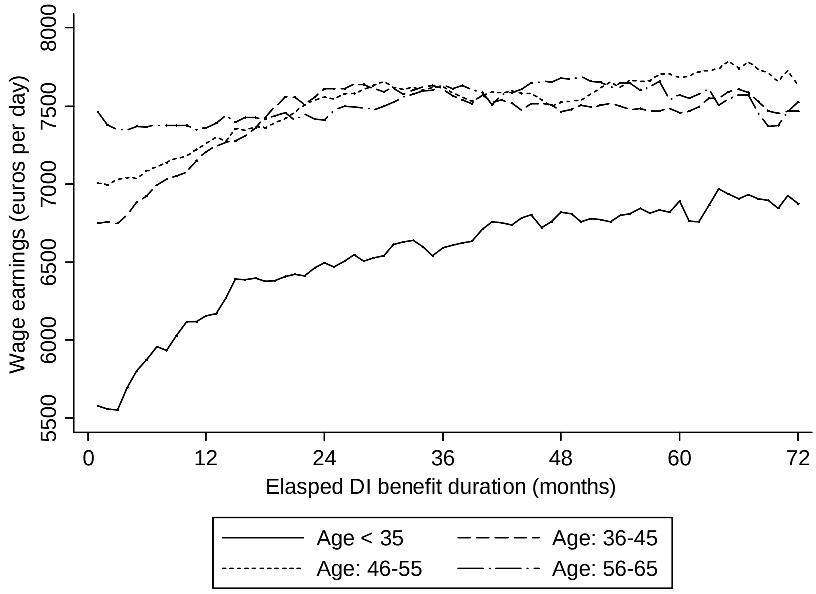


Figure 7: Empirical work resumption rates of partial DI recipients

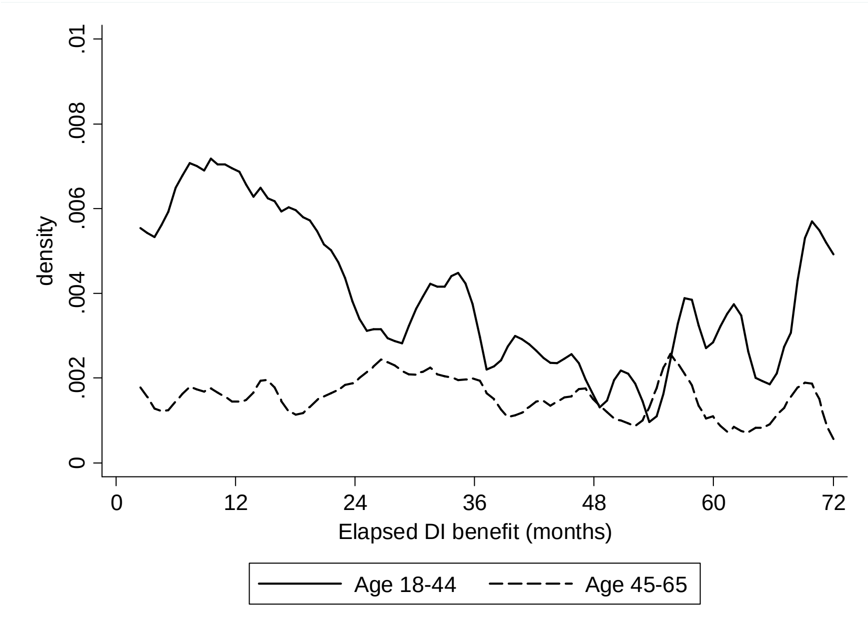
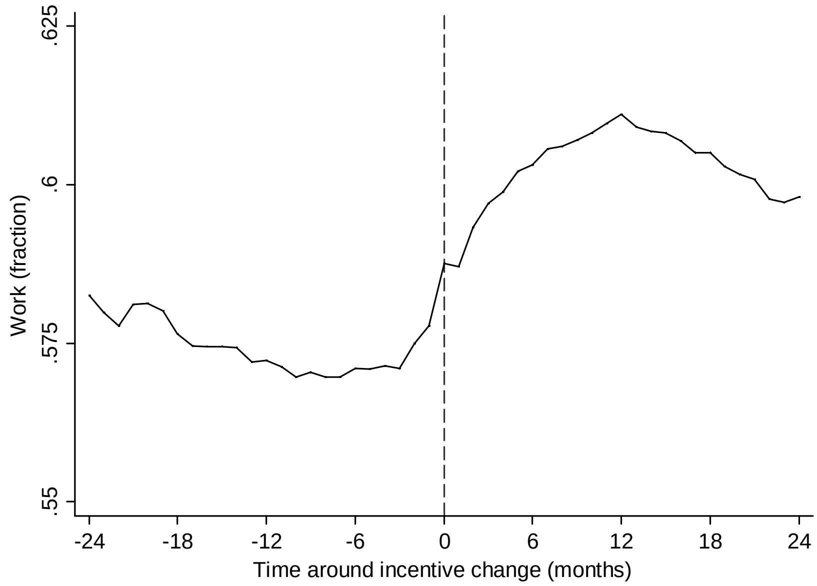


Figure 8: Average work incidence of partial DI recipients, 24 months prior and 24 months after the incentive change.
Full sample (Panel A) and sample stratified over age categories (Panel B).

Panel A



Panel B

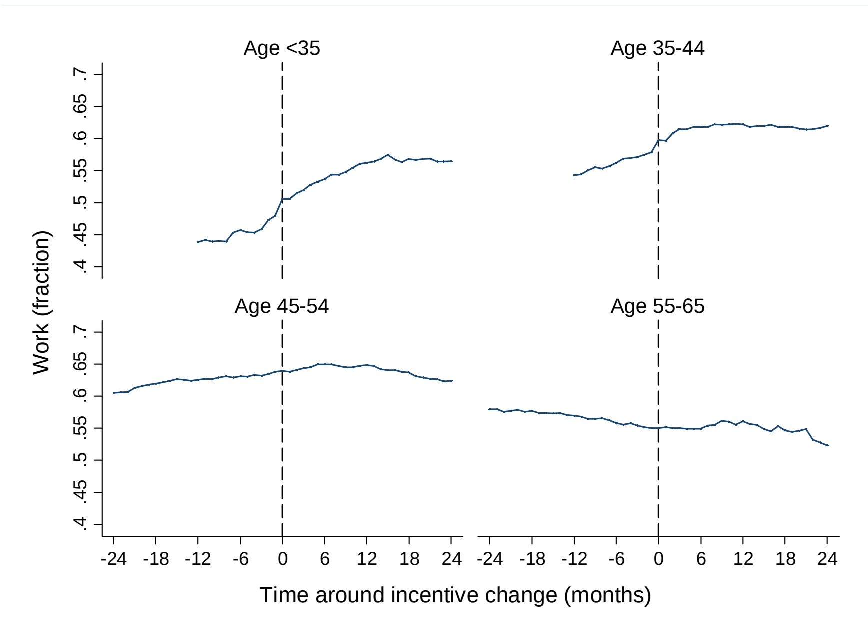
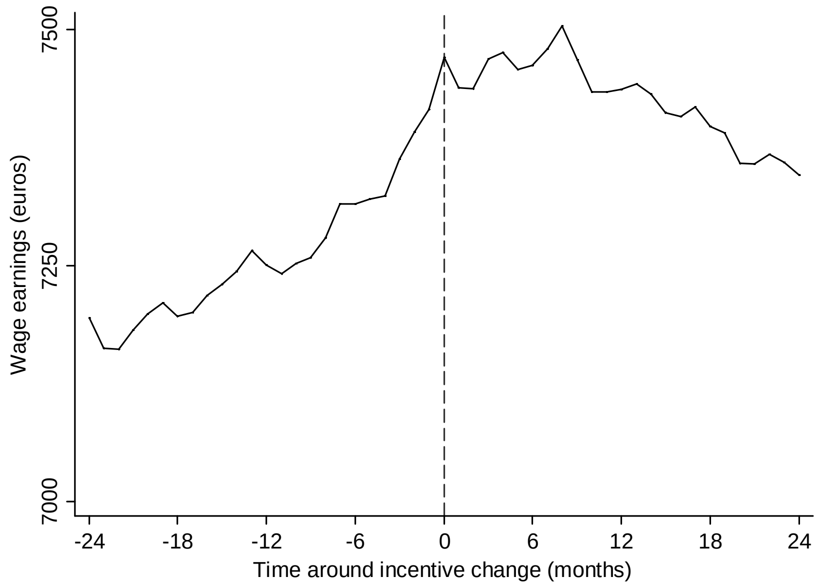


Figure 9: Average wage earnings of partial DI recipients with employment, 24 months prior and 24 months after the incentive change. Wage earnings in eurocents. per day. Full sample (Panel A) and stratified over age categories (Panel B)

Panel A



Panel B

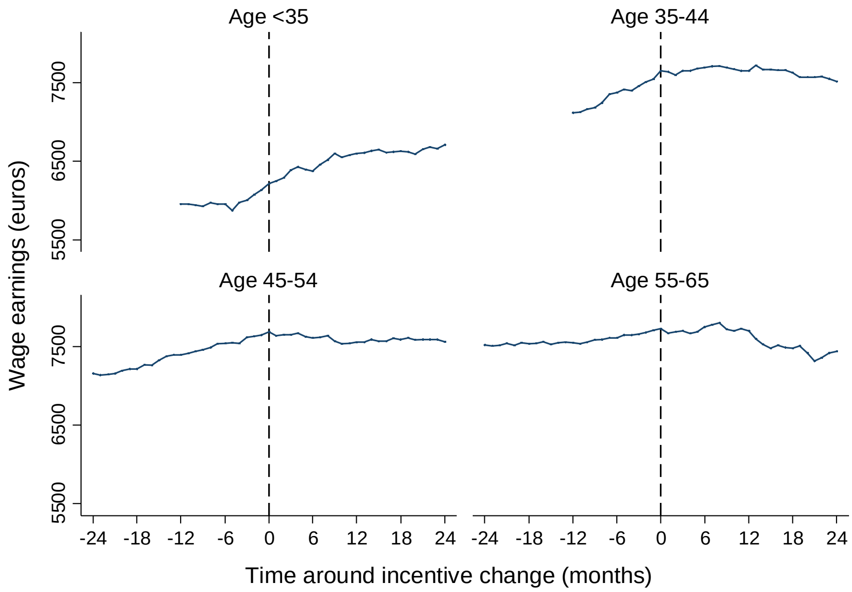
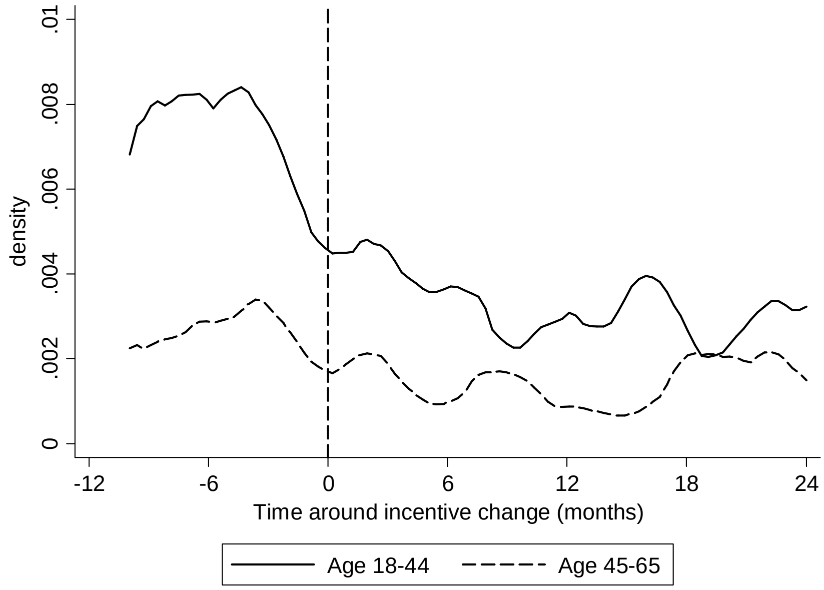


Figure 10: Empirical work resumption rates of partial DI recipients, 24 months prior and 24 months after the incentive change, stratified over age categories.



Appendix: additional figures

Figure A.1: Average work incidence of partially disabled workers, measured over the DI spell and stratified over gender

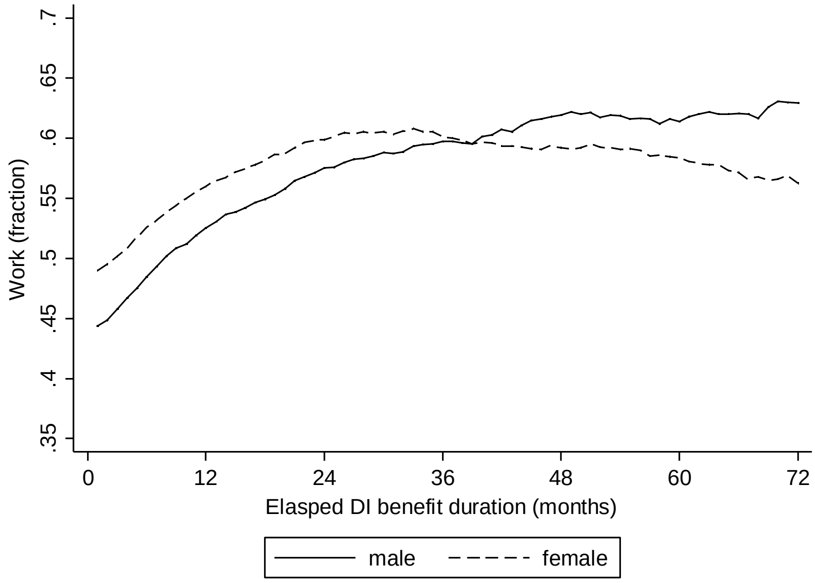


Figure A.2: Average wage earnings of partially disabled workers with work, measured over the DI spell and stratified over gender (wage earnings in eurocents per day)

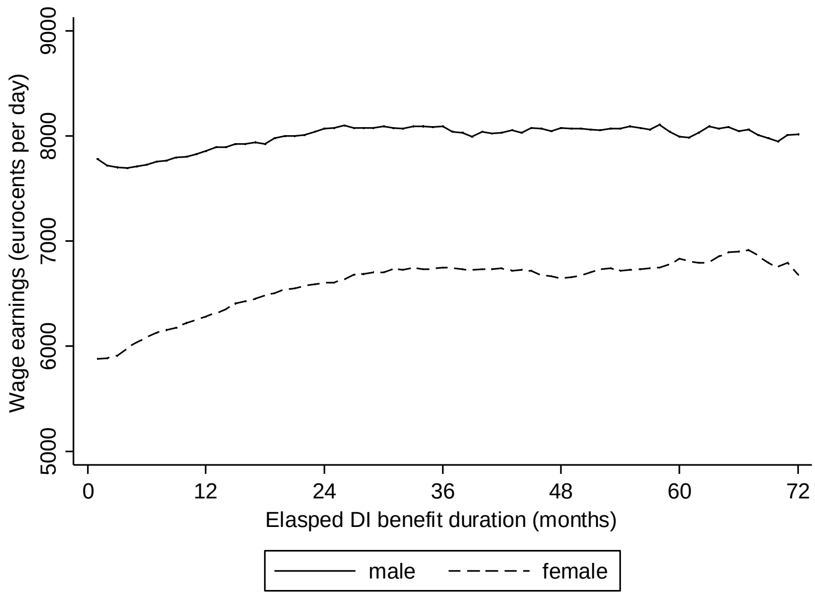


Figure A.3: Empirical work resumption rates of partial DI recipients, stratified by gender

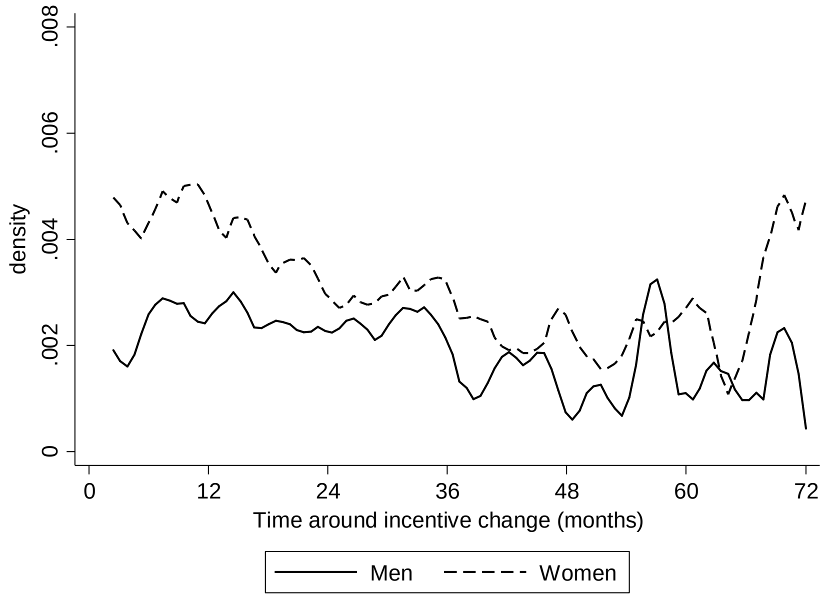


Figure A.4: Average work incidence of partially disabled workers, measured over the DI spell and stratified over impairment types

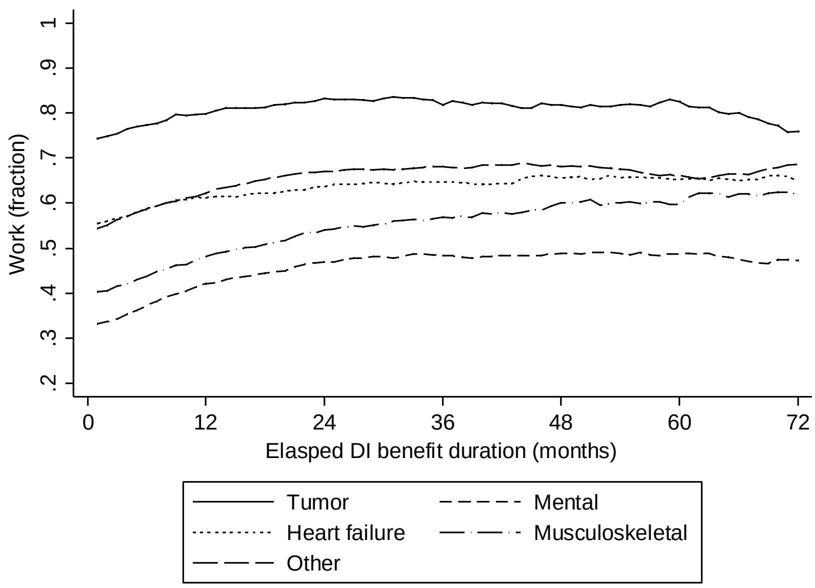


Figure A.5: Average wage earnings of partially disabled workers with work, measured over the DI spell and stratified over impairment types (wage earnings in eurocents per day)

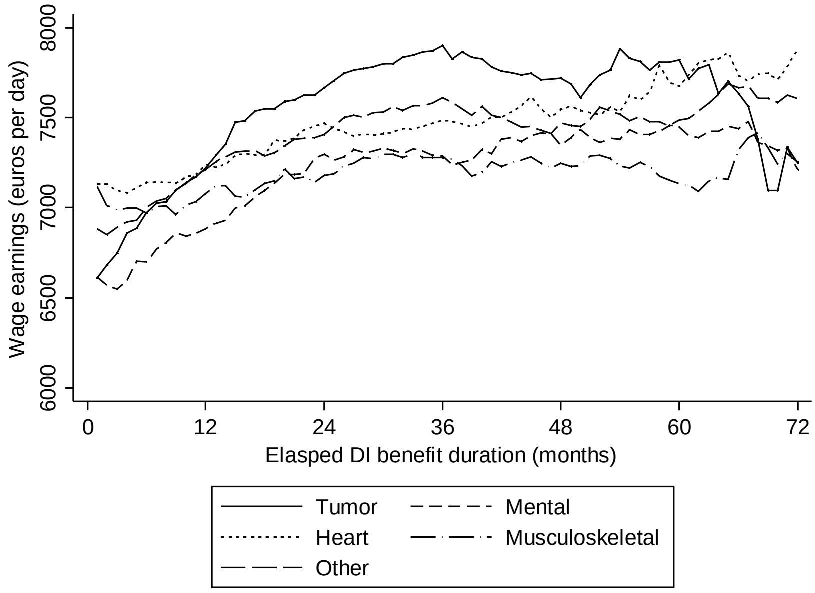


Figure A.6: Average work incidence of partially disabled workers, measured over the DI spell and stratified over disability degrees

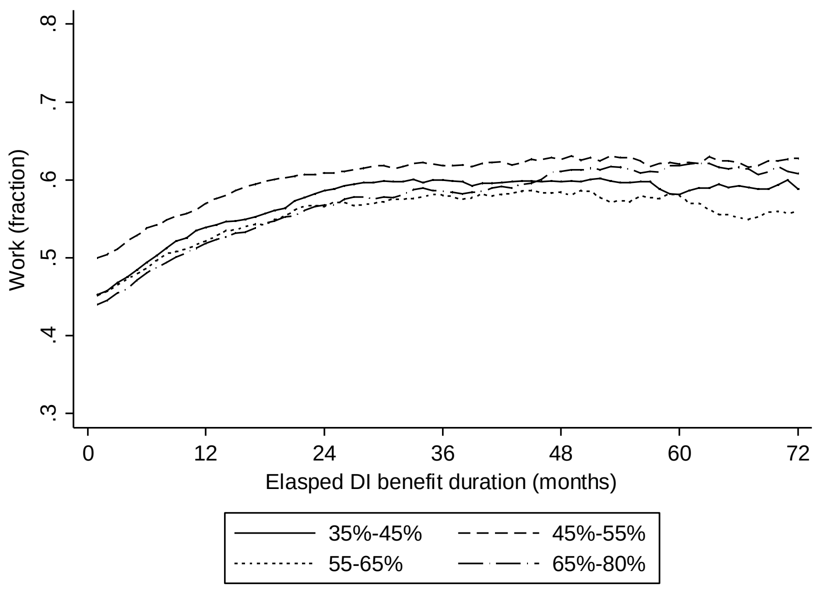


Figure A.7: Average wage earnings of partially disabled workers with work, measured over the DI spell and stratified over disability degrees (wage earnings in eurocents per day)