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Abstract

This paper studies how financial incentives shape labor supply decisions among disability insurance (DI) recipients who already combine benefits with part-time work. We exploit a distinctive feature of the Belgian Adapted Work Program, in which DI benefits are progressively withdrawn as earnings increase and the marginal withdrawal rate rises sharply at predefined thresholds. Because participants cannot freely adjust their working hours, this setting allows us to estimate how higher implicit taxation affects transitions out of partial work. Using administrative data and a Regression Kink Design, we find that higher implicit tax rates induce exits in two opposite directions: toward full-time employment and back to full DI. A one-euro increase in the implicit marginal tax per working day raises the probability of returning to full DI by 3.0 percentage points and of resuming full-time employment by 1.5 percentage points, corresponding to elasticities of 0.84 and 0.85. A simple labor supply framework rationalizes these divergent responses. Our findings show that the financial design of partial-benefit schemes can determine whether partial work serves as a bridge toward full employment or instead leads recipients back to full benefit dependency.

Keywords: Disability insurance; Return-to-work policies; Financial incentives; Regression kink design.

JEL classification: I13, I38, J14, J22.

1 Introduction

Disability Insurance (DI) plays a central role in the social protection systems of developed economies, with public expenditures averaging 2.2% of GDP across OECD countries (OECD, 2026). A central policy challenge is to provide adequate income protection while preserving incentives and opportunities to remain attached to, or return to, the labor market (Deshpande and Lockwood, 2022). This is particularly difficult because work capacity is imperfectly observable and often partial rather than all-or-nothing: many recipients cannot resume full-time employment but retain some capacity to work (Marie and Vall Castello, 2012; Maestas et al., 2013). One response is to allow DI recipients to combine benefits with part-time work, creating an intermediate state between full DI and full employment. Working while receiving DI is a quantitatively important phenomenon: 13% of DI-SSI beneficiaries in the United States were employed at the time of the 2019 National Beneficiary Survey (Social Security Administration, 2021), while in Belgium 16% of individuals receiving DI benefits had an active authorization to work part-time in 2023 (INAMI, 2023). These arrangements can support gradual reintegration, but their effectiveness depends on how benefits are withdrawn as earnings increase. Earnings thresholds and clawbacks create implicit taxes on work and can therefore distort labor supply decisions (Gelber et al., 2022; Kostøl and Mogstad, 2014; Vall Castelló, 2017; Ruh and Staubli, 2019; Zaresani and Olivo-Villabrille, 2022; Krekó et al., 2024).

A growing literature shows that DI recipients respond to financial incentives through changes in employment, earnings, hours, and bunching around program thresholds (Kostøl and Mogstad, 2014; Vall Castelló, 2017; Krekó et al., 2024). In particular, more generous earnings disregards and smoother benefit reductions can make work financially more attractive and thereby increase labor supply. Yet most of this evidence focuses on whether DI recipients work and, if so, how much they work. Much less is known about how financial incentives shape transitions out of partial work. For recipients who are already combining DI with employment, weaker work incentives may affect not only how much they work, but also whether they remain in this intermediate state. They may instead

leave partial work altogether and move either toward full employment or back to full DI. Understanding these transitions is essential for assessing whether partial work serves as a bridge toward labor market reintegration.

In this paper, we examine how stricter earnings rules affect transitions out of partial work among DI recipients who are already combining benefits with employment. In particular, we ask whether weaker financial incentives lead recipients to return to full DI or instead move toward full employment. We study this question in the Belgian Adapted Work Program (AWP), which allows DI recipients to work part time while retaining a share of their benefits. Two institutional features generate the variation used in our analysis. First, DI benefits are progressively reduced as daily wage earnings increase, with a kink in the benefit schedule at a daily wage of 24.97 euros, where the marginal benefit withdrawal rate rises sharply from 20% to 50%. Second, participants cannot freely adjust their earnings by changing their working hours, which are determined by an advisory physician based on their health condition and workplace characteristics. This limits strategic earnings adjustments around the threshold and allows us to examine how higher implicit taxation affects transitions out of partial work.

These features allow us to use a Regression Kink Design (RKD) to estimate the causal effect of higher implicit taxation on transitions out of partial work. The design exploits the change in the slope of the benefit schedule at the earnings threshold and examines whether it produces a corresponding change in the relationship between daily labor income and subsequent labor market outcomes. Because recipients have limited scope to sort around the threshold, an assumption that we formally assess in the empirical analysis, the kink provides variation in the marginal financial return to work without substantial strategic manipulation of earnings. Related studies have exploited kinks and nonlinearities in tax and benefit schedules to study behavioural responses to changes in financial incentives (Liebman et al., 2009; Bozio et al., 2017). We use this variation to estimate how higher implicit taxation affects the probability of remaining in the AWP, returning to full DI, or moving into full employment.

Our analysis uses comprehensive administrative records from the National Institute for Health and Disability Insurance (NIHDI). The data cover the universe of DI recipients participating in the AWP in Belgium in 2013 and contain information on disability recognition, benefit receipt, wages, employment histories, and socioeconomic and demographic characteristics. These data allow us to follow recipients across labor market states and examine how a reduction in the financial return to partial work affects subsequent employment and DI outcomes.

Our results show that higher implicit tax rates significantly increase exits from partial work. A one euro increase in the implicit marginal tax per working day reduces the probability of remaining in the AWP by 6.5 percentage points. We then examine where recipients go after leaving the program. The same increase in the implicit marginal tax raises the probability of returning to full DI by 3.0 percentage points and the probability of moving into full employment by 1.5 percentage points, while having no significant effect on other exit pathways.[1] The effects on returning to full DI and moving into full employment correspond to elasticities of 0.84 and 0.85, respectively. Thus, although the relative responses are similar, the effect in percentage point terms is twice as large for returns to full DI as for transitions to full employment. Higher implicit taxation therefore makes partial work less sustainable for some recipients and shifts more of them back toward full benefit dependency than toward full labor market reintegration.

To interpret these findings, we develop a simple labour supply framework. The model shows that when the marginal benefit withdrawal rate increases, recipients may respond differently depending on their earnings capacity and preferences for leisure. Some remain in adapted part time work despite the lower financial return, while others leave this intermediate state either by returning to full DI or by moving into full employment and exiting DI. Our empirical results are consistent with these predictions. Higher implicit taxation induces transitions in both directions, but the return to full DI is more prevalent than the transition to full employment.

[1] Other exit pathways include unemployment, retirement, death, and exclusion from the program, outcomes that are not expected to respond directly to financial work incentives.

This paper contributes to the literature on how financial incentives within DI programs shape beneficiaries' labour supply decisions. A large literature studies the effects of earnings limits, earnings disregards, and benefit withdrawal rules on employment, earnings, and labour force participation (Campolieti and Riddell, 2012; Kostøl and Mogstad, 2014; Vall Castelló, 2017; Ruh and Staubli, 2019; Zaresani and Olivo-Villabrille, 2022; Krekó et al., 2024; Levere et al., 2025). These studies establish that DI recipients can respond to the financial incentives embedded in benefit systems, although the magnitude and margin of adjustment vary considerably across settings. We build on this literature by studying how these incentives affect transitions out of partial work among recipients who are already combining DI benefits with employment.

Our first contribution is to study a different behavioural margin. Much of the existing literature asks whether DI recipients work and, if so, how they adjust their earnings or hours in response to program incentives (Campolieti and Riddell, 2012; Kostøl and Mogstad, 2014; Vall Castelló, 2017; Ruh and Staubli, 2019; Zaresani and Olivo-Villabrille, 2022; Krekó et al., 2024). We instead focus on recipients who are already working while receiving DI and have therefore demonstrated some residual work capacity. For these recipients, the relevant decision is not only how much to work, but whether to remain in partial work at all. We examine their choice among remaining in the intermediate state of work combined with DI, returning to full DI, and moving into full employment. Our contribution is therefore to shift attention from adjustments in the level of labour supply to transitions across qualitatively different labour market states.

Our second contribution is to show that a deterioration in financial incentives can induce recipients to leave partial work in opposite directions. Existing studies commonly measure behavioural responses through employment, earnings, hours, or bunching around program thresholds (Schimmel et al., 2011; Kostøl and Mogstad, 2014; Ruh and Staubli, 2019; Zaresani and Olivo-Villabrille, 2022; Krekó et al., 2024). Our results show that such outcomes do not fully capture how recipients respond when partial work becomes less financially attractive. Higher implicit taxation increases both transitions to full employment and returns to full DI. The latter effect is larger in percentage point terms.

Consequently, an increase in exits from partial work cannot by itself be interpreted as greater labour market reintegration. Some exits represent movement toward full employment, while others represent complete withdrawal from work and renewed reliance on DI. Our findings therefore show that financial incentives can reallocate recipients across labour market states rather than simply changing the amount they work.

This contribution is closely related to Krekó et al. (2024), who study a reduction in work incentives generated by a lower earnings limit and find that recipients respond primarily by reducing hours and earnings. We examine a different mechanism through which work incentives deteriorate, namely an increase in the marginal benefit withdrawal rate within a clawback regime. More importantly, our institutional setting limits recipients' ability to adjust working time in response to the benefit schedule. This allows us to study what happens when adjustment through hours and earnings is difficult. Rather than observing only an intensive margin response, we find that recipients leave partial work, with some returning to full DI and others moving into full employment. Our findings thus complement evidence on earnings responses by showing that restrictions on the scope for intensive margin adjustment can make transitions across labour market states an important response to financial incentives.

Our third contribution concerns the design of gradual return to work policies. Earnings disregards and gradual benefit reductions are intended to make employment compatible with DI receipt and facilitate labour market reintegration among individuals with residual work capacity (Campolieti and Riddell, 2012; Kostøl and Mogstad, 2014; Vall Castelló, 2017; Ruh and Staubli, 2019; Zaresani and Olivo-Villabrille, 2022; Levere et al., 2025). Our results show that allowing recipients to combine work and benefits is not sufficient for partial work to function as a bridge toward full employment. The financial return to remaining in this intermediate state also matters. When the marginal withdrawal of benefits becomes sufficiently steep, some recipients move into full employment, but a larger group in percentage point terms returns to full DI. The design of the clawback schedule can therefore influence whether partial work supports continued labour market attachment or instead leads recipients back toward full benefit dependency.

More broadly, our findings contribute to the literature on the labour supply effects of DI programs (Deshpande, 2016; Maestas et al., 2013; Low and Pistaferri, 2015; Mullen and Staubli, 2016; Haller et al., 2024). While much of this literature studies how DI receipt affects employment and labour force participation, we focus on the intermediate state between full DI and full employment. Our results show that the incentives embedded in this state can affect not only the level of labour supply, but also the direction of subsequent labour market transitions.

The remainder of the paper is organized as follows. Section 2 provides details on the Belgian DI scheme and the Adapted Work Program. Section 3 describes the data. Section 4 introduces the empirical strategy. Section 5 presents the main findings. We conclude in Section 6.

2 Institutional Setting

2.1 The Belgian DI System

In Belgium, every worker who has contributed sufficiently to Social Insurance is eligible for DI if they are unable to work for health reasons, regardless of their current employment status[2]. During the first month of sickness, employees remain entitled to their full salary. For white-collar workers, this is fully financed by the employer, whereas for blue-collar workers, it is partially financed by the employer, with the remainder paid by the National Institute for Health and Disability Insurance (NIHDI). From the second month onwards, DI benefits are paid entirely by the individual's health insurance fund (mutuality) [3]. The replacement rate depends on the individual's current employment status and decreases with the duration of the sickness absence, with regular employees initially receiving 60%

[2]To qualify, full-time workers and unemployed individuals must have completed a minimum of 180 working days (or days of active job search for the unemployed) in the past 12 months. Part-time workers must have been employed for at least 800 hours during the same period.

[3]In Belgium, the health care system is financed by compulsory social security contributions, but the reimbursement of medical expenditures is administratively outsourced to health insurance funds ("mutualities") funded by the NIHDI.

of their gross salary, subject to household-dependent ceilings and floors.

Sick leave can be initiated by any treating medical practitioner on the first day of illness. To qualify, individuals must meet three criteria: (i) they must cease all productive activity; (ii) this cessation must result from a deterioration in health unrelated to their professional activity, and (iii) there must be a reduction of at least 66% in work capacity relative to their previous occupation[4]. After one month of sick leave, an advisory doctor[5] assesses whether the individual qualifies for short-term DI based on medical documentation.

After one year, the mutuality doctor may propose enrolment in the long-term DI scheme. Eligibility is then reassessed by an advisory doctor, who may rely on updated documentation or conduct an additional evaluation. Both the short-term and long-term programs are financed by the NIHDI. The main differences between them concern the evaluation of residual work capacity and the calculation of the replacement rate: in the long-term program, the replacement rate increases to 65%, subject to further adjustments based on household composition[6].

2.2 The Adapted Work Program

Individuals receiving DI benefits may re-enter the workforce through the Adapted Work Program (AWP), subject to the approval from an advisory doctor. This program facilitates reintegration by allowing individuals to combine earnings from employment with disability benefits, while adapting their working hours to their health condition. Participants may return either to their previous job or to a new position, as long as it is compatible with their health status.

[4]After six months, the third criterion is reassessed based on the individual's ability to perform any type of work, taking into account their age, education, and experience. The reduction in work capacity is assessed by an advisory doctor. However, we do not observe significant exits from DI at that point, suggesting that this condition does not substantially affect program participation.

[5]The advisory doctors are physicians from the NIHDI, they assess whether a person is eligible to receive benefits due to a health-related work incapacity. They can also recommend the worker to gradually return to work and must provide official authorization.

[6]This replacement rate is 65% for individuals with dependents, 60% for single-person households, and 40% for cohabitants, subject to defined floor and ceiling amounts. For unemployed individuals, the applicable rate is calculated based on the last wage received before unemployment.

Individuals with a disability rating of at least 50% may request authorization to work part-time if the job is deemed suitable for their condition. The advisory doctor may also initiate such a proposal. The doctor determines the maximum number of hours the individual is allowed to work, taking into account their health and the job's physical and cognitive demands. Within this limit, the specific working hours are then negotiated between the individual and the employer. While participating in the AWP, the individual receives a combination of employment income and reduced disability benefits. The benefits are reduced only if the daily wage exceeds certain thresholds.

The follow-up of AWP participants is managed by the advisory doctor, who must renew consent every two years. If an individual wishes to modify their approved working hours, they must request an appointment with the advisory doctor, who will reassess their health condition and decide whether the change can be authorized. The institutional feature that workers cannot freely choose their working time supports our no-bunching assumption and represents a key distinction between the Belgian DI scheme and those commonly studied in the international literature. Any choice of working hours requires agreement from both the advisory doctor – who may deny an increase in hours – and the employer.

2.2.1 Financial Design of the AWP

The legislation governing the reduction of disability benefits for those working while on a claim has undergone several reforms[7]. This paper focuses specifically on the system as it stood in 2013, after a period of stabilization following earlier adjustments.

In our analysis, we focus on a kink at a daily salary of 24.97 euros, where the marginal tax rate on additional earnings increases from 20% to 50% – a jump of 30 percentage points. Although the full benefit schedule contains three kinks, we concentrate on the middle one, as it entails the largest change in the marginal tax rate and satisfies all the core assumptions underlying our empirical strategy[8]. Further details on these assumptions are

[7]Table D1 in the Appendix D reports all the implemented changes of these brackets since 2011.

[8]The first kink occurs at a daily salary of 15.61 euros, where the marginal tax rate increases from 0% to 20%. The second kink, at 24.97 euros, raised the rate from 20% to 50%, and the third, at 34.33 euros, brings it to 75%.

provided in Appendix A.

The relationship between daily benefits received and daily (before-tax) salary from adapted work around the second kink is formalized in Equation (1):

$$B_{AW}(\omega) = \begin{cases} B_0 - (\omega - 15.61) \cdot 0.2 & \text{if } 15.61 < \omega \leq 24.97 \\ B_0 - [(24.97 - 15.61) \cdot 0.2 + (\omega - 24.97) \cdot 0.5] & \text{if } 24.97 < \omega \leq 34.33 \end{cases} \tag{1}$$

where B_{AW} refers to the net benefits after applying the reduction (in brackets), ω is the daily salary, and B_0 denotes the daily benefits received before starting the adapted work.

The daily salary is computed by dividing the monthly earnings by the officially recognized average number of working days per month in Belgium[9]. As a result, the salary used in our analysis is not influenced by differences in daily working hours or the number of workdays per week. The drawback of this rule is that it does not allow us to distinguish between individuals working fewer hours at a higher wage and those working more hours at a lower wage. However, this limitation does not compromise the validity of our methodology.

To illustrate the reduction at the second kink, consider a worker earning a daily salary above 24.97 euros. Up to 15.61 euros, there is no reduction in benefits. For earnings between 15.61 and 24.97 euros, the marginal tax rate is 20%. Once earnings exceed 24.97 euros, they are subject to a 50% marginal rate, resulting in a steeper reduction in benefits. Figure 1 depicts this reduction, highlighting the change in the slope of the policy rule at the second kink, while Appendix Figure D1 provides the full marginal tax schedule by salary level.

The system's administrative complexity arises from the fact that monthly salary is divided by a variable number of days depending on the month. Accurately determining how a change in working time affects which side of the kink a worker falls on requires converting monthly income into its daily equivalent, then estimating how many hours would need

[9] 25 in months with 28 or 30 days, and by 26 in months with 31 days.

to be added or removed to alter that amount. Additionally, as noted above, working hours cannot be freely adjusted: any change must be approved by the advisory doctor – who may deny such requests – and agreed upon with the employer. Consequently, the only realistic response to changes in financial incentives may be to abandon the combined scheme entirely, either by returning to full-time employment (and exiting DI) or reverting to full DI dependency.

3 Data

We use three administrative datasets from the NIHDI, which contain information on short- and long-term disability recognitions, DI payments, and daily salary. These datasets are linked at the individual level using anonymized social security identifiers. We construct a comprehensive dataset covering all DI beneficiaries who participated in the AWP in Belgium during 2013. Participation in the program is relatively rare, only 3.84% of all DI beneficiaries were enrolled in the AWP in 2013 (INAMI, 2013). To ensure comparability in exposure to the program, we restrict the sample to individuals whose AWP spell began before 2013. This restriction follows two methodological considerations. First, individuals who enter the AWP during 2013 have mechanically shorter observed spells, since all outcomes are measured at a common calendar date (December 2013). Including such inflow participants would introduce substantial duration truncation, making their retention and exit patterns incomparable to those with longer exposure. Second, the behavioural responses we study (remaining in AWP, returning to full DI, or resuming full-time employment) are influenced by accumulated experience in the program. Restricting the sample to pre-2013 entrants yields a more homogeneous population in terms of exposure, health reassessment cycles, and labour-market attachment, thereby improving the internal validity of the comparisons around the kink. Importantly, this restriction does not affect identification. The kink in the marginal taxation schedule applies uniformly to all participants, and the no-manipulation condition remains unaffected. By focusing on individuals with sufficiently long exposure to the program, we ensure that all participants have had

the opportunity to respond to the financial incentives created by the kink[10]. The resulting sample comprises 20,423 individuals, representing all salaried AWP participants in 2013 who entered the program before January 1st of that year.

The data include detailed information on the DI spells, benefit amounts, salaries, medical condition, and reasons for exit— whether from DI or from AWP. They also contain a set of demographic characteristics, including gender, age, region, and social status. As our focus is on financial incentives arising from the combination of part-time earnings and disability benefits, we restrict the sample to salaried individuals. We exclude the self-employed, who fall under a different scheme, as well as individuals working in non-remunerated activities (i.e., voluntary work). This results in a sample of 20,546 individuals. The baseline analysis uses the subset of individuals for whom we have complete information (i.e., no missing values) for the entire year 2013, yielding a final sample of 20,423 individuals. As shown in Table 1, the sample consists predominantly of women (64%). The average age across all individuals is 48 years, and 58% are blue-collar workers. The mean daily salary is approximately 35 euros, while the mean daily benefit is around 36 euros. Notably, salary variation is somewhat greater than variation in benefits. This reflects the presence of statutory benefit floors and ceilings, which constrain dispersion around the mean, in contrast to salaries, which are freely determined.

Since our analysis focuses on a kink where the marginal tax rate increases, Table 1 also provides descriptive statistics for the subsample around the kink—defined as individuals with a daily salary within 9 euros of the kink point—comprising 7,078 observations. In Appendix A, we explain why this is our preferred estimation bandwidth. Within this subsample, both the share of women and the average age remain stable. As expected, the proportion of blue-collar workers rises somewhat, given that most white-collar workers earn higher wages. Consequently, the mean daily salary in the kink sample is lower, although mean daily benefits remain comparable to those in the full sample.

Table 1 also reports the most common medical conditions among part-time workers

[10]Estimating the same specification on the full sample yields similar results for returns to full DI but no significant effect on transitions to full-time employment.

through the AWP, their reasons for exiting the program, and their regional distribution. In both the full sample and the subsample around the kink, musculoskeletal disorders and mental health conditions are the two most frequent causes of disability, with stable prevalence rates across medical conditions. Additionally, the regional composition of participants does not differ noticeably between the two samples. Regarding the reasons for program exit, the most common are a return to full-time work (27% of those leaving the AWP) and a transition back to full DI status (32%), both measured at the end of 2013. Among individuals near the kink, the distribution of exit routes remains very similar: 30% return to full-time employment and 32% revert to full DI. This indicates that, in descriptive terms, individuals close to the kink do not differ markedly from the overall sample in the way they exit the program. The similarity in exit patterns across the full sample and the kink sample is consistent with the requirements of the RKD design, as it suggests the absence of sorting or compositional differences around the kink.

Figure 2 displays the distribution of daily salary relative to the kink. The 9 euros bandwidth captures individuals in the second quartile of the salary distribution.

The outcomes used in the analysis are based on participants' status at the end of 2013. Specifically, we define three binary outcomes: whether the individual remains in the AWP at year-end, whether they have exited to full DI status, and whether they have returned to full-time employment. All outcomes are measured at a common calendar date rather than at a fixed duration since program entry. Because our sample includes only individuals who entered the AWP before 2013, all participants have had sufficient time to accumulate exposure to the program prior to outcome measurement. As a result, this timing structure does not bias comparisons around the kink and does not compromise the internal validity of the RKD design.

4 Empirical Strategy

To identify the effect of a kink in the DI program we apply the Regression Kink Design (RKD) methodology, as proposed by Card et al. (2012, 2015, 2017). This approach exploits exogeneous changes in the slope of a deterministic policy rule that relates an explanatory variable of interest (in this case, the daily implicit tax on DI benefits) to an assignment variable (daily salary). Conceptually, this methodology is similar to an RDD, but instead of exploiting a discontinuity in levels, it relies on a discontinuity in the slope of the policy rule at a known "kink point". Intuitively, if a kink is observed not only in the policy rule but also in the relation between the outcome of interest (e.g., indicators of reverting to full DI, or returning to full-time work) and the assignment variable, this suggests that – under the identifying assumptions of the RKD – a discrete change in the implicit tax rate is associated with a corresponding change in the slope of the outcome. This can be interpreted as a causal effect.

Formally, the causal effect is identified by the ratio of the change in the slope of the expected outcome with respect to the assignment variable (which is estimated from the data) to the known change in the slope of the policy rule:

$$\beta = E\left[\frac{dY(w)}{d\tau(w)}\,\middle|\, w = w_k\right] = \frac{\lim_{w\to w_k^+}\frac{d\,E[Y|w=w_k]}{dw} - \lim_{w\to w_k^-}\frac{d\,E[Y|w=w_k]}{dw}}{\lim_{w\to w_k^+}\frac{d\tau(w)}{dw} - \lim_{w\to w_k^-}\frac{d\tau(w)}{dw}} \tag{2}$$

The expression on the right-hand side of this equation – the RKD estimand – is the change in slope of the conditional expectation function $E[Y|w]$ at the kink point ($w = w_k$), divided by the change in the slope of the deterministic assignment function $\tau(w)$ at the kink, and β is the weighted average of marginal treatment effects across the population. The weights reflect the relative likelihood that an individual has a daily salary $w = w_k$. Individuals who are more likely to be near the kink point receive greater weight. These weights can be adjusted, depending on the kernel function chosen in the estimation. Since the NIHDI strictly enforces the tax rules – with no exemptions for individuals in the DI scheme – we follow Landais (2015) and implement a sharp RKD.

The numerator captures the change in the slope of the conditional expectation function $E[Y|w]$ at the kink point, and is estimated semi-parametrically using the following local power series regression around the kink point (Landais, 2015)[11]:

$$E[Y_i \mid w_i = w] \approx \alpha_0 + \sum_{p=1}^{P} [\alpha_p (w - w_k)^p + \gamma_p D_i (w - w_k)^p] \tag{3}$$

where P is the chosen polynomial order and D is an indicator of the treatment status: $D_i(z_i) = 1$ if $z_i > 0$, and $D_i(z_i) = 0$ otherwise. Here, $z_i = w_i - w_k$, such that the treatment indicator equals 1 for observations to the right of the kink and 0 otherwise. We allow for different intercepts on each side of the kink (a potential level discontinuity), following standard practice in RKD. Note that $|w - w_k| \leq h$, where h is the bandwidth chosen for the estimation.

Technical details on the implementation of the RKD, including the choice of parameters and the discussion and empirical testing of the identifying assumptions (no sorting and smoothness), are provided in Appendix A. The results confirm that both assumptions are satisfied, supporting the validity of the RKD design in our setting.

5 Findings

We begin by providing graphical evidence on how higher taxation affects the likelihood of continuing to work part-time. Figure 3 depicts the relationship between the assignment variable and the outcome variable, using a bandwidth of 9 euros and bin widths of 0.5 euro, with linear trends fitted on either side of the kink. Panel A shows the effect of an increase in the implicit daily marginal tax rate – a reduction in financial incentives to work – on the probability of remaining in the AWP by the end of the year. Before the kink, the fitted line shows a clear upward trend: individuals with higher earnings

[11] Local power series estimation approximates a function by a polynomial within a neighbourhood of a specific point, typically around the kink. Linearizing a function provides a reasonable approximation close to the point of tangency. However, to fully represent an analytical function over its entire domain an infinite number of terms in the power series — such as a Taylor series — would be required.

from part-time work are more likely to stay in the program. At the kink point, where the implicit marginal tax rate on labour income jumps from 20% to 50%, this pattern reverses. Beyond this threshold, as the opportunity cost of working rises sharply, the probability of working part-time declines with increasing salary.

As an additional illustration, Panel B presents an alternative outcome: the total number of days each individual spent working part-time through the AWP during 2013. This variable offers a more continuous measure of program participation and allows us to examine whether the change in financial incentives affects overall engagement in the program, rather than only end-of-year retention. The pattern is consistent with the graphical evidence in Panel A. Before the kink, higher part-time earnings are associated with longer participation spells. At the kink, where the implicit marginal tax rate increases sharply, this relationship changes: beyond the threshold, the trend no longer increases with salary and becomes slightly downward-sloping. This shift in trend is consistent with the predicted behavioural response to the steeper tax schedule and reinforces the evidence from the binary retention outcome.

The observed drop in AWP participation following the increase in marginal taxation is unsurprising. What is more relevant – and central to our analysis – is understanding what individuals do once they exit. Do they stop working entirely and revert to full DI status, or conversely, do they transition to full-time employment and exit the DI system? In Appendix C, we develop a labour supply framework that characterizes individuals' choices between these alternative exit paths.

Figure 4 presents graphical evidence on all margins of exit. Panel A displays the probability of returning to full DI. Prior to the kink, the trend line shows a strong negative relationship between part-time earnings and the likelihood of exiting to full DI. However, at the kink, this trend flattens markedly, indicating a substantial increase in the probability of returning to full DI once the marginal tax rate jumps. Panel B shows the probability of resuming full-time work. Here we also observe a change in trend at the kink: while the probability of full-time re-entry slightly decreases with earnings below the threshold,

it turns upward after the kink. This suggests that once the marginal tax rate increases, individuals are also more likely to exit AWP into full-time employment. Finally, Panel C reports the probability of exiting AWP for all other possible reasons that are independent of beneficiaries' choices, including unemployment, retirement, death and exclusion from the program. In contrast to the previous outcomes, the relationship remains smooth around the kink, with no visible change in trend, which is consistent with the fact that the kink only affects individuals' labour supply decisions.

Taken together, the graphical evidence suggests that the increase in the implicit daily marginal tax on labour earnings through the AWP causes some individuals to leave the program. This shift is reflected in higher probabilities of both reverting to full DI and resuming full-time employment at the kink, although their relative importance is not yet clear.

To confirm the graphical evidence and quantify these probabilities, we estimate treatment effects empirically. Table 2 presents the results for the baseline estimation of equation (2)[12] For each outcome, we report the estimated RKD coefficient β, which is calculated by dividing the estimated treatment effect by the deterministic denominator in the first stage (0.3). This coefficient reflects the treatment effects at the kink. Alongside each estimate, we provide the robust confidence interval, the mean of the dependent variable within the 9 euros bandwidth around the kink, and the number of observations. We also report the associated significance levels and robust standard errors.

The set of covariates includes age, gender, region, and social status, variables which we demonstrated to be smoothly distributed at the cutoff in Appendix A, which may help to improve the precision of the estimates. Since information on medical diagnosis is only available for individuals in long-term disability, including this variable would restrict the estimating sample and slightly alter its composition. For this reason, and because adding diagnosis does not materially change the results, we exclude it from the main specification. Estimates including diagnosis are reported in Appendix Table D2.

[12]To obtain the value in equation (2), we parametrically estimate equation (3) and divide by the deterministic value in the first stage (0.3), which indicates the increase in the marginal tax rate.

Columns 1 and 2 of Table 2 present the estimated causal effect of the kink on the probability of remaining in the AWP by the end of the year, without and with covariates, respectively. Columns 3 and 4 report the results for the number of days worked under the AWP. Columns 5 and 6 show the effect on the probability of ceasing all work activity and returning to full DI status, while Columns 7 and 8 display the estimated impact on the probability of resuming full-time employment. Finally, Columns 9 and 10 report the effect on the probability to leave AWP for the other reasons above mentioned. Our main coefficient of interest, β, suggests that an increase of one euro in the implicit daily marginal tax reduces the probability of remaining in the AWP by 6.5 percentage points (6.0 p.p. when covariates are included) and decreases the average number of days worked by 5.2 p.p. which corresponds to around 12 fewer days in the program [13]. This, in turn, significantly increases the probability of returning to full employment by 1.5 percentage points (1.4 p.p. with covariates). These coefficients are statistically significant at conventional levels, with narrow robust confidence intervals. The estimated elasticity for the probability of returning to employment is 0.85 [14], implying that a 10% increase in the implicit marginal tax per working day is associated with an 8.5% increase in the likelihood of resuming full time employment. Although the absolute effect is modest, the corresponding elasticity is relatively large, given the low baseline probability of full-time re-entry near the kink. This indicates that higher marginal taxation not only pushes individuals out of part-time work but also increases the likelihood that some will transition into full-time employment. However, when looking at exits toward full DI, the estimated effects are substantially larger. A one-euro increase in the implicit daily marginal tax raises the probability of reverting to full DI by 3.0 percentage points (2.9 p.p. with covariates), with narrow robust confidence intervals. The estimated elasticity for the probability of returning to DI is 0.84[15], implying that a 10% increase in the implicit marginal tax per working day is associated

[13] This corresponds to 5.2% of the average 238.5 days worked in the AWP.

[14] The elasticity is obtained by multiplying the regression β coefficient by the average implicit tax paid per day at the threshold and dividing by the average probability of returning to full-time employment at the threshold: $\varepsilon = \frac{\beta\tau(24.97)}{\bar{Y}(24.97)} = \frac{0.015[(24.97-15.61)\cdot 0.2]}{0.0330} = 0.85$.

[15] The elasticity is obtained by multiplying the regression β coefficient by the average implicit tax paid per day at the threshold and dividing by the average probability of returning to full disability benefits at the threshold: $\varepsilon = \frac{\beta\tau(24.97)}{\bar{Y}(24.97)} = \frac{0.030[(24.97-15.61)\cdot 0.2]}{0.0667} = 0.84$.

with an 8.4% increase in the likelihood of reverting to full DI status. Personal income tax and social security contributions may also influence this decision. These additional disincentives help explain why the estimated elasticity is relatively high. The estimated coefficients for other exits are close to zero and statistically insignificant, confirming the absence of an effect of the kink on exits not driven by individuals' choices.

Our findings provide clear evidence that a substantial increase in the marginal tax rate for part-time workers receiving DI benefits raises the probability of returning to full-time employment as well as the probability of reverting to full DI. Although there is a positive employment effect following the change in financial incentives, there is also a detrimental effect, even larger in magnitude, on the probability of completely exiting the labour force and relying entirely on benefits. Even if the elasticities of both responses are similar, the absolute effect is considerably larger for returns to full DI, indicating that the policy shift drives many more individuals back onto full benefits than into full labour market reintegration.

These empirical results reinforce the graphical evidence and are consistent with earlier research showing that financial (dis)incentives for DI recipients working part-time shape labour supply decisions. Our results extend this evidence by examining a setting where adjusting hours at the intensive margin is not straightforward, and by showing that, in such cases, behavioural responses occur along the extensive margin: although higher marginal taxation increases transitions into full-time employment, it also generates a detrimental rise in resumptions of full DI, leading some individuals who had demonstrated work capacity to withdraw completely from the labour market in response to financial disincentives.

This dual adjustment mechanism has important policy implications. Regulations that modify the financial incentives to adapted work can trigger responses in both directions — toward full employment and toward full disability. This raises a key question: who chooses each pathway and why? Individuals' responses are likely to depend both on their preferences for leisure and on their earnings capacity, with lower work capacity reflected

in lower potential earnings. In Appendix C, we develop a labour supply framework that illustrates how these two dimensions shape individuals' choices between returning to full DI and transitioning to full-time employment.

Appendix B reports a series of robustness checks confirming the stability of our results, including sensitivity analyses to the density specification, bandwidth choice, and functional form, as well as placebo tests based on the alternative reasons for exiting part-time work separately and tests of functional dependence. The estimated effect on transitions back to full DI remains highly robust across all specifications, while the effect on transitions to full-time employment is somewhat more sensitive to specification choices, although its sign and overall pattern remain unchanged.

6 Conclusion

Disability insurance (DI) represents a substantial share of social expenditure in modern economies, making the design of effective return-to-work policies a key policy challenge. Financial incentives are central to these policies, particularly in programs that allow DI recipients to combine benefits with part-time employment. In Belgium, the Adapted Work Program (AWP) was introduced to facilitate gradual labour market reintegration. Our findings show, however, that the structure of financial incentives embedded in such programs plays a decisive role in shaping beneficiaries' exit decisions.

Exploiting a kink in the DI scheme, we apply a regression kink design to estimate the causal impact of a 30-percentage-point increase in the implicit daily marginal tax rate on labour earnings. We find that higher marginal taxation induces individuals to exit part-time work through two distinct channels. On the one hand, it increases the probability of resuming full-time employment by 1.5 percentage points. On the other hand, and more strongly in absolute terms, it raises the likelihood of reverting to full DI by 3.0 percentage points. Although the elasticities of these two responses are similar, the larger effect on returns to full DI implies that higher benefits reduction disproportionately pushes

individuals back into full benefit dependency rather than into sustained labour market reintegration.

These results contribute to the literature on financial incentives, DI, and return-to-work policies by highlighting the importance of extensive-margin responses in settings where adjusting hours at the intensive margin is not straightforward. Rather than simply affecting hours worked, changes in marginal taxation alter participation decisions, reallocating individuals away from partial work and into alternative states of attachment. These findings underscore the importance of carefully designing clawback regimes. While weaker financial incentives can induce some beneficiaries to transition to full-time employment, they may also lead a larger group of individuals with remaining work capacity to withdraw from employment altogether and return to full DI. Our labour supply framework rationalizes these heterogeneous responses by showing how differences in earnings capacity and preferences for leisure lead beneficiaries to follow different adjustment paths.

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Tables

Table 1. Summary statistics

		Full Sample Total (%)	Kink Sample Total (%)
Gender	Women	0.64 (0.48)	0.65 (0.48)
Age		47.84 (8.47)	47.13 (8.71)
Social State	Blue-collar	0.58 (0.49)	0.73 (0.44)
Days in AWP		233.39 (89.58)	236.29 (81.01)
Daily salary		35.56 (31.31)	26.51 (4.91)
Daily benefits		36.09 (20.42)	37.46 (16.09)
Medical diagnosis*	Musculoskeletal disorders	0.301 (0.459)	0.321 (0.467)
	Mental health	0.266 (0.442)	0.306 (0.461)
	Cancer	0.126 (0.332)	0.089 (0.284)
	Nervous system	0.072 (0.259)	0.065 (0.247)
	Circulatory system	0.067 (0.251)	0.054 (0.226)
	Trauma and poisoning	0.056 (0.230)	0.054 (0.226)
	Other	0.110 (0.313)	0.110 (0.313)
	Unknown	0.000 (0.018)	0.000 (0.012)
Reason for exit AWP**	Back full-time work	0.272 (0.445)	0.300 (0.457)
	Back full DI	0.326 (0.469)	0.320 (0.466)
	Unemployment	0.008 (0.091)	0.008 (0.093)
	Death	0.011 (0.106)	0.004 (0.063)
	Exclusion	0.087 (0.282)	0.132 (0.339)
	Other	0.102 (0.303)	0.105 (0.306)
	Unknown	0.155 (0.361)	0.133 (0.339)
Region	Brussels	0.050 (0.218)	0.037 (0.190)
	Wallonia	0.289 (0.453)	0.243 (0.429)
	Flanders	0.661 (0.473)	0.719 (0.450)
Observations		20,423	7,078

Notes: The table reports the mean value and, in parentheses, the standard deviation of all the salaried individuals in the AWP in 2013 who started the adapted work before the year started. The kink sample includes the same statistics around the kink, using a bandwidth of 9 euros. *Medical diagnosis is only available for individuals who have spent more than one year on DI (19,243 observations). **The averages of the reasons for exit AWP are calculated only considering those individuals who left the program in 2013 (5,125 and 1,453 observations for the full sample and the kink sample, respectively). If the entire kink sample is used instead, the average rate of return to full DI is 0.0817 and to full-time work is 0.0683; these values are used to compute the elasticity estimates.

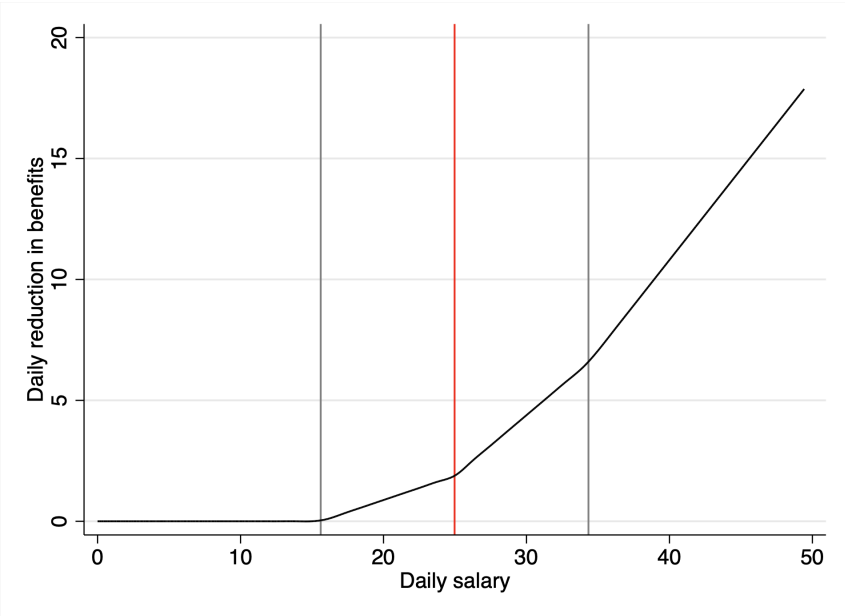
Table 2. Regression Results

	(1) Remain in AWP	(2) Remain in AWP	(3) Days in AWP	(4) Days in AWP	(5) Return to full DI	(6) Return to full DI	(7) Return to employment	(8) Return to employment	(9) Other exits	(10) Other exits
β	-0.065***	-0.060***	-5.029*	-5.226**	0.030***	0.029***	0.015**	0.014**	0.007	0.007
	(0.013)	(0.013)	(2.636)	(2.606)	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)	(0.006)
Robust CI	[-0.187,-0.085]	[-0.175,-0.072]	[-20.584,-0.070]	[-20.244,0.079]	[0.020,0.093]	[0.017,0.091]	[-0.000,0.048]	[-0.003,0.044]	[0.002,0.046]	[0.000,0.044]
Mean	0.831	0.831	238.50	238.50	0.067	0.067	0.033	0.033	0.031	0.031
Covariates	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Observations	20,439	20,363	20,439	20,363	20,439	20,363	20,439	20,363	20,439	20,363
Eff observations	7,083	7,061	7,083	7,061	7,083	7,061	7,083	7,061	7,083	7,061

Notes: All coefficients are estimated from independent local polynomial nonparametric regressions with a linear trend (polynomial order 1), a symmetric bandwidth of 9 euros and a uniform kernel. Treatment effects correspond to equation (2), obtained by dividing the estimated coefficient $\hat{\gamma}_1$ in equation (3) by the deterministic first stage value of 0.3. The coefficients represent the effect of a one-euro increase in the implicit marginal taxation per day worked on the different outcomes. Standard errors in parentheses. Robust confidence intervals reported. The column "Mean" reports the average of the dependent variable within the bandwidth. Covariates include region, age, gender and social status. Significance levels: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

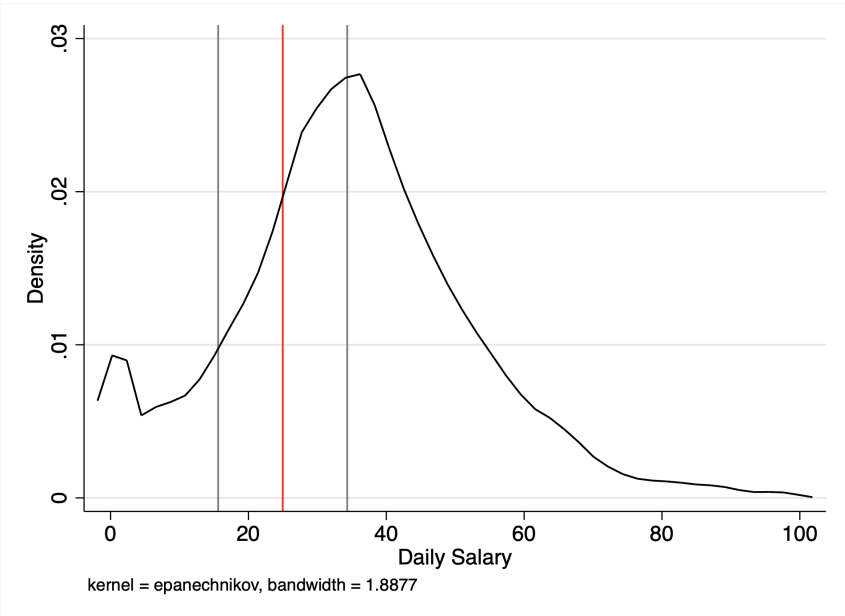
Figures

Figure 1. Kinks in the reduction in benefits



Note: This graphic simulates the reduction in benefits based on the taxation rules set by the NIHDI, which results from applying a marginal tax rate on salary of 20% after crossing the threshold of 15.6068 euros/day, 50% after the threshold of 24.9709 euros/day, and 75% from 34.335 euros/day. The horizontal axis shows daily salary in euros, while the vertical axis shows the corresponding daily reduction in benefits, also in euros.

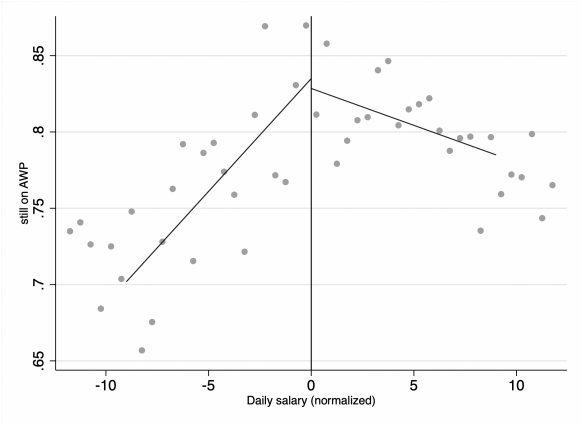
Figure 2. Density distribution of the average daily salary



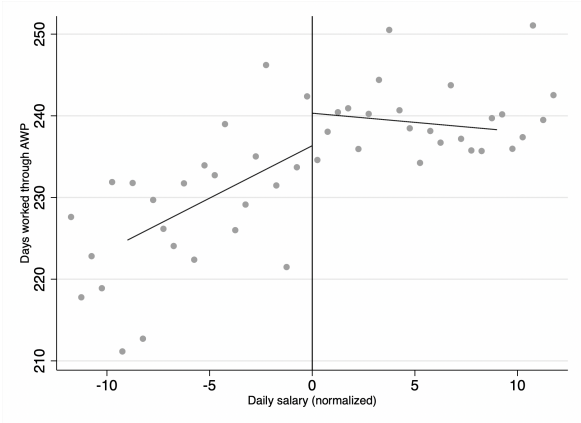
Note: Blue line represents the kernel density function distribution of the average daily salary. The red line indicates where the kink in the policy rule is located. Grey lines indicate the bandwidth of 9 euros. The horizontal axis shows average daily salary in euros, and the vertical axis shows the estimated density. The absence of bunching around the kink visually supports the assumption of no sorting.

Figure 3. Relationship between the outcome and salary level

Panel A: Probability of not leaving AWP



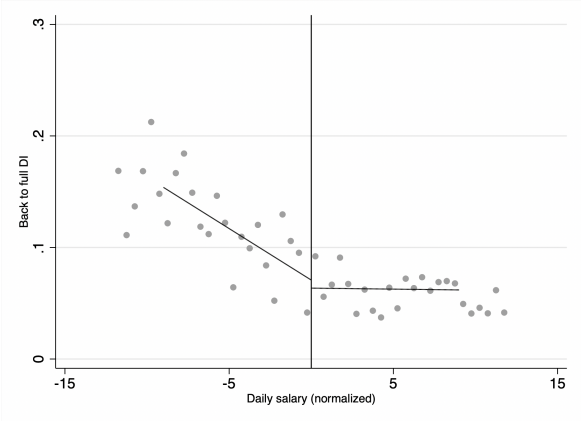
Panel B: Days worked through the AWP



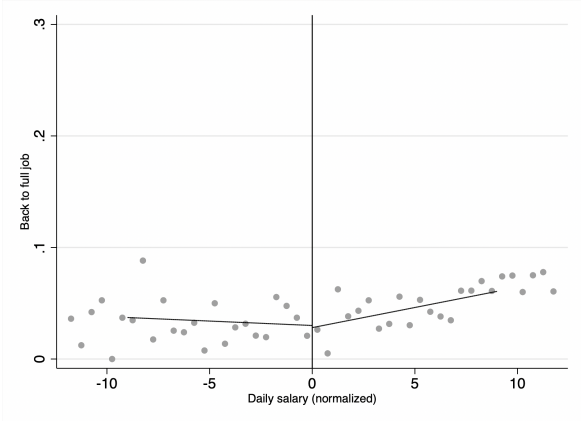
Notes: The horizontal axis plots normalized salary from the adapted work (relative to the kink), using 0.5 euro per bin and a bandwidth of 9 euros. The vertical axis plots the mean of the outcome variable (the probability to stay in AWP by the end of the year, which is a dummy variable taking value 1 if the individual is still on AWP in December 2013 and 0 otherwise and number of days worked through AWP in 2013) in each bin. The straight lines display the underlying relationship on each side of the kink. The vertical line indicates the salary kink. The plots are normalized at the salary kink (24.9709 euros/day, representing a change in taxation from 20% to 50%).

Figure 4. Relationship between the outcome and salary level

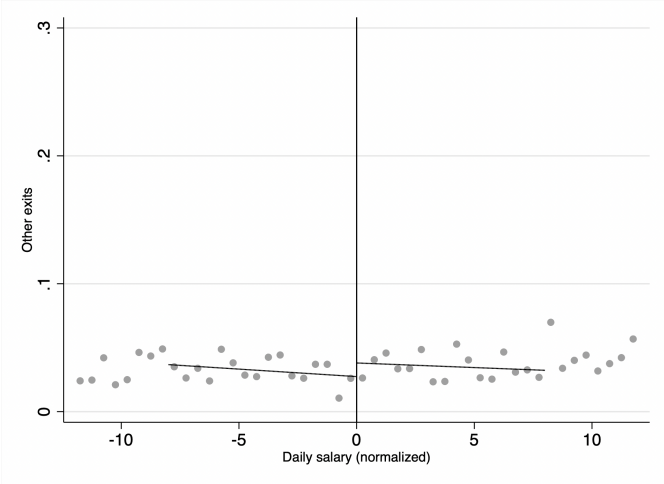
Panel A: Probability of returning to full DI



Panel B: Probability of resuming employment



Panel C: Probability of taking other exits



Notes: The horizontal axis plots normalized salary from the adapted work (relative to the kink), using 0.5 euro per bin and a bandwidth of 9 euros. The vertical axis plots the mean of the outcome variable (the probability returning to DI, the probability of resuming employment, or the probability of exiting AWP for other reasons) in each bin. The straight lines display the underlying relationship on each side of the kink. The vertical line indicates the salary kink.

Appendix

A Technical details on the RKD implementation

A.1 Choice of Estimation Parameters

Three parameters must be determined when estimating equation 3: the order p of the local polynomial regression, the kernel function K, and the bandwidth h.

Choice of polynomial order. Previous literature generally favours a local quadratic approach to a local linear one in the RKD context, as the former is expected to yield a smaller asymptotic bias. However, Card et al. (2017) caution against adopting the quadratic model as default and emphasize the importance of dataset-specific features, such as sample size. Indeed, some studies have found that in certain contexts, a local linear polynomial performs better. Given the linearity of the policy rule and our sample size, we adopt the local linear specification as our preferred approach, however, as a robustness check, we also test other functional forms in Appendix B.

Choice of Kernel. Liou et al. (1997) show that the triangular kernel is optimal at boundary points. Nonetheless, Card et al. (2017) argue that using a uniform kernel (i.e., assigning equal weight to all observations within the bandwidth) involves only a minimal loss while substantially simplifying the implementation of the RKD. Following this recommendation, we adopt the uniform kernel as our preferred choice. As a robustness check, we also report results using the triangular and Epanechnikov density forms in Appendix B.

Choice of bandwidth. The choice of bandwidth involves balancing variance and bias. A wider bandwidth reduces variance by incorporating more observations, but it may introduce bias if the true relationship between the outcome and the assignment variable is nonlinear farther from the kink. This makes local linear approximation less accurate and can distort the estimated treatment effect. In our context, avoiding overlap between kinks is essential to prevent confounding effects. This leads us to impose an upper limit of 9.36 euros on the bandwidth [16]. To explore the optimal bandwidth for each outcome, we use the data-driven procedure proposed by Calonico et al. (2014), which is specifically designed for RKD. This procedure yields optimal bandwidths ranging from approximately 6 to 10 euros, depending on the outcome and selection method. However, for comparison purposes, having a consistent bandwidth across different outcomes is important. Therefore, and considering our limit of 9.36 euros, we use a common bandwidth of 9 euros as our baseline. In Appendix B, we also report robustness checks using each outcome's optimal bandwidth as well as alternative bandwidth choices.

[16] The distance between each of the three kinks in the salary distribution is of 9.36 euros.

A.2 Identifying Assumptions

One basic condition to implement RKD is that the function must have at least one kink point. This means that the function is continuous and differentiable in segments, but in at least one point, it is continuous without being differentiable – i.e., having unequal left and right derivatives. This condition is easily identifiable from the policy rule and is illustrated in Figure 1. Additionally, the RKD relies on two important assumptions: no sorting and smoothness. In this subsection, we discuss and test these assumptions.

Assumption 1: No Sorting

The density of the assignment variable, the daily salary, must be smooth around the kink. This smoothness implies that individuals cannot manipulate their salary to position themselves on the more advantageous side of the function, which in this case would be just before the kink. Observable bunching near the kink, would invalidate this assumption. In our context, however, the local random assignment condition is likely to hold. Manipulation of earnings seems implausible, as individuals do not set their own salary. While they could theoretically adjust it by adapting their working hours, doing so involves complex calculations and requires the approval from both the advisory doctor and the employer, a process that may take a considerable amount of time. As discussed in Section 2, modifying working hours entails substantial costs. Therefore, it is highly unlikely that individuals can sort themselves within the salary distribution.

We start by providing graphical evidence of the absence of bunching before the kink in Figure 2. However, we go one step further and, following the literature (Kostøl and Mogstad, 2014; Card et al., 2015; Landais, 2015; Fontenay, 2026), present formal tests for this assumption in Figure A1. The kernel density plot of the salary distribution already suggests smoothness, with no visible discontinuity or bunching around the kink.

To formally assess the no-sorting assumption, we first report the results of the McCrary test. McCrary (2008) proposed this test to detect manipulation by assessing the continuity of the density of the assignment variable, an approach widely used in both the RDD and RKD literature. He explains that histograms and kernel density estimates are subject to bias and do not allow reliable point estimates or inference. The McCrary test complements these visual tools by testing for a discontinuity in the density of the assignment variable at the kink. Panel A of Figure A1 displays the results of this test, showing that they are insignificant and confirming the absence of a discontinuity.

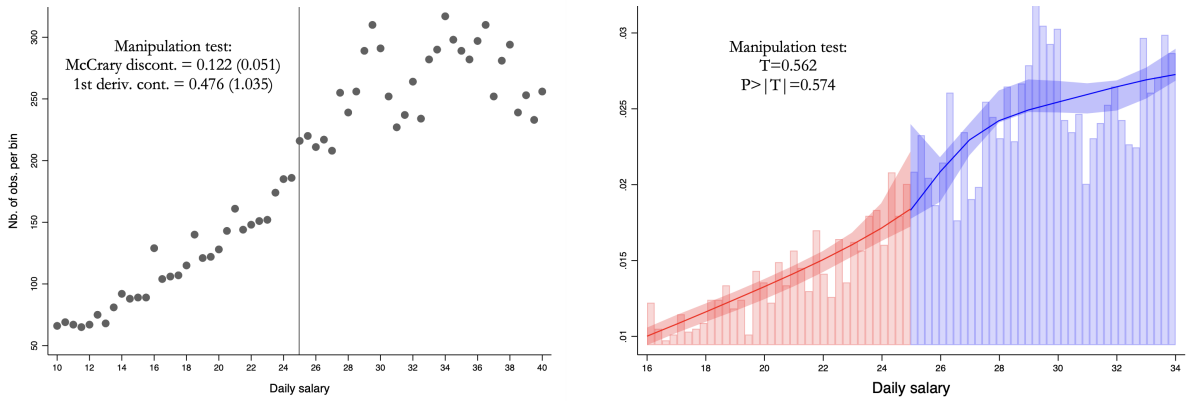
We further extend our analysis by applying the test proposed by Card et al. (2015), which examines the continuity of the first derivative of the probability density function (PDF) at the kink. Panel A of Figure A1 also shows the estimated coefficient and standard error of this test. The results confirm that the first derivative of the PDF is continuous at the

kink, providing additional support for the validity of the RKD.

Figure A1. Manipulation tests

Panel A: Frequency distribution of assignment variable and McCrary's (2008) test

Panel B: Manipulation testing using local-polynomial density estimation



Notes: The graphics assess the validity of RKD assumption 1 of no sorting. Panel A shows the frequency distribution of the daily salary in 50 euro cents bins. The graph also displays two manipulation tests: the standard McCrary test (McCrary, 2008) that checks for a "jump" in the probability density function of the assignment variable, and the extension proposed by Card et al. (2015) to test that the first derivative of the PDF is also continuous at the kink. We report the coefficients for both tests, as well as the corresponding standard errors in parentheses. The McCrary discontinuity test coefficient is 0.122 (0.051), dividing these values gives a t-value of 2.38; similarly, the first derivative continuity test coefficient is 1.15 (0.62), which results in 1.86, indicating in both cases that we do not reject the null hypothesis of continuity. Panel B represents the PDF of the daily salary around the kink, estimated using local polynomials, as proposed by Cattaneo et al. (2020). It includes the manipulation T-test coefficient and its corresponding p-value. The p-value > 0.05 indicates that there is not a statistically significant manipulation. Overall, graphical evidence and the formal tests suggest no manipulation of the assignment variable.

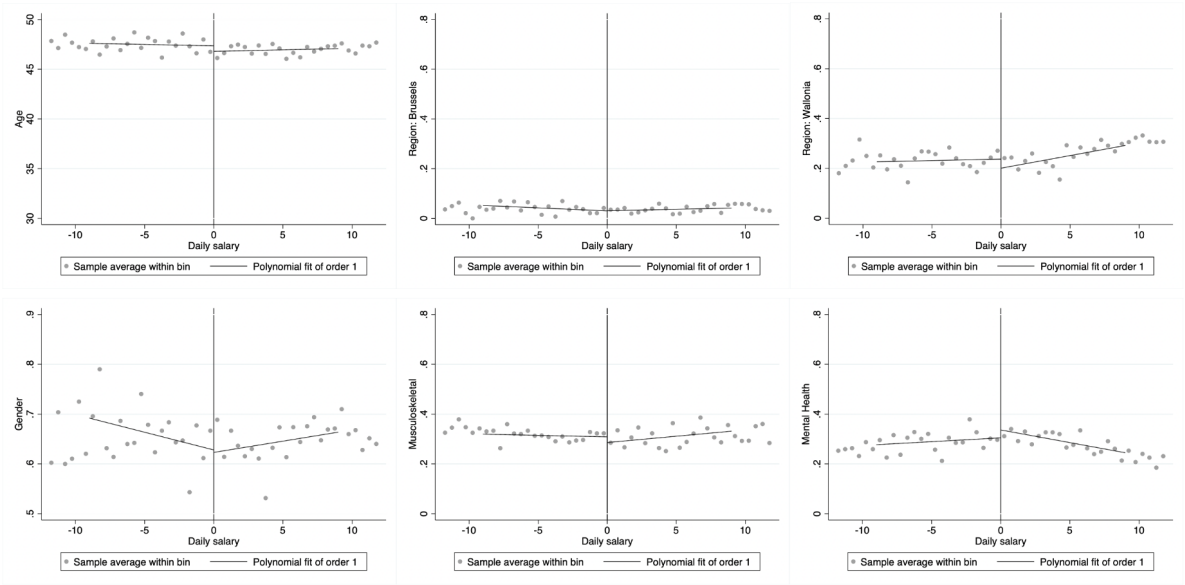
More recently, Cattaneo et al. (2020) developed a novel discontinuity-in-density testing procedure, which we also implement in this study. This procedure is based on their proposed local polynomial density estimator, and it is fully data-driven: it includes formal bandwidth selection methods along with inference methods that rely on robust bias correction. Panel B of Figure A1 displays the density of the assignment variable on both sides of the kink, as well as the formal results for the Cattaneo et al. (2020) manipulation test. The test confirms that we do not detect any manipulation around the kink. Specifically, the test statistic is 0.56, with a corresponding p-value of 0.57, indicating that we fail to reject the null hypothesis of no manipulation. Taken together, the graphical evidence and the results from all formal tests suggest that the no-sorting assumption holds in this setting, implying that individuals did not manipulate their earnings to position themselves at one side of the kink or the other.

Assumption 2: Smoothness

In the absence of kinks in the benefit function, the relationship between outcomes and

the assignment variable would be smooth. If this assumption holds, then a change in the slope at the kink can be interpreted as a causal effect of the benefit amount on the outcome. However, the assumption it is not directly testable, as we cannot observe the counterfactual scenario without the policy rule. Instead, we follow the standard approach in the RDD literature (Imbens and Lemieux, 2008), which is also applicable in the RKD context (Fontenay, 2026), and test for the smoothness of predetermined control variables at the kink. If these covariates display discontinuities, the assumption would be violated. Figure A2 shows that various control variables are indeed smooth around the kink, supporting the validity of the assumption.

Figure A2. Distribution of control variables around the kink



Notes: The horizontal axis plots daily salary in euros in bins of 0.5 euro, with a bandwidth of 9 euros. The vertical line indicates where the second kink is (24.9709 euros). The straight lines on both sides of the kink display the underlying linear relationship between the assignment variable and each of the control variables analysed here; they are estimated using local nonparametric regressions. The control variables represented are: age (continuous variable), gender (dichotomous variable), region (two dichotomous variables for Brussels and Wallonia; Flanders is the omitted variable), and a binary variable indicating the prevalence of both mental health and musculoskeletal conditions, which are the two most frequent pathologies in our sample.

As previously explained, our analysis focuses on the second kink, as the other two are not suitable for this analysis. The first kink presents challenges due to the smaller change in the marginal tax rate, the limited sample size around it, and its focus on individuals with very low earnings. The third kink is also unsuitable: as shown in Figure 2, the salary density drops immediately after the kink. Even if this drop is normal after the mode of any distribution, this complicates the testing of the validity of the RKD at this point.

B Robustness Analysis

To ensure the reliability and validity of our findings, we conduct a series of robustness checks.

Sensitivity analysis for the density function. As discussed in Appendix A, RKD estimates may be sensitive to several implementation choices, including the choice of kernel used in the local estimation. To assess the robustness of our results, we re-estimate the main specifications using alternative density functions. Table B1 reports the results obtained with triangular and Epanechnikov kernels. The estimated effect on the probability of returning to full DI remains remarkably stable in magnitude and statistical significance across these alternative specifications, confirming the robustness of our main finding. By contrast, the estimated effects on transitions to full-time employment are not stable across kernels and lose statistical significance under alternative density functions. This sensitivity suggests that, unlike the return-to-DI outcome, the employment result is less precisely estimated and should be interpreted with caution.

Sensitivity analysis for the choice of bandwidth. As also discussed in Appendix A, the choice of bandwidth in the RKD framework involves a trade-off between variance and bias. Table B2 reports estimates obtained using a range of bandwidths between 7.5 and 11 euros, as well as outcome-specific optimal bandwidths based on the Calonico et al. (2014) procedure. For the probability of returning to full DI, the estimated coefficients are highly stable in magnitude and statistically significant across all bandwidths considered. The data-driven optimal bandwidth for this outcome is 9.06 euros, yielding an estimated effect of 3 percentage points with a p-value below 0.01. For transitions to full-time employment, the estimated coefficients are smaller in magnitude and somewhat more sensitive to the choice of bandwidth. Estimates become significant for bandwidths of 8.5 euros and above. Notably, the optimal bandwidth suggested for this outcome is larger (9.95 euros), consistent with the idea that identifying employment responses requires a wider local window. Overall, while the employment results are less stable than those for returns to full DI, their persistence across a range of larger bandwidths suggests that they are not driven by a single specification choice.

Sensitivity analysis for the functional form. The results can also be sensitive to the choice of the functional form. We begin testing this with a graphical analysis presented in Figure B1, where we illustrate the outcomes of interest using a quadratic function of the assignment variable. In Panel A, the trend suggests a similar discontinuity at the kink for the probability of returning to full DI, whereas Panel B shows that for the probability of resuming full-time employment, there appears to be no significant discontinuity at the kink. The lines displayed in these graphics are aligned with those displayed when using the linear functional form in Figure 4.

To further validate these observations, we present the estimates for the treatment effects using a quadratic specification in Table B3. Column 1 demonstrates that the probability of returning to full DI remains statistically significant, albeit at a somewhat lower statistical level and even greater in magnitude. In contrast, Column 2 reveals that the probability of resuming full-time employment remains statistically insignificant and very close to 0. The increasing standard errors associated with the quadratic model, compared to those of the linear model, suggest that the linear polynomial is a more appropriate specification. This finding should not be surprising, as the policy rule is a linear function.

These findings corroborate the claim by Gelman and Imbens (2019) that the use of higher-order polynomials in regression discontinuity analysis can lead to inadequate coverage of confidence intervals. Consequently, our preferred specification is linear, consistent with most studies employing RKD (Ganong and Jäger, 2018).

Placebo test: other reasons for stopping part-time work. As an additional robustness check, we perform placebo tests by examining the exit routes from the AWP that should not be influenced by changes in the financial incentives, i.e. the ones that conform the outcome "other exits", separately. Specifically, among individuals who stop working part-time, we analyse whether the kink affects the likelihood of stopping due to reasons such as reaching retirement age, death, or being excluded from the program (even if we do not know the exact reason, this is due to no longer meeting medical or administrative requirements). These outcomes are not expected to respond to changes in marginal taxation and thus serve as natural placebo tests. Additionally, we consider exits to unemployment, although this channel may be more ambiguous in terms of sensitivity to financial incentives.

While these exit routes are less common[17], they still offer a useful benchmark. Figure B2 and Table B4 show the corresponding regression results. As expected, none of these outcomes exhibit a change in trend around the kink point, and none of the estimated coefficients are statistically significant. These findings reinforce the interpretation that the effects documented in the main analysis are driven by financial incentives rather than unrelated confounding factors.

Test on the functional dependence. As mentioned earlier, the RKD relies on the assumption that the relationship between the assignment variable and outcomes (in the absence of a kink) should display a degree of smoothness. A valid concern may be whether the effects detected by the RKD arise due to nonlinearities in this relationship. While the visual evidence presented earlier helps alleviate this potential concern, one way to test it is by including different controls in our regressions to account for possible nonlinearities.

[17] 67 due to deaths, 88 due to unemployment, 215 due to reaching the retirement age, and 1,196 due to exclusion from the program.

Fontenay (2026) takes a similar approach in his analysis and explains that controlling for relevant covariates should strengthen the credibility of the RKD. Tables 2 and D2 present baseline results both with and without covariates, showing no significant differences in the outcomes between the two specifications. The selected covariates (medical diagnosis, region, gender, age, and social state) are likely correlated with both the assignment variable and the outcomes of interest. In fact, they may be determinants, as they influence an individual's income level. Table 2 shows that the results remain consistent regardless of whether the covariates are included.

In summary, after conducting a comprehensive series of tests, we can confidently assert that our main finding on the increased probability of returning to full DI is highly robust across specifications. Our analysis also reveals a significant increase in the likelihood of returning to full-time employment, although this effect is somewhat more sensitive to alternative specifications. Crossing the salary kink—where the daily marginal implicit tax rate increases by 30 percentage points—has no effect on the other possible exit reasons, which are independent of beneficiaries' labour supply decisions.

Table B1. Sensitivity analysis for the density function: Regressions using triangular and Epanechnikov density functions

	(1)	(2)	(3)	(4)
	Return to full DI	Return to full DI	Return to full employment	Return to full employment
Density function	Triangular	Epanechnikov	Triangular	Epanechnikov
β	0.020**	0.023**	0.007	0.007
	(0.011)	(0.010)	(0.007)	(0.007)
Robust CI	[0.004,0.066]	[0.011,0.071]	[-0.007,0.033]	[-0.005,0.034]
Mean	0.067	0.067	0.033	0.033
Covariates	NO	NO	NO	NO
Observations	20,439	20,439	20,439	20,439
Eff observations	7,805	7,805	7,805	7,805

Notes: All the coefficients reported are calculated from independent local polynomial nonparametric regressions, using a linear trend (polynomial of order 1), a defined symmetric bandwidth of 9 euros and a triangular kernel functional form for columns 1 and 3, and an Epanechnikov functional form for columns 2 and 4. Treatment effects coefficients stem from equation (2), which is the result of dividing the coefficient estimated by RKD of equation (3) by the deterministic first stage value of 0.3. The coefficients show the estimated effect of a 1 euro increase in the implicit marginal taxation on two different outcomes (columns 1 and 2: the probability of returning to DI; columns 3 and 4: the probability of resuming full-time employment). Standard errors are in parentheses. We report robust confidence intervals. The column "Mean" reports the average of the dependent variable within the defined bandwidth. Significance levels: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

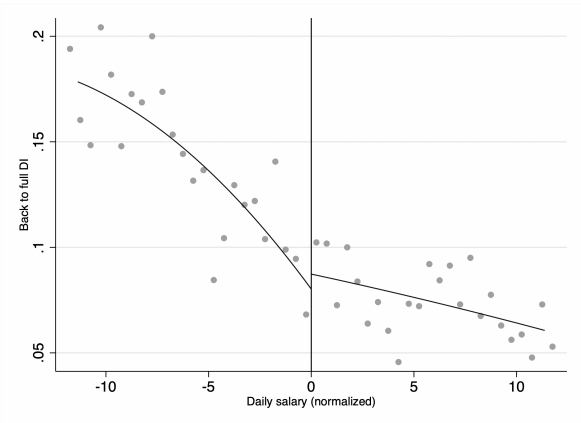
Table B2. Sensitivity analysis for the choice of bandwidth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bandwidth	7.5	8	8.5	9	9.5	10	11
Panel A: Outcome: Probability of returning to full DI (stop working entirely)							
β	0.021*	0.030***	0.033***	0.030***	0.028***	0.030***	0.023***
	(0.012)	(0.011)	(0.010)	(0.009)	(0.009)	(0.008)	(0.006)
Observations	20,439	20,439	20,439	20,439	20,439	20,439	20,439
Eff. obs.	5,924	6,298	6,672	7,140	7,514	7,889	8,656
Panel B: Outcome: Probability of returning to full employment							
β	0.005	0.006	0.015**	0.015**	0.016***	0.015***	0.015***
	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)	(0.004)
Observations	20,439	20,439	20,439	20,439	20,439	20,439	20,439
Eff. obs.	5,924	6,298	6,672	7,140	7,514	7,847	8,656

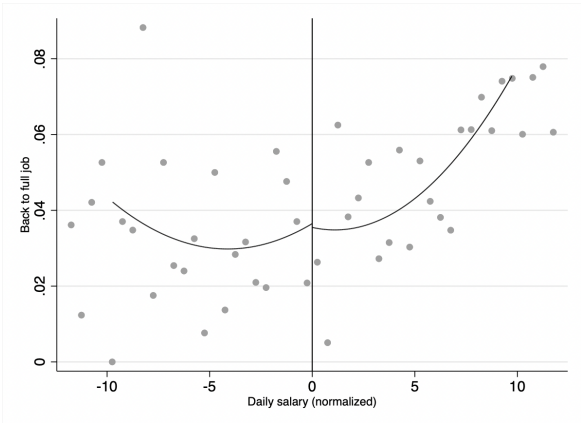
Notes: All the coefficients reported are calculated from independent local polynomial nonparametric regressions, using a linear trend (polynomial of order 1), a wide range of different defined symmetric bandwidths, and a uniform kernel functional form. Treatment effects coefficients report the result of equation (2), which is obtained by dividing the coefficient estimated by RKD of equation (3) by the deterministic first stage value of 0.3. The coefficients show the estimated effect of a 1 euro increase in the implicit marginal taxation on the two different outcomes. Standard errors are in parentheses. Regressions do not include covariates. In Panel A column (4) reports the optimal bandwidth (9.06 instead of 9), while in Panel B the optimal bandwidth, in column (6), corresponds to 9.95 (instead of 10). Significance levels: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Figure B1. Sensitivity analysis for the functional form: Plots using quadratic polynomial

Panel A: Probability of returning to full DI



Panel B: Probability of resuming full-time work



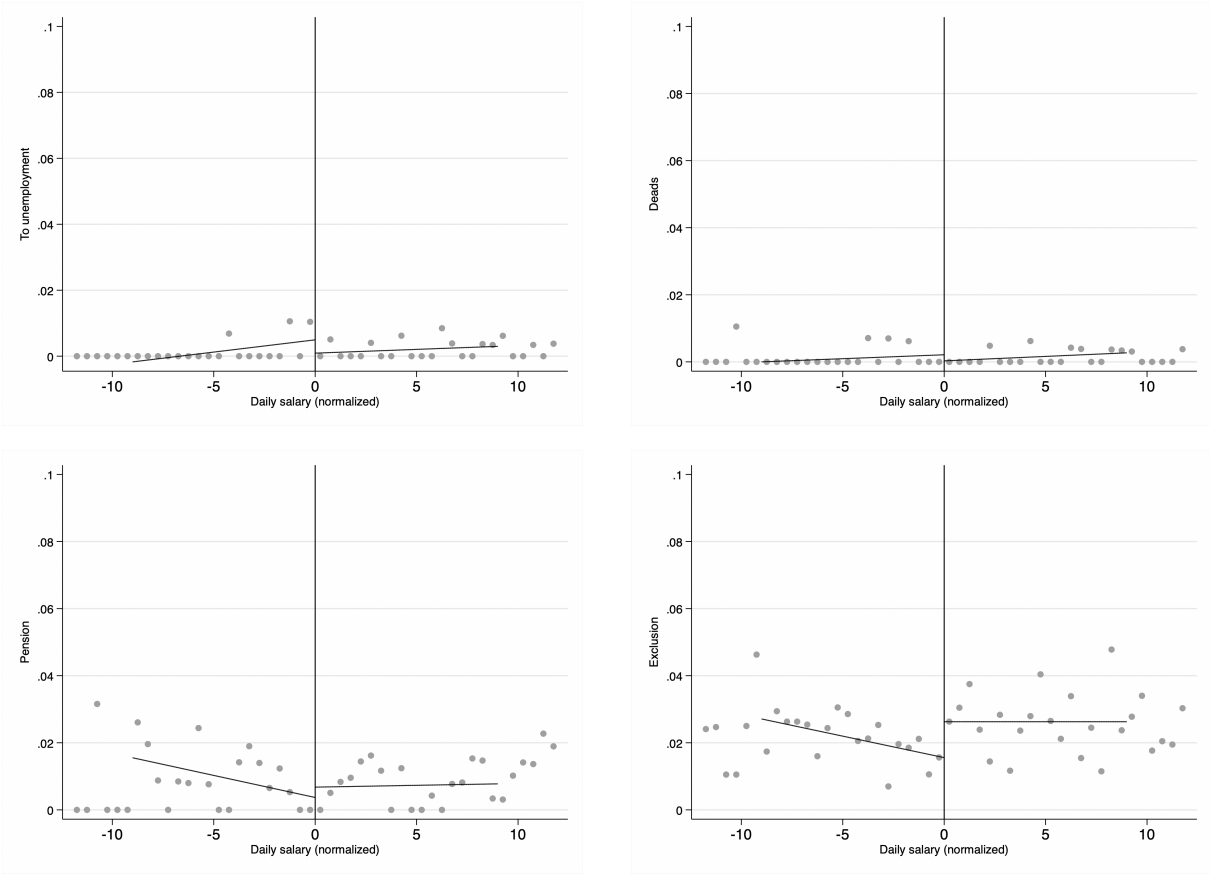
Notes: Horizontal axis plots normalized salary (relative to the kink) in 0.5-euro bins at each side of the cut-off. The bandwidth used are those proposed by the data-driven selector for each outcome. The vertical axis plots the mean of the outcome variable (the probability of returning to DI, or the probability of resuming full-time employment) in each bin. The quadratic lines display the underlying relationship on each side of the kink, using a polynomial of order 2. The vertical line indicates the salary kink.

Table B3. Sensitivity analysis for the functional form: Regressions using quadratic polynomial

	(1)	(2)
	Return to full DI	Return to full employment
Density function	Quadratic	Quadratic
β	0.057*	-0.007
	(0.033)	(0.024)
Mean	0.082	0.080
Covariates	NO	NO
Observations	36,778	36,778
Eff observations	10,137	14,647

Notes: All the coefficients reported are calculated from independent local polynomial nonparametric regressions, using a quadratic trend (polynomial of order 2), a defined symmetric bandwidth of 11.369 euros in column 1 and 9.727 euros in column 2, as suggested by the data-driven selector for each regression, and a uniform kernel functional form. Treatment effects coefficients stem from equation (2), which is the result of dividing the coefficient estimated by RKD of equation (3) by the deterministic first stage value of 0.3. The coefficients show the estimated effect of a 1 euro increase in the implicit marginal taxation on two different outcomes (column 1: the probability of returning to DI; column 2: the probability of resuming full-time employment). Standard errors are in parentheses. The column "Mean" reports the average of the dependent variable within the defined bandwidth. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Figure B2. Placebo tests: other reasons for exiting AWP



Notes: The horizontal axis plots normalized salary from the adapted work (relative to the kink), using 0.5 euro per bin and a bandwidth of 9 euros. The vertical axis plots the mean of the outcome variable (exiting AWP because: unemployment, death, pension or exclusion) in each bin. The straight lines display the underlying relationship on each side of the kink. The vertical line indicates the salary kink.

Table B4. Placebo tests: other reasons for exiting AWP

	(1) Unemployment	(2) Death	(3) Retirement	(4) Exclusion
β	-0.002	0.000	0.005	0.004
	(0.002)	(0.001)	(0.003)	(0.005)
Robust CI	[-0.011,0.001]	[-0.002,0.004]	[0.001,0.022]	[-0.002,0.034]
Covariates	NO	NO	NO	NO
Observations	20,439	20,439	20,439	20,439
Eff observations	7,805	7,805	7,805	7,805

Notes: All the coefficients reported are calculated from independent local polynomial nonparametric regressions, using a linear trend (polynomial of order 1), a defined symmetric bandwidth of 9 euros and a triangular kernel functional form. Treatment effects coefficients stem from equation (2), which is obtained by dividing the coefficient estimated by RKD of equation (3) by the deterministic first stage value of 0.3. The coefficients show the estimated effect of a 1 euro increase in the implicit marginal taxation on four different outcomes (the probability of exiting AWP due to unemployment, death, exclusion from the program, or reaching retirement age). Standard errors are in parentheses. We report robust confidence intervals. The column "Mean" reports the average of the dependent variable within the defined bandwidth. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

C Theoretical Framework

To rationalize the heterogeneous behavioral responses to an increase in the implicit marginal tax rate on earnings within the disability insurance (DI) scheme, we develop a simple static labor supply model with discrete choices at the extensive margin. The model considers how a given individual's optimal choice changes following an exogenous increase in the withdrawal rate of DI benefits. It formalizes the economic mechanism through which such a policy change may induce transitions both to full disability and to full-time employment, and provides a structured framework to interpret the heterogeneous empirical responses documented in the main text.

We consider a standard leisure–consumption framework with a budget constraint and smooth indifference curves. Individuals allocate a unit time endowment between leisure $L \in (0, 1)$ and work $1 - L$. Preferences over consumption C and leisure L are represented by a Cobb–Douglas utility function,

$$U(C, L) = C^{\alpha} L^{1-\alpha}, \qquad \alpha \in (0, 1), \tag{4}$$

which generates strictly convex indifference curves. The parameter α captures the relative weight placed on consumption, while $1 - \alpha$ reflects the relative preference for leisure.

The key difference from the canonical labor supply model is that leisure cannot be adjusted continuously at the intensive margin. Instead, individuals face a discrete choice set determined by institutional constraints. In particular, we consider three feasible labor market regimes:

- Full-time disability without work (denoted A),
- Part-time work combined with DI benefits (denoted P),
- Full-time work without DI (denoted F).

Let the wage be denoted by w and the DI benefit (in the absence of work) by A.

When working outside the DI scheme and receiving no benefits, consumption equals labor earnings,

$$C = w(1 - L). \tag{5}$$

When combining work and DI, benefits are withdrawn at marginal rate $t_0 \in (0, 1)$. The corresponding budget constraint is

$$C = A + (1 - t_0)w(1 - L) \tag{6}$$

We next consider a reform that raises the marginal withdrawal rate for all $L < 0.8$. The resulting budget constraint features the lower withdrawal rate t_0 for $0.8 < L \leq 1$ and the higher withdrawal rate t_1 for $L < 0.8$. For leisure levels below 0.8, the budget constraint can thus be written as

$$C = A + (1 - t_0)w(1 - 0.8) + (1 - t_1)w(0.8 - L) \tag{7}$$

The budget constraint outside the DI scheme exceeds the pre-reform DI budget constraint if

$$w(1 - L) > A + (1 - t_0)w(1 - L) \quad \Longleftrightarrow \quad L < 1 - \frac{A}{wt_0} \tag{8}$$

The budget constraint outside the DI scheme exceeds the post-reform DI budget constraint if

$$w(1-L) > A+(1-t_0)w(1-0.8)+(1-t_1)w(0.8-L) \quad \Longleftrightarrow \quad L < \frac{w\big(0.8t_1 + 0.2t_0\big) - A}{wt_1}. \tag{9}$$

C.1 Benchmark regime

We begin by considering a benchmark regime in which the withdrawal rate is fixed at $t = 0.5$. For illustrative purposes, we set $w = 10$ and $A = 4$, and allow that individuals can choose only between 3 values of leisure: $L = 1$ (A), $L = 0.6$ (P), and $L = 0.9$ (F). We have that consumption at F: $C_F = 10 * 0.9 = 9$ and at A: $C_A = 4$.

Under these assumptions, the budget constraint when combining work and DI becomes

$$C = 4 + 5(1 - L)$$

The pure labor earnings constraint is given by

$$C = 10(1 - L)$$

The two schedules intersect at the leisure level at which DI benefits are fully exhausted. Solving

$$4 + 5(1 - L) = 10(1 - L)$$

yields $L = 0.2$ and $C = 8$, which coincides with the inequality in equation 8. At this point, labor earnings are sufficiently high to exactly offset the DI benefit. For leisure levels $L < 0.2$, the individual receives no DI benefits and the relevant budget constraint

coincides with labor earnings,

$$C = 10(1 - L). \tag{10}$$

For $L > 0.2$, the individual combines work and DI and faces the implicit marginal withdrawal rate $t = 0.5$. The threshold at $L = 0.2$ therefore marks the point at which DI benefits are fully withdrawn.

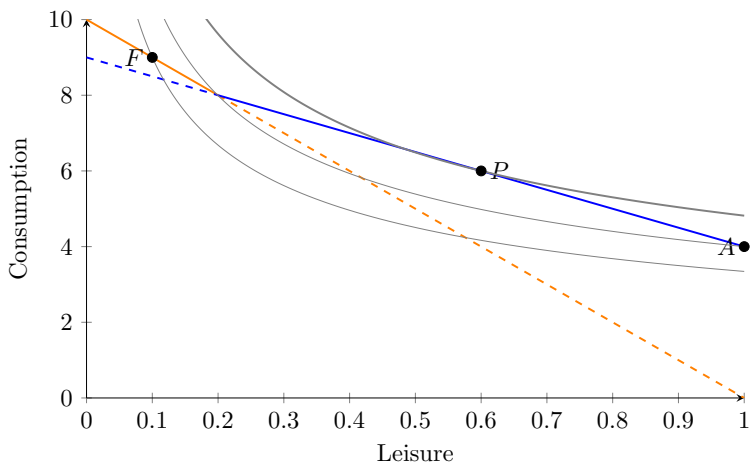


Figure C1. Benchmark budget constraints and optimal discrete choices. The blue line represents the budget constraint when combining work and DI benefits, while the orange line corresponds to labor earnings without DI. The gray curves represent convex indifference curves simulated from the Cobb–Douglas utility function.

Figure C1 illustrates this benchmark configuration. The blue line represents the budget constraint when combining work and DI benefits, while the orange line corresponds to labor earnings without DI. To the right of the threshold, individuals receive DI benefits and face the flatter segment of the budget constraint. To the left of the threshold, DI benefits are exhausted and the steeper earnings schedule applies. Preferences are represented by convex indifference curves derived from the Cobb–Douglas utility function introduced above. These curves are downward sloping and strictly convex, reflecting the standard trade-off between consumption and leisure. Their slope depends on the preference parameter α: higher values of α imply flatter indifference curves (lower relative weight on leisure), while lower values of α imply steeper indifference curves (higher relative weight on leisure).

Within this benchmark configuration, we restrict attention to the three discrete allocations corresponding to the institutional regimes. Full-time disability without work corresponds to $L = 1$ (point A). Part-time work combined with DI corresponds to $L = 0.6$ (point P). Full-time work without DI corresponds to $L = 0.1$ (point F).

The optimal allocation may depend on the preference parameter α or on the working capacity, proxied through wage rate w. For example, for sufficiently high preference for

leisure (low α, e.g. $\alpha < 0.6$), the indifference curve through A lies above those through P and F, implying full-time disability is optimal. For sufficiently low preference for leisure (high α, e.g. $\alpha > 0.8$), the indifference curve through F dominates and full-time work is optimal. For intermediate values (e.g. $\alpha = 0.7$), the highest attainable indifference curve passes through P, so part-time work combined with DI is optimal. The configuration illustrated in Figure C1 corresponds to such an intermediate value of α, for which part-time work combined with DI is optimal. Individuals with sufficiently different preference parameters would instead display indifference curves with a different slope, leading to optimal choices at A or F.

Formally, there exists an interval $(\underline{\alpha}, \overline{\alpha})$ such that for $\alpha \in (\underline{\alpha}, \overline{\alpha})$,

$$U(P) \succ U(A) \quad \text{and} \quad U(P) \succ U(F).$$

C.2 Policy change and heterogeneity in preferences:

We now consider a situation where agents have an increase in the marginal withdrawal rate from $t_0 = 0.5$ to $t_1 = 0.8$ for all $L < 0.8$. The objective is to analyze how the optimal choice changes for individuals with different preferences or different earnings capacities.

We start with the situation for agents with fixed wages and different preferences. To illustrate how an increase in the withdrawal rate may generate different exits paths, we use individuals whose preference parameter lies in the intermediate interval $(\underline{\alpha}, \overline{\alpha})$, that is, individuals who optimally choose part-time work (P) in the benchmark regime and a fixed wage at an intermediate level: $w = 10$. We then consider the optimal choice when the marginal withdrawal rate raises to $t_1 = 0.8$ for all $L < 0.8$.

We begin by showing that, in the first case, when the withdrawal rate is set uniformly at $t_0 = 0.5$, the optimal choice is always P for any value of $\alpha \in (0.6, 0.8)$. By contrast, in the second case, when marginal tax raises to t_1, P is optimal only for $\alpha = 0.7$, while the optimum is F for $\alpha = 0.8$ and A for $\alpha = 0.6$. This shows that an increase in the marginal withdrawal rate may lead to different, and even opposite, choices depending on individual preferences. We demonstrate this both numerically and graphically.

Pre-policy situation: uniform withdrawal rate at $t_0 = 0.5$.

We know the coordinated of the point $A(C, L)$ to be (4,1) and of point F to be (9,0.1). We use equation 6 to find the consumption level at point P (holding $L = 0.6$): $C_P = 4 + 0.5 * 10 * 0.4 = 6$, thus we have $P = (6, 0.6)$. Following equation 8, we know that consumption in the absence of DI benefits is larger if $L < (1 - \frac{4}{10*.5}) = 0.2$ as can be noted in Figure C1.

We consider the above mentioned three different α levels and calculate the utility at each point:

(i) Intermediate preference for leisure We use $\alpha = 0.7$ as an intermediate level of α:

Utility at A: $U_A = U(4,1) = 4^{0.7} * 1^{0.3} = 2.639$

Utility at P: $U_P = U(6,0.6) = 6^{0.7} * 0.6^{0.3} = 3.007$

Utility at F: $U_F = U(9,0.1) = 9^{0.7} * 0.1^{0.3} = 2.333$

$$U(P) \succ U(A) \succ U(F)$$

(ii) Low preference for leisure We use $\alpha = 0.8$:

Utility at A: $U_A = U(4,1) = 4^{0.8} * 1^{0.2} = 3.031$

Utility at P: $U_P = U(6,0.6) = 6^{0.8} * 0.6^{0.2} = 3.786$

Utility at F: $U_F = U(9,0.1) = 9^{0.8} * 0.1^{0.2} = 3.659$

$$U(P) \succ U(F) \succ U(A)$$

(iii) High preference for leisure We use $\alpha = 0.6$:

Utility at A: $U_A = U(4,1) = 4^{0.6} * 1^{0.4} = 2.297$

Utility at P: $U_P = U(6,0.6) = 6^{0.6} * 0.6^{0.4} = 2.389$

Utility at F: $U_F = U(9,0.1) = 9^{0.6} * 0.1^{0.4} = 1.488$

$$U(P) \succ U(A) \succ U(F)$$

For all these considered levels of α the preferred option is to work part-time and combine salary with benefits.

Post-policy situation: higher withdrawal rate at $t_1 = 0.8$ for $L < 0.8$.

As t affects only earnings when combining part-time work with DI benefits, point A and F remain unchanged. Importantly, the original part-time allocation P is no longer attainable under the new budget constraint. Holding working time fixed at $L = 0.6$, consumption falls vertically to a new point P' located on the flatter segment of the budget constraint.

We use equation 7 to find the consumption level at point P': $C_{P'} = 4 + (1 - 0.5) * 10 * (1 - 0.8) + (1 - 0.8) * 10 * (0.8 - 0.6) = 5.4$, thus we have $P' = (5.4, 0.6)$, which lies on the

new budget constraint. Following equation 9 we know that consumption in the absence of DI benefits is larger if $L < \frac{10*(0.64+0.1)-4}{10*0.8} = 0.425$.

Figure C2 illustrates this new configuration. Since we focus on individuals with $\alpha \in (\underline{\alpha}, \overline{\alpha})$, the benchmark optimal choice was P. After the increase in t, the optimal choice depends on the value of α, generating heterogeneous responses.

Since the reform is assumed to raise the withdrawal rate only for $L < 0.8$, the post-reform budget constraint is kinked. The higher withdrawal rate applies over the relevant range of leisure levels below the policy threshold. Over this segment, the budget line corresponds to the red segment in Figure C2.

For the same preference levels than before, three cases may arise:

(i) Intermediate preference for leisure. For intermediate values ($\alpha = 0.7$), the ranking becomes

$$U(P) \succ U(P') \succ U(A) \succ U(F)$$

As utility at P': $U_{P'} = U(5.4, 0.6) = 5.4^{0.7} * 0.6^{0.3} = 2.793$

Hence, $3.007 > 2.793 > 2.639 > 2.333$

In this case, although P is no longer attainable, P' yields higher utility than A and F, so the individual remains in part-time work under the new withdrawal rate. This situation is illustrated in Figure C2 (a).

(ii) Low preference for leisure. For individuals with relatively low preference for leisure (high $\alpha = 0.8$), the indifference curve is relatively flat. In this case, although P was preferred in the benchmark regime, the new ranking under the higher withdrawal rate becomes

$$U(P) \succ U(F) \succ U(P') \succ U(A)$$

As utility at P': $U_{P'} = U(5.4, 0.6) = 5.4^{0.8} * 0.6^{0.2} = 3.480$

Hence, $3.786 > 3.659 > 3.480 > 3.031$

Since P is no longer attainable under the new budget constraint, the individual chooses F. The policy change therefore induces a transition to full-time employment. This situation is illustrated in Figure C2 (b).

(iii) High preference for leisure. For individuals with relatively high preference for leisure (low $\alpha = 0.6$), indifference curves are steeper. Under the higher withdrawal rate, the ranking becomes

$$U(P) \succ U(A) \succ U(P') \succ U(F)$$

As utility at P': $U_{P'} = U(5.4, 0.6) = 5.4^{0.6} * 0.6^{0.4} = 2.242$

Hence, $2.389 > 2.297 > 2.242 > 1.488$

Since P is no longer feasible, the individual chooses A, implying a return to full-time disability. This case is illustrated in Figure C2 (c).

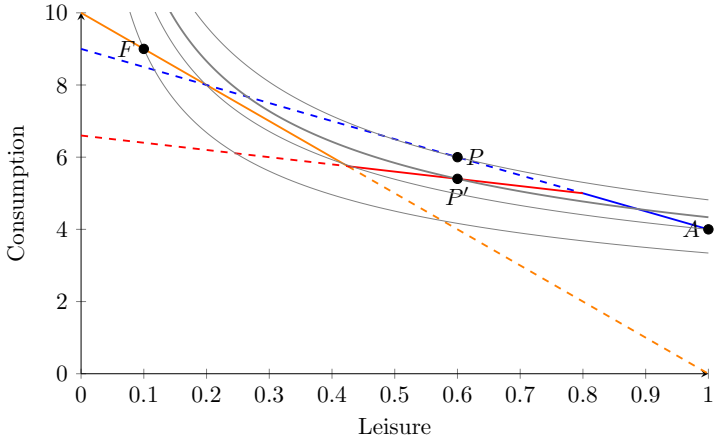
The model therefore predicts heterogeneous responses to an increase in the withdrawal rate. Among individuals who optimally chose P in the benchmark regime, some transition to full-time employment, others return to full disability, and a third group remains in part-time work at the adjusted allocation P'. The direction of this response depends on the preference parameter α.

C.3 Policy change and heterogeneity in earnings capacity:

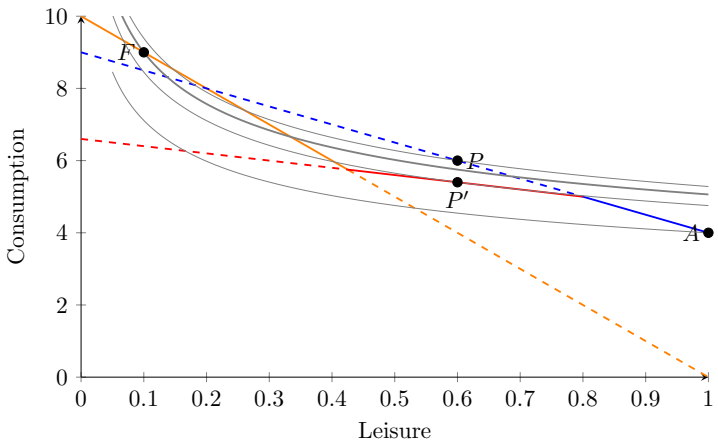
The heterogeneous responses illustrated above arise from differences in the preference parameter α. However, the same set of choices may also emerge when preferences are held fixed but individuals differ in their earnings capacity. In particular, individuals with identical preferences for leisure but different wage rates (a proxy for earnings capacity) face different opportunity costs of leisure and therefore different relative utilities of the allocations A, P' and F. As the wage rate increases, the consumption associated with working increases proportionally, which may alter the ranking of the feasible allocations.

Graphically, this implies that, instead of considering individuals with a common budget constraint but different indifference curves, one may alternatively consider individuals with common indifference curves but different initial budget constraints. Holding preferences fixed, a higher wage rate makes both the full-time earnings schedule and the part-time work schedule steeper, since the slope of the former is $-w$ and the slope of the latter is $-(1-t)w$. Thus, an increase in w raises the opportunity cost of leisure and rotates the budget constraints upward around point A, which remains unchanged because it depends only on the DI benefit level. Conversely, a lower wage rate has the opposite effect, making both budget segments flatter and reducing the opportunity cost of leisure. Figures C3 and C4 illustrates this alternative source of heterogeneity.

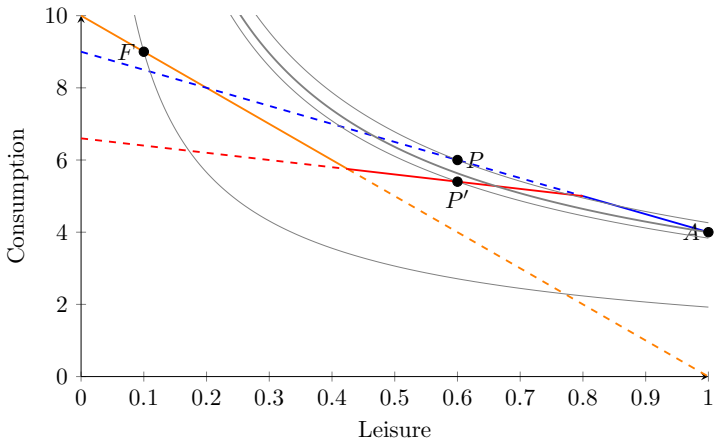
We now illustrate the reversed case than above. We set the leisure preference at an intermediate level: $\alpha = 0.7$ and consider three different wage levels (w). For each w, we show how in case the withdrawal rate is set uniformly at $t_0 = 0.5$ the optimal choice is P, while in the second case, when the withdrawal rate is increased to $t_1 = 0.8$, it is P' only for an intermediate wage level of $w = 10$, while it is F for a higher wage level of $w = 15$ and A for a lower wage level of $w = 6.5$, demonstrating that the increased marginal withdrawal rate may result in possibly opposing choices, depending on the wages.



(a) Intermediate preference for leisure ($\alpha = 0.7$, $1 - \alpha = 0.3$)



(b) Low preference for leisure ($\alpha = 0.8$, $1 - \alpha = 0.2$)



(c) High preference for leisure ($\alpha = 0.6$, $1 - \alpha = 0.4$)

Figure C2. Heterogeneous responses to an increase in the withdrawal rate from $t_0 = 0.5$ to $t_1 = 0.8$. In all panels, P is optimal in the benchmark regime. After the increase in t, the optimal choice depends on the preference parameter α.

Pre-policy situation: uniform withdrawal rate at $t_0 = 0.5$.

In this case, point A is fixed at (4,1) and it always report the same utility level, as it does not depend on wage rate. But the consumption level at point P (with $L = 0.6$) and point F (with $L = 0.1$) varies depending on the wage rate.

We consider the above mentioned three different w levels with $\alpha = 0.7$ fixed, and calculate the utility at each point:

(i) Intermediate wage level We use $w = 10$, and with $\alpha = 0.7$, this corresponds to case (i) in the previous sub-section.

Using equation 5, we know $C_F = 10*0.9 = 9$ and using equation 6, $C_P = 4+0.5*10*0.4 = 6$. Consumption in the absence of DI is higher if and only if $L < 1 - \frac{4}{10 \cdot 0.5} = 0.8$. Graphically, this corresponds to Figure C1.

Hence,

Utility at A: $U_A = U(4, 1) = 4^{0.7} * 1^{0.3} = 2.639$

Utility at P: $U_P = U(6, 0.6) = 6^{0.7} * 0.6^{0.3} = 3.007$

Utility at F: $U_F = U(9, 0.1) = 9^{0.7} * 0.1^{0.3} = 2.333$

$$U(P) \succ U(A) \succ U(F)$$

(ii) low wage level We use $w = 6.5$ (and $\alpha = 0.7$):

Using equation 5, we know $C_F = 6.5 * 0.9 = 5.85$ and using equation 6, $C_P = 4 + 0.5 * 6.5 * 0.4 = 5.3$. Consumption in the absence of DI is higher if and only if $L < 1 - \frac{4}{6.5 \cdot 0.5} = -0.233$. Since the threshold is negative, this condition is never satisfied over the feasible range of leisure choices, implying that consumption in the absence of DI is never higher in this case. Panel (a) of figure C3 shows the corresponding budget constraints, which never cross because the DI budget constraint is always above the budget constraint without DI over the relevant range.

Utility at A: $U_A = U(4, 1) = 4^{0.7} * 1^{0.3} = 2.639$

Utility at P: $U_P = U(5.3, 0.6) = 5.3^{0.7} * 0.6^{0.3} = 2.757$

Utility at F: $U_F = U(5.85, 0.1) = 5.85^{0.7} * 0.1^{0.3} = 1.726$

$$U(P) \succ U(A) \succ U(F)$$

(iii) high wage level We use $w = 15$ (and $\alpha = 0.7$):

Using equation 5, we know $C_F = 15 * 0.9 = 13.5$ and using equation 6, $C_P = 4 + 0.5 * 15 * 0.4 = 7$. Consumption in the absence of DI is higher if and only if $L < 1 - \frac{4}{15 \cdot 0.5} = 0.467$. This situation is represented in panel (a) of figure C4.

Utility at A: $U_A = U(4, 1) = 4^{0.7} * 1^{0.3} = 2.639$

Utility at P: $U_P = U(7, 0.6) = 7^{0.7} * 0.6^{0.3} = 3.350$

Utility at F: $U_F = U(13.5, 0.1) = 13.5^{0.7} * 0.1^{0.3} = 3.099$

$$U(P) \succ U(F) \succ U(A)$$

Post-policy situation: higher withdrawal rate at $t_1 = 0.8$ for $L < 0.8$.

This increase of taxation only affects to point P, as consumption at point A and F do not depend on t.

(i) Intermediate wage level We use $w = 10$, and with $\alpha = 0.7$, this still corresponds to case (i) post-policy situation in the previous sub-section, and it is represented in panel (a) of figure C2.

Using equation 5, we know $C_F = 10 * 0.9 = 9$ and using equation 7, $C_{P'} = 4 + 0.5 * 10 * 0.2 + 0.2 * 10 * 0.2 = 5.4$. Consumption in the absence of DI is higher if and only if $L < \frac{10(0.64+0.1)-4}{10 \cdot 0.8} = 0.425$.

Utility at P': $U_{P'} = U(5.4, 0.6) = 5.4^{0.7} * 0.6^{0.3} = 2.793$

Hence, $3.007 > 2.793 > 2.639 > 2.333$

$$U(P) \succ U(P') \succ U(A) \succ U(F)$$

In this case, although P is no longer attainable, P' yields higher utility than A and F, so the individual with intermediate preference level and intermediate wage remains in part-time work under the new withdrawal rate.

(ii) Low wage level set at $w = 6.5$

Using equation 5, we know $C_F = 6.5 * 0.9 = 5.85$ and using equation 7, $C_{P'} = 4 + 0.5 * 6.5 * 0.2 + 0.2 * 6.5 * 0.2 = 4.91$. Consumption in the absence of DI is higher if and only if $L < \frac{6.5(0.64+0.1)-4}{6.5 \cdot 0.8} = 0.156$.

Utility at P': $U_{P'} = U(4.91, 0.6) = 4.91^{0.7} * 0.6^{0.3} = 2.613$

Hence, $2.757 > 2.693 > 2.613 > 1.726$

$$U(P) \succ U(A) \succ U(P') \succ U(F)$$

Since P is no longer feasible, the individual chooses A, implying a return to full-time disability. Figure C3 illustrates the situation of the individual with low wage. In panel (a) we represent the situation before the policy change and in panel (b) the situation with the increased tax rate, where the optimal choice changes to A.

(iii) High wage level set at $w = 15$

Using equation 5, we know $C_F = 15 * 0.9 = 13.5$ and using equation 7, $C_{P'} = 4 + 0.5 * 15 * 0.2 + 0.2 * 15 * 0.2 = 6.1$. Consumption in the absence of DI is higher if and only if $L < \frac{15(0.64+0.1)-4}{15 \cdot 0.8} = 0.592$.

Utility at P': $U_{P'} = U(6.1, 0.6) = 6.1^{0.7} * 0.6^{0.3} = 3.042$

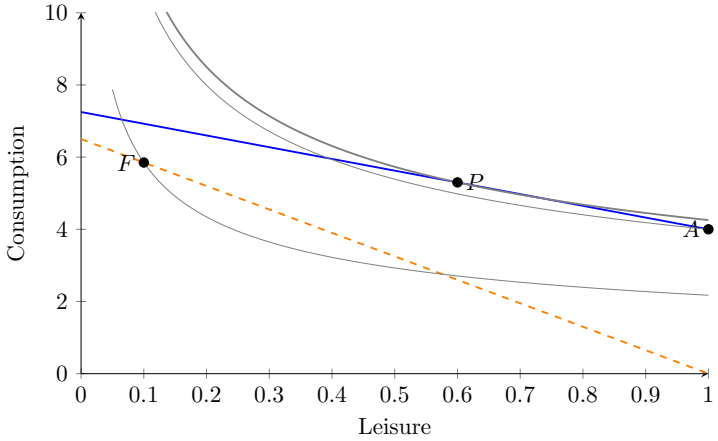
Hence, $3.350 > 3.099 > 3.042 > 2.639$

$$U(P) \succ U(F) \succ U(P') \succ U(A)$$

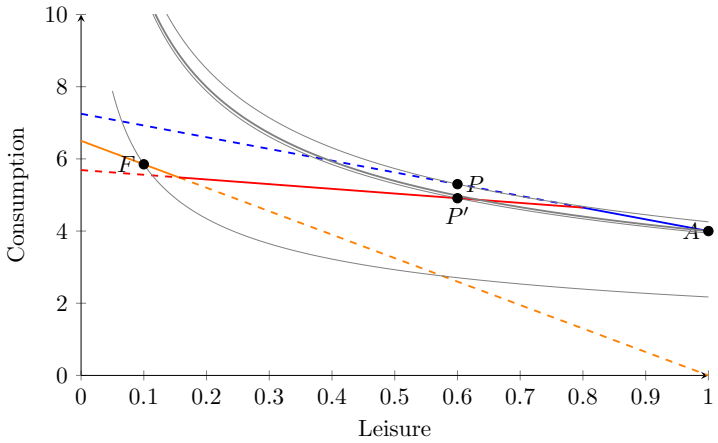
Since P is no longer attainable under the new budget constraint, the individual chooses F. The policy change therefore induces a transition to full-time employment. Figure C4 illustrates the situation of the individual with high wage, in panel (a) we represent the situation before the policy change and in panel (b) the situation with the increased tax rate, where the optimal choice changes to F.

This simple numerical illustration shows that, even holding preferences fixed, differences in wage rates alone may generate different post-reform exit paths. In particular, two individuals with different salaries may optimally choose part-time work in the benchmark regime, but after the increase in the withdrawal rate the lower-wage individual may return to full DI while the higher-wage individual may move to full-time employment. Utility at A does not depend on the wage rate, while utility at P' and F increases with w through higher consumption levels. For sufficiently low wages, the returns to work are small and A yields the highest utility. For intermediate wages, P' may dominate both A and F. For sufficiently high wages, the higher opportunity cost of leisure makes full-time work F optimal. Consequently, even with identical preferences, individuals with higher earnings capacity (and thus higher wages) may optimally choose to move to another point after a policy change.

The theoretical framework considers a counterfactual policy change for a given individual. In the empirical analysis, however, such a comparison is approximated by exploiting variation around the withdrawal threshold. Under the assumption that individuals can-

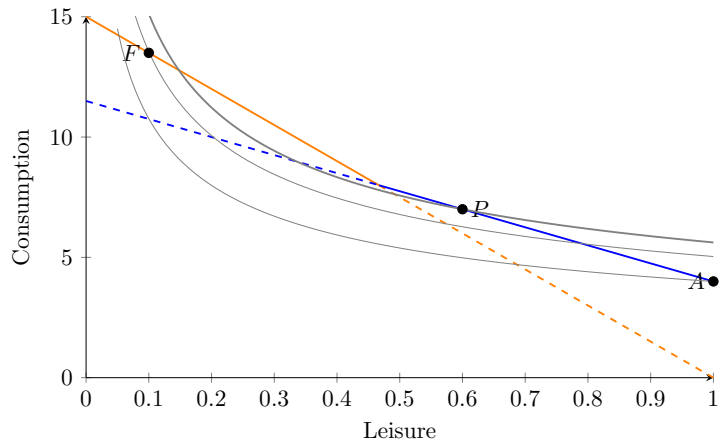


(a) Pre-policy situation: Intermediate preference for leisure and low wage

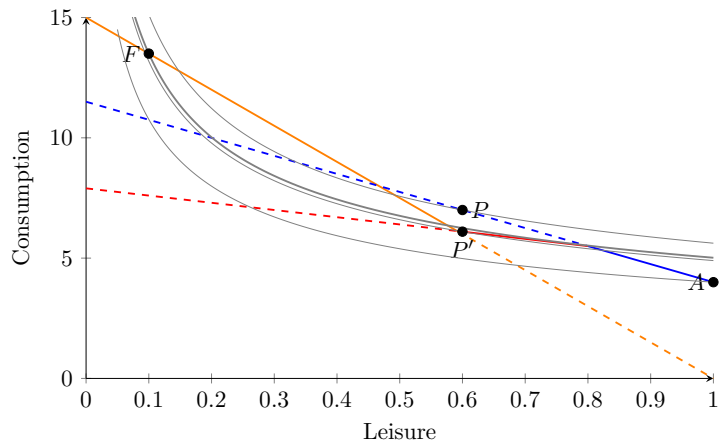


(b) Post-policy situation: Intermediate preference for leisure and low wage

Figure C3. Response to an increase in the withdrawal rate from $t_0 = 0.5$ to $t_1 = 0.8$ for an individual with intermediate preference level and low wage ($\alpha = 0.7$, $w = 6.5$).



(a) Pre-policy situation: Intermediate preference for leisure and high wage



(b) Post-policy situation: Intermediate preference for leisure and high wage

Figure C4. Response to an increase in the withdrawal rate from $t_0 = 0.5$ to $t_1 = 0.8$ for an individual with intermediate preference level and high wage ($\alpha = 0.7$, $w = 15$).

not sort precisely around this threshold, individuals located sufficiently close to it can be interpreted as comparable, allowing observed differences to approximate the causal response to a change in the implicit marginal tax rate.

D Additional Figures and Tables

Table D1. Evolution of the income brackets over time

Time	01/01/2011 to 30/04/2011	01/05/2011 to 31/08/2011	01/09/2011 to 31/12/2011	01/01/2012 to 31/01/2012	01/02/2012 to 30/06/2012	01/07/2012 to 31/08/2012
1st bracket	11.2652	11.4899	11.4899	15.0000	15.3004	15.3004
Next brackets	11.2652	11.4899	11.4899	9.0000	9.1803	9.1803

Time	01/09/2012 to 30/11/2012	01/12/2012 to 31/12/2012	01/01/2013 to 31/03/2013	01/04/2013 to 30/04/2013	01/05/2013 to 31/08/2013	01/09/2013 to 30/04/2014
1st bracket	15.3004	15.6068	15.6068	15.6068	15.6068	15.6068
Next brackets	9.1803	9.3641	9.3641	9.3641	9.3641	9.3641

Time	01/05/2014 to 31/08/2014	01/09/2014 to 31/03/2015	01/04/2015 to 30/04/2015	01/05/2015 to 31/08/2015	01/09/2015 to 31/12/2015	01/01/2016 to 31/03/2016
1st bracket	15.6068	15.6068	15.6068	15.6068	15.6068	15.6068
Next brackets	9.3641	9.3641	9.3641	9.3641	9.3641	9.3641

Time	01/04/2016 to 31/05/2016	01/06/2016 to 31/07/2016	01/08/2016 to 31/12/2016	01/01/2017 to 30/04/2017	01/05/2017 to 31/05/2017	01/06/2017 to 31/08/2017
1st bracket	15.6068	15.9190	15.9190	15.9190	15.9190	16.2372
Next brackets	9.3641	9.5514	9.5514	9.5514	9.5514	9.7423

Time	01/09/2017 to 30/09/2017	01/10/2017 to 31/12/2017	01/01/2018 to 30/04/2018	01/05/2018 to 30/06/2018	01/07/2018 to 31/08/2018	01/09/2018 to 31/12/2018
1st bracket	16.2372	16.2372	16.2372	16.2372	16.2372	16.5613
Next brackets	9.7423	9.7423	9.7423	9.7423	9.7423	9.9368

Time	01/01/2019 to 28/02/2019	01/03/2019 to 30/04/2019	01/05/2019 to 30/06/2019	01/07/2019 to 31/07/2019	01/08/2019 to 31/08/2019	01/09/2019 to 31/12/2019
1st bracket	16.5613	16.5613	16.5613	16.5613	16.5613	16.5613
Next brackets	9.9368	9.9368	9.9368	9.9368	9.9368	9.9368

Time	01/01/2020 to 29/02/2020	01/03/2020 to 30/04/2020	01/05/2020 to 31/12/2020
1st bracket	16.5613	16.8925	16.8925
Next brackets	9.9368	10.1355	10.1355

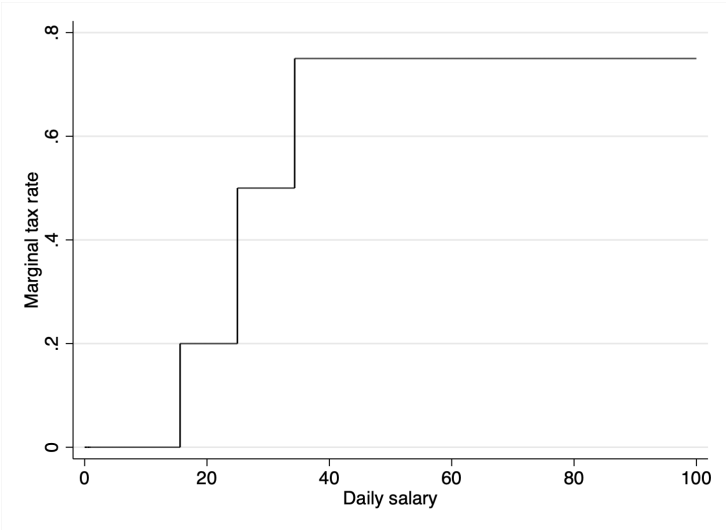
Source: NIHDI (2023).

Table D2. Baseline results: including medical diagnostic among the covariates

	(1) Remain AWP	(2) Days in AWP	(3) Return to full DI	(4) Return to employment
β	-0.060***	-4.072*	0.028***	0.012**
	(0.012)	(2.410)	(0.009)	(0.005)
Robust CI	[-0.171,-0.074]	[-17.168,1.750]	[0.012,0.087]	[-0.002,0.038]
Mean	0.831	238.50	0.067	0.033
Covariates	YES	YES	YES	YES
Observations	19,201	19,201	19,201	19,201
Eff observations	6,748	6,748	6,748	6,748

Notes: All the coefficients reported are calculated from independent local polynomial nonparametric regressions, using a linear trend (polynomial of order 1), a defined symmetric bandwidth of 9 euros and a uniform kernel functional form. Treatment effects coefficients stem from equation (2), which is obtained by dividing the coefficient estimated by RKD of equation (3) by the deterministic first stage value of 0.3. The coefficients show the estimated effect of a 1€ increase in the implicit marginal taxation per day worked on four different outcomes (column 1: the probability of remaining in AWP; column 2: the days in AWP; column 3: the probability of returning to DI; column 4: the probability of resuming full-time employment). Standard errors are in parentheses. We report robust confidence intervals. The column "Mean" reports the average of the dependent variable within the defined bandwidth. Covariates include region, age, gender, social status and pathology. Significance levels: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$.

Figure D1. Marginal tax rate at each level of salary



Note: This graphic represents the marginal tax rate applied at each level of salary. The horizontal axis represents the daily salary, and the vertical axis shows the corresponding marginal tax rate. There are three jumps, indicating the three changes of marginal tax rate (20%, 50% and 75%).