Petri Böckerman
Ohto Kanninen
Sami Jysmä

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Pre-analysis plan: The Causal Effects of the Finnish Guarantee Pension on Health

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TALOUDEN TUTKIMUS JA TYÖN
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We would like to thank the Social Insurance Institution of Finland (KELA) for financial support.

Petri Böckerman
Labour Institute for Economic Research LABORE
Email: petri.bockerman@labore.fi

Ohto Kanninen
Labour Institute for Economic Research LABORE
Email: ohto.kanninen@labore.fi

Sami Jysmä
Labour Institute for Economic Research LABORE
Email: sami.jysma@labore.fi

Helsinki, December 2025

ABSTRACT

This pre-analysis plan outlines the research design for estimating the causal effects of the Finnish guarantee pension—a minimum income floor for pension recipients—on mortality, morbidity, and prescription drug use. The 2011 reform generated a discrete change in the slope of the benefit schedule for low-income pensioners, creating a plausibly exogenous source of variation. We exploit this reform using a Difference-in-Kinks (DiK) estimator that compares changes in outcome gradients around the policy kink before and after the reform. The analysis is conducted using comprehensive Finnish administrative data from population registers, hospital records, prescription drug reimbursement databases, and pension and tax registers. Primary outcomes include all-cause mortality, inpatient hospital days, and annual prescription drug co-payments. Secondary analyses focus on alcohol-related mortality and mental-health-related medication use. We further examine the potential heterogeneity of the effects by gender. The PAP pre-specifies the hypotheses, outcome definitions, sample restrictions, identification assumptions, and estimation equations. All analyses will be implemented without additional controls, and all deviations from the pre-analysis plan will be transparently documented in the final study.

JEL Codes: I18, I38, H55, J14, C21

Keywords:
Guarantee pension, Difference-in-Kinks (DiK), Mortality, Morbidity

TIIVISTELMÄ

Ennakkoanalyysisuunnitelma: Suomen takuueläkkeen kausaaliset vaikutukset terveyteen

Tämä ennakkoanalyysisuunnitelma (PAP) kuvaa tutkimusasetelman, jonka avulla arvioidaan Suomen takuueläkkeen – pienituloisille eläkeläisille suunnatun vähimmäistulon – kausaalisia vaikutuksia kuolleisuuteen, sairastavuuteen ja lääkkeiden käyttöön. Vuoden 2011 takuueläkeuudistus muutti etuusasteikon kulmakerrointa pienituloisilla eläkeläisillä, mikä loi eksogeenisen vaihtelun lähteen. Hyödynnämme tätä uudistusta Difference-in-Kinks (DiK) -lähestymistavalla. Se vertaa vastemuuttujien kulmakertoimien muutoksia politiikkamuutoksen ympärillä ennen ja jälkeen uudistuksen. Analyysi perustuu kattaviin suomalaisiin rekisteriaineistoihin, kuten väestörekisteriin, sairaanhoitorekisteriin, lääkekorvausrekisteriin sekä eläke- ja verohallinnon rekistereihin. Tutkimuksen ensisijaiset vastemuuttujat ovat (kokonais)kuolleisuus, sairaalapäivien määrä ja lääkekustannusten omavastuuosuudet vuoden aikana. Toissijaiset analyysit keskittyvät alkoholiperäiseen kuolleisuuteen ja mielenterveyslääkkeiden käyttöön. Lisäksi tarkastelemme vaikutusten mahdollista eroa sukupuolen mukaan. PAP määrittelee etukäteen hypoteesit, vastemuuttujat, otosrajaukset, identifikaatio-oletukset ja estimointiyhtälöt. Kaikki analyysit toteutetaan ilman lisäkontrolleja, ja kaikki poikkeamat PAP-suunnitelmasta dokumentoidaan läpinäkyvästi lopullisessa tutkimuksessa.

JEL koodit: I18, I38, H55, J14, C21

Avainsanat:
takuueläke, Difference-in-Kinks (DiK), kuolleisuus, sairastavuus

Pre-Analysis Plan

Title: *The Causal Effects of the Finnish Guarantee Pension on Health*
Authors: Petri Böckerman, Ohto Kanninen, Sami Jysmä

1. Introduction

This study investigates how the Finnish minimum pension (the "guarantee pension") affects mortality, morbidity, and prescription drug use using register data. The guarantee pension represented a large income shock for low-income pensioners. The reform of 2011 altered the slope of the benefit schedule for low-income pensioners, enabling identification through a Difference-in-Kinks (DiK) estimator that exploits temporal variation in kink intensity. We register this PAP to pre-specify hypotheses, outcomes, and identification strategy.

2. Institutional background

In March 2011, Finland introduced the guarantee pension, shifting from a two-tier to a three-tier pension system. Tier 1 is the earnings-related pension, with accrual rates rising by age and flexible claiming rules between 62 and 68. Tier 2 is the national pension, a means-tested flat-rate benefit tapered against earnings-related pensions and typically claimed between ages 62 and 65.

The reform added tier 3, the guarantee pension, which ensures a minimum pension level for individuals whose combined tier 1 and tier 2 pensions fall below a set threshold (about €690 in 2011 and €750 in 2015). Claiming rules followed those of the national pension.

In our design, the combined tier 1 and tier 2 pension forms the running variable. The reform altered the slope of total pension with respect to this running variable: before 2011 the slope was 1 throughout, whereas after the reform it became 0 for those eligible for the guarantee pension, generating the differences-in-kinks identification strategy.

3. Hypotheses

H1: Guaranteed pension income reduces all-cause mortality.
H2: Higher minimum pension benefits reduce severe morbidity, measured by inpatient hospital days per year.
H3: Higher minimum pension benefits increase prescription drug use, consistent with the income effect.
H4: Alcohol-related mortality decreases due to guaranteed pension income.
H5: Effects differ between men and women.

4. Outcomes

4.1. Primary Outcomes (Table 1)

1. All-cause mortality
2. Total in-patient hospitalization days per year
3. Annual prescription drug co-payments in euros (based on reimbursement data from the Social Insurance Institution of Finland)
4. Observation window: 1 year

4.2. Secondary/exploratory Outcomes (Table 2)

1. Alcohol-related mortality
2. Annual mental-health related prescription drug co-payments in euros (based on reimbursement data from the Social Insurance Institution of Finland)
3. Observation window: 5 years (for primary outcomes only). Note: observation window for 4.2.1., and 4.2.2. is 1 year as in Table 1.

4.3. Heterogeneity Analyses (Table 3)

- Separately for women and men (for main outcomes only)

5. Identification Strategy

The 2011 reform changed the slope of the benefit schedule. Comparing slopes before and after identifies the causal effect of guarantee pension on health outcomes.

DiK method is described in detail at:

https://drive.google.com/file/d/1yF4uyNInNxed5rU-vKUVb-hffLDMpBfx/view

Assumptions:

- The kink in the policy rule changes from pre- to post-period and that these changes are known.

- There must be at least some individuals at the kink point.
- In the absence of the policy change, the limits of the derivative of the outcome from above and below would have evolved in the same way. This is the key identifying assumption in DiK and is analogous to the parallel trends assumption in DiD.
- No manipulation around kink
- Additional technical regularity conditions

6. Estimation Equations based on DiK

The equations

$$\sum_{i=1}^{n_t^{\pm}} \left[Y_{i,t}^{\pm} - \sum_{j=0}^{p} \beta_{j,t}^{\pm} \left(v_{i,t}^{\pm}\right)^j - \gamma_t \right]^2 K\left(\frac{v_{i,t}^{\pm}}{h}\right),$$

for $t \in \{0,1\}$ and $\pm \in \{+,-\}$ are the local polynomial regression equations used to estimate the DiK estimand.

- $Y_{i,t}^{\pm}$ is the outcome (e.g. mortality, hospital days, prescription drug use) for individual i in period t either $(-)$ below or above $(+)$ the threshold.
- $v_{i,t}^{\pm}$ is the running variable (annual pension without guaranteed pension, normalized at the kink)
- p is the order of the fitted polynomial (we will use order 1 in our main specifications)
- γ_t are year fixed effects
- K is the kernel (we will use a uniform kernel)
- h is the bandwidth

Running this local polynomial regression for $t \in \{0,1\}$ and $\pm \in \{+,-\}$, the sharp DiK estimator is defined as

$$\hat{\tau}_{SDiK} = \frac{\left[\hat{\beta}_{1,1}^{+} - \hat{\beta}_{1,0}^{+}\right] - \left[\hat{\beta}_{1,1}^{-} - \hat{\beta}_{1,0}^{-}\right]}{\left[\kappa_1^{+} - \kappa_0^{+}\right] - \left[\kappa_1^{-} - \kappa_0^{-}\right]},$$

where $\kappa_t^{\pm}$ is the known derivative of the policy schedule $b_t(v)$ in period t from below $(-)$ or above $(+)$ the threshold.

7. Controls

- DiK model does not include controls except year indicators.

8. Robustness checks

- Placebo kink
- Follow-up period length
- Local polynomial regression with polynomial order 2
- For Table 1 in the main text, otherwise in online appendix.

8. Data Sources

- Statistics Finland (FOLK)
- The Social Insurance Institution of Finland
- The Finnish Institute for Health and Welfare (HILMO/Avohilmo)
- The Finnish Centre for Pensions
- Finnish Tax Administration

9. Sample Restrictions

- Individuals age 65+
- Self-employed excluded
- Missing data excluded
- No trimming unless misreporting detected
- No method for estimating an optimal bandwidth around the threshold exists yet. We will provide estimates for a wide range of bandwidths.

10. Treatment Definition

Treatment is defined mechanically by eligibility and proximity to the guarantee pension kink. The pre-treatment threshold is assumed to be the 2011 level backed up at the index changes (national pension index), which governs the benefit rule changes after the introduction of the guarantee pension.

11. Pre-registration and Versioning

The PAP will be uploaded to the AEA Social Science Registry before analysis. All deviations from PAP will be documented in the article.

12. Concluding remarks

This pre-analysis plan establishes a transparent and pre-specified framework for estimating the health impacts of the Finnish guarantee pension using a Difference-in-Kinks design. By committing to these hypotheses, outcomes, and estimation procedures in advance, we aim to ensure credible causal inference and strengthen the integrity of the final study.

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Työn ja talouden tutkimus LABORE
Arkadiankatu 7 (Economicum)
00100 Helsinki
Puh. +358 40 940 1940
labore.fi

ISBN 978-952-209-233-5 (verkkojulkaisu)
ISSN 2984-2158 (verkkojulkaisu)