

# Does Secondary Education Affect Mental Health: Evidence from a Regression Discontinuity Design

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- Recent years have seen sharp increases in reported symptoms of depression, anxiety, and psychological distress among youth (Liu et al., 2025)

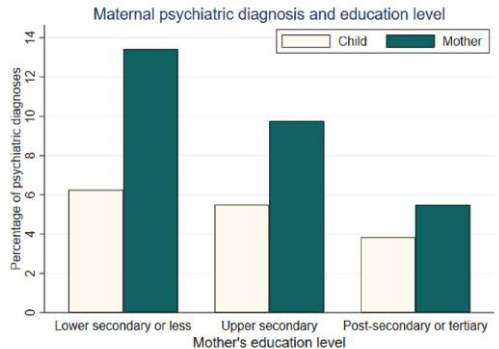
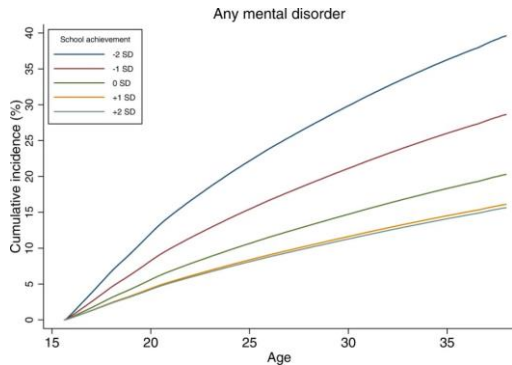
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  - Associated with reduced human capital accumulation, lower labor market productivity, and increased healthcare utilization (Dalsgaard et al., 2020; Lundborg et al., 2014; Mousteri et al., 2019).

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- How does education contribute to these trends?
  - Especially secondary education, as tracked secondary education systems that divide students into vocational and general tracks are common across many high-income countries (OECD, 2023)
  - Globally, nearly 50% of those who will ever receive mental health diagnosis are first diagnosed in late adolescence, by age 18 (Solmi et al., 2022)

# Association between education and mental health ([Weckström et al., 2023](#); [Vaalavuo et al., 2022](#))



- Causal relationship or driven by selection? Can we improve mental health by improving educational opportunities, access to education, etc.?

- we study the impact of secondary school admission on mental health using a regression discontinuity (RD) design and Finnish register data
  - School-program-year specific thresholds: admission score of the last applicant admitted to a given program
  - we build on earlier literature utilizing similar setting ([Bütikofer et al., 2023](#); [Huttunen et al., 2023](#); [Johnsen and Jansen, 2024](#); [Kuuppelomäki, 2021](#); [Ollikainen et al., 2024](#); [Silliman and Virtanen, 2022](#))
- we focus on two margins among the first-time applicants during the years 2008–2013:
  - 1 admission to vocational secondary education versus no admission (*vocational margin*), and
  - 2 admission to general secondary education versus vocational education (*general margin*)



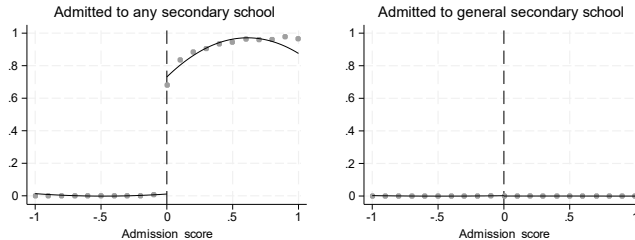
- Admission to vocational education (vs. no admission) reduces psychotropic drug use by 6.5 percentage points (-21%) within seven years.
- Admission to general (vs. vocational) education reduces specialized mental health healthcare visits by 4.5 percentage points (-21%) within seven years.

# Data & Identification

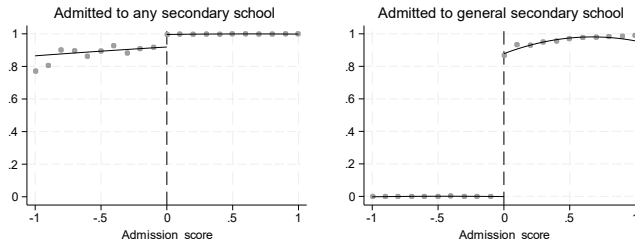
- Finnish Joint Application Registry administrated by Statistics Finland (EDUC-TYHR): first-time applicants applying in spring in 2008-2013 (N=361,932)
- FOLK-modules: data on completed degrees, labor market position and income, as well as parents, cohabitation and marriage, living conditions and demographic characteristics
- KELA: psychotropic drug use from the prescription register (Appendix 1)
- THL: mental health related healthcare use from the Care Register (Appendix 1)

# The probability of secondary school admission

Panel A: Vocational margin

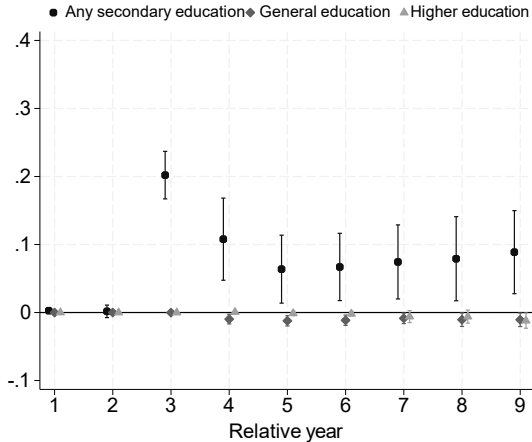


Panel B: General margin



# The effect of crossing the threshold on completed degrees

Panel A: Vocational margin



Panel B: General margin

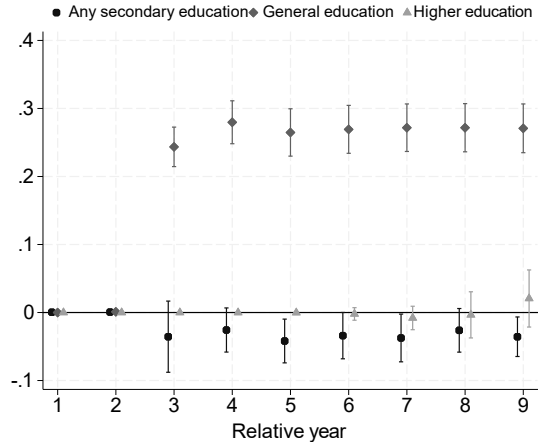
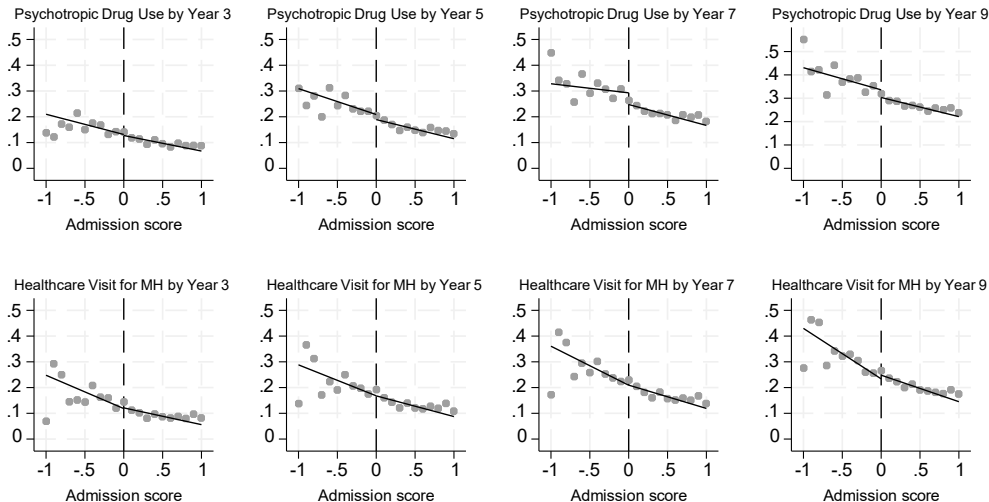


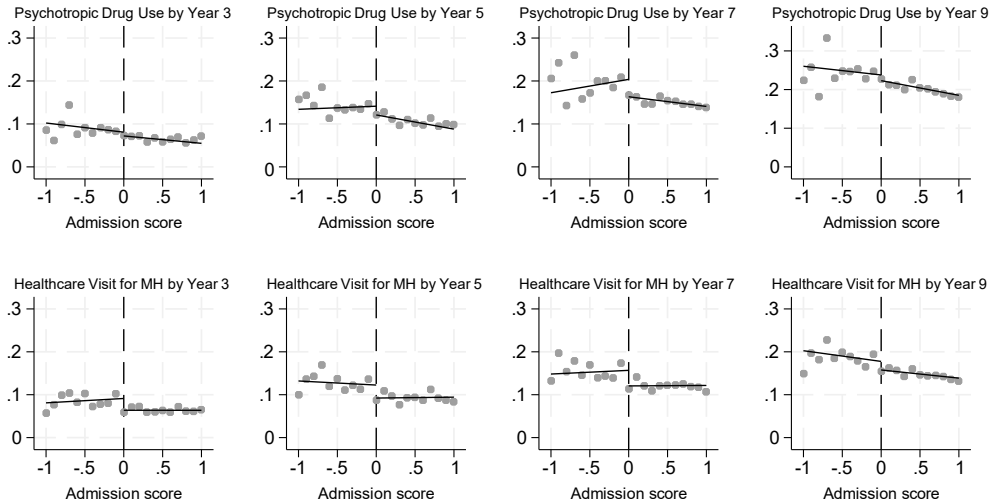
Figure: The effect of crossing the threshold on completed degree

# Main results

## Panel A: Vocational margin



## Panel B: General margin





# Main estimates on mental health (cumulative incidence)

|   | Year 3                  | Year 5                 | Year 7                  | Year 9               |
|---|-------------------------|------------------------|-------------------------|----------------------|
| <b>Panel A: Vocational margin</b>         |                         |                        |                         |                      |
| <i>Psychotropic drug use</i>              |                         |                        |                         |                      |
| Reduced form                              | .008 (-.071, .034)      | -.002 (-.11, .043)     | -.038*** (-.183, -.029) | -.019* (-.138, .008) |
| Counterfactual outcome                    | .129                    | .207                   | .301                    | .337                 |
| First stage                               | .605*** (.489, .57)     | .605*** (.489, .57)    | .605*** (.489, .57)     | .605*** (.489, .57)  |
| LATE: Admitted                            | .014 (-.115, .058)      | -.003 (-.181, .071)    | -.063*** (-.31, -.056)  | -.031* (-.231, .009) |
| <b>Observations</b>                       | 8274                    | 8252                   | 8228                    | 8209                 |
| <i>Healthcare visit for mental health</i> |                         |                        |                         |                      |
| Reduced form                              | .043* (-.007, .128)     | .033 (-.039, .097)     | .022 (-.073, .073)      | .034 (-.078, .093)   |
| Counterfactual outcome                    | .096                    | .155                   | .203                    | .23                  |
| First stage                               | .605*** (.489, .57)     | .605*** (.489, .57)    | .605*** (.489, .57)     | .605*** (.489, .57)  |
| LATE: Admitted                            | .071* (-.004, .221)     | .054 (-.058, .168)     | .036 (-.116, .125)      | .056 (-.121, .161)   |
| <b>Observations</b>                       | 8274                    | 8252                   | 8228                    | 8209                 |
| <b>Panel B: General margin</b>            |                         |                        |                         |                      |
| <i>Psychotropic drug use</i>              |                         |                        |                         |                      |
| Reduced form                              | -.007 (-.059, .021)     | -.014 (-.079, .024)    | -.035 (-.122, .043)     | -.015 (-.104, .084)  |
| Counterfactual outcome                    | .088                    | .151                   | .215                    | .249                 |
| First stage                               | .841*** (.771, .862)    | .841*** (.771, .862)   | .841*** (.771, .862)    | .841*** (.771, .862) |
| LATE: Admitted                            | -.009 (-.071, .025)     | -.017 (-.094, .028)    | -.042 (-.146, .049)     | -.017 (-.124, .099)  |
| <b>Observations</b>                       | 6023                    | 5998                   | 5976                    | 5938                 |
| <i>Healthcare visit for mental health</i> |                         |                        |                         |                      |
| Reduced form                              | -.033*** (-.105, -.024) | -.029** (-.103, -.005) | -.038*** (-.145, -.032) | -.016 (-.111, .014)  |
| Counterfactual outcome                    | .109                    | .14                    | .179                    | .196                 |
| First stage                               | .841*** (.771, .862)    | .841*** (.771, .862)   | .841*** (.771, .862)    | .841*** (.771, .862) |
| LATE: Admitted                            | -.039*** (-.127, -.029) | -.035** (-.123, -.007) | -.045*** (-.174, -.039) | -.019 (-.133, .016)  |
| <b>Observations</b>                       | 6023                    | 5998                   | 5976                    | 5938                 |

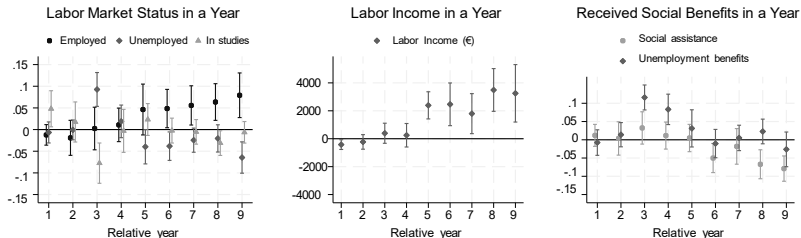
# Potential channels?

# Effect of crossing the threshold on enrollment and average peer characteristics

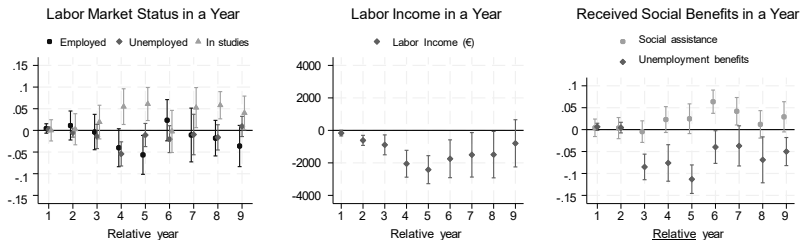
|  | Vocational margin             | General margin                   |
|--|-------------------------------|----------------------------------|
| <b>Enrollment</b>                                    |                               |                                  |
| Enrolled in any secondary school                     | .355*** (.212, .4)            | .096*** (.094, .222)             |
| Enrolled in general secondary school                 | -.022 (-.064, .01)            | .485*** (.399, .545)             |
| Enrolled in vocational secondary school              | .377*** (.227, .438)          | -.388*** (-.398, -.23)           |
| <b>Peer characteristics</b>                          |                               |                                  |
| fIPA among peers                                     | -.05 (-.181, .119)            | .566*** (.463, .64)              |
| Peers with secondary educated mothers                | -.008 (-.039, .07)            | .037*** (.017, .045)             |
| Peers with highly educated mothers                   | -.005 (-.042, .061)           | .081*** (.068, .099)             |
| Average income among peers' mothers                  | 675.072 (-3530.608, 2684.048) | 2224.392*** (1453.086, 2838.154) |
| Peers with secondary educated fathers                | .018 (-.039, .09)             | .064*** (.046, .076)             |
| Peers with highly educated fathers                   | -.009 (-.096, .026)           | .082*** (.061, .097)             |
| Average income among peers' fathers                  | 320.861 (-7007.811, 2583.745) | 3860.531*** (2529.207, 4474.102) |
| Peers with prior psychotropic drug use               | .018 (-.025, .088)            | -.01 (-.018, .008)               |
| Peers with prior healthcare visits for mental health | -.009 (-.121, .093)           | -.033*** (-.049, -.015)          |
| Observations   | 5030                          | 5616                             |

Notes: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . Note that the estimations on peer characteristics only include applicants who eventually gain access to secondary education by the end of the year despite the potential rejection in the first round. Individual level characteristics have been measured one year prior to the application year.

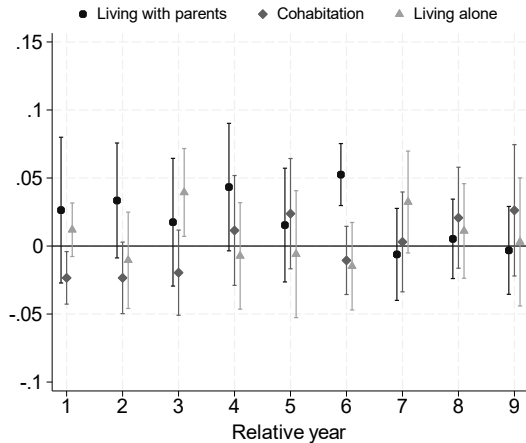
## Panel A: Vocational margin



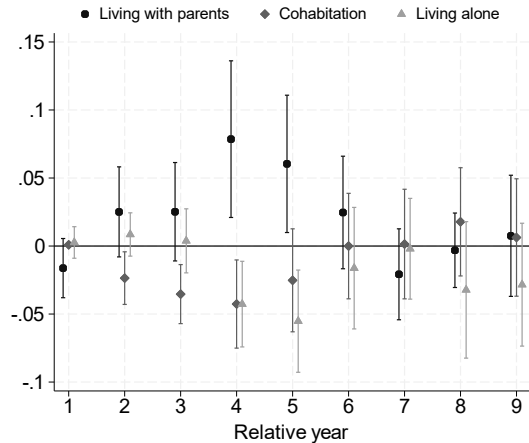
## Panel B: General margin



## Panel A: Vocational margin



## Panel B: General margin



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  - Improved labor market outcomes at later stage?
- Admission to a general secondary school instead of vocational school decreases mental health outcomes in the short term, **among those being at risk of rejection by their preferred general track**
  - Peers? Longer parental co-residence and reduced financial strain?

# What should we do?

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- Evidence from randomized controlled trials (RCT) suggests that school-based mental health interventions may effectively reduce depression and anxiety, particularly when implemented in secondary school environment and by certified healthcare professionals (Zhang et al., 2023).
- Given the resource constraints of education budgets, any decision to invest in school-based mental health programs should focus scarce resources on evidence based approaches

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# Appendices

## International Classification of Diseases

|  | ICD-9            | ICD-10               |
|--|------------------|----------------------|
| Any mental disorder  | 291*-316*        | F04*-F69*, F80*-F99* |
| Substance-use disorders  | 291-292, 303-305 | F10-F19              |
| Psychotic disorder   | 295*, 297*-299*  | F20*-F29*            |
| Mood disorder  | 296, 3004        | F30*-F39             |
| Bipolar disorders  | 2962-2967        | F30, F31             |
| Depressive disorders   | 2961, 3004A      | F32-F33, F341        |
| Anxiety disorder (incl. dissociative, stress-related, somatoform, and other nonpsychotic mental disorders) | 300*             | F40*-F489            |

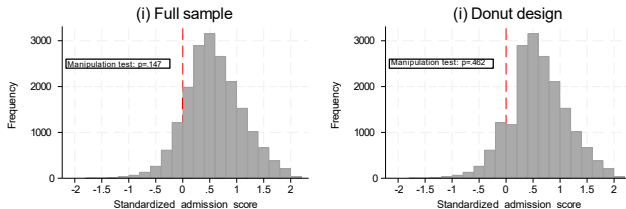
### Anatomical Therapeutic Chemical Classification

|                                    | ATC   |
|------------------------------------|-------|
| Antipsychotics                     | N05A  |
| Anxiolytics                        | N05B  |
| Hypnotics and sedatives            | N05C  |
| Antidepressants                    | N06A  |
| Antidepressants with psycholeptics | N06CA |

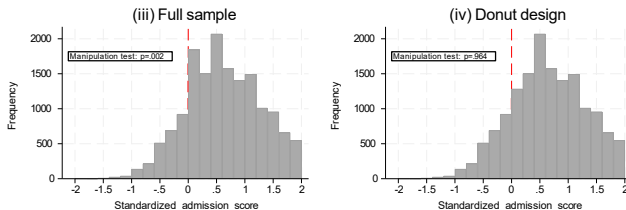
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# Distribution of the estimation samples across the admission score

Panel A: Vocational margin



Panel B: General margin





# Effect of crossing the threshold on pre-determined characteristics

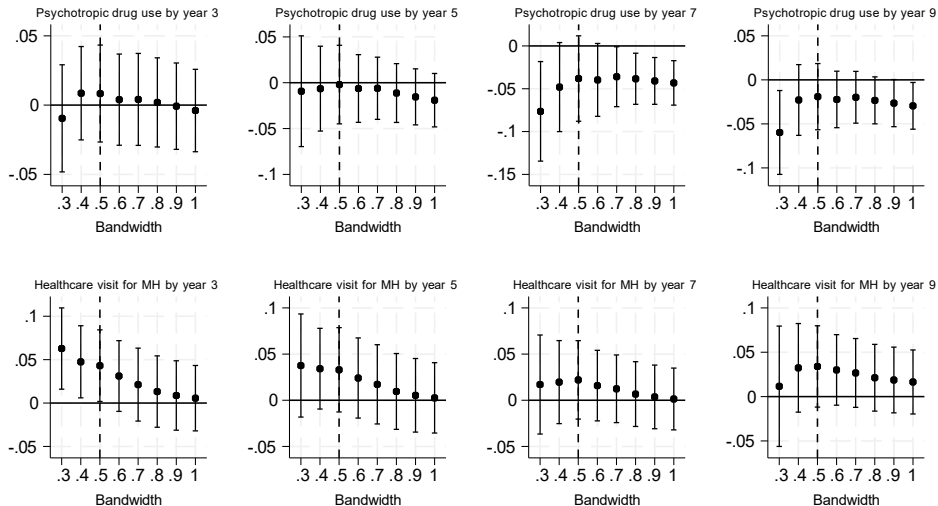
|   | Vocational margin              | General margin                  |
|---|--------------------------------|---------------------------------|
| fIPA                                      | .035 (-.052, .11)              | .002 (-.004, .011)              |
| Female                                    | .007 (-.109, .12)              | -.038 (-.122, .022)             |
| Lives in urban area                       | -.002 (-.023, .181)            | .001 (-.14, .023)               |
| Mother has secondary degree               | -.019 (-.091, .105)            | -.001 (-.065, .044)             |
| Mother has higher education degree        | -.002 (-.03, .082)             | .019 (-.036, .08)               |
| Mother's income                           | 609.429 (-1414.493, 4704.208)  | 1052.982 (-3784.637, 3403.087)  |
| Father has secondary education            | -.059 (-.188, .044)            | .02 (-.037, .114)               |
| Father has higher education degree        | -.008* (-.003, .059)           | .011 (-.062, .067)              |
| Father's income                           | -741.017 (-2576.757, 5659.998) | -1323.089 (-5131.065, 2228.006) |
| Ever used psychotropic drugs              | .028 (-.051, .151)             | .014* (-.004, .1)               |
| Ever visited healthcare for mental health | .016 (-.037, .149)             | -.006 (-.062, .05)              |
| Observations                              | 8302                           | 6036                            |

Notes: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

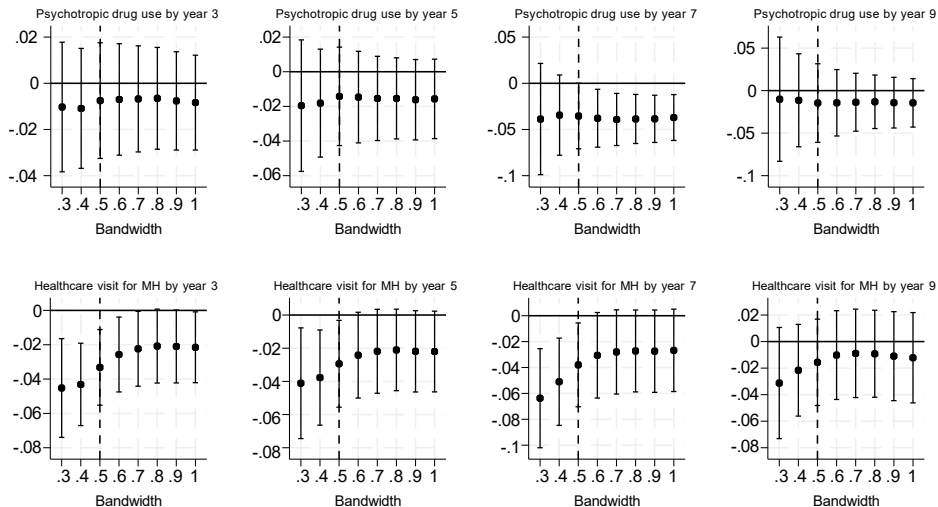
# Alternative specifications

|   | Year 3                | Year 5                 | Year 7                  | Year 9                 |
|---|-----------------------|------------------------|-------------------------|------------------------|
| <b>Panel A: Vocational margin</b>         |                       |                        |                         |                        |
| <i>Psychotropic drug use</i>              |                       |                        |                         |                        |
| Main estimate                             | .008 (-.071, .034)    | -.002 (-.11, .043)     | -.038*** (-.183, -.029) | -.019* (-.138, .008)   |
| Additional covariates                     | -.001 (-.084, .028)   | -.009 (-.123, .061)    | -.057** (-.192, -.02)   | -.044* (-.163, .006)   |
| Without fixed effects                     | .006 (-.086, .042)    | -.005 (-.127, .046)    | -.042*** (-.193, -.029) | -.024** (-.153, 0)     |
| <b>Observations</b>                       | 8274                  | 8252                   | 8228                    | 8209                   |
| Donut design                              | -.003 (-.096, .035)   | -.006 (-.112, .063)    | -.043** (-.188, -.008)  | -.031** (-.173, -.001) |
| <b>Observations</b>                       | 7459                  | 7439                   | 7419                    | 7401                   |
| Optimal window                            | .008 (-.037, .052)    | -.007 (-.072, .06)     | -.065** (-.155, -.005)  | -.027 (-.095, .025)    |
| <b>Observations</b>                       | 8274                  | 6440                   | 6417                    | 6399                   |
| <i>Healthcare visit for mental health</i> |                       |                        |                         |                        |
| Main estimate                             | .043* (-.007, .128)   | .033 (-.039, .097)     | .022 (-.073, .073)      | .034 (-.078, .093)     |
| Additional covariates                     | .027 (-.025, .11)     | .021 (-.037, .089)     | .004 (-.075, .05)       | .018 (-.084, .065)     |
| Without fixed effects                     | .039* (-.01, .133)    | .029 (-.045, .105)     | .02 (-.073, .083)       | .029 (-.092, .099)     |
| <b>Observations</b>                       | 8274                  | 8252                   | 8228                    | 8209                   |
| Donut design                              | .032* (-.011, .139)   | .022 (-.047, .12)      | .012 (-.076, .097)      | .024 (-.093, .106)     |
| <b>Observations</b>                       | 7459                  | 7439                   | 7419                    | 7401                   |
| Optimal window                            | .052*** (.021, .126)  | .034* (-.006, .101)    | .02 (-.032, .083)       | .032 (-.036, .103)     |
| <b>Observations</b>                       | 6454                  | 8252                   | 8228                    | 6399                   |
| <b>Panel B: General margin</b>            |                       |                        |                         |                        |
| <i>Psychotropic drug use</i>              |                       |                        |                         |                        |
| Main estimate                             | -.007 (-.059, .021)   | -.014 (-.079, .024)    | -.035 (-.122, .043)     | -.015 (-.104, .084)    |
| Additional covariates                     | -.012 (-.075, .01)    | -.015* (-.094, .008)   | -.038* (-.139, .011)    | -.011 (-.107, .057)    |
| Without fixed effects                     | -.01 (-.072, .031)    | -.02 (-.092, .023)     | -.04 (-.129, .036)      | -.014 (-.104, .088)    |
| <b>Observations</b>                       | 6023                  | 5998                   | 5976                    | 5938                   |
| Donut design                              | -.024** (-.106, -.01) | -.032** (-.137, -.016) | -.059* (-.174, .005)    | -.033 (-.148, .069)    |
| <b>Observations</b>                       | 5464                  | 5441                   | 5420                    | 5385                   |
| Optimal window                            | -.012 (-.045, .017)   | -.02 (-.067, .024)     | -.035 (-.094, .016)     | -.011 (-.078, .048)    |
| <b>Observations</b>                       | 4710                  | 3857                   | 4737                    | 5015                   |

## Panel A: Vocational margin



## Panel B: General margin



# Summary statistics

|   | All applicants | Vocational margin | General margin |
|---|----------------|-------------------|----------------|
| fIPA                                      | 7.69           | 6.76              | 7.78           |
| Admission score                           | 16.42          | 23.81             | 8.10           |
| Applied to general track                  | 0.65           | 0.00              | 1.00           |
| Applied to vocational track               | 0.59           | 1.00              | 1.00           |
| Applied to both types of tracks           | 0.24           | 0.00              | 1.00           |
| Female                                    | 0.50           | 0.40              | 0.43           |
| Lives in urban area                       | 0.66           | 0.81              | 0.77           |
| Mother has secondary degree               | 0.87           | 0.76              | 0.90           |
| Mother has higher education degree        | 0.21           | 0.08              | 0.24           |
| Mother's income                           | 34,170         | 31,235            | 35,342         |
| Father has secondary education            | 0.78           | 0.65              | 0.81           |
| Father has higher education degree        | 0.20           | 0.07              | 0.22           |
| Father's income                           | 41,372         | 35,021            | 43,207         |
| Foreign background                        | 0.03           | 0.06              | 0.03           |
| Ever used psychotropic drugs              | 0.14           | 0.17              | 0.13           |
| Ever visited healthcare for mental health | 0.12           | 0.20              | 0.09           |
| Observations                              | 361,932        | 19,141            | 17,155         |