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Does Broadband Technology Affect Social Security Applications?

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Abstract¹

Policymakers have recently been paying enormous attention to broadband connectivity in the US, with about \$65 billion allocated for high-speed internet across states. However, over 42 million Americans still lack internet connectivity, and a “digital divide” exists mainly in rural areas and low socioeconomic households. It is unclear whether broadband technologies affect an individual's likelihood of applying for Social Security Insurance (SSI) or Social Security Disability Insurance (SSDI). This paper evaluates whether better availability of broadband services affects the probability of applying for SSI and SSDI among the most vulnerable age group, i.e., older adults aged 50+. I leverage the quasi-experimental staggered rollout of high-speed broadband, combined with restricted individual panel data from the Health and Retirement Study (HRS), and exploit both spatial and temporal and individual-level variations in broadband availability. Employing the latest difference-in-differences (DID) estimator, I found broadband rollout statistically significantly increased the probability of applying for SSI and SSDI over time (dynamic treatment effect); however, there was a small and insignificant positive increase in the likelihood of applications as the average treatment effects (ATE). A back-of-the-envelope calculation suggests that broadband expansion added over 2,500 applicants for the SSI benefits 2018. The estimates from this paper highlight the unmeasured benefits of the broadband expansion and have important policy implications on policies related to SSI and SSDI and broadband availability.

Keywords: Broadband, SSI, SSDI

JEL Classification Codes: H55, J14, L86

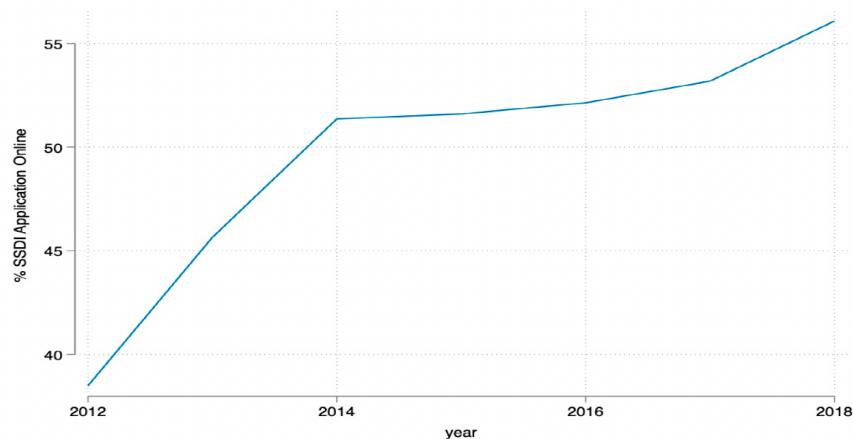
¹ I am grateful to my mentor, Carly Urban, for insightful guidance throughout this project. The feedback provided during the JSIT-2022 conference, particularly from J. Michael Collins, Jeremy Foltz, Mary Hamman, Sarah Halpern-Meekin, Justin Sydnor, and other JSIT-2022 participants, is also acknowledged with appreciation. I also thank Hallie Lienhardt for the valuable administrative support.

1. Significance

There are extensive administrative burdens for applying for Social Security benefits, including understanding eligibility and submitting paperwork and medical records. There could be an ambiguous effect of increasing these administrative burdens — only the people in dire need will apply for the benefits or opt out due to the high costs. Such administrative burdens are distributive, i.e., they affect some groups more than others, creating structural barriers (Herd & Moynihan 2019). Studies in behavioral economics suggest that these costs may discourage needy applicants (Bertrand et al. 2004). Especially for older adults (50+), these frictions could be a cornerstone for individuals deciding whether to apply for Social Security benefits.

We have made enormous technological progress in recent decades, providing access to computers, the Internet, and smartphones, with about 81 percent of households in 2016 having broadband connections (Ryan & Lewis 2017). However, more than 42 million Americans still lack access to broadband services, and significant geographical and socioeconomic disparities remain in broadband access (Busby et al. 2021). Figure 1 suggests that the percentage of people filling out online SSDI applications has been relatively consistent from 2014 onward, even after the increase in broadband technology. The COVID-19 period highlighted the urgent need for internet connectivity for employment, business, and other essential activities. Recent policies to expand broadband access, mainly in rural areas and low-income households, suggest stark disparities in technology access based on geography and income. At the same time, broadband availability for older adults is increasing. For instance, the availability of high-speed broadband for the 65+ population in 2010 was about 45 percent, but by 2018, it had become about 60 percent (Gawai, V. P. (2023)). However, it is unclear in the literature whether broadband availability increases the SSI or SSDI application rate, especially among older adults.

FIGURE (1) % of Total SSDI Applications Filled Online



Source: Author's calculation based on the publicly available data from the SSA.

This study is one of the first to provide causal evidence on whether better broadband access increases the probability of applying for SSI and SSDI benefits among older adults in the

US.² Specifically, I study whether broadband improves production efficiency and reduces the friction to apply for SSI and SSDI benefits. The paper employs a quasi-experimental design, using the staggered introduction of high-speed “fiber broadband” in census tracts, to evaluate broadband’s effects on the likelihood of applying for SSI and SSDI among older adults. I use the biennial waves from individual panel data of the Health and Retirement Study (HRS), a nationally representative study of individuals aged 51+. The analysis period is from 2010 to 2018, having over 11,000 person-year observations. The key dependent variable in my regressions is an indicator equal to one if the HRS respondent reports that they applied for the SSI and SSDI benefits during the survey year. I use two yearly data sets on broadband at the census tract level from 2010 to 2018. Merging individual panel HRS data with the broadband data at the census tract and year level allows me to exploit the spatial, temporal, and, importantly, individual-level variation in the staggered introduction of high-speed fiber broadband to estimate the intent to treat (ITT) effect. The new staggered difference-in-differences (DID) treatment estimator developed by Borusyak et al. (2021) forms the basis for my primary estimations because it addresses the negative weighting problems and does not rely on the strict assumption of homogeneity as commonly found in two-way-fixed-effects (TWFE) estimators.

I hypothesize that those with better internet availability are more likely to apply for SSI or SSDI benefits due to a reduction in the friction of application. The application cost may include the distance and time to visit SSA offices in person. For remote areas, these costs might be higher. So, the benefits of better internet might be saturated in rural areas. This is important to address the technological divide between urban and rural areas. On the other hand, the digital divide may exacerbate structural barriers among geographic locations with poor broadband connectivity and households with low socioeconomic status who might need access to these technologies, including training in internet literacy. Studies document that in-person assistance matters for low-income and low-education levels, even in online applications (Deshpande & Li 2019). Broadband access can promote the applications to SSI and SSDI benefits by reducing the distance and time.

This study finds that introducing high-speed fiber broadband technology positively affects the likelihood of applying for SSI and SSDI benefits over time (dynamic treatment effect) among older adults. I, however, find a statistically insignificant but positive effect in the average treatment effect (ATE). Specifically, I find a 0.4- and 0.2-percentage point increase in the likelihood of application for SSI and SSDI benefits, respectively. In 2018, there were over 640,000 applications for SSI benefits for the age group of 51 to 70.³ The estimates from this paper suggest an additional about 2,560 applicants for SSI benefits after the broadband expansion. These findings emphasize the need for policies that promote broadband expansion and more investments to understand other structural barriers involved in online applications for SSI and SSDI benefits.

One of SSA’s primary goals is to deliver services to the public effectively and efficiently. The causal evidence of whether broadband technology helps in this goal is unclear in the economics

² This paper is the extension of the Gawai, V. P. (2023), which studies the effect of broadband on mental health among older adults.

³ SSI Annual Statistical Report, 2018 for the SSI applicants.

literature. Butrica and Schwabish (2022) document the correlation between broadband and disability insurance awards, suggesting a weak correlation between these factors. Broadband access may be even more critical to reduce distance and time when SSA offices are not nearby. These costs might differ based on broadband availability and the ability to use those technologies. Studies document that broadband technology does not help 40 percent of older adults, and about 60 percent of individuals with less than high school education or residents of rural areas do not use the internet (Herd & Moynihan 2019).

Figures 2 and 3 show the share of the nationally representative sample of older adults who applied for SSI and SSDI benefits from 2010 to 2018. The application for SSDI declines after around 63 years, potentially due to OASI (Old-Age and Survivors Insurance) enrollment.

Figure 2: Share of Older Adults (50+) who Applied for SSI during Each Survey Year

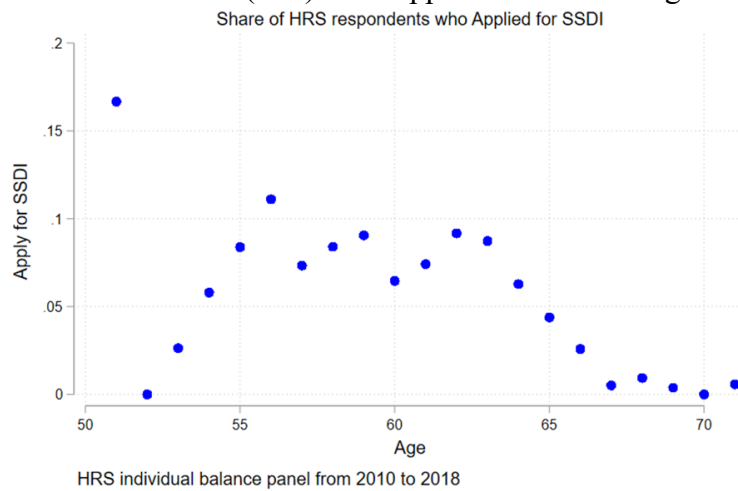
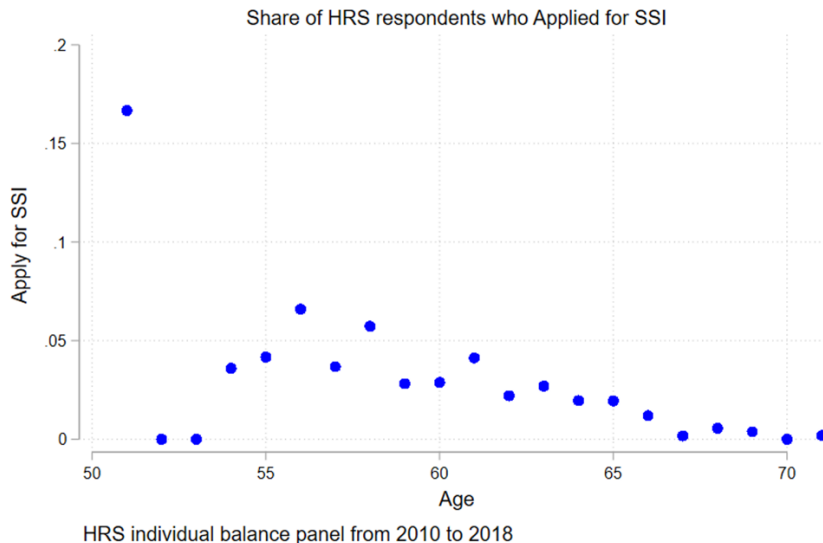


Figure 3: Share of Older Adults (50+) who Received SSDI during Each Survey Year



2. Literature Review

There is growing literature on information and broadband technology that could improve the take-up of social benefits. Research documents low enrollment rates among eligible recipients across various programs due to the need to be more aware of program availability and rules, which are barriers to taking up (Chetty et al. 2013). The information could be translated through peers (Dahl et al. 2014). The internet is a valuable tool for information, and evidence suggests that providing information increases the likelihood of enrollment in various welfare programs (Barr & Turner 2017; Notowidigdo 2016). Several recent studies suggest that informing likely-eligible individuals increases program enrollment (Armour 2018; Barr & Turner 2018; Bhargava & Manoli 2015; Finkelstein & Notowidigdo 2018). The only recent study I could find suggests that better internet access increases SSDI applications by about 1.6 percent and benefits rural areas more after the introduction of iClaim, an innovation in the online applications process (Foote et al. 2018). On the other hand, the complexity involved in using the internet or the lack of cognitive ability required to process online applications may discourage some applicants and create friction in the take-up of social benefit programs (Bhargava & Manoli 2015).

3. Data

3.1 Broadband Data

The empirical analysis draws upon panel data from two sources: the Federal Communications Commission (FCC) Form 477 spanning 2014 to 2018 and the National Telecommunications and Information Association's National Broadband Map (NBM) covering 2010 to 2013. This dataset encompasses crucial information, including the number of broadband providers, transmission technology (such as DSL, fiber, cable, or satellite), maximum download and upload speeds measured in Mbps, and whether the provider offers residential service at the census tract level. To ensure comprehensive coverage, broadband providers must submit data biannually, specifically in June and December, demonstrating their ability to deliver internet service with speeds surpassing 200 Kbps in at least one direction. The census tract, comprising smaller geographic units compared to counties, offers a finer granularity of analysis. With 84,414 census tracts in the United States, each ideally accommodating approximately 4,000 residents (Census Report). The census tract provides precise geographic treatment of broadband instead of aggregating at the county level, which has been done in the related literature. To ensure the most recent and reliable broadband data, the analysis primarily relies on the December dataset for each year.

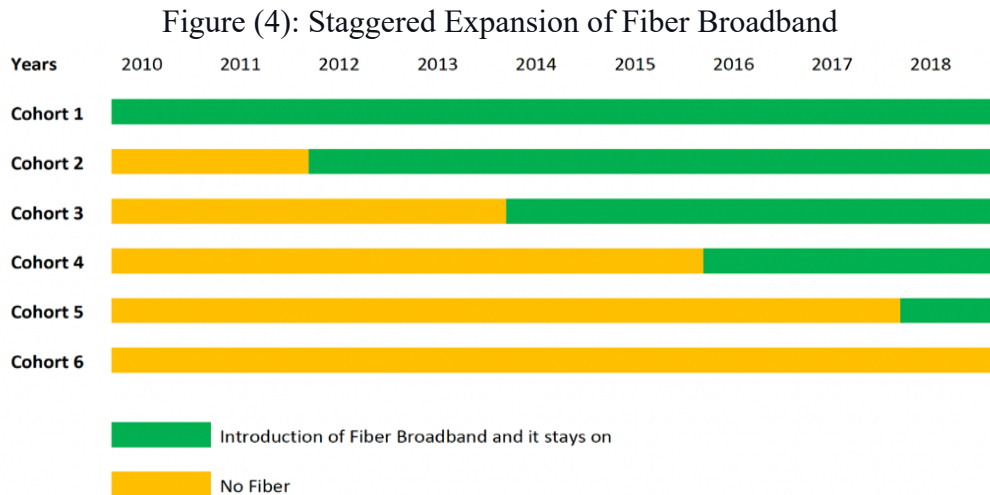
3.1.1 Definition of the Broadband Providers

The key treatment variable employed in this study pertains to introducing fiber broadband within a given census tract during a specific year. This binary variable takes the value of 1 in the year of introduction and persists as such in subsequent years. Conversely, for census tracts where fiber broadband has not been extended, the variable remains at 0 throughout the observation period, thus constituting the never-treated group. This research design effectively captures the staggered

implementation of the treatment. The inclusion of FCC data from 2014 onwards is primarily motivated by the need to address measurement issues present in earlier years. (Grubestic et al., 2019) documents some of the limitations of FCC data. Nevertheless, FCC data are the best publicly available records of broadband providers in the US (Mack et al., 2021).

3.1.2 Expansion of Fiber Broadband

Figure 4 categorizes the Health and Retirement Study (HRS) sample into different cohorts based on their exposure to fiber broadband expansion. Six distinct cohorts are identified, five corresponding to each year of introduction of fiber broadband, namely 2010, 2012, 2014, 2016, and 2018, and a sixth cohort representing individuals who never received fiber broadband during the study period. The selection of these specific years aligns with the biannual nature of the HRS data, which serves as the primary source for outcome measurements. By focusing on these time points, the analysis captures the dynamics of broadband adoption and its potential effects on mental health within the HRS sample.



Note: The figure shows the introduction of fiber broadband for various HRS Cohorts. Cohort 1 receives the fiber in 2010, cohort 2 in 2012, Cohort 3 in 2014, Cohort 4 in 2016, and Cohort 5 in 2018. Cohort 6 does not receive any fiber.

Note: The figure is borrowed from Gawai, V. P. (2023).

3.3 Health and Retirement Study

The Health and Retirement Study (HRS) is a nationally representative panel study surveying approximately 20,000 individuals aged 51 and older. The core HRS has been conducted annually since 1992, transitioning to a biennial format from 1996 onwards. This comprehensive survey collects demographic, health, relationship, income, and occupation-related information. Importantly, HRS also captures data on internet use, electronic devices within households, and the use of electronic technologies like health apps. Furthermore, the restricted files of the HRS contain information concerning respondents' geographic residence locations.

3.3 Descriptive Statistics

After broadband and HRS data are merged, Table 1 shows the sample characteristics. The HRS survey asks questions related to the application for SSI and SSDI during the current year of the survey. Please note that a small fraction of the respondents have reported applying for SSI and SSDI insurance. However, about 15 percent receive SSDI insurance during the current survey.

TABLE (1) Summary Statistics

Variables	Mean	SD
Applied for SSI	0.01	0.10
Applied for SSDI	0.02	0.15
Receives SSDI	0.15	0.36
Self-Reported Good Health	0.50	0.50
Age	72.57	10.00
Male	0.39	0.49
Above High School	0.40	0.49
White	0.73	0.44
Rural	0.22	0.41
Medicare	0.79	0.41
Medicaid	0.17	0.38
Gets Pension	0.27	0.44
Working for Pay	0.12	0.33
Currently Married	0.51	0.50
N Respondents-Year	16,133	

Note: The data are the balanced panel of HRS respondents merged with FCC for the periods 2010 to 2018 for every even year, using the geographical unit as census tracts.

4. Method

I first estimate a difference-in-differences (DID) regression using the following equation:

$$Y_{icgt} = \beta_0 + \beta \cdot \text{Fiber}_{gt} + \alpha_g + \gamma_t + \delta_i + \epsilon_{icgt}. \quad (1)$$

Here, Y_{icgt} is the outcome for individual i , living in census tract c , which belongs to the fiber expansion group g , in HRS survey year t . Fiber_{gt} is an indicator equal to one if the fiber was available at census tracts in expansion group g in survey year t , and zero otherwise. α_g represents the fiber expansion group fixed effects. γ_t signifies the survey year fixed effects accounting for

shocks that affect all individuals in a given survey year. Alternatively, I include individual fixed effects δ_i , instead of α_g , that control for the time-invariant characteristics of individuals and allow identification to come from within-individual changes in fiber availability.

I estimate the equation using the recent estimator provided by Borusyak et al. (2021).

The DID model specified above estimates the static treatment effect. My preferred estimate is the dynamic version of the DID estimator, as suggested by Borusyak et al. (2021), to test for parallel trends and estimate the dynamic effect of the introduction of high-speed fiber broadband on SSI and SSDI benefits applications. By incorporating time-varying treatment effects, this estimator provides valuable insights into the evolving impact of broadband expansion over time and allows for a more comprehensive analysis of the causal relationship between broadband access and SSDI reception.

I use the equation (2) for the dynamic treatment effect for the

$$y_{icgt} = \alpha_g + \gamma_t + \sum_{\tau=-3, \tau \neq -1}^3 \beta_{\tau} Fiber_{\tau(gt)} + \epsilon_{icgt}. \quad (2)$$

Recent advancements in the difference-in-differences (DID) literature suggest that the conventional two-way fixed effects (TWFE) estimator provides consistent estimates under the assumption of treatment effect homogeneity (Sun & Abraham 2021; De Chaisemartin & d'Haultfoeuille 2022). However, it is plausible to expect that introducing high-speed fiber broadband may result in a heterogeneous treatment effect, given the varying adoption rates among different economic agents, potentially influencing SSDI reception among older adults differently. Moreover, treatment effects may vary across individuals, exhibiting interesting heterogeneity based on various demographic characteristics. To capture this heterogeneity in treatment effects over time and across treated units, I employ the event study methodology proposed by Borusyak et al. (2021), which allows for the heterogeneous treatment effect of fiber broadband introduction.

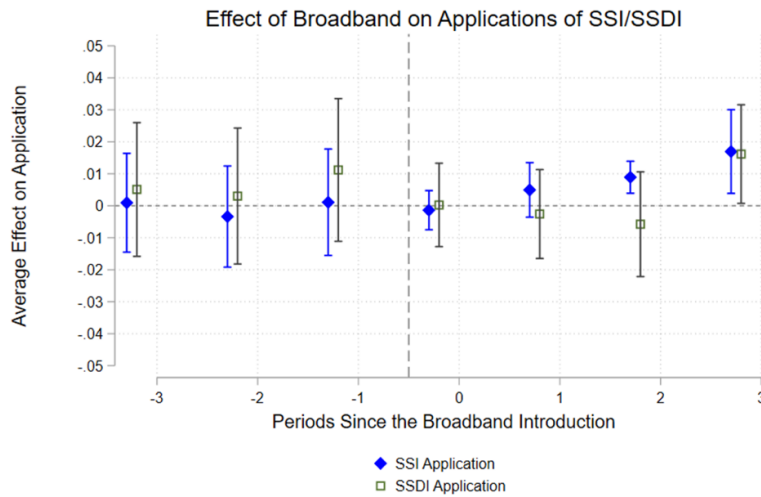
5. Results

I start the results with the dynamic treatment effects in Figure 5. Figure 5 shows the dynamic treatment effect using Equation 2 and estimated using the DID estimator proposed by Borusyak et al. (2021). Figure 5 suggests that the likelihood of applying for the SSI and SSDI benefits increases after high-speed fiber broadband is introduced. The dynamic effect becomes statistically significant over time, suggesting positive benefits for older adults. Figure 5 also suggests that the estimates before introducing the fiber broadband (period -2 and -3) are closer to zero and insignificant. I consider this evidence for no pre-trends and consistent with the parallel trend assumption.

Table 3 shows the average treatment effect. Columns 1 to 3 show the effects of the outcome as the application to SSI benefits. Column 1 includes the broadband expansion year fixed effects and the individual fixed effects. In Column 2, I include the time-varying individual controls, and in Column 3, I include the census tract fixed effects. Estimates in Column 3 suggest that the

broadband expansion increases the likelihood of SSI applications by 0.04 percentage points, which is significant at the 10-percent level. Further, Columns 4 to 6 show the estimates for applications for SSDI benefits as an outcome. Estimates in these columns suggest no effects on applications for SSDI benefits.

Figure (5): Dynamic Effect of Broadband Expansion on Applications for SSI and SSDI Benefits



Note: This figure shows the dynamic effects plots using Equation 2, estimating with the estimator provided by Borusyak et al. (2021). This table shows the average treatment effects of the staggered introduction of fiber broadband on the SSI and SSDI applications among older adults using Eq. 2 and estimating with the estimator provided by Borusyak et al. (2021). The sample is a balanced panel of Health and Retirement Study (HRS) respondents for biennial waves from 2010 to 2018. The treatment variable is equal to one if fiber is available to census tract residents in survey year t and is zero otherwise. The individual controls include whether the individual receives a pension, is currently married, and works for the pay. I also include the HRS person weights in the estimation. Standard errors in square brackets are clustered at the census tract level. The bars show the 95-percent confidence interval.

TABLE (3) Average Treatment Effect of Fiber Broadband on the Applications for SSI and SSDI

	SSI			SSDI		
	(1)	(2)	(3)	(4)	(5)	(6)
Post Fiber	0.002 [0.003]	0.002 [0.003]	0.004* [0.002]	-0.006 [0.007]	-0.006 [0.007]	0.002 [0.006]
Observations	11,936	11,936	12,357	11,920	11,920	12,339
Expansion Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Fixed Effects	Yes	Yes		Yes	Yes	
Controls		Yes			Yes	
Census-Tract Fixed Effects			Yes			Yes

Note: This table shows the average treatment effects of the staggered introduction of the fiber broadband on the SSI and SSDI applications among older adults using Eq. 1 and estimating with the estimator provided by Borusyak et al. (2021). The sample is a

balanced panel of Health and Retirement Study (HRS) respondents for biennial waves from 2010 to 2018. The treatment variable is equal to one if fiber is available to census tract residents in survey year t and zero otherwise. The individual controls include whether the individual receives pension, is currently married, and works for the pay. I also include the HRS person weights in the estimation. Standard errors in square brackets are clustered at the census tract level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

6. Conclusion

This study contributes to the existing literature by examining the causal relationship between the rollout of high-speed broadband technology and the probability of applying for SSI and SSDI benefits among older adults. The findings demonstrate that expanding broadband significantly increases the chances of applying for SSI and SSDI benefits over time. However, the average treatment effect is statistically insignificant, despite a positive increase in the applications. I find a small 0.4-percentage point increase in the likelihood of applications for SSI and a 0.2-percentage point increase in the probability of applying for SSDI benefits. In 2018, there were over 640,000 applications for SSI benefits for the age group of 51 to 70.⁴ The estimates from this paper suggest an additional about 2,500 applicants for SSI benefits after the broadband expansion.

These findings contribute important insights to the literature, informing policymakers and stakeholders about the implications of broadband expansion for the well-being of older adults. In future research, it will be crucial to understand what type of SSI/SSDI applications get affected. For instance, broadband services might not significantly impact the applications for issuing a new card since these applications may require in-person contact. On the other hand, the applications for benefits can be made entirely online and may have a significant impact.

⁴ SSA annual report 2018 for the SSI applicant.

References

- Abadie, A. 2021. “Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects.” *Journal of Economic Literature* 59 (2): 391–425.
- Armour, P. 2018. “The Role of Information in Disability Insurance Application: An Analysis of the Social Security Statement Phase-In.” *American Economic Journal: Economic Policy* 10 (3): 1–41.
- Barr, A., & S. Turner. 2018. “A Letter and Encouragement: Does Information Increase Postsecondary Enrollment of UI Recipients?” *American Economic Journal: Economic Policy* 10 (3): 42–68.
- Barr, A. and Turner, S., 2018. A letter and encouragement: Does information increase postsecondary enrollment of UI recipients? *American Economic Journal: Economic Policy*, 10(3), pp.42-68.
- Bertrand, M., S. Mullainathan, and E. Shafir. 2004. “A Behavioral-Economics View of Poverty.” *American Economic Review* 94 (2): 419–423.
- Bhargava, S., and D. Manoli. 2015. “Psychological Frictions and the Incomplete Take-Up of Social Benefits: Evidence from an IRS Field Experiment.” *The American Economic Review* 105: 3489–3529.
- Borusyak, K., Jaravel, X. and Spiess, J., 2021. Revisiting event study designs: Robust and efficient estimation. *arXiv preprint arXiv:2108.12419*.
- Busby, J., Tanberk, J. and Cooper, T., 2021. BroadbandNow estimates availability for all 50 States: Confirms that more than 42 million Americans do not have access to broadband. URL <https://broadbandnow.com/research/fcc-broadband-overreporting-by-state> (accessed 7.9. 21).
- Butrica, B.A., and J. Schwabish. 2022. “Technology and Disability: The Relationship between Broadband Access and Disability Insurance Awards.” Working Paper No. 2022-13. Center for Retirement Research, Boston College, Boston, MA.
- Callaway, B., and P. H. Sant’Anna. 2021. “Difference-in-differences with Multiple Time Periods.” *Journal of Econometrics* 225 (2): 200–230.
- Campbell, R.C., 2022. Need for Speed: Fiber and Student Achievement.
- Chetty, R., Friedman, J.N. and Saez, E., 2013. Using Differences in Knowledge across Neighborhoods to Uncover the Impacts of the EITC on Earnings. *American Economic Review*, 103(7), pp.2683-2721.
- Dahl, G. B., K. V. Løken, and M. Mogstad. 2014. “Peer Effects in Program Participation.” *American Economic Review* 104 (7): 2049–74.

De Chaisemartin, C. and d'Haultfoeuille, X., 2022. *Difference-in-differences estimators of intertemporal treatment effects* (No. w29873). National Bureau of Economic Research.

———. 2020. “Two-way Fixed Effects Estimators with Heterogeneous Treatment Effects.” *American Economic Review* 110 (9): 2964–2996.

Deshpande, M., and Y. Li. 2019. “Who Is Screened Out? Application Costs and the Targeting of Disability Programs.” *American Economic Journal: Economic Policy* 11 (4): 213–48.

Dettling, L. J., S. Goodman, and J. Smith. 2018. Every Little Bit Counts: The Impact of High-Speed Internet on the Transition to College.” *Review of Economics and Statistics* 100 (2): 260–273.

Finkelstein, A. and Notowidigdo, M.J., 2019. Take-up and targeting: Experimental evidence from SNAP. *The Quarterly Journal of Economics*, 134(3), pp.1505-1556.

Foote, A., Grosz, M. and Rennane, S., 2019. The effect of lower transaction costs on social security disability insurance application rates and participation. *Journal of Policy Analysis and Management*, 38(1), pp.99-123.

Gawai, V.P., 2023. Does High-Speed Internet Access Affect the Mental Health of Older Adults?.

Herd, P., and D. P. Moynihan. 2019. *Administrative Burden: Policymaking by Other Means*. Russell Sage Foundation.

Mack, E. A., E. Helderop, K. Ma, T. H. Grubestic, J. Mann, S. Loveridge, and R. Maciejewski. 2021. “A Broadband Integrated Time Series (Bits) for Longitudinal Analyses of the Digital Divide.” *PloS One* 16 (5), e0250732.

Notowidigdo, M. J. 2016. The impact of information and assistance on enrollment in public benefits among elderly individuals eligible for snap: A randomized evaluation.

Ryan, C.L. and Lewis, J.M., 2017. *Computer and internet use in the United States: 2016*. Washington, DC: US Department of Commerce, Economics and Statistics Administration, US Census Bureau.

Sun, L. and Abraham, S., 2021. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2), pp.175-199.



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