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To what extent do disadvantaged neighbourhoods mediate social assistance dependency? Evidence from Sweden

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This article investigates social assistance dependency and its relation to neighbourhood disadvantage in Sweden. We combine Swedish register data, tracking and analysing a cohort from 1998–2017, with the help of causal mediation, our analysis identifies the impact of early-adulthood social assistance on mid-adulthood social assistance. More specifically, we examine the mediating roles of neighbourhood conditions and compare this effect to the well-known mediating effect of unstable work experiences. Our findings suggest a differential effect for individuals with a high versus low probability of receiving social assistance in early adulthood. For individuals with a baseline high probability of receiving early-adulthood social assistance, the total estimated effect of early-adulthood social assistance on mid-adulthood social assistance reciprocity is over 15 per cent points. Neighbourhood disadvantage only has a minor mediating effect on average, however, for individuals with a high risk of early-adulthood social assistance, the effect is substantial, over 5 per cent points, even more than the mediating effect from unstable work. The findings suggest that for high-risk individuals, social assistance reciprocity in young adulthood is linked to subsequent entrenchment in disadvantaged areas and unstable employment, reinforcing a cycle of poverty. Our findings contribute to understanding the complex interactions between policy, socioeconomic status, and environmental factors in perpetuating social assistance dependency.

Introduction

The redistribution of wealth constitutes an important means of improving equality in opportunities in societies (Rawls, 1971; Birnbaum, 2010). In Sweden, one of the most generous welfare states in the world, the government disbursed approximately 10.4 billion SEK in social assistance in the year 2023 (National Board of Health and Welfare, 2023). During that year, approximately 146,000, or 3 per cent, of all Swedish households received social assistance. Social assistance usage varies significantly across different life stages, but is particularly common among adults aged 30–39, suggesting that financial precarity extends well beyond young adulthood and into middle age (National Board of Health and Welfare, 2023). Although social assistance is proven to facilitate everyday life for vulnerable populations, prolonged use of such assistance may

be insufficient to reduce poverty (Hussénius, 2021)—social assistance use may benefit some groups and also be a symbol of poverty for other groups. The link between past and future social assistance reciprocity can be understood as social assistance dependency, where the scarring effect is a possible process to understand this phenomenon. The scarring effect is defined as an increase in the probability of poverty in the future as a result of early exposure to poverty (Immervoll, Jenkins and Königs, 2015).

However, it remains weakly understood why different uptake patterns of social assistance impact the recipient's life-course outcomes. While various hypotheses have been suggested (Marttila et al., 2010; Bäckman and Bergmark, 2011; Mood, 2013), less known is about how the exposure to poverty in an individual's neighbourhood of residences plays a role in social assistance dependency as a cycle of disadvantages (Meers, 2022).

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More specifically, due to monetary and institutional restrictions, individuals who rely on social assistance are overrepresented in disadvantaged neighbourhoods (Mood, 2010), something which in turn is likely to impact their labour market outcomes, and subsequent poverty through a lack of role models and transmission of information (Mood, 2010; Bolt and van Kempen, 2013). This mechanism explaining social assistance dependency is however yet to be evaluated empirically.

The present study addresses two critical questions for understanding social assistance dependency: ‘the extent to which social assistance dependency exists’ and ‘whether exposure to disadvantaged neighbourhoods is a mediator of such a dependency’. We use Swedish register data to follow a full cohort of individuals born in 1978 from age 20 (1998) to age 39 (2017). First, we estimate the direct effect of early-adulthood social assistance reciprocity (ages 20–24) on mid-adulthood social assistance reciprocity (ages 35–39), in order to gauge the existence of social assistance dependency. Next, in order to identify mechanisms of social assistance dependency, we estimate the indirect effects of (1) exposure to disadvantaged neighbourhoods, based on the characteristics of the individuals living around each ego, and (2) unstable work resulting from such neighbourhood exposure, on social assistance reciprocity in mid-adulthood. Studying also the commonly studied mediating effect of unstable work provides us with an intuitive benchmark to contrast to the mediating effect of disadvantaged neighbourhoods because access and the need for social assistance are highly impacted by labour market participation (Mood, 2013; Hussénius, 2021). If exposure to disadvantaged neighbourhoods plays a major role in mediating social assistance dependency, this would indicate that exposure to the concentration of poverty substantially restricts individuals’ actions and choices, which indicates multiple disadvantages. If they play only a small role or have no statistically and substantively discernible effects in the mediation of social assistance dependency, then this small effect would instead indicate that dependency is likely more to be mediated by individual-level factors, i.e. psychological or physiological traits, or other demographic factors.

We use a novel causal mediation analysis combined with a sensitivity analysis (Zhou and Yamamoto, 2022; Lin, Pena and Daoud, 2023), to estimate path-specific effects and their heterogeneous patterns of two sets of mediators: (1) mediators regarding disadvantaged neighbourhoods and (2) mediators regarding unstable work.

Our findings show clear patterns of social assistance dependency, in particular for individuals who were at high risk for early-adulthood social assistance. Among these individuals, the total estimated effect of

early-adulthood social assistance on mid-adulthood social assistance reciprocity is about 15 per cent points. Individuals with a lower probability of receiving early-adulthood social assistance experience smaller, zero, and even negative total effects of receiving early social assistance, although they are less likely to need social assistance. The results indicate the possibility that for those who received social assistance in their early adulthood but did not experience the worst living conditions, social assistance helps them go through the transitions from family and school to work. Neighbourhood disadvantage only has a minor mediating effect on average. However, for the individuals with the highest risk of early-adulthood social assistance, the effect is substantial, indicating over 8 per cent points—even more than the mediating effect from unstable work. We interpret these findings as suggesting a pattern in social assistance dependency in Sweden: even if social assistance benefits help some individuals, it seems not to be sufficient to support the most disadvantaged youth to escape poverty, in part because the most disadvantaged individuals are more likely to experience living in disadvantaged neighbourhoods.

Literature review and conceptual framework

The direct effect of early social assistance on later social assistance

Although a lot of research suggests that social assistance dependency exists, we know little about the potential causal mechanisms of such a dependency. A common characteristic for almost all studies on the determinants of social assistance dependency is their focus on the moderating roles of individual-, parental-, or household-level characteristics, but most previous research does not unpack the mediating processes of social assistance dependency, i.e. why social assistance use at one point in time tends to lead to more social assistance use. Previous research has shown that social assistance reciprocity and how early social assistance uses impact late social assistance uses are highly dependent on socioeconomic backgrounds (Mood, 2013), parental characteristics and other individual-level attributes, such as low education—both one’s own (Hümbelin and Fritschi, 2018; Ilmakunnas and Moiso, 2019) and one’s parents’ (Ilmakunnas, 2018), socioeconomic status, possible criminal activity (Stenberg, 2000), immigrant background (Carpentier, Neels and Van den Bosch, 2017), and financial vulnerability and unemployment (Contini and Negri, 2007; Stranz and Wiklund, 2012). Furthermore, under the non-experimental setting, most research on social assistance dependency based on observational data is limited in causal arguments, including our research,

although we use a more rigorous causal identification (Daoud and Dubhashi, 2023).

Therefore, the direct effect of early social assistance use on later social assistance use is likely to be substantial, driven by a lock-in pattern shaped by a combination of structural factors, political design, and behavioural dynamics (Brady, 2019). The existence of social assistance dependency has been analysed in several studies (Marttila et al., 2010; Bäckman and Bergmark, 2011; Mood, 2013). Ilmakunnas and Moisio (2019) suggest that receiving social assistance in young adulthood increases the risk for later social assistance reciprocity due to the scarring effect. Other findings suggest a negative duration dependence, meaning that the longer individuals remain on social assistance, the lower their likelihood of exiting in Sweden (Bäckman and Bergmark, 2011). Although most of these studies did not unpack the mechanism behind social assistance dependency, they provide insightful and valuable empirical and theoretical support to assume a direct dependence between early-adulthood and mid-adulthood social assistance reciprocity. In line with the literature in the field, we expect to find such direct dependence, whereby previous social assistance reciprocity increases the risk for future social assistance. Due to data limitations, we set the age period for the treatment and outcome as 20–24, and 35–39, respectively. Thus, we formulate our first hypothesis as:

H1a: Individuals who were social assistance recipients at the age of 20 to 24 will have a higher risk of receiving social assistance at the age of 35–39 directly.

However, previous research also shows both negative effects and positive effects of social assistance reciprocity (Bargain and Doorley, 2017), which indicates possibly dual roles of social assistance: a stepping stone to reduce poverty but also a sign of poverty, depending on the individual. Individuals who experience social assistance use in early adulthood are not homogeneous. For some individuals in their early adulthood, social assistance use may not be necessary or only play a supporting role in the short term, e.g. during the transition from family or school to work in early adulthood or as a stepping stone to navigate periods of financial difficulty (Schels, 2013). Studies indeed show that social welfare programs can reduce poverty (Kenworthy, 1999; Barrientos, 2019). Sweden has a long-standing approach of combining welfare support with education and training to enhance employability rather than fostering dependency (Chevalier, 2015), which could suggest low levels of social assistance dependency. However, even if some individuals may utilize this system to successfully escape short-term disadvantaged living conditions, others may be trapped

in social assistance, indicating long-term poverty. For the more vulnerable individuals who have a high likelihood of receiving social assistance in their early adulthood, social assistance use is likely to rather become a symbol of long-term poverty than a stepping-stone to something else, not least given that social assistance use in Sweden does not always make any significant impact on reducing poverty and inequality in a wider context (Hussénus, 2021). It has been argued that exposure to social assistance may lead to a loss of human capital and have negative effects on individuals' socioeconomic status (Mood, 2013). Therefore, social assistance might not be sufficient to support the more vulnerable individuals to get rid of poverty (Korpi and Palme, 1998). Therefore, we hypothesize that:

H1b: The effects of early-adulthood social assistance reciprocity on mid-adulthood social assistance reciprocity are larger for vulnerable individuals.

The mediating role of neighbourhood in social assistance dependency

When studying neighbourhood effects, selection into neighbourhoods is often viewed as a nuisance factor that needs to be adjusted for (Arcaya et al., 2014). However, neighbourhood selection can also constitute an important mechanism that increases our understanding of a certain phenomenon (Sampson and Sharkey, 2008; Sampson, 2011; Arcaya et al., 2014). It is reasonable to assume that social assistance reciprocity is likely to increase the probability of remaining in or moving to neighbourhoods that are less beneficial to live in, which, in turn, is likely to impact individuals' future life prospects, such as their labour market opportunities and their likelihood of relying on social assistance in the future. Individuals who are in receipt of social assistance are more likely to face financial restrictions on where they can live and are thus more likely to be forced to be exposed to neighbourhoods with less favourable attributes. This might lead to a vicious cycle of social assistance dependency, possibly pushing individuals ever downward in social mobility (Andersson and Malmberg, 2014; Grander, 2017, 2021; Shahidi et al., 2019).

Exposure to disadvantaged neighbourhoods may increase the risk of later social assistance reciprocity through three key mechanisms. First, role models and information transmission play a role (Mood, 2010; Bolt and van Kempen, 2013). Resourceful neighbours may improve work incentives and provide job opportunities, but social assistance recipients often connect more with similarly disadvantaged individuals, limiting exposure to opportunities (Wilson, 2012; Browning et al., 2017). Additionally, disadvantaged neighbourhoods tend to circulate more information about the

social security system than employment opportunities, increasing welfare claims (Mood, 2010). Second, social institutions within neighbourhoods shape job search support, school quality, and access to services (Galster, 2012; Vandecasteele and Fasang, 2020). The decline of affluent households following school closures in Finland highlights how neighbourhood institutions affect socioeconomic conditions (Harjunen, Saarimaa and Tukiainen, 2021). Limited access to key amenities like food and healthcare can further detach individuals from the labour market (Camina and Wood, 2009). Third, geographical stigma may reduce employment prospects (Bolt and van Kempen, 2013; Vandecasteele and Fasang, 2020). Employers often discriminate based on residential location, leading to 14 per cent lower callback rates for applicants from disadvantaged areas (Carlsson, Reshid and Rooth, 2018), which can prolong welfare dependency (Bunel, L'Horty and Petit, 2015). Only a handful of studies have touched upon how neighbourhood characteristics mediate social assistance dependency, but the existing ones support this notion. For instance, a 1 per cent increase in neighbourhood poverty raises welfare reciprocity among U.S. young mothers from 0.12–0.45 and lowers employment odds by 57 per cent (Casciano and Massey, 2008). In Sweden, higher neighbourhood social assistance rates increase welfare reciprocity (Mood, 2010). In the Netherlands, unemployed youth in high-unemployment areas are less likely to exit welfare (van der Klaauw and van Ours, 2003). Similarly, in Sweden, a 10 per cent rise in peer welfare dependency increases individual reciprocity by 0.9 per cent (Åslund and Fredriksson, 2009).

There is thus both theoretical and empirical evidence suggesting that neighbourhood characteristics are likely to mediate social welfare dependency. However, causal evidence or rigorous discussions on causal identifications are lacking in most previous research. Theoretically, residing in a disadvantaged neighbourhood is likely to increase the risk of future social assistance reciprocity via a range of potential mechanisms, including human capital loss and unstable labour market attachment. Our second hypothesis therefore reads:

H2a: Exposure to disadvantaged neighbourhoods mediates the relationship between early-adulthood social assistance reciprocity, at age 20-24, and mid-adulthood social assistance reciprocity, at age 35-39.

In line with our reasoning about heterogenous *direct* effects from previous social assistance on future social assistance (H1b), the existence of heterogenous *indirect* effects is also highly plausible. That is, it is likely that the risk for social assistance dependency is mediated by the neighbourhood in which an individual resides,

and that this mediation effect is larger for individuals with a high baseline vulnerability of social assistance. This could be the case if at least one of two conditions were held. First, vulnerability impacts the baseline risk of being exposed to disadvantaged neighbourhoods. There is ample evidence for this to be the case. Housing queue systems will impact individuals' choice sets and decide where individuals in different financial situations can live, and gentrification processes result in the most disadvantaged individuals risk becoming stuck in suburban disadvantaged areas (Andersson and Turner, 2014), and groups with low or irregular incomes are less likely to have access to newly established public housings that tend to have higher rental requirements (Grander, 2017, 2021). The second condition is that vulnerable individuals are more affected by the neighbourhoods in which they reside. It is theoretically likely that individuals who lack individual-level resources are more dependent on networks or other neighbourhood resources than less vulnerable individuals. Studies on the US indeed suggest that individuals from poor home environments are more affected by neighbourhood effects (Wodtke, Harding and Elwert, 2016) whereas studies on the Nordic context show less proof for such heterogenous effects (Brandén, Haandrikman and Birkelund, 2023). However, given that the first condition is well-supported, we propose a sub-hypothesis which reads:

H2b: Exposure to disadvantaged neighbourhoods mediates the relationship between early-adulthood social assistance reciprocity, at age 20-24, and mid-adulthood social assistance reciprocity, at age 35-39, in particular for vulnerable individuals.

In addition to our core interest of the mediating effect of disadvantaged neighbourhoods, we compare its effect to that of a theoretically and empirically highly motivated mediator in studies on social assistance dependency, namely unstable work. The loss of human capital and subsequent negative effects on socioeconomic status have been argued to be a core mechanism behind social assistance dependency (Mood, 2013). Social assistance has been shown to lead to precarious employment that could harm disadvantaged individuals' future economic conditions (Malmberg and Andersson, 2015; Shahidi et al., 2019). Examining the mediating effect of unstable work provides us with a clear benchmark for comparing the mediating effect of disadvantaged neighbourhoods.

Graphical model and methods

Graphical model

In this section, we aim to disentangle the specific pathways through which early-adulthood social

assistance uses impact mid-adulthood social assistance use, indicating the persistence of poverty. To identify the multiple mechanisms of this process, a novel causal mediation analysis developed by [Zhou and Yamamoto \(2022\)](#) is used. Two big advantages of this method, compared to other related methods, are that it allows us to include a set of mediators, instead of including them one by one, and that it allows for causal dependencies between mediators. We include two core sets of mediators in our model: exposure to disadvantaged neighbourhoods and unstable work attachment.

[Figure 1](#) shows the causal diagram of potential mechanisms to accommodate our assumptions. This diagram includes four temporally ordered variables: (1) Social assistance reciprocity from age 20 to about 24 (Node A). (2) Exposure to disadvantaged neighbourhoods from age about 25 to about 29 (Node M1). (3) Unstable work from age about 30 to about 34 (Node M2). (4) Social assistance reciprocity at age about 35 to about 39 (Node Y). We focus on three possible mechanisms to understand how early social assistance reciprocity affects later social assistance reciprocity. (a) Early-adulthood social assistance reciprocity may increase mid-adulthood social assistance reciprocity directly, for instance, because of psychological factors, which aims to test Hypotheses 1a and 1b. (b) Early-adulthood social assistance reciprocity may impact the probability of exposure to disadvantaged neighbourhoods, which in turn affects mid-adulthood social assistance reciprocity directly and/or indirectly via the impact of living in a disadvantaged neighbourhood on unstable work, which aims to test Hypotheses 2a and 2b. (c) Regardless of exposure to disadvantaged neighbourhoods, early-adulthood social assistance reciprocity impacts unstable work, which in turn affects mid-adulthood social assistance reciprocity. We estimate the effect of unstable work to be a possible secondary mechanism.

To estimate these possible mechanisms, this causal diagram is a nonparametric structural equation model, with each node possessing its independent error ([Pearl, 2009](#); [Zhou and Yamamoto, 2022](#)). This model assumes that there are no unmeasured confounders between treatment and mediators, treatment and outcome, mediators and outcome, and one mediator sets to another mediator set. Therefore, we need to assume identification assumptions that there are no unmeasured confounders that could impact (1) early-adulthood social assistance reciprocity and its relationships with exposure to disadvantaged neighbourhoods, unstable work, and mid-adulthood social assistance reciprocity. (2) exposure to disadvantaged neighbourhoods and their relationships with unstable work and mid-adulthood social assistance reciprocity.

(3) the relationship between unstable work and mid-adulthood social reciprocity after conditioning on pre-treatment confounders. To estimate the impacts of these strong and untestable assumptions, we conduct a set of sensitivity analyses to explore how such violations may impact our results.

To identify these path-specific effects nonparametrically without function form assumption under a set of assumptions on unmeasured confounders above, we let A denote early-adulthood social assistance reciprocity as exposure/treatment. M_1 represents the first set of mediators and denotes disadvantaged neighbourhood exposure. M_2 represents the second set of mediators and denotes unstable work. C denotes the baseline confounders. Y denotes mid-adulthood social assistance reciprocity as the outcome. The average total effect (ATE) of early social assistance reciprocity on mid-adulthood social assistance reciprocity can be decomposed into three components assuming the DAG is in a linear and additive setting:

$$ATE = \tau_{A \rightarrow Y} + \tau_{A \rightarrow M_1 \rightarrow Y} + \tau_{A \rightarrow M_2 \rightarrow Y}$$

Where $\tau_{A \rightarrow Y}$, $\tau_{A \rightarrow M_1 \rightarrow Y}$ and $\tau_{A \rightarrow M_2 \rightarrow Y}$ represent the potential mechanisms (a) (b) (c) in [Figure 1](#) respectively.

Estimation methods

To estimate these path-specific effects, we use the imputation estimator, which is a model-assisted imputation of counterfactual outcomes with high flexibility on the distributions and relationships between mediators, proposed by [Zhou and Yamamoto \(2022\)](#) and their R package ‘paths’. In this analytical approach, we initially fit three models of receiving social assistance later in life. The first model is based on early social assistance and the baseline confounders, a model for $E[Y|C, A]$. The second model also considers the impact of living in disadvantaged neighbourhoods, along with all factors in model 1, a model for $E[Y|C, A, M_1]$. The third model further includes the influence of unstable work and all factors in model 2, a model for $E[Y|C, A, M_1, M_2]$. Following these, we apply two additional models for the conditional expectations to evaluate these two path-specific effects: $E[E[C, A = 1, M_1]|C, A]$ and $E[E[C, A = 1, M_1, M_2]|C, A]$ (Please check [Appendix A](#) to see technical details to check the identification of Path-Specific Effects). For the model fitting, we employ Generalized Boosted Regression Modeling (GBM), chosen for its good predictive capabilities ([Zhou and Yamamoto, 2022](#)). To assess the reliability of our findings, we use 1000 nonparametric bootstrap methods to calculate standard errors and confidence intervals. We also conduct sensitivity analysis based on the bias formula ([VanderWeele and Arah, 2011](#); [Zhou and Yamamoto, 2022](#)) to explore to what extent unmeasured confounders could distort the relationships

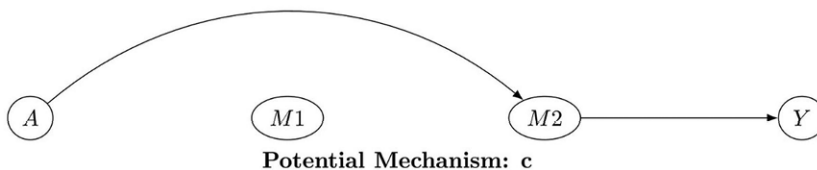
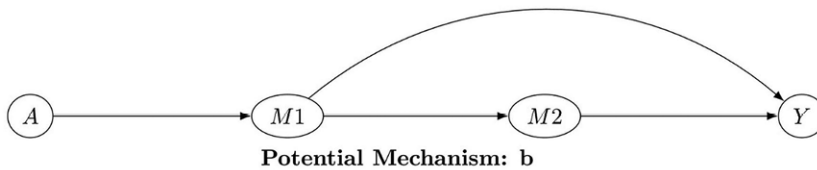
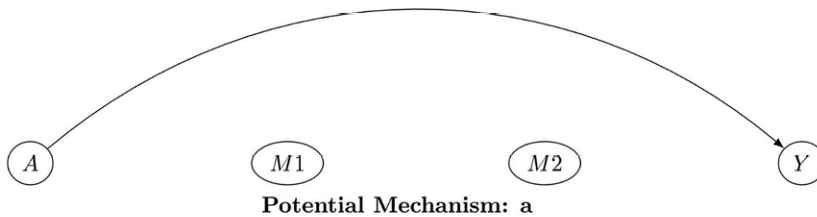
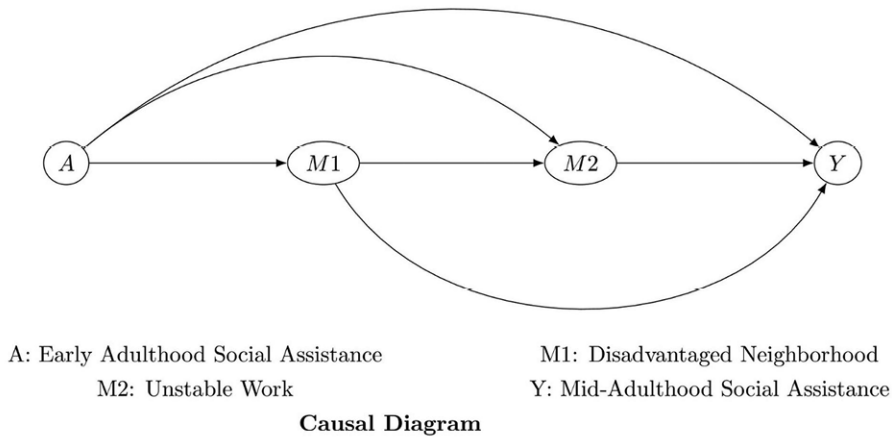


Figure 1 Causal diagram and potential mechanisms
Note: The baseline Confounders are omitted in the Graphs

between exposure to disadvantaged neighbourhoods and mid-adulthood social assistance use. Sensitivity analysis does not guarantee causal arguments but is a crucial step in exploring the uncertainty in the research design.

Data

Study population

We use Swedish population register data containing detailed annual information on individuals' social assistance uptake, labour market situation, other

socioeconomic and demographic characteristics, and geographical characteristics. We study a cohort of individuals who were born in 1978 and who lived in Sweden throughout the period from 1998–2017. The focus on this cohort enables us to study individuals during both young adulthood and mid-adulthood. In Sweden, young adults are one of the groups characterized by the highest poverty risks (Lorentzen et al., 2014), which motivates our focus on this group. We start studying this sample when they are aged 20 (1998) and follow them until the year in which they turn 39 (2017). An advantage of studying this cohort is that the national standard for social assistance was implemented in 1998, when our cohort was aged 20, meaning that they lived all their adult lives with this standard. We exclude individuals who got early retirement/sickness compensation as a kind of disability pension at any time between 1998 and 2002. It is very unlikely to get early retirement compensation for young people, so the variable primarily captures sickness compensation due to largely reduced working capacity that could restrict individuals' ability to work full-time. The main reason for the exclusion is that individuals who received such sickness compensation may experience different labour market paths or lack labour market participation. We also exclude individuals without full records in our dataset, leaving us with a sample of 87,854 individuals. To eliminate units with no common support, we fit a propensity score model with the GBM model for early social assistance use to exclude treated individuals with propensity scores higher than the maximum score among the controls and untreated individuals with propensity scores lower than the minimum score among the treated, giving us a final sample of 87,027. However, this approach only reduces the risk of violating the common support assumption (Cole and Hernán, 2008; Petersen et al., 2010). We also test the performance of Bayesian Additive Regression Trees as an alternative to estimate propensity scores (see. Appendix C).

Exposures, outcome, mediators, and confounders

The exposure of interest in this study is early social assistance recipiency. If an individual who had social assistance in their early adulthood has a higher risk of continuing to receive it in their mid-adulthood, it's a sign of dependency. It is measured annually from 1998–2002 during individuals' early adulthood at the household level, given that if one partner has a lot of income, the partner can't get social assistance, and can be seen as an indicator of poverty because only people who experience the most serious life and economic issues will get social assistance in Sweden (Mood, 2013). Individuals who have received a positive amount of

social assistance during a given year are defined as social assistance recipients in that year. While social assistance benefits in Sweden are approved and paid monthly, we only have data that are aggregated at the annual level. This means that we cannot consider status changes in social assistance recipiency within a given year. Therefore, if an individual got social assistance during this period once, it will be coded 1, otherwise 0.

Our outcome of interest is mid-adulthood social assistance recipiency, measured between 2013 and 2017. If an individual has received social assistance benefits at any point during these 5 years, he or she is defined as a social assistance recipient. The regulations surrounding social assistance are similar across Sweden. However, the actual amounts differ for individuals based on their income, family situation, and municipality-level regulations. Therefore, we focus on whether an individual got social assistance as our primary exposure. Although we think single social assistance recipiency as an indicator of poverty is sufficient to indicate the most serious economic issues and the most disadvantaged life experience, in robustness checks, we also show how different ways of measuring social assistance as an indicator of poverty may impact our results.

Our first set of mediators of interest is the exposure to disadvantaged neighbourhoods in the second period (2003–2007). We measured disadvantaged neighbourhoods based on Small Areas for Market (SAMS) which divides Sweden into around 9000 smaller subdivisions and districts of municipalities. The neighbourhood characteristics that we examine are (1) the share of neighbours with only compulsory schooling, (2) the share of neighbours in the lowest income decile, (3) the share of neighbours who are social assistance recipients, (4) the share of neighbours who have been registered as unemployed at any time during the year.

The second set of mediators of interest captures unstable work in the third period (2007–2012). We measured unstable work situations by four indicators; (1) the share of days an individual was unemployed during the studied period, (2) the number of income sources in this period, (3) the number of residential moves in this period, and (4) the average gross salary in this period.

All analyses adjust for several confounders that have previously been shown to be associated with poverty risks (Boschman et al., 2021). The baseline confounders were measured in the first period (1998–2002). These are gender and migration background (distinguishing between foreign-born and native-born); prop of time being a single parent in this period; prop of time being single in this period; prop of time being single in this period; educational level in the year 2000 where less than 1 per cent of total cases have missing

education information. In our current approach, we categorize these cases under education level 1, which includes individuals with education lower than secondary high school or no recorded education data; the average amount of parental benefit in this period; the average amount of sick pay in this period due to reduction in working capacity by at least one quarter, which requires to be insured for work-based benefits; the average amount of housing benefit in this period; the average amount of capital income in this period; the number of children in year 2000; prop of time indicating whether the individual lives in one of Sweden's three metropolitan counties (Stockholm, Västra Götaland or Malmö) in this period; average days of being temporary disable in this period; prop of time being students in this period; the total number of residential moves within the country in this period; prop of time owning a house that measures housing type in this period; the average gross salary in this period; a set of disadvantaged neighbourhoods characteristics at the baseline period; the total number of income sources across 5 years; the sum of days in part-time unemployment across 5 years; the sum of days in the training program across 5 years; the sum of days in supplemental jobs across 5 years; prop of time being registered as unemployment status in this period and the labour market features: the number of working age population by local labour markets in 2000 and the number of companies by local labour markets in 2000 (see details in [Appendix B](#)).

Results

Descriptive statistics

[Table 1](#) presents descriptive statistics of early-adulthood social assistance reciprocity in period 1, exposure to disadvantaged neighbourhoods in period 2, unstable work in period 3, and mid-adulthood social assistance reciprocity in period 4. Importantly, it shows that early social assistance use is closely connected to later social assistance use; 12 per cent of the social assistance recipients in period 1 also received social assistance in period 4, compared with 1.3 per cent of those who did not receive social assistance in period 1. It also shows that individuals who received social assistance in period 1 have a higher exposure to neighbours who were unemployed or on social assistance in period 2 and had lower salaries and more time in unemployment in period 3.

Total and Path-specific effects of early-adulthood social assistance reciprocity on mid-adulthood social assistance

We begin by examining the total and path-specific effects of early-adulthood social assistance reciprocity on

mid-adulthood social assistance reciprocity. Results are presented in [Figure 2](#) and indicate the percentage-point increase in the probability of mid-adulthood social assistance reciprocity associated with receiving social assistance in early adulthood. First, early-adulthood social assistance reciprocity increases mid-adulthood social assistance by about 4.8 per cent points, overall, indicating that individuals who received social assistance at period 1 have a 4.8 per cent point higher probability of receiving social assistance in period 4, compared to those who did not receive it at period 1, adjusted for all the controls. The estimated direct effect of early social assistance reciprocity on mid-adulthood social assistance reciprocity is about 2.7 per cent points. This is more than half the estimated total effect, supporting Hypothesis 1a. The estimated indirect effect of having an unstable work situation is about 1.5 per cent points. This can be compared to the small mediating effect from exposure to disadvantaged neighbourhoods, which only accounts for about 0.6 per cent points, providing weak support for Hypothesis 2a. Together, this suggests that on average, early-adulthood social assistance reciprocity impacts mid-adulthood social assistance reciprocity primarily directly, and that the mediating effects of exposure to disadvantaged neighbourhoods and unstable works are comparatively weaker, albeit statistically significant.

Although [Figure 2](#) shows that the average effect from early-adulthood social assistance reciprocity on mid-adulthood social assistance reciprocity is positive, previous research has suggested that the effects may differ between individuals, where social assistance in some cases may help some individuals escape poverty. In the next stage, we therefore test for heterogeneity within the effects of early-adulthood social assistance reciprocity on mid-adulthood social assistance reciprocity.

To evaluate whether the effects are heterogeneous, we calculate the propensity score of early social assistance reciprocity as a summary index of baseline confounders ([Zhou and Yamamoto, 2022](#)). We fit a generalized additive model for the relationship between 'individual-specific' estimates and estimated propensity scores with nonlinearity using a smoothing spline with ten degrees of freedom ([Ahearn, Brand and Zhou, 2023](#)).

[Figure 3](#) shows clear heterogeneity in the estimated effects. A first notable pattern is that individuals who have a higher propensity of receiving early-adulthood social assistance have a larger total estimated effect from early-adulthood social assistance reciprocity on mid-adulthood social assistance reciprocity. For instance, in [Figure 3a](#), the total estimated effect from early social assistance reciprocity for individuals whose propensity of early social assistance is above 0.8

Table 1 Descriptive statistics of treatment, mediators, and outcome

1998–2002		
Social Assistance Use	NO N = 63966	YES N = 23061
2003–2007		
The share of neighbours with only compulsory schooling	0.3(0.1)	0.4(0.1)
The share of neighbours in the lowest-income decile	0.4(0.1)	0.4(0.1)
The share of neighbours who are social assistance recipients	0.1(0.0)*	0.1(0.1)
The share of neighbours who have been registered as unemployed	0.0(0.0)*	0.1(0.0)
2008–2012		
The prop of time being unemployed		
0 per cent	90 per cent	71 per cent
20 per cent	5.8 per cent	12 per cent
40 per cent	1.9 per cent	6.6 per cent
60 per cent	1 per cent	4.4 per cent
80 per cent	0.6 per cent	3.3 per cent
100 per cent (5 years)	0.7 per cent	2.9 per cent
The number of income sources	6.7(3.2)	6.2(3.7)
The number of residential movements	1.0(1.1)	1.3(1.4)
The average gross salary (100SEK)	2629.5(1450.8)	1840.3(1255.1)
2013–2017		
Social Assistance Use	1.3 per cent	12 per cent

Continuous Variables, Mean (SD);

Categorical Variables, n/N (%).

0.0(0.0)* indicates the share is smaller than 0.1.

Limited decimal places can lead to rounding errors, which may cause the sum of percentages to exceed 100 per cent.

rises rapidly, indicating that it is for these individuals that early social assistance increases the risk of mid-adulthood social assistance. The total estimated effect of early social assistance on mid-adulthood social assistance reciprocity for individuals with high propensity scores to get early social assistance is over 15 per cent points, which is markedly larger than the average total estimated effect, presented in [Figure 2](#) (4.8 per cent points). This supports Hypothesis 1b.

Similar patterns are found when we estimate direct-versus mediating effects. [Figure 3b](#) shows that the estimated direct effect of early-adulthood social assistance on mid-adulthood social assistance is larger than 5 per cent points for the individuals with high propensity scores to receive early-adulthood social assistance, compared to an average direct effect of about 2.7 per cent points ([Figure 2](#)). Interestingly, [Figure 3c](#) shows that, on average, a small mediating effect of exposure to disadvantaged neighbourhoods found in [Figure 2](#) is more substantive when allowing for heterogeneous effects by an individual's propensity to receive early-adulthood social assistance. The estimated indirect effect which is canalized through exposure to disadvantaged neighbourhoods is as high

as over 5 per cent points for the individuals with high propensity scores to receive early-adulthood social assistance (H2b), which is markedly higher than the average estimated indirect effect presented in [Figure 2](#) (0.6 per cent points). This supports Hypothesis 2b. As a point of reference, [Figure 3d](#) shows the estimated indirect effect that is canalized through an unstable work situation. For the individuals with high propensity scores to receive early-adulthood social assistance, this indirect effect is over 3 per cent points, which is higher than the average estimated indirect effect via the pathway of unstable works (1.5 per cent points), but lower than the corresponding mediating effect from neighbourhood disadvantage.

In summary, the estimated weak positive average effects from early-adulthood social assistance on mid-adulthood social assistance seem to be primarily driven by individuals with a high propensity to receive early-adulthood social assistance. In addition, for the individuals with the highest propensity to receive early-adulthood social assistance, their exposure to disadvantaged neighbourhoods is an important mediator between early-adulthood and mid-adulthood social assistance.

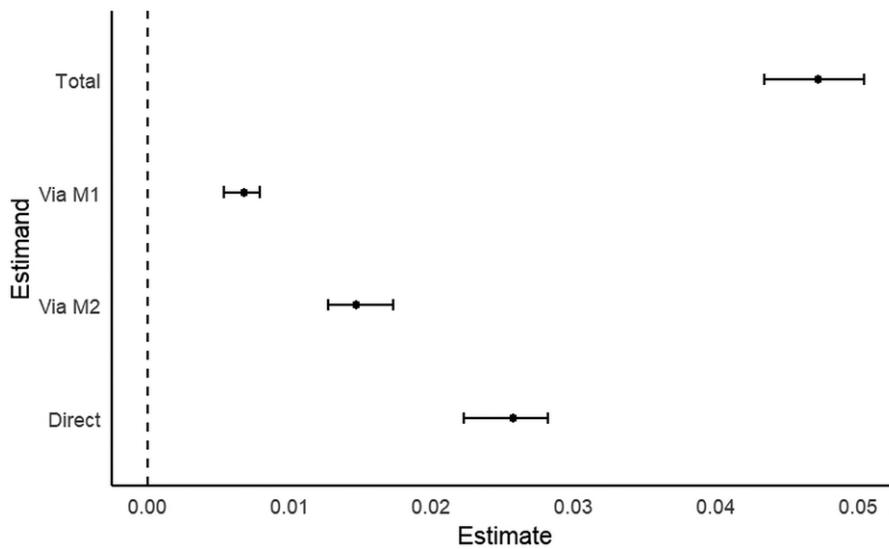


Figure 2 Estimated Path-specific Effects of Early-adulthood Social Assistance Use on Mid-Adulthood Social Assistance Use with 95 per cent Bootstrap Confidence Intervals (1000 iterations)

In order to ensure that our results are not impacted by model specifications, ways of measurement, and strong untestable assumptions, we conduct a set of robustness checks in terms of model specifications and ways of measurement, and sensitivity analyses in terms of those unmeasured confounders assumptions, presented below. The purpose of the robustness checks is to evaluate how different model specifications could impact the estimations, whereas the sensitivity analysis aims to explore the uncertainty from unmeasured confounders.

Robustness checks and sensitivity analyses

Robustness checks

Figure 4 shows how different measurements of outcomes and treatments affect our estimates. It shows the count outcome through the lens of the number of years individuals received social assistance between 2013 and 2017 (Figure 4a). Additionally, it adopts a stricter criterion for treatment measurement, focussing on individuals who received social assistance for at least three years during the period from 1998–2002 (Figure 4b). The findings highlight the still significant role of the exposure to disadvantaged neighbourhoods mechanism compared to the results in the previous analysis. Additionally, direct effects represented in Figure 4a constitute a smaller portion of the total effects. In general, this modification still yields results that align with previous findings but also indicates the heterogeneity in all effects due to markedly asymmetric confidence intervals. However, we will not claim that no model uncertainty is caused by the garden of forking paths (Gelman and Loken, 2013).

We also test if (1) using a sample without excluding individuals who do not have common support; and (2) using an imputation-based weighting estimator that is also developed by Zhou and Yamamoto (2022); (3) including one model to use machine learning techniques: Bayesian Additive Regression Trees (BART) (see Appendix A for details) for its superior performance to calculate propensity scores which may cause a different sample, in estimating the path-specific effects will change our results substantially, which shows almost consistent results, with slight shifts in point estimates. See Appendix C for detailed analyses.

Sensitivity analysis

The illustration depicted in Figure 5 demonstrates the potential influence of unmeasured binary confounders on our calculations of indirect effects mediated by neighbourhood factors, which is the main goal of our analysis. The estimation of the indirect effect, mediated by neighbourhood factors, shows considerable resilience to binary unmeasured confounders between the mediators and the outcome. We do not expect that there are no unmeasured confounders and the results of sensitivity analysis on the indirect effect of exposure to disadvantaged neighbourhoods indicate to what extent an unmeasured confounder could distort the relationship. For instance, a -0.05 effect of the unmeasured confounder on the outcome, coupled with a 0.15 difference in prevalence between treated and untreated groups, could negate the indirect effect mediated by neighbourhood factors, indicating that the effect turns to zero when

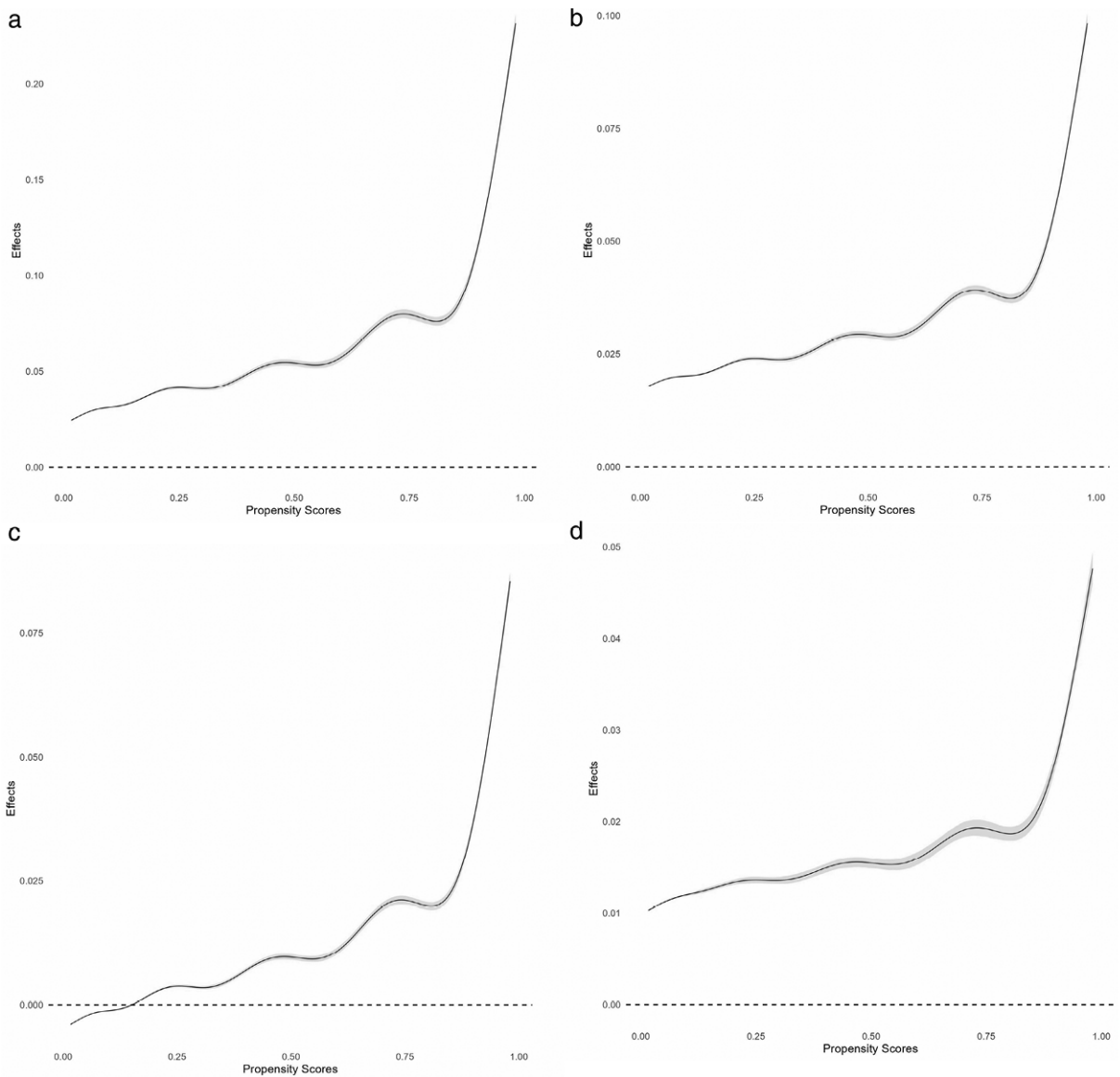


Figure 3 Heterogeneous total, direct, and indirect effects of early-adulthood social assistance use on mid-adulthood social assistance use by propensity scores with 95 per cent bootstrap confidence intervals (1000 iterations). (a) Total Effect. (b) Direct Effect. (c) Via Neighbourhoods. (d) Via Unstable Work.

we assume the existence of such an unmeasured confounder.

Discussion

The results presented in this paper improve our understanding of social assistance dependency in several ways.

First, our results suggest that social assistance dependency is primarily a problem for individuals

who were at high risk of receiving social assistance, to begin with, whereas individuals who were at low risk of receiving social assistance typically benefit from receiving it at a young age, if needed. These results are consistent with what has been suggested from scarring effect research, indicating how early-adulthood social assistance use can harm mid-adulthood living conditions among the most disadvantaged individuals, because social assistance transfers are possibly not sufficient to support this group (Hussénius, 2021). These

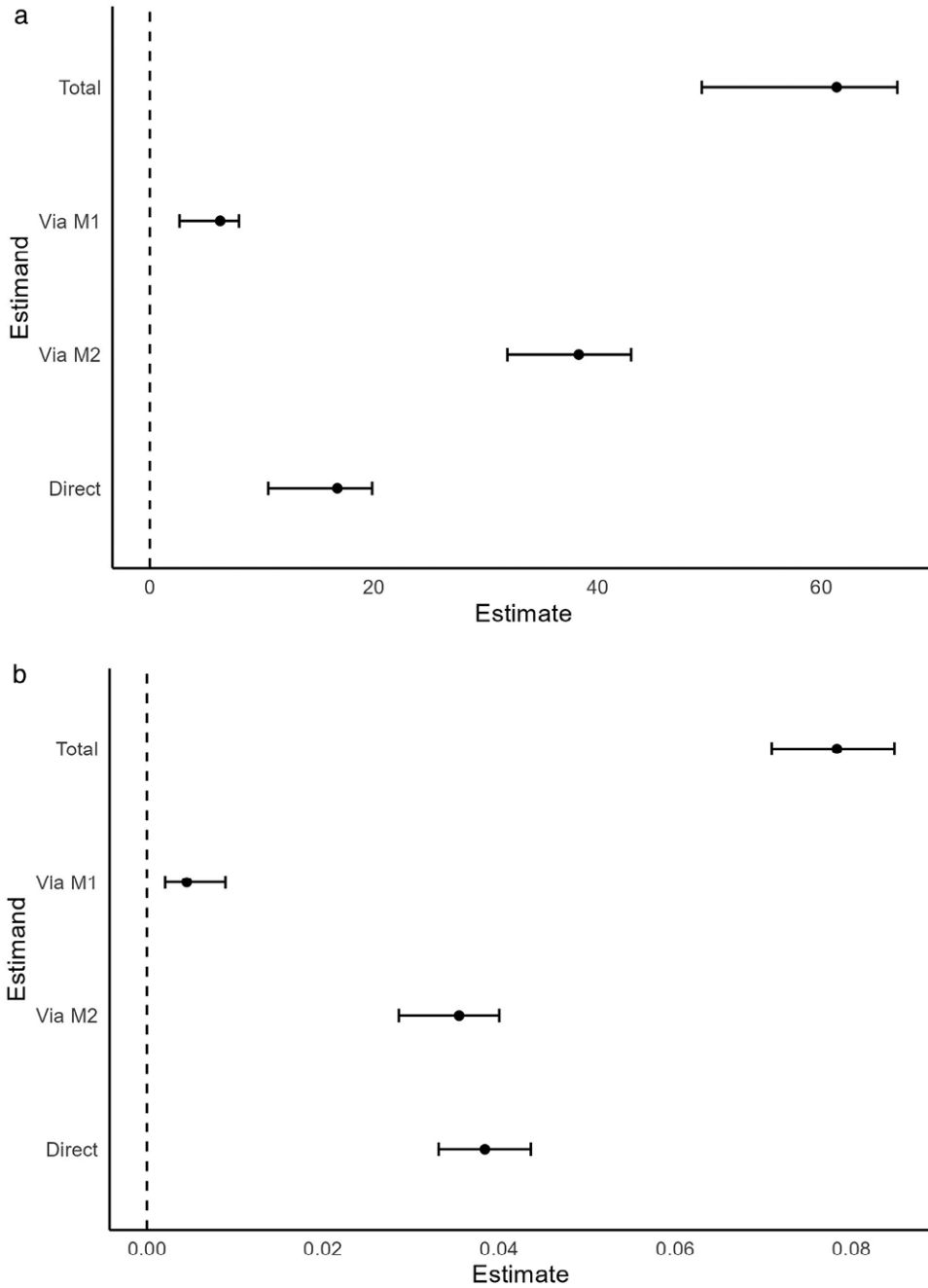


Figure 4 Robustness Checks in Different Measurements. (a) Count Outcome. (b) Stricter Criterion for Treatment Measurement

novel results also point to the usefulness of studying the ‘individual treatment effect’ (Ahearn et al., 2023), where we move past studying average effects for the whole population. Based on the ‘individual treatment effect’, we found that social assistance transfers play dual roles: a supporting role for the less disadvantaged

individuals, but a risk factor for poverty for the most vulnerable individuals.

Second, up until now, the neighbourhood dimension has been almost completely neglected by research on social assistance dependency. This has limited our understanding of whether social assistance dependency

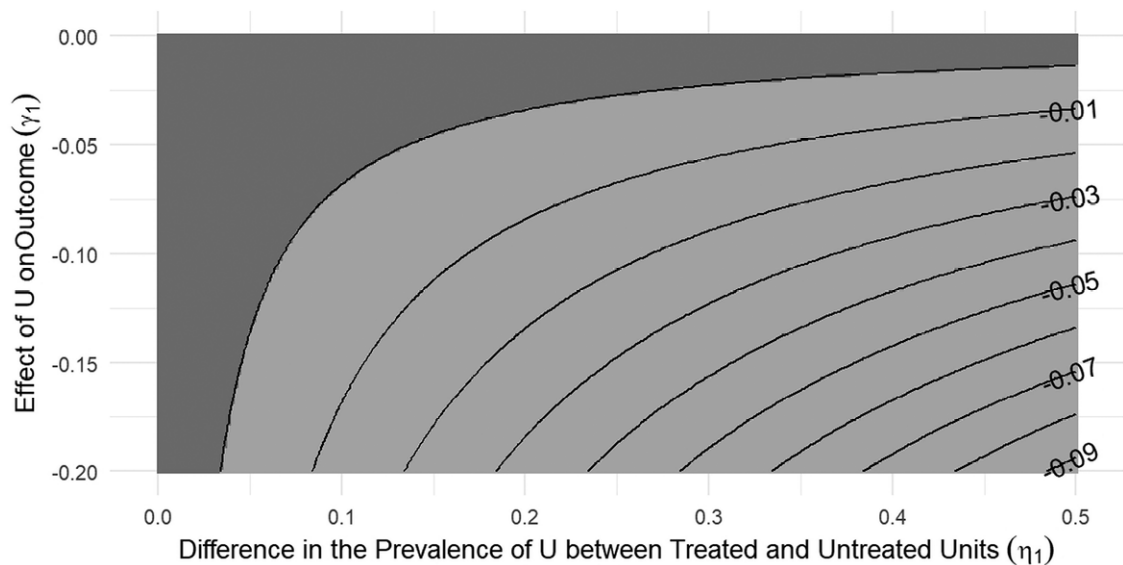


Figure 5 Contour Plot of Sensitivity Analysis on the Indirect Effect of Disadvantaged Neighbourhoods

is an individual-level process or if it is driven by an interplay with meso-level societal structures. In the present study, we have bridged this gap by investigating whether living in a disadvantaged neighbourhood exacerbates social assistance dependency. More specifically, we have examined the mediating role played by exposure to disadvantaged neighbourhoods on the effect of past social assistance reciprocity on future reciprocity. Our findings show that whereas the average mediating effect from neighbourhood disadvantage is low, and substantially lower than the mediating effect from having an unstable work attachment, it is markedly larger for individuals who were at high risk of receiving social assistance to begin with. In fact, for the individuals who have the highest risk of receiving social assistance in early adulthood, the mediating effect from neighbourhood disadvantage is even larger than the mediating effect of having an unstable work attachment. This suggests that exposure to disadvantaged neighbourhoods plays a crucial role in the poverty cycle of the group, which includes two paths. First, the impact from the exposure to disadvantaged neighbourhoods as a kind of contextual effect may impact the most disadvantaged individuals via work-irrelevant paths, i.e. human capital accumulation and health (Curley, 2010). Second, exposure to disadvantaged neighbourhoods in early adulthood may impact mid-adulthood social assistance via work-relevant paths. The results show how early-adulthood social assistance use as a sign of poverty for the most disadvantaged individuals is persistent through exposure to disadvantaged neighbourhoods and unstable work attachment, which increases the risk of receiving

social assistance use in their mid-adulthood. This suggests that disadvantaged neighbourhoods may be a key mechanism for the scarring effects of early-adulthood social assistance on mid-adulthood social assistance reciprocity.

Still, for most individuals, the mediating effect of exposure to disadvantaged neighbourhoods is relatively modest. This might be understood through the lens of Swedish segregation patterns. In Sweden, the government introduced social-mix housing policies as early as the 1970s, indicating that the housing markets in Sweden may harm the most disadvantaged individuals more. These policies are more egalitarian and universal than those in many other Western countries, including the US. The Swedish government has aimed to create urban areas with decreased or no segregation by changing the composition of both disadvantaged and advantaged areas, whereas other countries' social-mix housing policies have often only targeted disadvantaged areas (Bergsten and Holmqvist, 2013). In addition, the Swedish government has aimed to implement social-mix housing policies via city planning in connection with new construction rather than via planned demolition, which is common in other European countries, or via dispersal programs, such as those in the US (Holmqvist and Bergsten, 2009). In general, social-mix housing policies focus on reducing economic segregation rather than ethnic segregation (Holmqvist and Bergsten, 2009). For our study, this may mean that individuals who rely on social assistance in Sweden are less overexposed to disadvantaged neighbourhoods than similar individuals in other countries, which may explain the low or

moderate mediating effect produced by such exposure. The research field would benefit from future studies studying this association in contexts with segregation patterns that differ from those found in Sweden due to possible country-level heterogeneity in the mediating role of disadvantaged neighbourhoods.

Our findings contribute to the understanding of multiple disadvantages, revealing a reinforcing process in which individuals at high risk of social assistance dependency—once they begin receiving it—experience both individual-level deprivation and neighbourhood-level disadvantage. These factors lead to an increase in the likelihood of returning to social assistance, reinforcing persistent poverty. This underscores the need to integrate micro-level (individual) and meso-level (neighbourhood) processes when analysing long-term welfare dependence. This also underscores that anti-poverty policies should move beyond individualized approaches to recognize the structural conditions that shape long-term welfare dependency. While Sweden's social-mix housing policies may have mitigated some neighbourhood effects, our findings suggest that spatial disadvantage still plays a critical role in sustaining poverty cycles. To tackle long-term welfare dependency policies should provide individual support while breaking neighbourhood patterns that perpetuate disadvantage (Zhou and Liu, 2022).

Our study indicates that neighbourhood effects exert their strongest influence on those already at high risk of receiving social assistance. This aligns with the 'Tipping-the-Balance' argument in education research, which suggests that contextual factors are most consequential for individuals who are on the margins of an outcome (Andersson and Malmberg, 2014). Just as elite neighbourhoods help 'tip the balance' toward university attainment for students who might otherwise hesitate, disadvantaged neighbourhoods may tip the balance toward persistent poverty for those already vulnerable to welfare dependency (Andersson and Malmberg, 2014).

For high-risk individuals, neighbourhood disadvantage does not merely represent an additional burden—it is a decisive factor that shapes long-term dependency patterns. Our findings show that disadvantaged neighbourhoods act as an amplifier, intensifying pre-existing inequalities and making it harder for vulnerable individuals to escape welfare dependence (Andersson and Malmberg, 2014). This tipping effect means that early exposure to neighbourhood disadvantage can lock individuals into persistent poverty, reinforcing the scarring effects of early-adulthood social assistance (Andersson and Malmberg, 2014).

Although our use of a temporal framework and causal mediation analysis enables us to make important

contributions to theory and policy, our methodological approach is not without limitations.

First, while this study incorporates a set of mediators, it is unlikely to account for all potential post-treatment covariates, particularly those that may also function as mediators. We have made a concerted effort to identify key mediators relevant to our research question, but we acknowledge the possible presence of unmeasured mediators or confounders—especially those linking neighbourhood disadvantage to later social assistance use. While the sensitivity analysis approach helps mitigate concerns, it does not entirely eliminate them (Lin et al., 2023). To assess the extent to which our results might be driven by such potential confounders, we conducted a sensitivity analysis. The results suggest that our results would remain robust even if we have omitted strong confounders between disadvantaged neighbourhoods and the outcome. However, sensitivity analysis has limitations. Our model assumes simple relationships between unmeasured confounders, treatment, mediator, and outcome, without accounting for their complex dynamics or potential treatment-mediator interactions. Since we focus on the mediating role of disadvantaged neighbourhoods, we do not fully model all confounding relationships, which may overlook certain complexities.

If we have failed to control for some crucial confounders between treatments, mediators, and outcomes, our estimates will be biased. Psychosocial factors and biological factors might play unmeasured confounding roles at the individual level. DellaVigna et al. (2017) use the concept of reference dependence, which refers to the way individuals express preferences according to a status quo, as a means of explaining how individuals' preferences impact different probabilities of escaping from unemployment during different periods of unemployment insurance. Among those who are in the mid-term of their unemployment insurance benefits, by which time they have become used to having a low income from these benefits, individuals reduce their efforts to find a job, whereas the effort devoted to finding work is higher during the beginning of a spell of unemployment and directly before the expiry of unemployment insurance (DellaVigna et al., 2017). In other words, the reference preference might constitute a potential psychological mechanism underlying the disincentive effect of welfare benefits (Schmieder and von Wachter, 2016). In addition, as noted by Bor, Cohen and Galea (2017), poor health could lead to human capital loss and poverty, and poor health could also impede an individual's chances of leaving a disadvantaged neighbourhood (Arcaya et al., 2014). There is also a risk that the link between early-adulthood and mid-adulthood social assistance reciprocity is impacted by the assessments of social workers, due to discretion (Hussénus,

2021). Given that we do not know how social workers evaluate individuals based on their previous social assistance reciprocity and/or residential context, this also constitutes a potential unobservable confounder. Furthermore, we also do not have parental information for many immigrants, which may also cause possible biases. Finally, it is possible that family structure and fertility behaviours are possible mediators or confounders that we do not adjust for with the current design.

Second, our approach does not fully capture dynamic treatment effects, such as lagged or cumulative (compounding) effects over time and interactions between treatment and mediators. Therefore, our models cannot capture the higher-ordered complexity in the DAG.

While these temporal dependencies are important, our primary goal is to identify the mechanisms underlying social assistance dependency, making this a necessary trade-off. Future research could extend this framework by combining path-specific effects estimation with more flexible temporal modelling. For instance, one possible way is to consider how to combine different estimation approaches and path-specific effects (VanderWeele and Tchetgen Tchetgen, 2017; Zhou, 2022). Connected to this, the temporal structure of this method introduces certain trade-offs in estimating path-specific effects of social assistance dependency. The primary costs of this approach include a relative lack of explicit modelling of post-treatment confounders and a limited ability to capture dynamic treatment effects over time.

Finally, a possible limitation is our definitions of disadvantaged neighbourhoods. We base this on the share of neighbours with a low level of education, the share of low-income neighbours, the share of social assistance recipients, the share of unemployed neighbours, and the share of neighbours in low-skilled occupations. These indices may not fully capture neighbourhood disadvantage due to loss of information in measurements. For instance, as noted by Andersson, Hennerdal and Malmberg (2019), one could consider using age peers to measure context.

With these caveats in mind, the results presented in this paper provide important evidence of the heterogeneous patterns of social assistance dependency and the mediating role of neighbourhood in understanding this dependency. In sum, our results suggest that to reduce social assistance dependency, we need to consider both individual-level and contextual-level factors, and we need to be aware of heterogeneous treatment effects where some individuals are affected positively, and other individuals are affected negatively by the same treatment. For the most vulnerable individuals, the effect sizes are meaningful for policy implications. The development of formal sensitivity analysis methods, using monthly data to test if similar patterns exist, and testing the role

and heterogeneity of disadvantaged neighbourhoods in relation to poverty dynamics in different contexts both constitute key issues for future research.

Supplementary Data

Supplementary data are available at *ESR* online.

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Author contributions

Cheng Lin (Conceptualization [lead], Data curation [lead], Formal analysis [lead], Methodology [lead], Software [lead], Validation [lead], Visualization [lead], Writing—original draft [lead], Writing—review & editing [equal]), Adel Daoud (Conceptualization [equal], Funding acquisition [equal], Project administration [equal], Resources [equal], Supervision [equal], Writing—original draft [equal], Writing—review & editing [equal]), and Maria Branden (Conceptualization [equal], Funding acquisition [equal], Project administration [equal], Resources [equal], Supervision [equal], Writing—original draft [equal], Writing—review & editing [equal])

Data availability

The data that support the findings of this study are available from the respective government authorities. Restrictions apply to the availability of these data and so they are not publicly available.

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