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Understanding the Geographic Variation in Social Security Disability Insurance[1]

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Abstract

We examine county-level variation in Social Security Disability Insurance (SSDI) applications and allowances from 1996 to 2014. We document substantial variation across counties, and that variation is rising over time. Rural counties generally have especially high rates of both allowances and applications. Mortality and poverty rates are associated with both higher allowance rates and with the growth rate of allowances over time. Male and female SSDI outcomes have different trends, as growth has been larger and more skewed across counties for women than for men. Male allowances and applications have relatively strong associations with economic factors, while female applications and allowances have relatively strong associations with mortality rates.

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I. Introduction

Social Security Disability Insurance (SSDI) provides income payments and medical assistance to more than ten million disabled workers and their dependents, or approximately four percent of the working-age population (Social Security Administration (SSA), 2018). Despite being a federal program with policies and payment formulas that are applied consistently across the United States, there is substantial geographic heterogeneity. At the extremes, some counties have up to one-fifth of their working-age residents on SSDI, while others had less than one percent (Gettens, Lei and Henry, 2016).

Spatial concentration has been present since the inception of the program. Schmulowitz and Lynn (1966) analyzed program data for 1957-1963 and coined the term "the disability belt" to describe the heavy concentration of SSDI beneficiaries in the Appalachian region, Mississippi Delta region, and nearby Southern states. Analysis of geographic patterns in the 1980s and in 1990 by McCoy and Weems (1989) and McCoy, Davis, and Hudson (1994) showed that this concentration in the disability belt persisted over time, along with large differences across other parts of the United States. More recent work shows such variation is still present (e.g., Coe et al. 2011; Gettens, Lei and Henry, 2018).

In this paper, we examine the spatial concentration of SSDI applications and allowances, document how it has changed from the mid-1990s to now, and identify what factors are closely related to having relatively high rates of SSDI beneficiaries in a community. We do so using county-level data. The U.S. has more than 3,000 counties and county-equivalents (parishes, independent cities, boroughs), and using this level of data allows us to use the substantial variation in SSDI outcomes that occurs across counties.

We study the period from 1996-2014, which is interesting because it includes a period of rapid growth in allowances between 1996 and 2010, after which there has been a steady decline. Using SSDI administrative panel data, we find that the top 10% of counties in terms of SSDI allowance rates consistently accounted for approximately 25% of all national allowances, while the top 25% of counties accounted for 50% of the total. We find considerable persistence in terms of which counties have relatively high and low rates of SSDI allowances and applications. The year-to-year rank correlation of allowances per 1,000 people is 96% both during the rise from 1996 to 2010 and during decline from 2010 to 2014. The county rank of applications per 1,000 are even more persistent: 97% in the rising period before 2010 and 98% in the decline since. This suggests that counties maintain a similar rank in terms of SSDI allowance and application rates, even as national rates move up and down.

We then consider what factors are most relevant for understanding the spatial heterogeneity in SSDI. We consider four types of factors, all of which either directly relate to SSDI program rules or are characteristics that economic theory predicts would affect application or award rates. We use measures of (1) population health; (2) economic conditions; (3) cost of living; and (4) state-level policies and other state-level characteristics. The underlying health of a county's residents has a direct and obvious link to applications and allowances. A health-related work limitation is required for an allowance to be granted and also lowers the return to market work, thus making applying for SSDI relatively attractive. Labor market activity and other economic conditions have also been shown to increase applications, again by making work relatively less attractive (e.g., Black, Daniel and Sanders, 2002; Autor and Duggan, 2003; Autor, Dorn and Hanson, 2014). Economic conditions may also increase conditional allowance rates through the vocational assessment of whether work is available that is suitable to an individual's work limitation, given their prior education and work experience (Michaud and Wiczer, 2019). The progressive formula that converts past earnings into SSDI payments means that areas with relatively low costs of living may raise the real value of SSDI benefit payments, even if local wage levels reflect those living costs. Finally, state-specific factors could affect SSDI applications or allowances, such as Medicaid and other health insurance policies (e.g., Maestas, Mullen and Strand, 2014; Burns and Dague, 2017), state governance (e.g., Iyengar and Mastrobuoni, 2014), and even local processes and decisions by administrators at the state's Disability Determination Services (DDS).We find that mortality rates are strongly associated with allowance rates at the county level, accounting for about half of the residual variation within states. This county-level analysis is important, because nearly 75% of the cross-county variation in allowances and 80% of cross-county variation in applications occurs within states.

Finally, we examine what factors are associated with changes in allowances at the county-level over the rise from 1996-2010 and fall from 2010 to 2014. For the 1996-2014 period, we find that deteriorating health – that is, relatively higher mortality rates – is again a very important factor increasing SSDI allowances. This accounts for about 30% of the variation in the county-level growth rate in allowances between 1996 and 2014. Somewhat surprisingly, changes in housing prices and population density jointly account for another 40%, which may reflect the desirability of living in a particular county and perhaps its overall economic activity.

We make several contributions to research on understanding geographic variation in SSDI (e.g., Strand, 2002; Autor and Duggan, 2003; Coe et al. 2011; Rupp, 2012; Gettens, Lei and Henry, 2016), as well as to a broader set of studies that use changes in SSDI rates over time to assess the relative importance of different factors that may affect SSDI outcomes (e.g., Rupp and Stapleton, 1998; Duggan and Imberman, 2009; Liebman, 2015). We do so by focusing on counties as units of analysis. Previously, states have been the most commonly used geographical unit, but there is enormous variation within states that is missed in such analysis. At the county level, we can see considerably more of the heterogeneity in SSDI, can measure several characteristics that might affect SSDI rates, and can measure how much state level factors such as policies and governance that affect allowances.

The rest of the paper proceeds as follows. In Section 2, we first summarize the application and allowance process and compare our geographic data to the national trends. In Section 3, we outline our data sources and the coverage of the SSDI data. In Section 4, we examine and describe the evolution of the distribution in allowances and applications. To understand this variation, in Section 5 we summarize the economic and demographic characteristics that explain the cross-sectional patterns in SSDI outcomes, while in Section 6 we examine how county-level characteristics associated with changes in SSDI outcomes over time. We conclude in Section 7.

2. Disability Insurance Applications and the Allowance Process

In order to understand the potential sources of geographic differences, it is important to understand how the processes governing SSDI applications and allowances. It is also useful to understand what has been happening to overall SSDI outcomes in recent years before considering changes over time at the county level.

Individuals can apply for SSDI in person at an SSA field office, over the phone with a claimants' representative, or online. The application is normally processed by the SSA field office responsible for the ZIP code in which the individual resides, irrespective of the office and method used to file the claim. There are approximately 1,200 SSA field offices in the US, and recent research has found that proximity to a field office does increase the likelihood of applying to SSDI (Deshpande and Li, forthcoming).

SSDI has both financial and nonfinancial criteria for eligibility. SSA uses a sequential five-step process to determine whether an applicant should be allowed or denied benefits:

1. Step 1 involves the SSA field office screening based on financial characteristics. They verify that the applicant is insured for SSDI by checking that they have sufficient quarters of Federal Insurance Contributions Act (FICA) contributions in the past ten years. They also check that the applicant does not earn more than the "Substantial Gainful Activity" limit, an earnings threshold above individuals demonstrate significant work activity that disqualifies them for SSDI. It is currently $1,220 per month for non-blind applicants.
2. Step 2 is a medical screen judging whether an applicant has a severe impairment. This and subsequent steps are handled by a disability examiner employed at a state Disability Determination Service (DDS). The medical evidence must establish that a physical or mental impairment or combination of impairments are of sufficient severity to prevent the applicant to engage in SGA. The examiner also judges whether the impairment or combination of impairments is expected to last more than 12 months or result in death. Applicants who do not pass either test are denied SSDI.
3. Step 3 determines whether an applicant has an impairment that qualifies for eligibility with no further evaluation. SSA has a *Listing of Impairments*, which includes over 100 medical conditions that are classified as severe impairments that definitely prevent working at SGA levels. Any applicant whose impairment is judged to one of those conditions, or medically equivalent to them, becomes eligible for SSDI. Other applicants are evaluated further.

4. Step 4 involves determining whether an applicant could work in jobs similar to what they had in the past, typically in the 15 years before adjudication. To do this, the disability examiner considers whether the applicant have enough residual capacity to complete the skill and task requirements of past jobs, they are denied SSDI. Other applicants are evaluated at step 5.
5. Step 5 involves assessing whether an applicant can work in jobs other than those previously held. The examiner does this by considering vocational factors (age, education and work experience) along with residual work capacity. Determination depends on medical-vocational guidelines (known as the "vocational grid"), which increase the likelihood of qualifying for SSDI upon reaching specific ages, beginning at age 50. Applicants are allowed or denied at step 5.

If an applicant is denied after this evaluation process, that can pursue a sequence of appeals. First, applicants in most states can appeal to the DDS for a reconsideration of their claim by a different disability examiner. Second, they can request a hearing with an Administrative Law Judge. Third, they can appeal their claim to the SSA Appeals Council. Fourth, they can appeal to a federal court. At each level, applicants have 60 days to file the request for appeal. Appeals must be determined using the same criteria as those initially used at SSA field offices and by DDS examiners, although new information can be added through the appeals process (Lahiri, Vaughan and Wixon, 1995; Wixon and Strand, 2013).

2.1 National Trends in Applications and Allowances

In order to understand the geographic variation in SSDI activity, it is useful to briefly describe the national trends between 1996 and 2014. We use data from the *Annual Statistical Report on the Social Security Disability Insurance Program, 2017* (SSA, 2018), scaled by annual population counts for the working-age population (ages 21 to 64) drawn from our population data (described below).

Panel A of Figure 1 shows the average applications per working-age population for this period. In 1996, there were 8.5 applications per 1,000 population. This dipped to 7.2 applications per 1,000 population in 1998, before rising steadily until 2010 to a level that represented a 115 percent increase in the application rate. In the four years after 2010, the application rate declined by approximately 25%. Allowances per working-age population are shown in Figure Panel B of Figure 1.[2] The trends follow a similar pattern, although the changes are smaller in magnitude. From a low of 3.9 allowances per 1,000 population in 1997, the rate increased by approximately 50% through 2010, before declining by 15% through 2014. The slightly different trends in the two series comes from a declining allowance rate, as shown in Panel C of Figure 1. The figure also includes the DDS allowance rate (number of DDS allowances divided by overall applications), showing that some of the decline occurs at the early screening at the DDS stage.

3. Data

We develop a longitudinal panel data set of county-level information on SSDI outcomes and economic measures that may be related to SSDI activity. Specifically, we merge together data on SSDI applications and allowances; population; labor market outcomes; living costs; and health outcomes. The panel contain annual data at the county level, split by sex and age. The observations span 1996 to 2014, which is the period over which we have a complete set of data.

3.1 Disability Insurance data

Our data on SSDI applications and awards come from the SSA Disability Research File (DRF). The DRF is a data file designed to track cohorts of individuals filing for SSDI and SSI through the disability decision and appeal process. It is constructed by drawing on multiple administrative data sources, and updated annually. The DRF allows the status of a claim for SSDI to be tracked throughout the adjudicative steps, as well as providing key demographic information about the applicant, including their county and state of residence, as well as their sex and age. It has been used by other researchers to examine different aspects of the SSDI and SSI programs (e.g., Meseguer, 2013; 2018; Costa, 2017; Foote, Grosz and Renanne, 2019; Foote, Grosz and Stevens, 2019).

For this study, we were able to obtain geographically defined counts from the DRF for claims filed from 1995 to 2014. We restrict the data to applicants aged 21 to 64 years, as 65 years was

[2] We include pending cases as allowances, as the majority ultimately result in allowances. This somewhat affects the counts in 2014, and has a negligible impact in other years.

the Full Retirement Age at the beginning of the sample period.[3] All of the outcomes are organized in terms of the date of filing (i.e., we measure allowances by year of application, even if the claim is actually allowed in a subsequent year). We follow the classification system of Wixon and Strand (2013) to organize SSDI determination outcomes.

The data include the following outcomes:

1. Counts of SSDI applications;
2. Counts by the type of SSDI outcome:
    a. Allowances made by Disability Determination Services (including reconsiderations);
    b. Denials made by Disability Determination Services who appealed and were subsequently allowed by an Administrative Law Judge or at a higher level (including pending cases);
    c. Denials made by Disability Determination Services who appealed and were subsequently denied by an Administrative Law Judge or at a higher level;
    d. Denials made by Disability Determination Services who did not appeal to an Administrative Law Judge or at a higher level;
3. Counts of SSDI applications and type of outcome by age groups:
    a. Ages 21 to 49 years;
    b. Ages 50 to 64 years.

To maintain confidentiality, the SSA suppressed any counts that were fewer than ten. Whenever the suppression of only one group could lead to the identification of a suppressed value, an additional value was suppressed. These confidentiality restrictions informed our classification of outcomes and ages when we initiated the data request. We combined reconsiderations with initial decisions by Disability Determination Services because allowances via a reconsideration typically accounts for only around three percent of all applicants' outcomes (SSA, 2018). Likewise, pending cases are rare once a claim has been in the system for a couple of years, so we

[3] The Full Retirement Age is higher for more recent birth cohorts, starting in 1938 (who turned 65 in 2003). This extended the age over which SSDI is available. To be able to merge to other data sources and have a consistent sampling frame, we omit applications at age 65.

assign those cases as ultimately allowed after appeal (i.e., defined in 2b), which is the most common for pending cases (SSA, 2018). The age-based split divides applicants into two groups of roughly equal size, while the decision to separate applicants at ages 50 and over also allows us to identify individuals subject to different "vocational grid" rules than those at earlier ages.

The suppression leads to a number of missing cells. We focus on creating balanced panels. We include as units of observation individual counties that have all 38 observations for each county (i.e., 19 years each for males and for females). For applications, we have complete observations for 2,560 counties (83% of total). When classified by the four types of outcome, we have a complete set of counts for 1,140 counties (37% of total). When the four types of outcomes are further divided into two age groups, we have a complete set of observations for 316 counties (10% of total). At each level, we create additional units of observation by aggregating the remainder of the counties in each state and including in the analysis.

In terms of SSDI measures, the coverage is much greater than suggested by the fraction of counties included in these datasets. In Panel A of Figure 2, we assess the national coverage of SSDI applications in our different panel data sets using statistics based on program administrative data presented in SSA (2018). The panel of counties for which we have a complete set of application counts represents 93% of all applications in the US during this period. The national coverage of applications when the data are restricted to our balanced panel of SSDI allowances is also high: although this data includes 37% of all counties, it covers 81% of SSDI applications. When the data are restricted to the balanced panel of SSDI allowances by age groups, the 10% of counties account for 55% of all SSDI applications. In each case, the coverage is consistent over time. Panel B of Figure 2 shows the national coverage of SSDI allowances. The coverage is similar for allowances: the balanced panel of allowances covers 83% of all allowances, while the balanced panel of allowance outcomes by age group accounts for 54% of all allowances. Again, grouping the suppressed counties within a state gives us close to complete coverage of applications and allowances.

3.2 Population Data

We use population and demographic data from the Census Bureau that was compiled by the Surveillance, Epidemiology, and End Results program of the National Cancer Institute. The data includes annual estimated population counts by sex and single years of age. We measure the working-age population as 21 to 64 years, and then calculate the fraction of the population in different age group and by sex when controlling for demographic characteristics in our regression analyses.

3.3 Mortality Data

We use a compilation of mortality data from the Institute for Health Metrics and Evaluation. The mortality rates are created from deidentified death records from the National Center for Health Statistics, who compile data from death certificates lodged with state vital statistics bureaus. Census population data are used to create the rates. We use county-level rates by sex, and consider mortality rates for all ages, and by age ranges more focused on the working-age population (ages 25 to 64, and also split by ages 25 to 44 and 45 to 64).

3.4 Housing Price Index Data

The Federal Housing Financing Agency constructs an index of housing prices that is available at the county level (Bogin, Doerner, and Larson, 2016). The Housing Price Index uses proprietary data held by the Agency on single family homes with roughly constant characteristics throughout the measurement period. It is constructed by regressing the change in log sale price of a home on period fixed effects and then taking the exponential of the fixed effects coefficients.

3.5 Poverty Data

Poverty data come from the Small Area Income Poverty Estimates program, which is a US Census Bureau project estimating median income and the fraction of households whose pre-tax earnings are below poverty thresholds defined by the Census Bureau. These thresholds vary by household composition and location. Thresholds are also adjusted annually by changes in the Consumer Price Index. The poverty estimates are developed using a forecasting model applying an empirical Bayesian framework to predict the aforementioned counts and American

Community Survey county poverty counts estimates coupled with predictors coming from Census' data, including its administrative records.

3.6 Labor Market Data

Measures of the labor market and economic conditions come from the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW). The QCEW tabulates regional employment numbers and establishment counts among workplaces reporting to state unemployment insurance programs. An establishment is defined as a locale where goods and services are produced or provided; this means that a single business can have multiple establishments. The employment counts are the total numbers of paid jobs by the 12th of each month, irrespective of a job's characteristics. QCEW data includes roughly 97 percent of the US workforce each period, as it excludes self-employed workers as well as military personnel and a small contingency of diverse employment arrangements. From this we use the measure of average annual earnings.

4. Describing Geographic Variation in SSDI Outcomes

To understand the distributions of applications and allowances per 1,000 residents aged 21 to 64 years, we plot the rates at key quantiles of each over time: the median, 10^{th} and 90^{th} percentile. What is immediately notable about Figure 3 is that the distribution stays disperse throughout the periods of rapidly rising SSDI rates and in the period when allowances were declining. The median of applications rose more quickly than allowances, but the two series mostly track each other. The whole distribution, bottom and top deciles also follow the contours of the median, rising from the mid-1990s through 2010 and declining thereafter.

Disability applications and allowances have historically been more prevalent in a subset of counties. In 1996, 12% of the U.S working-age population lived in a county with a SSDI allowance rate that was more than twice the median value. Since then, the share of the working-age population receiving an SSDI allowance has become even more heterogeneous across counties. The first panel of Figure 4 shows the ratio of application rate at the 90^{th} percentile divided by the application rate at the 10^{th} percentile. This measure of dispersion starts at 2.4 in 1996: that is, a county at the 90^{th} percentile has an applicate rate 140% greater than a county at the 10th percentile. This ratio increases substantially in the 1990s to approximately 2.75 by 2000, before declining slightly and generally lies between 2.6 and 2.7 in the rest of the sample period. The 90/10 ratio of allowance rates follows a similar pattern, although dispersion was lower in the 2000s (and closer to the initial 1996 level). Interestingly, at the start of the period applications were less dispersed than allowances, but that flipped in 2002 and has remained since.

Skewness also has varied over the sample period. We measure skewness using Kelly's measure, which is the difference between the density in the left tail and the right tail, normalized by overall dispersion. This is shown in Panel B of Figure 4. At the start of the period, Kelly's measure is just over 0.2 for allowances and just under 0.2 for applications. A 0.2 measure means that, of the 90-10 difference, just over 60% is in the upper tail and 40% is in the lower tail. Among applications, Kelly's measure rose most through 2004 and then stayed at about that level, meaning the upper tail of applications now accounts for 6% more of the dispersion than at the beginning of the sample (i.e., the distribution is becoming skewed towards having a small number of counties with high application rates). Among allowances, skewness declined somewhat in the early period as the dispersion was rising, meaning that the median rose faster than the bottom 10th percentile and this accounted for more of the dispersion than the increase in 90th percentile beyond the median.

Counties with exceptionally high rates of SSDI applications persistently remain at the top of the distribution. Table 1 shows the autocorrelation of applications and allowances, both in levels and ranks. In terms of both applications and allowances, counties' rank correlation is very close to one, meaning that from year-to-year the ordering of counties is nearly constant. Over 20 years, however, these correlations allow for more mobility in terms of where counties rank in terms of SSDI applications. For instance, the year-to-year rank correlation of about 96% for allowances implies a rank correlation just over just over 50% over the whole period of rising rates from 1996 to 2010. This means that about half of a county's rank in the distribution of allowances at the end of the sample period is predicted by its initial rank, while the other half comes from changes that occurred over the 14-year period. In terms of SSDI applications, the autocorrelation in levels is above one in the period of rising SSDI. This means that the counties that begin the period with high rates of applications increased even more than the rest, contributing to the rise in dispersion.

Breaking down these trends in applications and allowances by gender and age, we again see that subgroups followed the same basic trends. Figures 5 and 6 show the median, 10th and 90th quantiles for applications and allowances broken down by sex. In this figure, we rank counties by their sex-specific rates (i.e., we focus on the distribution of males and females separately, rather than taking in account the overall rates for both sexes. It is evident at both the median and 90th percentiles that female application and award rates grew faster than the male ones. In fact, by the end of the sample period counties at the 90th percentile for female applications and allowances have higher female-specific rates than the male-specific rates for counties at the 90th percentile for men. In Figures 7 and 8 we show the same disaggregation by splitting those older than 50 from those 49 and younger. Most notable is the very large growth in applications among the young, particularly at the top of the distribution: The 90th percentile of applications doubled from the late 1990s through the peak in 2010. Allowances, however, not show such a stark rise and much of the decrease in allowances after 2010 came from the decline among those under 50, particularly at the 90th percentile.

5. The Association between SSDI Outcomes and County-level Characteristics

We next explore what county-level characteristics are associated with a higher SSDI allowance rates. Table 2 summarizes some of the key differences between a relatively high number of allowances per working-age resident and counties with a relatively low number of allowances per working-age resident, both at the start and end of our sample period. Several features are worth noting. There are large differences in earnings, with average wages considerably higher in the lowest-SSDI counties compared to the highest. This difference is consistent with the percentage of households below the poverty line. Geography characteristics also differ considerably, with the counties with the highest rate of allowances disproportionately being rural, low density places. The differences in geographic characteristics have become starker over time. Relatedly, whereas housing prices did not differ by allowance rates much at the start of the period, counties with relatively low SSDI rates now have considerably higher house prices. Mortality rates also vary greatly, with much higher rates in the high-allowance counties. While mortality rates fell nationally between 1996 and 2014, the average mortality rates in the high-allowance counties did not.

We incorporate these factors into a regression in order to understand what is correlated with cross-county variation. First, demographics in the region could affect the application and allowance rate; in particular, it is likely that age matters. Workers over the age of 50 are treated more leniently by the vocational grid (Michaud and Wiczer, 2019). They may also have lower incentives to invest in new skills or continued labor market attachment given their shorter retirement horizon.

Second, population density could be an important factor. The stylized fact is that SSDI is much more prevalent in rural than urban counties. Even after conditioning on our other characteristics, counties in Metropolitan Statistical Areas have fewer SSDI allowances per year than counties that are not. Population density incorporates this difference more precisely.

Third, we incorporate the measure of county-level health because worse average health of the population should be associated with higher allowance rates. Poor health should increase applications by reducing the value of work – both through wages and other costs (e.g., effort/pain associated with work – and applicants in worse health are more likely to receive an allowance.

Fourth, worse economic conditions are associated with higher applications and allowances (e.g., Black, Daniel and Sanders, 2002; Autor and Duggan, 2003; Autor, Dorn and Hanson, 2014). This is true both for the prevailing level conditions and for the change over time. Individuals in areas with lower nominal earnings are less likely to lose eligibility for exceeding the SGA threshold of earnings. For this reason, we include county-level employment rates and median wages in the county. Furthermore, worsening economic conditions can lower the expected future benefits of work and push workers over the application threshold. For this reason, we also include changes in wages.

Fifth, lower cost of living in an area should be associated with an increase in award rates. SSDI benefit payments are set federally through a formula where relatively low earners have a higher replacement rate than higher earners. We include housing price index values for counties as a measure of cost of living. This housing price index also may reflect the medium-run outlook for the county, such as whether the location is thriving or not and whether it is a desirable place to live.

Sixth, we include state-level fixed effects to control for permanent differences across DDS offices, as well as state-level policies that could affect applications and allowances such as Medicaid policies, food stamp regulations, etc. These state fixed effects are important, as they jointly account for between 20-30% of the variation in county-level. In additional specifications we add state-time effects to control for variation in state-level policies and characteristics.

We estimate a regression model that takes the form:

$$y_{it} = X_{it}\beta + \gamma_{it} + \epsilon_{it} \quad (1)$$

In the primary specification, y_{it} is either SSDI application or allowance rates in county *i* and year *t*. In terms of the independent variables on the right-hand side, X_{it} of county-level characteristics that are related to economic activity (wage levels); population health (mortality rates); and living costs (housing price index values). We also include state-level fixed effects or state-by-year fixed effects, represented by γ_{it}; these control for either permanent differences in state characteristics or time-varying state-level characteristics, respectively. The final term is an error term.

Results from this regression are in Table 2. Note, the R^2 on these regressions is quite high: with state-by-year fixed effects, our preferred specification, we are picking up about 80% of the variation. To understand the most important components, we use a Shapley-Owen decomposition to quantify the contribution of each regressor to the variance across counties while allowing for a covariance between the regressors. Column (3) shows the percentage contribution to the model sum of squares from the regression in Column (2) after controlling for state-by-year fixed effects. Column (6) decomposes the model sum of squares from column (5). Differences in mortality are the most important contributor to both allowances and applications. To put this finding differently, variation in our county-level health measure is the one that is most strongly associated with county-level differences in SSDI applications and allowances. Poverty rates and average wages also contribute to cross-county differences. Though poverty may not explicitly lead to an SSDI application, it may be a good proxy for very bad local economic shocks.

In the next step, we run these regressions separately by gender and age. Men and women may react differently to the same health condition either because the condition manifests itself differently or because the nature of their work experience differs in a way that makes them more or less able to adapt and continue work in spite of their health condition. Many of the same considerations are true of differences for different age groups. They may respond more strongly to an economic shock, as they have less time to respond and, further, they are treated differently in the vocational grid, as "advanced age." Most basically, health tends to deteriorate with age, potentially in ways correlated with but not perfectly measured by mortality risk.

We run the main cross-section specification for four separate sub-groups. In Table 3, we separate the county populations into two age-based groups: 21-49 and 50-64 years. In Table 4, we separate the county populations into males and females. In both of these, we present only the results with state-by-year fixed effects, our preferred specification. In Table 3, split by age, the most notable differences are that the older group have a stronger association with the poverty rate than do the younger group. There is also a significant sign change in how the fraction of the population that is older than age 50 affects the application rate: for the younger group, the fraction of the population that is 50 or older is associated higher SSDI applications, while it is reversed for the older group. For both, an older population is associated with more allowances. The breakdown across gender is in Table 4. Notice that males generally respond more strongly to economic factors than women. The marginal effect of the poverty rate on male applications is 25% higher than for women, and the marginal effect on allowances is 50% higher. Females, however, are more sensitive to mortality risk, both in terms of applications and allowances.

Counties with different allowance rates also may differ on how these allowances were awarded. In our sample, around 2/3 of allowances are granted at the DDS stage, but there is considerable heterogeneity across counties and over time in this figure, as suggested by Table 2. In Table 6, we run our baseline regression specification again by splitting allowances at the DDS stage and at the appeal stage. Note that the outcome variable in these regressions is smaller, because we are not adjusting the denominator of the total population as we were when we conditioned on age or sex. That is to say, there are fewer allowances at the appeal stage per 1,000 21-64 year-olds than there are overall allowances per 1,000. Comparing across columns, we see that outcomes through appeal are considerably more sensitive to the poverty rate in the county, though mortality risk drives differences at the DDS stage. This makes sense as poor health may be more easily determined at the DDS stage, while high rates of poverty may be more associated with complicated cases and cases more likely adjudicated at later stages.

6. County-level Characteristics Associated with Changes in SSDI Outcomes over Time

In the previous section, we studied what characteristics of counties are associated with higher allowance to population ratios, averaged over time. Now, we would like to understand what has driven trends in national allowance rates exploiting county-level variation.

Our baseline dynamic estimation adds county-level fixed effects to the baseline cross-section regression specification expressed in equation (1). To focus on large temporal variation, we compare a period at the start of the sample period (1996 and 1997) to a period at the end of the sample period (2013 and 2014). Consequentially, we run a first-differences estimation and remove the state effects to result in the following specification:

$$\Delta y_{it} = \Delta X_{it}\beta + \epsilon_{it} \tag{2}$$

Our dependent variable is the log difference, meaning that we are looking at growth rates and so while SSDI counties with high application or allowance rates may have large differences in absolute levels, we are looking at their relative increase. The regression specification relies on the assumption that the effect of a marginal percent change in the regressors is independent of the level of the regressor. This is unlikely to be true. In particular, counties with worse average economic conditions, worse average health, or lower average cost of living should have more individuals on the margin of applying to SSDI and a larger marginal effect of a change in any other regressor.

These results are similar to the previous results. Again, we find that population density and poverty rates are associated with larger increases in SSDI allowances and applications. Changes in the wage rate, however, take a less prominent role than changes in the poverty rate, as the former has a statistically insignificant relationship to applications. Mortality risk is still a large and robustly significant factor, particularly for explaining the growth in allowances, but less so for applications.

As in the baseline regression, Table 7 shows a relatively high R^2, and so we can again decompose the contributions to the model's explained sum of squares. Mortality risk is still an important contributor, explaining 30% of the growth of allowances and 10% of the growth in applications. Housing prices are also an important factor. To understand applications, we see growth in the older working-age population in a county is associated with rapidly growing application rates. Again, changes in the poverty rate are also associated with changes in the application rate, so places where the poverty rate increased rapidly have the largest increase in applications, although the contribution is smaller for allowances. Instead, increases in allowances were more strongly associated with falling average wages.

Finally, as was noted in the time-series figures, female growth was faster than male growth. Hence, we split these two samples. Most notably, an increase in the older age group is more strongly associated with rising female rates than male aging. On the other hand, increases in mortality risk are associated with increases in allowances, but this relationship is much stronger among men than women: places with declining male health saw increases in male allowances to a greater extent than for women, although the effect is still there.

7. Conclusion

In this paper, we analyzed county-level data on SSDI allowances and applications. We first outlined the patterns in these distributions, finding that dispersion increased particularly in the late 1990s and early 2000s. Just as allowances and applications have increased fastest among females, their geographic dispersion has increased the most, particularly at the top tail of the distributions of applications and allowances. While there is considerable cross-sectional variation at the county-level, there is considerable persistence in the rank of individual counties from year-to-year. We then analyzed what features of these counties were most associated with high allowance and application rates. Broadly speaking, there is a trend that poorer, more rural counties have higher disability rates. Quantitatively, differences across counties in mortality rates are particularly important determinants, accounting for 40% of the variance in allowances and half the variance in applications. In terms of growth, we find the same general relationships, that poorer counties with worsening health have the most growth in SSDI allowances.

Understanding this geographic variation is important to understand the value of SSDI. This paper pointed out that the single factor with the strongest association with the geographic heterogeneity in SSDI participation is heterogeneity in mortality rates. That is to say, population health differs and this is reflected in differences in SSDI. To the extent that SSDI is concentrated in some counties much more than others, this is largely reflected in the underlying mortality rates being different. Beyond this factor though, we also found that economic forces which may drive the application decision were complementary: in places where the cost of living is lower, proxied by low population density and house prices, we indeed found an association with higher application and allowance rates. These results hold for the poverty rate. This county-level variation is quite informative for understanding variation in SSDI over time. In future work, we will couple these findings with differences in applicant wait times to better understand heterogeneity in the trade-offs potential applicants face and the value of SSDI.

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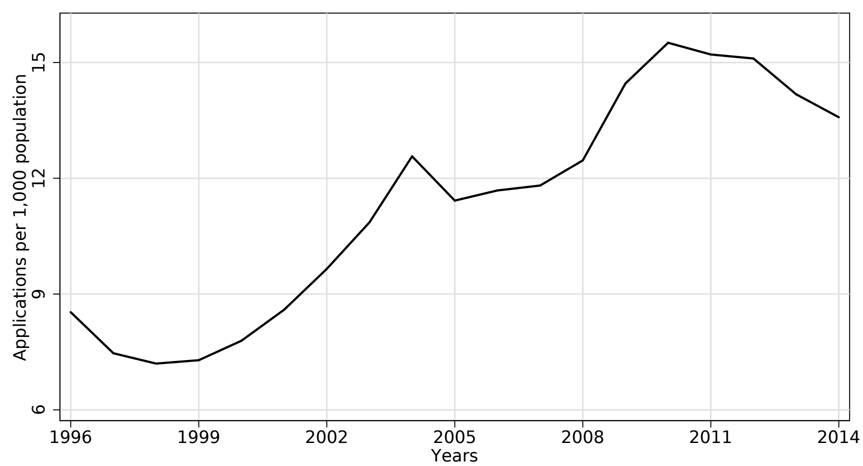
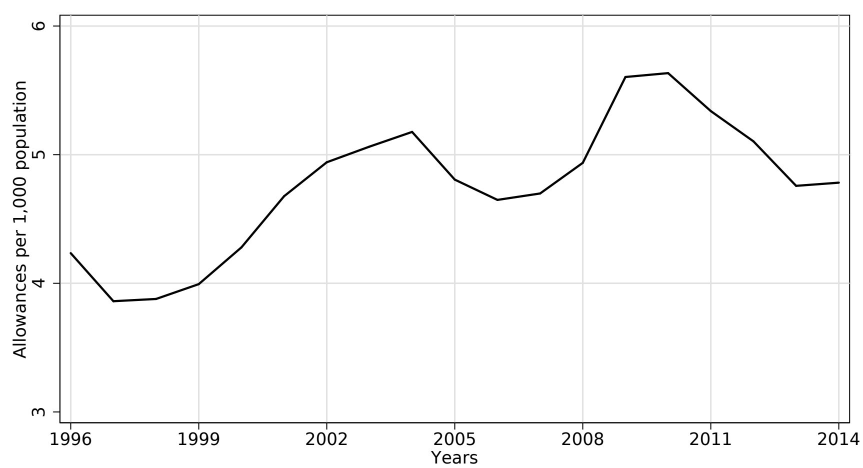
Figure 1: National Trends in SSDI Applications and Allowances based on Filing Year

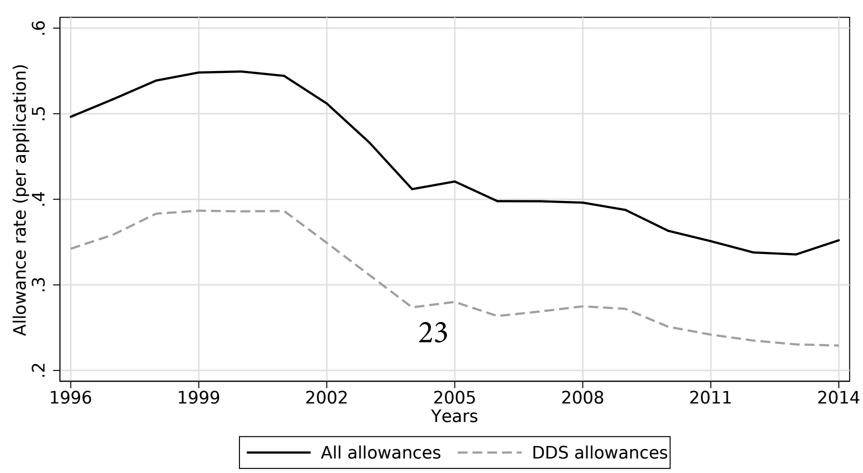
(a) Applications per 1,000 working-age population



(b) Allowance per 1,000 working-age population



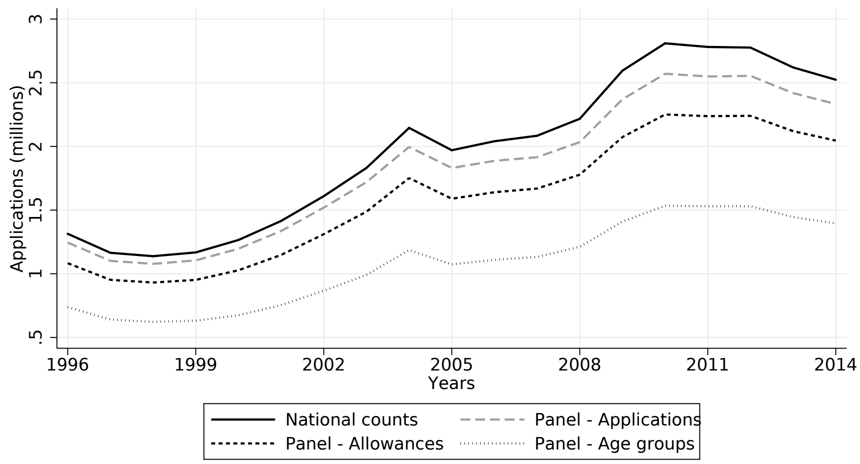
(c) Average allowances per application



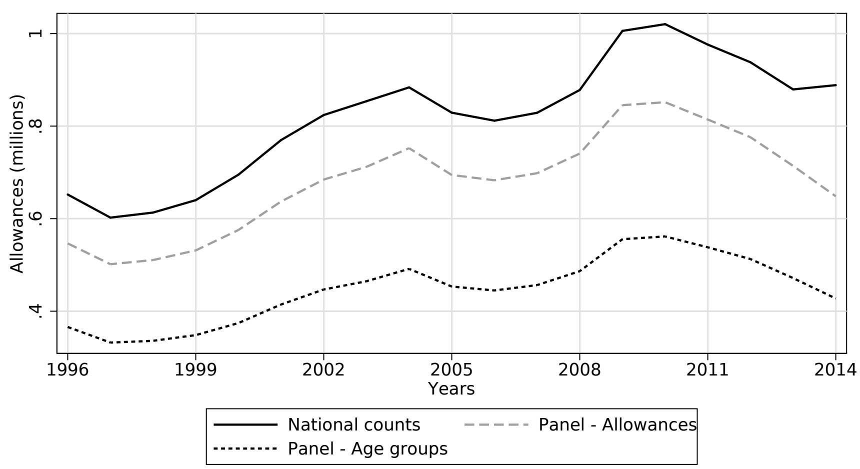
Source: SSA (2018)

Figure 2: SSDI Applications and Allowances in Our Data Sets Compared to National Numbers

(a) Applications



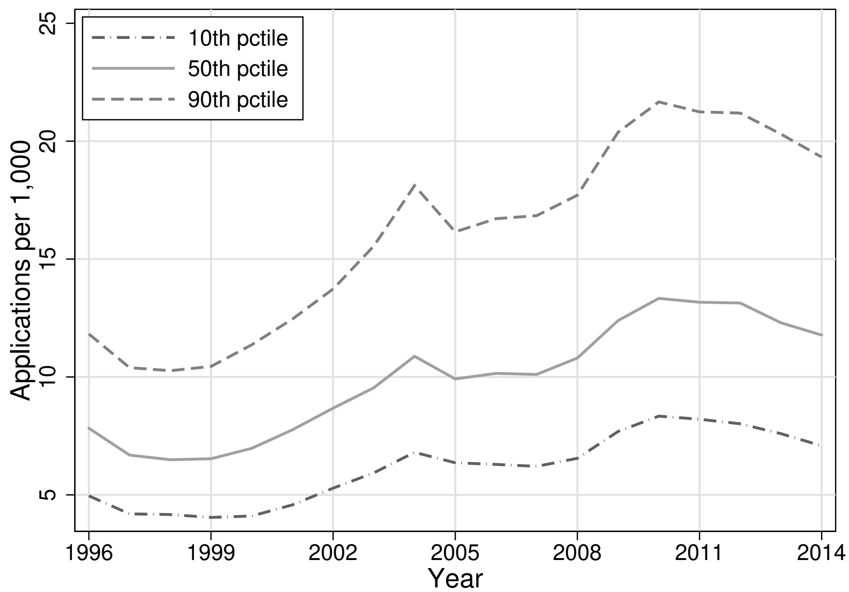
(b) Allowances



Source: SSA (2018) and Authors' Calculations

Figure 3: Trends in Different Parts of the Distribution of SSDI Applications and Allowances

(a) Applications



(b) Allowances

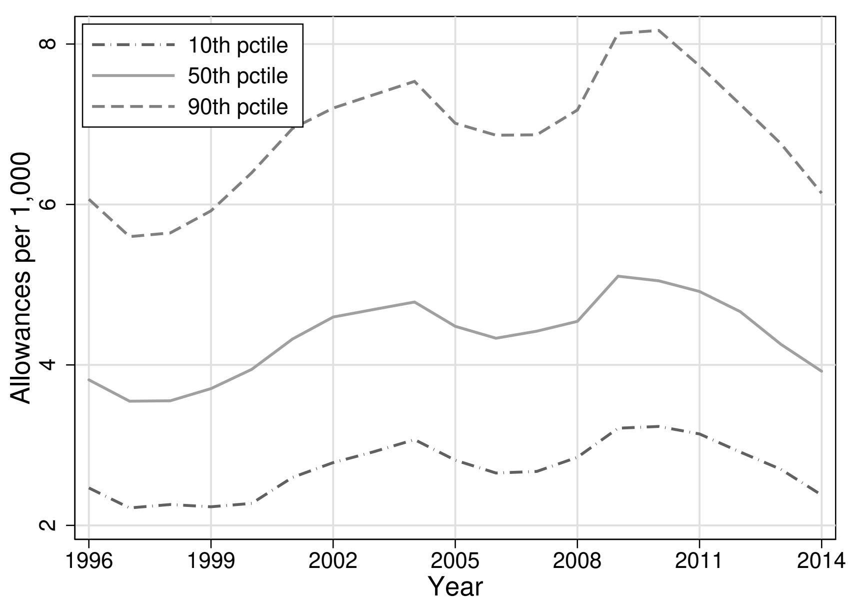
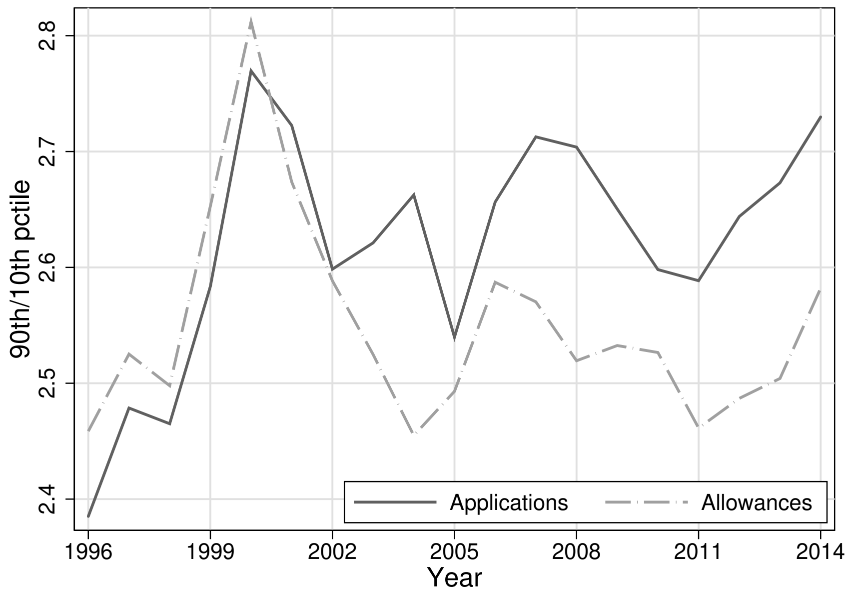


Figure 4: Dispersion and Skewness of the Application and Allowance Distributions

(a) Dispersion, measured as $\frac{p90}{p10}$, where p is the percentile



(b) Skewness, measured as $\frac{(p90-p50)-(p50-p10)}{p90-p10}$, where p is the percentile

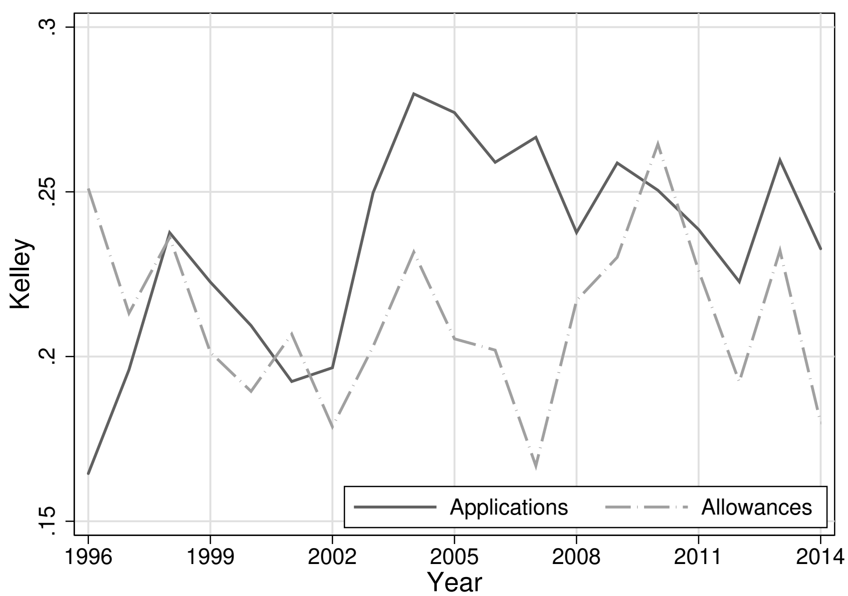
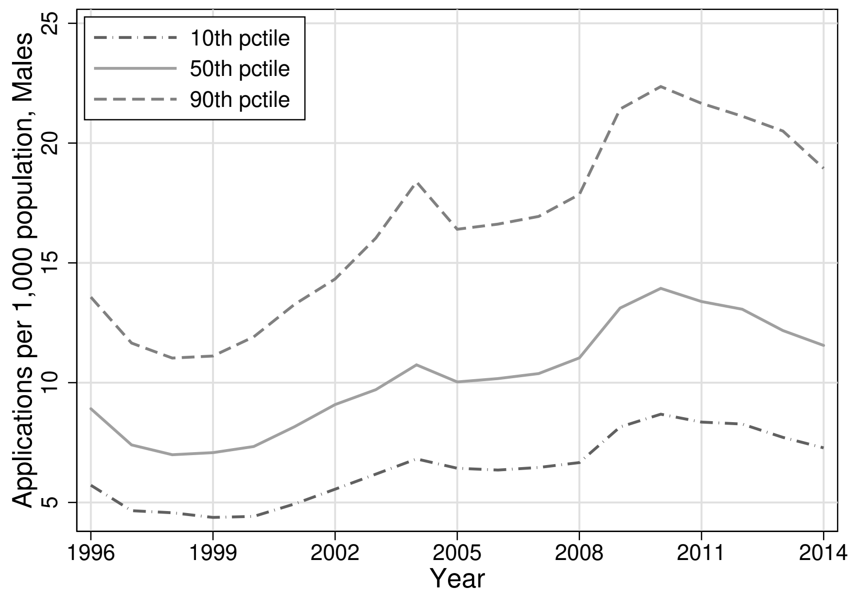


Figure 5: Quantiles of the application distribution split by sex.

(a) Males



(b) Females

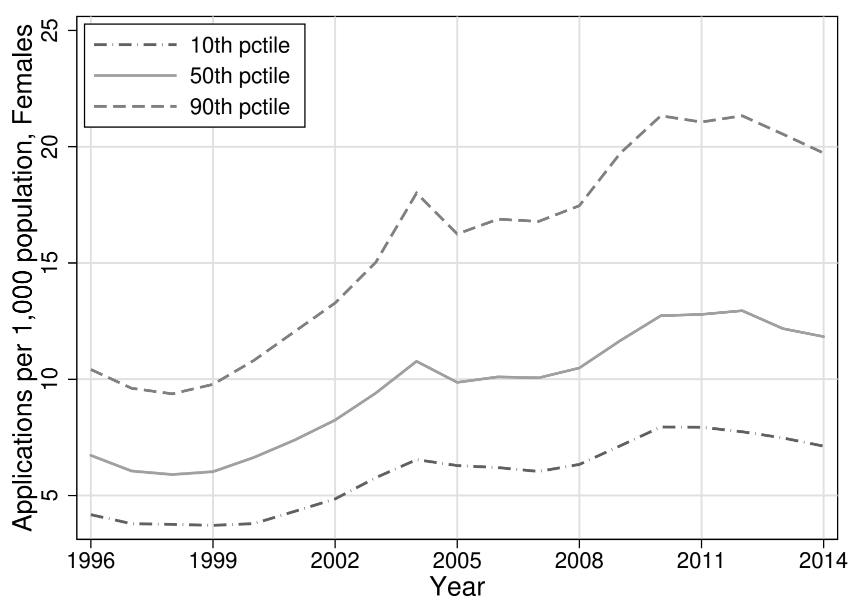
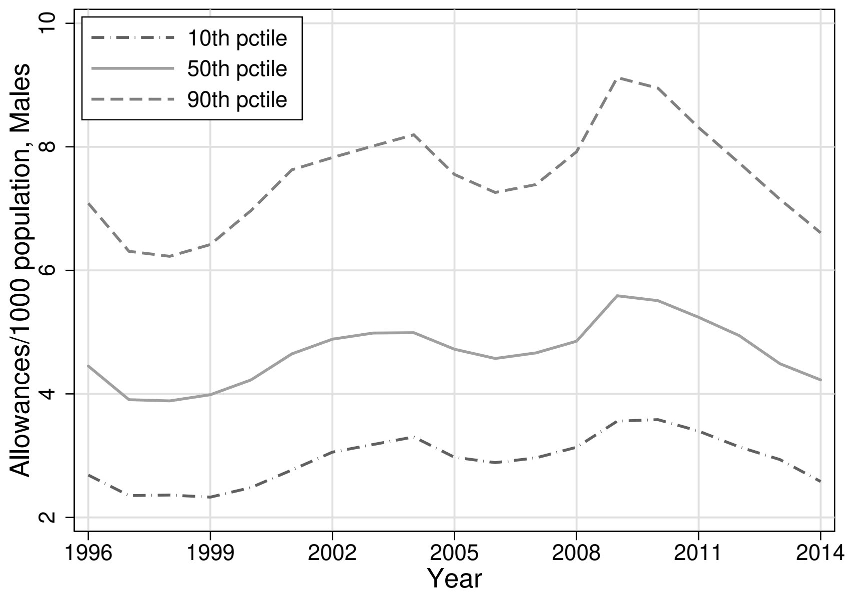


Figure 6: Quantiles of the allowance distribution split by sex.

(a) Males



(b) Females

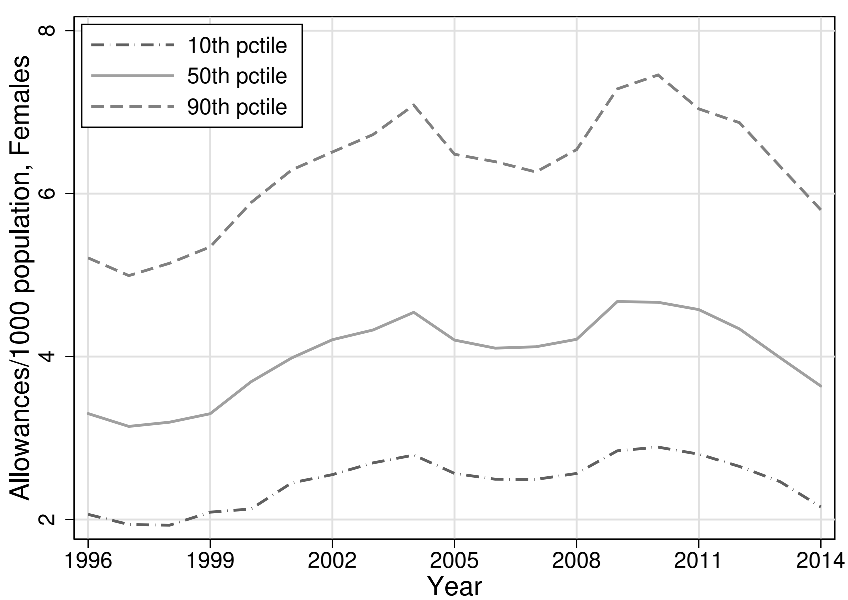
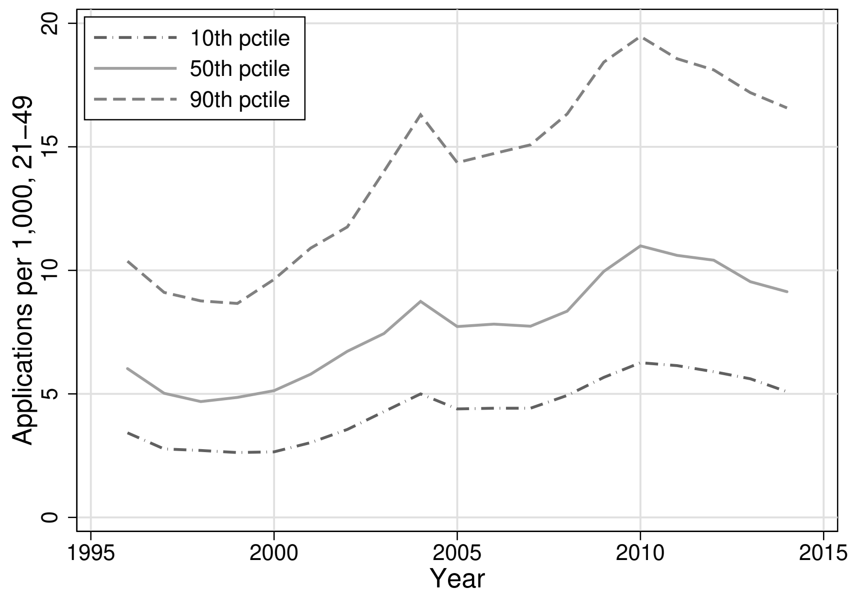


Figure 7: Quantiles of the application distribution split by age.

(a) Younger than 50



(b) Older than 50

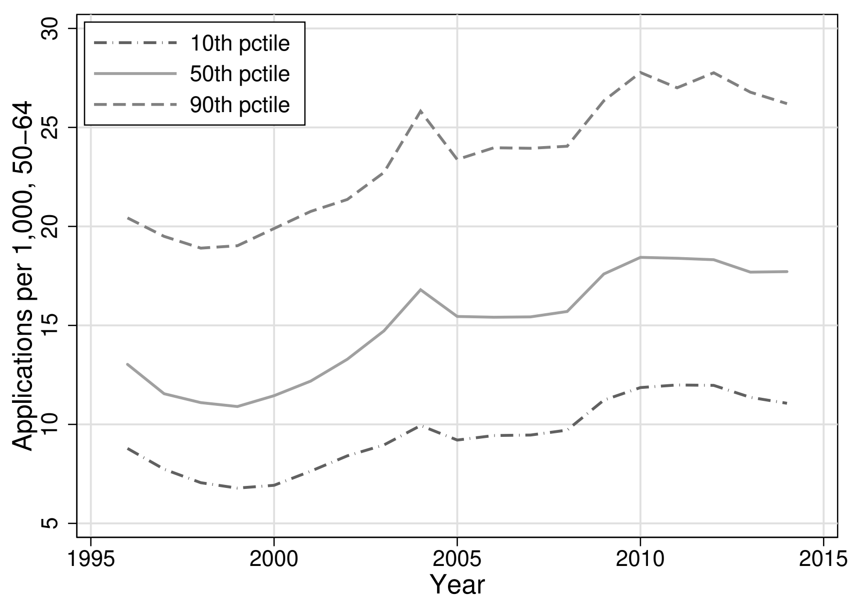
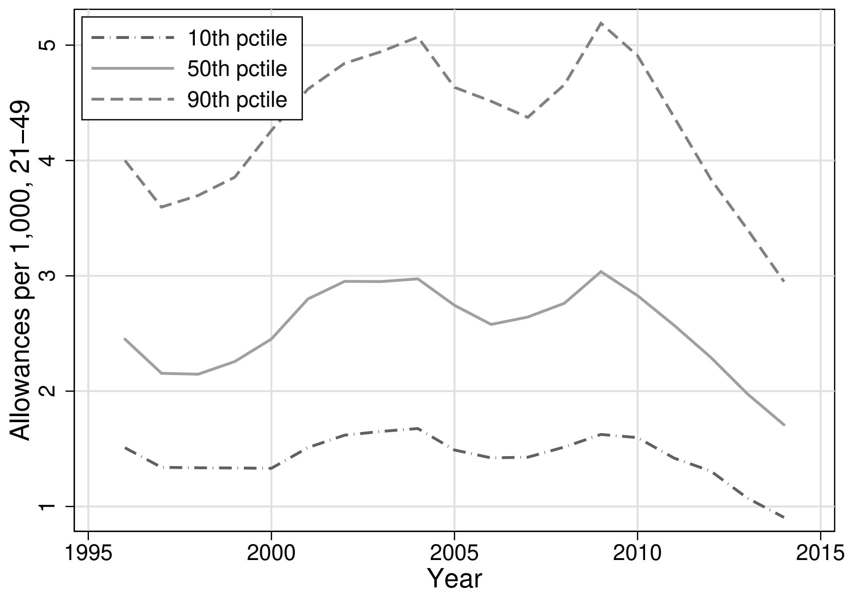


Figure 8: Quantiles of the allowance distribution split by age.

(a) Younger than 50



(b) Older than 50

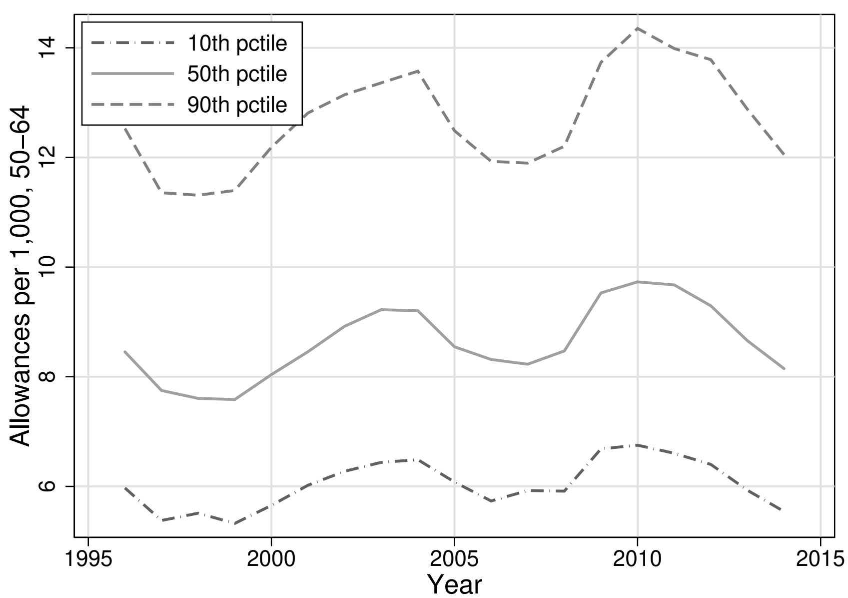


Table 1: Year-to-year autocorrelation of county applications per 1,000 and allowances per 1,000

	Level		Rank	
	1996-2009, Rise	2010-2014, Decline	1996-2009, Rise	2010-2014, Decline
Applications	1.0036	0.9599	0.9743	0.9815
Allowances	0.9553	0.9089	0.9594	0.9619
Observations	16296	5820	15132	5820

Table 2: Characteristics of top and bottom counties, ranked by their allowances per 1,000.

	1996				2014			
	Top		Bottom		Top		Bottom	
	10%	25%	25%	10%	10%	25%	25%	10%
Female Allowances/1,000	7.25	6.22	2.42	2.03	8.81	7.85	3.04	2.39
Male Allowances/1,000	9.55	7.96	2.86	2.24	10.47	9.23	3.37	2.71
Fraction of Allowances	0.32	0.57	0.08	0.03	0.33	0.57	0.06	0.02
Allowances/Applications	0.57	0.57	0.55	0.57	0.36	0.36	0.37	0.37
Allowances at DDS	0.57	0.60	0.72	0.73	0.60	0.63	0.73	0.75
Population 50-64	0.29	0.29	0.23	0.22	0.37	0.37	0.32	0.32
Mortality Risk	17.17	16.33	11.78	10.88	16.74	15.74	9.90	8.93
Population Density	0.11	0.15	1.49	1.75	0.14	0.20	2.08	2.87
In MSA	0.25	0.38	0.95	0.97	0.31	0.41	0.96	0.96
House Price Rank	0.49	0.51	0.49	0.49	0.46	0.46	0.58	0.65
Poverty Pct	18.13	16.66	9.94	7.81	22.50	20.79	13.04	11.40
Wage Rank	0.08	0.11	0.47	0.56	0.10	0.12	0.55	0.65

Table 3: Baseline regression results

	(1) Applications	(2) Applications	(3) Contribution (%)	(4) Allowances	(5) Allowances	(6) Contribution (%)
Population Density /1000	-0.07***	-0.06***	1.28	-0.03***	-0.04***	3.04
	(0.023)	(0.023)		(0.007)	(0.007)	
Percent 50-64	52.17***	28.04***	7.58	13.89***	15.67***	23.62
	(1.921)	(1.949)		(0.464)	(0.845)	
Mortality Risk	0.82***	1.03***	53.01	0.39***	0.36***	40.72
	(0.053)	(0.050)		(0.018)	(0.019)	
House Price Index	-0.17	-0.61*	1.54	-0.26***	-0.18	2.10
	(0.354)	(0.373)		(0.079)	(0.138)	
Log Average Wage	-0.37	-2.10***	8.55	-1.78***	-1.63***	17.51
	(0.474)	(0.527)		(0.212)	(0.237)	
Percent Poverty	37.07***	21.66***	28.04	0.25	2.45***	13.01
	(2.770)	(2.581)		(0.743)	(0.932)	
Observations	15984	15984	15984	15984	15984	15984
R^2	0.798	0.867		0.762	0.843	
State Effects	Yes	Yes	Yes	Yes	Yes	Yes
State-Year Effects		Yes	Yes		Yes	Yes

Standard errors clustered on county in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Regression results by age group

	(1)	(2)	(3)	(4)
	Applications		Allowances	
	21-49	50-64	21-49	50-64
Population Density /1000	-0.07***	-0.02	-0.03***	-0.06***
	(0.018)	(0.031)	(0.006)	(0.011)
Percent 50-64	19.96***	-14.06***	11.04***	4.75***
	(2.286)	(3.089)	(0.649)	(1.328)
Mortality Risk	0.97***	1.24***	0.24***	0.64***
	(0.058)	(0.087)	(0.014)	(0.036)
House Price Index	-1.45***	-1.48***	-0.15	-0.26
	(0.419)	(0.442)	(0.114)	(0.212)
Log Average Wage	0.01	-0.27	-0.89***	-3.32***
	(0.514)	(0.614)	(0.170)	(0.390)
Percent Poverty	17.24***	32.23***	1.15	5.74***
	(2.766)	(4.558)	(0.729)	(1.748)
Observations	15984	15984	15984	15984
R^2	0.765	0.734	0.806	0.807
State Effects	Yes	Yes	Yes	Yes
State-Year Effects	Yes	Yes	Yes	Yes

Standard errors clustered on county in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Regression results by sex

	(1)	(2)	(3)	(4)
	Applications		Allowances	
	Males	Females	Males	Females
Population Density /1000	-0.15***	-0.10*	-0.10***	-0.06***
	(0.043)	(0.054)	(0.018)	(0.015)
Percent 50-64	32.79***	24.73***	18.63***	13.23***
	(2.008)	(2.023)	(0.895)	(0.851)
Mortality Risk	0.86***	1.24***	0.30***	0.42***
	(0.053)	(0.057)	(0.017)	(0.023)
House Price Index	-0.33	-0.79**	-0.10	-0.23*
	(0.391)	(0.364)	(0.150)	(0.135)
Log Average Wage	-1.59***	-2.66***	-1.93***	-1.34***
	(0.525)	(0.553)	(0.259)	(0.226)
Percent Poverty	24.97***	20.49***	3.52***	2.27***
	(2.782)	(2.564)	(1.089)	(0.876)
Observations	15984	15984	15984	15984
R^2	0.861	0.856	0.835	0.813
State Effects	Yes	Yes	Yes	Yes
State-Year Effects	Yes	Yes	Yes	Yes

Standard errors clustered on county in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Regression on allowances, split by those granted at DDS or appeal stage

	(1)	(2)	(3)	(4)
	DDS	DDS	Appeal	Appeal
Population Density /1000	-0.02***	-0.02***	-0.02***	-0.02***
	(0.004)	(0.004)	(0.003)	(0.004)
Percent 50-64	8.80***	9.61***	4.54***	5.81***
	(0.314)	(0.518)	(0.245)	(0.454)
Mortality Risk	0.25***	0.23***	0.15***	0.14***
	(0.013)	(0.014)	(0.008)	(0.009)
House Price Index	-0.14***	-0.12	-0.17***	-0.12*
	(0.049)	(0.083)	(0.039)	(0.066)
Log Average Wage	-1.09***	-1.03***	-0.74***	-0.61***
	(0.126)	(0.146)	(0.101)	(0.107)
Percent Poverty	-0.04	1.20*	0.23	1.50***
	(0.538)	(0.645)	(0.351)	(0.440)
Observations	15984	15984	15984	15984
R^2	0.692	0.818	0.714	0.805
State Effects	Yes	Yes	Yes	Yes
State-Year Effects		Yes		Yes

Standard errors clustered on county in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: First-difference regression for growth from 1996-97 to 2013-14

	(1) Applications	(2) Contribution (%)	(3) Allowances	(4) Contribution (%)
Population Density /1000	0.08***	3.61	0.01	10.49
	(0.017)		(0.015)	
Percent 50-64	4.12***	57.14	0.90***	11.77
	(0.114)		(0.105)	
Mortality Risk	-0.00	10.46	0.06***	27.53
	(0.009)		(0.008)	
House Price Index	-0.10***	1.72	-0.17***	35.05
	(0.025)		(0.023)	
Log Average Wage	-0.06	0.67	-0.19**	11.57
	(0.086)		(0.079)	
Percent Poverty	1.35***	26.39	-1.25***	3.59
	(0.305)		(0.281)	
Observations	1776	1776	1776	1776
R^2	0.851	0.851	0.274	0.274

coefs coefficients; Standard errors clustered on county in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: First-difference regression for growth from 1996-97 to 2013-14

	(1)	(2)	(3)	(4)
	Males		Females	
	Applications	Allowances	Applications	Allowances
Population Density /1000	0.10***	-0.02	0.19***	0.04
	(0.031)	(0.030)	(0.039)	(0.035)
Percent 50-64	3.32***	0.43***	4.87***	1.30***
	(0.105)	(0.100)	(0.140)	(0.124)
Mortality Risk	0.01	0.07***	-0.03***	0.03***
	(0.006)	(0.006)	(0.012)	(0.011)
House Price Index	-0.08***	-0.14***	-0.11***	-0.19***
	(0.024)	(0.023)	(0.030)	(0.027)
Log Average Wage	-0.05	-0.15*	-0.07	-0.24***
	(0.081)	(0.077)	(0.102)	(0.090)
Percent Poverty	1.46***	-1.02***	1.36***	-1.42***
	(0.289)	(0.275)	(0.362)	(0.321)
Observations	1776	1776	1776	1776
R^2	0.803	0.387	0.858	0.218
State Effects				
State-Year Effects				

Standard errors clustered on county in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$