HHS Public Access

Author manuscript

J Public Econ. Author manuscript; available in PMC 2022 July 01.

Published in final edited form as:

J Public Econ. 2021 July ; 199: . doi:10.1016/j.jpubeco.2021.104410.

The effect of economic conditions on the disability insurance program: Evidence from the great recession

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Abstract

We examine the effect of job displacement during the Great Recession on the Social Security Disability Insurance (SSDI) program. Exploiting variation in the severity and timing of the recession across states, we estimate the effect of unemployment on SSDI applications and awards. We find the Great Recession induced nearly one million SSDI applications that otherwise would not have been filed, of which 41.8% were awarded benefits, resulting in over 400,000 new beneficiaries who made up 8.9% of all SSDI entrants between 2008 and 2012. More than one-half of the recession-induced awards were made on appeal. The induced applicants had less severe impairments than the average applicant. Only 9% had the most severe, automatically-qualifying impairments, 33% had functional impairments and no transferable skills, and the rest were denied for having insufficiently severe impairments and/or transferable skills. Our estimates imply the Great Recession increased claims processing costs by $2.960 billion during 2008–2012, and SSDI benefit obligations by $55.730 billion in present value, or $97.365 billion including both SSDI and Medicare benefits.

Keywords

Disability insurance; Unemployment; Great Recession

1. Introduction

More than eight million former workers receive Social Security Disability Insurance (SSDI) benefits, a number equivalent to approximately five percent of the U.S. labor force. As the program has expanded over the last six decades, observers have debated the degree to which this program growth has been due to historical policy changes and anticipated growth in the insured population, or declining labor market opportunities for low-skilled workers. The SSDI program was designed to insure workers against permanent earnings losses arising from a severe, and long-lasting disability. While some disabilities qualify on medical criteria

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

alone, disability awards can also take account of vocational factors that indicate degree of skill transferability–education, prior jobs, and age. Individuals who have enough remaining work capacity to perform a prior job do not qualify for SSDI benefits; but those whose remaining work capacity and skills do not transfer to existing jobs, may be awarded SSDI benefits under medical-vocational criteria.

Because labor market opportunities factor into SSDI decisions, low-skilled, older workers may be especially likely to turn to the SSDI program should they lose their job during a downturn. Workers who are laid off from a long-term job experience near-permanent losses in earnings (Jacobson et al., 1993; Von Wachter et al., 2009), and these losses are especially large for older workers and those who are laid off during a recession (Davis and von Wachter, 2011). For such people, the SSDI program is the only available source of long-term earnings replacement prior to age 62—but only if they also have a serious health problem.

About 40% of SSDI applicants have at least some ability to work (Maestas et al., 2013). It is this group for whom the decision to participate in the labor force versus apply for SSDI benefits may be sensitive to economic conditions. If they have a suitable job match (possibly one that accommodates their disability), they choose to work; but it they lose their job, they turn to the SSDI program. It is unknown whether these economically-induced applicants are (1) workers with very severe ("listing-level") impairments (e.g., chronic kidney disease, Crohn's Disease with complication), who qualify automatically regardless of whether they have transferable skills; (2) workers with less severe functional impairments who lack transferable skills, and therefore qualify under medical-vocational provisions, especially if they are age 55 or older; or (3) workers with non-severe impairments or some transferable skills, who do not qualify.[1]

Once people qualify for SSDI benefits, they rarely re-enter the labor force. Although SSDI has incentive programs to encourage beneficiaries to work,[2] participation rates are low, perhaps because expected compensation from employment for someone with reduced earnings capacity is often less than the value of stable cash benefits and Medicare coverage, especially when factoring in the risk of future job loss. As a result, some productive workers who are displaced during a downturn are not available for re-employment during the subsequent recovery because they have entered the SSDI program; this creates efficiency losses for the economy as a whole, and possibly also for the individual who foregoes the possibility of future income growth.[3]

In this paper, we estimate the effect of job displacement during the Great Recession on SSDI program participation.[4] According to the National Bureau of Economic Research, the Great

[1]According to Title 20 of the Code of Federal Regulations, the Listing of Impairments defines impairments that are severe enough to prevent *any* gainful activity (§416.925) whereas the more general definition of disability is the inability to do any *substantial* gainful activity (§404.1505). Also, our usage of'severe" follows one of several SSA usages: "Severe means medical severity as used by the medical community. The term does not have the same meaning as it does when we use it in connection with a finding at the second step of the sequential evaluation processes… " (Pt. 404, Subpt. P, App. 1).

[2]These include the Ticket to Work program, the Trial Work period, exclusion of Impairment-Related Work Expenses from earnings, and other related provisions.

[3]Burkhauser and Daly (2011) show that people with disabilities have experienced no real income growth over the past several decades.

[4]We focus on the effects of increased unemployment during the Great Recession and not the effects of other, concurrent events such as the housing or financial crisis. Also, we do not attempt to answer the related, but distinct question of how the existence of the SSDI program affects employment outcomes of displaced workers.

Recession began in December 2007, when the national unemployment rate was 5.0%. In the months that followed, unemployment rose rapidly, peaking at 10.0% in October 2009, four months after the recovery officially began. Fig. 1 juxtaposes the monthly unemployment rate (left axis) against the number of SSDI applications filed each month, and the number of SSDI awards ultimately made to those applicants.[5] Organized in this manner, it is visually evident that SSDI claims rose in lockstep with the unemployment rate, and so did SSDI awards.[6] Fig. 1 also reveals there were two distinct waves of applications during the Great Recession. The number of awards appears to have increased sharply during the first wave, but not as much during the second wave. This pattern motivates our use of a distributed lag model in the empirical analysis to explore the extent of intertemporal shifting of SSDI applications in response to economic shocks. The ratio of the award and application curves implies that the SSDI allowance rate decreased during the Great Recession, which in turn suggests the recession-induced claims were from applicants with less severe impairments, who in better economic times would have worked.

While compelling, Fig. 1 is inconclusive owing to the possibility of confounding secular trends in both claims and allowances. There are at least two potential confounders. First, the Social Security Administration (SSA) began focused reviews of appellate claims decided by administrative law judges in 2011 (Ray and Lubbers, 2014). These reviews revealed systematic decision errors by judges, which once corrected, resulted in a steady reduction in the hearing-level allowance rate. A second potentially confounding factor is demographic: the oldest members of the large Baby Boom cohort (b. 1946–1964) became eligible for early Social Security retirement benefits in 2008 and full retirement benefits in 2012. Indeed, after decades of nearly continuous growth, the SSDI case-load began to contract in 2015 (Social Security Administration, 2020a,b,c; Table 3). Thus, as the leading edge of the Baby Boom began to age out of the disability program at full retirement age and into the retirement program, the applicant pool became younger on average, resulting in fewer applicants who would have qualified at a higher rate due to their age.

Our analysis uses the universe of SSDI applications filed between 2006 and 2012 and tracks their outcomes through the appellate level. To address potential confounding from secular trends, we make use of variation in the timing and severity of the recession across U.S. states by regressing the number of applications of a given type filed by state and month on state-month unemployment.[7] We depart from the previous literature by specifying the independent variable of interest as the state-month count of unemployed workers rather than the unemployment rate since the denominator of the unemployment rate may change endogenously in response to economic shocks. This methodology allows us to estimate the effect of unemployment on SSDI applications and awards. Because our data also record the

[5]This is different from official statistics that would show awards by month of *award*. Because there can be substantial time lags between filing and award, our method of plotting awards by initial filing date makes it easier to detect the time series correlation between the unemployment rate and SSDI awards. In the figure, the number of claims and awards are adjusted for monthly seasonality, smoothed using a 3-month moving average, and re-centered around their initial value in October 2006, all to aid visual clarity.

[6]We use “awards” and “allowances” interchangeably, although the Social Security Administration draws an administrative distinction between them. Specifically, applicants can be *allowed* benefits on medical review, but not *awarded* benefits if they are subsequently found to be ineligible for technical reasons (e.g., return to substantial gainful activity).

[7]Bitler (2016) use a similar design to investigate the effects of the Great Recession on anti-poverty programs using data from 1980 covering several downturns.

reasons for allowance or denial, we can investigate the characteristics of recession-induced applicants and beneficiaries, and shed light on the important question of whether the induced new beneficiaries were inframarginal individuals who could have qualified automatically before the Great Recession but who preferred to work as long as they had a job, or whether they were people lacking transferable skills whose disabilities were closer to the margins of eligibility.

Our analysis yields several key findings. First, the Great Recession induced new SSDI applications that otherwise would not have been filed, and, to a lesser degree, accelerated the timing of applications that would have been filed anyway at a later date. Specifically, we estimate the Great Recession led 1.4 million former workers to apply for SSDI benefits during 2008–2012; nearly 1 million (72%) were induced in the sense they otherwise would not have applied, while the rest (28%) would have applied anyway, and the timing of their application was accelerated by only a few months. On net, the induced applicants (excluding the accelerated applicants) accounted for 11.6% of all applications filed during 2008–2012.

Second, more than one-half million of the recession-induced applicants were awarded benefits; over 400,000 were induced awards to people who otherwise would not have entered the SSDI program, while the rest were accelerated awards to people who would have entered the program anyway at a later date. On net, the induced awardees (excluding accelerated awardees) made up 8.9% of all new beneficiaries who entered SSDI during 2008–2012. The Great Recession had little effect on the number of awards made at the initial review level, but increased awards made at the appellate levels. More than half (53%) of the induced new beneficiaries were awarded benefits on appeal.

Third, induced applicants had less severe impairments than the average applicant, and those who were awarded benefits were more likely to be allowed on the basis of functional limitations and no transferable skills. The mean allowance rate among induced applicants was 42% (accounting for appeals), substantially lower than the average allowance rate of 54% for the system as a whole. Further, allowances to applicants with listing-level impairments—automatically qualifying conditions that are identifiably severe — did not rise by nearly as much as allowances to applicants for medical-vocational reasons—people with functional disabilities and no transferable skills. Overall, the induced applicants were either denied (58%) or allowed for medical-vocational reasons (33%); relatively few were allowed for severe, listing-level impairments (9%).

Lastly, our estimates imply that the Great Recession had a significant impact on SSDI program costs, both administrative processing costs and benefit obligations. We estimate processing costs rose by $2.960 billion dollars during 2008–2012 as the system responded to an influx of induced applications (excluding the accelerated applications), many of which were reviewed more than once (and often three times) as they progressed from initial review to reconsideration to the hearing level. The impact of the Great Recession on benefit obligations was even more substantial because very few people leave the SSDI program to return to work and qualification for SSDI benefits confers entitlement to Medicare benefits.[8] Based on our finding that the average induced beneficiary was 53 years old and therefore would claim SSDI benefits for an average of 13 years (until death or aging out), our

estimates imply the Great Recession added $55.730 billion to SSDI benefit obligations in present value, or $97.365 billion including both SSDI and Medicare benefits.

These findings are novel and important contributions to the literature. Surprisingly, there are no estimates of the effects of unemployment on SSDI program participation that are both comprehensive (in accounting for applications *and* awards, including awards on appeal) and nationally generalizable to the U.S.[9] While Autor and Duggan (2003) showed that structural changes in labor demand for lower-skilled workers in the 1980s and 1990s contributed to SSDI program growth during that period, only a handful of studies have examined fluctuations during business cycles. Stapleton et al. (1988) showed that SSDI *applications* were responsive to the annual unemployment rate across states during the 1980s and early 1990s, as did Cutler et al. (2012) and Maestas et al. (2015) for the 2000s. Nichols et al. (2017) found that applications for the Supplemental Security Income (SSI) program (the means-tested counterpart to SSDI) were responsive to the unemployment rate during the Great Recession. In addition, prior work has documented that people who apply for SSDI benefits during a recession have greater work capacity than those who apply during expansions (Coe and Matthew, 2013; Lindner et al., 2017) and have experienced a longer spell of non-employment (Maestas et al., 2015). Despite the fact that Unemployment Insurance (UI) benefits are often temporarily extended during recessions to mitigate the effects of high unemployment rates, there is no evidence of a causal relationship between UI benefit extensions and SSDI applications (Mueller et al., 2016).

Stapleton et al. (1988) had data on initial awards (but not awards on appeal) and found that these increased among men, but not women, in response to increases in the unemployment rate in the 1980s through early 1990s. In contrast, Maestas et al. (2015) found initial awards *decreased* in response to increases in the unemployment rate during 1992–2006, and were unresponsive during 2006–2012, the period that included the Great Recession. Like the Stapleton et al. (1988) study, Maestas et al. (2015) examined initial awards, but not awards on appeal. The omission of awards on appeal is an important limitation. Historically, awards on appeal have accounted for around 30% of all SSDI awards (Social Security Administration, 2020a,b,c; Tables 60 and 63). Thus, for a full accounting of the effects of recessions on the disability program, one must track and account for claims that progress beyond the initial review level.

Lastly, two papers have examined the local effects of economic shocks on SSDI benefit payments in areas heavily affected by extraction industries.[10] In a study of Appalachia in the 1970s and 1980s, Black et al. (2002) found SSDI payments responded negatively to earnings shocks caused by the coal boom and bust cycle. A recent paper by Charles et al. (2018) extends the Black et al. analysis to oil and gas price shocks between 1970 and 2010 and finds a similar elasticity of SSDI payments with respect to area-level earnings. While these

[8]Using longitudinal data, Liu and Stapleton (2011) estimate that 3.7% of beneficiaries leave the rolls to return to work within ten years of entry.

[9]Using tax records, Yagan (2019) examines the effect of local unemployment shocks in 2007–2009 on long run employment outcomes among American workers ages 30–49 in 2007. He finds a positive but statistically insignificant effect on the rate of SSDI participation in 2015.

[10]Rege et al. (2009) found that plant downsizing increased disability insurance claims of affected workers in Norway.

studies provide important evidence of effects of economic conditions on the SSDI program, neither is generalizable to the national level (by design), and neither had the ability to directly measure and track the *inflow* of induced applications and awards because they did not use claims data. Claims microdata is necessary to estimate the number and characteristics of recession-induced SSDI applications and awards, the implied lifetime costs of the benefits awarded to induced beneficiaries, including Medicare benefits, and the administrative costs of processing an influx of recession-induced applications as they moved through the review system.

2. Background on SSDI

The Social Security Disability Insurance (SSDI) program insures covered workers against loss of ability to perform substantial gainful activity in the economy because of a medical impairment that is expected to last at least twelve months (or result in death). The disability decision process proceeds in five steps. Step 1 is performed by SSA field offices, and consists of technical verification of SSDI insured status and confirmation that the applicant is not engaged in substantial gainful activity (SGA), defined in 2018 as earning $1,180 per month or more (if not blind). If these criteria are met, the field office collects all required application materials, and forwards the application to the state-run Disability Determination Service (DDS) office, where it is assigned to a disability examiner for medical review (Steps 2–5). Step 2 requires the examiner to determine if the individual's impairment is non-severe or temporary (i.e., expected to last less than twelve months). If this is the case, then the claim is denied on this basis. Step 3 requires the examiner to determine whether the applicant has a medical impairment that appears on SSA's "Listing of Impairments," which includes over 100 impairments that are thought to be so severe that they preclude *any* gainful activity. If the applicant is found to have a listed impairment (or an unlisted impairment that "equals" the severity of a listed impairment), then the applicant automatically qualifies for SSDI without further review of their actual functional capacity and transferability of skills to other occupations. If the applicant does not have a listed impairment, he or she is not denied benefits but proceeds to Step 4. At Step 4, the examiner determines whether the individual is capable of performing any of their past jobs. If the applicant is found able to perform a past job then his claim is denied; otherwise, it is evaluated at Step 5, for which the examiner determines whether the applicant has the functional capacity and skills to perform *any* job in the *national* economy-based on the vocational factors of age, education and work history, regardless of whether such work exists in the applicant's area of residence. An applicant found capable of work is denied benefits; an applicant found incapable of work is allowed benefits based on his combination of medical and vocational factors.

Applicants denied benefits by the DDS have the option to appeal the decision.[11] The next level of appeal depends on the applicant's state of residence. Applicants residing in "non-prototype" states appeal again to the DDS for "reconsideration" of their case; those denied at the reconsideration level then have the option to request a hearing before an administrative law judge. Applicants residing in "prototype" states skip the reconsideration step and go

[11]Allowed claimants may also appeal other aspects of their case, such as the onset date determined by the examiner, which has implications for when applicants are eligible to begin receiving benefits (or back pay). We exclude such appeals from our analysis.

straight to the hearing level. The ten prototype states are: Alabama, Alaska, California (LA North and LA West Only), Colorado, Louisiana, Michigan, Missouri, New Hampshire, New York, and Pennsylvania. At the hearing level, the judge is instructed to follow the same five-step disability determination process as the DDS examiners, but new evidence may be presented. Applicants whose claim is denied at the hearing level may further appeal to the Appeals Council. The number of cases that progress to the Appeals Council is very small. Applicants denied by the Appeals Council can take their case to federal court, but this, too, is uncommon.

Applications that progress to the hearing level can take a very long time—in some cases, several years—to resolve. At the outset of the Great Recession, in fiscal year 2008, the average processing time for hearing requests was 514 days.[12] Using administrative data on initial claims filed in 2005, Autor et al. (2015) estimate an average *cumulative* processing time of 33.5 months for claims that progressed to the hearing level, with half of all hearing-level claims taking at least 28.6 months to progress from initial filing date to final decision and 90% of these claims taking at least 63.9 months. Hence, to observe the full effect of the Great Recession on the SSDI caseload, it is important to allow for a very long follow-up period.

3. Data and summary statistics

Our analysis data consists of all SSDI applications[13] filed between October 2006 and December 2012 that received medical review by a state DDS.[14] We extract these application records from the Social Security Administration's "831" files. Each record in the 831 data system represents a disability determination rendered by the DDS on either initial review or reconsideration, and contains the application filing date, the applicant's state of residence, the DDS decision (e.g., allowed or denied), and the basis for the decision (i.e., why the application was allowed or denied). Next, we determine which applicants subsequently appealed their initial determination, to either the reconsideration level, the hearing level, or both.[15] Hearing-level appeals are recorded in the Office of Hearings Operations (OHO) Case Processing and Management System (CPMS). We match our database of applications to these systems and record whether one or more appeals were filed at any point through September 2016, and if so, the outcome of the appeal. Consequently, we observe the universe of SSDI applications filed between October 2006 and December 2012, and any appeals that occurred up to 10 years after the initial application.[16]

[12]See SSA's Annual Performance Plan for Fiscal Year 2010 and Revised Final Annual Performance Plan for Fiscal Year 2009, pg. 11, https://www.ssa.gov/budget/hist/FY2010/FinalFY10APP.pdf, accessed 12/30/17.

[13]We include SSDI applications that are concurrently evaluated for SSI eligibility.

[14]We exclude technical denials, most of which are rendered by local field offices prior to sending the application to the DDS for medical review. Common reasons for technical denial include insufficient work credits (resulting in non-insured status) and engagement in substantial work activity.

[15]A small number of appeals progress to the Appeals Council or federal courts, but we do not track these outcomes. For applications filed in 2014, there were an additional 1400 allowances at the Appeals Council and 150 in federal courts recorded by 2020. This is 0.1% of all allowances (Social Security Administration, 2020).

[16]Our sample includes reapplications. A small fraction (3.3%) of applicants submit a new application to the state DDS after being denied, often concurrent with an appeal (Autor, Maestas, Mullen, & Strand, 2015).

Our primary measure of unemployment is the state-level count of unemployed persons, measured monthly and seasonally-adjusted, from the Bureau of Labor Statistics (BLS).[17] The official unemployment level measures the number of "jobless persons who are available to take a job and have actively sought work in the past four weeks." The unemployment rate, i.e., the unemployment level as a percent of the labor force, is one of several major macroeconomic indicators that are used to monitor and define fluctuations in economic activity. Empirically, changes in the unemployment rate are negatively correlated with changes in GDP growth (Abel et al., 2013), another major indicator used to define economic expansions and contractions.

While the unemployment rate is the official measure of labor underutilization in the economy, it has several well-known limitations. The main concern is that it *understates* labor utilization because during a prolonged contraction many people who would prefer to work become discouraged and stop searching; once that happens, they are no longer considered part of the labor force, and they drop out of both the numerator and the denominator of the measured unemployment rate. In addition, the official unemployment rate counts the underemployed (people who are working fewer hours than they would like to for economic reasons) as if they were fully employed. BLS offers several alternative measures of labor underutilization designed to specifically capture discouraged workers, the long-term unemployed, and involuntary parttime workers. Unfortunately, none of these series are measured at the state-month level during our period of interest. Nonetheless, the different measures of labor underutilization track one another closely over time, including across business cycles, and this holds for states as well as the nation (Local Area Unemployment Statistics, 2017).

In October 2006, the start of the fiscal year before the Great Recession began, the national unemployment rate was only 4.4%. Although unemployment subsequently rose in all states during the Great Recession, there was substantial variation across states in the timing and magnitude of the increase in unemployment and in the subsequent recovery. Fig. 2 shows the variation in the unemployment rate by state and month between 2006 and 2012, with states grouped by Social Security region for visual clarity.[18] States within the same region often had very different experiences. For example, the unemployment rate spiked rapidly in Michigan prior to rising in nearby states, reached a high of 14.2% in late 2009, then declined relatively quickly. Nevada also experienced rapid growth in unemployment, but high unemployment was more persistent there, remaining above 10% well into 2012. States in the Dallas Region (Arkansas, Louisiana, New Mexico, Oklahoma and Texas) were notably less affected by the Great Recession than states in other regions (although even there the unemployment rate doubled), and two states—North Dakota and Nebraska-had low unemployment to begin with and peaked at just 4.3 and 4.8% unemployment, respectively, during the Great Recession.

[17]The unemployment series were extracted using the local area unemployment statistics searchable database available at https://www.bls.gov/lau/#data.

[18]Fig. A1 shows the unemployment time series in changes rather than levels.

Between October 2006 and December 2012, 10.2 million individuals applied for SSDI benefits. As shown in Table 1, their mean age was 46.6, females comprised 48%, and 52% filed concurrently for means-tested SSI benefits—an indicator of impoverishment. About one-quarter of applicants resided in a prototype state, and therefore would skip the reconsideration step if their case progressed to an appeal. Some 32% of applicants applied because of a musculoskeletal impairment, 20% applied because of a mental impairment, 9% indicated a circulatory disease, and 7% had a neoplasm (cancer). Only 34% were allowed benefits at the initial determination, but 54% ultimately received SSDI benefits.

Fig. 3 shows how these SSDI applications flowed through the disability review system, from initial review to the hearing level. Overall, applications were filed at a rate of 135,945 per month (see also Table 1), with 103,557 originating in non-prototype states and 32,388 originating from prototype states. The rate of initial allowance was slightly higher in prototype states than in non-prototype states (36.6 versus 33.6%, respectively). Among applicants who were initially denied, just over half chose to file an appeal of their initial denial (54.7% in non-prototype states, 52.6% in prototype states). In non-prototype states, these applications proceeded to reconsideration, where only 14.8% were allowed. Among those who were denied at reconsideration, 81.3% chose to further appeal this decision to the hearing level. In contrast, appellants in prototype states moved directly from initial denial to the hearing level. Hearing-level appeals were filed at a rate of 37,414 per month, for a total of 2.8 million over the 75 months in our sample period.[19] Of these, 58.6% were allowed, 27.1% were denied, and 14.4% were dismissed.[20]

Table 2 summarizes how allowances and denials were distributed across the different justifications for determination at each level of administrative review. Initial allowances were divided approximately evenly between listing-level allowances (most severe) and medical-vocational allowances (less severe); reconsideration allowances were similarly evenly divided between listing and medical-vocational allowances. In sharp contrast, the clear majority (85%) of allowances at the hearing level were medical-vocational allowances.[21] Among denials, more applications were denied on initial review for non-medical reasons, or for being non-severe or of short duration, than was the case among appellate denials. Denials on the basis of medical-vocational factors (i.e., for being capable of past work or other work) were more common on initial review than on appeal. About 14% of appellate cases were dismissed by a judge.

4. Empirical strategy

Our goal is to estimate the number of SSDI applications induced by the Great Recession, and among those, the number ultimately awarded. We begin by collapsing the claims microdata to the state-month level by counting the number of initial claims filed in a state

[19]As noted earlier, we exclude appeals of initial allowances that dispute some other aspect of their case such as the date of disability onset (less than one percent of all appeals).
[20]The most common reasons for dismissal are abandonment and withdrawal.
[21]Hearing level allowances that are neither listing-level nor medical-vocational allowances include “fully favorable decisions without a hearing” made by Senior Attorney Adjudicators based on (new) evidence in the appellant’s file.

and month. We then regress the number of initial claims per state-month on the number of unemployed persons observed in the same state and month, as shown in Eq. (1):

$$y_{jst} = \beta^j(L)U_{st} + \alpha_s + \delta_t + \varepsilon_{jst} \quad (1)$$

where y_{jst} is the number of SSDI claims of outcome type j (e.g., all initial applications, all initial allowances, all initial denials appealed, all appellate allowances, etc.) filed in state s in month-year t. U_{st} is the number of unemployed persons in state s in month-year t. Importantly, across all models, t always refers to the initial filing month. The function $\beta^j(L)$ is a lag polynomial that measures the effects of both contemporaneous and past values of unemployment on the number of SSDI applications filed in month-year t per state. We refer to β^j as the sum of the individual lag weights β_k^j, and thus β^j represents the cumulative, net number of SSDI claims induced by current and past changes in unemployment. Lastly, a_s and δ_t are state and month-year fixed effects, respectively, which control for common national trends and states differences in factors that affect the number of SSDI claims filed, such as population size. Because our dependent variables are counts of the entire population of claims, and not rates, there is no need to further weight the data to adjust for state differences in population size (as one would do in a rate-based model) or in precision due to sampling variation (as one would do with survey-based measures of claims). We estimate specification (1) following McDowell (2004) and cluster standard errors at the state level.

To obtain the implied number of applications filed per month *nationwide* and per one-point change in the national unemployment *rate,* we multiply β^j by 1.54 million (the number of persons equaling one percent of the national labor force during our sample period). Although we could have regressed the state application rate on the state unemployment rate, our approach avoids confounding from state-time differences in labor force size (the denominator of the state unemployment rate). In addition, because we keep the units the same on both sides of the estimating equation (an individual person), the estimated coefficients give the number of SSDI applications filed per unemployed person per month averaged across states, making it straightforward to scale the coefficients to obtain the national number of applications filed per unemployed person or per one-point change in the percent of the labor force that was unemployed (i.e., the unemployment rate).

We repeat this series of steps for each outcome type j to obtain the number of initial applications filed between 2006 and 2012 that were eventually allowed, denied or dismissed at each administrative level due to the Great Recession. For example, to estimate the number of induced hearing level claims, we again collapse the microdata by state and initial filing month, but this time we count only the number of initially denied claims that were decided at the hearing level by September 2016. We then re-estimate Eq. (1) for this new outcome variable. Following the same procedure, we further subset claims that proceeded to the hearing level according to whether they were allowed, denied or dismissed, and the coefficients on unemployment at time t from each model will sum to the coefficient on unemployment at time t from the model of the total number of induced claims handled at the hearing level.

Once we obtain an estimate of the number of induced applications of a given type (e.g., initial) and the corresponding number of induced allowances, we can compute the *allowance rate* among induced applications of that type by dividing the estimated number of induced allowances (given by the coefficient on unemployment in the equation for allowances) by the estimated number of induced applications (given by the coefficient on unemployment in the equation for applications).[22]

Specification (1) identifies the causal effect of increased unemployment during the Great Recession on SSDI application outcomes under certain assumptions. First, it assumes there are no unobservable variables (such as policies) that co-vary with both unemployment and SSDI applications at the state-month level. For example, if state-level policies such as unemployment insurance (UI) benefits, which are commonly extended during recessions, also causally affect SSDI applications, then this would confound our estimates. Mueller et al. (2016) examined the causal effect of unemployment benefit extensions on SSDI applications in the Great Recession and found no statistical or economically meaningful relationship; moreover, they found that only about 1% of SSDI awardees received UI in the prior calendar year, indicating little overlap between the two programs.[23] Similarly, there is no evidence of interaction between SSDI and other major state programs that are countercyclical, such as the Supplemental Nutrition Assistance Program/Food Stamps or Medicaid.[24] But to the extent that other such policies or state program interactions exist, then their indirect effects on SSDI outcomes will be included in our estimate of the effect of unemployment on SSDI outcomes in addition to the direct effect; in that case our estimate would be the gross (rather than net) effect of increased unemployment levels during the Great Recession.

Relatedly, specification (1) assumes no differential geographic sorting, either pre- or post-Great Recession, based on unobservable factors correlated with both unemployment and SSDI participation levels. For example, as noted in Yagan (2019) the effects of the Great Recession were concentrated in areas that attracted lower-skilled workers, who may be more likely to apply for and receive SSDI benefits than higher-skilled workers at a given unemployment level. Figs. A2 splits the sample into states with above- and below-median changes in their unemployment rate between 2008 and 2010 and presents time series for mean SSDI claims, allowances and unemployment rates for each group of states before and after the Great Recession, with the pre-period extended back to 2005; although states with larger unemployment shocks did have more SSDI claims and allowances before the Great Recession, the pre-trends are for the two groups are parallel, suggesting time-invariant state fixed effects are sufficient to control for pre-Recession sorting. At the same time, lower-skilled workers may be less mobile than higher-skilled workers in response to economic

[22]We obtain the standard error of the effect ratio by using the suest command in Stata to account for the fact that the coefficients come from different regressions.

[23]Although application for unemployment insurance (UI) does not necessarily preclude someone applying for and receiving SSDI benefits, this information can be used by the disability examiner in the disability determination. Practically, eligibility for UI benefits is conditional on actively seeking employment, whereas eligibility for SSDI benefits is conditional on inability to engage in substantial gainful activity (i.e., employment).

[24]For example, Bitler and Figinski (2019) found no relationship between food stamp benefits and SSDI participation. Baicker et al. (2014) found that while Medicaid enrollment increased food stamps receipt, there was no impact on SSDI. Schmidt et al. (2020) provide corroboration, finding no effect of the ACA's Medicaid expansions on SSDI (or SSI) applications or awards.

shocks, leading to post-Recession sorting that could confound our estimates. However, since we focus on changes at the monthly frequency, this would have to play out much more rapidly than has been observed in the literature to drive our results (see e.g., Notowitigdo, 2020).

Finally, specification (1) assumes the effects of unemployment on SSDI outcomes are symmetrical and do not vary based on whether the unemployment rate is rising or falling from its prior level. In Section 5.3, we test this assumption by interacting the unemployment variable with an indicator for whether it is higher or lower than its previous level. We find no evidence of asymmetry.

5. Main results

This section begins by answering the question of whether the Great Recession induced *new* SSDI applications, or merely accelerated applications that would have been filed anyway. We then present estimates of the effects of changes in the unemployment rate by application outcome (allowed or denied), overall and by administrative review level (initial, reconsideration, and hearing level). This is followed by a series of robust tests to alternative specifications, including common specifications in the prior literature.

5.1. Dynamic effects of unemployment

To understand whether the Great Recession resulted in new costs for the SSDI program, or simply shifted forward costs that would have been incurred anyway, we begin with an analysis of the dynamic effects of changes in unemployment. If such shifting occurs, one might expect an increase in unemployment in a given month to increase SSDI applications contemporaneously, and perhaps a few months later, but at the same time *decrease* SSDI applications a few months or years in the future.

To investigate this, we estimate Eq. (1) using a polynomial distributed lag model, and compare it to a base model with no lags, which we estimate by ordinary least squares regression. The two specifications are presented side-by-side in Table 3, first for the number of applications filed (columns 1 and 2) and then for the number of allowances made at any level (columns 3 and 4). To select the polynomial degree and number of lags used for each model, we minimize the Akaike Information Criteria (AIC)/Bayesian Information Criteria (BIC). Using these criteria, we select a quartic polynomial and 14 monthly lags for the effect of unemployment on applications. The model for allowances calls for a quadratic polynomial and 3 monthly lags of unemployment. We allow the lag structure to differ between the two models to account for any differences in processing time for applications induced at different times. Table A1 presents estimates for a range of specifications with different polynomial degrees and the implied optimal lag structure using the AIC/BIC minimization criteria, as well as estimates from a model of awards with the same specification as the optimal specification for claims (polynomial degree 4, 14 lags).

In the distributed lag model for applications (Table 3, column 2), contemporaneous changes in unemployment have the largest effect, and the first lag comes in statistically significant at about one-third the size of the coefficient on contemporaneous unemployment. The

coefficients on lags 3 through 6 are negative (and statistically significant for lags 3 through 5), implying the *absence* of applications that otherwise would have been filed in those months. In other words, some of the additional applications filed in months 0 through 2 in response to an increase in unemployment in month 0 were indeed shifted forward—albeit by only a few months. The remaining lag weights are mostly positive, but comparatively small and in most cases statistically insignificant. Fig. 4 presents the estimated lag weights graphically, for the optimal quartic polynomial, as well as for polynomials of greater and lesser degree. For all degrees, the same pattern is evident; most of the impact of unemployment on SSDI applications in a given month occurs contemporaneously, with a modest amount of shifting by only a few months.

If we sum the positive lag weights, we find that the gross number of applications filed per month for every one-point increase in unemployment was 6,455. Of these, 1,836 (28%) were shifted forward (obtained by summing the negative lag weights). Thus, on-net, there were 4,619 induced new applications (s.e. = 96) filed each month for every one-point increase in unemployment (obtained by adding up the coefficients across all lags).[25] Notably, 4,619 is statistically equivalent to the base model estimate of 4,445 induced claims (s.e. = 978), and thus we can reasonably interpret the base model estimate as the number of induced new claims *net of any forward-shifted claims.* In addition, the AIC/BIC criteria are virtually identical between the two models. Thus, if the purpose is to estimate the total number of induced claims net of any accelerated claims, the distributed lag model adds little value over the model with only contemporaneous unemployment. Because this is our purpose, in the next sections, we use the base specification with no lags.

Importantly, dynamic effects were less important for allowances (Table 3, columns 3 and 4). Most of the effect of unemployment at time t arises contemporaneously, with the first lag coming in only one-fifth the size of the contemporaneous impact and not statistically significant. There is, again, modest evidence of shifting, but just by a couple of months. In gross terms, there were 2,618 new awards made each month per one-point increase in unemployment, but 733 (28%) were shifted forward by 2–3 months—i.e., they would have been awarded anyway a couple of months later—and therefore the net number of induced awards is 1,885. As in the model for applications, the net number of induced awards is similar to the number of induced awards implied by the base model with no lags (1,860) and the AIC/BIC criteria are nearly identical across models. Thus, for awards too, the base model with contemporaneous unemployment and no further lags is sufficient to capture the total number of net new induced awards.

Lastly, if we annualize the above monthly estimates and multiply by the observed difference between the average unemployment rate of 4.6% in 2007 and the annual unemployment rate each year from 2008 to 2012, we obtain an estimate of the gross number of applications and awards attributable to the Great Recession, the number of induced claims that were new, and the number that were merely accelerated. In total, we find the Great Recession led 1.4 million former workers to apply for SSDI benefits during 2008–2012. Nearly 1 million (72%) were induced and otherwise would not have applied, while the rest, approximately

[25]We obtain the standard errors of these quantities using the delta method.

400,000 (28%) would have applied anyway. In terms of awards, more than one-half million of the recession-induced applicants were awarded benefits, and over 400,000 were induced awards to people who otherwise would not have entered the SSDI program. The remainder, approximately 100,000, were accelerated awards to people who would have entered the program anyway 2–3 months later than they did.

5.2. The effect of unemployment on SSDI claims, allowances and denials by administrative review level

We present our main estimates in Table 4. Each group of numbers presents the estimated effect of a one-point increase in the unemployment rate on the number of SSDI applications filed per month of a given type for the nation as a whole.[26]

We find that a one-point increase in the unemployment rate induced 4,455 new SSDI claims per month nationwide in the same month, representing a 3.3% increase in claims per one-point increase in unemployment. Thus, at the peak of the recession in October 2009—when the unemployment rate had risen by 5 points—the SSDI system was receiving 16.5% (3.3 * 5) more claims than usual. Of these 4,455 induced claims, 873 claims were initially allowed (marginally significant, $p = 0.062$) and 3,582 claims were initially denied. In percent terms, initial allowances increased by a marginally significant 1.9% per one-point increase in the unemployment rate, while initial denials rose by 4.0% per one-point increase in unemployment. To infer the initial allowance rate among the induced claims, we divide the number of induced allowances (873) by the number of induced claims (4,455). This gives an initial allowance rate of 19.6% among the induced claims, which is well below the initial allowance rate of 34.3% for all claims received during this period (see Table 2). Thus, we find that induced claimants were only 57% as likely as average claimants during the sample period to be awarded SSDI benefits at the initial level. The fact that induced applicants were less likely to qualify for benefits implies the average recession-induced claimant was healthier than the average SSDI claimant.[27]

But, as Fig. 3 showed, more than half of applicants who are initially denied go on to appeal their initial decision—and many ultimately succeed—at either the reconsideration or hearing level. To assess whether this was true for recession-induced claims, we estimate Eq. (1) for the number of reconsideration claims, and, separately, for the subsets of reconsideration claims that were allowed and denied. The second column of Table 4 shows that 1,997 individuals filed for reconsideration each month, a 5.3% increase in the total number of reconsideration claims, for every one-point increase in the unemployment rate. Among the induced claims filed for reconsideration, 259 per month were allowed at that level. As a result, reconsideration allowances increased by 5.0% for every one-point increase in the unemployment rate. That said, reconsideration denials also increased—there were 1,738

[26]As explained above, the coefficient β^j in Eq. (1) gives the number of new applications (of type j) filed per month per state *per person unemployed.* In Table 4, we report the implied number of applications filed per month nationwide and per number unemployed equal to one percent of the national labor force, obtained by multiplying β^j by 1.54 million (the number of persons equivalent to one percent of the national labor force in our sample period). To obtain the annual impact, the reported monthly coefficients can be further multiplied by 12.

[27]An alternative explanation is that disability examiners become more strict during economic downturns. Empirically, we cannot distinguish between these two possibilities.

induced denials per month, representing an increase of 5.3%. On net, the allowance rate among induced reconsideration claims was 12.9% (259/1,997)—lower than the average reconsideration allowance rate of 14.8% during this period (see Fig. 3).

Claimants who are denied on reconsideration in non-prototype states or on initial review in prototype states may file an appeal to the hearing level, where their case is heard by an administrative law judge. Table 4, Column (3) shows that hearing-level appeals increased by 1,736 cases each month, a 4.6% increase in workload per one-point increase in unemployment, or an increase of 23% at the peak of the recession. These hearing-level appeals, which include appeals from both non-prototype and prototype states, comprised 48.5% (1,736/3,582) of all induced initial denials; higher than the 41.9% (37,414/(68,769 + 20,548), see Fig. 3) of all initial denials that progressed to the hearing level during this time. Thus, induced claimants were much more likely to appeal an initial denial to the hearing level than the average claimant during this time. This is not surprising since the opportunity cost of continuing a claim—potential earnings—would have been lower for recession-induced applicants.

A substantial number of induced hearing-level appeals were allowed. Of the 1,736 hearing-level appeals filed each month, 728 were allowed, a 3.3% increase in the number of allowances for every one-point increase in unemployment (Table 4, Column (3)). Another 733 appeals were denied (a 7.2% increase in the number of denials), and 275 claims were dismissed (a 5.1% increase in dismissals). Overall, the allowance rate among induced claims at the hearing level was 41.9% (728/1,736), well below the average hearing-level allowance rate of 58.6% during this period (Fig. 3). Thus, even though the recession-induced claims were allowed by judges at a lower rate than the average claim—presumably because the recession-induced applicants had less severe impairments on average—a substantial proportion of the recession-induced claims that proceeded to the hearing level (41.9%) were nonetheless awarded benefits. In fact, our estimates imply that 53% ((728 + 259)/(873 + 259 + 728) from Table 4) of the induced beneficiaries were allowed on appeal (reconsideration or hearing), compared to 39% of all new beneficiaries during 2006–2012. Breaking apart the two types of appeals, reconsideration awards accounted for 14% of induced awards, compared to 7.5% of all awards, and awards made by administrative law judges accounted for 39% of induced awards, compared to 30% of all awards.

Considering the combined effect of all review levels, we find that the number of SSDI awards increased by 1,860 per month (2.5%) for every one-point increase in the rate of unemployment (Table 4, Column (4)). Relative to the number of induced initial claims, we find that 41.8% of all recession-induced applicants (1,860/4,455) were awarded SSDI benefits. Scaling these estimates by the actual increase in the national unemployment rate experienced in each year between January 2008 and December 2012 relative to the average unemployment rate in 2006, we find the Great Recession induced a total of 997,475 additional SSDI applications and 416,454 additional SSDI disabled worker beneficiaries. Thus, recession-induced beneficiaries accounted for 8.9% of the 4.5 million new beneficiaries who entered the SSDI program during 2008–2012.[28] In Section 6, we investigate the characteristics of these new beneficiaries, including the proportion who entered the program based on medical-vocational criteria.

5.3. Robustness

It is possible that some individuals who became unemployed during the Great Recession searched for new employment before applying for SSDI benefits. If this were the case, then the relevant unemployment rate might not be economic conditions at the time of filing, but rather conditions at the time they were laid off from their job. To explore this, we examine whether the number of SSDI claims in month *t* is affected by the unemployment rate in the *month of disability onset,* rather than the (later) filing month. Importantly, the date of disability onset is not necessarily the date of *medical* onset; rather, it is the later of the medical onset date and the date the applicant stopped working. If an individual who experienced onset of a medical problem subsequently continued to work (perhaps with accommodations from their employer), but was laid off during the recession, the established disability onset date could be the lay-off date.[29] Even if the applicant searched for a new job for several months, any subsequent SSDI application should be attributed to economic conditions at the time of layoff. The date of disability onset is determined by the disability examiner and is only recorded for initially allowed claims in the 831 files; thus, this test can only be performed on this subset of claims. After sub-setting on initially allowed claims and re-collapsing the data to count claims by onset month and state, we show in Appendix Table A2 that a one-point increase in unemployment *in the month of disability onset* led to an increase in the number of initial allowances equal to 757 per month (s.e. = 449), which is not statistically different from our main estimate for initial allowances of 873 (s.e. = 458) from Table 4 (and reproduced in Appendix Table A2 for ease of comparison). Further, unemployment at onset and filing explain an identical proportion of the variation in filing.

Next, we test the robustness of our main estimates to alternative specifications used in the prior literature. As described above, our base specification regresses state-month application counts on the number unemployed per state-month, with state fixed effects to account for fixed differences across states in factors such as population size (and month fixed effects to account for secular trends in applications). This count-on-count specification facilitates transparent accounting of individual applications as they progress across different levels of review. It also implicitly assumes that state population size affects applications additively. In this section, we explore several specifications that let state population enter multiplicatively.

Stapleton et al. (1988) regressed the log SSDI application rate in year *t* (estimated from administrative data) on the log unemployment rate. One rationale for the log(rate)-log(rate) specification (as opposed to our count-on-count or a rate-on-rate model) is that it is easy to estimate percent changes as opposed to percentage-point changes. To implement this specification, we first convert our application counts to application rates by dividing the counts by state population, obtained from the Census Bureau (expressed in thousands). We then regress the log application rate on the log of the unemployment rate, weighted by state population (as in Stapleton et al., 1988). Because we use the same population denominator on both sides of the equation, this specification is equivalent to estimating a log(count)-on-

[28]The total numbers of disabled worker applications and beneficiaries during 2008–2012 were computed from our data extract, which differs slightly from official statistics owing to definitional differences.

[29]Applicants who have had an impairment for a long time can *allege* an earlier onset date, but SSA will set the "established onset date" to be no earlier than the date the applicant most recently stopped working. The established onset date determines how much back pay is owed to the applicant at the time of approval, up to a maximum of 12 months' worth of benefits.

log(count) (because the log(population) terms cancel out). From this specification, we obtain an elasticity of 0.20 (Appendix Table A3, column 2), implying a 0.20% increase in SSDI applications for every 1% increase in the unemployment rate, or a 20% increase in claims at the height of the Great Recession, which doubled unemployment in most states. This elasticity is comparable to the elasticity of 0.25 implied by our count-on-count specification, reproduced in column (1) of Appendix Table A3.

Our second alternative specification is the rate-on-rate specification, whereby we regress the application rate per 1,000 workers (i.e., in the labor force) on the unemployment rate (this is similar to that used by Cutler et al., 2012, except we use the labor force as the denominator on both sides of the equation, whereas Cutler et al. scaled DI applications by the number of *covered* workers. The rate-on-rate specification gives a somewhat lower elasticity than the other specifications, 0.12, implying a 12% increase in applications at the peak of the recession. One complication with this specification is that if SSDI application rates vary systematically with population size, then the estimated elasticity is the coefficient on an interaction term, which then must be interpreted in conjunction with its main effect. In our data, state application rates are positively correlated with population size, suggesting that the elasticity from the rate-on-rate model is not readily comparable with the elasticity from the other models. Finally, we include a specification that regresses the log application count on the number unemployed per thousand (as in Maestas et al., 2015). This estimated elasticity is 0.21, similar to the elasticity from the other log specification and our baseline specification.

Finally, in Table A4, we explore whether the effects of unemployment on SSDI outcomes are symmetrical by interacting the unemployment variable with an indicator for whether it is higher or lower than its previous value. Column 1 reproduces our main estimates from Table 4 and columns 2–3 present the estimated effects of the unemployment rate interacted with indicators for positive and negative changes, respectively, from the same regression (per row). We do not find evidence of nonsymmetrical effects for any outcomes.

6. Characteristics of the recession-induced applicants

Our main results indicate that 416,454 disabled workers entered the SSDI program because of the Great Recession, making up 8.9% of all new beneficiaries during 2008–2012. It is important to understand the composition of these induced beneficiaries, particularly with respect to the type and severity of their impairments. On the one hand, induced entrants might be individuals who were medically eligible for SSDI but who otherwise had been working (perhaps with employer accommodation). If they were laid off, they might immediately apply for SSDI benefits, recognizing they would be likely to succeed (and perhaps also recognizing the difficulty of finding a new employer willing to accommodate them). Such individuals would have qualifying impairments that were easier to medically determine, and as a result these applicants would be more likely to qualify on the initial review than on appeal, and to qualify because their impairments meet or equal the listing of impairments (regardless of vocational factors). On the other hand, the induced entrants might be people with functional impairments and diminished long-run labor market opportunities. If they are laid off, these individuals might spend more time searching for

work before applying for SSDI, they would be more likely to succeed on appeal than on initial review (perhaps after further case development), and more likely be allowed for vocational reasons than because their impairments meet or equal the listings. Their impairments would be harder to medically diagnose and verify.

Several pieces of evidence point to the induced entrants being of the latter type. First, as we documented in Table 4, the induced applicants were less likely to be allowed than the average applicant during this time, which indicates they generally had impairments of lesser severity. Second, as documented in Maestas et al. (2015), more time had elapsed between alleged disability onset and time of filing for induced applicants than for the average applicant, suggesting they were more likely to have spent time searching for work before applying for SSDI benefits. Below we show how claims for disabilities of different types and severities were treated at different levels of the system.

When disability adjudicators decide a case, they must record the justification for their decision, using the 5-step process described in Section 2. In particular, the process is designed to distinguish applicants with non-severe or temporary impairments from applicants (step 2) with the most severe, automatically-qualifying impairments (step 3). If an application is neither non-severe or medically qualifying, the adjudicator then considers whether the applicant has the skills to perform the occupations that their residual functional capacity would allow them to do (steps 4 and 5). We use this information to draw inferences about the severity of disabilities in the recession-induced applicant pool and present our findings in Table 5.[30] To obtain the estimates in Table 5, we subset the initial claims filed in each month by the type of determination they received, separately for the initial and appellate levels. We then regress the number of each outcome type on state unemployment in the month of initial filing. This disaggregation procedure yields a set of coefficients that add up to the coefficient for the aggregated outcome (either initial claims or appellate claims),[31] and thus by dividing each disaggregated coefficient by the aggregate coefficient, we obtain the percent distribution of induced claims across the determination categories.

Table 5 shows that at the initial level (first column), allowances for meeting or equaling the listing of impairments—the most severe kind of impairments—were largely unresponsive to the increase in unemployment; they rose by a statistically insignificant 1.0% per one-point increase in unemployment. On the other hand, initial allowances for medical-vocational reasons rose by a statistically significant 2.6%. As a share of all induced claims, listing allowances were just 4.7% (second column), compared to 15.6% of initial claims in the full population (Table 2). Medical-vocational allowances made up 14.9% of all induced applications as compared to 18.7% of the general applicant population. Thus, a *smaller* share

[30]The initial and appellate review systems use the same criteria and 5-step review process; yet case outcomes often diverge substantially. Table A5 crosswalks appellate outcomes by reason for initial denial and shows how many induced denials of each type were not appealed, or if appealed, how many were allowed, denied or dismissed.

[31]For example, the reported coefficients in the first column of Table 5 add up to the coefficient on initial claims in Table 4 (4455), which is an estimate of the total number of induced initial claims per month per one-point increase in unemployment. The coefficients in the second column of Table 5 add up to the total number of induced appellate claims, which is 2317 per month per one-point increase in unemployment. Note this is not the sum of the induced reconsideration and hearing claims reported in Table 4, because in this section we use the term appellate claim to refer to *any* reconsideration or hearing-level claim; that is, claims that proceed to *both* reconsideration and the hearing level are counted only once.

of recession-induced applicants qualified by meeting the listings compared to the general applicant population.

At the same time, initial denials for reason of non-severity spiked, by 7.1% for every one-point increase in unemployment (Table 5, first column), making up 25.9% of all induced claims. In the general applicant population, initial denials for non-severity made up only 11.9% of claims (Table 2). Perhaps most revealing, initial denials for being capable of substantial gainful activity (either past or other work) also rose by 4.1 and 3.7% respectively, together accounting for 50.1% of initial applications, compared to 32.3% in the general applicant population (Table 2).

Although *initial* allowances for listing-level impairments did not increase in response to the rise in unemployment, Table 5 shows that listing allowances did increase at the appellate level (reconsideration and hearings combined)—by 3.9% per one-point increase in unemployment (Table 5). Medical-vocational allowances at the appellate level also rose in response to unemployment, by 3.6% per one-point increase in unemployment. As a share of all induced claims that reached the appellate levels, 8.2% were allowed for meeting or equaling the listing of impairments, and 33.8% were allowed on medical-vocational grounds —this implies that nearly 79.3% of recession-induced allowances at the appellate levels were for medical-vocational reasons, the same as in the general appellate population (79.5%). Appellate denials of all types also increased sharply, especially those based on capability for past work or other work.

The last column of Table 5 presents estimates of total induced claims, both initially and at the appellate level, by reason of determination as a percent of all induced denials. Only 9% had the most severe, automatically-qualifying impairments, 33% had functional impairments and no transferable skills, and the rest were denied for having insufficiently severe impairments and/or transferable skills.

Table A6 tracks induced applications and their outcomes by type of impairment, with the goal of understanding whether the recession-induced claims were more likely to come from people with difficult-to-verify impairments and, if so, how these claims fared as they moved through the adjudication system. The Great Recession induced new claims in *all* impairment categories; however, claims increased relatively more for musculoskeletal and mental impairments than for circulatory, neoplasm and all other diagnoses combined. The number of initial allowances for musculoskeletal impairments increased by 3.8% for every one-point increase in unemployment, and appellate allowances for these impairments rose by a similar percentage (4.0%). Interestingly, initial allowances for mental impairments were not responsive to the unemployment rate, while appellate allowances for mental impairments rose by 5.2%.

Finally, in Table 6 we examine heterogeneity in the effects of unemployment on SSDI outcomes by age group and SSDI-SSI concurrent status. Effects by age group are informative for how long the average recession-induced applicant is likely to remain out of the labor force, especially if he or she is awarded benefits. As noted earlier, concurrent eligibility for means-tested SSI benefits is a proxy for low prior earnings, which we do not

directly observe in the data. If recession-induced beneficiaries are younger or have higher earnings, then the SSDI program may be a particularly inefficient mechanism for replacing lost earnings in economic downturns like the Great Recession. Table 6 shows that recession-induced applicants who are awarded benefits tend to be in their 50 s and 60 s (a 3.3% and 3.6% increase in awards, respectively), with much smaller and only marginally statistically significant increases among those under 50 (see row for Total Allowances). Also, recession-induced beneficiaries are disproportionately more likely to have applied for SSDI and SSI concurrently.

7. Implications for the SSDI program

In this section, we discuss the implications of our findings for two key measures by which program performance and financial sustainability are often evaluated: administrative processing costs and benefit obligations.[32] Note that we do not present an analysis of the welfare impacts of the SSDI program as an alternative to explicit countercyclical programs such as unemployment insurance, which may be more efficient because—unlike SSDI—they do not tend to induce displaced workers out of the labor market permanently. At the same time, however, the SSDI program insures medically eligible workers against earnings losses that are likely to be especially large and persistent among older individuals (see, e.g., Couch et al., 2009).

Our findings imply the Great Recession had a substantial impact on the administration and financing of the SSDI program. According to tabulations provided by SSA to the Social Security Advisory Board,[33] the unit cost of processing an initial claim is $1,187. Given our estimate that 997,475 induced claims were processed at the initial level, this implies the Great Recession increased initial processing costs by a total of $1.184 billion.[34] Some 447,128 of these claims were then reviewed a second time by the DDS under a request for reconsideration; at a unit cost of $585 per claim, this resulted in increased reconsideration costs of $261.4 million. Of the nearly 1 million induced claims, 388,690 were appealed to the hearings level, where they were heard by an administrative law judge. Given the average cost of a hearing is $3,653, this implies increased processing costs at the hearing level of $1.42 billion. If denied cases were further appealed to the Appeals Council and to federal court at the same rate as in the general applicant population, then we estimate claims processing costs at these levels increased by $84.4 million and $10.2 million, respectively.[35] In total, the Great Recession increased SSA's claim processing costs by $2.960 billion between 2008 and 2012.[36]

Nearly 42% of recession-induced applications or 416,454 people were ultimately awarded benefits. If they were to receive benefits for only one year, then, assuming an average annual

[32]We present an analysis of how the Great Recession impacted another measure of program performance, system allowance rates, in the Appendix; we find the Great Recession was only partially responsible for the much-noted reduction in hearing allowance rates among administrative law judges since 2009.
[33]This information was provided to us by the Social Security Advisory Board via personal communication.
[34]We exclude the shifted claims from this calculation since they would have been processed anyway.
[35]The unit cost of processing claims at the Appeals Council and in federal court is $1220 and $5444, respectively (same source for unit costs as referenced above).
[36]As noted above, we do not include the small fraction of applications denied at the hearing level that went on to further review by the Appeals Council, and if denied there, to the federal courts.

SSDI benefit of $13,546 in 2010 and average Medicare expenditure of $11,897 in 2010, this would imply additional benefit payments equal to $5.641 billion for SSDI alone, or $10.596 billion for SSDI and Medicare combined.[37] For context, SSDI benefit payments to all disabled workers were $105.122 billion in 2010.[38] But, most SSDI entrants receive benefits until they convert to regular Social Security retirement benefits at full retirement age or they die. Since the average age of the induced entrants was 53.1 (somewhat older than the average applicant during this time, who was 47), the average induced entrant would receive benefits for a maximum of 13 years (from age 53 to 65).[39] Assuming a discount rate of 2% and an annual mortality rate of 3.1% (following Autor and Duggan, 2006), we estimate the Great Recession increased SSDI benefit obligations by $55.359 billion in present value, or $96.298 billion for SSDI and Medicare benefits combined.[40] In addition, the Great Recession accelerated the awards of an additional 164,192 awardees by 2–3 months. Including these additional benefit costs increases total SSDI benefit obligations to a grand total of $55.730 billion.[41] Including Medicare further increases total program costs to $97.365 billion.[42]

As large as they are, these costs are an underestimate of the total effects of the Great Recession on the disability insurance system. They do not account for the costs of issuing technical denials to applicants who were not insured for SSDI benefits (such applicants are denied by their local field office before they submit applications for medical review), the additional costs of providing dependent benefits to eligible recipients, and the costs of providing SSI and Medicaid benefits to impoverished beneficiaries who are dually entitled to SSDI and SSI.[43]

8. Conclusion

The Great Recession led 1.4 million former workers to apply for SSDI benefits during 2008–2012. Of these, nearly 1 million (72%) would not have applied if the recession had not occurred, while the rest (28%) would have applied anyway, but at a later date. By the recession's peak, the system was receiving 16.5% more applications than usual, resulting in substantial processing backlogs. Induced applicants (excluding the accelerated applicants) accounted for 11.6% of all applications filed during 2008–2012.

[37]We use the average medical expenditure among all Medicare beneficiaries because the average expenditure for the induced applicants is not known.

[38]Total payments made to disabled worker beneficiaries in 2010 taken from Table 20 of the Annual Statistical Report on the Social Security Disability Insurance Program, 2010, accessed 1/25/18 from https://www.ssa.gov/policy/docs/statcomps/di_asr/2010/sect01c.html.

[39]We obtain the average age of induced entrants by estimating separate regression models for the number of final allowances on unemployment for the following age groups: 18–39 (8% of induced allowances), 40–49 (10%), 50–61 (71%) and 62–64 (12%). We then multiply the midpoint of each age group by the age-group's share of induced allowances to estimate the average age among induced beneficiaries.

[40]We assume Medicare benefits begin one year after SSDI benefits payments begin to account for the Medicare waiting period (which begins with disability onset date, not award date), and are received through age 64.

[41]Table A7 presents sensitivity of the total SSDI benefit obligation estimate to different discount and mortality rates and ranges from $48.300 to $65.300 billion.

[42]This assumes the forward-shifted beneficiaries would draw cash benefits and/or Medicare for an additional 2 months as well.

[43]Other potential costs include higher benefit payments to the induced beneficiaries when they convert to Social Security retirement benefits at full retirement age.

Our estimates of the effect of unemployment on SSDI claims and initial awards are consistent with prior estimates in the literature. Table A8 reports the implied elasticities of estimates found in the literature, which pertain to different populations, time periods and time series frequency. Our estimated elasticity of unemployment on SSDI applications, 0.25, is quite similar to previous estimates, which range from 0.09 to 0.31. The range of estimates for initial awards is larger and centered around zero (−0.21 to 0.19), and our estimate of 0.14, though only marginally statistically significant, is within this range. An important contribution of this paper is that it provides a new estimate of the effect of unemployment on ultimate SSDI awards: 0.19.[44]

We find that more than one-half million of the recession-induced applicants were awarded benefits. Over 400,000 were awards to people who otherwise would not have entered the SSDI program, while the rest were awards to people who would have entered the program anyway in the near future. The induced awardees were more likely to have been allowed on appeal than on initial review—53% of the induced new beneficiaries were allowed on appeal (rather than on initial review), compared to 37% of all new beneficiaries during 2008–2012. On net, the induced awardees (excluding accelerated awardees) made up 8.9% of all new beneficiaries who entered SSDI during 2008–2012. While some people with automatically-qualifying disabilities choose to work rather than claim SSDI benefits, we find little evidence that the recession-induced applicants came from this group. In fact, the induced applicants had less severe impairments and were more likely to have transferable skills. They were either allowed for medical-vocational reasons (33%) or denied (58%); relatively few were allowed for severe, listing-level impairments (9%).

The impact of the Great Recession is economically significant. In terms of human capital, over 400,000 workers were awarded benefits who would not otherwise have entered the program. Because working above SGA after program entry is rare, this corresponds to a near-permanent decline in productive capacity. In terms of the fiscal health of the U.S. disability insurance system, both contemporaneous and future SSDI program costs increased significantly. Administrative claims processing costs rose by $2.960 billion dollars during 2008–2012, while SSDI benefit obligations increased by $55.730 billion in present value, or by $97.365 billion when the present value of Medicare benefits is included.

Acknowledgments

This research was supported by (1) the U.S. Social Security Administration (SSA) through grant #1 DRC12000002–04 to the National Bureau of Economic Research (NBER) as part of the SSA Disability Research Consortium; and (2) the National Institutes of Health/National Institute on Aging (1R01AG056239). The findings and conclusions expressed are solely those of the author(s) and do not represent the views of SSA, NIH, any agency of the United States Government, or the NBER. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of the contents of this research. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply endorsement, recommendation or favoring by the United States Government or any agency thereof. We thank Francoise Becker, Fred Galeas, George Green and Thuy Ho for sharing their expertise with the data; Ken Couch, Austin Nichols, David Stapleton, participants of the 2019 CEPRA/NBER Workshop on Ageing

[44]Our results are also consistent with Yagan (2019) finding of a positive but statistically insignificant effect of local unemployment shocks in 2007–2009 on SSDI participation in 2015 among those aged 30–49 in 2007. Among applicants under age 50, we find a positive but statistically insignificant effect of unemployment shocks on allowances (at any level).

and Health (Lugano) and seminar participants at Dartmouth College, Tulane University, University of Connecticut, and Vanderbilt University for helpful comments; and Lucas Cusimano, Linda Li, and Thabo Samakhoana for diligent research assistance.

Appendix A.: Supplemental Analysis: the Effect of the Great Recession on Allowance Rates

The Great Recession induced both allowances and denials at all administrative levels. However, the induced claims were also more likely to result in denial at all levels. These effects combine to affect the allowance rates at the initial and hearing levels. We illustrate the effect of the Great Recession on the allowance rate with a simple simulation. First, we multiply the estimated coefficients in Table 4 by the observed difference in the national unemployment rate each month relative to October 2006, to simulate the numbers of claims and allowances that were attributable to the Great Recession. Next, we subtract the number of induced claims from total claims and the number of induced allowances from total allowances to simulate the number of claims and allowances that would have been observed at each level if the unemployment rate had remained at pre-recession levels over the entire period from 2007 to 2012. Finally, to obtain the counterfactual allowance rate in the absence of the Great Recession we divide the estimated number of non-induced allowances by the estimated number of non-induced claims.

Figs. A3 presents the results of the simulation, with Panel A showing the effect of the Great Recession on the allowance rate at the initial level and Panel B showing the effect on the allowance rate at the hearing level. In the figure, the solid lines represent the actual allowance rate among all applications at the initial and hearings levels, respectively, and the dashed lines represent the simulated allowance rate removing the induced applications.[45] As can be seen in both panels of the figure, since unemployment did not accelerate until 2008, there were few induced claimants and the actual and counterfactual allowance rates were similar before then. However, during 2009, the unemployment rate peaked at 10.0%. This induced a flow of claims with a below-average probability of allowance.

Panel A shows that without the Great Recession and the accompanying induced claims, the allowance rate at the initial level would have been around two to four percentage points higher, reflecting the absence of the recession-induced applications from applicants with less severe impairments. That said, the evolution of the allowance rate during this period—rising then falling slightly and flattening—is unchanged with and without the induced applications. Panel B, on the other hand, shows the Great Recession had a large effect on the allowance rate at the hearing level. The actual allowance rate—including the induced claims—fell steadily over this period, from around 80% for claims initially filed in 2007 to around 57% for claims filed in 2013. By contrast, the simulated allowance rate without the induced claims predicts, in the absence of the Great Recession, the allowance rate at the hearing level would have remained near 80% for applications initially filed through the end of 2009, at which point it would have started falling precipitously, beginning with the appellate hearings held for applications that were initially filed near the start of 2010 (hearings that would have

[45]Since we measure timing by initial filing, note that the allowance rates will not necessarily coincide with SSA official statistics which tend to group applications by decision year (vs. filing year).

been held in 2011 or later, given lengthy wait times for hearings during this period). Thus, the Great Recession cannot explain the significant decline in the hearing-level allowance rate that began in 2011 (and is evident when decisions are organized by decision date rather than by filing date as we do in Figs. A3 (Ray, 2015)). Concurrent with this decline, SSA introduced focused reviews and new training initiatives to improve the quality of judicial decision-making (Ray and Lubbers, 2014).

See Figs. A1–A3 and Tables A1–A8.

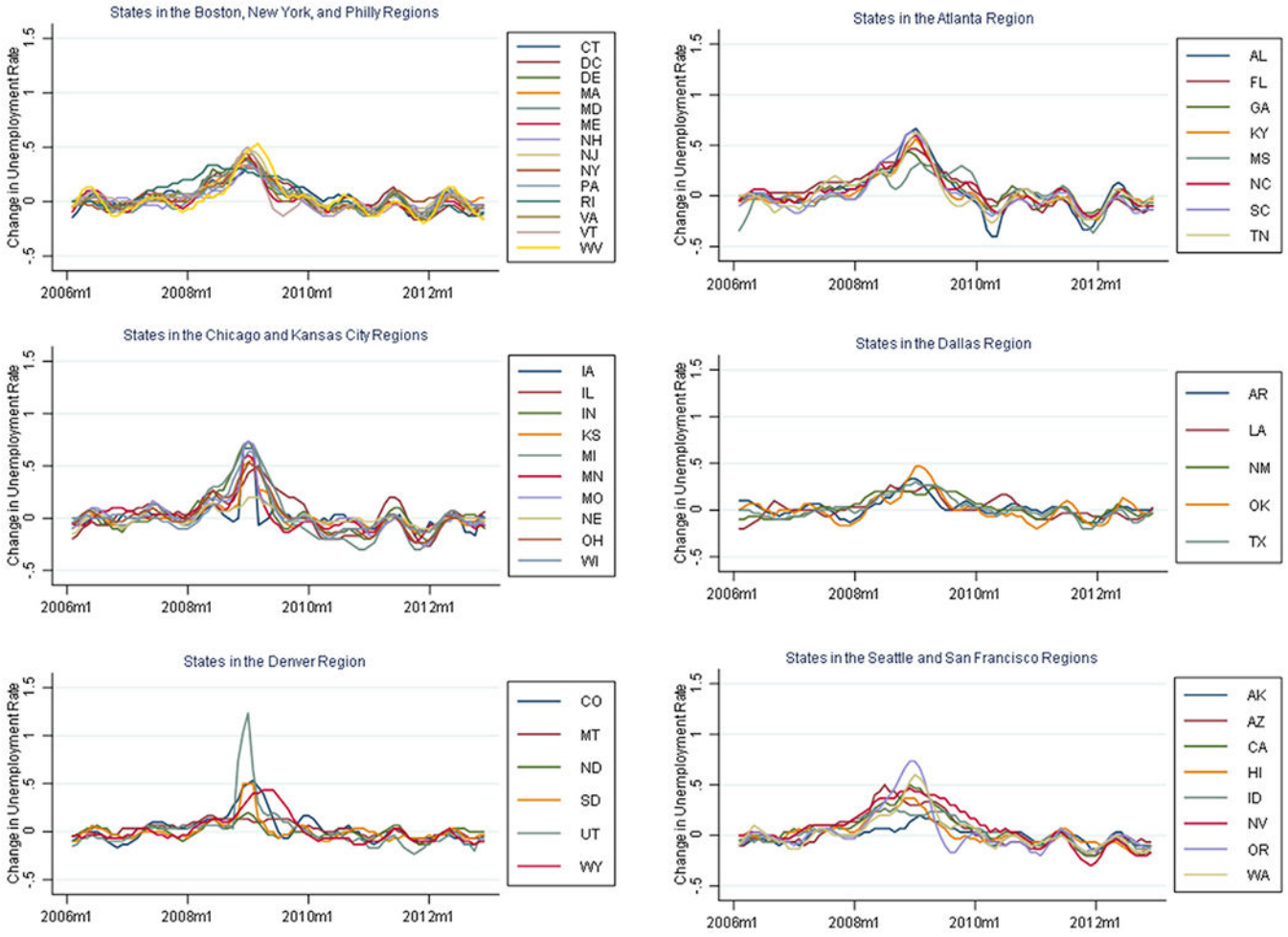

Fig. A1.

Changes in Monthly Unemployment Rate by State, 2006–2012. Source: Bureau of Labor Statistics (Unemployment Rates for States, Seasonally Adjusted).

Fig. A2.

Trends in Claims, Awards and Unemployment Rate, Separately for States Above and Below the Median Change (between 2008 and 2010) in Unemployment Rate. Sources: Bureau of Labor Statistics (Unemployment Rate, Seasonally Adjusted) and Social Security Administration 831 Files in Case Processing and Management System (SSDI Claims and Awards).

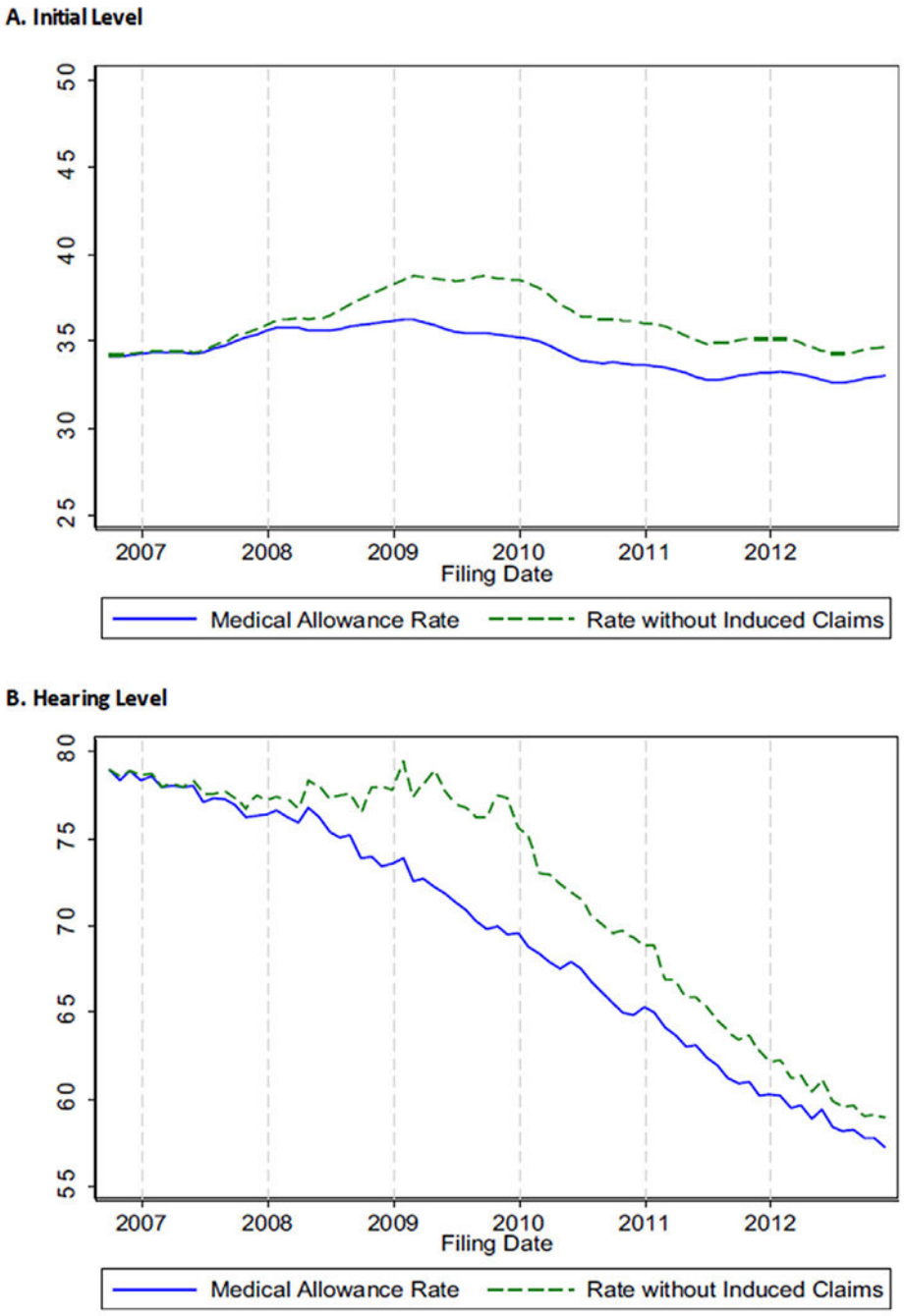

Fig. A3.
Counterfactual Allowance Rates in Absence of Great Recession.

Table A1

Effect of Unemployment Rate on Monthly SSDI Claims and Allowances, Different Distributed Lag Specifications, by Polynomial Degree.

Polynomial Degree	Number of applications					Number of allowances, all levels						
	2	3	4	5	6	2	3	4	4	5	6	
Contemporaneous	2,602	3,049	3,642	3,908	4,200	2,195	2,266	2,259	1,808	2,311	2,276	
L1	1,529	1,494	1,319	1,131	752	423	174	211	682	100	159	
L2	668	423	31	−170	−326	−415	−229	−225	39	−159	−172	
L3	19	−238	−528	−581	−444	−318	−26	−106	−256	−48	−106	
L4	−419	−560	−615	−529	−317		−300	−42	−317	−108	−110	
L5	−646	−618	−444	−303	−215			−205	−241	−254	−178	
L6	−662	−484	−180	−78	−168			−322	−106	−202	−175	
L7	−466	−230	57	63	−117			319	30	117	−37	
L8	−59	70	196	105	−15				125	131	152	
L9	560	343	210	79	122				159		205	
L10	1,390	517	119	39	216				127		15	
L11		518	−8	38	180				45		−144	
L12		274	−60	109	18				−52			
L13			126	237	−20				−112			
L14			755	339	763				−63			
L15				242								
Total Effect	4,517	4,558	4,619	4,629	4,630	1,885	1,885	1,888	1,867	1,889	1,885	
	−93	−94	−96	−97	−96	−50	−50	−50	−52	−50	−51	
Percent Shifted Forward	33.3% (3.8)	31.8% (4.2)	28.4% (5.2)	26.4% (5.8)	25.9% (8.0)	28.0% (4.9)	22.8% (7.5)	32.3% (7.9)	38.1% (5.6)	29.0% (7.8)	32.8% (11.1)	
	AIC	54,489	54,482	54,475	54,475	54,477	49,761	49,762	49,762	49,765	49,764	49,766
BIC	54,514	54,513	54,512	54,519	54,527	49,786	49,793	49,800	49,802	49,808	49,816	

Notes: standard errors in parentheses.

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level. In all models, $N = 3825$ state-month observations of the number of SSDI claims filed. Estimates are the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a given outcome type induced by a one-point increase in the unemployment rate.

Table A2

Effects of Unemployment Rate at the Time of Filing and the Time of Onset, Respectively, on *Initial Allowances.*

	Filing		Onset
Coef.	873*	757*	
SE	(458)		(449)
Mean DV	46,627		46,755
Pct. Change	1.9		1.6

	Filing	Onset
Elasticity	0.14	0.12
R-squared	0.982	0.982
N	3,825	3,825

Notes:
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level. In all models, *N* = 3825 state-month observations of the number of SSDI claims filed. Coef. refers to the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a given outcome type induced by a one-point increase in the unemployment rate. Mean DV, the mean of each dependent variable, gives the average monthly claims of a given outcome type. Percent change is the Coef./Mean DV, or the percent change in the outcome.

Table A3

Effect of Unemployment Rate on Monthly SSDI Claims, by Specification.

		Count-count (1)		Log(rate)-log(rate) (2)		Rate-rate (3)	Log(count)-rate (4)
Claims	*Coef.*	4,455***	0.195***	0.0016***	0.0153**		
	SE	978		0.0354		0.000475	0.00581
	Mean DV	1,35,945		−2.441		0.0933	8.293
	Pct. Change	3.3		–		–	1.5
	Elasticity	0.25		0.20		0.12	0.21
Weighted by state population?		No		Yes		No	Yes
R-squared		0.987		0.976		0.956	0.997
N		3,825		3,825		3,825	3,825

Notes:
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level. In all models, *N* = 3825 state-month observations of the number of SSDI claims filed. Coef. refers to the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a given outcome type induced by a one-point increase in the unemployment rate. Mean DV, the mean of each dependent variable, gives the average monthly claims of a given outcome type. Percent change is the Coef./Mean DV, or the percent change in the outcome.

Table A4

Symmetry of Positive and Negative Unemployment Rate Changes.

		Main Spec. (Table 4) (1)		Interacted Specification	
				Positive Change (2)	Negative Change (3)
Claims	*Coef.*	4,455***	4,249***	4,458***	
	SE	(978)		(957)	(993)
	Mean DV	1,35,945		1,35,945	1,35,945
	Pct. Change	3.3		3.1	3.3

		Main Spec. (Table 4) (1)		Interacted Specification	
				Positive Change (2)	Negative Change (3)
	Elasticity	0.25		0.12	0.12
Allowances	*Coef.*	873 *	998 **	872 *	
	SE	(458)		(449)	(449)
	Mean DV	46,627		46,627	46,627
	Pct. Change	1.9		2.1	1.9
	Elasticity	0.14		0.08	0.07
Denials	*Coef.*	3,582 ***	3,251 ***	3,586 ***	
	SE	(545)		(524)	(567)
	Mean DV	89,318		89,318	89,318
	Pct. Change	4.0		3.6	4.0
	Elasticity	0.31		0.14	0.15
Total Allowances	*Coef.*	1,860 ***	1,940 ***	1,859 ***	
	SE	(555)		(543)	(549)
	Mean DV	73,751		73,751	73,751
	Pct. Change	2.5		2.6	2.5
	Elasticity	0.19		0.10	0.10
Total Denials	*Coef.*	2,596 ***	2,310 ***	2,599 ***	
	SE	(446)		(428)	(465)
	Mean DV	62,194		62,194	62,194
	Pct. Change	4.2		3.7	4.2
	Elasticity	0.32		0.14	0.16

Notes:
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level. Column 1 reproduces the estimated coefficient on unemployment from the main specification (Table 4). Columns 2–3 present estimated coefficients on unemployment interacted with indicator for positive or negative change with respect to prior month, respectively, from the same regression.

Table A5

Effect of Unemployment Rate on Appellate Outcomes, by Reason for Initial Denial.

		Initial Denials		Appellate Outcome among Initial Denials				
				No appeal		Allowed	Denied	Dismissed
A. Effect of Unemployment Rate								
All Induced Denials	*Coef.*	3,582 ***	1,265 ***	986 ***	1,056 ***	274.6 ***		
	SE	(545)		(176)		(108)	(226)	(61)
	Mean DV	89,318		40,096		27,124	16,722	5,376
	Pct. Change	4.0		3.2		3.6	6.3	5.1

		Initial Denials		Appellate Outcome among Initial Denials				
				No appeal		Allowed		Denied	Dismissed
By Reason for Initial Denial									
Non-Medical Reason	*Coef.*	242***	136***	28		43***	34***		
	Std. Err.	(84)		(44)		(18)		(16)	(12)
	Mean DV	10,248		7,469		1,238		1,041	499
	Pct. Change	2.4		1.8		2.3		4.2	6.9
Not Severe	*Coef.*	1,153***	578***	149***	304***	123***			
	Std. Err.	(111)		(48)		(10)		(36)	(21)
	Mean DV	16,152		9,065		2,360		3,406	1,321
	Pct. Change	7.1		6.4		6.3		8.9	9.3
Short Duration	*Coef.*	−42		−45***	−1		5		−1
	Std. Err.	(27)		(8)		(10)		(11)	(2)
	Mean DV	5,424		2,405		1,992		778	249
	Pct. Change	−0.8		−1.9		−0.1		0.7	−0.3
Capable of Past Work	*Coef.*	1,018***	243***	391***	333***	52***			
	Std. Err.	(228)		(72)		(51)		(100)	(18)
	Mean DV	25,063		9,455		9,539		4,777	1,292
	Pct. Change	4.1		2.6		4.1		7.0	4.0
Capable of Other Work	*Coef.*	1,210***	353***	420***	371***	67***			
	Std. Err.	(136)		(36)		(32)		(70)	(24)
	Mean DV	32,430		11,702		11,994		6,719	2,016
	Pct. Change	3.7		3.0		3.5		5.5	3.3
B. Appellate Outcome as Percent of Induced Initial Denials									
All Induced Denials		100.0		35.3***	27.5***	29.5***	7.7***		
				(1.4)		(1.7)		(2.0)	(0.9)
By Reason for Initial Denial									

	Initial Denials	Appellate Outcome among Initial Denials					
		No appeal		Allowed		Denied	Dismissed
Non-Medical Reason	100.0	56.3***	11.6***	17.9***	14.2***		
		(7.2)		(4.3)		(1.7)	(1.9)
Not Severe	100.0	50.1***	12.9***	26.3***	10.6***		
		(1.3)		(0.7)		(0.8)	(0.9)
Short Duration	100.0	–		–		–	–
Capable of Past Work	100.0	23.8***	38.4***	32.7***	5.1***		
		(2.0)		(4.1)		(3.1)	(1.3)
Capable of Other Work	100.0	29.2***	34.7***	30.6***	5.5***		
		(1.7)		(2.1)		(2.8)	(1.7)

Notes:
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level. Each group of cells presents results from separate OLS estimations of Eq. (1). In all regressions, $N = 3825$ state-month observations of the number of SSDI claims filed that resulted in a given outcome. Coef. is the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a give outcome type induced by a one-point increase in the unemployment rate. Mean DV, the mean of each dependent variable, gives the average monthly claims of a given outcome type. Percent change is the Coef./Mean DV, or the percent change in the outcome.

Table A6

Effects of Unemployment Rate on Initial Claims, Denials, Appellate Claims, and Outcomes on Appeal, by Primary Diagnosis.

								Among Initial Denials					
		Initial Claims (1)		Initial Allowances (2)		Initial Denials (3)		No Appeal (4)		Allowance (5)		Den (6)	
A. Effect of Unemployment Rate													
Musculoskeletal	*Coef.*	1,785**	463**	1,322***	381***	459***	397***	86***					
	SE	(345)		(181)		(171)		(41)		(48)		(76	
	Mean DV	43,423		12,228		31,196		11,731		11,515		6,1	
	Pct. Change	4.1		3.8		4.2		3.2		4.0		6.5	
Mental	*Coef.*	992***	−52		1,044***	459***	222***	282***	81***				
	SE	(241)		(99)		(147)		(60)		(28)		(54	
	Mean DV	27,059		8,706		18,353		8,960		4,307		3,7	
	Pct. Change	3.7		-0.6		5.7		5.1		5.2		7.5	

								Among Initial Denials				
		Initial Claims (1)		Initial Allowances (2)		Initial Denials (3)		No Appeal (4)		Allowance (5)		Der (6)
Circulatory	*Coef.*	352**	124*	227***	78***	69***	68***	13*				
	SE	(132)		(62)		(73)		(24)		(19)		(26
	Mean DV	12,592		5,578		7,014		2,955		2,530		1,1
	Pct. Change	2.8		2.2		3.2		2.6		2.7		5.9
Neoplasms	*Coef.*	184***	136***	49***	17***	18***	12***	2**				
	SE	(22)		(25)		(7)		(5)		(3)		(2)
	Mean DV	9,011		7,075		1,936		926		680		250
	Pct. Change	2.0		1.9		2.5		1.8		2.6		4.9
Other	*Coef.*	1,142***	203**	940***	331***	218***	297***	94***				
	SE	(256)		(100)		(168)		(63)		(22)		(72
	Mean DV	43,859		13,041		30,819		15,524		8,091	5,406	1,7
	Pct. Change	2.6		1.6		3.0		2.1		2.7		5.5
B. Primary Diagnosis Percent of Induced Claims												
Musculoskeletal		100.0		25.9***	74.1***							
				(5.2)		(5.2)						
Mental		100.0		−5.3		105.2***						
				(11.1)		(11.1)						
Circulatory		100.0		35.3***	64.7***							
				(5.7)		(5.7)						
Neoplasms		100.0		73.7***	26.3***							
				(5.8)		(5.8)						
Other		100.0		17.8***	82.3***							
				(5.2)		(5.2)						
C. Primary Diagnosis Percent of Induced Initial Denials												
Musculoskeletal						100.0		28.8***	34.7***	30.0***	6.5***	
								(1.3)		(1.8)		(2.0
Mental						100.0		44.0***	21.3***	27.0***	7.8***	
								(1.6)		(1.7)		(1.4
Circulatory						100.0		34.3***	30.3***	29.8***	5.6***	
								(2.1)		(2.2)		(2.7
Neoplasms						100.0		34.4***	37.0***	25.2***	3.3**	
								(6.4)		(3.1)		(4.9
Other						100.0		35.2***	23.2***	31.6***	10.0***	
								(1.8)		(2.3)		(2.6

Notes:
*** Significant at the 1% level.
** Significant at the 5% level.

*Significant at the 10% level. Each group of figures presents regression estimates for a different outcome. In all models, N = 3825 state-month observations of the number of SSDI claims filed that resulted in a given outcome. Coef. refers to the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a give outcome type induced by a one-point increase in the unemployment rate. Mean DV, the mean of each dependent variable, gives the average monthly claims of a given outcome type. Percent change is the Coef./Mean DV, or the percent change in the outcome.

Table A7

Sensitivity of Total Benefit Costs to Discount and Mortality Rates (Billions of 2010$).

		Discount Rate				
		1.0%	**1.5%**	**2.0%**	**2.5%**	**3.0%**
Mortality	1.1%	$65.304	$63.528	$61.830	$60.204	$58.648
Rate	2.1%	$61.830	$60.204	$58.648	$57.158	$55.730
	3.1%	$58.648	$57.158	$55.730	$54.361	$53.048
	4.1%	$55.730	$54.361	$53.048	$51.788	$50.580
	5.1%	$53.048	$51.788	$50.580	$49.419	$48.304

Notes: To calculate the implied increase in SSDI benefit obligations, we assume 416,454 new beneficiaries receive an average annual benefit of $13,546 until age 65. See text for details on how we obtain the average age of induced entrants. Our preferred estimate assumes a discount rate of 2% and an annual mortality rate of 3.1%.

Table A8

Summary of prior state-level fixed effects DI studies.

Study	**Elasticity**	**Period**	**Time Series Frequency**
1. Initial Claims			
Stapleton et al. (1988)			Annual
DI only	0.28**	1980–1993	
	0.24**	1980–1987	
	0.25**	1988–1993	
DI concurrent	0.26**	1980–1993	
	0.09	1980–1987	
	0.26**	1988–1993	
Cutler et al. (2012)	0.31***	2001–2011	Quarterly
Maestas et al. (2015)	0.19***	1992–2012	Monthly
	0.10***	2006m10–2012m12	
Maestas et al. (2020) (this paper)	0.25***	2006–2012	Monthly
2. Initial Awards			
Stapleton et al. (1988)		1988–1992	Annual
DI only, men	0.18**		
DI only, women	0.06		
DI concurrent, men	0.19**		
DI concurrent, women	0.02		
Maestas et al. (2015)	−0.21***	1992–2012	Monthly
	−0.04	2006m10–2012m12	
Maestas et al. (2020) (this paper)	0.14*	2006–2012	Monthly
3. Total Awards			

Study	Elasticity	Period	Time Series Frequency
Maestas et al. (2020) (this paper)	0.19***	2006–2012	Monthly

Notes:
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level. Dependent variables are measured in log of rates which are measured as the number of claims per 1000 population. Independent variables are logs of the unemployment rate.

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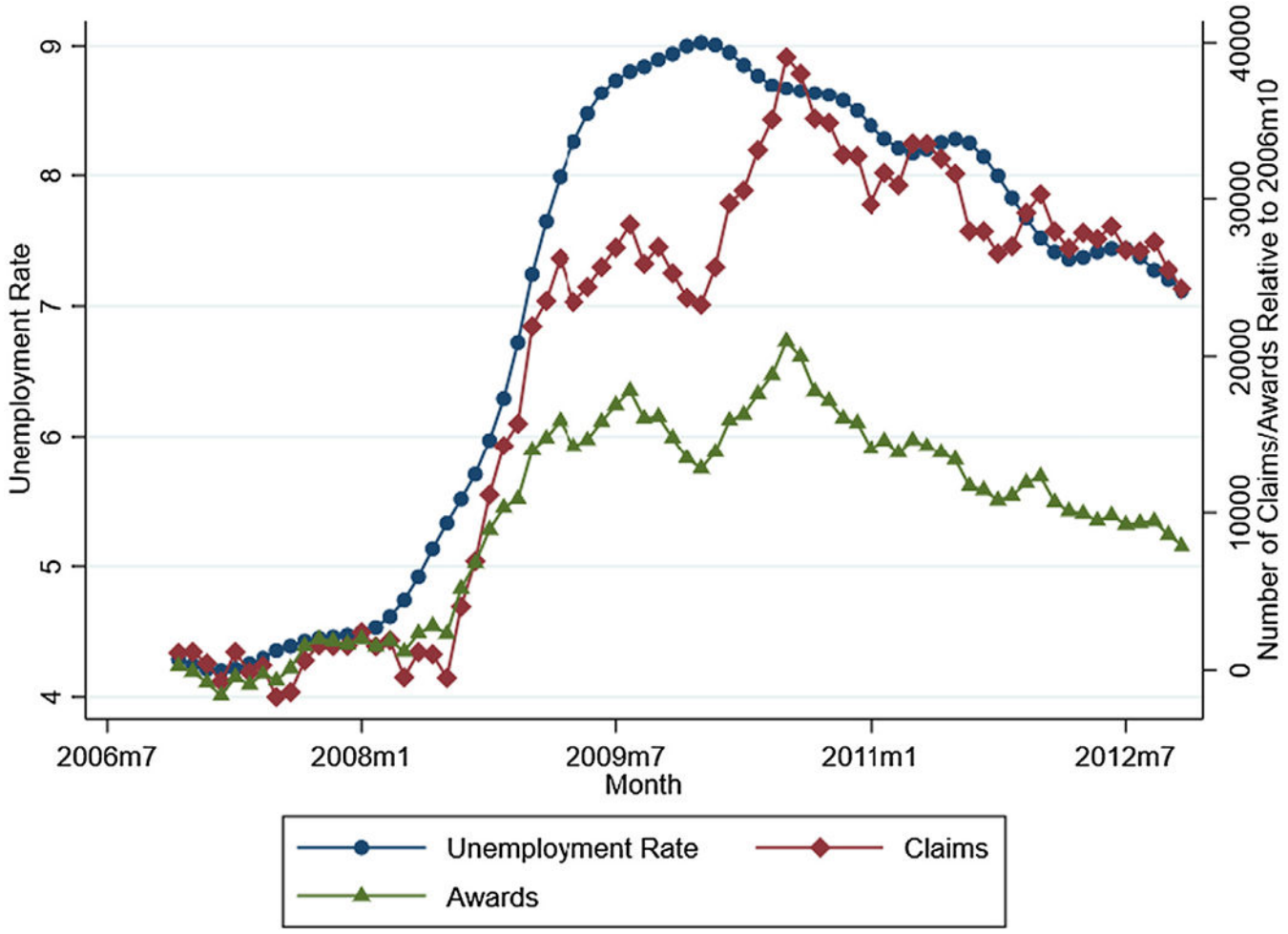

Fig. 1.

Unemployment Rate, SSDI Claims, and Awards, 2006–2012. *Notes:* Awards, like claims, are organized by month of initial filing, not month of award. SSDI claims and awards are adjusted for monthly seasonality and then smoothed using a 3-month moving average. We then re-center each series around its initial value in 2006m10 to make it easier to see them on the same scale. Sources: Bureau of Labor Statistics (Unemployment Rate, Seasonally Adjusted) and Social Security Administration 831 Files in Case Processing and Management System (SSDI Claims and Awards).

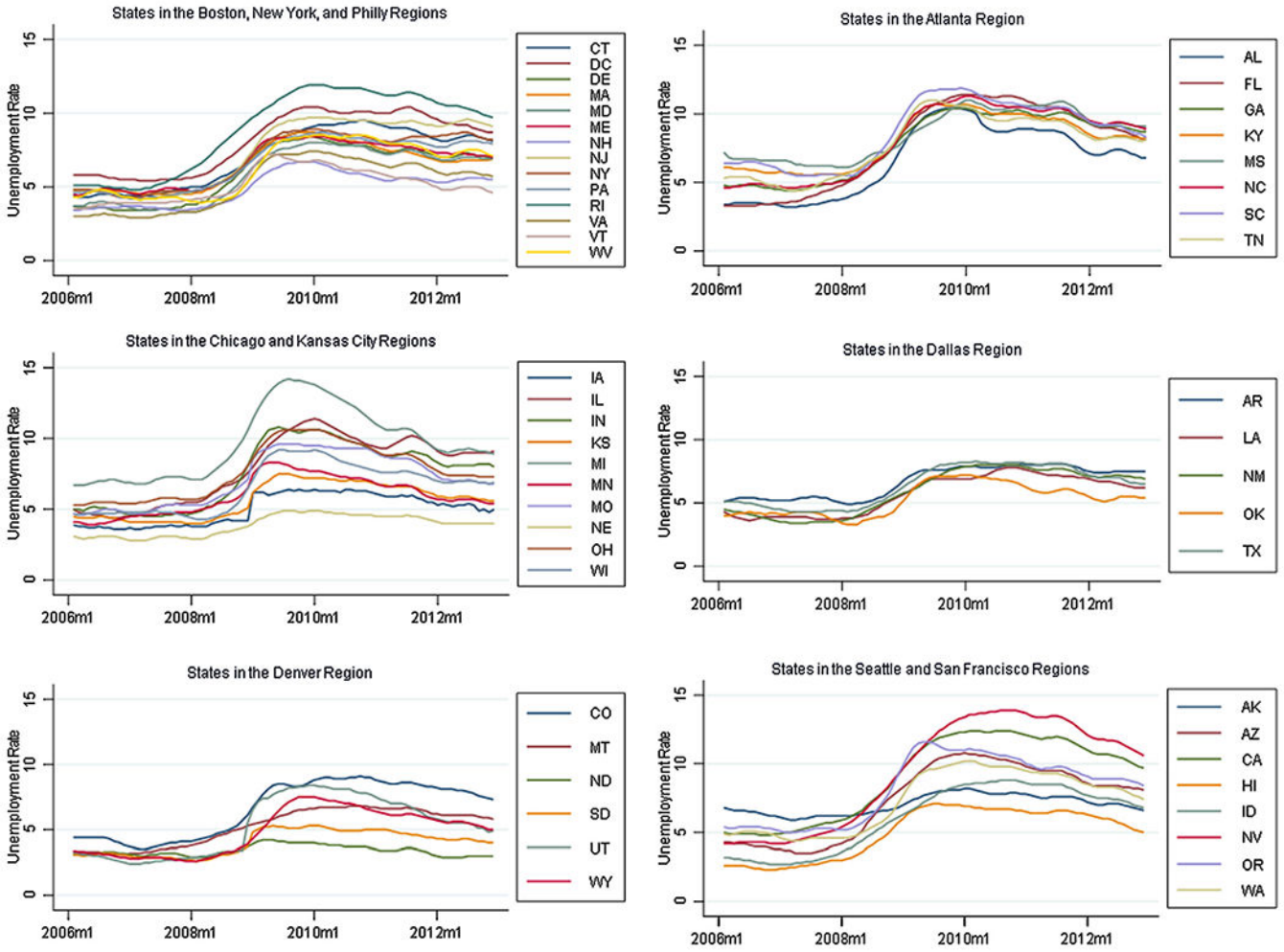

Fig. 2.

Monthly Unemployment Rate by State, 2006–2012. Source: Bureau of Labor Statistics (Unemployment Rates for States, Seasonally Adjusted).

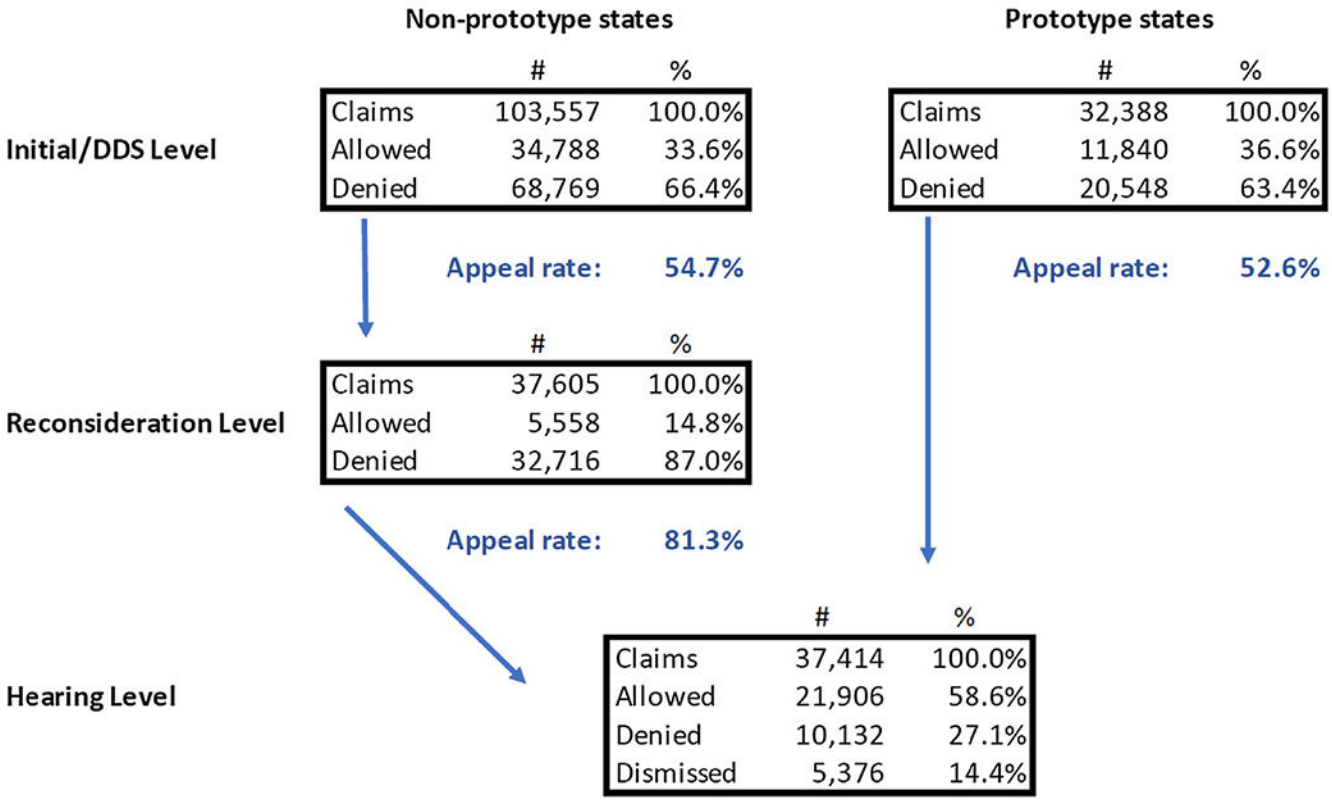

Fig. 3.

Monthly Flow of SSDI Claims Filed in 2006–2012. *Notes:* We do not include as appeals claims that were initially allowed but subsequently appealed. There are 300 claims per month of this type (for a total of 22,460 applications during the sample period). Also, in this figure, we do not include as reconsiderations claims that were filed in prototype states but received a reconsideration in a non-prototype state. Prototype states are Alabama, Alaska, California (LA North and LA West Only), Colorado, Louisiana, Michigan, Missouri, New Hampshire, New York, and Pennsylvania.

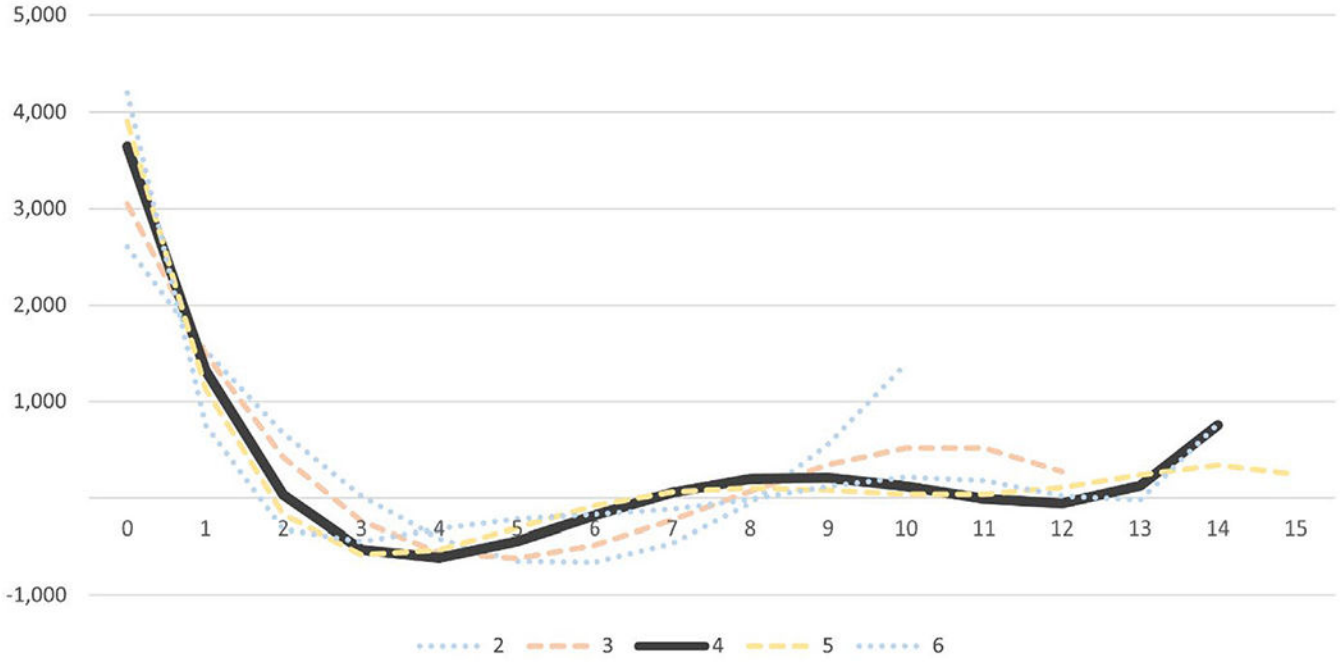

Fig. 4.

Dynamic Effects of Unemployment on SSDI Applications: Estimated Lag Pattern by Polynomial Degree. *Notes:* Number of lags for each polynomial determined by minimum AIC/BIC. Polynomial of degree 4 is the global minimum.

Table 1

Summary Statistics for SSDI Applications Filed 2006–2012.

Characteristic	Statistic
Age (years)	46.6 (11.4)
Female (%)	48.1
Concurrent claim (%)	52.2
Prototype state (%)	23.8
Primary diagnosis category (%)	
Musculoskeletal	31.9
Mental	19.9
Circulatory	9.3
Neoplasms	6.6
Other categories	32.3
Total	100.0
Initial allowance (%)	34.3
Final allowance (%)	54.3
Claims	1,01,95,864
Claims per month	1,35,945

Notes: Standard deviation in parentheses. Sample is all SSDI applications filed from October 2006 through December 2012.

Table 2

Percent Distribution of SSDI Applications across Decision Outcomes, by Administrative Level.

		Initial	Recon-sideration	Hearing
Allowed				
	Meets or equals listings (%)	15.6	5.8	7.2
	Medical-vocational (%)	18.7	7.9	49.6
	Other (%)			1.8
Denied				
	Non-medical (%)	7.5	3.3	1.1
	Not severe (%)	11.9	13.1	1.3
	Short duration (%)	4.0	4.0	0.0
	Capable of past work (%)	18.4	27.5	8.2
	Capable of other work (%)	23.9	38.3	16.4
Dismissed		0.0	0.0	14.4
Total (Column %)		100.0	100.0	100.0
N		1,01,95,864	28,52,831	28,06,061

Notes: Sample is all SSDI applications filed from October 2006 through December 2012.

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Table 3

Effect of Unemployment Rate on Monthly SSDI Claims, Base Model vs. Distributed Lag Specification.

	Number of Applications					Number of Allowances, All Decision Levels				
	Base model (1)		Distributed lag model: AIC/BIC optimizing lag (2)			Base model (3)			Distributed lag model: AIC/BIC optimizing lag (4)	
Contemporaneous	4,455***	(978)	3,642***	(345)	1,860***	(555)	2,195***	(286)		
L1			1,319***	(101)					423*	(245)
L2			31			(184)			−415*	(246)
L3			−528***	(184)					−318	(276)
L4			−615***	(133)						
L5			−444***	(106)						
L6			−180			(129)				
L7			57			(144)				
L8			196			(129)				
L9			210**	(105)						
L10			119			(131)				
L11			−8			(183)				
L12			−60			(184)				
L13			126			(96)				
L14			755***	(329)						
Total Effect	4,455***	(978)	4,619***	(96)	1,860***	(555)	1,885***	(50)		
Mean DV	1,35,945		1,35,945				73,751		73,751	
Pct. Change	3.3		3.4				2.5		2.6	
Elasticity	0.25		0.26				0.19		0.19	
Sum of Positive Lags			6,455***	(503)					2618***	(193)
Sum of Negative Lags			−1,836***	(472)					−733***	(181)
Percent Shifted Forward			28%***	(5.2%)					28%***	(4.9%)
AIC	54,534		54,475				49,802		49,761	
BIC	54,540		54,512				49,808		49,786	

	Number of Applications		Number of Allowances, All Decision Levels	
	Base model (1)	**Distributed lag model: AIC/BIC optimizing lag (2)**	**Base model (3)**	**Distributed lag model: AIC/BIC optimizing lag (4)**
R-squared	0.987	-	0.987	-
N	3,825	3,825	3,825	3,825

Notes:

*** Standard errors in parentheses. Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level. In all models, *N* = 3825 state-month observations of the number of SSDI claims filed. Estimates are the coefficient on the number unemployed multiplied by the number of workers equivalent to one% of the national labor force, and thus indicates the number of additional applications of a given outcome type induced by a one-point increase in the unemployment rate.

Table 4

Effect of Unemployment Rate on Monthly SSDI Claims, Allowances and Denials by Administrative Level.

		Appellate				
		Initial (1)		**Reconsideration (2)**	**Hearing (3)**	**All Levels (4)**
Claims	*Coef.*	4,455***	1,997***	1,736***		
	SE	(978)		(386)	(314)	
	Mean DV	1,35,945		38,038	37,414	
	Pct. Change	3.3		5.3	4.6	
	Elasticity	0.25		0.40	0.35	
Allowances	*Coef.*	873*	259***	728***	1,860***	
	SE	(458)		(22)	(101)	(555)
	Mean DV	46,627		5,217	21,906	73,751
	Pct. Change	1.9		5.0	3.3	2.5
	Elasticity	0.14		0.38	0.25	0.19
Denials	*Coef.*	3,582***	1,738***	733***	2,596***	
	SE	(545)		(371)	(175)	(446)
	Mean DV	89,318		32,821	10,132	62,194
	Pct. Change	4.0		5.3	7.2	4.2
	Elasticity	0.31		0.40	0.55	0.32
Dismissals	*Coef.*				275***	
	SE				(61)	
	Mean DV				5,376	
	Pct. Change				5.1	
	Elasticity				0.39	
Allowance Rate among Induced Claims (%)		19.6%***	12.9%***	41.9%***	41.8%***	
			(6.1)		(1.9)	(2.9)	(3.8)
Claims as % of Induced Initial Denials		–	58.8%***†	48.5%***	–	
					(4.0)	(2.1)	

Notes:

***Significant at the 1% level.

**Significant at the 5% level.

*Significant at the 10% level. Each group of figures presents regression estimates for a different outcome. In all models, $N = 3825$ state-month observations of the number of SSDI claims filed that resulted in a given outcome. Coef. refers to the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a given outcome type induced by a one-point increase in the unemployment rate. Mean DV, the mean of each dependent variable, gives the average monthly claims of a given outcome type. Percent change is the Coef./Mean DV, or the percent change in the outcome.

†Induced reconsideration claims computed as % of initial denials in non-prototype states

Table 5

Effect of Unemployment Rate on Claims by Reason for Determination and Administrative Level.

		Initial Level				Appellate			Total
		Effect of Unemp. Rate		% of Induced Initial Claims		Effect of Unemp. Rate		% of Induced Appell. Claims	% of Induced Initial Claims
Allowances									
Meets or equals listings	*Coef.*	208		4.7%***	191***	8.2%***	9.0%***		
	SE	(130)		(1.9%)		(20)		(0.9%)	(1.3%)
	Mean DV	21,231				4,893			
	Pct. Change	1.0				3.9			
	Elasticity	0.07				0.30			
Medical-vocational	*Coef.*	666**	14.9%***	782***	33.8%***	32.5%***			
	Std. Err.	(330)		(4.2%)		(93)		(2.3%)	(2.8%)
	Mean DV	25,396				21,571			
	Pct. Change	2.6				3.6			
	Elasticity	0.20				0.28			
Other Allowances	*Coef.*	–		–		13***	0.6%***	–	
	Std. Err.	–		–		(4)		(0.2%)	–
	Mean DV	–		–		659			
	Pct. Change	–		–		2.0			
	Elasticity					0.15			
Denials									
Non-Medical	*Coef.*	242***	5.4%***	35***	1.5%***	6.2%***			
	Std. Err.	(84)		(0.8%)		(8)		(0.2%)	(0.9%)
	Mean DV	10,248				879			
	Pct. Change	2.4				4.0			
	Elasticity	0.18				0.30			
Not Severe	*Coef.*	1,153***	25.9%***	164***	7.1%***	29.6%***			
	Std. Err.	(111)		(3.5%)		(17)		(0.8%)	(4.1%)
	Mean DV	16,152				1,967			
	Pct. Change	7.1				8.3			

		Initial Level				Appellate			Total
		Effect of Unemp. Rate		% of Induced Initial Claims		Effect of Unemp. Rate		% of Induced Appell. Claims	% of Induced Initial Claims
	Elasticity	0.54				0.63			
Short Duration	*Coef.*	−42		−0.9%		−9		−0.4%	−1.1%
	Std. Err.	(27)		(0.8%)		(7)		(0.3%)	(0.9%)
	Mean DV	5,424				310			
	Pct. Change	−0.8				−2.8			
	Elasticity	−0.06				−0.22			
Capable of Past Work	*Coef.*	1,018***	22.9%***	320***	13.8%***	30.0%***			
	Std. Err.	(228)		(1.8%)		(65)		(0.7%)	(2.1%)
	Mean DV	25,063				4,979			
	Pct. Change	4.1				6.4			
	Elasticity	0.31				0.49			
Capable of Other Work	*Coef.*	1,210***	27.2%***	546***	23.6%***	39.4%***			
	Std. Err.	(136)		(3.6%)		(140)		(2.5%)	(3.3%)
	Mean DV	32,430				8,586			
	Pct. Change	3.7				6.4			
	Elasticity	0.28				0.48			
Dismissed	*Coef.*	–		–		275***	11.9%***	–	
	Std. Err.	–		–		(61)		(1.4%)	–
	Mean DV	–		–		5,376			
	Pct. Change	–		–		5.1			
	Elasticity					0.4			

Notes: Standard errors in parentheses.

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level. Appellate refers to reconsideration and hearings claims combined. Each group of figures presents regression estimates for a different outcome. In all models, N = 3825 state-month observations of the number of SSDI claims filed that resulted in a given outcome. Coef. refers to the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a give outcome type induced by a one-point increase in the unemployment rate. Mean DV, the mean of each dependent variable, gives the average monthly claims of a given outcome type. Percent change is the Coef./Mean DV, or the percent change in the outcome.

J Public Econ. Author manuscript; available in PMC 2022 July 01.

Table 6

Effect of Unemployment Rate on Monthly SSDI Claims, Allowances and Denials, by Age Group and SSDI-SSI Concurrent Status.

		By Age Group									By SSDI-SSI Concurrent Status		
		Ages 18–39		Ages 40–49		Ages 50–59		Ages 60–64		Difference (50–40 s)	Concurrent	DI Only	Difference (DI-Concurrent)
Claims	*Coef.*	1,262***	785***	1,778***	631***	992***	2,351***	2,104***	−247				
	SE	(322)		(249)		(347)		(65)		(99)	(390)	(601)	(260)
	Mean DV	36,193		35,591		47,200		16,961			64,026	71,918	
	Pct. Change	3.5		2.2		3.8		3.7			3.7	2.9	
	Elasticity	0.27		0.17		0.29		0.28			0.28	0.22	
Initial Allowances	*Coef.*	−22		−49		595**	349***	643***	698**	175	−523***		
	SE	(60)		(65)		(251)		(87)		(186)	(278)	(184)	(111)
	Mean DV	6,447		7,609		22,003		10,568			28,915	17,713	
	Pct. Change	−0.3		−0.6		2.7		3.3			2.4	1.0	
	Elasticity	−0.03		−0.05		0.21		0.25			0.18	0.08	
Initial Denials	*Coef.*	1,284***	833***	1,183***	282***	349***	1,653***	1,929***	276				
	SE	(266)		(190)		(116)		(35)		(95)	(131)	(424)	(305)
	Mean DV	29,746		27,982		25,197		6,393			35,112	54,206	
	Pct. Change	4.3		3.0		4.7		4.4			4.7	3.6	
	Elasticity	0.33		0.23		0.36		0.34			0.36	0.27	
Total Allowances	*Coef.*	151*	177*	1,084***	447***	906***	1,277***	583**	−693***				
	SE	(88)		(99)		(288)		(83)		(188)	(316)	(250)	(127)
	Mean DV	11,913		16,586		32,754		12,498			42,578	31,173	
	Pct. Change	1.3		1.1		3.3		3.6			3.0	1.9	
	Elasticity	0.10		0.08		0.25		0.27			0.23	0.14	
Total Denials	*Coef.*	1,111***	607***	693***	184***	86		1,074***	1,521***	447*			
	SE	(237)		(155)		(78)		(29)		(94)	(96)	(357)	(267)
	Mean DV	24,279		19,006		14,446		4,463			21,449	40,745	
	Pct. Change	4.6		3.2		4.8		4.1			5.0	3.7	
	Elasticity	0.35		0.24		0.37		0.31			0.38	0.28	

Notes:

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level. Each group of figures presents regression estimates for a different outcome. In all models, $N = 3825$ state-month observations of the number of SSDI claims filed that resulted in a given outcome. Coef. refers to the coefficient on the number unemployed multiplied by the number of workers equivalent to one percent of the national labor force, and thus indicates the number of additional applications of a given outcome type induced by a one-point increase in the unemployment rate. Mean DV, the mean of each dependent variable, gives the average monthly claims of a given outcome type. Percent change is the Coef./Mean DV, or the percent change in the outcome.