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Macroeconomic antecedents of psychiatric emergencies and inpatient admissions in the US, 2006 to 2011.

DISSERTATION

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for the degree of

DOCTOR OF PHILOSOPHY

in Public Health

by

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Graduate Student Researcher

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PEER-REVIEWED PUBLICATIONS

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Trinh, N., **Singh, P.**, Cerda, M., & Bruckner, T. A. (2020). Opioid-related emergencies in New York City after the Great Recession. *Journal of Substance Abuse Treatment*.

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- The South Asia Food and Nutrition Security Initiative (SAFANSI). 2016. Impacting food security and nutrition outcomes through strengthening livelihoods- The experience from India Livelihood Projects. World Bank Group, South Asia Region. Available at: http://documents.worldbank.org/curated/en/765331468195548755/pdf/106468-BRI-ADD-SERIES- PUBLIC.pdf
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ABSTRACT OF THE DISSERTATION

Macroeconomic antecedents of psychiatric emergencies and inpatient admissions in the US, 2006 to 2011

By

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University of California, Irvine, 2020

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Background: Economic downturns may increase stress due to income and job loss among the directly affected, as well as uncertainty, fear and anxiety among those who remain employed. For those who work during recessions, studies suggest a rise in working hours, reduction in pay and increased stress due to uncertainty of employment. During such times, populations may experience adverse mental health and greater psychiatric help-seeking manifested as higher number of emergency department (ED) visits. Conversely, recessions may also correspond with increase in healthy behavior as a response to financial uncertainty- a phenomenon also referred to as the "inhibition effect." Low-income African Americans appear especially vulnerable to economic recessions. During the recent 2008 recession, African Americans lost more jobs, had a steeper reduction in income and were more likely to lose health insurance relative to whites. Societal responses to ambient stressors also put African Americans at greater risk of psychiatric hospital admissions. In addition, reduction in tolerance towards behavior deemed as 'deviant' or

'threatening' during economic contractions may result in greater reporting-- especially of African American males-- to law enforcement for involuntary psychiatric holds and inpatient admissions.

Objective: In this dissertation, I test whether economic downturns precede an increase in: the overall incidence of psychiatric ED visits (Chapter 2); psychiatric ED visits among African Americans more than whites (Chapter 3); and psychiatric inpatient admissions requested by law enforcement/courts among African American males relative to other race/ethnicity and gender groups (Chapter 4).

Methods: I operationalize exposure to recession 'shocks' as monthly declines in employment in a Metropolitan Statistical Area (MSA). I use data from the Statewide Emergency Department Database (SEDD) and the Statewide Inpatient Database (SID) for select US states (Arizona, California, North Carolina, New Jersey and New York) to retrieve, as my outcome, the census of all psychiatric ED visits and inpatient admissions for the time period of 2006 to 2011. I use monthly time resolution to establish temporal order such that the exposure (percentage change in monthly employment) precedes the outcome (monthly psychiatric visits). I specify brief exposure time lags of 0 to 3 months to estimate proximate responses to MSA-level aggregate macroeconomic decline. I utilize linear, logistic, negative binomial regression methods with inclusion of region, month, year fixed effects and linear time trends.

Results: In Chapter 2, I find that psychiatric ED visits decline immediately following MSA-level aggregate employment decline. This decline concentrates among those with private insurance, and among alcohol abuse-related emergencies. Concurrently, I also find an increase in psychiatric ED visits following MSA-level employment decline among publicly insured children. In Chapter 3, I find that working age (18 to 64 years old), publicly insured African Americans (versus whites) show increased odds of a psychiatric ED visit within 0 to 3 months of MSA-level employment

decline. In Chapter 4, I find that psychiatric inpatient admissions requested by law enforcement/court orders increase within one month of aggregate employment decline among African American males but not among other race/ethnicity and gender groups.

Conclusion: The aggregate, population-level decline in psychiatric ED visits supports the 'inhibition' mechanism wherein economic uncertainty may correspond with reduction in unhealthy consumption. These results also align with prior research which posits that mental health care shows high price-elasticity in that reduction in income may elicit a greater decline in mental health care utilization relative to other types of health care. However, findings among publicly insured children indicate greater vulnerability among low-income groups that may differ in psychiatric response during economic contractions, relative to high-income groups. Increased odds of psychiatric ED visits among working age, publicly insured African Americans, relative to whites, also provide evidence of differential vulnerability of this group during ambient economic crises. Lastly, an increase in psychiatric inpatient admissions requested by law enforcement/court orders among African American males supports the 'reduced tolerance' hypothesis and highlights unique social responses that may affect mental health outcomes among African American men during recessions. To my knowledge, the research described in this dissertation presents the first evidence reconciling pro- and countercyclical trends in population-level psychiatric emergencies following economic downturns, and highlights the unique vulnerability of African Americans over a time period that includes the recent Great Recession.

Chapter 1: Introduction

Research on economic downturns and mental health traces its origins to the late 19th century when it was first proposed that recessions could lead to marked changes in population-level psychiatric pathology (Durkheim, 1951). Employment loss and threat to future employment constitute stressful life events that may precipitate the onset of or elevate the severity of psychopathological outcomes like clinical depression (Dohrenwend, 2006). Fluctuations in the economic cycle may increase the incidence and intensity of stressful life events that are, in turn, associated with several adverse health outcomes such as suppression of immune activity, rise in cardiovascular diseases, and exacerbation of pre-existing illnesses (Catalano and Dooley, 1979a; McEwen, 1998a, 1998b; Rozanski et al., 1999; McEwen, 2004). Conversely, recessions may also correspond with increased healthy behavior that may reduce substance use and mortality (Ruhm, 1995, 2000; Ruhm and Black, 2002). These relations may vary heterogeneously by socioeconomic status, labor market attachment, occupation type and status and social support systems (Zivin et al., 2013).

The economy as a stressor

Stress and coping mechanisms are thought to mediate the impact of economic downturns on mental illness by triggering a rise in expression of psychiatric symptoms and development of new mental disorders (Goldman-Mellor et al., 2010). Employment loss and financial insecurity stemming from sudden economic contractions are regarded as acute stressors that impact both the employed as well as those who lose employment during recessions (Brenner, 1990; Brenner, 1973; Trainor et al., 1987). Among those who experience job loss, stress can negatively impact psychological well-being through loss of social standing, reduced social support, strain on familial relationships and loss of personal control (Zivin et al., 2011; Burgard et al., 2013; Price et al., 2002; Atkinson et al., 1986). Stress induced by employment loss can also increase maladaptive

health behaviors such as smoking and drinking (Brenner, 1975; Brenner, 1990; Harhay et al., 2013; Catalano et al., 1993; Dee, 2001). Studies show that unemployment increases the risk for mood, anxiety, psycho-somatic and alcohol-related disorders. Among those who retain employment during recessions, economic downturns are associated with loss of morale and increased fear of future job loss (López Bohle, 2017).

Theoretical pathways

The provocation hypothesis suggests that economic recessions lead to a rise in 'newly disordered' psychiatric cases (Dooley et al., 1981; Brenner, 1973; Brenner, 1969; Catalano and Dooley, 1977). New disorders may arise from increased stress and subsequent maladaptive behaviors, including violence, aggression and substance use following job loss (Zivin et al., 2013). Anticipation or fear of future job loss may also 'provoke' mental disorders in otherwise healthy individuals (Dooley and Catalano, 1984). Sudden and undesirable changes in the macroeconomic environment may induce uncertainty around individuals' response to unpredictable stimuli and increase anxiety and other psychiatric symptoms during recessions (Dooley and Catalano, 1984).

Uncovering posits that recessionary shocks might make it difficult for chronically ill patients to manage their pre-existing conditions either due to reduced resources (loss of income, health insurance, inability to continue medications) or due to increased reporting of disorders (Catalano and Dooley, 1979b; Catalano et al., 1981; Catalano et al., 2011). Prior research finds stronger support for uncovering relative to provocation, presumably because adult behavioral responses to crises and psychiatric disposition are often programmed during childhood and these latent mental conditions are likely 'uncovered' following acute stressors (Dooley and Catalano, 1984; Kessler et al., 2009). Uncovering may also correspond with increased prophylactic care-seeking and greater utilization of mental health care services in anticipation of financial uncertainty

(Kushel et al., 2002; Catalano et al., 1981; Catalano et al., 1985). The combination of provocation (new disorder) and uncovering (exacerbated disorder) may elevate the rate of psychiatric diagnoses during recession and suggests an aggregate shift towards help-seeking in the population (Dooley and Catalano, 1984).

On the other hand, 'inhibition' or risk averse-responses to economic downturns may reduce psychiatric symptoms as populations adjust to ambient stressors and exhibit cautionary behaviors such as reduced consumption of alcohol, tobacco and substance use (Ruhm, 2015). Other evidence of risk averse behavior following macroeconomic contractions draws from decline in fertility through postponement of pregnancy and a decline in motor vehicular accidents caused by drunk driving in the US during the 2008 recession (Schneider, 2015; Catalano et al., 1993; Longthorne et al., 2010; He, 2016).

Reduced tolerance, considered a variant of the uncovering hypothesis, suggests that during times of economic hardship, communities at large become less tolerant towards aberrant or deviant behavior (Goldman-Mellor, 2010; Catalano et al., 2007a; Kessell et al., 2006). Reduced tolerance invokes the frustration-aggression-displacement theory wherein communities may use certain groups as scapegoats in times of heightened ambient stress (Hovland and Sears, 1940; Berkowitz, 1989; Dollard et al., 1939; Miller, 1941). In the context of economic downturns, tests of reduced tolerance provide evidence that incidence of involuntary psychiatric examinations and hospital admissions rises during times of economic uncertainty, indicating lower societal tolerance than during economic stability (Kessell et al., 2006; Catalano et al., 2007a). Taken together, uncovering and reduced tolerance hypotheses suggest that populations may respond to ambient economic stressors in ways that may not only increase incidence, but also raise the prevalence of mental disorders by revealing erstwhile dormant or unreported cases.

Classification of evidence in systematic reviews

Scholars have attempted to classify the web of mixed findings pertaining to mental health and economic recessions into two broad groups: pro-cyclical (illness declines when economy declines) and counter-cyclical (illness increases when the economy declines). Burgard et al. (2013) suggest that the divergence between pro- and counter-cyclic findings may plausibly arise from the unit of analysis. Much of the literature presenting pro-cyclical evidence is ecological in nature, in contrast to the majority of individual-level studies that find counter-cyclical relations between economic downturns and mental health (Burgard et al., 2013). At the aggregate level, Burgard et al. (2013) describe increase in stress, reduction in working hours, reduced transmission of infectious illnesses, availability of higher quality care (particularly for the elderly) and changes in risky consumption as aggregate-level phenomena linking recessions to population-level health outcomes. In their review, the authors present evidence that at the population-level, lower consumption corresponds with reduced substance use as well as lower utilization of health care services (Burgard et al., 2013). The authors also describe time use towards healthy behaviors as a plausible pathway underlying improved health outcomes during recessions (Burgard et al., 2013). The pro-cyclical literature argues that much of the stress in daily life comes from working, and increase in leisure time, following job loss mediates health behavior and favorable health outcomes during economic contractions (Ruhm, 2000). Among population-level studies reviewed by Burgard et al. (2013), increase in stress, however, corresponds with adverse mental health outcomes and substance use, in contrast to the other pathways (time use and lower harmful consumption). Individual-level studies described by Burgard et al. (2013), predominantly present counter-cyclic evidence in that employment loss and reduction in assets during recessions corresponds with increase in mental and somatic illness, increased unhealthy consumption

including substance use, increase in suicides and reduction in utilization of health care (Burgard et al., 2013). Consumption of preventative or primary mental health care has high income elasticity and income loss may precede reduced psychiatric care utilization during times of economic uncertainty (Chen and Dagher, 2016; Watts et al., 1986; McGuire, 1981; Horgan, 1986). Time use appears as the only hypothesized pathway, across both population and individual-level studies that may confer health 'benefits' following recessions, whereas stress uniformly corresponds with poor health outcomes in both types (population and individual-level) of research (Burgard et al., 2013).

In their review of longitudinal causal research examining the relation between economic decline and health outcomes, Catalano et al. (2011) classify pro- and counter-cyclical evidence based on three mechanisms: (1) stress, (2) frustration-aggression, and (3) effect budgeting. Findings from research invoking the stress mechanism align with counter-cyclical expectations from economic cycles (Catalano et al., 2011). Frustration-aggression mechanism can correspond with both pro- and counter-cyclical mental health responses to economic downturns (Catalano et al., 2011). Job loss may increase violence and aggression, or promote alcohol/substance use as coping mechanisms among those who experience unanticipated loss of employment (Catalano et al., 2011). Conversely, frustration-aggression may also correspond with increase in behavior control among those who fear job loss, and reduce violence and harmful consumption (collectively referred to as 'inhibition effect'), thus aligning with pro-cyclical expectations in relation to macroeconomic decline (Catalano et al., 2011). Effect budgeting proposes that economic uncertainty and income loss force individuals to prioritize investments based on available resources (time, money). Effect budgeting may correspond with a 'bandwidth tax', wherein mental attention to salutary tasks (such as infant care) may get diverted or depleted during economic downturns and correspond with adverse health outcomes particularly among vulnerable groups

such as children and the elderly (Bruckner, 2006, 2008a, 2008b; Catalano et al., 2011). Conversely, effect budgeting may also increase time available for health-promoting behaviors and caregiving, in addition to reduced expenditure on non-necessity goods such as tobacco and alcohol (Catalano et al., 2011).

Goldman-Mellor et al. (2010) focus on mental health outcomes following economic contractions and classify evidence based on individual versus population-level longitudinal research. The authors caution that individual-level studies may suffer from reverse causation between economic downturns and increased mental illness owing to adverse selection into job loss during recessions (Goldman-Mellor et al., 2010). This concern is also echoed in a review of health outcomes, specifically pertaining to the 2008 recession, by Margerison-Zilko et al. (2016). Goldman-Mellor et al. (2010) report that most individual-level studies indicate increase in depression, substance use and violent behavior and suicide during economic downturns. Population-level or ecological studies examined in this review, however, only align with individual-level evidence for suicide, but not for depression, substance use (primarily alcohol consumption and binge drinking) and violence (Goldman-Mellor et al., 2010).

Zivin et al. (2013) draw attention to the heavy reliance of mental health research on self-reported mental health outcomes in relation to economic recessions. They classify the extant literature based on (1) clinically diagnosed psychiatric disorders, (2) psychiatric inpatient admissions and (3) suicide (Zivin et al., 2013). This review presents evidence indicating heterogeneous response in psychiatric disorders and inpatient admissions by individual attributes such as gender, income, education and psychiatric history, during economic downturns (Zivin et al., 2013). Findings for suicide in relation to recessions appear mixed, with considerable variation by age, gender, occupational status and social safety nets (Zivin et al., 2013). The authors offer

two key recommendations towards addressing current gaps in our understanding of mental health outcomes: (1) use of psychiatric diagnosis and use of mental health services as outcome measures and (2) use of theoretically motivated temporal lags to ascertain incubation period and response time in psychiatric outcomes following economic downturns (Zivin et al., 2013).

Economic downturns and mental health among African Americans

Economic downturns may adversely affect those who do not possess sufficient resources to augment lost income. Persistently high poverty, lack of financial buffers (income, assets) and entrenched socio-structural disadvantages (disadvantaged neighborhoods, low upward mobility) place a heavy burden on African Americans coping with a contracting economy (Snowden and Bruckner, 2014). African Americans form a vulnerable group that is often the first to be laid off during macroeconomic decline (Couch and Fairlie, 2010; Perron, 2010). During the Great Recession of 2008, one in four African Americans reported job loss and the unemployment rate among African American males exceeded that of all other race/ethnicities in the US (US Bureau of Labor Statistics, 2012; Hoynes et al., 2012). Construction and manufacturing sectors were the worst affected, and the collapse of these sectors corresponded with greater loss of employment and wages among African Americans relative to other groups (Hoynes et al., 2012). During this time period, loss of income and health insurance appears to have reduced access to and utilization of routine mental health services, particularly among African American men (Chen and Dagher, 2016). Deferring or rationing health care may exacerbate pre-existing conditions and increase treatment costs (Maeda et al., 2014; American Academy of Family Practice, 2009).

African Americans also exhibit lower access to primary mental health care, higher use of Emergency Departments (EDs), face greater stigma pertaining to mental health within the health care system and at the community-level, and often receive sub-par care when they access psychiatric services (Snowden et al., 2009; Snowden and Bruckner, 2014). Given their differential exposure and vulnerability to macroeconomic downturns, it is plausible that mental health outcomes may worsen among African Americans, relative to other race/ethnicities. Research predating the 2008 recession finds increased psychiatric emergency visits among low-income (publicly insured) African American children following state-level macroeconomic contraction, plausibly owing to greater financial pressure among low-income families and increase in familial strain during periods of high employment uncertainty (Bruckner et al., 2014). Studies also suggest that mentally ill African Americans may face reduced societal tolerance and increased risk of involuntary psychiatric commitment, despite relatively higher cognitive functioning (compared to whites), during economic downturns (Catalano et al., 2007a). Research on psychiatric help-seeking among African Americans during the recent Great Recession, however, remains scarce.

Quantifying economic downturns

Current research in the US employs a variety of measures of economic contractions, the most commonly used being unemployment rate, foreclosures, mass layoffs and employment change. The unemployment rate is measured in the US by the Bureau of Labor Statistics (BLS) as the number of people who are unemployed and actively looking for employment (BLS-LAUS, 2018). Unemployment rate is obtained by dividing the number of unemployed by the civilian labor force. Unemployment number and unemployment rate, while widely used for

quantifying the status of the economy, can be misleading because unemployment rate can be high during periods of economic prosperity owing to technologies that require labor reallocation, specialized skills or are in the initial phase of new business formation (Aghion and Howitt, 1994; Hamilton, 1988; Hamilton, 1989). Furthermore, unemployment rate does not take into account changes in the civilian labor force, wherein a decline in size of the labor force can inflate the unemployment rate even when absolute number of unemployed individuals remains constant but the civilian labor force contracts (for instance, where out-migration occurs following sharp declines in job availability and people move out of a county to seek employment elsewhere) (Foote et al., 2019).

Foreclosures represent acute events that directly impact populations who are displaced by loss of their homes. However, they appear to have relatively lower negative externality or spill-over effects on those who do not face foreclosures (Downing et al., 2017; Gerardi et al., 2015; Downing et al., 2016). Hence, while they might be suitable for examining the impact of the 2008 economic recession on select groups, they do not appear to possess the qualities of an ecological stressor, and may be weak approximations of exposure towards assessing impacts on health outcomes.

Mass layoffs, similar to foreclosures, also represent acute events, but have spill-over effects on non-affected populations with respect to rise in working hours, fear of future job-loss, financial uncertainty and educational performance (López Bohle et al., 2017; Gathmann et al., 2014; Ananat et al., 2011). However, their measurement relies on unemployment insurance claims filed following a mass layoff event, which does not capture a significant proportion of workers who lose employment during economic recessions (US Department of Labor, 2017). Furthermore, state-level variations in the regulations for filing unemployment insurance claims

hinders estimations at a national or sub-national level, as timing variations in filing claims do not correspond with when the exposure actually occurred (US Department of Labor, 2017).

Employment, as measured by the US Bureau of Labor Statistics, provides the total number of people who worked for pay (either part time or full time) during the survey reference week (BLS-LAUS, 2018). Employment change, defined as the difference in a month's number of employed persons from the previous month divided by the previous month's total employed people, gives acute changes in a local economy in that it is zero (or of negligible value) if there is very little change in number of employed people, but high (either negative or positive) in circumstances of abrupt economic decline or expansion. Employment change accounts for changes in the civilian labor force and is well suited for modelling economic recession as 'shocks'. It presents the deviation of aggregate employment levels from their steady state (periods of non-significant economic change) when number of employed people falls sharply due to reduction in number of jobs or withdrawal of marginally attached workers from the labor force. Month-to-month variation in employment change overcomes the drawbacks of unemployment rate, mass layoffs and foreclosures as (a) it is not limited to only those eligible for unemployment insurance, (b) represents immediate change, accounts for inflows, outflows or changes in the civilian labor force and (c) does not present directional distortion during brief periods of economic expansion. Its suitability as a strong, acute indicator of economic contraction is further evidenced by its use in literature documenting associations between economic contractions and health outcomes (Bruckner, 2008a; Aum et al., 2017).

Structure of the dissertation

In this dissertation, I examine three research questions pertaining to macroeconomic antecedents of psychiatric emergency visits and inpatient admissions over a period of 2006 to 2011, which includes the recent Great Recession, across select states in the US. In Chapter 2, I conduct a population-level ecological analysis of psychiatric Emergency Department (ED) visits by age group and insurance status (as a proxy for socioeconomic status) in relation to monthly employment change to determine whether trends in psychiatric ED visits show pro- or counter-cyclical relations with economic downturns. I motivate the use of objectively defined psychiatric diagnoses as a reliable measure of population-level mental health outcomes and discuss the rationale for using brief temporal lags of 0 to 3 months in exposure (aggregate monthly employment change) towards examining the relation between economic contraction and mental health. In Chapter 2, I also explore population-level response to aggregate employment change by select psychiatric disorder groups to ascertain whether and to what extent specific illness types correspond with ambient macroeconomic shocks in the population.

In Chapter 3, I focus on individual-level psychiatric ED visits among African Americans, and test psychiatric help-seeking among this group relative to whites. I hypothesize that given their differential vulnerability and exposure to the consequences of the recent 2008 recession, the odds of a psychiatric ED visit would increase among African Americans, relative to whites, following aggregate decline in monthly employment change. I further test whether and to what extent the relation between odds of African American psychiatric ED visits (relative to white) and monthly employment change varies by age group and socioeconomic status (approximated using insurance status, private insurance = high income, public insurance = low income).

In Chapter 4, I test the reduced tolerance hypothesis by examining population-level inpatient psychiatric admissions requested by law enforcement/court orders among African

American males following aggregate monthly employment decline. I also examine other race/ethnicities and genders (females) to identify whether and to what extent any relation between law enforcement/court order initiated inpatient psychiatric admissions and macroeconomic decline exists among groups other than African American males, and whether non-law enforcement/court order-requested inpatient psychiatric admissions show changes in relation to the exposure (aggregate monthly employment change) over the same time period (2006 to 2011). In Chapter 5, I conclude with a summary of my findings and implications for future research.

Chapter 2: Psychiatric emergencies following the Great Recession- An ecological examination of population-level responses in 4 US states

Introduction

The 2008 economic recession is widely regarded as one of the most severe financial crises in modern US history. Between late 2007 and mid-2009, about 8.7 million people lost their jobs and consumer spending reached its lowest levels since World War II (Barello, 2014). This crisis manifested through 2.5 million home foreclosures, over 43,000 mass layoff events that directly impacted at least 4.6 million people, an almost two-fold increase in the unemployment rate, and substantial decline in median household income (Bocian et al., 2010; BLS, 2013; Hoynes et al., 2012; Smeeding, 2012). During the height of this recession, two out of five Americans reported living below 200 percent of the federal poverty level (Monea and Sawhill, 2011). Understandably, the 2008 recession has spurred research on the relation between economic cycles and mental health (Margerison-Zilko et al., 2016). However, ecological studies that examine aggregate population trends in mental health outcomes following macroeconomic decline remain scarce (Goldman-Mellor et al., 2010).

Longitudinal research examining the relation between macroeconomic downturns and population-level mental health-related outcomes finds evidence of both pro-cyclic and counter-cyclic trends. Pro-cyclic (i.e. economic downturns correspond with decline in illnesses) findings indicate that a contracting economy promotes healthy behavior (e.g. exercise) and reduces harmful consumption (e.g. smoking, alcohol) (Ruhm, 1995, 2000; Ruhm and Black, 2002). This body of research is largely ecological in nature and invokes increase in leisure time and greater investments in home production (relative to work production) during economic recessions as plausible mechanisms underlying increase in healthy behavior (Ruhm, 2000). A competing explanation for improved behavioral health during recessions proposes the ‘inhibition effect’ wherein populations living in a contracting economy become risk averse and reduce harmful behavior to prevent

adverse events (Goldman-Mellor et al., 2010). The literature also describes reduction in spending on risky consumption (e.g. cigarettes, alcohol) as an 'income effect' following economic downturns, although recent research finds that this reduction in expenditure may extend to lower utilization of health care services as well (Mortensen and Chen., 2013; Chen and Dagher, 2013).

The counter-cyclic (economic downturns correspond with increase in illnesses) literature argues that economic downturns increase the incidence (i.e. provocation of 'new' illness) or prevalence (i.e. uncovering of pre-existing 'concealed' illness) of psychiatric disorders (Goldman-Mellor et al., 2010). Research on mental health outcomes following economic recessions largely converges towards counter-cyclical findings, although some exceptions are also observed (Goldman-Mellor et al., 2010). Recessions may serve as ecological stressors and increase anxiety, fear and uncertainty among both the employed and the unemployed (Dua and Smyth, 1993; Modrek et al., 2015). Counter-cyclical findings suggest an increase in psychiatric disorders (e.g. anxiety, depression and substance use), stress-related somatic conditions (e.g. cardio-vascular disease) and greater mortality from suicides (for an exception, see Harper and Bruckner, 2017) (Margerison-Zilko et al., 2016; Goldman-Mellor et al., 2010). These studies posit loss of income and health insurance, reduced utilization of mental health care and increase in familial strain as underlying mechanisms linking recessions to increased mental disorders.

I contend that the divergence in findings described in the foregoing may arise from three factors- (1) differences in the level of analysis i.e. ecological versus individual-level research, (2) absence of joint analysis of aggregate trends in the population in conjunction with examination of vulnerable sub-groups within the same population, and (3) use of self-reported mental health versus objectively defined, clinically diagnosed mental disorders as outcomes. I describe each of these factors below.

Differences in level of analysis:

An important concern in examining the relation between recessions and mental disorders lies in the problem of reverse causation. Behaviorally disordered individuals are more likely to be laid off in a contracting economy, making it difficult to establish whether job loss precedes the illness or vice versa. Individual-level studies that examine the effect of unemployment on mental health may not be able to adjust for this endogeneity as most psychiatric disorders often begin in childhood and may influence an individual's response to adverse events (such as job loss) in adulthood (Kessler et al., 2009). Ecological studies that examine aggregated population-level trends, on the other hand, are better-suited to account for reverse causation as the underlying population includes both the employed and the unemployed (Goldman-Mellor et al., 2010). Even at the peak of recessions, the proportion of the population that is employed significantly outnumbers the unemployed (Dua and Smyth, 1993). Ecological analyses thus reflect "net effect" of macroeconomic changes, evaluate the role of economic recession as an ambient exposure (as opposed to individual-level job loss) and reduce the possibility of reverse causation (changes in population-level mental health likely do not cause recessions).

Aggregate and sub-group analysis

Whereas "net effect" analyses using aggregate population-level psychiatric responses to recessions provide a 'big picture' view of social phenomena, these net effects may obscure differential responses within vulnerable sub-groups. Low-income populations that are less likely to possess sufficient resources to weather economic crises may report worse mental health relative to high-income groups. Research finds that psychiatric emergencies increase among low-income children during recessions (Bruckner et al., 2010a). Working-age adults, owing to their strong overlap with the civilian labor force, may also be differentially exposed to the mental health-related

sequelae of a contracting economy (Burgard et al., 2013; Riva et al, 2011). On the other hand, some studies show that elderly adults report better mental health due to improved quality of available care during recessions (Stevens et al., 2011). These sub-groups are typically examined in isolation, which limits the comparability of results. Joint examination of ecological trends in conjunction with group-specific analyses for the *same underlying population* may inform on whether any observed aggregate trends appear homogenous or vary heterogeneously across socioeconomic and demographic groups (Zivin et al., 2011). Such an exercise may serve in reconciling contradictory findings reported in the literature.

Clinically diagnosed mental health outcomes

Epidemiological surveillance of most health conditions relies upon clinically diagnosed disorders. The same, however, does not extend uniformly to mental health research. Studies examining mental health responses to economic downturns utilize objectively defined psychiatric diagnoses based on DSM-IV criteria to a lower extent than for somatic health. This difference presumably arises from limited availability of population-level databases that provide information on psychiatric, rather than self-reported mental health (Zivin et al., 2011). Interestingly, research finds that whereas subjectively measured mental health indicators may worsen during recessions, they may not always correspond with clinically-validated measures of mental health (McInerney, 2013). Perhaps for this reason, much literature on mental health and economic recessions examines suicides, which although unambiguous in nature, only represent the 'tip of the mental health iceberg'.

Recent studies that have utilized objective psychiatric diagnoses in population-representative samples use annual temporal resolution to gauge mental health responses to the 2008 recession (Mehta et al., 2015). Scholars posit that psychological crisis following economic

shocks is more likely to manifest in the months that immediately follow, rather than over longer temporal lags (of one or more years) (Catalano et al., 1985). Prior research finds that macroeconomic decline corresponds with changes in mental health primarily within the first three months (Catalano and Dooley, 1977). Moreover, monthly resolution also enables the use of time lags that establish precise temporal order in that exposure precedes the outcome. However, few population-level studies examining recessions and mental health incorporate this principle in analysis (Goldman-Mellor et al., 2010; Margerison-Zilko et al., 2016). Ecological research using brief temporal lags, in essence, measures immediate changes in health outcomes following acute, macro-level exposure. Hence, it is important to carefully consider which type of population mental health 'signals' may plausibly be detectable at aggregated levels. Acute events, such as psychiatric emergencies, that by definition reflect an immediate health crisis, may serve well towards ecological examination of the relation between economic recessions and population mental health (Bruckner et al., 2014).

In the present study, I utilize data on psychiatric emergencies from four US states (Arizona, California, New Jersey and New York) to examine whether aggregate monthly employment decline in a Metropolitan Statistical Area (MSA) precedes a change in population rates of psychiatric Emergency Department (ED) visits over a 72-month period that includes the 2008 economic recession (2006 to 2011). I use the State Emergency Department Database (SEDD), which contains a near-census of all emergency visits in a state, and serves as one of the most comprehensive sources of psychiatric epidemiological surveillance in the US (SEDD, 2017). I identify psychiatric emergency visits in the SEDD using ICD 9 diagnosis codes (based on DSM IV criteria) to capture acute psychiatric responses in populations. I specify brief exposure lags of 0 to 3 months and allow within and across-region heterogeneity in outcome and exposure by

examining multiple counties (and MSAs). I also examine whether aggregate population responses to ambient economic downturns vary by age group (children, working-age adults and elderly adults) and income levels (approximated through private and public insurance). To my knowledge, there exist no other ecological studies that examine precisely-timed population-level psychiatric responses to aggregate economic decline in the context of the 2008 recession. This study may help further our understanding of population-level phenomena pertaining to psychiatric health outcomes during periods of acute economic crises.

Methods

Data and Variables

I retrieved data on psychiatric Emergency Department (ED) visits from the State Emergency Department Database (SEDD), which is made available for purchase by the Agency for Healthcare Quality (AHRQ) under the Healthcare Cost Utilization Project (HCUP) (SEDD, 2017). SEDD is an administrative database that provides a census of all ED visits that did not result in an inpatient admission (i.e. outpatient treat-and-release ED visits) within participating states.[1] Multiple, large-scale studies on psychiatric emergencies attest to the high quality of SEDD data, and this database covers nearly all hospitals in reporting ED visits among states participating in the HCUP (Wier et al., 2010; Bruckner et al., 2019; Singh et al., 2019).

I identified psychiatric ED visits as cases with at least one psychiatric diagnosis (based on ICD 9 codes) within the list of possible diagnoses per visit (Dx1 to Dx25) in SEDD. I adopted this approach based on prior research that recommends including all diagnoses for identifying health conditions when using administrative databases (Mutter and Stocks, 2014). I classified individual

[1] Per these data, over 75% of all psychiatric ED visits are outpatient (treat-and-release), and <25% are subsequently admitted as inpatients.

ICD 9 codes pertaining to psychiatric diagnoses into clinically meaningful groups based on classifications provided by HCUP under the Clinical Classification Software (CCS) (HCUP, 2019a). CCS categories serve as a useful way to examine and analyze psychiatric illness groups (e.g. anxiety disorders, mood, substance use disorders) and are extensively utilized in mental health research (Bruckner et al., 2019; Singh et al., 2019). Detailed list of psychiatric ICD 9 codes and their respective CCS groups included in this dissertation appears in the Appendix (Table A.1).

I chose the period of 2006 to 2011 (i.e. 72 months) to include an approximately equal number of pre-, during and post-recession months in my analysis. Arizona, California, New York and New Jersey uniformly report month of ED visit, county identifiers and key individual visit-level attributes (e.g. insurance status, age) over the study period in SEDD. These four states represent multiple geographic regions, account for one-fifth of the national population and form the study region for this research. SEDD reports four uniformly coded insurance groups based on the expected primary payer: private (HMOs, PPOs, commercial carriers), public (Medicaid, Medicare), self-pay/charity and other (SEDD:PAY1, 2017). Of these, public and private insurance groups permit approximation of low versus high SES respectively (SEDD:PAY1, 2017; Bruckner et al., 2014). I, therefore, only retrieve ED visits for public and private insurance groups for this study. These restrictions yield a total of nearly 13 million psychiatric ED visits across the 4 study states from 2006-2011. Based on prior research that describes heterogeneous relations between economic downturns and mental health outcomes in children, working-age adults and the elderly, I aggregate psychiatric ED visits by 3 age groups: children (age < 20 years), working-age adults (age 20 to 64 years) and elderly adults (age > 64 years) (Burgard et al., 2013; Riva et al., 2011).

I obtained county-level, age-specific population data for these four states from US Census Bureau's Population Estimates database (U. S. Census Bureau, 2016). I merged these data with

psychiatric ED visit counts aggregated by county, month and age groups. The age-specific population estimates serve as denominators for converting ED visit counts into population rates for analysis. I define, as my outcome, the population rate of psychiatric outpatient ED visits per 100,000 population. My final analytic sample comprises 96 counties (4 states) over 72 months (2006 to 2011) with a total of 38,352 observations (including three age and two insurance groups per county-month).

I retrieved data on monthly employment per Metropolitan Statistical Area (MSA) for the four study states from the Local Area Unemployment Statistics (LAUS) series (BLS, 2019a). LAUS data are sponsored by the U.S. Bureau of Labor Statistics and provide monthly counts of persons who are employed, unemployed and are currently in the civilian labor force. These data form the basis of government monitoring of local and national economic indicators and are publicly available, thus allowing independent replication and verification of analyses (BLS-LAUS, 2019b). MSAs serve as a geographically meaningful unit of measurement as they form the nucleus of economic activity in a region and have been used as the spatial unit of macroeconomic exposure in prior ecological research (BLS, 2019b; Bruckner, 2008a). The LAUS data, however, do not provide sex-specific employment counts, hence, this study does not examine population trends in psychiatric ED visits by sex. MSAs are also limited to urban geographies, and hence, the present analyses do not include rural regions.

Using the LAUS employment series, I define, as my exposure, the monthly (percent) change in employment in an MSA, formulated as $\frac{x_m - [x_{m-1}]}{x_{m-1}}$ where $x_m$is the number of people employed in the current month and $x_{m-1}$is the number of people employed in the previous month in an MSA. Specified in this manner, monthly employment change in an MSA takes a positive

value when employment in a given month increases relative to previous month, is zero if employment stays constant and takes a negative value when employment declines. This month-to-month change models acute economic 'shocks' and negative monthly employment change indicates that a portion of the population has lost employment, which if sufficiently large, may ripple through the economy and correspond with elevated stress, fear and uncertainty among both the employed and the unemployed. Monthly employment change has been utilized as a measure of macroeconomic contractions in prior ecological research (Catalano and Dooley, 1979; Bruckner, 2008a) and overcomes some of the limitations of alternate measures of economic recessions (e.g. mass lay-offs, unemployment rate) as it represents acute change, is not limited to one sector or industry and accounts for changes in the civilian labor force (Foote et al., 2019; Aghion and Howitt, 1994; Hamilton, 1988; Hamilton, 1989). In keeping with prior research that utilizes this exposure, I use 0 to 3 month lags of monthly employment change to estimate proximate responses to macroeconomic downturns among psychiatric ED visits rates in the population (Catalano et al., 1985; Catalano and Dooley, 1977; Bruckner, 2008a). Inclusion of lags establishes precise temporal order in that the exposure precedes the outcome, and brief lag duration of 0 to 3 months reduces potential confounding from (i) long-run sequelae of economic contractions and (ii) secular trends in the outcome. I limit the exposure lags to 3 months (and not beyond) as this period captures quarterly economic cycles, and those who remain unemployed after job loss for periods greater than 3 to 6 months may have selected into long-term unemployment owing to pre-existing psychiatric or behavioral conditions (Catalano et al., 1985; Catalano and Dooley, 1977; Kokko et al., 2000). I merged the monthly employment change series (aggregated) SEDD files using a county-MSA crosswalk file provided by the National Bureau of Economic Research

(NBER, 2018). My final analytic sample includes 49 MSAs subsuming 96 mutually exclusive counties (4 states) for 72 months (2006-2011).

Analysis

I test whether aggregate employment decline in an MSA precedes a change in population rates of outpatient psychiatric ED visits. I assume that counties within an MSA are uniformly (and equally) exposed to monthly employment change in that MSA and estimate the following linear regression equation:

$$Y_{a,i,c,r,m,t} = \beta_0 + \sum_{n=1}^{4} \beta_n X_{r,(m-n+1),t} + \beta_5' \boldsymbol{Age_a} + \beta_6' \boldsymbol{Insurance_i} + \beta_7' \boldsymbol{County_c} + \beta_8' \boldsymbol{Month_m} + \beta_9' \boldsymbol{Year_t} + \beta_{10}' \boldsymbol{State_s} * Linear\ time + \varepsilon_{a,i,c,r,m,t} \quad \textbf{- Equation 1}$$

where:

$Y_{a,s,i,c,r,m,t}$ is the population rate of psychiatric ED visits by age-group *a*, insurance type *i*, in county *c* nested within MSA *r* during month *m* in year *t*.

$\sum_{n=1}^{4} X_{r,(m-n+1),t}$ is the set of exposures representing monthly employment change *X* in MSA *r*, month *m* (lag 0), *m-1* (lag 1), *m-2* (lag 2) and *m-3* (lag 3) in year *t*.

β_n (n = 1 to 4) are the coefficients of interest indicating the relation between *Y* and 0 to 3 monthly lags of *X*.

$\boldsymbol{Age_a}$ is a vector comprising 3 age groups (children: < 20 years, working-age adults: 20 to 64 years; elderly adults: > 64 years).

$\boldsymbol{Insurance_i}$ is the vector of 2 insurance groups (private, public).

$\boldsymbol{County_c}$ is the vector of county-specific fixed effects (indicator variables). County fixed effects enable within-county identification and reduce confounding by unobserved county-specific, time invariant factors.

$\boldsymbol{Month_m}$ is the vector of month indicators that control for seasonality in outcome distribution.

$\boldsymbol{Year_t}$ is the vector of year indicators to account for year-specific perturbations in psychiatric inpatient admissions that may arise from policy changes or other factors that affect all study regions.

$\boldsymbol{State_s} * Linear\ time$ is the vector of state-specific (s) linear time trend (1 to 72 months treated as continuous) that accounts for unobserved factors that may correlate with psychiatric ED visits and inpatient admissions and are trending linearly over the study period of 72 months (2006-2011).

$\varepsilon_{a,s,i,c,r,m,t}$ is the heteroscedasticity-robust standard error term to account for non-independence of residuals.

In addition to analyzing the full sample, I estimate separate regressions by 3 age groups (< 20 years, 20 to 64, > 64 years) and by 2 insurance types (public, private) to determine whether stratified analyses by these groups indicate differential responses to the exposure. To account for multiple testing, I apply the Bonferroni correction and conduct inference only for estimates with p value < 0.01 [derived for 2 insurance and 3 age groups as 0.05/(2*3)]. These stratified analyses test whether low income populations (publicly insured) and groups with a differentially greater exposure to labor market contractions (i.e. working-age adults aged 20 to 64 years) exhibit perturbations in psychiatric ED visit rates following aggregate employment decline.

I conduct two sensitivity tests. First, I log transform the outcome and re-estimate equation 1 to ascertain whether results from the main analyses appear to be sensitive to outliers. Next, I convert the exposure i.e. monthly employment change, to employment decline "shock" by changing all positive values of this variable (that indicate employment gain) to zero and estimate equation 1. The second test informs on whether results from main analyses correspond with primarily with monthly employment decline or are also related to employment gain.

As an exploratory analysis, I examine which psychiatric disorders (by CCS groups) exhibit the highest ED visit rates in the sample. I re-estimate equation 1 for the top 5 disorder groups to explore whether trends observed in main analysis concentrate among specific disorder types in psychiatric ED visits (inference limited to exposure coefficients with Bonferroni-corrected p values < 0.01). I conduct all analyses using Stata SE (version 14.2) (StataCorp., 2015a).

Results

Table 1.1 presents the descriptive statistics of the outcome and exposure variables in this study. Over the study period, psychiatric visits average about 84 visits per 100,000 population per county, per month. ED visit rates are highest among the working-age group, followed by elderly adults. Psychiatric ED visit rates among the publicly insured are over twice that of the privately insured population. Mood, anxiety, alcohol abuse, substance use and schizophrenia/psychotic disorders are the 5 most common illness groups in this population, with the visit rate for mood disorders being the highest. Mean value of monthly employment change over the study period is -0.03 indicating a period of economic decline. Nearly half of all county-months in the study exhibit negative employment change. The total sample size, inclusive of age and insurance groups per county-month is 38,352.

Figure 1.1 graphs average psychiatric ED visits (per 100,000 population) over the 72 month study period (2006-2011). The secular increase in psychiatric ED visits (Figure 1.1) coheres with trends reported in the current literature (Weiss et al., 2006). Figure 1.2 graphs psychiatric ED visit rates by age groups. Among children, visit rates remain fairly stable, with a modest increase from 2010 to 2011. Psychiatric ED visit rates increase secularly over the study period for both working-age and elderly adults. Working-age adults exhibit the highest psychiatric ED visit rates of the three age groups, exceeding 150 visits per 100,000 in 2011. Elderly adults also show a rise in psychiatric ED visits over the study period, with a slightly pronounced increase in 2011.

Figure 1.3 graphs average monthly employment change in the study sample. Here, positive values indicate employment gain and negative values indicate employment decline (relative to the previous month). January 2009 (2009m1) shows the highest decline in monthly employment.

Table 1.2 presents results from fixed effects regression analyses predicting psychiatric ED visit rates per 100,000 population as a function of monthly employment change (0 to 3 months lags) and other covariates. Psychiatric ED visits decline at 0 and 2 months following employment decline. A unit decline in employment change in the concurrent month (lag 0) corresponds with 0.54 fewer psychiatric ED visits per 100,000 population ($p < 0.001$) (Table 1.2). Decline in employment change two months prior varies with a decline in psychiatric outpatient ED visit rate of 0.52 per 100,000 population ($p < 0.001$) (Table 1.2). This aggregate decline in ED visits appears to concentrate among privately insured children (Table 1.3, Model A), privately insured working-age adults (Table 3, Model C) and privately insured elderly adults (Table 1.3, Model E). Conversely, publicly insured children show an increase in psychiatric ED visit rates one month following aggregate employment decline (Table 1.3, Model B). Taken together, these results reflect pro-cyclical (i.e. illness declines when the economy declines) trends among the privately

insured but counter-cyclical relations between economic downturns and mental health among publicly insured children.

Table 1.4 presents results of exploratory analyses examining psychiatric ED visits rates by the five most common diagnosis groups in the sample. Decline in monthly employment precedes a decline in ED visits for alcohol abuse disorders for 0, 1 and 2 lags of the exposure (Table 1.4, Model C). ED visits for mood disorders also decline after two months following employment decline (Table 1.4, Model B). The other disorder groups show no relation with the exposure at any lags. The decline in ED visits for alcohol abuse, in particular, aligns with the inhibition effect described in the pro-cyclical literature. Among publicly insured children (Table 1.5), analyses by psychiatric disorders do not identify a specific diagnosis as the driver of increased psychiatric ED visits in this group following employment decline. However, alcohol abuse-related ED visits decline 3 months following aggregate employment decline in this group as well (Table 1.5)

Sensitivity tests using log transformed outcome show qualitatively similar results overall (Table 1.5), and by age and insurance groups (Table 1.6). Analyses of monthly employment change re-formulated as employment decline "shocks" (illustrated in Figure 1.4) show no change in inference for exposure lag 0 (relative to Table 1.2), but the relation between outcome and exposure lag 2 is no longer significant (Table 1.7). This suggests that the main analytic results in Tables 1.2 and 1.3 may be driven, in part, by positive values of the exposure as well, indicating psychiatric ED visits in the population correspond with economic cycles.

Discussion

Ecological research on mental health effects of economic recessions presents mixed findings. Pro-cyclical findings suggest a decline in illness presumably from reduction in harmful consumption (e.g. alcohol). Counter-cyclical research presents evidence of increase in mental

disorders following economic downturns and primarily invokes the stress mechanism. This difference in findings may arise from the ecological versus individual level of analysis. I examine, in a longitudinal and ecological manner, whether regional economic decline precedes a change in population-level psychiatric Emergency Department (ED) visits across 4 US states (AZ, CA, NY, NJ) and 72 months (2006-2011) in the context of the 2008 economic recession. Fixed effects regression analyses that control for spatial, temporal and seasonal factors find a decline in psychiatric emergencies within 0 to 3 months of aggregate employment decline. Stratified analysis finds, among the privately insured, a decline in ED visits for all age groups (children, working-age adults and elderly adults). Conversely, I also observe an increase in psychiatric emergencies among low income (publicly insured) children following employment decline.

Exploratory analyses by psychiatric disorder groups show that the aggregate decline in ED visits following employment decline concentrates among alcohol abuse disorders. Taken together, these results provide the first evidence of acute psychiatric outcomes in the population following sudden macroeconomic contraction during the 2008 recession. These findings may serve to reconcile the pro-and counter-cyclical findings in research in that while psychiatric emergencies appear to decline in the population overall, certain sub-groups within the same population show simultaneous increase in psychiatric ED visits following the same macroeconomic exposure. Sensitivity analyses using employment change "shock" (as opposed to full range of employment change values) also indicate that the observed inverse relation between the exposure and aggregate population-level psychiatric ED visits are not limited to extreme economic decline, but may hold during economic expansion (i.e. psychiatric ED visits increase when the economy expands) as well.

Aggregate results among the privately insured (high income) and among alcohol abuse disorders cohere with the inhibition hypothesis described in the pro-cyclical literature (Ruhm, 1995, 2002). This inference is supported by exploratory analyses that find immediate decline in ED visits for alcohol abuse within 3 months of aggregate employment decline. However, in alignment with prior research that invokes familial transmission of stress and highlights the vulnerability of low-income children following ambient economic decline, my study also finds counter-cyclical psychiatric response among this sub-group (Bruckner et al., 2010a; Bruckner et al., 2014).

Strengths of this study include its longitudinal design and the use of near-census of all psychiatric emergency visits across 4 US states. I use high temporal resolution, in the form of monthly data, and specify brief exposure lags of 0 to 3 months which enables precise estimation of ecological responses to ambient economic decline and reduces plausible endogeneity from reverse-causation. Spatial and temporal fixed effects account for unmeasured attributes that correspond with regional time-invariant factors and seasonality in psychiatric ED visits respectively. State-specific linear time trends control for factors that may affect ED visits and are trending linearly over the study period. Sensitivity checks show that the analytic results are not influenced by outliers.

Ecological studies, such as this one, are often viewed with concern owing to misleading interpretation of findings as being indicative of individual-level behavior- also referred to as the 'ecological fallacy'. This study only examines aggregate trends, and is strictly limited in its ability to explain individual-level mental health responses to financial crises. My findings, rather, describe aggregate phenomena and may help policy-makers and public health officials anticipate short-term

changes in population psychiatric outcomes following economic downturns (Goldman-Mellor et al., 2010; Catalano et al., 2011).

It is plausible that the observed decline in psychiatric emergencies within 3 months of aggregate employment decline corresponds with subsequent "harvesting" or increase in psychiatric ED visits over longer time periods. Whereas the present study is limited in its scope to conduct the suitable time series analysis for 49 MSAs simultaneously, future research may use advanced forecasting techniques to explore psychiatric 'harvest' effects in the population. Data on my exposure- monthly employment change- are not available by sex. Hence, I do not analyze sex-specific responses to employment change in this study. Future research may use monthly, MSA or county-level sex-specific employment series to examine whether psychiatric responses to economic decline differ between males and females.

Another limitation of this study is that I do not distinguish between emergent and non-emergent ED visits. It is plausible that the population-level decline in psychiatric ED visits arises from decline in non-emergent visits (Bruckner, 2014). Whereas data available under the SEDD do not permit identification of emergent versus non-emergent psychiatric emergencies, I encourage future research to examine differences by emergent and non-emergent ED use following macroeconomic downturns.

Based on the magnitude of regression coefficients in my analysis, children (age < 20 years) appear particularly sensitive to economic recession among both the publicly and privately insured. As a *post hoc* speculation, I propose that changes in time use may plausibly explain why macroeconomic shocks precede a decline in psychiatric emergencies among high-income (privately insured) children but not among low-income children. Increase in leisure time, which is often invoked to explain pro-cyclical relations between the economy and unhealthy behavior, may

correspond with increased parental caregiving during economic recessions (Aguiar et al., 2013). High-income groups may be able to better afford leisure time owing to savings and assets that compensate for foregone wages. Low-income groups, on the other hand, may not have sufficient resources to augment income loss during recessions that in turn, may increase stress within a household and worsen mental health among children. This speculation would benefit from further refinement and testing.

Decline in health care utilization and health expenditure, or an 'income effect', may offer an alternative explanation for the observed reduction in population-level psychiatric ED visits following aggregate employment decline. Individual-level studies show that physician visits for mental health decreased during the 2008 recession and declines in health service use concentrated among racial/ethnic minorities (Mortensen and Chen, 2013; Chen and Dagher, 2016). These studies, however, do not examine decline in mental health use by income (or insurance) groups. For my results to plausibly arise from an income effect, I would expect the sharpest decline in ED utilization among low-income groups that do not have sufficient resources to weather economic downturns and may reduce expenditure on health services, including the ED, following aggregate employment decline. I, however, find the opposite. High income, privately insured groups show a reduction in psychiatric emergencies. I believe that this observation, in combination with aggregate level reduction in ED visits for alcohol abuse, supports inhibition as well as income effects.

The 2008 economic recession has renewed interest among scholars regarding the relation between economic shocks and mental health outcomes. However, ecological research examining population-level responses to ambient economic downturns remains limited. My study finds a decline in psychiatric emergencies following aggregate employment decline over a period that includes the 2008 recession, across 4 US states. I also observe a concurrent increase in psychiatric

ED visits among low-income (publicly insured) children. These findings suggest that pro- and counter-cyclic relations between population health and economic downturns may vary by age and socioeconomic status, and are not necessarily in conflict with each other. Policy makers may use these findings to pro-actively anticipate population responses to macroeconomic contractions and allocate resources towards vulnerable groups.

Tables & Figures

Table 1.1: Description of psychiatric outpatient ED visits (per 100,000 population) and monthly employment change (4 states: AZ, CA, NJ, NY), 2006-2011, in study sample.

Sample Attributes	Mean	Std. Deviation
Psychiatric outpatient ED visit rates per 100,000 population per county-month	83.92	118.55
Outpatient psychiatric ED visit rates per 100,000 population per county-month by age groups		
Children (age < 20 years)	39.22	41.76
Working-age adults (Age 20 to 64 years)	110.46	119.01
Elderly adults (Age > 64 years)	103.16	157.62
Outpatient psychiatric ED visit rates per 100,000 population per county-month by insurance status		
Private	80.93	71.09
Public	165.40	169.09
Outpatient psychiatric ED visit rates per 100,000 population per county-month by top 5 diagnoses		
Anxiety disorders	15.17	21.31
Mood disorders	17.25	26.63
Alcohol abuse disorders	11.48	16.61
Substance use disorders	6.33	10.34
Schizophrenia/psychoses	4.10	7.83
Monthly employment change	-0.03	1.45
County-months in sample	6,480	
County-months with employment decline	3,203	
Total sample size (county-month-age-insurance units of analysis)	38,352	

Figure 1.1: Average psychiatric ED visits per 100,000 population per county-month (96 counties, 4 states: AZ, CA, NJ, NY) 2006-2011

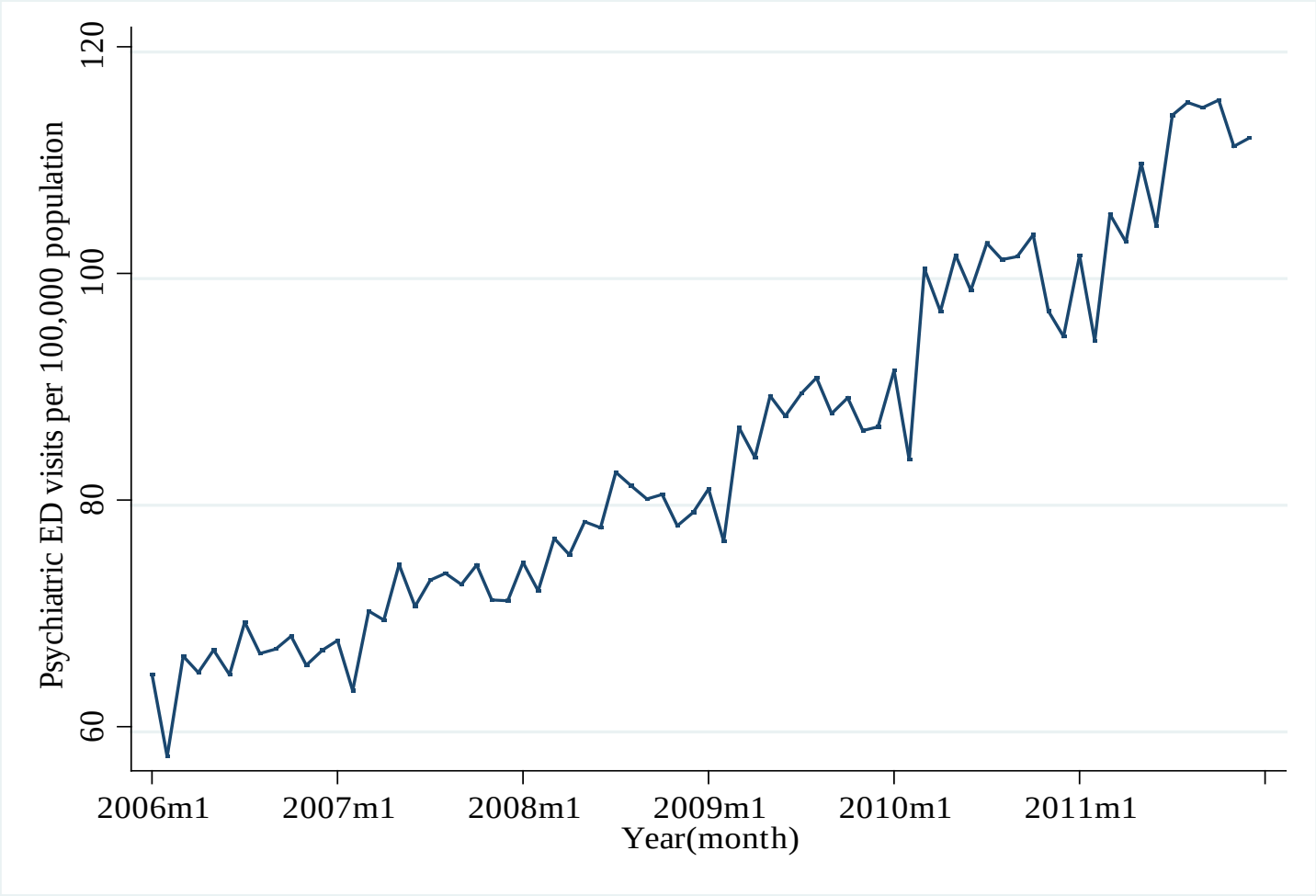


Figure 1.2: Average psychiatric ED visits per 100,000 population by age groups, per county month (96 counties, 4 states: AZ, CA, NJ, NY), 2006-2011

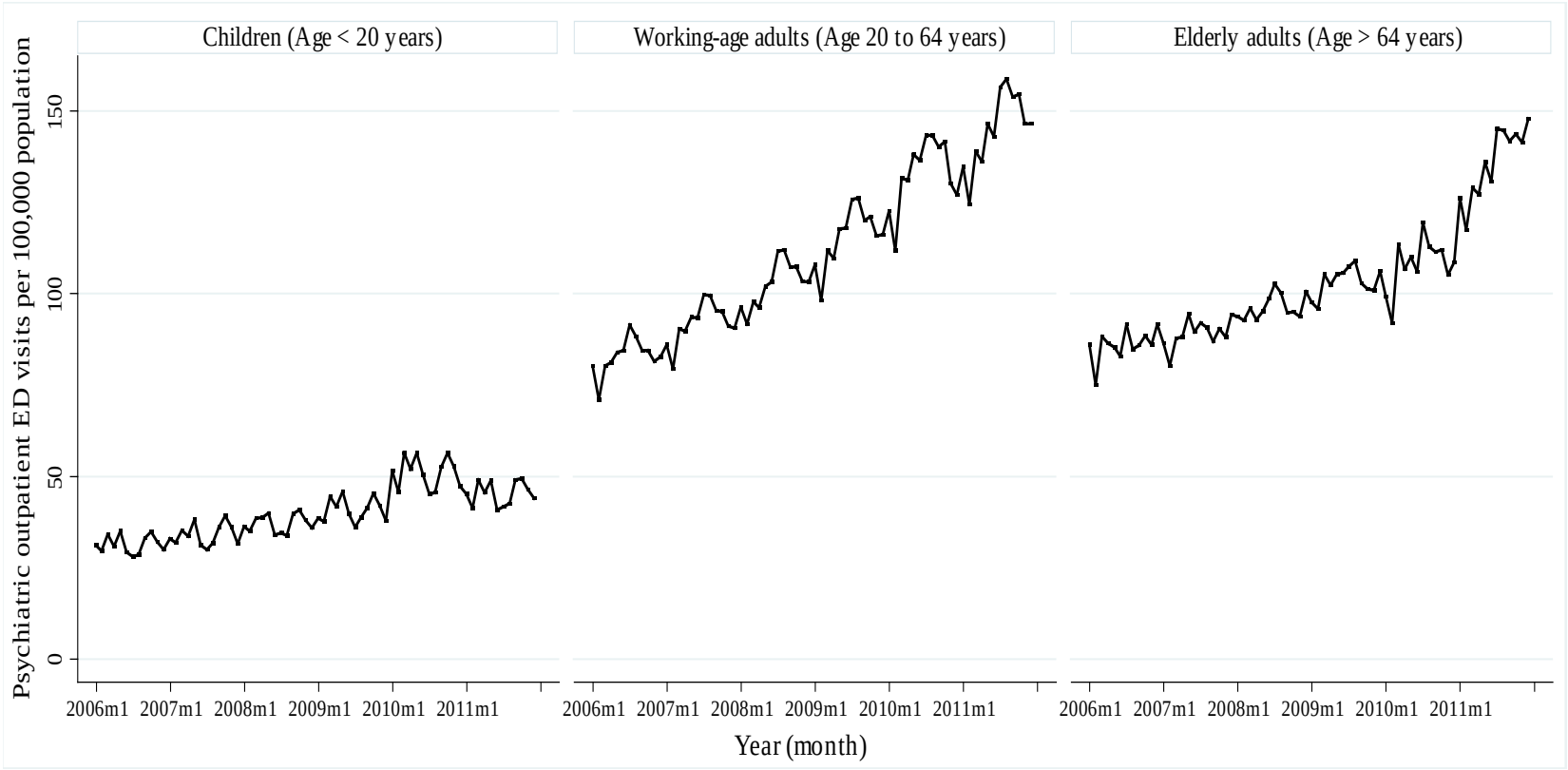


Figure 1.3: Average monthly percent employment change in 49 Metropolitan Statistical Areas (4 states: AZ, CA, NJ, NY), 2006-2011

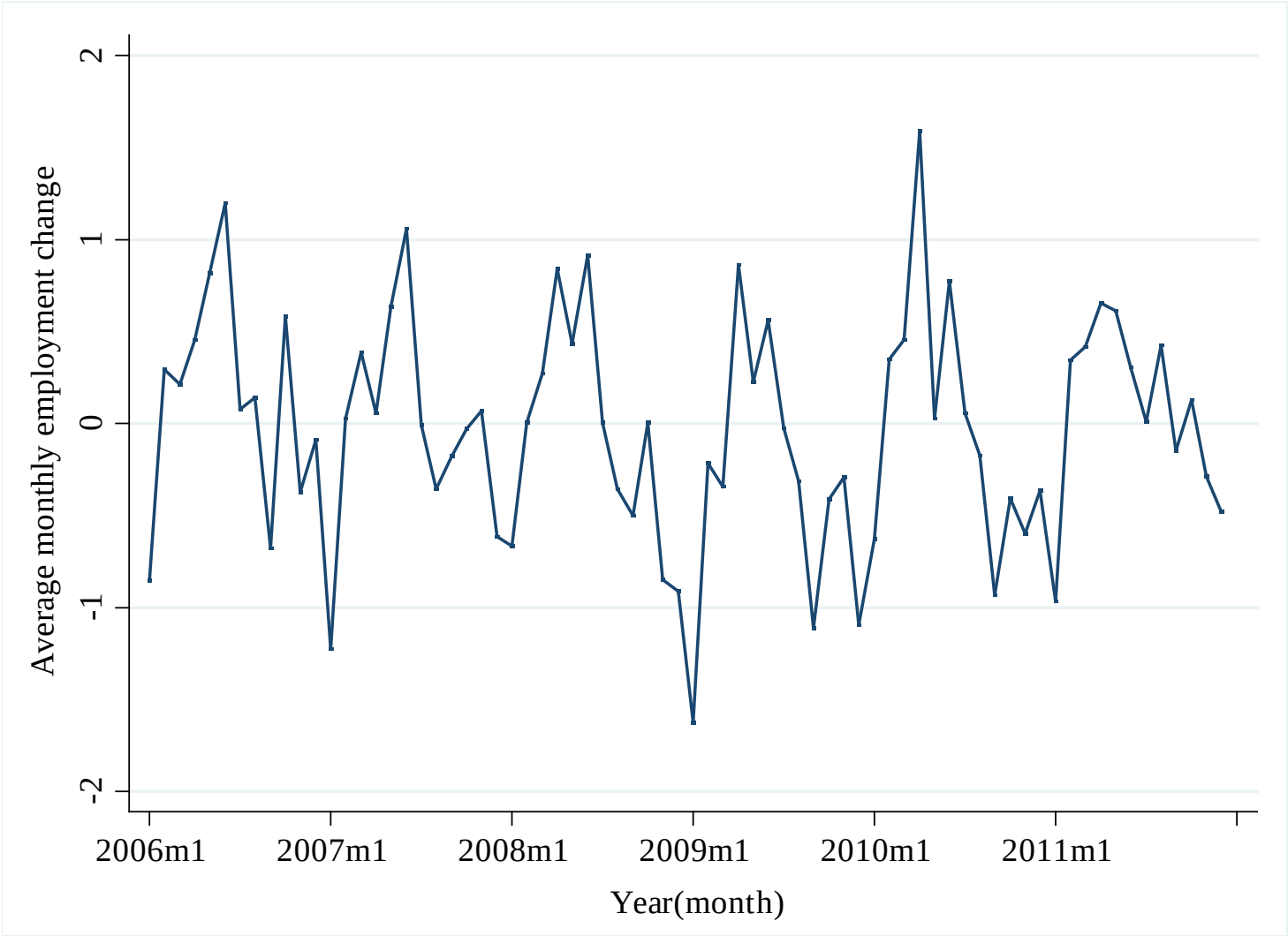


Table 1.2: Fixed effects linear regression results predicting psychiatric outpatient ED visits (per 100,000 population) as a function of employment change lag 0 to 3 months, insurance and age groups (other covariates not shown). Robust standard errors shown in parentheses (SE).

	Outcome = psychiatric ED visits per 100,00 population
Exposures	**Model A**
	Coefficient (SE)
Employment change lag 0	0.54 (0.14)**
Employment change lag 1	0.03 (0.22)
Employment change lag 2	0.52 (0.14)**
Employment change lag 3	0.20 (0.19)
Public insurance (reference = private insurance)	84.34 (8.61)**
Age group (reference = children, age < 20 years)	
Working-age adults, age 20 to 64 years	93.64 (7.80)**
Elderly adults, age > 64 years	96.92 (6.04)**
Sample size	38,352

**p value < 0.01; **p value < 0.001*

Table 1.3: Fixed effects linear regression results predicting psychiatric outpatient ED visits (per 100,000 population) as a function of employment change lags 0 to 3 months (other covariates not shown) for: Model A- Privately insured children (age < 20 years); Model B: Publicly insured children; Model C: Privately insured working-age adults (age 20 to 64 years); Model D- Publicly insured working-age adults; Model E: Privately insured elderly adults (age > 64 years); Model F: Publicly insured elderly adults. Robust standard errors shown in parentheses (SE).

	Children (Age < 20 years)		**Working-age adults (Age 20 to 64 years)**		**Elderly adults (Age > 64 years)**	
	Private insurance	Public insurance	Private insurance	Public insurance	Private insurance	Public insurance
Exposures	**Model A** Coefficient (SE)	**Model B** Coefficient (SE)	**Model C** Coefficient (SE)	**Model D** Coefficient (SE)	**Model E** Coefficient (SE)	**Model F** Coefficient (SE)
Employment change lag 0	1.29 (0.26)**	0.20 (0.17)	0.54 (0.19)*	0.23 (0.32)	0.37 (0.24)	0.72 (0.43)
Employment change lag 1	0.49 (0.43)	-0.35 (0.13)*	0.49 (0.27)	-1.05 (0.46)	-0.12 (0.21)	0.59 (0.57)
Employment change lag 2	1.18 (0.30)**	-0.19 (0.21)	0.98 (0.25)*	0.21 (0.30)	0.63 (0.17)**	0.55 (0.65)
Employment change lag 3	0.55 (0.36)	0.15 (0.18)	0.41 (0.23)	-0.49 (0.45)	0.17 (0.20)	0.74 (0.56)
Sample size	6,458	6,391	6,479	6,480	6,073	6,471

**p value < 0.01, **p < 0.001*

Table 1.4: Fixed effects linear regression results predicting outpatient ED visits (per 100,000 population) by psychiatric disorder groups as a function of employment decline lags 0 to 3 months (other covariates not shown) for: Model A- psychiatric outpatient ED visits for anxiety disorders; Model B- psychiatric outpatient ED visits for mood disorders; Model C: psychiatric outpatient ED visits for alcohol abuse disorders; Model D- psychiatric outpatient ED visits for substance use disorders; Model E: psychiatric outpatient ED visits for schizophrenia/psychotic disorders. Robust standard errors shown in parentheses (SE).

	Psychiatric outpatient ED visits per 100,000 population				
	Anxiety disorders	Mood disorders	Alcohol abuse disorders	Substance us disorders	Schizophrenia/ psychoses
Exposures	**Model A** Coefficient (SE)	**Model B** Coefficient (SE)	**Model C** Coefficient (SE)	**Model D** Coefficient (SE)	**Model E** Coefficient (SE)
Employment change lag 0	0.05 (0.07)	0.06 (0.05)	0.18 (0.05)*	0.03 (0.02)	4.3e-3 (0.03)
Employment change lag 1	0.06 (0.04)	-0.08 (0.04)	0.18 (0.05)**	-0.01 (0.02)	0.01 (0.02)
Employment change lag 2	0.10 (0.04)	0.12 (0.04)*	0.16 (0.05)*	0.04 (0.02)	-3.5e-3 (0.02)
Employment change lag 3	0.03 (0.04)	0.09 (0.04)	0.09 (0.06)	0.04 (0.02)	1.0e-3 (0.02)
Sample size	38,352	38,352	38,352	38,352	38,352

**p value < 0.01, **p value < 0.001*

Table 1.5: Fixed effects linear regression results predicting outpatient ED visits (per 100,000 population) among publicly insured children by psychiatric disorder groups as a function of employment decline lags 0 to 3 months (other covariates not shown) for: Model A- psychiatric outpatient ED visits for anxiety disorders; Model B- psychiatric outpatient ED visits for mood disorders; Model C: psychiatric outpatient ED visits for alcohol abuse disorders; Model D- psychiatric outpatient ED visits for substance use disorders; Model E: psychiatric outpatient ED visits for schizophrenia/psychotic disorders. Robust standard errors shown in parentheses (SE).

	Psychiatric outpatient ED visits per 100,000 population				
	Anxiety disorders	Mood disorders	Alcohol abuse disorders	Substance us disorders	Schizophrenia/ psychoses
Exposures	**Model A** Coefficient (SE)	**Model B** Coefficient (SE)	**Model C** Coefficient (SE)	**Model D** Coefficient (SE)	**Model E** Coefficient (SE)
Employment change lag 0	0.04 (0.12)	-0.04 (0.07)	0.08 (0.03)	-3.2e-3 (0.03)	-0.01 (0.02)
Employment change lag 1	-0.08 (0.05)	-0.17 (0.07)	-0.03 (0.03)	0.02 (0.03)	0.03 (0.02)
Employment change lag 2	-0.10 (0.07)	-0.07 (0.08)	-0.05 (0.03)	-0.04 (0.03)	0.01 (0.02)
Employment change lag 3	0.02 (0.05)	0.06 (0.08)	0.11 (0.03)**	0.01 (0.03)	-0.02 (0.03)
Sample size	6,391	6,391	6,391	6,391	6,391

**p value < 0.01, **p value < 0.001*

Table 1.6: Fixed effects linear regression results predicting log transformed psychiatric outpatient ED visits (per 100,000 population) as a function of employment change lag 0 to 3 months, insurance and age groups (other covariates not shown). Robust standard errors shown in parentheses (SE).

Covariates	**Coefficient (SE)**
Employment change lag 0	0.01 (2.1e-2)**
Employment change lag 1	1.20e-3 (1.9e-3)
Employment change lag 2	0.01 (1.8e-3)**
Employment change lag 3	4.6e-3 (1.4e-3)*
Public insurance (reference = private insurance)	0.60 (0.10)**
Age group (reference = children, age < 20 years)	
Working-age adults, age 20 to 64 years	0.97 (0.03)**
Elderly adults, age > 64 years	0.56 (0.04)**
Sample size	38,352

**p value < 0.01, **p value < 0.001*

Table 1.7: Fixed effects linear regression results predicting log transformed psychiatric outpatient ED visits (per 100,000 population) as a function of employment change lags 0 to 3 months (other covariates not shown) for: Model A- Privately insured children (age < 20 years); Model B: Publicly insured children; Model C: Privately insured working-age adults (age 20 to 64 years); Model D- Publicly insured working-age adults; Model E: Privately insured elderly adults (age > 64 years); Model F: Publicly insured elderly adults. Robust standard errors shown in parentheses (SE).

	Children (Age < 20 years)		**Working-age adults (Age 20 to 64 years)**		**Elderly adults (Age > 64 years)**	
	Private insurance	Public insurance	Private insurance	Public insurance	Private insurance	Public insurance
Exposures	**Model A** Coefficient (SE)	**Model B** Coefficient (SE)	**Model C** Coefficient (SE)	**Model D** Coefficient (SE)	**Model E** Coefficient (SE)	**Model F** Coefficient (SE)
Employment change lag 0	0.02 (3.1e-3)**	0.01 (3.6e-3)	0.01 (2.0e-3)**	1.6e-3 (1.5e03)	0.01 (0.01)	2.9e-3 (1.9e-3)
Employment change lag 1	0.01 (4.3e-0)	-0.01 (2.3e-3)**	0.01 (2.4e-3)	-2.1e-3 (2.5e-3)	-0.01 (0.01)	3.5e-3 (2.9e-3)
Employment change lag 2	0.01 (3.8e-3)**	-2.6e-3 (2.9e-3)	0.01 (2.3e-3)**	4.4e-4 (1.1e-3)	0.02 (4.5e-3)**	1.3e-3 (2.5e-3)
Employment change lag 3	0.01 (3.6e-3)	0.01 (2.5e-3)	4.2e-3 (2.9e-3)	-7.5e-4 (2.0e-3)	0.01 (4.6e-3)	3.8e-3 (2.3e-3)
Sample size	6,458	6,391	6,256	4,829	6,479	6,480

**p value < 0.01, **p < 0.001*

Figure 1.4: Employment change “shock” (average monthly employment change reformulated as zero for positive values, negative values retained as original) in 49 Metropolitan Statistical Areas (4 states: AZ, CA, NJ, NY), 2006-2011

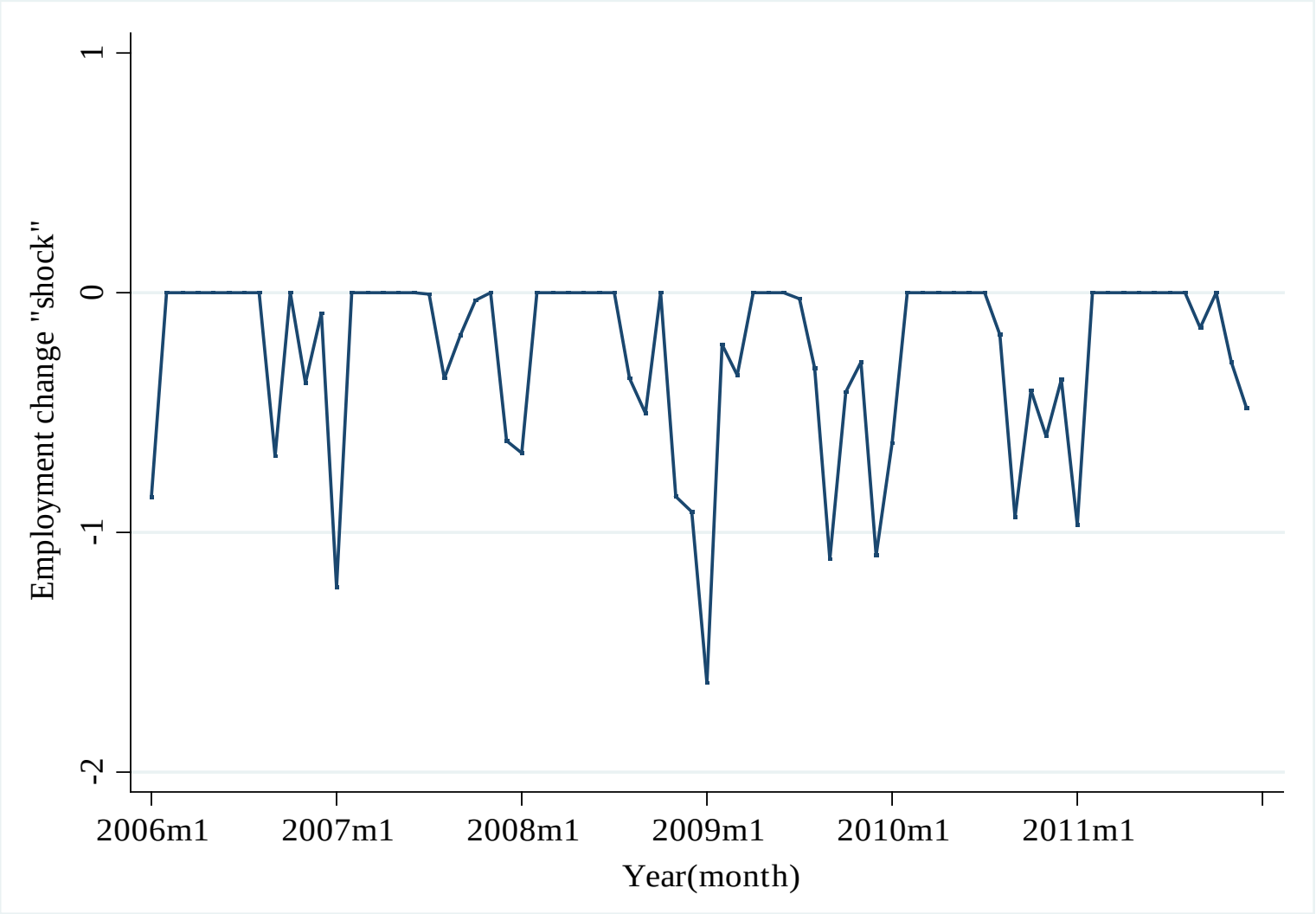


Table 1.8: Fixed effects linear regression results predicting psychiatric outpatient ED (per 100,000 population) as a function of employment change "shock" lag 0 to 3 months, insurance and age groups (other covariates not shown). Robust standard errors shown in parentheses (SE).

Covariates	**Coefficient (SE)**
Employment change "shock" lag 0	0.65 (0.24)*
Employment change "shock" lag 1	0.28 (0.37)
Employment change "shock" lag 2	0.55 (0.34)
Employment change "shock" lag 3	0.41 (0.40)
Public insurance (reference = private insurance)	84.36 (8.62)**
Age group (reference = children, age < 20 years)	
Working-age adults, age 20 to 64 years	93.64 (7.8)**
Elderly adults, age > 64 years	96.96 (6.04)**
Sample size	38,328

**p value < 0.01, **p value < 0.001*

Chapter 3: Macroeconomic antecedents of racial disparities in psychiatric Emergency Department visits

Introduction

Emergency departments (EDs) are not considered ideal for treating psychiatric illnesses as they provide episodic care for conditions that need continuous case management (Zun, 2012). Most EDs have inadequate systematic linkage and follow-up mechanisms to ensure continuity of care post discharge, and thus, may not confer long-term benefits to psychiatric patients (Boudreaux et al., 2011). High ED reliance for mental health portends inferior health outcomes and greater costs for both patients and hospital systems (Arfken et al., 2004).

In the US, African Americans utilize EDs at a disproportionately greater rate for routine psychiatric care relative to all other races and ethnicities. This greater reliance on the ED occurs despite the fact that population-level epidemiological estimates do not find a greater prevalence of mental illness among African Americans (Snowden et al., 2009; Breslau et al., 2006). This racial disparity in psychiatric ED visits for mental health derives from several static and dynamic factors. Static factors that generally do not change over time include low access, poor quality of care when accessed, socio-cultural barriers to help-seeking and racial discrimination within the healthcare system (Snowden et al., 2009). Dynamic factors, on the other hand, tend to vary over time. Some examples of dynamic factors that may correspond with differentially greater psychiatric ED visits in African Americans relative to others are exogenous changes such as economic downturns (Snowden et al., 2009).

Economic downturns are particularly salient for African Americans as this group is especially vulnerable to the consequences of a declining economy. African Americans possess fewer socio-economic buffers (income sources, savings and assets) that confer financial security in times of economic uncertainty, employment loss or income decline (Jaynes and Williams, 1989). Over the course of the most recent recession of 2008, African Americans lost more jobs,

had a steeper reduction in income and were more likely to lose health insurance relative to whites (Smeeding, 2012; Pfeffer et al., 2013; Bohn and Schiff, 2011; Engemann and Wall, 2009; Jacobsen and Mather, 2011). Construction, manufacturing and service sectors were particularly affected and employed a large number of African Americans in temporary, low-wage positions (Wessler, 2009). Studies show that these groups are often the 'last hired, first fired' during economic downturns (Couch and Fairlie, 2010).

Economic downturns are considered population level or ecological stressors as they increase stress from income and job loss among the directly affected, as well as uncertainty, fear and anxiety of potential job loss among those who remain employed (Catalano et al., 2011). For populations that are not laid off during recessions, studies suggest a rise in working hours, reduction in pay and increased stress due to future uncertainty of employment (López Bohle, 2017). Research shows that those who fear job loss significantly outnumber those who are laid off during economic downturns, and that periods of economic decline induce fear and anxiety regardless of employment status (Dua and Smyth, 1993; Catalano and Dooley, 1979). During such times, populations may experience adverse mental health outcomes and exhibit greater psychiatric care-seeking, manifested as higher number of mental health-related visits to health care providers (Goldman-Mellor et al., 2010).

Macroeconomic downturns may increase help-seeking for mental health through multiple mechanisms such as prophylactic care-seeking (pre-emptive help-seeking to prevent illness), provocation (development of new illness), uncovering (exacerbation of pre-existing psychiatric conditions) and cost-shifting (increased reliance on safety nets for mental health) (Goldman-Mellor et al., 2010, Zivin et al., 2011). Prior research finds an increase in help-seeking through greater hospital in-patient admissions and psychiatric ED visits within three months following

macroeconomic contractions (Bruckner et al., 2014; Catalano and Dooley, 1977; Dooley and Catalano, 1979). These trends may concentrate among low SES groups that do not have sufficient financial and social assets to weather sudden macroeconomic shocks (Jaynes and Williams, 1989; Snowden and Bruckner, 2014).

The age group of 18 to 64 years overlaps closely with the US civilian labor force and may exhibit particularly acute psychiatric responses to abrupt decline in labor demand during economic recessions (Snowden and Bruckner, 2014). In addition to employment-related 'direct' stressors, low income, working-age populations experiencing financial insecurity also face indirect stressors such as increased familial strain, reduction in resources for caregiving to children, elderly and the infirm, and loss of psychosocial assets (Rook et al., 1991; Lincoln et al., 2005; Jahoda, 1982; Warr, 1994). These stressors are compounded for low SES working-age African Americans who find themselves shouldering many competing responsibilities but possess limited financial means to purchase substitute care and augment income loss following economic decline (Roschelle, 1997). In such times, they may turn to the only safety net in the country that is required, by law, to provide care to every visitor regardless of their ability to pay: the ED. Thus, owing to their differentially greater exposure and vulnerability to economic downturns, low SES working-age African Americans may exhibit greater help-seeking manifested through increased rates of psychiatric ED visits following ambient economic decline.

This paper examines whether help-seeking in EDs for mental health, measured through psychiatric ED visits, increases among low SES African Americans relative to low SES whites, following economic downturns, in the context of the 2008 recession. To my knowledge, only one prior study assesses racial disparities in psychiatric ED visits following ambient economic shocks (Bruckner et al., 2014). Here, the authors examine publicly insured African American youth (aged

5 to 21 years), relative to white youth, in California from July 1999 to April 2008, and observe an increase in African American visits one month after increase in state-level mass layoffs (Bruckner et al., 2014). However, the authors do not examine working-age adults and do not include the complete time period of the 2008 recession (December 2007 to June 2009) (Bruckner et al., 2014; Labonte, 2010). Their aggregate-level analysis is also limited to the state of California and does not control for potential individual-level confounders (e.g., gender) (Bruckner et al., 2014).

I build upon this prior research by examining all age groups using individual-level data on outpatient (treat-and-release) psychiatric ED visits from four US states spanning 2006-2011. Consistent with prior work, I use public insurance to approximate low SES (Bruckner et al., 2014). I test differential help-seeking for emergency mental health services among African Americans relative to whites. I hypothesize that ambient economic decline (measured as monthly employment change in a Metropolitan Statistical Area) precedes an increase in the likelihood of psychiatric ED visits in African Americans relative to whites among publicly insured (low SES) populations but not among those with private insurance. If results support this hypothesis, I then test, within the publicly insured, whether different age groups (< 18, 18-64, >65 years) exhibit differential responses to monthly employment change. Here, I expect that owing to its strong link to the labor market, the working-age group of 18 to 64 years will drive any association observed in the first test.

Methods

Variables and Data

Similar to my approach in Chapter 2, I retrieved psychiatric ED visit data for African Americans and whites from the State Emergency Department Database (SEDD) (SEDD, 2017). Given my focus on African-American / white differences, I excluded all other race/ethnicities from the analysis.

I defined psychiatric ED visits as observations reporting a psychiatric diagnosis within the set of diagnoses provided (Dx1 to Dx25) in the SEDD (Appendix Table A.1). I obtained SEDD data for 4 states (Arizona, California, New York and New Jersey) that provide uniform monthly reporting of ICD-9 psychiatric diagnoses, race/ethnicity, gender, public/private insurance status, age and county. As previously described in Chapter 2, I operationalized the key independent variable as monthly percent employment change in a Metropolitan Statistical Area (MSA) using the US Bureau of Labor Statistics' metropolitan area employment data series (BLS, 2019a). I retrieved population denominators, by race and age groups, from the US Census Bureau's Population Estimates database, which were merged to SEDD and BLS-LAUS data (U. S. Census Bureau, 2016). The analytic period includes 48 MSAs (4 states) for 72 months (2006-2011). In keeping with past research on the induction period of increase in psychiatric symptoms, ED visits and hospitalizations following ambient changes, I test for perturbations in psychiatric ED visits from zero to 3 months after aggregate employment change (Bruckner et al., 2014; Catalano and Dooley, 1977; Dooley and Catalano, 1979). This short lag period tests for proximate responses to exposure and avoids potential confounding by other factors that may correlate with economic downturns but take longer to manifest (such as home foreclosures) (Currie and Tekin, 2015).

Analysis

I test whether African Americans, more than whites, show increased odds of a psychiatric ED visit following employment decline in that MSA-month. I define race as a binary outcome variable (African American = 1; white = 0) to examine whether changes in exposure (area level monthly employment decline) increase the odds of a psychiatric ED visit by an African American relative to white. I use public insurance as a surrogate for low SES relative to the privately insured (high SES) (Bruckner et al., 2014). Commensurate with theory that predicts greater psychiatric help-seeking and ED reliance among low SES populations, I estimate separate models by insurance groups (private, public) to test whether a decline in aggregate (MSA-level) percent employment precedes an increase in the odds of African American ED visits, relative to white, only among the publicly insured (Bruckner et al., 2014). I further stratify these two insurance types by age groups (<18 years, 18 to 64 years and > 64 years). I assume varying levels of exposure to employment change by age group based on their connection to the labor force and test whether groups that do not form a large part of the civilian labor force (i.e. <18 years and >64 years) do not show as strong an association between exposure and outcome as do individuals most likely to be directly affected by economic decline, i.e. those between 18 to 64 years of age.

I estimate the following logistic regression equation:

$$\frac{\pi(Yi,c,m,t)}{1-\pi(Yi,c,m,t)} = \exp[\beta_0 + \sum_{n=1}^{4} \beta_n X_{r,\, m-n+1,t} + \beta' \mathbf{K}_{i,c,t,m} + \beta' \boldsymbol{\gamma_r} + \beta' \mathbf{m} + \beta' \mathbf{t} + \beta' \boldsymbol{\gamma_r} * L + \varepsilon]$$

….. **Equation 2**

where $\frac{\pi(Yi,c,m,t)}{1-\pi(Yi,c,m,t)}$ is the log-odds of a psychiatric diagnosis occurring in African Americans (Y = 1) relative to whites (Y = 0) for ED visit *i* in county *c* during month *m* and year *t*. The set

of $\sum X_{r,t,m-n+1}$ (n = 1 to 4) represents the percent employment change variable X in MSA *r*, month *m*, *m-1* (month lagged by 1) , *m-2* (lag 2), *m-3* (lag 3) and year *t* respectively. **K** is the vector of visit-level characteristics: gender, age, age squared and insurance status (private, public). Indicator variables for each county, $\boldsymbol{\gamma_r}$, control for time-invariant county (and MSA) level factors that correlate with both MSA level employment change and race differences in psychiatric ED visits. Indicators for month **m** absorb seasonality shared by psychiatric ED visits and employment cycles. Year fixed effects, **t**, account for annual policy changes (eg. expansion of mental health parity under the Affordable Care Act) that may affect the outcome. $\boldsymbol{\gamma_r}$*L is a vector of county-specific linear time trends that control for unobserved variables that trending linearly over the 72 month study period and may influence racial disparities in psychiatric ED use (eg. secular trends in psychiatric ED visits). I cluster standard errors at the MSA level to account for heteroskedasticity.

For tests that reject the null, I estimate the number of African American psychiatric ED visits statistically attributable to a unit increase in exposure in the following manner: (i) First, I obtain odds of African American psychiatric ED visits relative to white within one standard deviation of employment change. (ii) Next, I apply the discovered coefficient (odds ratio) of exposure from logistic regression analysis to the odds ratio from step (i) to estimate the additional African American psychiatric ED visits corresponding to unit decline in employment change.

Given that I test the individual-level odds of African American psychiatric ED visits relative to whites, following aggregate monthly percent employment decline, it remains plausible that any hypothesis tests that reject the null may arise from a net *decline* in psychiatric ED visits among whites, that may mislead inference as a 'true' increase in odds among African Americans. To address this concern, I aggregate psychiatric ED visit rates (per 100,000 population) by race

(African American, white) and test, in a linear fixed effects regression framework, the relation between population rates of psychiatric ED visits and percent employment change for each race (separately, for hypothesis tests that reject the null). I also examine aggregate-level racial disparities in psychiatric ED visits following economic contraction by interacting the exposure (0 to 3 month lags) with binary race indicator (African American = 1, white = 0), to gauge whether and to what extent individual-level results conform with aggregate-level results (for hypothesis tests that reject the null). Similar to equation 2, these analyses of aggregate-level trends control for region, month, year fixed effects, state-specific linear time trends and incorporate heteroscedasticity-robust standard errors.

As a robustness check, I test the consistency of direction of association between the dependent and independent variables in equation 2 through a linear probability model using OLS regression (binary outcome) for hypothesis tests that reject the null. I also conduct a test of extreme 'employment decline shocks' to gauge whether odds of African American psychiatric ED visits following sudden and stark regional economic contractions align with findings from a more continuous treatment of the exposure.

The inclusion of the year 2011 raises an important concern regarding changes in psychiatric ED visits due to insurance coverage expansion under the Affordable Care Act (ACA) (Hamel et al., 2014). After the initial provisions of mental health parity under the ACA took effect in 2010, ED visits rose among the newly insured and among new Medicaid recipients not accepted by primary care physicians (Mulcahy et al., 2013; Miller and Wherry, 2016; Decker, 2012). Newly insured African Americans may have therefore increased ED utilization for mental health after 2010, as suggested by findings from the Oregon health insurance experiment (Taubman et al., 2014). For this reason, I conduct a sensitivity analysis by estimating equation 2

for all years excluding 2011 to test whether the association between employment decline and psychiatric ED visits matches results from hypothesis testing. I conduct all analyses with Stata SE (version 14.2) (StataCorp., 2015).

Results

Table 2.1 shows the descriptive statistics of my analytic sample. Between 2006 and 2010, SEDD includes 6.7 million psychiatric ED visits of which nearly 80 percent are white and 20 percent are African Americans. The number of visits among the publicly insured is about 1.4 times higher than those with private insurance. The most common diagnoses, accounting for nearly 40% of all psychiatric ED visits, are mood, anxiety and alcohol abuse-related disorders. Monthly percent employment change has a mean of -0.04 percent, indicating a general period of employment decline reaching as low as -17.9 percent. Overall, the sample has 103 more MSA-months with employment decline (percent employment change < 0) than employment gain (percent employment change > 0). Nearly 7% of MSA-months with negative employment change show extreme decline i.e. exceed three standard deviations below the mean.

Figure 2.1 shows the trends in psychiatric ED visits (per 100,000 population) by race in my study sample. The positive slopes of ED visit rates for both races cohere with national trends in emergency department utilization for psychiatric care over the study period (Larkin et al., 2005; Capp et al., 2016). Figure 2.2 compares employment change across 2 different MSAs- New York (Figure 2.2, Panel A) and San Francisco (Figure 2.2, Panel B), and illustrates the heterogeneity in exposure across different MSAs. Monthly employment declines in 2009 for both New York and San Francisco MSAs, but the decline is slightly higher in magnitude for New York. Subsequent recovery (or increase in employment after the 2009 decline) is higher in San

Francisco (in 2010), relative to New York (Figure 2.2) For aggregate trends in employment change averaged across all MSAs included in the study, please see Figure 1.3 (Chapter 2).

Table 2.2 presents the results of logistic regression analysis for psychiatric ED visits among African Americans and whites. For the full sample (Model a), we fail to reject the null at any of the specified exposure lags. However, among the publicly insured (Model b), decline in percent employment change lagged by 3 months precedes an increase in the odds of an African American psychiatric ED visit relative to white. Here, a unit decrease in employment decline three months prior (m-3) increases the odds of an African American ED visit by 0.5% (compared to white). We observe no relation between percent employment change and the odds of African American psychiatric ED visits at any specified lags (0 to 3) for the privately insured population (Model c). Female gender is associated with lower odds of African American psychiatric ED visits overall and among the privately insured, but not among those with public insurance.

Table 2.3 presents the results of logistic regression by age groups among the publicly insured. Percent employment change at all lags shows no relation with odds of African American psychiatric ED visits (relative to white) for children (Model a) and older adults (Model c). However, among the 18 to 64 year age group, odds of an African American psychiatric ED visit increase by 0.6% following decline in employment change lagged at three months. The magnitude of association between odds of an African American psychiatric ED visit and the 3rd lag of monthly employment change is consistent with Table 2.2 (Model b) but of slightly greater magnitude.

Using the coefficient of exposure at lag 3 from Table 2.3 (Model b), I estimated the number of African American psychiatric ED visits statistically attributable to decline in employment change. In my data, a median county-month (based on the ratio of African American

to white psychiatric ED visits), has 23 African American and 109 white psychiatric ED visits (publicly insured, working-age), yielding a base odds ratio of 0.045. Application of the discovered coefficient of exposure at lag 3 (from Table 2.3, model b) to this base rate yields 1.5 additional African American visits per unit decline in employment change (out of a base monthly rate of 23 psychiatric ED visits in this group). Put another way, I observe 15 additional psychiatric ED visits in a median county among low SES, working-age African Americans, relative to white, three months after a 10% decline in MSA-level monthly employment.

Tables 2.4 to 2.7 present results from robustness and sensitivity checks. Among the 18-64 year old, publicly insured group, aggregate analyses show marginal increase in rates (per 100,000 population, log transformed outcome) of psychiatric ED visits 1 month following decline in exposure among whites and 3 months after percent monthly employment decline among African Americans (Table 2.4, Models a, b). Interaction of exposure with binary race shows increase in population rates of African American psychiatric ED visits, relative to whites, at exposure lag 3, which aligns with findings from Table 2.3, Model b (Table 2.4, Model c). Whereas these exposure coefficients (Table 2.4) do not reach conventional levels of statistical significance, they provide evidence that my original inference does not likely arise from a net decline in psychiatric ED visits among whites.

Coefficients from OLS regression-based linear probability models (Table 2.5) show consistency with results from Table 2.3 (Model b) in the direction of association between percent employment change and outcome among 18-64 year olds who are publicly insured. Table 2.6 shows logistic regression results of sensitivity analysis after excluding the year 2011. The direction and magnitude of association between percent employment change at lag 3 and odds of African American ED visits (relative to whites) is identical to that in Table 2.3 (Model b)

indicating that expansion of mental health parity under initial provisions of the ACA does not account for results from hypothesis tests.

As another sensitivity analysis, I conduct an extremes test of employment decline 'shocks', I converted the exposure to zero for all employment change values greater than -3 (representing three standard deviations below the mean) leaving values less than -3 continuous (see Figure 1.4 for an illustration of this formulation). I used this exposure specified at lags 0 to 3 to replicate the logistic regression analysis from Table 2.3, Model b. Results from this extremes test (Table 2.7) cohere with original tests. The association between employment shock at lag 3 and odds of African American psychiatric ED visit relative to white is over twice that of the exposure at lag 3 in Table 2.3, Model b. Per this extremes test, incremental employment decline at the extremes corresponds with a 1.3% increase in an African American psychiatric ED visit relative to white.

Discussion

I focused on racial disparities between African Americans and whites with respect to psychiatric ED visits and tested whether a decline in aggregate employment precedes a rise in the odds of African American visits relative to whites. I specified a time period that included the 2008 economic recession. I used high quality Emergency Department data for 48 Metropolitan Areas (4 states) spanning 72 months from 2006 to 2011. Results show that employment decline during the study period corresponds with a modest increase in the odds of publicly insured African American visits relative to whites three months after exposure. Furthermore, as hypothesized (owing to their close overlap with the civilian labor force), I observe this result only among the working-age population (18-64 years) of publicly insured African Americans. These

results remain robust to alternate specifications and multiple sensitivity checks.

Strengths of this study include the use of repeated cross-sectional time series data comprising 6.7 million psychiatric ED encounters across a broad range of MSAs over a 5-year period (2006-2011). This time period includes both the Great Recession as well as years of economic stability. I utilize objectively defined clinical psychiatric ICD 9 diagnoses that reduce measurement errors associated with self-reported data. Brief exposure time lags minimize confounding that may arise from long-run sequelae of economic downturns. I also control for time-invariant regional differences in ED use by including county "fixed effects." In addition, I control for any patterns over time in ED use across all MSAs by including year and month indicator variables. I know of no study that has longitudinally examined racial disparities in psychiatric help-seeking over the period of the 2008 recession, focusing on low-income, working-age African Americans.

Four potential mechanisms contribute to psychiatric help-seeking during economic contractions: (i) provocation, (ii) uncovering, (iii) prophylaxis, and (iii) cost shifting (Goldman-Mellor et al., 2010; Zivin et al., 2011). The provocation pathway proposes an increase in new disorders following macroeconomic decline due to increased socioeconomic disadvantage and elevation of stressful life events (Catalano and Dooley, 1977). Uncovering posits increased hospitalization among the chronically ill as economic adversity might make it difficult for patients to manage their pre-existing conditions due to reduced resources (loss of income, health insurance, inability to continue medications) and increased reporting (arising from reduced tolerance to mental illness or disordered behavior) (Catalano et al., 1981). Prophylaxis encompasses increase in utilization of mental health care facilities either in anticipation of, or as a risk-averse response to financial uncertainty (Dooley and Catalano, 1984). Cost shifting predicts that following income

or job loss, people may 'shift' from private treatment to public facilities and safety nets, such as EDs, for psychiatric care (Catalano et al., 1985).

Collectively, these help-seeking pathways may underlie differentially greater psychiatric ED visits among African Americans compared to other groups during economic downturns (Dooley and Catalano, 1984; Catalano et al., 1985). The literature finds that forced/involuntary commitments to psychiatric institutions increase selectively among adult African American males in times of economic uncertainty, providing evidence of uncovering due to reduced tolerance (Catalano et al., 2007a). Prior research also shows that economic contractions may provoke or uncover mental disorders among low SES African American youth resulting in greater utilization of emergency psychiatry services relative to other races/ethnicities (Bruckner et al., 2014). However, these studies predate the Great Recession of 2008 that was deeper and longer lasting than all other recessions since World War II, and hence, may have elicited characteristically different responses relative to earlier economic downturns (Labonte, 2010).

An important limitation of my study is the lack of distinction between emergent and non-emergent users of EDs. Owing to data constraints in SEDD, I cannot identify whether the observed (relative) increase in publicly insured African American visits arises from true psychiatric emergencies or as a consequence of higher utilization by non-emergent cases. It remains plausible that among low SES minorities, aggregate employment decline may increase non-emergent ED usage (not limited to psychiatric visits only), without increasing the incidence or severity of illnesses (Padgett et al., 1992). Conversely, prior research also shows that utilization of routine (non-urgent) psychiatric services declines among African American youth (relative to white) after ambient economic shocks, suggesting that while white youth may increase service utilization for routine psychiatric care, African Americans experience a higher proportion of 'true

emergencies', tilting the overall rates of psychiatric ED visits in their direction (Bruckner et al., 2014). Future research may utilize measures of severity, such as inpatient admission following ED visit, or disorders classified as SMIs (Severe Mental Illness), to examine whether racial disparities in psychiatric ED visits vary by illness severity.

I also do not have *a priori* hypotheses for racial differences in 'help-seeking incubation period' (i.e. monthly exposure lags) of different illnesses following aggregate employment decline. Hence, I do not test differential responses to the exposure by illness 'type' (e.g. mood disorders versus psychoses). While studies observe a rise in clinical depression, alcohol abuse (binge drinking) and suicides among vulnerable socio-demographic groups following the 2008 recession, the underlying theory of illness-specific temporal lags in relation to racial disparities remains under-developed, and may be explored in future research (Gili et al., 2013; Bor et al., 2013; Stuckler et al., 2009).

My analysis indicates 1.5 additional African American psychiatric ED visits in a county-month following a one percent decline in employment change. The small magnitude of this finding holds more relevance to the theory of dynamic determinants of racial disparities in psychiatric ED visits, rather than to health policy. Based on this average "effect size", i.e. additional 1.5 African American psychiatric ED visits in a county-month, it remains difficult to ascertain whether these perturbations in racial disparities in psychiatric ED visits reach levels that warrant policy-level redirection of resources and public health investments. This modest increase in racial disparities may arise from a combination of 'new', singleton ED visitors and/or higher number of revisits among high ED utilizers (i.e. repeat visitors). Each of these two types of ED visitors hold different implications towards our conceptual understanding of who increases their help-seeking following economic downturns. Future research may elucidate potential differential

associations of these revisits with racial disparities in psychiatric ED care.

Clinicians and the public regard EDs as “the safety-net of safety-nets” (Hsia et al., 2011). However, crisis oriented care offered in EDs is limited in its ability to ensure the continuity of care and case management required for proper treatment of psychiatric conditions. High psychiatric ED reliance among African Americans reflects the inadequate reach of mental health systems in providing appropriate and timely care to this group. It is plausible that this mental health services ‘gap’ expands during economic recessions when public health agencies face funding shortages and may have to reduce supply (Hodgkin and Karpman, 2010). My study shows that low SES African Americans marginally increase psychiatric ED utilization than do whites during times of ambient economic decline. These findings add to the current knowledge base regarding drivers of racial disparities in ED use for mental health.

Tables & Figures

Table 2.1: Description of key attributes of psychiatric ED visits and 48 MSAs by race (4 states: AZ, CA, NJ, NY), 2006-2011, in study sample.

Individual level Attributes	**African American N (%)**	**White N (%)**
Sample size	1,376,698 (20.4)	5,382,753 (79.6)
Females	728,316 (53)	2,996,646 (56)
Males	648,382 (47)	2,386,107(44)
Private insurance	473,494 (34.4)	2,331,507 (43.3)
Public insurance	903,204 (65.6)	3,051,246 (56.7)
Top 3 diagnoses:		
Mood disorders	416,444 (17.4)	1,892,343 (23)
Anxiety disorders	270,356 (11.3)	1,490,265 (18.1)
Alcohol abuse-related disorders	399,778 (16.7)	1,274,905 (15.5)
MSA-level Attributes		
Mean Percent Employment Change (Std. Dev.)	-0.04 (0.94)	
Range of Percent Employment change	Minimum: -20.6 Maximum: 17.9	
Total number of MSAs	48	
Total number of counties	96	
Number of MSA-months with employment decline (employment change < 0)	1,575	
Number of MSAs-months with employment gain (employment change > 0)	1,472	
Number of MSA-months with acute employment decline (employment change < -3)	111	

Figure 2.1: Monthly psychiatric ED visits per 100,000 population for African Americans and whites in 48 MSAs (4 states: AZ, CA, NJ, NY), 2006-2011, in study sample.

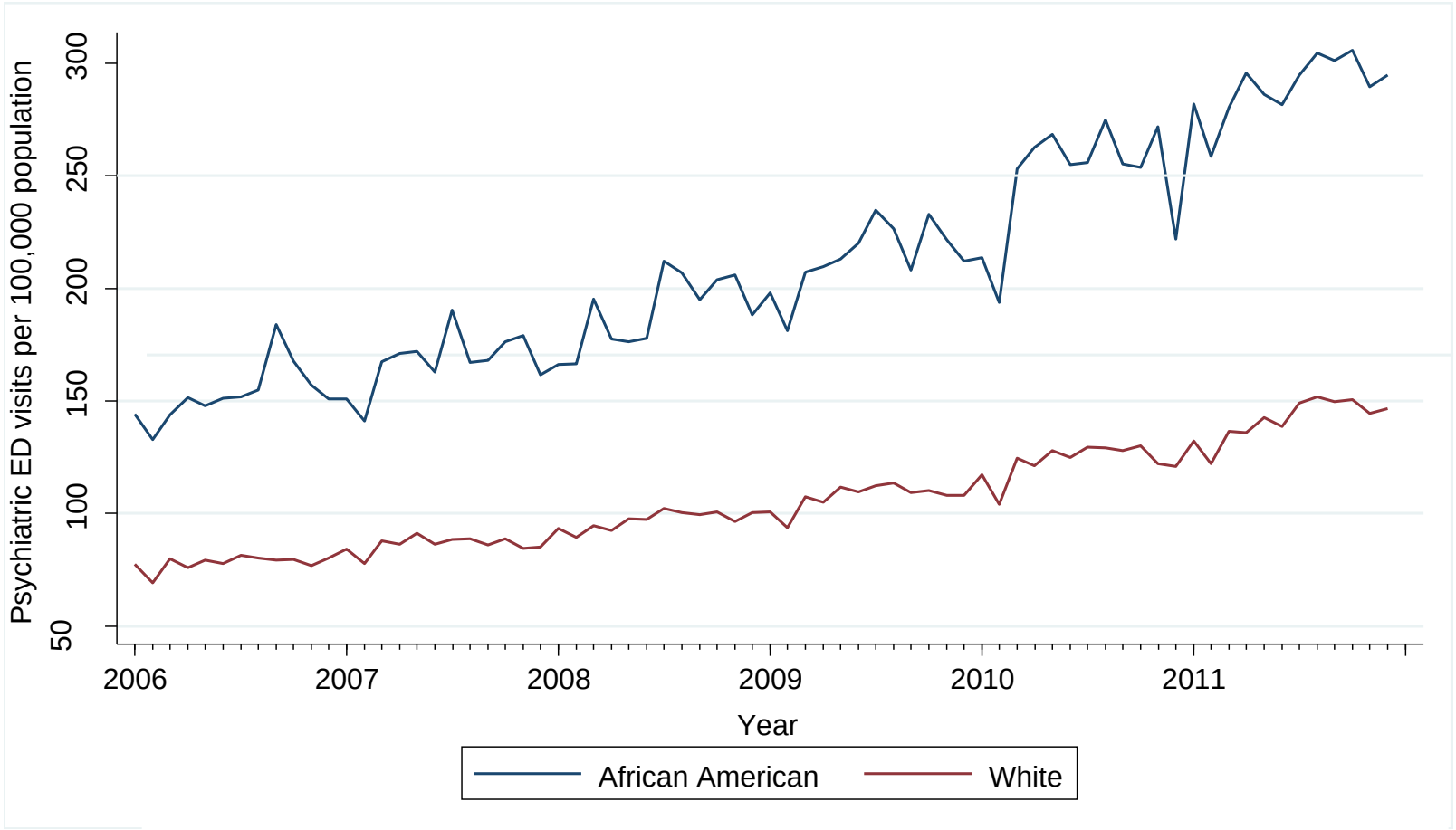


Figure 2.2: Monthly percent employment change in New York (Panel A) and San Francisco (Panel B) MSAs, 2006-2011

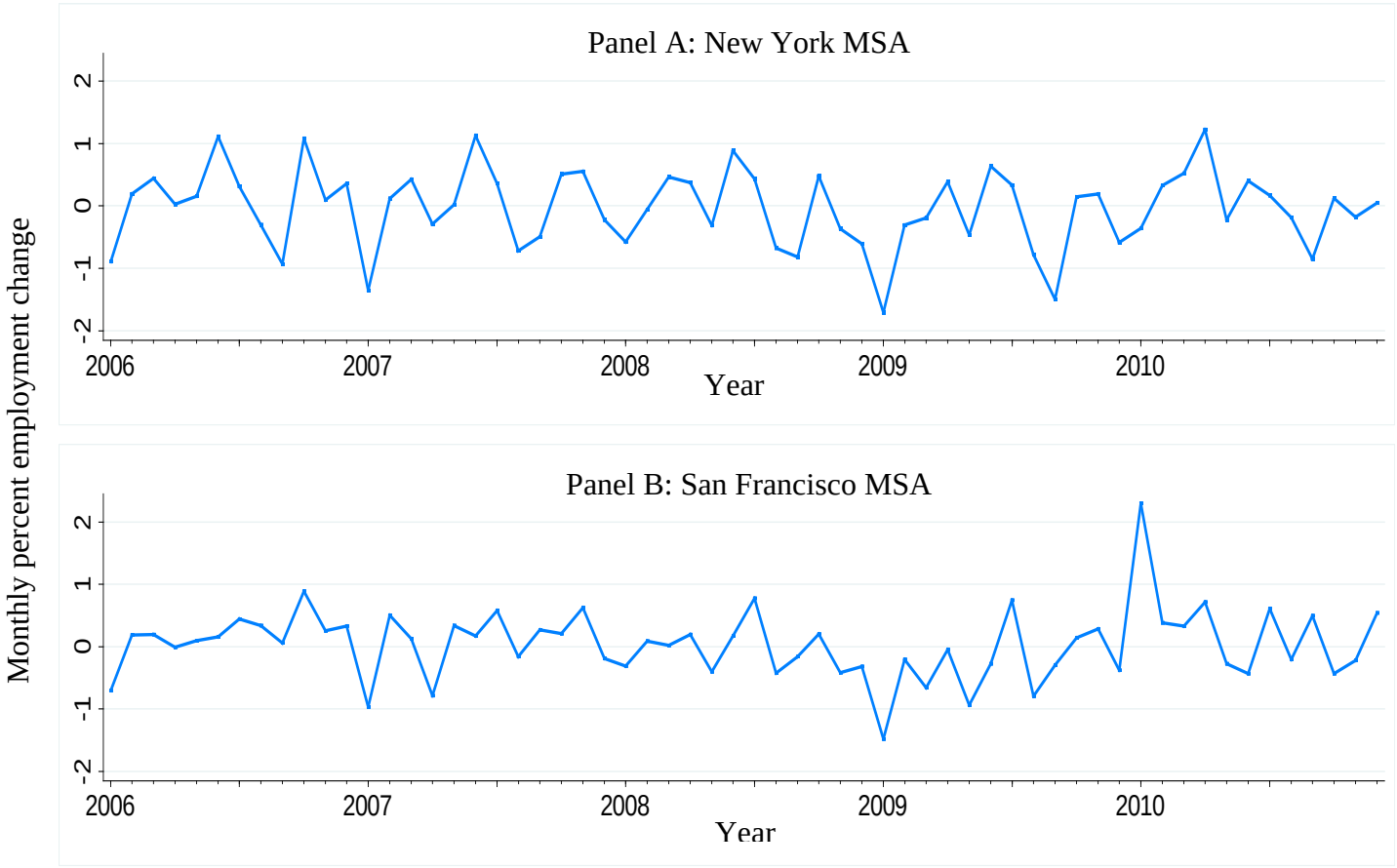


Table 2.2: Logistic regression results predicting African American race (relative to white) among psychiatric ED visits as a function of monthly percent employment change lagged by 0 to 3 months (other covariates not shown). *Model a* shows results from analysis of unrestricted full sample; *Model b* shows results among psychiatric ED visits with public insurance; *Model c* shows results among psychiatric ED visits with private insurance.

Covariates	*Model a: Full sample*		*Model b: Public insurance*		*Model c: Private insurance*	
	Odds ratio	**95% confidence interval**	**Odds ratio**	**95% confidence interval**	**Odds ratio**	**95% confidence interval**
Employment change (lag 0)	0.996	[0.991 1.001]	0.998	[0.993 1.002]	0.991	[0.982 1.001]
Employment change (lag 1)	0.998	[0.994 1.003]	0.999	[0.994 1.003]	0.998	[0.989 1.008]
Employment change (lag 2)	0.998	[0.993 1.002]	0.998	[0.994 1.002]	0.997	[0.987 1.006]
Employment change (lag 3)	0.996	[0.991 1.000]	0.995*	[0.991 0.999]	0.996	[0.987 1.005]
Sex: Female (reference = male)	1.073**	[1.026 1.122]	1.034	[0.985 1.085]	1.137***	[1.082 1.195]
Age	1.020***	[1.005 1.035]	1.013	[0.996 1.030]	1.003	[0.984 1.023]
Age squared	1.000***	[0.999 1.000]	0.999***	[0.999 0.999]	0.999	[0.999 1.000]
Public insurance (reference = private)	2.277***	[2.093 2.478]	--	--	--	--
Sample size (N)	6,681,934		3,897,218		2,784,716	
*p value < 0.05; **p value < 0.01; ***p value < 0.001						

Table 2.3: Logistic regression results predicting African American race (relative to white) among publicly insured psychiatric ED visits as a function of monthly percent employment change lagged by 0 to 3 months (other covariates not shown). *Model a* shows results from analysis of publicly insured psychiatric ED visits aged < 18 years; *Model b* shows results among publicly insured psychiatric ED visits aged 18 to 64 years; *Model c* shows results among publicly insured psychiatric ED visits aged > 64 years.

Covariates	*Model a: age < 18 years*		*Model b: age 18 to 64 years*		*Model c: age > 64 years*	
	Odds ratio	**95% confidence interval**	**Odds ratio**	**95% confidence interval**	**Odds ratio**	**95% confidence interval**
Employment change (lag 0)	0.997	[0.986 1.008]	0.997	[0.991 1.0032]	1.002	[0.991 1.012]
Employment change (lag 1)	1.002	[0.986 1.020]	1.001	[0.995 1.006]	0.987	[0.974 1.001]
Employment change (lag 2)	1.008	[0.994 1.022]	0.997	[0.992 1.002]	0.997	[0.985 1.010]
Employment change (lag 3)	0.998	[0.986 1.009]	0.994**	[0.990 0.998]	1.000	[0.987 1.011]
Sex: Female (reference = male)	0.986	[0.938 1.037]	1.067*	[1.013 1.124]	1.000	[0.949 1.054]
Age	1.022	[0.969 1.077]	1.004	[0.991 1.016]	0.945	[0.820 1.089]
Age squared	0.998	[0.996 1.001]	1.000*	[0.999 0.999]	1.000	[0.999 1.001]
Sample size (N)	165,945		2,659,531		1,071,742	
*p value < 0.05; **p value < 0.01; ***p value < 0.001						

Table 2.4: Overall Least Squares (OLS) linear fixed effects regression results predicting log transformed population rates (per 100,000 population) of psychiatric ED visits among 18-64 year old publicly insured group as a function of monthly percent employment change lagged by 0 to 3 months (other covariates including not shown) for: whites (Model a), African Americans (Model b), and interaction of binary race (African American = 1, white = 0) with monthly percent employment change lagged by 0 to 3 months (Model c). SE = Standard Error.

Covariates	*Model a: White*		*Model b: African American*		*Model c: Interaction between exposure and binary race*	
	Coefficient	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
Employment change (lag 0)	0.002	0.002	-0.002	0.004	0.001	0.002
Employment change (lag 1)	-0.003*	0.002	-0.002	0.003	-0.003	0.002
Employment change (lag 2)	-3.1e-5 (1.2e-4)	0.001	0.003	0.003	0.001	0.001
Employment change (lag 3)	-9.1e-5 (1.4e-4)	0.001	-0.006*	0.003	-1.8e-5	0.002
Race (binary, reference = white)	--	--	--	--	1.543****	0.068
Employment change (lag 0)*Race	--	--	--	--	-0.002	0.005
Employment change (lag 1)*Race	--	--	--	--	-0.001	0.003
Employment change (lag 2)*Race	--	--	--	--	0.002	0.004
Employment change (lag 3)*Race	--	--	--	--	-0.007*	0.003
*p value < 0.1; **p value < 0.05; ***p value < 0.01; ****p value < 0.001						

Table 2.5: Linear (OLS) regression results predicting African American race (relative to white) among publicly insured psychiatric ED visits aged 18-64 years as a function of monthly percent employment change lagged by 0 to 3 months (other covariates not shown).

Variables	**Coefficient**	**95% Confidence Interval**
Employment change (lag 0)	-2.1e-4	[-0.001 0.001]
Employment change (lag 1)	1.6e-4	[-0.001 0.001]
Employment change (lag 2)	-2.7e-4	[-0.001 3.3e-4]
Employment change (lag 3)	-0.001*	[-0.001 -4.7e-5]
Sex: Female (reference = male)	0.010*	[0.001 0.019]
Age	0.001	[-0.001 0.003]
Age squared	-3.3e-5*	[-6.4e-5 -1.03e-6]

*p value < 0.05; **p value < 0.01; ***p value < 0.001

Table 2.6: Logistic regression results predicting African American race (relative to white) among publicly insured psychiatric ED visits aged 18-64 years, excluding year 2011, as a function of monthly percent employment change lagged by 0 to 3 months (other covariates not shown) (N = 2,224,053).

Variables	**Odds Ratio**	**95% Confidence Interval**
Employment change (lag 0)	0.999	[0.992 1.007]
Employment change (lag 1)	1.001	[0.993 1.009]
Employment change (lag 2)	0.995	[0.990 1.001]
Employment change (lag 3)	0.994*	[0.989 0.999]
Sex: Female (reference = male)	1.060*	[1.007 1.115]
Age	1.006	[0.994 1.018]
Age squared	1.000*	[1.000 1.000]

*p value < 0.05; **p value < 0.01; ***p value < 0.001

Table 2.7: Logistic regression results predicting African American race (relative to white) among publicly insured psychiatric ED visits aged 18-64 years, as a function of monthly percent employment decline shocks lagged by 0 to 3 months (other covariates not shown).

Variables	**Odds ratio**	**95% Confidence Interval**
Employment shock at lag 0	0.996	[0.985 1.007]
Employment shock at lag 1	1.009	[0.995 1.023]
Employment shock at lag 2	0.997	[0.988 1.005]
Employment shock at lag 3	0.987**	[0.978 0.996]
Sex: Female (reference = male)	1.067*	[1.013 1.124]
Age	1.004	[0.992 1.016]
Age squared	1.000*	[1.000 1.000]

*p value < 0.05; **p value < 0.01; ***p value < 0.001

CHAPTER 4: Psychiatric inpatient admissions requested by law enforcement/court orders among African American men during the 2008 recession

Introduction

In the US, persons perceived as dangerous to self, dangerous to others or gravely disabled may be hospitalized for psychiatric treatment against their will (Monahan et al., 1995). Such involuntary psychiatric hospitalizations, also referred to as civil commitments, require clinical assessment and often initiate from community-level reporting of mentally disordered persons to law enforcement and mental health professionals (Faulkner et al., 1986; Ross et al., 1996). Health care practitioners seldom have the means to conduct population-level surveillance of disordered behavior and grave disability. Hence, they rely on the community and law enforcement to identify such individuals for treatment (Catalano et al., 2007a).

However, community-level identification of individuals for involuntary psychiatric hospitalization tends to reflect inherent biases against sub-groups regarded as threatening or disturbing to the well-being of other members (Steadman et al., 2000). During periods of heightened ambient stress, these biases may lead to over-reporting of some members, particularly from minority populations. This phenomenon, ascribed to the 'reduced tolerance' hypothesis, finds support in the literature wherein societies under duress may lower their tolerance of deviant and noisome behavior in general, and of sub-groups traditionally perceived as threatening, in particular (Catalano et al., 1997, 2002, 2007a; Hacker, 2010).

Economic contractions serve as population-level exogenous stressors that plausibly increase the incidence of involuntary psychiatric hospitalizations (Catalano et al., 1997, 2002, 2007a). Unanticipated job loss during economic contractions may provoke frustration and aggressive behavior among those who perceive their layoff as arbitrary or unfair (Berkowitz, 1989; Catalano et al., 1997). Aggressive or violent behavior may increase identification and reporting of such individuals to authorities. Such behavior may increase the risk of involuntary psychiatric

hospitalization if it presents danger to others (Catalano et al., 2002, 2007a). Research finds that during economic decline, persons with a history of aggressive behavior exhibit markedly higher violent behavior relative to others, following job loss (Catalano et al., 1993). This observation indicates plausible endogeneity or reverse causation between economic contraction and involuntary psychiatric hospitalization as individuals with pre-existing underlying behavioral disorders likely lose employment before others, and exhibit more severe psychological reactions to job loss relative to those who do not have a history of aggression (Catalano et al., 1993, 1997). Ecological or aggregate analyses of populations during recessions, rather than individual-level examination of job loss and involuntary psychiatric admissions, reduce the possibility of reverse causation. This inferential threat remains low in ecological studies since involuntary psychiatric admissions do not cause recessions.

Ecological research suggests that during economic downturns, populations may cope with economic uncertainty by moderating their own behavior and regulating their immediate environment (Catalano et al., 2007a). Regulation of immediate environment at the population-level may increase frustration, micro-aggression and risk aversion towards bothersome or 'noisome' individuals, and lower social tolerance of the mentally ill, or of individuals whose behavior departs from the perceived social order (Berkowitz, 1989; Dollard et al., 1939; Blalock, 1967; Blumer, 1958; Kinloch, 1974; Vanneman and Pettigrew, 1972). Regulation of own behavior, on the other hand, may correspond with lower aggression and greater impulse control (Dollard et al., 1939; Catalano et al., 2002). The 'net effect' of these mechanisms depends on the relative contribution and strength, at the population level, of reduced tolerance and self-regulation.

Previous research supports a parabolic relation between economic downturns and involuntary psychiatric admissions (Catalano et al., 1997). Ecological studies show that

involuntary psychiatric admissions increase in the time period (i.e. proximate weeks, months) immediately following ambient macroeconomic contraction plausibly reflecting increased violence and reduced tolerance. Then, these admissions subsequently decline during protracted economic downturns, suggesting increased self-regulating behavior (inhibition effect) in the population (Catalano et al., 2002, 1997, 1993). Empirical tests of overall or 'net effects' find a net increase in involuntary psychiatric hospitalizations following economic contraction, supporting greater aggregate effects of reduced tolerance and increased violence relative to inhibition (Catalano et al., 1993, 1997).

The reduced tolerance hypothesis suggests that reporting of behaviorally disordered individuals partly depends upon social perception of certain groups as threatening or disruptive to social order (Berkowitz, 1989; Dollard et al., 1939; Catalano et al., 2002, 2007a). Research examining this hypothesis finds a pronounced increase in involuntary psychiatric hospitalization following economic downturns among males (Catalano et al., 2007a, 2002; Kessell et al., 2006). This relation presumably arises from (1) societal perception of males as more threatening relative to females, and (2) greater labor market attachment of males relative to females that may elicit a stronger response to labor market contraction (Maccoby and Jacklin, 1978; US Bureau of Labor Statistics, 2012; Hoynes et al., 2012). African American males, in particular, may face a higher risk of social punitive measures, including involuntary psychiatric hospitalizations, owing to stereotypical social perceptions of this group as more threatening relative to other race/ethnicities (Geller, 1982; Wilson et al., 2017; Hacker 2010).

Seminal research presents evidence of reduced tolerance and subsequent aggression towards African Americans in the form of lynching following decline in cotton prices in the late 19th and early 20th century (Hovland and Sears, 1940). In the modern context, reduced tolerance

during economic downturns may correspond with greater social micro-aggressions in that members of the civil society may not overtly aggress against African American males. However, citizens may leverage socially sanctioned mechanisms to report and remove individuals through law enforcement authorities (Catalano et al., 2007a). These aggressions may lead to over-reporting and subsequent involuntary psychiatric hospitalization of African American males despite higher cognitive functioning, relative to other race/ethnicities (e.g. white), following economic downturns (Catalano et al., 2007a).

Relative to involuntary psychiatric hospitalizations initiated by other sources (e.g. family members or mental health professionals), those requested by law enforcement/court orders may specifically indicate reduced tolerance (Kessell et al., 2006). It is plausible that a contracting economy may increase the number of disordered persons (owing to loss of resources, exacerbation of pre-existing conditions and increased stress) who meet the clinical criteria for involuntary psychiatric hospitalization. The relative incidence, however, of such hospitalizations should not be expected vary by source of initiation (i.e., by law enforcement or by psychiatrist) if the incidence of disorder increased uniformly (Kessell et al., 2006). Empirical research does not support this expectation. By contrast, the literature finds an increase in law enforcement-initiated psychiatric hospitalizations among males increase during economic downturns even after controlling for those initiated by mental health providers (Kessel et al., 2006). Researchers attribute this increase to reduced tolerance in the population as these hospitalizations arise from community-level reporting to law enforcement authorities that in turn, may reflect social biases not shared by mental health providers (Kessell et al., 2006).

The research described above does not examine whether involuntary psychiatric hospitalizations requested by law enforcement/court orders vary by race/ethnicity. In addition,

prior work examines only Florida. To my knowledge, there exists no study that examines law enforcement/court order-requested involuntary psychiatric hospitalizations of African American men during economic contractions. I build upon prior work by Catalano et al. (2007a) and Kessell et al. (2006), to test whether population rates of law enforcement/court order-requested involuntary psychiatric hospitalizations among African American men, increase within 0 to 3 months of aggregate macroeconomic decline from 2006 to 2011 across four US states (Arizona, California, New York, North Carolina).

As described in Chapters 1 and 3 in this dissertation, African Americans exhibit differentially greater exposure and vulnerability to economic recessions that may increase psychiatric illness in this population. Exacerbated disorder, in turn, may increase the likelihood of an individual being identified and reported to law enforcement for treatment against his/her will. Thus, it is plausible that the overall population-level incidence of psychiatric admissions may increase among African American males during economic downturns, and a small fraction of these admissions requested by law enforcement/court orders may similarly increase. Hence, I examine whether population rates of all psychiatric hospitalizations not requested by law enforcement/court order among African American men increase following economic downturns (2006 to 2011).

Lastly, I examine trends in psychiatric inpatient admissions in other race/ethnicities and in females to determine whether there exist shared patterns across race/ethnicity or gender that may confound the hypothesized relation. Unlike previous research that examines state-level trends in involuntary psychiatric hospitalizations, I exploit regional heterogeneity in economic contractions and analyze within-county variations in race and gender-specific psychiatric hospitalizations following regional employment decline over a time period that includes the Great Recession of 2008 (Catalano et al., 2007a; Kessell et al., 2006). The present analysis may hold

both theoretical and clinical relevance for understanding the unique vulnerability of African American men during macroeconomic downturns.

Methods

Data and variables

I retrieved data on psychiatric inpatient admissions for select states from the State Inpatient Database (SID). SID provides a near-census of all hospital inpatient admissions for participating states and is made available for purchase by AHRQ under the Healthcare Cost Utilization Project (HCUP) (SID, 2019). SID reports individual admission-level diagnosis (ICD 9 codes) for all inpatients. I include all inpatients with a psychiatric diagnosis for mental illnesses listed within the Clinical Classification Software (CCS) categories (HCUP, 2019a) (Appendix Table A.1). Some states also allow SID to report whether a psychiatric admission was requested by law enforcement/court order (coded under admission source or point of origin) (HCUP, 2019b). Among the states that participated in HCUP SID from 2006 to 2011, California, Arizona, North Carolina and New York report admission source (including law enforcement/court order), race, gender, county identifier and admission month. The most populous state in this study, California, does not provide information on race starting 2012, hence, I restrict my analysis to 2011. These states comprise the study regions in my analysis and yield a total of 13.1 million psychiatric inpatient admissions from 2006 to 2011.

The SID does not directly report whether a psychiatric inpatient admission was voluntary or involuntary. I approximate this status based on whether an admission was requested by law enforcement (or a court order) in keeping with the medico-legal definitions of

voluntary/involuntary status of inpatient psychiatric admissions in the US (Lutterman et al., 2017; Menninger, 2001; Zhang et al., 2015). Two variables in SID, namely *asource* (admission source) and *pointoforigin* (point of origin), directly reported from the Uniform Billing form (UB04)- which is the standard claim form for billing medical and mental health claims- report whether a patient's inpatient admission was requested by a law enforcement authority and/or a court order (HCUP, 2008a, 2008b; CMS, 2019; CMS and DHSS, 2010). Psychiatric inpatient admissions that were transported to the hospital by emergency law enforcement responders do not receive a 'requested by law enforcement/court order' status on the UB04 form and in the SID (CMS and DHSS, 2010). This status, also referred to as a patient's 'legal status' helps identify involuntary versus voluntary admissions as patients voluntarily admitted for psychiatric treatment largely originate from non-law enforcement/court order admission sources or point of origin (e.g. emergency room, another hospital, other health facility, routine etc.) (Lutterman et al., 2017; Menninger, 2001; Zhang et al., 2015; SAMHSA, 2019). Other studies use *asource* and *pointoforigin* variables for examining characteristics of psychiatric inpatient admissions and quality of care in the SID (Mark et al., 2010; Chin et al., 2016). Based on information provided by *asource* and *pointoforigin* variables in the SID, I identified 46,188 law enforcement/court order-initiated involuntary psychiatric inpatient admissions within the 13.1 million 'universe' of all psychiatric admissions. My observed count of 46,188 law enforcement/court order initiated involuntary psychiatric admissions aligns with expected counts reported nationally by the Substance Abuse and Mental Health Services Administration and hospital/facility count in the SID (SAMHSA, 2014; AHRQ, 2014).[2]

[2] SAMHSA (2014) reports a total of 82,914 involuntary psychiatric inpatient admissions across 10,374 psychiatric-related care facilities in 2010 in the US (in SAMHSA, 2014: see Table 1.1, Table 3.1a, Table 3.2a). This yields an average annual number of such admissions per facility = 8. Number of facilities (hospital IDs) reported in my study sample in SID (for AZ, CA, NC, NY) = 884 (AHRQ, 2014). Extrapolating over my study period of 6 years in my sample, crude 6-year estimate of involuntary psychiatric inpatient admissions = 8*884*6 = 42,392.

I excluded all psychiatric inpatient admissions that were missing information for race, sex, month, admission source (or point of origin) and county identifiers (~10% of total observations). My final analytic sample comprised 25,640 county-months (95 counties over 72 months, with four race and sex sub-groups per county-month). Of these, 6,866 county-months reported one or more psychiatric inpatient admissions requested by law enforcement/court order.

Male African American psychiatric inpatients admitted through a request from law enforcement/court order form the main subgroup of interest in my analysis. I aggregated the monthly count of psychiatric inpatient admissions per county over 72 months (January 2006 to December 2011) by race (African American, all other races), sex (male, female) and admission status (requested by law enforcement/court order, all other admission types). I converted the monthly counts of psychiatric admissions to rates per 100,000 population using county-level race and gender population denominators from the US Census Bureau's Population Estimates database (U. S. Census Bureau, 2016). The resulting series of monthly population rates (by race, sex, admission type) form my outcome variable.

I operationalized, as my exposure, the percent change in monthly employment per MSA. Similar to Chapters 2 and 3, I obtained monthly aggregated employment series, per Metropolitan Statistical Area (MSA) within my study states, from the Local Area Unemployment Statistics database made available by the US Bureau of Labor Statistics (BLS, 2019a). I merged MSA-level data to SID counties using MSA-to-county crosswalk made available by the National Bureau of Economic Research (NBER, 2018). My final analytic sample comprised 46 MSAs (spanning 95 counties in four states) over 72 months (2006-2011).

Analysis

I hypothesize that the incidence of psychiatric inpatient admissions requested by law enforcement/court order increases among African American men, but not among other race/gender groups, in the months immediately following a decline in percent monthly employment change. Additionally, I also examine whether monthly employment decline precedes changes in non-law enforcement/court order-requested inpatient psychiatric admissions among African American men and other race/ethnicity and sex groups, wherein I expect a null relation (based on analytic results from Chapter 3, Table 2.2, Model A). I estimate the following linear regression:

$$\boldsymbol{Y_{r,s,p,c,m,t} = \beta_0 + \sum_{n=1}^{4} \beta_n X_{a,(m-n+1),t} + \beta' County_c + \beta' Month_m + \beta' Year_t + \beta' State_z * L + \varepsilon_{r,s,p,c,m,t}}$$

(Equation 3)

where:

$\boldsymbol{Y_{r,s,p,c,m,t}}$ is the population rate of psychiatric inpatient admission for race *r* (African American, non-African American), sex *s* (male, female), by psychiatric admission type *p* (law enforcement/court order-requested, all others) in county *c* during month *m* in year *t*.

$\boldsymbol{\sum_{n=1}^{4} X_{a,(m-n+1),t}}$ is the set of exposures representing percent monthly employment change *X* in MSA *a*, month *m* (lag 0), *m-1* (lag 1), *m-2* (lag 2) and *m-3* (lag 3) in year *t*.

$\boldsymbol{\beta_n}$ are the coefficients of interest indicating the relation between *Y* and 0 to 3 monthly lags of *X*.

$\boldsymbol{County_c}$ is the vector of county-specific fixed effects (indicator variables). County fixed effects enable within-county identification and reduce confounding by unobserved county-specific, time invariant factors.

$\boldsymbol{Month_m}$ is the vector of month indicators that control for seasonality in psychiatric inpatient admissions.

$\boldsymbol{Year_t}$ is the vector of year indicators to account for year-specific perturbations in psychiatric inpatient admissions that may arise from policy changes or other factors that affect all study regions.

$\boldsymbol{\beta' State_z * L}$ is the vector of state-specific (*z*) linear time trends (*L*) that accounts for unobserved factors that may correlate with psychiatric inpatient admissions and are trending linearly over the study period of 72 months (2006-2011).

$\boldsymbol{\varepsilon_{r,s,p,c,m,t}}$ is the standard error term clustered at the MSA level to account non-independence of residuals among county-months within an MSA.

I estimate separate regressions per admission type (requested by law enforcement/court order, all other psychiatric admissions), by race (African American, non-African American) and sex (male, female). In alignment with prior work, I contend that absent an increase in non-law enforcement/court order-requested psychiatric inpatient admissions, any observed rise in law enforcement-requested involuntary admissions among African American men following ambient macroeconomic decline would offer partial support for the reduced tolerance hypothesis (Kessell et al., 2006). For tests that reject the null, I estimate the predicted counts of inpatient psychiatric admissions with incremental change in exposure. I use Stata's 'margins' command to compute and graph average marginal predicted counts of psychiatric inpatient admissions (per unit increase in exposure) for race/sex groups and admission types that reject the null (StataCorp, 2015a). I conduct all analyses in Stata SE (version14.2) (StataCorp, 2015b).

I utilize three robustness checks to determine whether any observed relations in the hypothesis tests described above arise from correlated residual errors. I obtain regression residuals for tests that reject the null and conduct (1) Wooldridge test for autocorrelation in residuals (Wooldridge, 2002; Drukker, 2003) (2) Arellano-Bond test for autocorrelation in residuals (Arellano and Bond, 1991) and (3) re-estimation of equation 3 including a time propensity covariate derived from higher order autocorrelation-adjusted residuals using Box-Jenkins ARIMA methods (Box et al., 2015; Catalano et al., 2007b).

Results

Table 3.1 shows describes psychiatric inpatient admissions and percent monthly employment change in my study sample. Psychiatric inpatient admissions requested by law enforcement/court order are greatest among African American males followed by African American females. The same is true for psychiatric inpatient admissions *not* requested by law enforcement/court orders although the magnitude of these admission types are starkly different from the former owing to the rare nature of law enforcement-initiated admissions. Mean value of the exposure- percent monthly employment change- is negative indicating a period of average employment decline.

Temporal (monthly) trends in law enforcement/court order-requested psychiatric inpatient admissions show substantially higher rates among African American males relative to all other groups (Figure 3.1). Among psychiatric hospitalizations that are *not* requested by law enforcement/court order, African Americans exhibit higher rates than non-African Americans but males and females (within African Americans) show similar admission rates over time (Figure 3.2). Figure 3.3 shows the frequency distribution of psychiatric inpatient admissions (per 100,000

population) in my sample. The highly skewed nature of this distribution motivates log-transformation. Hence, I use the natural logarithm of the outcome for linear regression analysis. Figure 3.4 graphs the average monthly change in MSA-level employment across the 46 MSAs included in this study. Here, negative values indicate employment decline and positive values show aggregate increase in employment (relative to previous month).

Table 3.2 presents the results from linear fixed effects regression analysis of (log transformed) psychiatric inpatient admissions requested by law enforcement/court order as a function of percent monthly employment change (lag 0 to 3). Decline in percent employment change lagged by 1 month precedes an increase in psychiatric hospitalizations requested by law enforcement/court order among African American males but not among other race/sex groups. Here, a one unit decline in percent monthly employment corresponds with 0.03 unit increase in (log-transformed) psychiatric admissions (Table 3.2, Model a). Put another way, law enforcement/court order-requested psychiatric inpatient admission (per 100,000 population) among African American males increase by 3 percent, following a one percent decline in exposure.

Among psychiatric admissions that were not requested by law enforcement/court order, I fail to reject the null for all race and sex groups at all exposure lags (Table 3.3). Taken together, results from Tables 3.2 and 3.3 support the reduced tolerance hypothesis. Firstly, no other race/sex groups show an increase in psychiatric admissions requested by law enforcement/court order following exposure, except for African American males. This observation indicates that trends in law enforcement/court ordered psychiatric inpatient admissions among African American men are unique to this group, and may not arise from a common increase (or decrease) in admission rates for other race/sex groups within this admission type. Secondly, if there was a general increase in psychiatric admissions among African American males following aggregate employment decline,

Tables 3.2 and 3.3 (Model a in both) would have shown qualitatively similar results. However, the absence of any relation between outcome and exposure(s) among non-law enforcement/court ordered admissions indicates that results in Table 3.2 (Model a) presumably arise specifically from increase in African American males being involuntarily hospitalized through law enforcement/court order requests.

As a sensitivity check for shared trends between the two admission types, I replicate the analyses from Table 3.2 and include non-law enforcement/court ordered psychiatric admissions as a covariate (Table 3.4). Inference from results presented in Table 3.4 remains unchanged relative to Table 3.2 and non-law enforcement/court ordered psychiatric admissions do not show any relation to the outcome (admissions requested by law enforcement/court order). Figure 3.1 shows slightly higher values of law enforcement/court order-requested psychiatric inpatient admissions starting May, 2011. I conduct a second sensitivity by re-estimating equation 3 for African American males, excluding year 2011, to gauge whether higher values of the outcome in 2011 do not influence inference. Regression results in Table 3.5 shows that exclusion of year 2011 does not affect original inference from Table 3.2.

Robustness checks indicate absence of first-order autocorrelation in residuals based on results from (i) Wooldridge test for serial correlation in Table 3.6 (Drukker, 2003; Wooldridge, 2002) and (ii) from Arellano-Bond test using lagged values of residuals as predictors of residual series (Tables 3.7a, 3.7b) (Arellano and Bond, 1991). As the final robustness check, I use Box-Jenkin's iterative Autoregressive Integrated Moving Average (ARIMA) method to identify and remove higher order autocorrelations (of lags at months 1, 2, and 3) from regression residuals (obtained from Table 3.2, Model a) and use this 'de-trended' series as a covariate to re-estimate equation 3 (Box et al., 2015). This method, also called 'time propensity correction,' controls for

higher order seasonality in the outcome variable (Catalano et al., 2007b). Results from this estimation show qualitatively similar inference relative to the original analyses (Table 3.2, Model a). Whereas coefficient size at exposure lag 1 remains consistent, the strength of statistical detection declines marginally (as standard errors increase in magnitude) and model fit (indicated by R^2) increases by nearly two-fold (Table 3.8).

Based on the distribution of my outcome variable, the model selection and analytic approach for this Chapter derived from two main factors: (a) excess number of county-months with zero psychiatric inpatient admissions requested by law enforcement/court order (as seen in Figure 3.5), and (b) selection of an analytic approach that could apply uniformly to all the groups analyzed in this Chapter, including psychiatric admissions *not* requested by law enforcement/court orders (for comparability of results across models). Given the rare nature of psychiatric inpatient admissions requested by law enforcement/court order, using count data estimation methods such as fixed effects negative binomial regression may serve as a useful alternative to linear regression. However, when applied to my data, negative binomial models (with county fixed effects) failed to achieve statistical convergence. I examined potential causes of non-convergence and observed that several counties in my sample had very low African American population. This attribute led to infeasible starting values for iterative parameter estimation when using race and sex-specific population counts as the offset in negative binomial specification. I incrementally tested population thresholds and observed that fixed effects negative binomial models predicting counts of psychiatric inpatient admissions requested by law enforcement/court orders among African American males started converging when restricted to counties with at least 5% African American population. I observed a similar pattern when examining counts of non-law enforcement/court order requested psychiatric inpatient admissions (i.e. non-convergence of negative binomial model

unless restricted to counties with > 5% African American population) as well. Table 3.9 shows the results of restricted fixed effects negative binomial regression analysis among African American males wherein the relative risk (IRR or Incidence Rate Ratio) of a psychiatric inpatient admission requested by law enforcement/court order increases by 8% with a unit decline in aggregate employment one month prior. Whereas these results align qualitatively with my original inference, zero inflation (i.e. excess zeros) and conditionality of model convergence on subjectively determined population thresholds make fixed effects negative binomial models less appropriate for my analyses relative to linear fixed effects regression approach.

To give the reader a sense of the magnitude of psychiatric admissions requested by law enforcement/court orders statistically attributable to decline in exposure, I estimated the predicted counts of admissions in this group using Stata's *margins* routine (StataCorp, 2015a). Using covariate specification identical to Equation 3 (excluding county fixed effects), I fit a zero-inflated negative binomial model to the raw counts of psychiatric admissions requested by law enforcement/court order among African American males. I chose this approach as the count distribution of the outcome showed high dispersion and excessive zeroes due to several counties with very low African American populations (Figure 3.5). Zero inflated negative binomial regression models are widely utilized in mental health research to model rare count outcomes with excessive zeroes (Elhai et al., 2008, 2006; Goldman-Mellor et al., 2014). I did not include county fixed effects in this estimation as inclusion of county indicators led to non-convergence of the model.

Figure 3.6 shows the predicted counts of psychiatric admissions requested by law enforcement/court orders among African American males versus non-African American males per unit increase in monthly percent employment change (lag 1). I applied the average increase in

predicted count (=0.3, per unit decline in percent employment) to the mean count of psychiatric admissions requested by law enforcement/court orders among African American males (=4.2) over county-months (that report these admissions among African American males) with negative employment change (=790). This exercise yields, for the state-years analyzed, an additional 995 admissions (=4.2*790*0.3) among African American males statistically attributable to aggregate employment decline.

Discussion

Social groups undergoing exogenous shocks such as economic downturns may exhibit reduced tolerance of deviant behavior (Berkowitz, 1989; Catalano et al., 2007a). This reduction in tolerance may, following macroeconomic contraction, manifest as greater reporting of mentally disordered African American males to authorities for involuntary hospitalization. African American males may be perceived as threats to social well-being to a greater extent than females and other racial/ethnic groups (Hacker, 2010). I examined this relation for four US states over a 72 month period that includes the recent 2008 recession (2006-2011). I find that psychiatric inpatient admissions requested by law enforcement/court orders increase among African American males (but not in other groups) one month following aggregate employment decline in a Metropolitan Statistical Area. Additional sensitivity tests also show that this increase does not extend to non-law enforcement/court ordered psychiatric admissions in African American men. Application of predicted counts of these admissions (per county-month) yields an excess of 995 hospitalizations statistically attributable to decline in monthly percentage employment in my sample.

Key strengths of this study include its longitudinal design using monthly resolution and examination of multiple geographies in the US. Prior studies that motivated the present research are restricted to small areas (or single states) and predate the 2008 recession (Catalano et al., 2007a; Kessell et al., 2006). My analysis supports external validity to prior research on reduced tolerance during economic downturns. I utilize datasets that capture nearly all psychiatric inpatient admissions on a monthly basis for four US states (Arizona, California, North Carolina, New York) and report whether these admissions were requested by law enforcement/court orders in a uniformly coded manner. As a measure of economic downturns, I use MSA-level aggregate monthly percent employment decline as the exposure, which models monthly macroeconomic 'shocks' and has been used in similar research (Bruckner, 2008a). I estimate relations between the outcome and exposure for brief time lags (0 to 3 months) which establishes temporal order such that the exposure precedes the outcome, and rules out confounding from long-run sequelae of economic downturns. I also control for inherent spatial and temporal attributes that may correspond with trends in psychiatric admissions using county, month and year fixed effects, and state-specific linear time trends. Multiple sensitivity checks of potential violations of i.i.d. assumption in regression approaches further support the internal validity of results.

Limitations include that I do not distinguish between (i) danger to others from danger to self and grave disability within psychiatric admissions requested by law-enforcement/court orders, and (ii) other types of involuntary psychiatric admissions, such as those requested by mental health professionals. This circumstance stems from the data limitation that SID does not report reason for admission and whether an involuntary psychiatric admission was requested by other (non-law enforcement/court order) authorities or family members. However, this delineation may not be strictly necessary for testing the reduced tolerance hypothesis as prior studies emphasize

psychiatric admissions requested by law enforcement/court orders to gauge social tolerance (Kessell, 2006). Lastly, psychiatric inpatient admissions may concentrate in areas that have psychiatric facilities, and thus, the distribution of my outcome variable may not arise solely from concentrated "demand", but also be partly driven by "supply" of psychiatric beds and inpatient facilities. In my sample, the highest number of psychiatric inpatient admissions occur in Napa (CA), New York (NY) and Orange (NC) counties- all of which possess large psychiatric inpatient facilities. The distribution and variance of my outcome variable (psychiatric inpatient admissions) may thus differ qualitatively from involuntary psychiatric holds (that commonly occur in EDs or other settings), during economic downturns.

Involuntary psychiatric admissions differ from involuntary psychiatric holds (or examinations) in a clinically meaningful aspect: the decision to hospitalize or admit a patient is made after a physician's evaluation of illness severity and medical necessity (Hedman et al., 2016). Involuntary psychiatric holds, on the other hand, may occur before a physician's evaluation, based on perceived, rather than clinically determined need for treatment (Hedman et al., 2016). Involuntary psychiatric admissions (such as those requested by law enforcement/court orders) may thus reflect the 'right tail' of illness severity distribution in the population. Severely disordered individuals admitted involuntarily as psychiatric inpatients following economic contractions may have required medical attention during non-recession periods as well, but were identified at a higher frequency during economic contraction. This mechanism would support the uncovering hypothesis (economic recessions exacerbate pre-existing conditions) as opposed to provocation (i.e. development of new disorders following economic downturns) (Catalano and Dooley, 1979). Future studies may incorporate patient psychiatric history to examine whether macroeconomic

downturns correspond with ‘uncovered’ or ‘provoked’ cases among psychiatric admissions requested by law enforcement/court orders.

Economic downturns may limit the ability of low-income groups to care for ailing family members and force families to present a disordered member to the authorities for involuntary commitment (Catalano et al., 2007a). In such circumstance, families’ decision to report their relative to law enforcement *vis-à-vis* mental health personnel may depend on deferred cost as well as disability or willingness of the individual to seek treatment. Future research may extend the present study by combining empirical analysis with qualitative methods to examine the potential role of familial motivations for approaching authorities for involuntary hospitalization of a family member.

Because the social ‘threshold’ of disordered behavior appears to vary inversely with the level of ambient economic distress, individuals reported to authorities for disturbing behavior during such times may have lower severity of mental illness and greater cognitive functioning than in non-recession periods. Indeed, scholars examining this mechanism find that while the incidence of African American males involuntarily admitted for psychiatric treatment increases during economic downturns, these individuals exhibit greater cognitive functioning relative to those committed during economic prosperity and other race/ethnicities (Catalano et al., 2007a). Whereas the SID does not report cognitive functioning scores, future research may incorporate similar measures of illness severity to examine whether the 2008 recession period also corresponds with greater functioning (or lower severity of psychiatric disability) among involuntarily admitted African American males.

A plausible rival to my inference from the analyses presented in this study may arise from increased criminal activity during recessions that may put mentally disordered individuals in

greater contact with law enforcement. I do not believe my results arise from this rival because (1) extensive research shows that crime declined over my study period and during the 2008 recession (Rosenfeld, 2014; Lauristen et al., 2014; Wolff et al., 2014; Finkelhor et al., 2014), (2) crime, arrest and incarceration rates do not explain why African American men would selectively exhibit greater involuntary psychiatric inpatient admissions requested by law enforcement/court orders, and (3) the reduced tolerance hypothesis motivates a relatively more parsimonious explanation of my findings relative to the crime and incarceration argument (Catalano et al., 2007a).

The nature of my analytic results, in combination with those from prior research, underscores the lack of mental health care access among African Americans (Snowden, 2001). This group exhibits lower access to primary mental health care services and relies extensively on emergency departments for psychiatric care owing to lack of insurance, greater stigma, discrimination within the health care system, low quality of treatment and higher likelihood of misdiagnosis (Snowden et al., 2009, 2011). These barriers are more pronounced for African American men who tend to exhibit lower psychiatric help-seeking relative to African American women during recessions (Chen and Dagher, 2016). These systemic 'gaps' and unmet needs in mental health care may expand during economic downturns when public health agencies face funding shortages and may be forced to reduce supply. Expansion of primary care, through increased supply (e.g. through Federally Qualified Health Centers) and greater access (through insurance coverage expansion under the Affordable Care Act), may reduce these long-standing disparities in mental health care and plausibly lower the incidence of involuntary psychiatric hospitalizations among African Americans (Bruckner et al., 2019; Bruckner et al., 2020; Chen et al., 2016).

Apart from economic downturns, other types of ambient shocks associated with violence or hostility may also reduce societal tolerance towards the mentally ill. Research finds that in Florida, law enforcement-initiated involuntary psychiatric examinations increased in the weeks immediately following the 9/11 terrorist attacks, (Catalano et al., 2005). It is plausible that such exogenous shocks, that either increase social fear or promote targeting of ethnic minorities, may reduce social tolerance and correspond with higher involuntary psychiatric admissions of the targeted groups. For instance, research examining population responses to the 2016 US elections finds an increase in internet searches for mental health-related terms and reports of increased stress among immigrant communities, racial/ethnic minorities during this period (Williams and Medlock, 2017; Krupenkin et al., 2019). I encourage future research to examine whether involuntary psychiatric holds and admissions requested by law enforcement/court orders also increased following this or similar exposures.

Tables & Figures

Table 3.1: Descriptive statistics of psychiatric inpatient admissions by race, sex and type (requested by law enforcement/court order, not requested by law enforcement/court order) and percent monthly employment change across 95 counties (within 46 MSAs, AZ, CA, NC, NY) over 72 months (2006-2011)

Variables	Mean	SD	Range (min)	Range (max)
Psychiatric inpatient admissions (counts) requested by law enforcement/court order per county-month among:				
African American males	7,076			
African American females	3,032			
Non-African American race/ethnicity males	23,830			
Non-African American race ethnicity females	12,250			
Psychiatric inpatient admissions (per 100,000 population) requested by law enforcement/court order per county-month among:				
African American males	7.03	2.92	2.18	15.22
African American females	2.18	1.59	0.54	9.95
Non-African American race/ethnicity males	1.35	0.96	0.39	6.56
Non-African American race ethnicity females	0.80	0.97	0.16	5.92
Psychiatric inpatient admissions (per 100,000 population) not requested by law enforcement/court order per county-month among:				
African American males	416.64	37.87	350.96	528.77
African American females	403.82	38.70	319.48	501.49
Non-African American race/ethnicity males	262.63	19.30	224.64	301.92
Non-African American race ethnicity females	286.88	20.96	241.15	328.59
Percent monthly employment change per MSA-month	-0.02	1.26	-10.18	10.45

Figure 3.1: Average county-level psychiatric inpatient admissions (per 100,000 population) per month requested by law enforcement/court order by race (African American, non-African American) and sex (male, female), across 46 MSAs (AZ, CA, NC, NY), 2006-2011

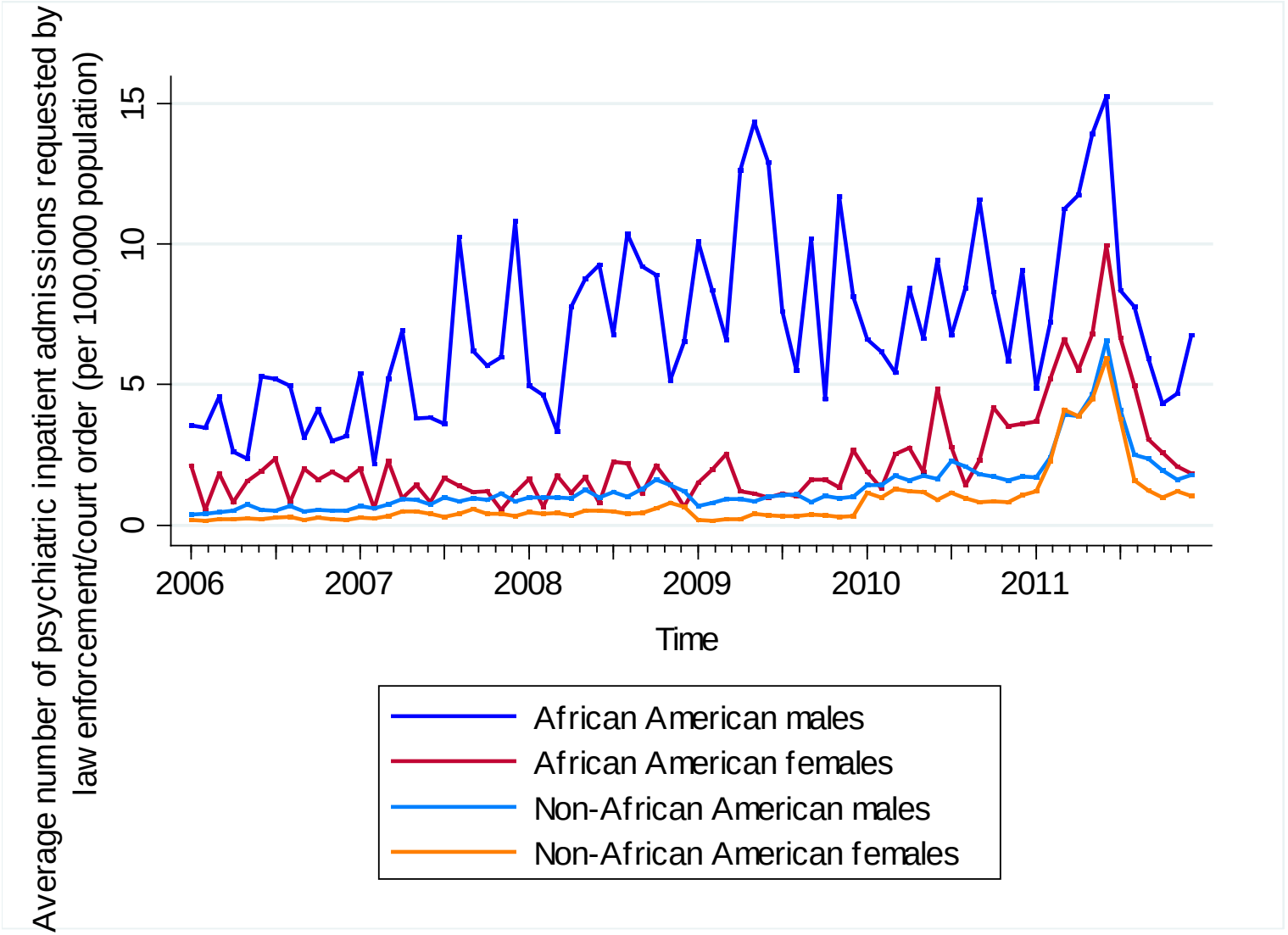


Figure 3.2: Monthly trends in average county-level psychiatric inpatient admissions (per 100,000 population) *not* requested by law enforcement/court order in study sample by race (African American, non-African American) and sex (male, female), 2006-2011

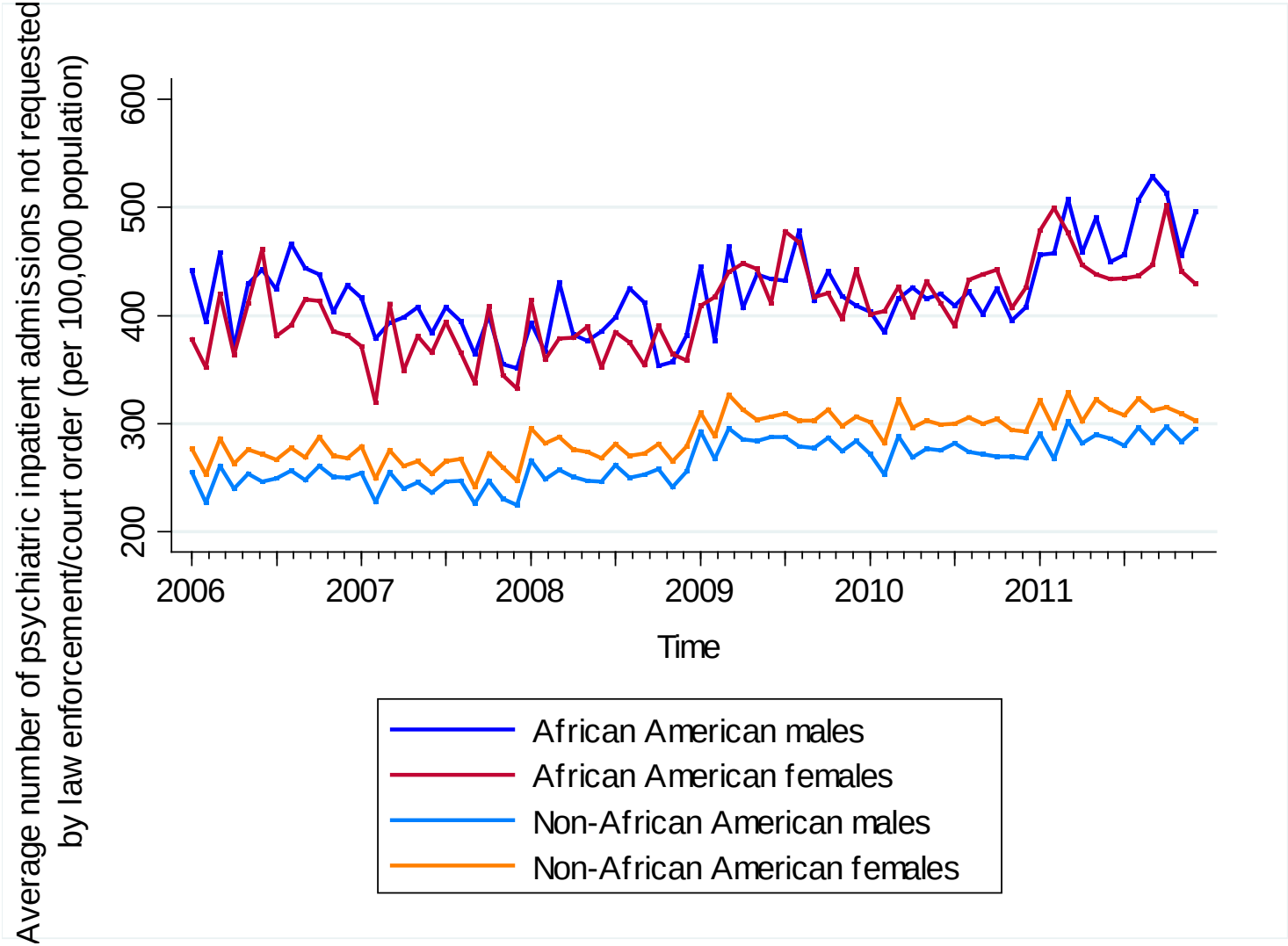


Figure 3.3: Frequency distribution of psychiatric inpatient admissions (per 100,000 population, per county-month) in 95 counties (4 states), 2006-2011. High outlier counties with psychiatric inpatient admissions (per 100,000 population) > 500 include Napa (CA), New York (NY) and Orange (NC).

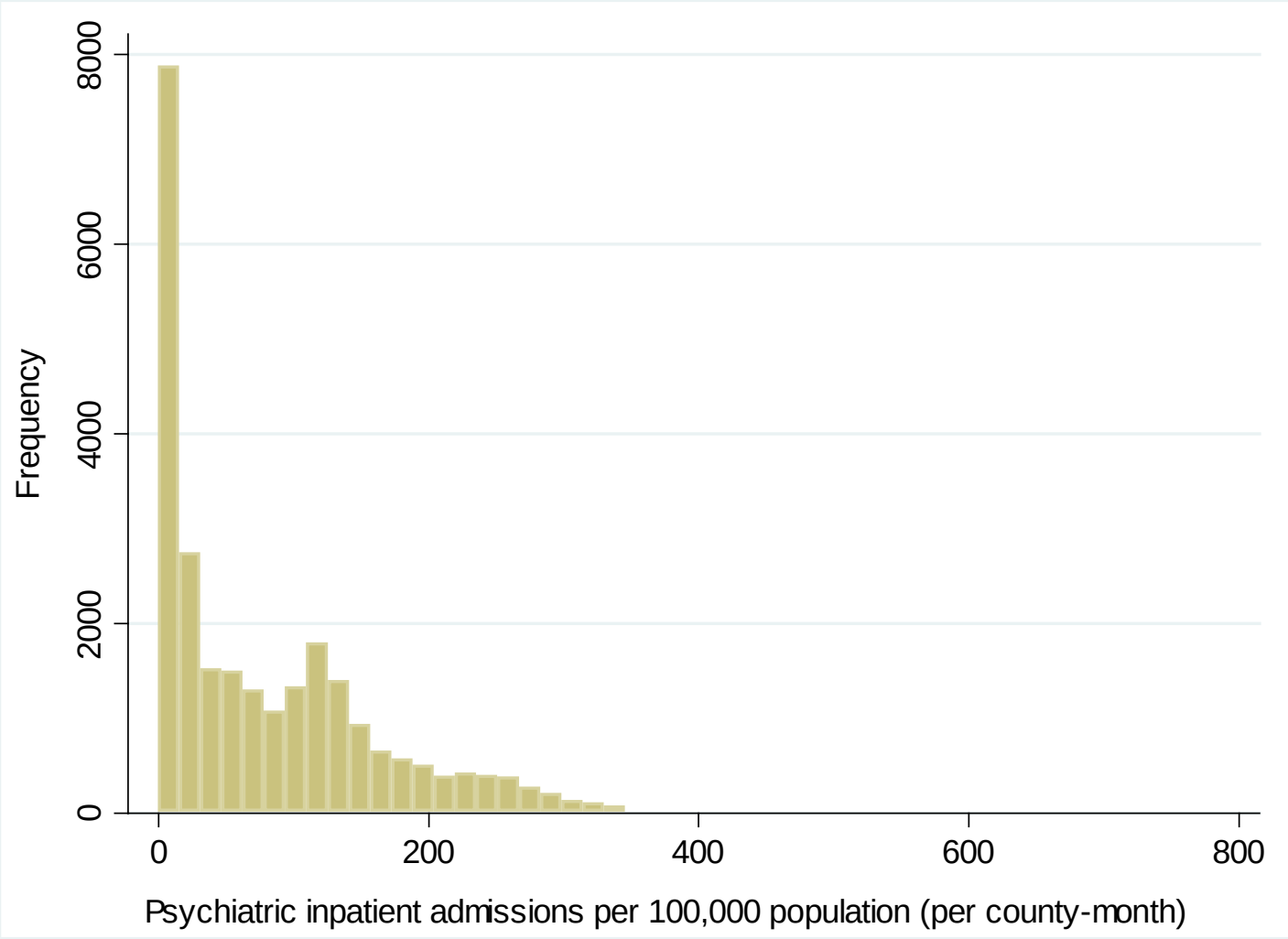


Figure 3.4: Average monthly percent employment change across 46 MSAs (AZ, CA, NC, NY), 2006-2011

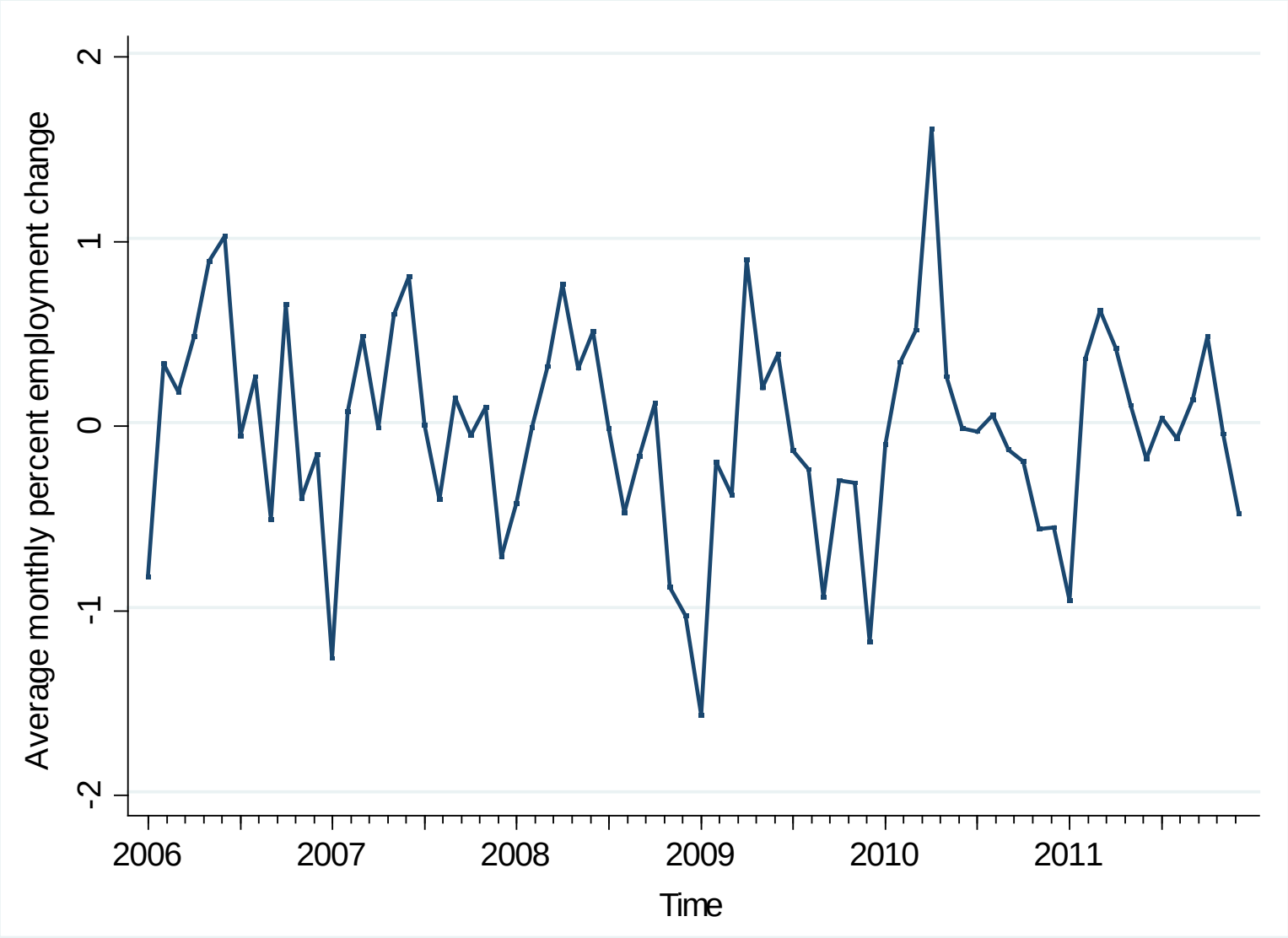


Table 3.2: Linear fixed effects regression results predicting (log transformed) psychiatric inpatient admissions (per 100,000 population) requested by law enforcement/court order as a function of percent monthly employment change (0 to 3 month lags) (other covariates not shown)

	African American				Non-African American			
Exposure	Model a: Males		Model b: Females		Model c: Males		Model d: Females	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Percent monthly employment change Lag 0	-0.03	0.02	-0.01	0.01	-0.01	0.01	7.8e-4	0.01
Percent monthly employment change Lag 1	-0.03*	0.01	0.01	0.01	-0.01	0.01	0.01	0.02
Percent monthly employment change Lag2	0.01	0.01	2.2e-3	0.01	3.0e-3	0.01	0.01	0.02
Percent monthly employment change Lag 3	3.6e-3	0.01	0.02	0.01	9.5e-4	0.01	0.01	0.01
Sample size (county-months)	1,645		949		2,536		1,736	
R^2 (within county)	0.08		0.09		0.10		0.09	

*p value < 0.05, **p value < 0.01, ***p value < 0.001

Table 3.3: Linear fixed effects regression results predicting (log transformed) psychiatric inpatient admissions (per 100,000 population) *not* requested by law enforcement/court order as a function of percent monthly employment change (0 to 3 month lags) (other covariates not shown), by race and sex

	African American				Non-African American			
Exposure	Model a: Males		Model b: Females		Model a: Males		Model b: Females	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Percent monthly employment change Lag 0	0.01	0.01	-0.01	0.01	1.9e-3	2.2e-3	1.4e-3	2.2e-3
Percent monthly employment change Lag 1	0.01	4.1e-3	3.9e-3	4.0e-3	1.0e-3	1.3e-3	6.5e-4	1.8e-3
Percent monthly employment change Lag2	3.4e-3	0.01	0.01	0.01	2.9e-3	2.1e-3	1.1e-3	1.8e-3
Percent monthly employment change Lag 3	1.0e-3	0.01	-0.01	4.3e-3	1.5e-3	2.1e-3	2.1e-4	2.2e-3
Sample size (county-months)	6,052		5,949		6,801		6,828	
R^2 (within county)	0.07		0.07		0.10		0.08	

*p value < 0.05, **p value < 0.01, ***p value < 0.001

Table 3.4: Linear fixed effects regression results predicting (log transformed) psychiatric inpatient admissions (per 100,000 population) requested by law enforcement/court order as a function of (1) percent monthly employment change (0 to 3 month lags) and (2) non-law enforcement/court ordered psychiatric admissions per 100,000 population, (other covariates not shown), by race and sex

	African American				Non-African American			
Exposure	Model a: Males		Model b: Females		Model a: Males		Model b: Females	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Percent monthly employment change Lag 0	-0.02	0.02	-0.01	0.01	-0.01	0.01	0.01	0.01
Percent monthly employment change Lag 1	-0.03*	0.01	1.8e-3	0.01	-0.01	0.01	0.01	0.02
Percent monthly employment change Lag2	0.01	0.01	2.1e-3	0.01	3.4e-3	0.01	0.01	0.02
Percent monthly employment change Lag 3	4.0e-3	0.01	0.03	0.01	1.0e-3	0.01	0.01	0.02
Non-law enforcement/court ordered psychiatric admissions (per 100,000 population)	-0.15	0.21	-0.18	0.15	0.07	0.29	-0.37	0.32
Sample size (county-months)	1,645		949		2,536		1,736	
R^2 (within county)	0.08		0.09		0.10		0.10	

*p value < 0.05, **p value < 0.01, ***p value < 0.001

Table 3.5: Linear fixed effects regression results predicting (log transformed) psychiatric inpatient admissions (per 100,000 population) requested by law enforcement/court order as a function of percent monthly employment change (0 to 3 month lags) (other covariates not shown), by race and sex for 2006 to 2010 (**2011 excluded**)

	African American				Non-African American			
Exposure	Model a: Males		Model b: Females		Model a: Males		Model b: Females	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Percent monthly employment change Lag 0	-0.02	0.02	1.6e-3	0.01	-0.01	0.01	0.01	0.01
Percent monthly employment change Lag 1	-0.04*	0.01	2.3e-3	0.01	1.5e-3	0.01	0.01	0.02
Percent monthly employment change Lag2	0.01	0.01	3.2e-3	0.01	1.0e-3	0.01	0.01	0.02
Percent monthly employment change Lag 3	3.2e-3	0.01	0.02	0.01	0.01	0.01	0.01	0.01
Sample size (county-months)	1,378		784		2,111		1,444	
R^2 (within county)	0.08		0.07		0.08		0.06	

*p value < 0.05, **p value < 0.01, ***p value < 0.001

Table 3.6: Results of Wooldridge test examining serial correlation in regression residuals obtained from Table 3.2 (Model a). H_0= null hypothesis.

Wooldridge test for autocorrelation in panel data (Stata command: *xtserial*[3])	
H_0: no first order autocorrelation	
F(1, 42) =	2.276
Prob > F =	0.1389

Table 3.7(a): Results of Arellano-bond linear dynamic panel-data estimation predicting residuals (obtained from Table 3.2, Model a) as a function of lag 1, 2 and 3 of (the same) residuals. (Stata command: *xtabond, twostep robust*[4]).

	Coef.	SE
Residuals Lag1	-0.03	0.14
Residuals Lag 2	-0.09	0.13
Residuals Lag 3	-0.02	0.08

Table 3.7(b): Post-estimation Arellano-Bond test results (following dynamic panel-data estimation shown in Table 3.7(a)) examining serial correlation in regression residuals. H_0: null hypothesis. (*Stata command: estat abond*[3]).

Arellano-Bond test for zero autocorrelation in first-differenced errors		
H_0: no autocorrelation		
Order	z	Prob > z
1	-3.41	0.006*
2	0.85	0.40

*When errors are independently and identically distributed (i.i.d), the first-differenced errors are first-order serially correlated (Order 1) but not correlated for higher orders (Order 2).[3] Results in Table 3.7(b) indicate absence of serial correlation in first-differenced errors at order 2.

[3] Drukker, D. M. (2003). Testing for serial correlation in linear panel-data models. The Stata Journal (3)2, 168-77.
[4] Stata Manuals. (2013). xtabond. Arellano-Bond linear dynamic panel data estimation. Available at: https://www.stata.com/manuals13/xtxtabond.pdf

Table 3.8: Linear fixed effects regression results predicting (log transformed) psychiatric inpatient admissions (per 100,000 population) requested by law enforcement/court order as a function of percent monthly employment change (0 to 3 month lags) and ARIMA-derived residual time propensity (other covariates not shown), among African American males (2006 to 2011).

	Coeff.	SE
Percent monthly employment change Lag 0	-0.02	0.01
Percent monthly employment change Lag 1	-0.03*	0.01
Percent monthly employment change Lag2	0.01	0.01
Percent monthly employment change Lag 3	3.0e-3	0.01
Residual time propensity	1.25****	0.22
Sample size (county-months)	1,645	
R^2 (within county)	0.15	

*p value < 0.1, **p value < 0.05, ***p value < 0.01, ****p value < 0.001

Table 3.9: Negative binomial fixed effects regression analysis predicting Incidence Rate Ratio (IRR) of psychiatric inpatient admissions requested by law enforcement/court order (counts) as a function of percent monthly employment change (0 to 3 month lags) (other covariates not shown) among African American males in counties with at least 5% African American population (2006 to 2011).

	IRR (Incidence Rate Ratio)	95% Confidence Interval
Percent monthly employment change Lag 0	0.94*	[0.89 0.99]
Percent monthly employment change Lag 1	0.92**	[0.87 0.97]
Percent monthly employment change Lag2	0.99	[0.95 1.05]
Percent monthly employment change Lag 3	1.01	[0.96 1.07]
Sample size (county-months)	3,152	

*p value < 0.05, **p value < 0.01, ***p value < 0.001

Figure 3.5: Frequency distribution of raw counts (per county-month) of psychiatric inpatient admissions requested by law enforcement/court order in study sample (95 counties in AZ, CA, NC, NY, 72 months)

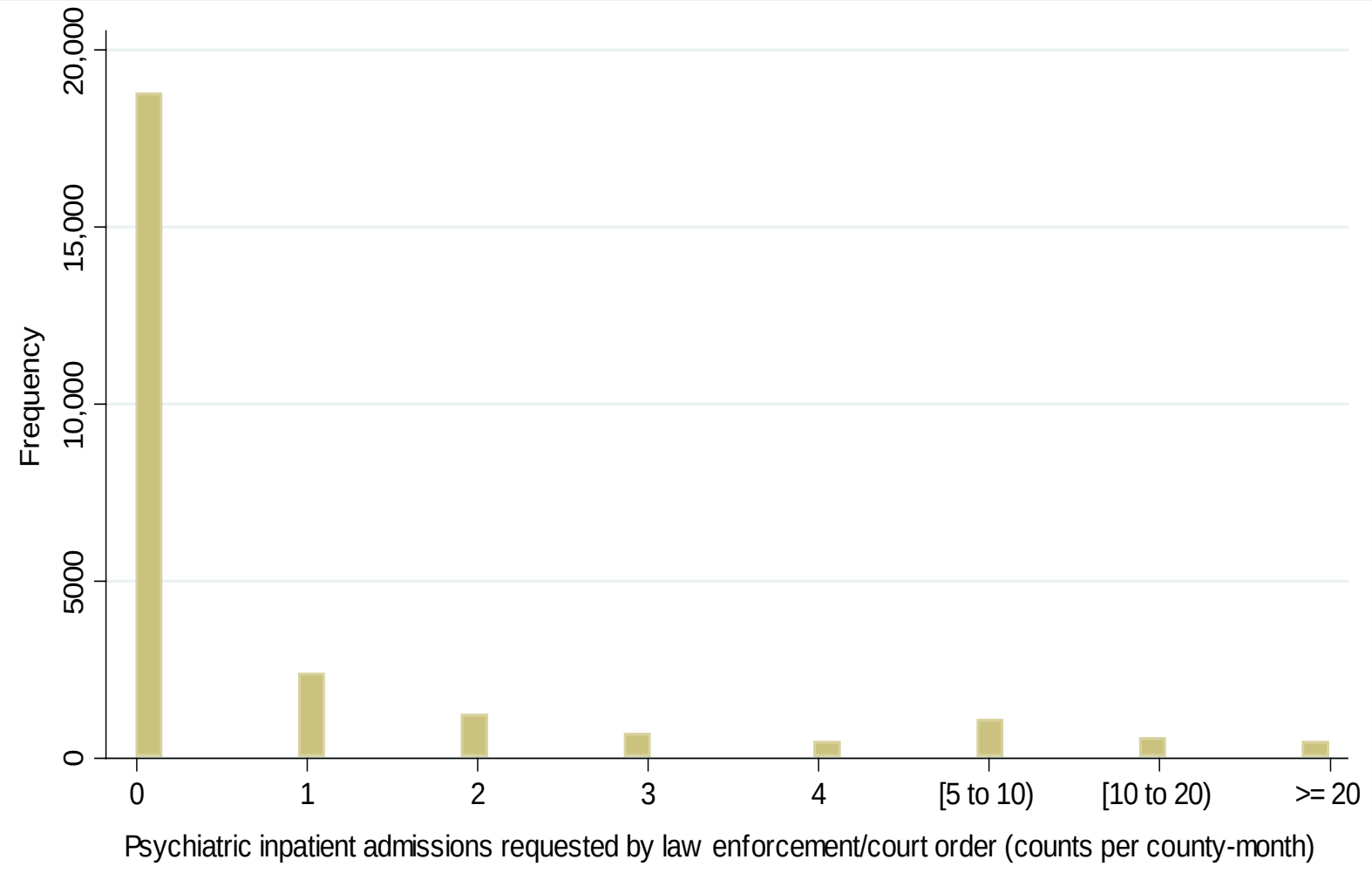
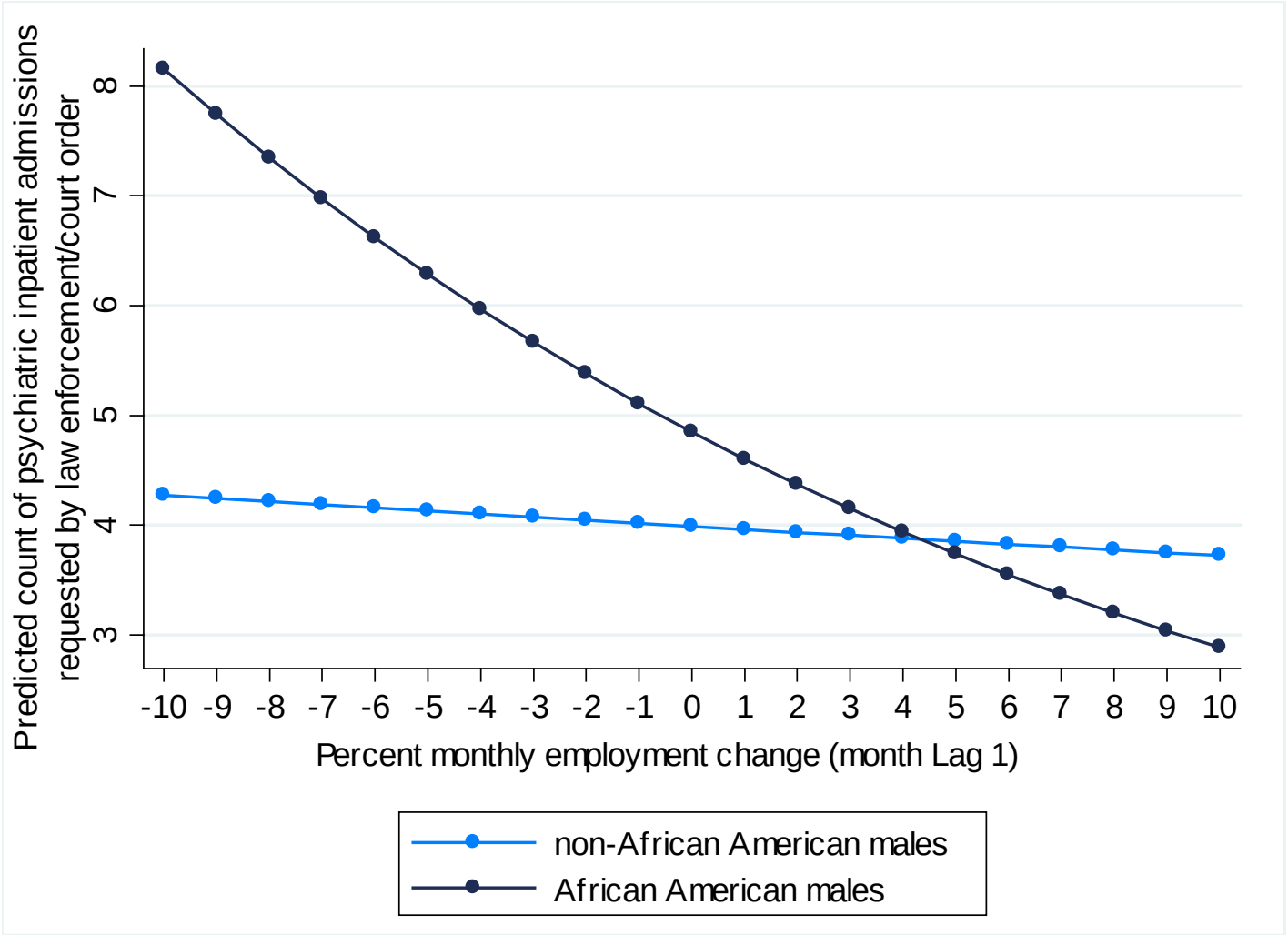


Figure 3.6: Predicted counts of psychiatric inpatient admissions requested by law enforcement/court order among African American and non-African American males per unit increment in percent monthly employment change (lag 1). Predicted counts shown represent average marginal effects estimated from zero-inflated negative binomial regression analysis.



CONCLUSION

Economic recessions are widely regarded as exogenous, ambient exposures that may correspond with changes in psychiatric outcomes in the population. The extant literature examining the relation between mental health and macroeconomic decline reports countervailing findings with population-level ecological studies reporting improved mental health outcomes, particularly for alcohol and substance use, while the majority of individual-level studies report worsening of mental health symptoms with economic decline. Research on differential impact of economic downturns on mental health among African Americans, who face disproportionately higher risk of employment loss and increased strain on limited resources during recessions, remains scarce. In addition to economic vulnerability, mentally ill African Americans may also experience social intolerance that in turn may correspond with adverse outcomes such as involuntary psychiatric admissions.

A key limitation of current research, particularly in the context of the recent 2008 recession, lies in the use of self-reported versus objectively defined, clinically diagnosed psychiatric disorders. Utilization of appropriate time lags, that establish temporal order wherein the exposure (economic recession) precedes mental health outcomes, reflects another important limitation in the literature. In this dissertation, I use data from reliable sources that provide the census of all Emergency Department visits and inpatient admissions for multiple US states that collectively account for nearly 20% of the national population and retrieve psychiatric visits/inpatient admissions based on objectively defined ICD 9 diagnoses. My study design, across all analyses, establishes precise temporal order between psychiatric ED visits/inpatient admissions and economic contraction (formulated as employment change in a Metropolitan Statistical Area). I use brief exposure lags of 0 to 3 months that permits attribution of any changes in the population and individual-level psychiatric outcomes to changes in the exposure. I also control for region,

month and year fixed effects, in addition to state-specific linear time trends, which account for unobserved factors that may correspond with psychiatric ED visits and inpatient admissions over my study period. To my knowledge, the studies described in this dissertation present the first attempt to combine clinically diagnosed psychiatric diagnoses with precise temporal order of exposure in examining the mental health effects of economic contraction over a time period that includes the 2008 recession.

Summary of Main Findings

In Chapter 2, I examine the relation between monthly aggregate employment decline and psychiatric emergency department visits across 96 counties within 49 Metropolitan Statistical Areas (MSAs) in 4 US states (Arizona, California, New York, New Jersey) by age and income groups. I approximate income level based on insurance status (private insurance= high-income, public insurance = low-income). I use linear regression analysis to test whether monthly decline in aggregate employment in an MSA corresponds with (i) changes in population rates of psychiatric ED visits and (ii) whether the relation between the outcome and exposure varies by insurance status (private, public) and age group (children, age < 20 years; working-age adults, age 20 to 64 years; elderly adults, age > 64 years). Regression results show that overall, psychiatric ED visits (per 100,000 population) decline with decline in monthly employment at exposure lag 0 and lag 2. Privately insured (high-income) groups also show a decline in psychiatric ED visits following decline in aggregate employment. Conversely, publicly insured children show an increase in psychiatric ED visits one month (i.e. lag 1) following employment decline. Exploratory analyses by disorder groups show that the population-level decline in psychiatric ED visits concentrates among visits for alcohol abuse disorders at 0, 1 and 2 month lags of employment

decline. This study provides evidence of pro- as well as counter-cyclic trends in psychiatric emergency visits following aggregate employment decline in an MSA. Whereas declines in psychiatric emergencies support a risk-averse response to economic recessions, these aggregate trends may mask countervailing trends among vulnerable groups.

In Chapter 3, I hypothesize that given their strong labor market attachment but low resources, publicly insured (low income), working age (non-elderly adult) African Americans will show increased help-seeking through greater reliance on EDs for psychiatric care, following aggregate employment decline. I use individual-level data on 6.7 million psychiatric ED visits, from 2006 to 2011 across 4 US states (Arizona, California, New York, New Jersey), and test whether monthly declines in aggregate employment precede a rise in the odds of a psychiatric ED visit among African Americans, relative to whites, and whether this response concentrates among working age, low-income (publicly insured) African Americans. Logistic regression results indicate that the odds of a psychiatric ED visit among publicly insured, working-age African Americans (relative to whites) increase three months after ambient employment decline. This increase is marginally detected in sensitivity analyses using aggregated population rates (as opposed to individual-level odds) and is modest in magnitude. Reliance on the ED for psychiatric care portends poor continuity of treatment for patients and a significant cost burden on patients and emergency psychiatry services. I find that economic downturns increase psychiatric help-seeking in EDs among African Americans relative to whites and this increase occurs among those who do not have private health insurance and may rely on EDs as a safety net for psychiatric care.

In Chapter 4, I test the 'reduced tolerance' hypothesis wherein societies under duress may increase the reporting of disordered persons to law enforcement for involuntary psychiatric commitment. During periods of heightened ambient stress, reduced tolerance may correspond with

over-reporting of sub-groups traditionally perceived as threatening. Prior research contends that mentally ill African American males are perceived as more threatening relative to females and other race/ethnicities. Economic contractions may serve as stressful "shocks" that increase the incidence of involuntary psychiatric hospitalizations among African American men, particularly through increased reporting to law enforcement authorities. I examine whether population rates of law enforcement/court order-requested involuntary psychiatric hospitalizations among African American men rise after economic downturn, across 4 US states (Arizona, California, North Carolina, New York), from 2006 to 2011. In addition, I also examine whether non-law enforcement/court order-requested psychiatric inpatient admissions increase among African American males, following decline in aggregate employment, as well as whether involuntary psychiatric admissions requested by law enforcement/court orders increase in other race and sex groups. Linear fixed effects regression show that decline in monthly employment lagged by 1 month precedes a 3% increase in psychiatric hospitalizations requested by law enforcement/court orders among African American males but not among other race/sex groups. I also find no change in rates of non-law enforcement/court order-requested psychiatric inpatient admissions among African American males within the specified exposure lags. Estimation of average marginal effect of exposure predicts an excess of 995 law enforcement/court order-requested involuntary admissions among African American males statistically attributable to employment decline. Economic downturns serve as ecological stressors that may reduce societal tolerance of behaviorally disordered African American males. I find an increase in psychiatric inpatient admissions requested by law enforcement/court orders specifically among African American males one month following ambient employment decline in the context of the 2008 recession. This

finding aligns with prior tests of the reduced tolerance hypothesis and highlights the unique vulnerability of racial/ethnic minorities during economic contractions.

Limitations

The studies examining psychiatric ED visits in this dissertation do not distinguish urgent from non-urgent psychiatric emergencies. Future work may analyze emergent and non-emergent users separately to test whether (1) reduced psychiatric ED visits rates among high-income groups arise from decline in non-emergent visits, and (2) excess psychiatric ED cases among low income children and publicly insured, working age African Americans arise from triggered psychiatric disorders versus increased ED reliance for non-urgent care.

It is plausible that populations with a previously diagnosed disorder may respond differently than others. However, the data that I utilize in this dissertation do not permit identification of psychiatric history. This limitation precludes my present analyses from identifying provocation versus uncovering mechanisms following macroeconomic downturns. Future research may utilize datasets that provide case histories at monthly resolution to examine whether observed trends in psychiatric ED utilization, in the general population as well as among African Americans, correspond with provocation of new disorders, or uncovering of pre-existing conditions, or both.

Apart from Chapter 4, I do not examine sex-specific differences in psychiatric response to economic contractions. This limitation arises from lack of availability of sex-specific employment monthly data for MSAs. Differences in the extent of labor market attachment and psychiatric help-seeking behavior may correspond with gendered responses to sudden economic

shocks. I encourage future work to examine sex differences in psychiatric responses to aggregate employment decline using data that provide high spatio-temporal resolution.

Implications for Future Research

Population patterns in time use- arguably the most valuable and scarcest resource- may help explain why certain groups appear to benefit during recessions while others do not. The opportunity cost of time may vary by macroeconomic conditions. During economic expansions, individuals may find employment easily and invest more in paid market work relative to home production (Ruhm, 2000). In such circumstance, the cost of undertaking health-related activities such as exercise, cooking at home and seeking primary/preventative care may outweigh time spent in earning wages (Ruhm, 2000). Economic downturns reduce employment opportunities and may change the opportunity cost of time. This change may promote greater investment in unpaid work at home, healthy behaviors and caregiving (Ruhm, 2000; Aguiar et al., 2013). Financial uncertainty and ambient stress during recessions may also alter family dynamics that, in turn, may correspond with increased caregiver supply (Fonseca et al., 2016; Costa-Font et al., 2016). These patterns are likely to vary by socio-economic status, given differential flexibility in work hours and savings/assets that may permit certain groups to better afford leisure time or purchase substitute care relative to others (Strazdins et al., 2006). For instance, examination of time use patterns during the 2008 recession finds an increase in fathers' caregiving time to children and this increase appears to concentrate among low-income, non-white fathers (Aguiar et al., 2013; Gorsuch, 2016). Studies also report increased informal caregiving to elderly groups in European countries during economic downturns (Costa-Font et al., 2016). These changes in caregiving patterns during recessions may correspond with improved mental health outcomes, particularly among groups that

rely on caregiving, such as children and the elderly. Conversely, added stress during recessions may translate into more restrictive time constraints and distracted caregiving, particularly for low-income populations, resulting in adverse health outcomes (Bruckner, 2008a). Given these countervailing mechanisms, in the near future, I plan to examine whether and to what extent regional trends in time use for caregiving underlie differential patterns in how population-level mental health responds to economic downturns.

As an extension of this dissertation research, I am currently in the process of collaborating with the University of South Florida to further test exogenous predictors of involuntary psychiatric holds in the population. I plan to use Florida's centralized repository (created under the Baker Act) of involuntary psychiatric holds (University of South Florida, 2020). These psychiatric holds (also called examinations) presumably occur before inpatient admissions, with the latter being determined as medically necessary by a physician. These data are collected with high temporal and spatial resolution and provide the source of request for psychiatric holds (e.g. law enforcement, mental health professional) which permits detailed examination of variation in social vis-à-vis health-system based identification of persons deemed a danger to self, danger to others or gravely disabled (University of South Florida, 2020). Ambient shocks other than economic downturns may also alter social tolerance of mental illness (Catalano et al., 2005). To that end, I plan to study trends in involuntary psychiatric examinations following ambient events that are thought to reduce social tolerance, increase social vigilance and promote fear or violence in the community (e.g. terrorist attacks, mass shootings, political elections), that may differentially impact minority groups (Catalano et al., 2005; Gemmill et al., 2019).

Higher number of involuntary psychiatric commitments may indicate lower capacity of health systems towards provision of primary and mental health care services (Bruckner et al.,

2010b). Increase in mental health system capacity may reduce psychiatric emergencies that in turn, may also correspond with fewer involuntary psychiatric commitments (Bruckner et al., 2010b, 2012, 2019). In the future, I aim to examine whether increase in mental health care supply through expansion of primary care and mental health services corresponds with fewer involuntary psychiatric commitments and inpatient admissions (Buckner et al., 2019).

ED visits and inpatient admissions may not serve as appropriate measures of population-level psychiatric epidemiological surveillance during economic downturns that qualitatively differ from the 2008 recession. The current and ongoing macroeconomic contraction owing to the COVID19 pandemic is one such circumstance. Overburdened hospital systems, stay-at-home orders and social distancing during the COVID19 pandemic preclude the use of EDs for approximating "true" psychiatric help-seeking (Gostin and Wiley, 2020). In such case, alternative means of psychiatric surveillance, such as internet surveys, tracking of social media use, mobile technology-based applications and use of self-reported responses to clinically validated anxiety and depression questionnaires may offer viable alternatives for examining mental health outcomes in populations dealing with ambient shocks (Gao et al., 2020; Huang and Zhao, 2020; Galea et al., 2020; Keep mental health in mind, 2020). Experts anticipate increase in anxiety, depression, aggression, substance use and suicides during the current pandemic-related economic contraction (Galea et al., 2020; Keep mental health in mind, 2020; Reger et al., 2020). Recent studies have reported worsened mental health outcomes among frontline healthcare workers, and national polls indicate marked increase in stress in the US adult population (Lai et al., 2020; Panchal et al., 2020) polls.

In the current scenario, tele psychiatry, phone/internet-based counselling and access to psychiatric medications through home-delivery or other accessible services may serve as useful

tools in meeting mental health care needs of the population (Galea et al., 2020; Keep mental health in mind, 2020). Investment in population-wide screening for psychiatric symptoms using digital technologies may also help identify high-risk populations and direct resources accordingly (Galea et al., 2020; Keep mental health in mind, 2020). Primary care services and physician providers may incorporate simple screening and diagnostic tools (e.g. the Generalized Anxiety Disorder 7-item questionnaire) for providing targeted mental health services and phone/internet-based follow-up of patients who exhibit severe psychiatric symptoms (Galea et al., 2020; Keep mental health in mind, 2020). Whereas some US states such as California instituted "rainy day" funds after the 2008 recession (for providing assistance during economic downturns), and the unprecedented $3 trillion COVID19 federal relief package may partly alleviate income shocks, the extent to which these supplementation measures correspond with psychiatric outcomes in the population remains uncertain (BBC News, 2020; LA Times, 2020). As of April 2020, safety net systems such as Medicare and Medicaid have expanded coverage to include tele-health services and virtual counselling sessions with mental health care professionals (Centers for Medicare & Medicaid Services, 2020). These measures, in combination with income buffers (through fiscal relief packages) and augmented support systems may aid in reducing adverse mental health outcomes during the current economic downturn.

APPENDIX

Table A.1: List of ICD 9 codes for psychiatric diagnosis (per Clinical Classification Software categories) used for sample selection (HCUP, 2019a).

Description	ICD 9 codes
Adjustment disorders	3090 3091 30922 30923 30924 30928 30929 3093 3094 30982 30983 30989 3099
Anxiety disorders	29384 30000 30001 30002 30009 30010 30020 30021 30022 30023 30029 3003 3005 30089 3009 3080 3081 3082 3083 3084 3089 30981 3130 3131 31321 31322 3133 31382 31383
Attention-deficit, conduct, and disruptive behavior disorders	31200 31201 31202 31203 31210 31211 31212 31213 31220 31221 31222 31223 3124 3128 31281 31282 31289 3129 31381 31400 31401 3141 3142 3148 3149
Delirium, dementia, and amnestic and other cognitive disorders	2900 29010 29011 29012 29013 29020 29021 2903 29040 29041 29042 29043 2908 2909 2930 2931 2940 2941 29410 29411 29420 29421 2948 2949 3100 3102 3108 31081 31089 3109 3310 3311 33111 33119 3312 33182 797
Developmental disorders	3070 3079 31500 31501 31502 31509 3151 3152 31531 31532 31534 31535 31539 3154 3155 3158 3159 317 3180 3181 3182 319 V400 V401
Disorders usually diagnosed in infancy, childhood, or adolescence	29900 29901 29910 29911 29980 29981 29990 29991 30720 30721 30722 30723 3073 3076 3077 30921 31323 31389 3139
Impulse control disorders, NEC	31230 31231 31232 31233 31234 31235 31239
Mood disorders	29383 29600 29601 29602 29603 29604 29605 29606 29610 29611 29612 29613 29614 29615 29616 29620 29621 29622 29623 29624 29625 29626 29630 29631 29632 29633 29634 29635 29636 29640 29641 29642 29643 29644 29645 29646 29650 29651 29652 29653 29654 29655 29656 29660 29661 29662 29663 29664 29665 29666 2967 29680 29681 29682 29689 29690 29699 3004 311
Personality disorders	3010 30110 30111 30112 30113 30120 30121 30122 3013 3014 30150 30151 30159 3016 3017 30181 30182 30183 30184 30189 3019

Schizophrenia and other psychotic disorders	29381 29382 29500 29501 29502 29503 29504 29505 29510 29511 29512 29513 29514 29515 29520 29521 29522 29523 29524 29525 29530 29531 29532 29533 29534 29535 29540 29541 29542 29543 29544 29545 29550 29551 29552 29553 29554 29555 29560 29561 29562 29563 29564 29565 29570 29571 29572 29573 29574 29575 29580 29581 29582 29583 29584 29585 29590 29591 29592 29593 29594 29595 2970 2971 2972 2973 2978 2979 2980 2981 2982 2983 2984 2988 2989
Alcohol-related disorders	2910 2911 2912 2913 2914 2915 2918 29181 29182 29189 2919 30300 30301 30302 30303 30390 30391 30392 30393 30500 30501 30502 30503 3575 4255 5353 53530 53531 5710 5711 5712 5713 76071 9800
Substance-related disorders	2920 29211 29212 2922 29281 29282 29283 29284 29285 29289 2929 30400 30401 30402 30403 30410 30411 30412 30413 30420 30421 30422 30423 30430 30431 30432 30433 30440 30441 30442 30443 30450 30451 30452 30453 30460 30461 30462 30463 30470 30471 30472 30473 30480 30481 30482 30483 30490 30491 30492 30493 30520 30521 30522 30523 30530 30531 30532 30533 30540 30541 30542 30543 30550 30551 30552 30553 30560 30561 30562 30563 30570 30571 30572 30573 30580 30581 30582 30583 30590 30591 30592 30593 64830 64831 64832 64833 64834 65550 65551 65553 76072 76073 76075 7795 96500 96501 96502 96509 V6542
Suicide and intentional self-inflicted injury	E9500 E9501 E9502 E9503 E9504 E9505 E9506 E9507 E9508 E9509 E9510 E9511 E9518 E9520 E9521 E9528 E9529 E9530 E9531 E9538 E9539 E954 E9550 E9551 E9552 E9553 E9554 E9555 E9556 E9557 E9559 E956 E9570 E9571 E9572 E9579 E9580 E9581 E9582 E9583 E9584 E9585 E9586 E9587 E9588 E9589 E959 V6284
Screening and history of mental health and substance abuse codes	3051 30510 30511 30512 30513 33392 7903 V110 V111 V112 V113 V114 V118 V119 V154 V1541 V1542 V1549 V1582 V6285 V663 V701 V702 V7101 V7102 V7109 V790 V791 V792 V793 V798 V799
Miscellaneous mental health disorders	29389 2939 30011 30012 30013 30014 30015 30016 30019 3006 3007 30081 30082 3021 3022 3023 3024 30250 30251 30252 30253 3026 30270 30271 30272 30273 30274 30275 30276 30279 30281 30282 30283 30284 30285 30289 3029 3060 3061 3062 3063 3064 30650 30651 30652 30653 30659 3066 3067 3068 3069 3071 30740 30741 30742 30743 30744 30745 30746 30747 30748 30749 30750 30751 30752 30753 30754 30759 30780 30781 30789 3101 316 64840 64841 64842 64843 64844 V402 V403 V4031 V4039 V409 V673

Source: Healthcare Cost and Utilization Project: Clinical Classification software (HCUP CCS). https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp.

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