

IS FORECLOSURE HARMING OR IMPROVING THE HEALTH OF THE USA?

by

SERENA O'BRIEN

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ABSTRACT

IS FORECLOSURE HARMING OR IMPROVING THE HEALTH OF THE USA?

Serena O'Brien¹

Background: Prior to the housing crisis in 2008, research had seldom been conducted on the effects of housing foreclosures on health outcomes. Even though national housing markets have somewhat recovered from the 2008 recession, mortgage loan borrowers across the U.S. remain adversely impacted by the foreclosure crisis. **Objectives:** The purpose of this research is to evaluate the relationship between foreclosure rates and mental and physical health outcomes, at the U.S. state-level, over a period of seventeen years (2000-2016). This study expects that all the seven health variables in question will share a significant positive relationship with foreclosure. **Methods:** In this study (N=816), panel regression analysis, using a fixed effects model, is used to analyze the relationship between the two economic variables and seven health variables in question. **Results:** A significant positive relationship exists between foreclosure and the following health outcomes: major depressive disorder (0.35*** p < 0.001, CI = 0.26 — 0.43), nutritional deficiencies (3.80*** p < 0.001, CI = 3.04 — 4.57), and self-harm and interpersonal violence (0.71*** p < 0.001, CI = 0.55 — 0.86). The health outcomes shown to share a statistically significant negative correlation between foreclosure include: anxiety disorders (0.52*** p < 0.001, CI = -0.60 — -0.44), alcohol use disorders (0.41*** p < 0.001, CI = -0.57 — -0.25), and drug use disorders (0.24*** P = 0.001, CI = -0.39 — -0.10). No significant relationship was elucidated between foreclosure and hypertensive heart disease. **Conclusion:** Although significant relationships were uncovered between foreclosure and rates of major depressive disorder, nutritional deficiencies, and self-harm and interpersonal violence, more research is required to further evaluate the relationship between economic outcomes and health outcomes. Specifically, more research is necessary to unveil the relationships between foreclosure and the health outcomes: anxiety disorders, drug use disorders, alcohol use disorders, and hypertensive heart disease.

Keywords: foreclosure, health, unemployment, major depressive disorder, anxiety disorder, nutritional deficiencies, self-harm and interpersonal violence, drug use disorder, alcohol use disorder, hypertensive heart disease

¹Master of Science in Management (MScM), Ted Rogers School of Management, Ryerson University, Toronto, Ontario

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CONFLICTS OF INTEREST

The author declares no conflicts of interest.

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1-INTRODUCTION

Having one's home lost to foreclosure can impose major physiological and psychological damage on the health and well-being of homeowner households (Libman, Fields, & Sagert, 2011; Alley, Lloyd, Pagán, Pollack, Shardell, & Cannuscio, 2011). When a homeowner loses their home by way of foreclosure, the event can not only be financially devastating, especially given that most homeowners consider their home to be one of their most valuable investments, but the event can also be emotionally traumatic and physiologically distressing (Carter & Gottschalck; Government of Canada, 2011; Osypuk et. al., 2012). Given this information, this study serves to broaden and build on the scope of prior research conducted, to address, and attempt to clarify, the relationship between foreclosure and seven selected health outcomes. Specifically, this study examines how changes in foreclosure rates in the United States, between 2000-2016, influence state-level rates of: major depressive disorder, anxiety disorders, self-harm and interpersonal violence, drug-use disorders, alcohol use disorders, nutritional deficiencies, and hypertensive heart disease. The health outcomes which are classified as being mental health outcomes include: major depressive disorder, anxiety disorder, drug-use disorder, and alcohol use disorder, and self-harm and interpersonal violence. By contrast, the selected physical health outcomes characterize: nutritional deficiencies, and hypertensive heart disease. Nearly all prior research conducted on the relationship between housing foreclosure and health investigates how foreclosures have affected either levels of mental health, or levels of physical health. Little, to no, research has been conducted on evaluating the holistic relationship between housing foreclosure and both mental and physical health outcomes in the U.S. population. As a result, to address this gap in the literature, this study serves to collect data on foreclosure rates,

unemployment rates, and the aforementioned mental and physical health outcomes, using data from three key sources. To our knowledge, no study to date has investigated the breadth of physical and mental health consequences of foreclosure, with a data sample that covers all U.S. states, over a period of seventeen years (2000-2016). Based on the existing body of literature on the subject, this study hypothesizes that all of the seven health variables in question will share a significant positive association with foreclosure.

2-LITERATURE REVIEW

2.1 - Background

As of July 2018, 1 in every 2055 homes in the United States is facing foreclosure, with the greatest rate of housing foreclosures occurring in New Jersey, at a rate of 1 in every 607 homes (RealtyTrac, 2018). Rates of housing foreclosures, however, have not always been as optimal as those recently reported. For instance, housing foreclosure reached record high rates following the United States' subprime mortgage crisis between 2007 and 2010, which resulted in a nationwide recession (Cannuscio et. al., 2012; Immergluck, 2016). Even though national housing markets have somewhat recovered from this nationwide recession, mortgage loan borrowers across the U.S. remain adversely impacted by the foreclosure crisis, with 19% of homeowners falling behind on their mortgage payments (Keene & Baker, 2016). In 2009, a historically high rate of 2.82 Million homes faced foreclosure-an incident that exceeded the rate of homes foreclosed upon in 2008 and 2007 by 21% and 120%, respectively (RealtyTrac, 2010). Prior to the housing crisis, research had seldom been conducted on the effects of housing foreclosures on health outcomes. Gazing a decade into the future, more and more researchers are

beginning to consider the gravity of the health consequences brought on by the increased rates of housing foreclosures, particularly following the financial crisis. Having said this, while research has been conducted on the effects of foreclosure on mental health, suicide rates, health disparities, non-elective hospital and emergency room visits, few researchers have jointly investigated the adverse effects of foreclosure rates on both physical and mental health outcomes in the U.S. (Cagney, Browning, Iveniuk, & English, 2014; Houle, 2014; Houle & Light, 2014; Saegert, Fields, & Libman, 2011; Currie & Tekin, 2015). One of the few research papers that studied the effects of foreclosure on health, whereby health is measured by rates of non-elective hospital admissions, only investigated the relationship in four (Arizona, Florida, California, and New Jersey) out of fifty of the states in the U.S. (Currie & Tekin, 2015). Apart from only researching four out of fifty states, Currie & Tekin's research was limited to five years worth of data on health, provided by the Healthcare Cost and Utilization Project. Furthermore, the researchers solely evaluated health outcomes in the physical context. As a result, my research serves to shed a holistic light on the relationship between foreclosure and health outcomes, both mental and physical, through a broader health context and scope, whereby foreclosure rates and health data will be collected from each state in the USA, over a period of seventeen years, from 2000-2016.

Housing foreclosure is a phenomenon that results from a homeowner being unable to make their monthly mortgage payments. During the foreclosure process, a homeowner is evicted from their home, and, the property is then legally seized and sold by the homeowners' mortgage lender (RealtyTrac). Numerous factors come into play when analyzing the causes, increasing rates, and consequences of housing foreclosures. In the context of the United States, rates of

housing foreclosures continually began to increase from 2000, and peaked during 2008 and 2009 (Joint Center for Housing Studies 2007; Mortgage Bankers Association 2008). An underlying factor that contributed to this rise in foreclosure rates, between 2007 and 2010, was the major change in the United States' macroeconomic landscape, due to the housing crisis. During this time, financial deregulation, risky borrowing practices and abuses of subprime lending were to blame for instigating the rise in housing foreclosures, especially with regards to the homebuyer population (Kaplan & Sommers, 2009; Been, Chan, Ellen, & Madar, 2011; Fligstein & Goldstein, 2011; Gerardi & Willen, 2009). Kaplan and Sommers (2009) indicate that certain circumstances make households more susceptible and vulnerable to foreclosure. For instance, if housing prices are high, prospective homebuyers may be compelled to purchase a home with a small or zero dollar down payment (Kaplan & Sommers, 2009). This leaves the homebuyer with the burden of undertaking a large amount of debt, from a willing lender, to finance a home that they may not be fully able to afford (O'Sullivan, 2003). If, for example, this newly classified homeowner were to experience a loss of employment, or a demotion, the ability of the homeowner to make their monthly mortgage payments would become significantly jeopardized.

To remedy the financial burden of an unaffordable mortgage, or an inability to make monthly mortgage payments, borrowers have the option of selling their home to recover existing equity, but this option only works successfully if the home's value has been increasing. If, for instance, the values of housing have been decreasing, those who have financed their home with a mortgage loan may discover their debt load to be greater than the worth of their property (Kaplan & Sommers, 2009). In instances where a mortgage lent to a borrower exceeds the true selling value of one's home, combined with stressful events, such as divorce or unemployment—two

elements ranked as being highly stressful life events on the Holmes-Rahe Stress Scale—foreclosure may become an enticing option to release a lender’s responsibility to pay back the mortgage loan (Capozza, Kazarian, and Thomson 1997). Prior to the 1990s, potential homebuyers were very restricted with regards to what homes they could buy, based on the type of loans for which they were eligible. Mortgage lenders valued their loans based on characteristics of the home being purchased, the classification of the loan, and the term of the loan, and would not issue credit to borrowers if they were not deemed to be creditworthy (Kaplan & Sommers, 2009). This lending process was privy to an abundance of abuses, whereby provisions of credit were inequitably distributed, and prevented minority groups from accessing prime loans (Rugh & Massey, 2010; Dingemans, 1979; Squires & Velez, 1987; Shlay 1988; Shlay, 1989; Bradbury, Case, & Dunham 1989; Myers 1995; Buist, Megbolugbe, & Trent 1994; Leven & Sykuta 1994). However, access to mortgage loans began to improve during the 1990s, with the increasing provision of subprime lending.

According to the Joint Centre for Housing Studies, subprime loans accounted for approximately 20% of mortgages in 2006, and rose from being a \$35 billion business in 1994, to being a \$600 billion business in 2005 (Joint Center for Housing Studies, 2007; Avery, Brevoort, & Canner, 2006). The increased provisions of subprime loans served as a response for the need to increase credit accessibility to all populations. Consequently, if borrowers were not previously offered the opportunity to obtain a mortgage loan through favourable prime lending, be it due to inequitable reasons or not, they were now increasingly able to qualify for subprime loans beginning in the 1990s and onwards. Subprime lending is divided into several categories: Alt-A, or near prime, B, C, and D (Renuart, 2004). To compensate for the increased risk of providing a

loan to a borrower who does not qualify for a prime loan, subprime loans are provided to borrowers at increasingly expensive rates, whereby interest rates are higher and loan terms are less favourable than those offered to prime borrowers. Consequently, those who were drawn to acquire subprime loans often came from lower socio-economic status households, minority communities, and vulnerable population groups and were found to be more negatively impacted by the foreclosure crisis than affluent communities (Houle, 2014; Rugh & Massey, 2010; National Fair Housing Alliance, 2012).

2.2-Foreclosure as a Stressful Life Event

The Holmes-Rahe Stress Inventory scale comprises a comprehensive inventory of forty-three life events deemed to be considered highly stressful, whereby each life event is ranked in order of their level of stressfulness and is associated with a numerical score in points. According to this extensively researched scale, major changes in one's financial state (#16, 38 points), taking on a mortgage (#20, 31 points), foreclosing on a home or loan (#21, 30 points), major changes in living conditions (#28, 25 points), and major changes in one's residence (#32, 20 points) all pose as stressful life events. When one experiences a combination of the aforementioned stressful life events, among others life events listed in the inventory, the associated sum of a person's scores can serve to infer the likelihood of a stress-induced health breakdown. To put the scale into perspective, if someone scores 150 points or less, they have a relatively low amount of life change, and a low susceptibility to stress-induced health breakdown. However, if a person's points amount to 150 to 300 points, there is roughly a 50% chance of a major health breakdown implied to follow in the proceeding 2 years. If one's points

amount to a sum of 300 or more, the likelihood of a major health breakdown occurring within the next two years increases to roughly 80%, according to the Holmes-Rahe statistical prediction model. Consequently, given that the scale comprises of numerous stressful life events related to housing and foreclosure, this research will serve to look at state-level changes in rates of foreclosure and the resulting effects that may be yielded upon the American nation's health outcomes.

In accordance with Holmes & Rahe's research, other academics have classified foreclosures as a stressful life event which serves to undermine the mental and physical health and well-being of mortgage borrowing households (Houle, 2014; Houle & Light, 2014; Cagney, Browning, Iveniuk, & English, 2014). According to recent research, increased rates of foreclosure share a relationship with increased rates of stressors in communities and unnecessary hospital admissions (Houle, & Light, 2014; Currie & Teiken, 2015). Increased housing foreclosures are also associated with decreased social capital, civic engagement, and residential stability—all of which are social resources for mental health and well-being (Estrada-Correa & Johnson, 2012; Li, Morrow-Jones & Johnson, 2010; Jia, Moriarty, Kanarek, 2009). While a few studies have investigated the effects of foreclosure on health outcomes, they have primarily looked at the health effects in single communities, counties, or cities, and focus solely on mental or physical health outcomes, rather than evaluating both forms of health outcomes alongside each other (Arcaya et. al., 2013; Arcaya et. al., 2014; Currie & Tekin, 2011; Currie & Tekin, 2015). Concisely, despite the grand scale of the foreclosure crisis, we know relatively little about the associated effects on the overall health, both mental and physical, and well-being of the U.S. population, particularly with data collected and analyzed from a comprehensive state-level,

seventeen-year data set. As a result, the major scope of the foreclosure crisis breeds grounds for investigating the relationship between rates of foreclosure and the physical and mental health and well-being of the U.S. population.

2.3 - The Link Between Foreclosure and Health (Mental and Physical) Outcomes

Housing foreclosures have been shown to share a relationship with numerous adverse physical and mental health outcomes. According to Currie and Tekin, some of these adverse physical health outcomes include: significant increases in non-elective, or preventable, hospital and emergency room visits for conditions such as chest pain, dysrhythmias, heart attacks, strokes, respiratory failures, gastrointestinal haemorrhages, urinary tract infections, and kidney failures (Currie & Tekin, 2015; Currie & Tekin, 2011). Similarly, in a study which evaluates the relationship between recessions and foreclosure on diagnosed mood and anxiety disorders in Spain between 2006 and 2008, Gili and colleagues conclude that a negative association exists between foreclosure and health outcomes (Gili, Roca, Basu, McKee, & Stuckler, 2012). As a consequence of the results of the aforementioned studies, this research will evaluate the relationship between foreclosure and hypertensive heart disease, as well as the association between foreclosure and anxiety disorders. This research, then, hypothesizes that the two health outcomes, hypertensive heart disease and anxiety disorders, will be positively correlated with foreclosure.

Some researchers argue that prior poor health may be associated with foreclosures, and not the other way around (Houle & Keene, 2014; Robertson, Egelhof & Hoke, 2008). Robertson and colleagues surveyed one hundred and twenty-eight distressed homeowners from four states and found that, when respondents are given the opportunity to mention all of the factors that

contributed to their difficulties in making mortgage payments, almost half indicate medical bills, loss of work due to illness or injury, personal illness, or illness of a family member as a reason they were struggling to maintain their mortgage payments (Robertson et. al., 2008). This study, however, had a relatively small sample size (N=128), with a low response rate of 7%. Having said this, despite having a sample size and response rate that could stand to be greater, the results reveal a need for increased investigation of the foreclosure and health relationship.

In another study, conducted by Houle and Keene (2014), data from the National Longitudinal Survey of Youth 1979 Cohort (NLSY-79) was used to analyze whether existing health conditions among middle-aged adults (40-50 years old) predict mortgage default and foreclosure between 2006 and 2008 (N=4307). The authors deduced that those who are sick are at greater risk of defaulting on their mortgage, and experiencing foreclosure, due to declines in family income and loss of health insurance. However, despite trying to control for confounding variables, the authors were unable to conclude that a causal relationship exists between preceding health conditions and default and foreclosure, as health and health change act as endogenous variables (Houle & Keene, 2014). The limitations of the aforementioned studies, thus, lend themselves to requiring further research to be conducted to clarify the true relationship between foreclosure and health outcomes.

Financial strain has been shown to be associated with increased mortality, greater psychological distress, higher blood pressure, and earlier disability, and further research indicates that people undergoing foreclosure report greater rates of certain chronic diseases (Steptoe, Brydon, & Kunz-Ebrecht, 2005; Szanton, Allen, Thorpe, Seeman, Bandeen-Roche, Fried, 2008; Kahn, Pearlin, 2006; Matthews, Smith, Hancock, Jagger, & Spiers, 2005; Blazer, Sachs-Ericsson, & Hybels, 2005; Lantz, House, Mero, & Williams, 2005; Pollack & Lynch, 2009; Pollack,

Lynch, Alley, & Cannuscio, 2010). As a result, Pollack and colleagues sought to conduct a case-control study in Philadelphia, using medical record data, to examine the health care utilization and health conditions of homeowners prior to experiencing foreclosure (Pollack, Kurd, Livshits, Weiner, & Lynch, 2011). The researchers found that homeowners who received notice of foreclosure between 2005 and 2008 were significantly more likely to have hypertension and renal disease, were more likely to visit the hospital two years prior to receiving their foreclosure notice, and were less likely to have visited their primary care physician in the six months preceding the receipt of their foreclosure notice. These results provide valuable insight into the demographics of those who are more at risk of experiencing foreclosure, and the changes in utilization of healthcare prior to foreclosure. However, they do not infer that increased rates of hypertension and renal disease, both conditions which characterize a person's physical health, cause foreclosure. Furthermore, this research examines only the physical aspects of health outcomes and foreclosure, creating an opportunity for more research to be conducted on evaluating the relationship between foreclosure and combined mental and physical health outcomes. As such, this research paper aims to provide a more detailed view of how physical health outcomes, such as hypertensive heart disease, and mental health outcomes, such as major depressive disorder, interact with foreclosure.

Expensive debt repayments, such as mortgage payments, can serve as a source of household concern which may lead to psychological distress, and result in poor mental and physical health outcomes (Keese & Schmitz, 2014; Mathews & Gallo, 2011; Berger, Collins, & Cuesta, 2013; Choi, 2009). Mortgage debt can serve to drain non-mortgage related resources, leading to and further exacerbating poor mental and physical health outcomes (Turunen & Hiilamo, 2014; Münster, Rürger, Ochsmann, Letzel, & Toschke, 2009). Furthermore, in addition

to instigating poor physical and mental health outcomes, a decline in non-mortgage related resources, arising from mortgage debt, can lead to a decrease in a household's ability to pay for household essentials like nutritious food. When financial stress from foreclosure or unemployment is imposed on a household, such that individuals must make a decision between two basic human needs, like making a mortgage payment or buying food, people are more likely to cut their grocery budget, by reducing costly produce consumption, in order to maintain a roof over their head (Milicic & DeCicca, 2017). Having to forgo the consumption of nutritionally dense fruits and vegetables can lead to the development of nutritional deficiencies, which is why the health outcome variable, nutritional deficiencies, is being studied alongside foreclosure. Furthermore, due to the aforementioned research results, this study assumes that the health variable, nutritional deficiencies, will be positively correlated with foreclosure.

Findings from a longitudinal study that evaluates the influence of housing instability on drug use, suggest that changes in housing status, and decreases in regular employment share a positive association with drug use (Cheng, Wood, Nguyen, Kerr, & DeBeck, 2014). In other studies, which aim to examine the changes in alcohol consumption in the USA during the Great Recession, and during general economic downturns, researchers determined that there was an increased risk for frequent binge drinking of alcohol, particularly if one fell unemployed, as the economy declined (Bor, Basu, Coutts, McKee & Stuckler, 2013; Dee, 2001). As a result, this research serves to evaluate drug and alcohol use disorders as health outcome variables to be examined against rates of foreclosure and unemployment. Based on the scholarly work of Cheng et. al. (2014), Bor et. al. (2013), and Dee (2001), this study anticipates that both drug use disorders and alcohol use disorders will share a positive relationship with foreclosure.

Evidence from a survey conducted in Germany, using national data from 1999 to 2009 to assess the relationship between household debt and self-reported health outcomes, suggests that high levels of debt, such as those offered by owning a mortgage loan, have adverse outcomes on mental and physical health (Keese & Schmitz, 2014). The stress derived from experiencing foreclosure is associated with inferior health and psychological distress (Burgard, Seefeldt, & Zelner, 2012; Osypuk, Caldwell, Platt, & Misra, 2012; McLaughlin et. al., 2012; Cannuscio et. al., 2012). In a study which looks at data from 2245 counties in the fifty U.S. states, from 2006 to 2011, increases in a county's foreclosure rate was found to be correlated with a decline in residents' mental health (Houle, 2014). Similarly, in another study conducted by Houle and colleagues, increased rates of foreclosures were found to be associated with significant increases in suicide rates and suicide attempts (Houle & Light, 2014). Concisely, since mental health is a key determinant of physical health outcomes over the life span, and recent research indicates an existing relationship between increasing foreclosure and decreasing physical health and mental health, it is important that this area of research be further examined (Houle, 2013; Arcaya et. al., 2013; Arcaya et. al., 2014). As such, the health outcomes in question that will be examined alongside foreclosure and unemployment include: major depressive disorder, anxiety disorders, hypertensive heart disease, nutritional deficiencies, self-harm and interpersonal violence, drug use disorders, and alcohol use disorders. Based on evidence from the current literature, it is expected that all seven health outcomes will share a positive relationship with the economic outcomes, by rising in response to increases in foreclosure and unemployment.

3-DATA

In this study, panel regression analysis, using the fixed effects model, is applied to analyze the relationship between the economic and health outcomes in question. The economic measures, which serve as the independent variables, consist of: state-level foreclosure rates (FOR) and state-level unemployment rates (UNE). State-level foreclosure rates were collected from the National Delinquency Survey (NDS), which were made available by the Mortgage Bankers Association (MBA, 2018). State-level unemployment rates were collected from Home Facts, which provides publicly available data on an amalgamation of key, state-level real estate data and neighborhood data (Home Facts, 2018). State-level unemployment rates will serve to control for broad-level economic conditions. As a result, if there appears to be a significant relationship between any given health outcome and foreclosure, unemployment rates should mirror, or reflect, that same interaction (Rana & Shea, 2015). The health outcome variables, which serve as the dependent variables, consist of: major depressive disorder (MDD), anxiety disorders (AD), self-harm and interpersonal violence (SHIV), drug-use disorders (DUD), alcohol use disorders (AUD), nutritional deficiencies (ND), and hypertensive heart disease (HHD). Major depressive disorder is defined as a commonly diagnosed, but serious, mood disorder that results in feelings of persistent sadness and hopelessness, and lost interest in daily activities once enjoyed (Uher, Payne, Pavlova & Perlis, 2014). In order to be diagnosed with the disorder, symptoms must persist for a minimum of two weeks (Uher, Payne, Pavlova & Perlis, 2014). Anxiety disorders are defined as a group of mental health disorders, such as generalized anxiety disorder and social anxiety disorder, that characterize feelings of worry and fear of future events (National Institute of Mental Health, 2018; Canadian Mental Health Association, 2018). Anxiety

disorders are the most commonly diagnosed mental health problem, that make up a group of mental health disorders, and can affect any individual at any given age (Canadian Mental Health Association, 2018). Alcohol use disorders are defined as mental health disorders which lead to the compulsive use of alcohol, a loss of ability to control the level of alcohol being consumed, and the experience of a negative emotional state when the intake of alcohol is not occurring (National Institute of Alcohol Abuse and Alcoholism, 2018). The health variable self-harm and interpersonal violence comprises of several subsets of data which are divided into two groups: self harm and interpersonal violence. Self-harm, in the context of this study, includes self-harm by other specified means, and self-harm by firearm. By contrast, interpersonal violence comprises of data on: physical violence by firearm, physical violence by sharp object, physical violence by other specified means, and intimate violence (Global Health Data Exchange, 2018). Drug use disorders make up conditions that are characterized by the use of and dependence on one or more psychoactive drugs, such that an individual's physical and mental health, and the welfare of others may be impaired (Substance Abuse and Mental Health Services Administration, 2015). In the context of this study's drug use disorder sample, substances that fall into the category of this health variable include: opioids, cocaine, amphetamines, cannabis, and other drugs that can be used to instigate the development of drug use disorders (Global Health Data Exchange, 2018). Finally, hypertensive heart disease is defined as a heart condition characterized by hypertrophy of the left ventricle due to persistent and prolonged arterial pressure, often caused by physiological stresses imposed upon the body (Diamond & Phillips, 2005; Maurer, Burkhoff, Fried, Gottdiener, King, & Kitzman, 2007).

In this panel dataset, each economic and health observation has been collected at the U.S state level, per year, from 2000 to 2016. The fixed effects model is being used in the regression analysis in an effort to analyze the impact of the variables in question over time. In the case of this study, the fixed effects model explores the relationship between the predictor variables (FOR and UNE) and outcome variables (MDD, AD, SHIV, DUD, AUD, ND, and HHD) within each state, whereby each state has its own individual characteristics, that may or may not influence the predictor variables. Individuals from all age groups were included in the sample of this study, as the health outcome variables in question have the ability to impact individuals at all different age groups, much like the shocks of foreclosure. Furthermore, the sample includes both females and males, as the health and economic variables can be experienced by both genders.

Table 1 denotes key descriptive statistics involved in the dataset. The dataset is comprised of a total of 867 observations for the variables: state, year, foreclosure and unemployment. In terms of the health outcomes in question, expressed as percent prevalence (pp), data was available solely for the 2000 (min) to 2016 (max) time period. As a result, state-level percent prevalence rates of major depressive disorder (MDD), anxiety disorder (AD), self-harm and interpersonal violence (SHIV), drug-use disorders (DUD), nutritional deficiencies (ND), and hypertensive heart disease (HHD), also consist of 867 observations each. When evaluated in percent change form, the number of observations in each health variable is reduced from 867 observations to 816 observations. This occurs due to the fact that the percent change in any given health outcome can not be evaluated for the year 2000 of each state, as preceding data from 1999 is not included in this panel dataset. Concisely, the percent change variables are derived from evaluating the percent changes in the prevalence in numbers or percentages of a health outcome

from 2000 to 2001, 2001 to 2002, 2003 to 2004, and so on and so forth. Overall, one year of data is lost from each of the fifty-one U.S. states, resulting in a reduction in the number of observations by fifty-one values ($n=867-51=816$).

Table 1. State-Level Foreclosure & Health Descriptive Statistics

Variable	Abbreviation	Observations	Mean	Std. Dev.	Min	Max
Foreclosure	for	867	2.02%	1.61%	0.20%	14.27%
Foreclosure Percent Change	forpc	816	-2.8%	28%	-150%	76%
Unemployment	une	867	6.29%	2.05%	2.5%	14.4%
Unemployment Percent Change	unepc	816	-0.84%	16.42%	-43.94%	52.87%
Major Depressive Disorder Percent Prevalence	mddpp	867	3.9%	0.4%	2.9%	5.1%
Major Depressive Disorder Percent Change	mddppc	816	-0.23	37%	-182%	58%
Anxiety Disorders Percent Prevalence	adpp	867	6.5%	0.3%	5%	6.9%
Anxiety Disorders Percent Change	adppc	816	-3.5%	32%	-99%	43%
Self-Harm and Interpersonal Violence Percent Prevalence	shivpp	867	4.5%	0.5%	3.5%	6.8%
Self-Harm and Interpersonal Violence Percent Change	shivppc	816	-22%	73%	-309%	113%
Drug Use Disorders Percent Prevalence	dudpp	867	3.1%	0.6%	1.8%	5%
Drug Use Disorders Percent Change	dudppc	816	16%	61%	-170%	276%
Alcohol Use Disorders Percent Prevalence	audpp	867	2.3%	0.5%	1.7%	4.3%

Alcohol Use Disorders Percent Change	audppc	816	8.7%	80%	-428%	437%
Nutritional Deficiencies Percent Prevalence	ndpp	867	3.5%	0.6%	2.1%	5.3%
Nutritional Deficiencies Percent Change	ndppc	816	154%	330%	-475%	1103%
Hypertensive Heart Disease Percent Prevalence	hhdpp	867	0.3%	0.1%	0.15%	0.5%
Hypertensive Heart Disease Percent Change	hhdppc	816	-3.4%	130%	-408%	343%

With reference to the economic variables, the overall average foreclosure rate, among all states, from 2000 to 2017, is 2.02% (SD = 1.61%, n = 867) and the overall average unemployment rate is 6.29% (SD = 2.05%, n = 867). In terms of the two mental health outcomes, the overall average percent prevalence of major depressive disorder (MDDpp) across all states is 3.9% (SD = 0.4%, n = 867) and the overall average percent prevalence of anxiety disorder (ADpp) is 6.5% (SD = 0.3%, n = 867). With respect to the other four health outcomes, the overall mean percent prevalence of self-harm and interpersonal violence (SHIVpp) is 4.5% (SE = 0.5%, n = 867); the drug use disorder variable (DUDpp) has an overall mean percent prevalence of 3.1% (SD = 0.6%, n = 867); the alcohol use disorder health outcome (AUDpp) has an overall average percent prevalence of 2.3% (SD = 0.5, n = 867); hypertensive heart disease (HHDpp) has an overall mean percent prevalence of 0.3% (SD = 0.1%, n = 867). Across all observations, foreclosure rates consist of a minimum rate of 0.2%, in California (2005), and a maximum rate of 14.27%, in Florida (2011). Unemployment rates range from a minimum value

of 2.5%, in Hawaii (2007), to 14.4%, in Michigan (2010). By contrast, the percent prevalence of major depressive disorder shares a minimum rate of 2.9%, in New Jersey (2016), and a maximum rate of 5.1%, in Utah (2010). Anxiety disorder percent prevalence rates range from a minimum of 5% in Oregon (2016) to 6.9% in New Hampshire (2005). With regards to percent prevalence rates of self harm and interpersonal violence, the health outcome variable holds a minimum rate of 3.5% in Iowa (2016) and a maximum rate of 6.8% in the District of Columbia (2000). The percent prevalence rates of drug use disorders (DUDpp) range from a minimum rate of 1.8% in Iowa (2005) to a maximum rate of 5% in Rhode Island (2016). In terms of alcohol use disorders, the percent prevalence rates range from a minimum of 1.7% in New Jersey (2005) to a maximum rate of 4.3% in the District of Columbia (2000). The percent prevalence rates of nutritional deficiencies ranges from a minimum rate 2.1% in Connecticut (2000), to a maximum rate of 5.3% in Utah (2010). Finally, the percent prevalence rates of hypertensive heart disease range from a minimum of 0.15% in Alaska (2005), to a maximum rate of 0.5% in the District of Columbia (2000).

In an effort to further evaluate the interactions between foreclosure and health, and to identify prevalent trends in the data, correlation analysis was used. For this correlation analysis, the average USA health variable values and average USA foreclosure values, from 2000 to 2016, from each state, were examined. Table 2, denotes a summary of the descriptive statistics involved in this correlation analysis. In this table, the average value, per year, of each state's health and economic outcomes, has been assessed. The data involves seventeen years worth of averaged state-level USA data from 2000 to 2016 for the averaged health and economic outcomes, and

sixteen years worth of averaged USA percent change data for health and economic variables from 2001 to 2016. From these descriptive statistics, several key observations can be made.

Table 2. USA-Level Foreclosure & Health Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Average USA Foreclosure	17	2.02%	95%	96%	370%
Average USA Foreclosure Percent Change	16	-1.92%	22.4%	-27.7%	34.1%
Average USA Unemployment	17	6.36%	1.63%	4.41%	9.71%
Average USA Unemployment Percent Change	16	-60%	1452%	-1798%	3509%
Average USA Major Depressive Disorder	17	3.87%	0.045%	3.8%	3.9%
Average USA Major Depressive Disorder Percent Change	16	-22.7%	31.8%	-63.5%	17.9%
Average USA Anxiety Disorders	17	6.47%	0.141%	6.25%	6.62%
Anxiety Disorder Percent Prevalence Percent Change	16	-34.8%	32.1%	-77%	107%
Average USA Self-Harm and Interpersonal Violence	17	4.49%	0.076%	4.31%	4.58%
Average USA Self-Harm and Interpersonal Violence Percent Change	16	-22.2%	65%	-105.9%	33.4%
Average USA Drug-Use Disorders	17	3.12%	0.039%	3.09%	3.21%
Average USA Drug Use Percent Change	16	16%	45.1%	-47%	75.1%
Average USA Alcohol Use Disorders	17	2.31%	0.0071%	2.29%	2.32%
Average USA Alcohol Use Disorders Percent Change	16	8.71%	10.3%	-12.4%	18.9%
Average USA Nutritional Deficiencies	17	3.47%	0.44%	2.94%	4.1%
Average USA Nutritional Deficiencies Percent Change	16	154%	318%	-261%	760%
Average USA Hypertensive Heart Disease	17	0.30%	0.0065%	0.297%	0.315%
Average USA Hypertensive Heart Disease Percent Change	16	-3.44	89.9%	-131%	110%

For instance, the overall mean for average foreclosure rates between 2000 and 2016 was 2.02% (SD = 95%, n = 17). Furthermore, USA experienced the lowest average rates of foreclosure in 2005, while the nation experienced the highest averages rates of foreclosure in 2011. In terms of average unemployment rates, the overall mean unemployment rate is 6.36% (SD =2.05%, n = 17), with a minimum average rate of 4.41%, in 2001, and a maximum average unemployment rate of 9.71%, in 2010.

With reference to the average USA mental and physical health outcome variables, anxiety disorders are the most prevalent (M = 6.47%, SD = 0.141%), followed by self harm and interpersonal violence (M = 4.49%, SD = 0.076%), major depressive disorder (M = 3.87%, SD = 0.0449%), drug use disorders (M = 3.12%, SD = 0.0387%), nutritional deficiencies (M = 3.47%, SD = 0.045%), alcohol use disorders (M = 2.31%, SD = 0.0071%), and hypertensive heart disease (M = 0.30%%, SD = 0.0065%). In terms of volatility, nutritional deficiencies come first, with a minimum average rate of 2.94% and a maximum average rate of 4.1%. The second most volatile health outcome consists of anxiety disorders, with a minimum average rate of 6.25% and a maximum average rate of 6.62%, followed by self harm and interpersonal violence (min = 4.31%, max = 4.58%), major depressive disorder (min = 3.76%, max = 3.9%), drug use disorders (min = 3.09%, max = 3.21%), alcohol use disorders (min = 2.29%, max = 2.32%), and hypertensive heart disease (min = 0.297%, max = 0.315%).

Correlation coefficients were obtained to determine the strength of the relationships between foreclosure and each of the seven health outcomes. The results appear in Table. 3 and Table 4. From these tables we are able to decipher which health variables share a strong relationship with foreclosure, and which health variables share a weak association with

foreclosure, and, in which direction. In these two tables, the values of the correlation coefficients vary between -1 and +1. An exact value of +1 or -1 denotes a perfect degree of association between two variables. By contrast, as the value of the correlation coefficient declines towards 0, the relationship between the two variables in question becomes weaker. The positive and negative sign in front of the correlation coefficients indicate the direction of the relationship. In terms of the average USA rates of major depressive disorder and foreclosure from 2000 to 2016, the two variables share a weak positive association, denoted by a positive correlation coefficient of 0.043. When evaluating the correlation between the average USA rates of anxiety disorders and foreclosure, the two variables appear to share a moderately strong negative association, denoted by a correlation coefficient of -0.58. With regards to the average USA rates of self-harm and interpersonal violence and foreclosure, the two variables share a weak positive association, as indicated by the correlation coefficient of 0.34.

Table 3. Correlation Coefficients: USA Average Rates of Foreclosure and Health

Variable	Average USA Foreclosure	Average USA Major Depressive Disorder Prevalence	Average USA Anxiety Disorder Prevalence	Average USA Self-Harm and Interpersonal Violence Prevalence
Average USA Foreclosure	1.00			
Average USA Major Depressive Disorder Prevalence	0.043	1.00		
Average USA Anxiety Disorders Prevalence	-0.58	0.76	1.00	

Average USA Self-Harm and Interpersonal Violence Prevalence	0.34	0.92	0.52	1.00
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Table 4 is a continuation of Table 3, and denotes the correlations between the average USA rates of foreclosure, and the average USA rates of drug use disorders, alcohol use disorders, nutritional deficiencies and hypertensive heart disease. With respect to the average USA rates of foreclosure and drug use disorders, both variables share a very weak negative relationship, with a correlation coefficient of -0.13. Similarly, the average USA rates of alcohol use disorders also share a very weak negative relationship with foreclosure, indicated by a correlation coefficient of -0.16. Furthermore, while the average USA rates of nutritional deficiencies share a strongly positive association with foreclosure (0.82), average USA rates of hypertensive heart disease were found to share a moderately weak, negative association with USA rates of foreclosure with a correlation coefficient of -0.40. Overall, with reference to both Table 1.1 and Table 1.2, the health outcome variable that shares the strongest (positive) correlation with foreclosure is nutritional deficiencies, followed by anxiety disorders, which shares the second strongest (negative) association with foreclosure. By contrast, the health outcome variable that shares the weakest (positive) relationship with average USA rates of foreclosure is major depressive disorder, followed by drug use disorders, which share the second weakest (negative) association with foreclosure. Among all the seven health outcomes, three of them denote a positive correlation with foreclosure. These three health variables include: major depressive disorder, self harm and interpersonal violence, and nutritional deficiencies.

Table 4. Correlation Coefficients: USA Average Rates of Foreclosure and Health Part Two

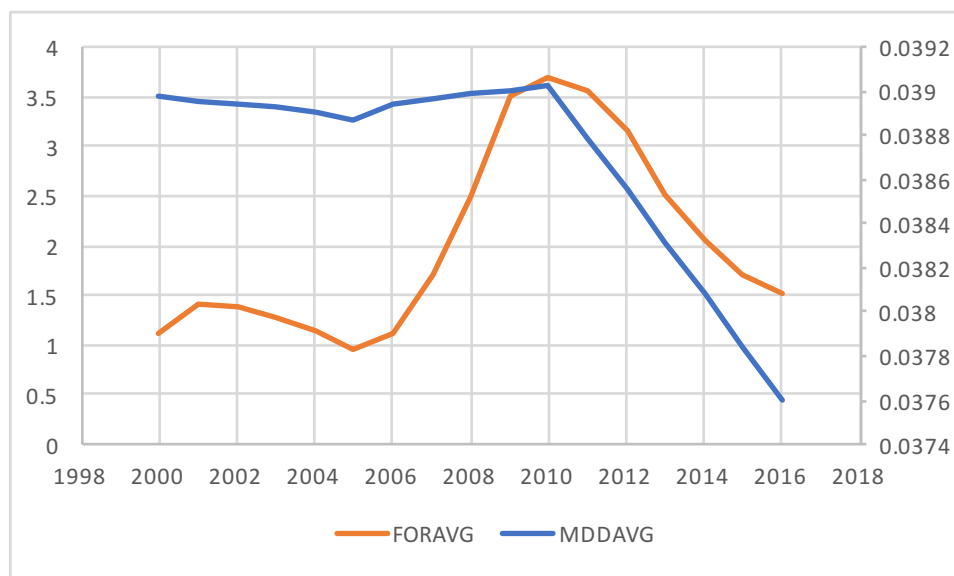
Variable	Average USA Foreclosure	Average USA Drug Use Disorders Prevalence	Average USA Alcohol Use Disorders Prevalence	Average USA Nutritional Deficiencies Prevalence	Average USA Hypertensive Heart Disease Prevalence
Average USA Foreclosure	1.00				
Average USA Drug Use Disorders Prevalence	-0.13	1.00			
Average USA Alcohol Use Disorders Prevalence	-0.16	0.34	1.00		
Average USA Nutritional Deficiencies Prevalence	0.82	0.34	0.35	1.00	
Average USA Hypertensive Heart Disease Prevalence	-0.40	0.82	0.12	-0.13	1.00

On the other hand, the remaining four health variables which share a negative relationship with foreclosure include: anxiety disorders, alcohol use disorders, drug use disorders, and hypertensive heart disease.

3.1 - Descriptive Foreclosure and Health Graphs

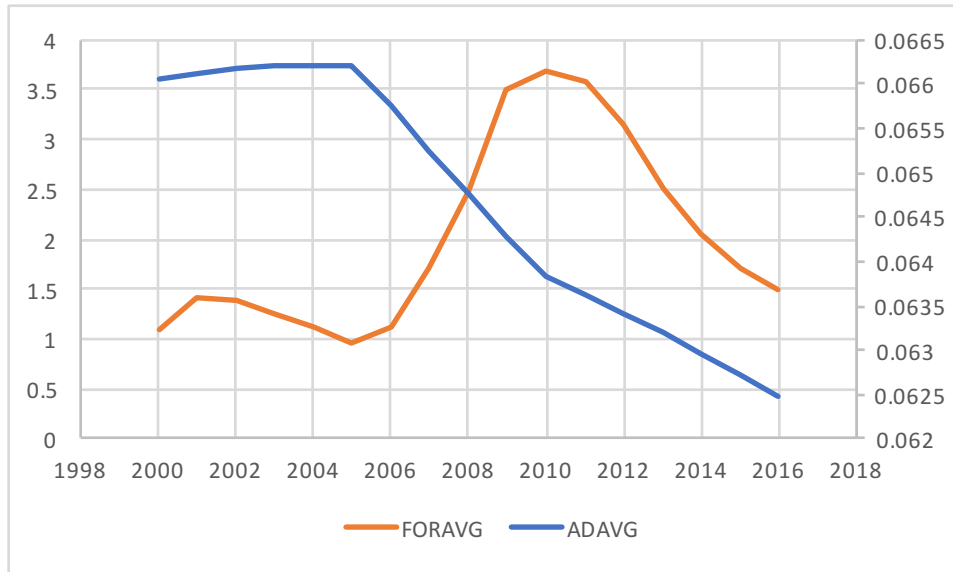
The graphs that follow serve as visual tools to showcase the individual volatility of foreclosure and seven health variables in question, and, to shed light on the ways in which each health outcome variable varies alongside foreclosure:

Figure 1. Average Rates of USA Foreclosure vs. Average Rates of USA Major Depressive Disorder (2000 - 2016).



In Figure 1, the average USA rates of major depressive disorder (MDDAVG) have been compared with average USA rates of foreclosure (FORAVG). A positive relationship is evident between these two variables, whereby FORAVG and MDDAVG both decrease slightly in 2005, and proceed to peak in 2010, before rates begin to fall steadily after 2010 into 2016.

Figure 2. Average Rates of USA Foreclosure vs. Average Rates of USA Anxiety Disorders (2000 - 2016).



In Figure 2, a negative relationship is depicted between average USA foreclosure rates (FORAVG) and average USA rates of anxiety disorders (ADAVG). While FORAVG dips in 2005 and peaks in 2010, ADAVG peaks in 2005 and continues to dip from 2010 into 2016. Both FORAVG and ADAVG seem to embark on a downwards trend following 2010.

Figure 3. Average Rates of USA Foreclosure vs. Average Rates of Self-Harm and Interpersonal Violence (2000 - 2016).

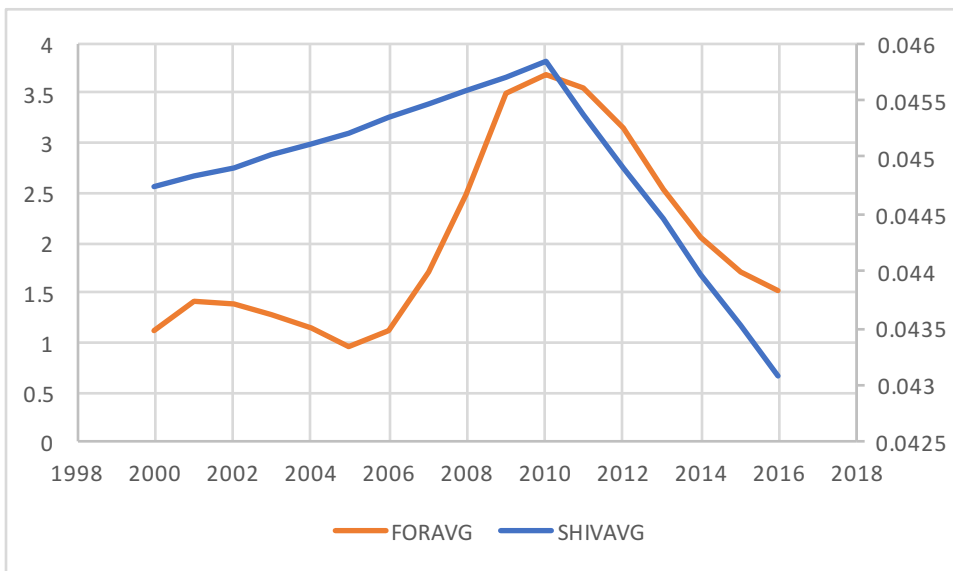
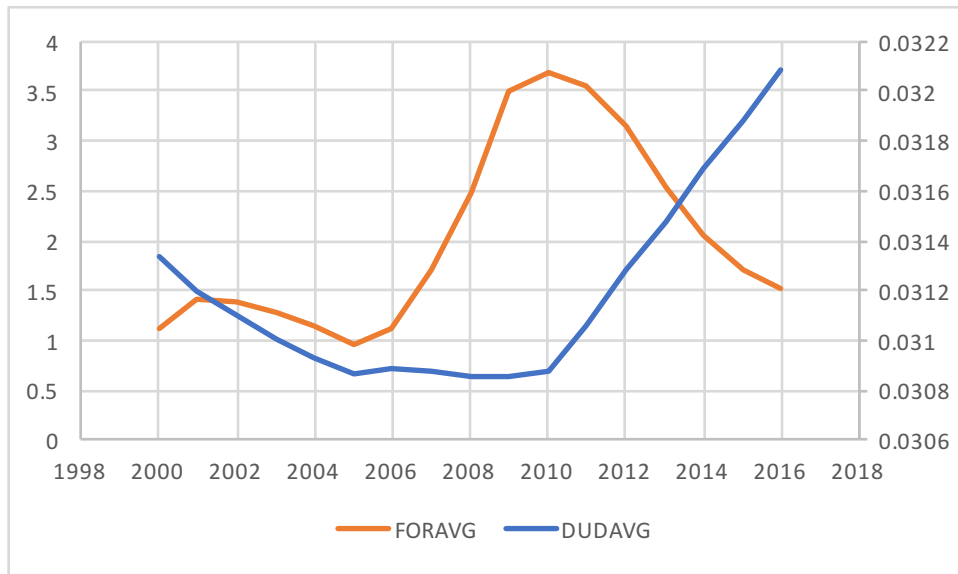


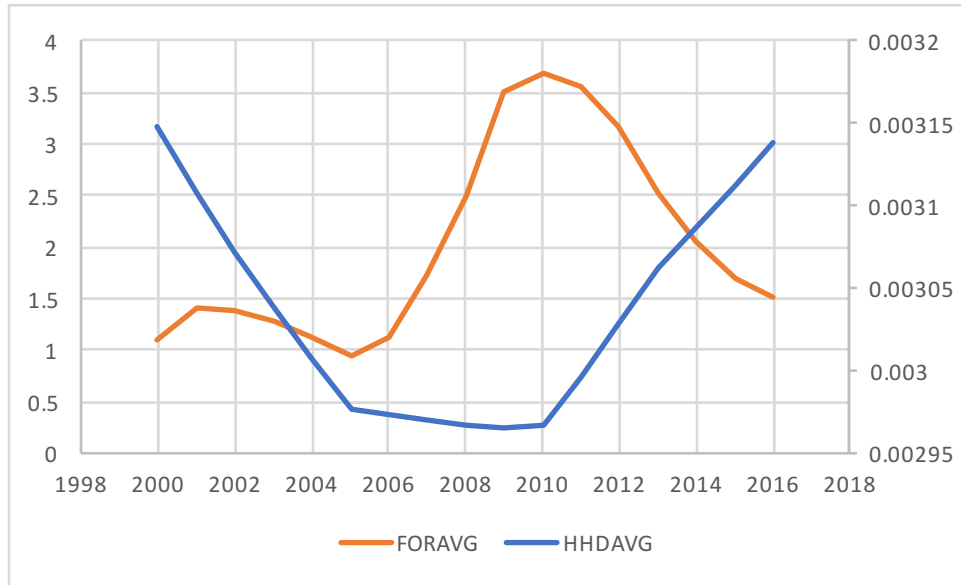
Figure 3 denotes the interaction between FORAVG and average U.S. rates of self harm and interpersonal violence (SHIVAVG). Similarly to the relationship between FORAVG and MDDAVG, SHIVAVG peaks at 2010, alongside FORAVG, and decreases in the proceeding years.

Figure 4. Average Rates of USA Foreclosure vs. Average Rates of Drug Use Disorders (2000 - 2016).



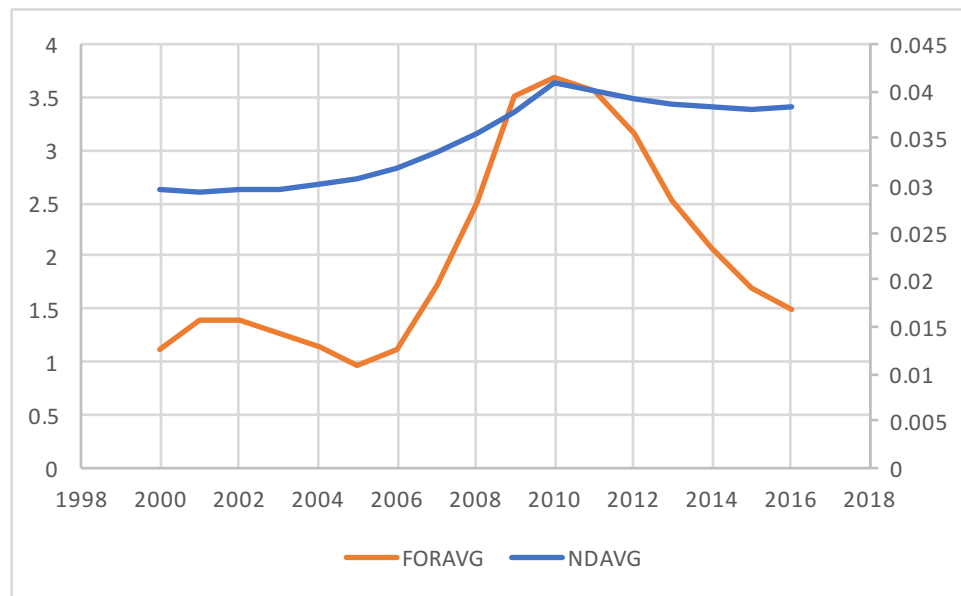
Similarly to the ADAVG, average rates of Drug Use Disorders plummet in the year 2010, in comparison to FORAVG. Both FORAVG and DUDAVG share a similar pattern from around 2001 to approximately 2006, but begin to change paths between 2007 and 2016. While FORAVG denotes a descending pattern following 2010, DUDAVG denotes an ascending pattern following 2010.

Figure 5. Average Rates of USA Foreclosure vs. Average Rates of Hypertensive Heart Disease (2000 - 2016).



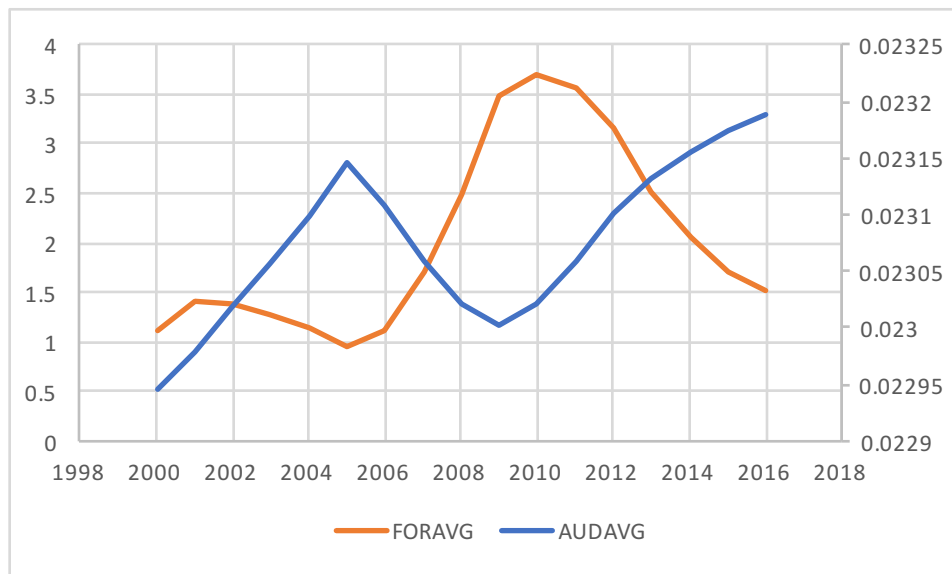
Reminiscent of the FORAVG and DUDAVG graph, Figure 5, which illustrates FORAVG and the average rates of hypertensive heart disease (HHD AVG), shares a very similar pattern but with slight differences. For instance, while both FORAVG and HHD AVG share the same negative interaction in 2010, the variables also show negative interaction between 2000 and 2005, as well as from 2010 to 2016.

Figure 6. Average Rates of USA Foreclosure vs. Average Rates of Nutritional Deficiencies (2000 - 2016).



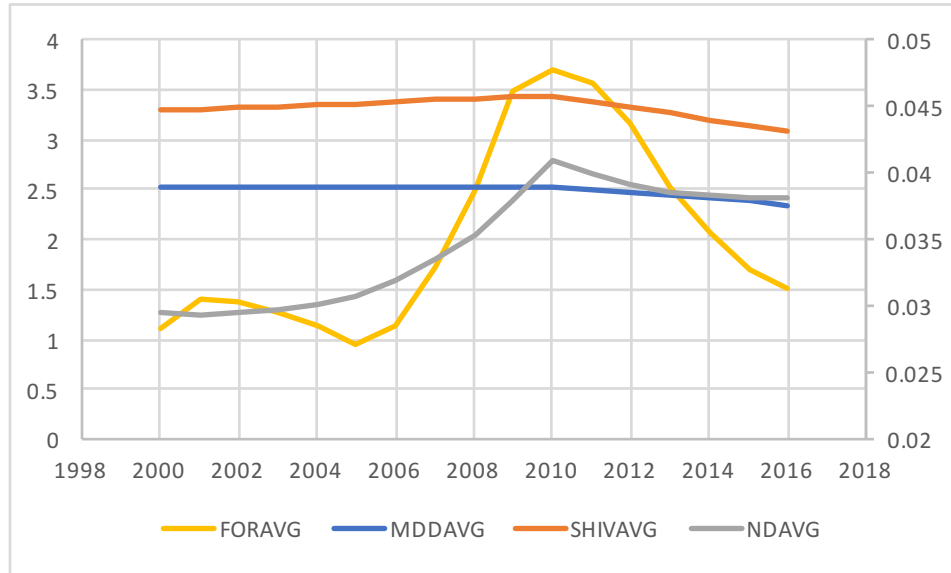
The preceding graph, in Figure 6, denotes a positive association between FORAVG and the average U.S. rates of nutritional deficiencies (NDAVG). NDAVG seems to follow a similar trend in line with FORAVG, especially when FORAVG and NDAVG peak in 2010 and dip slightly in 2005.

Figure 7. Average Rates of USA Foreclosure vs. Average Rates of Alcohol Use Disorders (2000-2016).



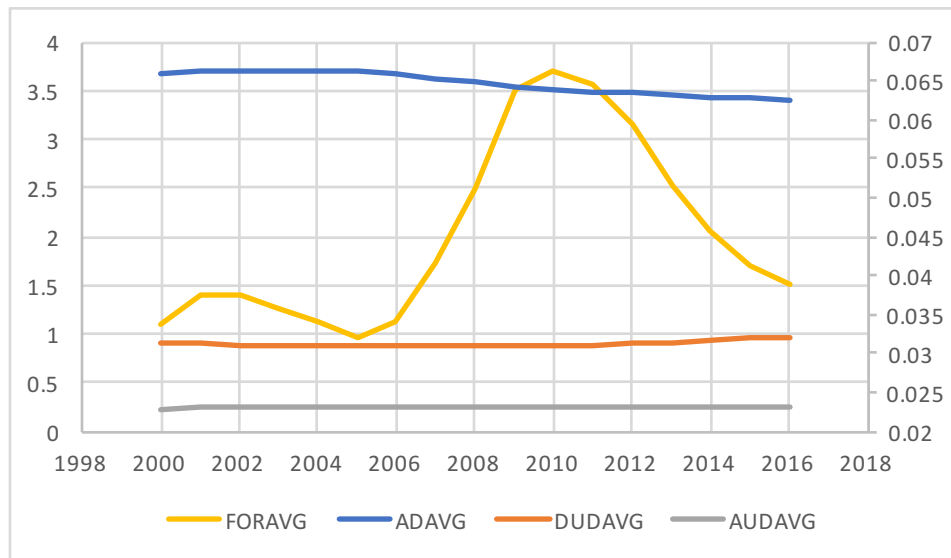
In Figure 7, average rates of alcohol use disorders depict a negative correlation between average U.S. rates of foreclosure. As FORAVG decreases in 2005, AUDAVG increases, and as FORAVG increases in 2010, AUDAVG decreases.

Figure 8. Average Rates of USA Foreclosure vs. MDDAVG, SHIVAVG, and NDAVG (2000-2016)



Shown in Figure 8 are the three positive relationships revealed between FORAVG and MDDAVG, SHIVAVG, and NDAVG. With this scale, NDAVG seems to follow the most similar pattern as FORAVG, while MDDAVG and SHIVAVG create outlines alongside FORAVG that are almost homologous.

Figure 9. Average Rates of USA Foreclosure vs. ADAVG, DUDAVG, and AUDAVG (2000-2016)



In Figure 9, the negative relationships between FORAVG and ADAVG, DUDAVG, and AUDAVG are illustrated. All three health variables mirror FORAVG in a contradictory fashion, with specific emphasis on AUDAVG and FORAVG. In Figure 9, two seemingly related health variables are portrayed and contrasted against FORAVG, however, MDDAVG and ADAVG both share contrasting relationships with FORAVG. While MDDAVG shares a positive relationship with FORAVG, ADAVG shares a negative relationship with the same economic variables (reasons which will be discussed in the discussion section). Overall, from these graphs, one key finding is very clear: foreclosure varies more dramatically over time, in comparison to each of the seven health outcomes. This is attributed to the differences in each variable's standard deviation. For instance, while foreclosure varies by 95% (SE = 0.95), while major depressive disorder varies minimally by 0.045% (SE = 0.00045). The remaining six health outcomes likewise mirror minimal variation, in comparison to foreclosure.

4-METHODOLOGY

In this study, an empirical model consistent with previous literature is adopted, whereby state-level differences in foreclosure and unemployment depend on the state-level health outcomes in question (Jimenez-Rubio, 2011; Kennelly, O'Shea, & Garvey, 2003; Or, 2000; Or, Wang, & Jamison 2005). This study serves to expand on traditional economic functions developed in previous literature by introducing different types of economic indicators (foreclosure and unemployment), that vary at the U.S. state-level over time, in order to test their impact on the following health outcomes: major depressive disorder (MDD), anxiety disorder (AD), self-harm and interpersonal violence (SHIV), drug-use disorders (DUD), alcohol use disorders (AUD), nutritional deficiencies (ND), and hypertensive heart disease (HHD). This

balanced dataset consists of 816 total observations—765 observations, however, when the economic variables have been lagged—across all the United States, over a seventeen year time period. The linear models, which aim to distinguish the relationship between our economic and health observations of each state (i), which fluctuate over the seventeen different points in time (t), are defined as follows:

$$\text{Equation 1: } \text{MDDppc}_{it} = \beta_0 + \beta_1 \text{FORpc}_{it} + \beta_2 \text{UNEpc}_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 2: } \text{ADppc}_{it} = \beta_0 + \beta_1 \text{FORpc}_{it} + \beta_2 \text{UNEpc}_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 3: } \text{SHIVppc}_{it} = \beta_0 + \beta_1 \text{FORpc}_{it} + \beta_2 \text{UNEpc}_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 4: } \text{DUDppc}_{it} = \beta_0 + \beta_1 \text{FORpc}_{it} + \beta_2 \text{UNEpc}_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 5: } \text{AUDppc}_{it} = \beta_0 + \beta_1 \text{FORpc}_{it} + \beta_2 \text{UNEpc}_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 6: } \text{NDppc}_{it} = \beta_0 + \beta_1 \text{FORpc}_{it} + \beta_2 \text{UNEpc}_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 7: } \text{HHDppc}_{it} = \beta_0 + \beta_1 \text{FORpc}_{it} + \beta_2 \text{UNEpc}_{it} + \alpha_i + \varepsilon_{it}$$

Equations 1 through 5 characterize the relationship between the percent change in the mental health outcomes in question (MDDppc, ADppc, SHIVppc, DUDppc, AUDppc, respectively), and the percent changes in foreclosure (FORpc) and unemployment (UNEpc), that vary by state (i) over time (t). By contrast, Equation 6 and Equation 7 denote the relationship between the percent change in the physical health outcomes in question (NDppc and HHDppc), and the percent change in foreclosure (FORpc) and unemployment (UNEpc), that change by state (i) over time (t).

Lagged variables are being used in this regression analysis to provide robust estimates of the effects of the independent variables (FOR and UNE) on the dependent variables (MDD, AD, SHIV, DUD, AUD, ND, and HHD). The use of lagged variables will help to define the long-run

effect of foreclosure on the health incomes in question, and will aid in preventing the generation of autocorrelation results. Ultimately, lagged models are being used to test whether there is a one-year lag between the onset of changes in foreclosure and the onset of changes in health outcomes. While some changes between foreclosure and select health variables may take place within the same year, others may take a full year for the stress of foreclosure to manifest into an adverse health outcome. As a result, the linear models, which aim to discern the interaction between the lagged economic variable observations and the health outcome variable observations from each state (i), which vary over seventeen different points in time (t), are defined as follows:

$$\text{Equation 8: } MDDppc_{it} = \beta_0 + \beta_1 LAGFORpc_{it} + \beta_2 LAGUNEpc_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 9: } ADppc_{it} = \beta_0 + \beta_1 LAGFORpc_{it} + \beta_2 LAGUNEpc_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 10: } SHIVppc_{it} = \beta_0 + \beta_1 LAGFORpc_{it} + \beta_2 LAGUNEpc_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 11: } DUDppc_{it} = \beta_0 + \beta_1 LAGFORpc_{it} + \beta_2 LAGUNEpc_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 12: } AUDppc_{it} = \beta_0 + \beta_1 LAGFORpc_{it} + \beta_2 LAGUNEpc_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 13: } NDppc_{it} = \beta_0 + \beta_1 LAGFORpc_{it} + \beta_2 LAGUNEpc_{it} + \alpha_i + \varepsilon_{it}$$

$$\text{Equation 14: } HHDppc_{it} = \beta_0 + \beta_1 LAGFORpc_{it} + \beta_2 LAGUNEpc_{it} + \alpha_i + \varepsilon_{it}$$

Equations 8 through 12 characterize the relationship between the percent change in the mental health outcomes in question (MDDppc, ADppc, SHIVppc, DUDppc, AUDppc, respectively), and the lagged percent change in foreclosure (LAGFORpc) and unemployment (LAGUNEpc), that vary by state (i) over time (t). By contrast, Equation 6 and Equation 7 denote the interactions between the percent change in the physical health outcomes in question (NDppc and HHDppc), and the lagged percent change in foreclosure (LAGFORpc) and unemployment (LAGUNEpc), that change by state (i) over time (t). In all of the equations, Equations 1-14, the β_0 portion of the

equations represents the constant coefficient. The notation of β_1 serves as the estimated effect of foreclosure (FOR) on health outcomes (MDDppc, ADppc, SHIVppc, DUDppc, AUDppc, NDppc, and HHDppc), controlling for state-specific, and year-specific shocks or, in other words, the state and year fixed effects. The α_i portion of the the equations estimates the common change across all eighteen years, from 2000 to 2017, for the percent prevalence rates in state i relative to state 1, controlling for population density and year-specific characteristics, or shocks, common to all states (state-level fixed effects). The portion α_i of the equations represents state-level fixed effects because the difference is common to all years in state i ; in other words, the ‘effect’ of state i is ‘fixed’ across the given time period, controlling for baseline differences between different states. Finally, the stochastic error term (ϵ_{it}), otherwise known as the residual, represents the margin of error within the statistical model that serves to provide an explanation for the difference between the results of the model and actual observed results.

5 - EMPIRICAL RESULTS

Table 5 and Table 6 denote the results of the regression analysis, using the fixed effects model, based on the estimation of economic outcomes, as specified in Equations 1-14, for seven health indicators: major depressive disorder (MDD), anxiety disorder (AD), self-harm and interpersonal violence (SHIV), drug-use disorders (dud), alcohol use disorders (AUD), nutritional deficiencies (ND), and hypertensive heart disease (HHD). For each health indicator, a set of two different empirical models were used to assess the relationship and significance level of a percentage change in the economic outcomes (foreclosure and unemployment) and the health outcomes in question, with all regressions employing the fixed effects model. While Table 2 showcases the results of the non-lagged regression analysis for each economic and health

variable over time, Table 6 reveals the results of lagged foreclosure against each health variable, over time.

5.1 - NON-LAGGED MODELS

In Model 1, the percentage change in state-level, annual-level foreclosure rates and unemployment rates were regressed against state-level, annual-level percent change prevalence rates of major depressive disorder. The results of the regression analysis reveal a highly significant relationship, at $p < 0.001$, between foreclosure and major depressive disorder, yielding a coefficient of 0.35. As a result, for every 1% increase in foreclosure, there is an associated 0.35% increase in major depressive disorder. Results also indicate a significant relationship, again at the $p < 0.001$ significance level, between major depressive disorder and unemployment in Model 1. So, for every 1% increase in unemployment, there is a 0.60% increase in the percent prevalence of major depressive disorder. Model 2 denotes the regression results of the percentage change in state-level, annual-level foreclosure rates against the percent change in the state-level, annual-level prevalence rates of anxiety disorder. In this regression analysis, a significant negative relationship, at $p < 0.001$, between the percent change in foreclosure and the percent change in state-level rates of anxiety disorder was revealed. So, for every 1% increase in foreclosure there is a 0.52% decrease in anxiety disorder. By contrast, in the same regression analysis, anxiety disorder shares a weakly significant positive relationship with unemployment, at $p < 0.05$, where every 1% rise in unemployment leads to a 0.15% increase in the prevalence of the health outcome.

Table 5. Panel Regression Estimations on Foreclosure and Health, Fixed Effects Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	Major Depressive Disorder (MDDppc)	Anxiety Disorder (ADppc)	Self Harm and Interpersonal Violence (SHIVppc)	Drug Use Disorders (DUDppc)	Alcohol Use Disorders (AUDppc)	Nutritional Deficiencies (NDppc)	Hypertensive Heart Disease (HHDppc)
	1	2	3	4	5	6	7
Percent Change in Foreclosure	0.35***	-0.52***	0.71***	-0.24***	-0.41***	3.80***	-0.30 ^{ns}
Percent Change in Unemployment	0.0060***	0.0015*	0.014***	-0.010***	0.00042 ^{ns}	0.062***	-0.017***
Constant	-0.21***	-0.36***	-0.20***	0.15***	0.076***	1.68***	-0.053 ^{ns}
Fixed effects	YES	YES	YES	YES	YES	YES	YES
R-squared (Overall)	0.19	0.18	0.29	0.11	0.014	0.28	0.065
N	816	816	816	816	816	816	816

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

In terms of Model 3, results indicate the presence of a strongly significant relationship, at $p < 0.001$, between the percent change in state-level rates of self-harm and interpersonal violence and foreclosure and unemployment. For instance, in this regression analysis, for every 1% increase in foreclosure, there is an associated 0.71% increase in the percent prevalence of self-harm and interpersonal violence. Furthermore, for every 1% growth in unemployment, there is a 0.014% increase in the prevalence of self-harm and interpersonal violence, at the $p < 0.001$ significance level. In Model 4, whereby the percent change in the economic variable rates were regressed against the percent change in drug use disorders, a significant negative relationship was revealed, at the $p < 0.001$ level. So, for every 1% increase in foreclosure, in Model 4, there is an associated 0.24% decrease in drug use disorders. In terms of the economic control variable in Model 4, there is a 0.010% decrease in drug use disorders for every 1% increase in

unemployment. With regards to Model 5, the percent change in alcohol use disorders was regressed against the percent change in foreclosure. While alcohol use disorders were found to share a significant negative relationship with foreclosure, decreasing 0.41% for every 1% increase in foreclosure, no significant relationship was revealed to exist between the percent change in unemployment and the percent change in alcohol use disorders.

Model 6 denotes the percentage change in foreclosure and the percentage change in unemployment regressed against the percentage change in nutritional deficiency rates. The results demonstrate a strongly significant relationship between foreclosure and nutritional deficiencies, with a p-value < 0.001, and a coefficient of 3.80. As a result, for every 1% increase in foreclosure, there is a 3.80% increase in the prevalence of nutritional deficiencies. Likewise for unemployment, a significant positive correlation, at $p < 0.001$, is present between nutritional deficiencies and unemployment. So, there is a 0.62% increase in the prevalence of nutritional deficiencies for every 1% increase in unemployment.

No results were revealed to support any form of significant relationship between the percent change in foreclosure, in Model 7, and the percent change in the prevalence of hypertensive heart disease. Having said this, in this model, hypertensive heart disease was found to share a significant negative association with the percent change in unemployment. As a result, for every 1% increase in unemployment there is an associated 0.017% decrease in the prevalence hypertensive heart disease.

5.2 - LAGGED MODELS

In Model 8, the percentage changes in lagged foreclosure and unemployment were regressed against the percent change in major depressive disorder. While there was no statistically significant relationship shared between the lagged percent change in foreclosure and

the percent change in major depressive disorder, a significant relationship, at $p < 0.001$, was revealed to exist between the percent change in major depressive disorder and unemployment. Concisely, for every 1% increase in unemployment, there is a 0.0074% increase in the prevalence of major depressive disorder. In Model 9, a significant negative relationship was shown to exist between the lagged percent change in foreclosure and the percent change in anxiety disorder. So, for every 1% increase in foreclosure there is a 0.38% decrease in the prevalence of anxiety disorder. No significant relationship was revealed to subsist between anxiety disorder and unemployment in Model 9.

Table 6. Panel Regression Estimations on Lagged Foreclosure and Health, Fixed Effects Model

	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
	Major Depressive Disorder (MDDppc)	Anxiety Disorder (ADppc)	Self Harm and Interpersonal Violence (SHIVppc)	Drug Use Disorders (DUDppc)	Alcohol Use Disorders (AUDppc)	Nutritional Deficiencies (NDppc)	Hypertensive Heart Disease (HHDppc)
	8	9	10	11	12	13	14
Percent Change in Lagged Foreclosure	0.0969 ^{ns}	-0.38 ^{***}	0.38 ^{***}	-0.12 ^{ns}	-0.27 ^{ns}	2.6 ^{***}	0.12 ^{ns}
Percent Change in Lagged Unemployment	0.0074 ^{***}	0.0014 ^{ns}	0.015 ^{***}	-0.011 ^{***}	0.00019 ^{ns}	0.067 ^{***}	-0.018 ^{***}
Constant	-0.23 ^{***}	-0.39 ^{***}	-0.23 ^{***}	0.19 ^{***}	0.078 ^{***}	1.78 ^{***}	0.037 ^{ns}
Fixed effects	YES	YES	YES	YES	YES	YES	YES
R-squared (Overall)	0.14	0.097	0.21	0.11	0.0051	0.25	0.057
N	765	765	765	765	765	765	765

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

With respect to Model 10, results indicate the presence of a strongly significant relationship, at $p < 0.001$, between the percent change in state-level rates of lagged foreclosure and unemployment, and self-harm and interpersonal violence. Thus, as lagged foreclosure and unemployment increase by 1%, the prevalence of self-harm and interpersonal violence increases by 0.38% and 0.015%, respectively. These denoted relationships are statistically significant at the $p < 0.001$ level. The regressions run for Model 11 revealed the presence of an insignificant relationship between drug use disorders and lagged foreclosure. However, while lagged foreclosure and drug use disorders share no significant relationship, every 1% increase in unemployment was found to lead to a 0.12% decrease in the prevalence of drug use disorders, significant at $P < 0.001$. In Model 12, no significant relationship was revealed to subsist between the lagged economic variables and alcohol use disorders.

Model 13 denotes the lagged percentage change in foreclosure and unemployment regressed against the percentage change in nutritional deficiency rates. In the regression analysis of this model, results yielded between the health outcome and the economic outcomes suggest a statistically significant relationship exists at all three significance levels. Consequently, for every 1% increase in lagged foreclosure, there is a statistically significant increase in the prevalence of nutritional deficiencies, at $p < 0.001$, by 2.6%. In terms of the relationship between the percent change in unemployment and the percent change in nutritional deficiencies in Model 13, for every 1% increase in unemployment, there is a statistically significant increase in the prevalence of nutritional deficiencies, at $p < 0.001$, by 0.067%. No results were revealed to support any form of significant relationship between the lagged percent change of foreclosure, in Model 14, and the prevalence of hypertensive heart disease. Having said this, hypertensive heart disease was found to share a significant negative association with unemployment in Model 14. As a result, for

every 1% increase in lagged unemployment there is a corresponding 0.018% decrease in the prevalence hypertensive heart disease.

Overall, the health outcome variables revealed to support a statistically significant positive association with foreclosure and unemployment include: major depressive disorder, nutritional deficiencies, and self-harm and interpersonal violence. The health outcomes that were shown to share a statistically significant negative relationship between foreclosure include: anxiety disorders, alcohol use disorder, and drug use disorders. No significant relationship was found to exist between foreclosure and hypertensive heart disease. The results of the regressions solely supported a significant negative relationship between hypertensive heart disease and unemployment.

6 - DISCUSSION

Following the aftermath of the foreclosure crisis, researchers have begun to investigate the relationship between foreclosure and population health outcomes. In spite of new research emerging on the subject, few academic researchers have appraised the holistic association between foreclosure and both mental and physical health outcomes (Cagney, Browning, Iveniuk, & English, 2014; Houle, 2014; Houle & Light, 2014; Saegert, Fields, & Libman, 2011; Currie & Tekin, 2015). In this study, several significant results emerged from running panel regression analysis, using the fixed effects model, on the collected economic and health data. The health outcome variables revealed to support a statistically significant positive association with foreclosure and unemployment include: major depressive disorder (MDD), nutritional deficiencies (ND), and self-harm and interpersonal violence (SHIV). The health outcomes that were shown to share a statistically significant negative relationship between foreclosure include:

anxiety disorders (AD), alcohol use disorders (AUD), and drug use disorders (DUD), while no significant relationship was found to exist between foreclosure and hypertensive heart disease (HHD). The results of the regressions solely supported a significant negative relationship between hypertensive heart disease and unemployment. It was thought that all seven health outcomes would end up being positively correlated with foreclosure, but the data of this study reveals findings that are not perfectly consistent. While three key significant positive relationships emerged that confirmed our hypothesis (MDD, SHIV, and ND), the remaining four health outcomes (AD, AUD, DUD, and HHD) made the relationships between foreclosure and health less clear.

Overall, while some of the significant regressed results between foreclosure and select health outcomes aligned with previous findings from prior conducted research, other significant results among the economic variables and select health variables seemed counterintuitive. For instance, based on the current literature surrounding foreclosure and its association with psychological distress, yielding a significant correlation between foreclosure and major depressive disorder appears to align with the existing evidence of other similarly conducted studies (Steptoe, Brydon, & Kunz-Ebrecht, 2005; Szanton, Allen, Thorpe, Seeman, Bandeen-Roche, Fried, 2008; Kahn, Pearlin, 2006; Matthews, Smith, Hancock, Jagger, & Spiers, 2005; Blazer, Sachs-Ericsson, & Hybels, 2005; Lantz, House, Mero, & Williams, 2005; Pollack & Lynch, 2009; Pollack, Lynch, Alley, & Cannuscio, 2010).

Foreclosure sharing a highly significant relationship with nutritional deficiencies also aligns with previously conducted research (Carter & Gottschalck; Osypuk et. al., 2012). With the economic hardship that foreclosure imposes, it makes intuitive sense that those who experience foreclosure are more likely to be nutritionally deficient, as they may not have sufficient

disposable income to spend on more nutritionally dense food. Additionally, if foreclosure serves to decrease one's mental health by way of physiological and financial stress, leading to household food insufficiency, this is an additional mechanism through which the foreclosure and nutritional deficiency relationship may operate.

The results from this research study revealed foreclosure to be significantly and positively associated with self-harm and interpersonal violence. This significant association between the two variables also aligns with results from previous studies conducted on the subject. Researchers reason that interpersonal violence increases as declines in financial status are experienced, as is the case when a person undergoes the process of foreclosure (Renzetti, 2009). Furthermore, self-harm and interpersonal violence is known to arise from community-level factors such as economic inequality, poverty, weak economic safety nets, and unemployment (Waters, Hyder, Rajkotia, Basu, Rehwinkel, Butchart, & World Health Organization, 2004). As foreclosure is often borne through socioeconomic inequality, weak economic safety nets, and unemployment, this shared positive relationship between self-harm and interpersonal violence and foreclosure elucidates a mechanism through which the two variables may interact. Now, while three out of the seven health outcomes portrayed significant positive relationships with foreclosure, the counterintuitive results of the relationships between foreclosure and the remaining four health variables leave us with a need to conduct more research, to better understand the mechanisms through which the variables act.

It is important to note that this study is not without limitations. For instance, while this longitudinal study was set up using panel data and a fixed effects model to establish whether causal relationships exist between the economic outcomes and health incomes in question, correlations, rather than causal relationships, were determined through running multivariate

regressions. Furthermore, the mechanism of how economic conditions, such as foreclosure and unemployment, influence individual-level health outcomes is multifactorial and has yet to be studied comprehensively, so further research is required to provide additional analysis of foreclosure and health. While this research sought to elucidate a positive significant relationship between foreclosure and health, the findings revealed were not perfectly consistent. This research shed light on three significant positive relationships, that confirmed our hypotheses, between foreclosure and the health outcomes major depressive disorder, nutritional deficiencies, and self harm and interpersonal violence. The study's findings also revealed the presence of three significant negative relationships and one insignificant relationship, that opposed our hypotheses, between foreclosure and anxiety disorders, alcohol use disorders, drug use disorders, and hypertensive heart disease. The seemingly contradictory findings between foreclosure and the health outcomes anxiety disorders, alcohol use disorders, drug use disorders, and hypertensive heart disease may, ultimately, be due to the heterogeneity in other unobserved factors. For instance, there are a wide variety of factors that influence health, such as income and socioeconomic status, level of education and literacy, culture and ethnicity, access to healthcare services, social support networks, social and physical environments, and biological and genetic endowment—factors which were not evaluated in this particular study but that should be evaluated in future research (World Health Organization, 2008). By virtue of this information, the main limitation essentially comes down to the inclusion criteria of this study. As a result, further research in this area should be pursued and examined, whereby the empirical models control for some, or all, of the aforementioned determinants of health. Doing so, will aid in enabling researchers to clarify the nature of the perplexing relationships between foreclosure and health.

7 - CONCLUSION

Overall, this study served to elucidate the relationship between foreclosure and seven health outcomes, during a time period fraught with wavering economic conditions. The findings highlight the importance of policy-level approaches, both in real estate, health, and insurance domains, that work towards minimizing the impact of depleted resources, as economic conditions fluctuate. The results of the study indicate that foreclosure brings about significant increases in the risk of major depressive disorder, nutritional deficiency, and self-harm and interpersonal violence, across all of the United States studied. These results provide important evidence in the debate on the health impact of foreclosure and recessionary periods. As a result, policy makers may wish to implement new policies making the provision of supplementary health resources necessary when homeowners are at risk of having their home foreclosed upon, or are in the process of undergoing foreclosure. For instance, financial institutions who monitor the status of client mortgages could be necessitated to issue resources that provide guidance and support on how to prevent home foreclosure and, they may also provide information on which health helplines clients may consult if they are at risk of experiencing home foreclosure. When homeowners are at risk, or are undergoing foreclosure of their home, legislation may be set in place by health officials to have financial institutions send a notice to the homeowners' health care team to result in the issue of a physical and mental health assessment of the homeowner. This process would facilitate the delivery of healthcare that would potentially help homeowners manage risks of becoming depressed, acquiring nutritional deficiencies, or committing acts of self-harm and interpersonal violence. Having clients at risk of facing home foreclosure go in to see their family physician or health care team would, ultimately, serve as a pro-active approach to help clients maintain their mental and physical health. By being made aware of what supports

the client can access through the healthcare industry, this method may even go so far as to develop the clients' mental resilience to help prevent them from having their home foreclosed upon.

While significant positive relationships were found to be shared among major depressive disorder, nutritional deficiencies, and self-harm and interpersonal violence, and foreclosure significant negative associations were also brought to light. Specifically, anxiety disorders, drug-use disorders, and alcohol use disorders were all found to share a significant negative relationship with foreclosure and unemployment, while no significant relationships were discovered to exist between foreclosure and heart disease. Based on the revolving research pertaining to the aforementioned health variables (AD, AUD, DUD, and HHD) and foreclosure, theoretically, the health variables should share a positive association, rather than a negative one. As such, there may be an issue of multicollinearity with these particular health outcome variables due to unobserved characteristics. Additionally, it is very likely that the expansion of Medicaid, and unemployment benefits under the 2009 American Recovery and Reinvestment Act exerted a substantial buffering effects on U.S. health outcomes (Modrek, Stuckler, McKee, Cullen, & Basu, 2013). Ultimately, more research is necessary to clarify the nature of the relationships between foreclosure and the health outcomes, especially with regards to anxiety disorders, drug use disorders, alcohol use disorders, and hypertensive heart disease. Overall, this study served to bridge a preliminary gap in examining the link between foreclosure and health. Future studies should strive to evaluate the economic and health variables in greater detail, with the incorporation of more control variables in their models to further elucidate existing relationships between foreclosure and health.

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