STRUCTURAL UNEMPLOYMENT: A NEW MEASUREMENT AND CONTINUING DISCUSSION OF AN ELUSIVE ECONOMIC INDICATOR

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Abstract

The Workforce Innovation and opportunity Act (WIOA) and the Trade Act of 1974 were both intended to address conditions that today may be characterized as contributors to "structural unemployment." These contributors include, primarily, mismatch between worker skillsets and the skills needs of employers in the relevant labor markets. WIOA seeks to coordinate skill development and credentialing at a local level to better match workers' abilities with employers' skills needs. The Trade Act is intended to assist workers adversely affect by foreign trade by providing, among other things, training to prepare them for new careers. Our review of the relevant literature suggests that there is no uniform definition or accepted quantitative measure of "structural unemployment" that would be comparable to the standard unemployment rate (U3) or U3 plus marginally attached workers (U5).We propose two new measures of economic labor utilization based on data from the Bureau of Labor Statistics that provide both a qualitative and quantitative measure of structural unemployment, called U-7X and U-7XR. We believe that these measures gauge the extent of unemployment intrinsic in an economy that is intransigent because of a variety of factors including skills-based-employer need mismatch, aging demographics, and people with disabilities. In turn, these measures can be used as an assessment of the state level implementation of both WIOA and the Trade Act.

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INTRODUCTION

The Trade Act of 1974 was designed to provide assistance to workers who have been adversely affected by foreign trade. A generation later in 2014, the Workforce Innovation and Opportunity Act (WIOA) was introduced in order to coordinate skill development and credentialing at the local level, in an evidence based and data-driven way in order to ensure accountability and transparency, according to the Department of Labor. Where these two acts overlap is in their aim to identify the intransigent mismatch between employer needs and workers' skills. We agree with widely shared economic opinion that trade, globalization and advancing technologies represent structural elements of the economy. That is to say that they are slow moving, deeply influential and more difficult to quantify than issues such as the supply and demand of labor. It is our belief then, that both the Trade Act of 1974 and the Workforce Innovation and Opportunity Act are attempts to address structural unemployment, and that by analyzing said unemployment we can begin to understand whether or not these acts have succeeded in their goals.

The concept of structural unemployment (SU) has been widely studied and debated in economic, statistical, and governmental settings throughout the last century. Peter Diamond (2013) suggests that it is generally when unemployment remains high for relatively long periods of time, that analyses begin to address whether or not there is a structural change occurring. However, such interest can often be a double-edged sword as competing theories and measurements vie for supremacy. With more time elapsing since the recession of 2007-09, we are currently experiencing an era of increased focus on the topic. It is our belief that through open discussion and a more simplistic understanding of structural unemployment, we can implement a measurement of structural unemployment that can be applied across all 50 states and lead to a greater understanding of local labor forces and economic health.

What we propose is a refined way to measure and analyze structural unemployment. We depart from the current literature by focusing attention on unemployment itself, rather than the factors affecting it. While both are of extreme importance, we believe that more value can be gained from a deeper understanding of how to measure structural unemployment as a concept. Using the Bureau of Labor Statistics (BLS) Alternative Measures of Labor Underutilization (or "U's") as a blueprint, we introduce two new measures into the ongoing debate surrounding structural unemployment.

The aim of this paper is to spark a new debate in the literature by conceptualizing structural unemployment in a way that is more nuanced than current research suggests. In the work that follows we first discuss the existing literature on structural unemployment. We identify two primary bodies of work that cover different aspects of structural unemployment. One addresses structural causes of unemployment, while the other attempts to measure unemployment in a way that eliminates cyclical and frictional "noise." In the second section we introduce our basic theoretical framework, as it relates to the current scholarship. Third we re-trace the algebraic and logical process we used in order to build our models. In the fourth section, we discuss some preliminary findings from our models, and inferences that may be drawn. Next, as a test of robustness and validity, we apply our models to national data and a

sample of other states. The sixth section addresses questions and potential criticisms, while the final section concludes and provides potential avenues for future research.

EXISTING RESEARCH

A Brief Overview of Unemployment

In the domestic literature, there is seemingly little time spent providing a qualitative understanding of structural unemployment. This is largely because there is strong consensus among scholars over what exactly structural unemployment is.[1] Structural unemployment as it is most commonly understood can be defined simply as unemployment that results from a mismatch between labor supply and demand. These structural changes can be the result of ongoing demographic shocks, or mismatches between labor skills and industry demands that increases unemployment in simply being long-term. Other scholars explain structural unemployment as the long-term unemployment. In other words, the long-term trend of unemployment is said to be structural and slow moving.

While we are primarily concerned with structural unemployment, it is imperative to have an understanding of unemployment more broadly. Therefore, we briefly consider its other two most commonly cited components. Cyclical unemployment refers to changes in demand that occur within a given business cycle. These demand shifts can be attributed to layoffs, a reduction in employee hours, or other responses to a temporary downturn in business.[2] Finally, some scholars introduce the idea of "frictional unemployment" to refer to short-run unemployment due to frictions in the job search process.[3] These frictions can be thought of as delays in finding employment due to common actions such as filling out and submitting applications, creating resumes, or seeking assistance from a workforce services professional. Though theoretically useful, such a term is too difficult to separate. Moreover, the idea of frictional unemployment merely places added weight on the job search process, an inevitable feature of becoming employed. As there is little that can be done to adjust frictional outside of personal efforts, we center this paper on the structural and cyclical components unemployment.

When conceptualizing structural unemployment, two main theories are prominent. The first holds structural unemployment constant, and the second views it variably. The belief that structural unemployment is a constant used to be widely accepted in the literature and relies heavily on a macroeconomic theory of unemployment.[4] Simply put, it states that in the long-term, there is equilibrium between inflation and unemployment. In the short-term, cyclical changes raise or lower unemployment, and inflation rates adjust to bring it back into equilibrium. This balance is considered to be structural unemployment. Put another way, structural unemployment is relatively constant, adjusting only when necessary to maintain a properly functioning economy. This is sometimes referred to interchangeably as "permanent unemployment" or "long-term unemployment."

While the idea of equilibrium is often useful in macroeconomic theory, it is the second understanding of structural unemployment that we find most appropriate. This view holds that structural unemployment is variable and subject to meaningful change. Within this camp, there are differences of opinion. Most prominent is that structural unemployment is a mismatch between skills supply and demand. This is sometimes viewed in terms of education rates of the working age population and the unemployed, mobility between industries, and the erosion of skills during periods of unemployment. Another group views this type of structural unemployment in terms of economic and population demographics. For example, the age and location of the workforce, changing technologies, and education rates are used as proxies for changes to the economic structure, thus impacting unemployment rates among other factors. It is this understanding of structural unemployment that we use as our foundation.

[1] These definitions and discussions are given in several previous studies. For a complete discussion see Lazear and Spletzer (2012) and Levine (2013).
[2] Levine (2013)
[3] This term is discussed in detail by Aysun, Bouvet, and Hofler (2014). In their analysis Aysum, Bouvet, and Hofler attempt to empirically disentangle structural, cyclical, and frictional unemployment into their separate components. They utilize stochastic frontier analysis to measure the minimum point that total unemployment can attain. This minimum point is said to be net of frictional unemployment.
[4] See for example Leonard (1986)

Building from this foundational understanding of structural unemployment, we develop a unique approach to the debate surrounding structural unemployment that attempts to address a key flaw in much of the literature. When discussing structural unemployment, most economists focus on causes of unemployment. The common theme is that if the causes are structural, so too must be the resulting unemployment. A largely separate branch of economics is concerned with more appropriately measuring unemployment in ways that are more theoretically complete and useful. As our theory will suggest, labor economics would be best served by a clearer convergence of these bodies of work. Before elaborating on our contributions, we briefly review the main tenets of these existing areas of research.

The Causes of Structural Unemployment: A Tale of Mismatches

Much of the economic research on structural unemployment is dominated by a focus on the *causes* of long-term unemployment. For many, structural refers not to unemployment itself, but rather to whether or not the factors leading to increases or decreases in unemployment are structural in nature. The most common type of factor is a mismatch between the labor supply and the demand of the job market. Mismatches occur between the unemployed and job vacancies in countless forms. The most commonly explored are skills, education, age, geographic location, and cultural components that may raise and lower the cost of unemployment. The relationship of mismatches between the unemployed and job openings is often spoken of in terms of the Beveridge Curve[5], a topic we will devote more time to later.

Centering on the most recent economic recession, economists have concluded that structural forces such as demographic and industrial shifts have not resulted in a permanent increase in long-term unemployment.[6] For example, Lazear and Spletzer (2012) conclude that many scholars found no evidence of shifts in industry, demographics, or education that would suggest structural change. While they do find evidence of mismatches between job vacancies and the unemployed based on occupation and industry, the authors note that these mismatches declined as quickly as they rose, leading to the conclusion that only more pronounced cyclical factors explain the recent rise in unemployment during the Great Recession. Similar conclusions are drawn by Rothstein (2012) who finds that although recent years have seen higher unemployment than cyclical explanations would predict continued poor performance is due primarily to aggregate demand, a cause associated traditionally with cyclical unemployment.[7]

Looking further into the idea of labor market mismatches as a structural cause of unemployment can often lead to contrarian findings. For instance, focusing on the issue of a housing lock,[8] Schmitt and Warner (2011) find little support that poor housing conditions have led to a significant rise in unemployment.[9] However, Estavao and Tsounta (2011) conclude that particularly when poor housing conditions are coupled with skills mismatches, unemployment does see a statistically significant increase.[10] Further complicating matters, although Sahin et al do not find support for geographic mismatches specifically, they do conclude that mismatches between job vacancies and unemployment generally account for a third of the rise in unemployment. This conclusion would seem to suggest that the authors still put theoretical weight on structural causes of unemployment. Additionally, studies such as the one conducted by Mayer (2014) suggest that cyclical unemployment can lead to structural unemployment. Mayer states that cyclical unemployment can become structural, specifically if the recent rise in long-term unemployment lead to those individuals seeing their skills erodes during that time. This allows for the possibility that arguments for both cyclical and structural unemployment rising hold merit.

To be sure, mismatches are not the only structural causes of unemployment that the literature explores. In their study, Coibon et al (2013) find that traditional culprits of persistent unemployment do not account for current

[5] For a more thorough examination of the Beveridge Curve and current scholarly debate surrounding the topic, see Elsby, Michaels, and Ratner (2015).

[6] See, for example, Rothstein (2012) and Hoynes, Miller, and Schaller (2012).

[7] See also Levine (2013).

[8] A housing lock is the idea of individuals being "stuck" in their current location due to poor housing market conditions. The argument is that poor housing conditions make it difficult for unemployed people to sell their home and move for employment. For further examination, see Estavao and Tsounta (2011).

[9] This is echoed in the work of Sahin et al (2012), who conclude that geographic mismatches play little to no role in rising unemployment.

[10] Kocherlakota (2010) is also singled out by Lazear and Spletzer for finding evidence for an increase in structural unemployment during the Great Recession.

trends in the United States.[11] Instead they turn their focus to labor mobility, changing age composition of the working age population, and the general culture of trust.[12] The authors find that only cultural explanations hold statistical significance for the persisting high levels of unemployment. Coibon et al posit that there may be a decline in the negative stigma attached to accepting government benefits, such as unemployment insurance. Indeed, Hagerdorn et al (2013) claim that "unprecedented extensions" of unemployment benefit eligibility is to blame for the increase in long-term unemployment as it discourages labor supply. The work of Farber and Valletta (2015) shows mixed support for this claim, finding that although extended UI benefits appear to have increased unemployment by approximately 0.4 percentage points, most of this is a result of individuals remaining in the labor force longer than they normally would and not due to an effect on re-employment per se.

In summary, while the work on structural causes of unemployment is extensive, there are often competing conclusions in the literature. More troubling, and without condemning an entire section of economic research, this body of work largely holds all forms of unemployment equal. Specifically, many of the authors here attempt to address if causes thought to be structural in nature, have increased unemployment levels. The issue is one of model misspecification. Specifically, the dependent variable is total unemployment, while it is referred to as structural unemployment. It is assumed that if the causes are structural, the resulting unemployment must be as well. In these instances, the model is misspecified by selecting an inappropriate dependent variable, leading to inferences being drawn without appropriate statistical evidence. Were the same measure of unemployment change without being accompanied by structural causes, the dependent variable would logically need to be classified as cyclical, frictional, or total unemployment. This is not logically sound if the measurement remains constant, and only the definition changes. Though the structural causes literature discussed in this section heavily factors into our own models, we are predominantly concerned with this issue of misspecification and therefore turn our attention to the examination of structural unemployment as an *effect*.

Measuring Unemployment: The Natural Rate and Beyond

As stated above, the second area of scholarship that we are interested in is the study of how best to measure unemployment. Within this body of literature, focus is placed overwhelmingly on the natural rate of unemployment. Brauer (2007) explains that the natural rate of unemployment arises from all sources except fluctuations in aggregate demand. Included is the rate at which jobs are simultaneously created and destroyed, the rate of turnover in particular jobs, and how quickly unemployed workers are matched with vacant positions. Aysun et al (2014) put it more plainly when they propose that the natural rate is comprised of cyclical, frictional, and structural unemployment; though they admit disentangling these components is empirically difficult. Therefore, it is useful to begin with the idea of a natural rate of unemployment, before attempting to measure the structural component by itself.

In their paper, Weidner and Williams (2011) argue that the natural rate of unemployment cannot be measured directly, and instead must be inferred from other information. They first address the Non-Accelerating Inflation Rate of Unemployment (NAIRU), offered by the Congressional Budget Office (CBO).[13] The authors argue that this is a poor indicator if there have been recent "significant structural changes," leaving it suspect for our purposes. Furthermore, Aysun et al (2014) suggest that the NAIRU, along with common smoothing filters that attempt to separate natural unemployment's interrelated components, merely represents a long-run average of total unemployment.[14] As such, the measure falls short of an efficient and effective measure of unemployment, though it maintains usefulness for studying economic health.

Because the NAIRU is not without its criticisms, Weidner and Williams examine four alternative measures of what they refer to as the normal rate of unemployment. These measures are: 1) the Beveridge Curve; 2) perceptions of how easy it is to find a job; 3) the Job Quits Rate; and 4) a survey of businesses asking if they have

[11] The authors examine several factors including financial shocks, monetary and fiscal policies, and wage rigidity

[12] In the paper, the authors measure the culture of trust using two questions from the World Values Survey. One is whether or not most people can be trusted, and the other is if you think it is justifiable (from 1-never justifiable to 10-always justifiable) to claim government benefits for which you are not entitled.

[13] This figure is reported in the CBO's annual outlook for the budget and the economy, which can be viewed at https://www.cbo.gov/topics/economy/outlook-budget-and-economy

[14] In their own unique attempt, the authors utilize a stochastic frontier analysis to measure natural unemployment free of frictional components, which keeps their measurement of structural unemployment necessarily below total unemployment.

hard to fill vacancies. All four measures behave similarly, and lead the authors to conclude that structural factors are likely to blame. Because each measure follows the same curve and leads to the same results, we focus on the Beveridge Curve as it is more generally applied across the literature.

Much of the current research on structural unemployment focuses on the idea of a mismatch between labor supply and industry demand. Regardless of the causes in question, the literature is largely centered on the Beveridge Curve, which illustrates that as the vacancy rate (labor demand) increases, the unemployment rate (labor supply) decreases.[15] A shift outward in this curve is said to be an indication of structural unemployment, while movement along the curve is indicative of cyclical change.[16] In the debate surrounding the Great Recession discussed by the skills mismatch literature we addressed, economists largely agree that there has been a shift outward in the Beveridge Curve (See **Figure 1** in Appendix). The arguments taken up in that body of literature have focused on whether or not that shift is temporary (cyclical) or permanent (structural). We have addressed this debate already and now turn our attention to the usefulness of the Beveridge Curve itself.

It is our belief that although the macroeconomic foundation of the Beveridge Curve holds great value, it is too simplistic an approach to structural unemployment. In other words, the concept of structural unemployment is more nuanced than the basic relationship between labor supply and demand. If the aim is truly to measure structural unemployment, the Beveridge Curve does little more than offer a theoretical framework from which to start. Though often treated as evidence of structural unemployment in and of itself, it relies only on the predominant measurement of total unemployment and offers no greater insight into its composition, or alternate measurement.

One final measure worth mentioning is one utilized by Daly et al (2011). The authors follow another common approach to unemployment modeling: equilibrium. Used in countless economic applications, equilibrium can prove to be a useful tool to determine a perfect state of being. In this case, the authors employ a model of equilibrium functional unemployment developed by Pissarides (2000). The model utilizes the Beveridge Curve, and adds to it a Job Creation Curve. Where these points meet is said to be equilibrium. Daly et al explain that by examining how this equilibrium changes from a shifting Beveridge Curve is a much more appropriate way to draw inferences from a shifting curve than by looking at the Beveridge Curve alone.

For all of their thoughtfulness, the authors mentioned in this section still fail to develop an appropriate way to measure structural unemployment. While the models of natural rates of unemployment are useful, they fail to single out structural unemployment. Rather, much like the work examining causes of unemployment discussed earlier, this body of work is left making inferences as to whether shifts in the natural rate of unemployment are a result of structural causes. Though the measures are specified more appropriately, scholarship in each area has left us without a clear empirical analysis of structural unemployment. It is this shortcoming in the literature that we hope to ignite a debate on.

THEORY DEVELOPMENT

When we began to consider studying structural unemployment, one thing quickly became clear: The shortfall of the existing literature is largely the lack of detail surrounding the topic. As the previous section discussed, the existing literature often conflates long-term unemployment with structural unemployment and natural unemployment, suffers from model misspecification by looking at traditional unemployment measures as the dependent variable while attempting to only explain structural rise. However, there is also much time devoted to minutia such as how long structural unemployment must occur to actually be classified as structural.[17]

We believe that adding to the debates regarding causes and appropriate duration is futile while there is still a need for a cohesive definition and basic measurement of structural unemployment. Therefore, we build our theoretical arguments and resulting models from a new perspective. While acknowledging the usefulness of

[15] While William Beveridge (1944) is credited with establishing the relationship between job vacancies and unemployment, Dow and Dicks-Mireaux (1958) are cited as first plotting the curve.
[16] The Job Openings and Labor Turnover Survey (JOLTS) Program, conducted by BLS, provides graphs and highlights monthly depicting the Beveridge Curve. These can be viewed at https://www.bls.gov/jlt/.
[17] For example, Mayer (2014) suggests that long-term unemployment is only structural if skills of the unemployed erode during that period. Furthermore, Lazear and Spletzer (2012) argue that the resulting skills matches are not structural if they are temporary.

classical theory, we only remain beholden to it insofar as it helps accurately explain reality. It is our hope to refresh the debate surrounding structural unemployment, and therefore start from the beginning by proposing a basic definition.

Structural Unemployment: *The intrinsic, underlying portion of unemployment that is intransigent in the current labor market and is not subject to predicted fluctuations due to the business cycle.*

Re-Conceptualizing Structural Unemployment

Using the above definition as a starting point, we begin to build out our theory in order to understand how best to measure it. We depart from much of the current literature by suggesting that structural unemployment is best understood as a complex interaction between labor supply and demand as well as idiosyncratic perceptions that dictate behavior. It is important to note that there are countless forces being exerted on each of these three features of structural unemployment. We do not place a limit on what these factors may be, or how many may be working at any given moment. Some of the factors most commonly discussed in the literature are geographic and skills mismatches, as well as drastic changes to the industrial landscape from emerging technologies, or changing demographic and education patterns. While we certainly feel that these factors play a role in moving unemployment rates, we do not feel that it is necessary to view them on their own, particularly with the extensive and often conflictual work that has already been accomplished. Furthermore, it is widely discussed that these factors are difficult to address, as traditional fiscal and monetary policy are likely to have little impact on structural unemployment by its very definition. We believe that through a better understanding of the *components* of structural unemployment we can begin to assess what policies may be enacted to alleviate some of the consequences.

We identify four primary components to our understanding of how structural unemployment behaves. One key feature of our conceptualization is the inclusion of the complex interaction between both the supply of labor (unemployed persons) and industry's labor demand. Often, labor demand is excluded from structural unemployment theories, as demand is often classified as cyclical.[18] However, we believe that the two are intertwined and cannot logically be separated. This idea is supported if one is to believe the arguments for skills mismatches and the Beveridge Curve that are prevalent in the literature. Moreover, while some aspects of demand may be cyclical, it is inappropriate to assume that all demand is cyclical. For instance, changing legislation, shifting demand for goods and services, and ever-evolving globalization, all affect industry's labor demand and can all said to be indicative of structural shifts in the economy.

Where we depart from much of the existing literature on the interaction between labor supply and demand, is that we allow for a more complex interaction than the Beveridge Curve suggests. As explained earlier, the Beveridge Curve suggests an inverse relationship between labor supply and demand. What this curve implies is that the cost of employment is equal for both employers (demand) and unemployed persons (supply). In instances when this does not hold, the curve will necessarily shift, implying structural change. However, this would suggest that structural unemployment should shift much more frequently than classical theories propose, a paradox for this literature.

The second main feature of our conceptualization is the importance given to idiosyncratic perceptions in the labor market. While attempting to measure perception is never an easy task, we believe that it is necessary to fully understand the intricacies of labor markets.[19] The idea of supply and demand in economics, presupposes the existence of changing cost dynamics. This means that both employers and the unemployed face costs of employment. In the case of unemployment rates, perception is the only way to begin conceiving these costs. Take for example the issue of extending unemployment benefits. Farber and Valletta (2015) explain that this provides income to individuals that would have otherwise left the labor force. As a result, individuals stay "unemployed" (as defined by traditional measurements of total unemployment such as that offered by BLS) longer as their costs change. However, such calculations are done at an individual level as recipients must weigh potential income against unemployment benefits and other costs such as emotional well-being and community status. This

[18] Lazear and Spletzer (2012) argue that demand is short-lived and therefore cyclical, while supply is structural as it is based on features such as demographics.

[19] Though empirically taxing and often avoided as a result, the inclusion of perception into measures of unemployment is nothing new. For example, see Weidner and Williams's (2011) discussion of the Conference Board's Consumer Confidence Survey and Coibon et al's (2013) examination of the culture of trust.

demonstrates the need to consider the individual when thinking about structural unemployment, not just the workforce as a whole.

The third key component of our understanding of structural unemployment is the importance placed on *employed* individuals. Understandably models of structural unemployment focus on the unemployed. However, as explored in more detail in the following section, we include employed individuals. This is because some categories of employed individuals, specifically the underemployed, can reflect structural changes in the labor market. Consider two relatively recent and overlapping economic events; the Great Recession, and the implementation of the Affordable Care Act. Each of these events saw a rise in the number of individuals employed part time, largely due to the changing costs of labor for employers. What is interesting is that these numbers have stayed elevated.[20] This is in line with what we consider to be an economy wide adjustment in hiring practices, signaling structural change in the economy. However, by omitting employed individuals from one's understanding of unemployment, these scenarios would go unaccounted for. This is an unfortunate, albeit common, consequence of explaining modern phenomena through the lenses of classical theories in need of updating.

Finally, our conceptualization of structural unemployment allows for a certain amount of volatility and temporariness. Without repeating previous discussions, much of the current literature on structural unemployment conflates the term with long-term unemployment, which we believe is inappropriate and leads to model misspecification. Even the authors that do not make this logical conclusion still maintain that structural unemployment must necessarily be slow moving. While we do agree that in the long-run structural unemployment should be steadier than total unemployment, we see no reason to place further restrictions on its behavior. For instance, while Lazear and Spletzer (2012) argue that structural changes do not occur as rapidly as unemployment in the most recent recession, Leonard (1986) argues that establishments respond to changing demand quickly, often within one year. Therefore, it is illogical to presuppose that structural unemployment must be steady or slow moving.

We believe that this type of nuanced understanding is of particular use if the goal is to move beyond economic theory more broadly, and attempt to fully understand and alleviate the consequences of structural unemployment.[21] At the very, least we hope to illustrate that holding steadfastly to classic beliefs about structural unemployment, can at times hold back the usefulness of explaining reality.

Hypotheses

From the preceding discussion, we propose three hypotheses for our study of structural unemployment:

H_1: $0 < SU < U\text{-}3$

We believe that structural unemployment should remain between zero and total unemployment.[22] While either limit may theoretically be approached, they should never meet. Put differently, there should always be some amount of structural unemployment and structural unemployment should never exceed total unemployment.

H_2: The slope of the SU trend line should be minimally positive across an indefinite time period

Building from the first hypothesis, we posit that as economies are ever evolving - through new technologies, increasing globalization, generational changes in terms of mobility and career goals, changing cultural norms, and changing industrial compositions of the economy that often point to a future labor demand lower than that of the past - structural unemployment should be ever-evolving as well. Though we believe structural unemployment to be slow-moving and free to increase or decrease, there should be a slight upward trend in the long

[20] According to the Current Population Survey, the number of individuals employed part-time for economic reasons in Virginia was approximately 88,500 in the quarter before the Great recession. By the end of the recession, this number increased to approximately 186,000. Most recent data shows that numbers of involuntary part-time workers in Virginia are still double that of pre-recession levels at more than 160,000. Source: Current Population Survey underlying level estimates for alternative measures of labor underutilization retrievable from https://www.bls.gov/lau/stalt_archived.htm.

[21] For example, Mocan (1999) finds that as structural unemployment increases, so does income inequality.

[22] Total unemployment is a potentially difficult term to measure. For our purposes, we use the official unemployment rate, U-3, to measure total unemployment.

run. Were the factors mentioned here to remain constant, we could assume that structural unemployment would not change. However, as few would argue that any one of the forces discussed in this paper are stationary, we feel that the resulting tumultuous behavior of the economy would suggest that structural unemployment, as a signal of overall economic health, must grow in order to continually adjust to new demands.

There are two key assumptions being made in the second hypothesis that are key to its understanding and validity and require a bit more attention. First, the idea of a long-run trend. It is logical that any economic indicator is subject to short term fluctuations from the business cycle, changing consumer demand, or any number of other shocks to the economy naturally occurring or otherwise. However, following most shocks the indicator should return to normal pre-shock levels. What is different about structural unemployment is that a shock significant enough to alter its level substantially likely represents a structural economic change, and though the rate is likely to lower over time, it is not expected to return to pre-shock levels. The second assumption required is the idea that technology (be it computers, various forms of automation, or advances in manual processes) is always advancing. While progress in the workplace is undoubtedly a good thing, it is also near impossible to halt or reverse. For that reason, structural changes are a necessary consequence of progress as the labor market attempts to keep up. This relationship is further exacerbated by the seemingly increasing pace of technological advancement.

H_3: SU should behave differently across different state and regional economies

Though structural unemployment should be bound empirically and logically by the first two hypotheses, we believe that movements should behave differently across different economies. In other words, we should see distinct patterns of structural unemployment across states. In the next section, we build our unique models of structural unemployment that will help us to test these hypotheses.

BUILDING OUR MODELS

The idea for our models arose from an ongoing project analyzing the Alternative Measures of Labor Underutilization reported quarterly by the Bureau of Labor Statistics (BLS).[23] The goal of this project from the Virginia Employment Commission is to gain a better understanding of Virginia's labor force, in the hope that government agencies, local workforce development boards, and various non-governmental organizations can be better suited to address their localities and measure their impact.[24] An earlier version of the models presented here first appeared in the inaugural report on alternative measures in Virginia.[25] Our work on structural unemployment came about as a direct result of this initiative. In this section, we begin by outlining the process through which we developed our models.

Because our models rely heavily on the information presented in the BLS alternative measures, we discuss the project briefly here. The alternative measures (often referred to as the "U's") represent various measurements of unemployment, ranging from narrow (persons unemployed 15 weeks or longer as a percent of the civilian labor force, known as "U-1") to the broadest definition of an underutilized labor force (all unemployed persons, all marginally attached workers, and all persons working part-time for economic reasons as a percent of the civilian labor force, plus all marginally attached workers, known as "U-6"). Utilizing these six alternative measurements individually and in various algebraic configurations can provide a more complete understanding of local unemployment statistics, such as underemployment rates and the rate of would-be-worker discouragement.[26] **Table I** offers definitions of key terms useful for this paper, while **Table II** briefly explains each of the U's offered by BLS.

[23] For a complete history and explanation of the alternative measurements, see Bregger and Haugen (1995).
[24] Existing reports can be found on the Virginia Labor Market Information website at https://data.virginialmi.com/vosnet/lmi/default.aspx?pu=1&plang=E.
[25] Daniels (2017)
[26] For example, see Mayer (2014) and the Bureau of Labor Statistics' Local Area Unemployment Statistics discussion at https://www.bls.gov/lau/stalt.htm.

More broadly, the alternative measures and their underlying variables are derived from the Current Population Survey (CPS).[27] The CPS is a monthly household survey conducted by the Census Bureau. The purpose is to provide hours of work, earnings, and other characteristics of individuals in and out of the labor force. This is separate from the Current Employment Statistics (CES) program, which is a survey of businesses and may not equal employment rates from the CPS.[28] The CPS surveys approximately 60,000 households each month, across a representative 824 sampling areas. The sample areas are further divided into different groups to ensure that 75 percent of the sample is common from month to month, and 50 percent is common from year to year for the same month. Finally, according to BLS, "although the estimating methods used in the CPS do not produce unbiased estimates, biases for most estimates are believed to be small."[29]

As mentioned above, the Economic Information & Analytics Division of the Virginia Employment Commission began an ongoing study of the Alternative Measures data. Upon graphing the six U's (**Figure 2** in the Appendix), we first noticed that all measures largely mirror one another.[30] The biggest difference that is immediately noticeable is the levels of each measure. As is expected, U-1 and U-2 have the narrowest definitions of unemployment and, therefore, fall much below the other measures. Measures U-4 and U-5 add relatively small groups[31] to the official unemployment rate and, therefore, largely wrap around U-3. Finally, U-6 continuously has the largest values, as it is not only encompassing of all previous measures, but includes some employed persons as well – those involuntarily working part-time because they cannot find full-time employment, nor can they afford financially to be out of work.

Another issue that **Figure 2** reveals is that after the Great recession – represented by the shaded region – the gap between measures U-6 and U-3 becomes much larger. Further, the gap does not appear to be decreasing at a substantial rate. In fact, the difference grew from 2.8 percentage points immediately before the recession, to 5.4 percentage points in the final quarter of the recession. **Figure 3** examines this differenced rate for all measures. Interestingly, though many measures saw an increase in their deviation from the official unemployment rate as a result of the Great Recession, none saw as great an increase as U-6. While U-6 deviated by as much as 3.2 percentage points above pre-recession levels, measures U-1 and U-2 rose by only 1.3 and 1.9 percentage points respectively. Measure U-4 only saw an increased deviation of 0.4 percentage points from pre-recession levels.

In the years following the last recession, the differenced values have experienced some volatility, but one thought-provoking feature stood out. Despite differences in magnitude, some measures have shown a reluctance to return to pre-recession levels. For example, U-6 has remained at an average of 5.4 percentage points (5.2 points for the last two years) above U-3, showing little indication of it returning to pre-recession levels. Measures U-1, U-2, and U-4 have shown a slight downward trend, suggesting that they are slowly returning to pre-recession levels. Finally, measure U-5 has also shown reluctance to return to previous levels, as has U-6. However, U-5 also shows some indication of trending in the opposite direction, suggesting that the marginally attached sub-group may be increasing.

The differenced values of U-6 and U-5 appeared to us to exhibit structural characteristics. Specifically, they behave largely the same as other unemployment measures, and then after a significant economy-shifting event such as the Great Recession[32] (highlighted in grey in **Figures 2** and **3**), a new pattern emerges. What we developed

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[27] For a complete guide of definitions and sampling from the CPS website, see https://www.bls.gov/cps/eetech_methods.pdf.

[28] For a complete discussion of the difference between the two surveys, see the discussion on the BLS website at https://www.bls.gov/web/empsit/ces_cps_trends.htm.

[29] CPS *Household Data, Reliability of Estimates*, p 194. Retrievable from https://www.bls.gov/cps/documentation.htm#reliability.

[30] BLS explains this in their overview of the measures available at https://www.bls.gov/lau/stalt.htm.

[31] Measures U-4 and U-5 add different combinations of marginally attached workers. It can be said that marginally attached workers are unemployed, but are not categorized as such by BLS due to not looking for work during the reference period of the CPS.

[32] According to the National Bureau of Economic Research, the Great Recession began in December 2007 and ended in June 2009. The alternative measures somewhat complicate this as they are reported as a 4 quarter moving average. For this reason, the highlighted section in **Figures 2** and **3** begin with the 2007 annual average (the first appearance of the 4th Quarter 2007 data) and end with the period covering 2nd Quarter 2009 – 1st Quarter 2010 (the last appearance of the 2nd Quarter 2009 data). This is done to account for all periods that include recession data.

first was a new measurement of labor underutilization, U-7, that acted for us as a proxy variable for structural unemployment.[33] The measure was created by taking apart the components of BLS's alternative measures and deciding which groups of individuals appeared to be driving measures U-6 and U-5. Luckily, BLS provides state-level estimates of the underlying components of the alternative measures.

Ultimately the inclusion of persons involuntarily working part time (a) and marginally attached workers (m) are driving the behavior of U-6 and U-5. However, it is theoretically difficult to include all marginally attached workers into a measure of structural unemployment, as these could include people not looking for work because they have to stay home for family reasons, have an extended illness, or other reasons that are theoretically difficult to explain through structural terms. Therefore, we focused on discouraged workers (d). Discouraged workers are a sub-set of marginally attached workers. They are available and want to find employment but did not search during the CPS reference period, disqualifying them from unemployed status, and moving them to the marginally attached category. However, the striking feature of this group is that they specify not being able to find work because they believe there is nothing available for them. As such, our initial model is as follows:

$U\text{-}7 = (d + a)/(c + d)$
Where d = discouraged workers; a = involuntarily part-time for economic reasons; and c = civilian labor force

The numerator of U-7 groups individuals working part-time for economic reasons and discouraged workers. The logic for this follows from our theoretical understanding of structural unemployment outlined in the previous section. As a brief review, we believe that structural unemployment is a function of a complex interaction between labor supply and demand and the idiosyncratic perceptions of the labor force.

Structural unemployment – f (Labor Supply, Labor Demand, Idiosyncratic Perceptions)

Based on our theoretical assumptions, discouraged workers and involuntary part-time workers capture many facets of structural unemployment. For instance, discouraged workers for us capture the idea of a mismatch between labor supply and demand. Be it skills-based, location, or other demographics, these individuals have halted their job search because they believe that the market does not have the type of employment that they are seeking and are qualified for. Regardless of the specific mismatch and whether the supply or demand is to "blame," this group points to the *perception* that the current labor market has nothing available for them.

Similar to discouraged workers, individuals that are categorized by BLS as wanting to work full-time, but currently working part-time for economic reasons, indicate a perception of the current labor market. However, two things are characteristic of this group. First, as they are employed, the logic of a skills mismatch may not hold. Indeed, Mayer (2014) presumes that part-time workers have no skills mismatch. However, the author goes on to suggest that as demand increases, there may be a mismatch for full-time work. If true, this points to a portion of the mismatch literature that has gone under-examined. The second key feature of involuntary part-time workers is the very fact that they are employed. As we set out in our theoretical discussion, we do not believe that employment should necessarily disqualify a structural unemployment measure. Rather, we believe that structural factors are often at play for this category of workers. As previously discussed, the implementation of the Affordable Care Act has been widely thought to cause more employers hiring workers to part-time positions. Furthermore, occupations in healthcare such as nursing and speech pathology are increasingly moving from traditional full-time employment, and instead to part-time or as needed employment. This illustrates a structural shift within the industry itself

The above examples indicate structural changes often left out of the literature discussed earlier. The foundational belief is that structural unemployment refers to the number of people that are unemployed as a result of supply and demand shifts in the labor market and occasionally other singular factors studied on their own. However, measure U-7 is an attempt to model a simple proxy variable for structural unemployment that allows for a more complex understanding of how the labor market behaves in the real world.

Figure 4 graphs U-7 against Virginia's other alternative measures. As expected U-7 behaves similar to other measures before the recession, and is at a level between the narrowest measures and the official measure of unemployment. It makes sense that the behavior is not spectacular at the beginning of the series. Structural unemployment, as a portion of total unemployment, should behave similarly in the absence of any structural shocks.

[33] For a complete discussion of the initial work that leads to this conclusion, see Daniels (2017).

However, after the recession (highlighted in grey), U-7 behaves wildly differently. Any sign of a trend is eliminated after the initial, drastic rise. **Figure 5** provides further indication that this measure is an appropriate proxy for structural unemployment. Specifically, the fluctuations from quarter to quarter are generally minor. This should be the case as structural change is either slow moving or takes a significant and infrequent event to change with any great magnitude.

Figure 4: Alternative Measures of Labor Underutilization in Virginia Including Original Measure, *U-7

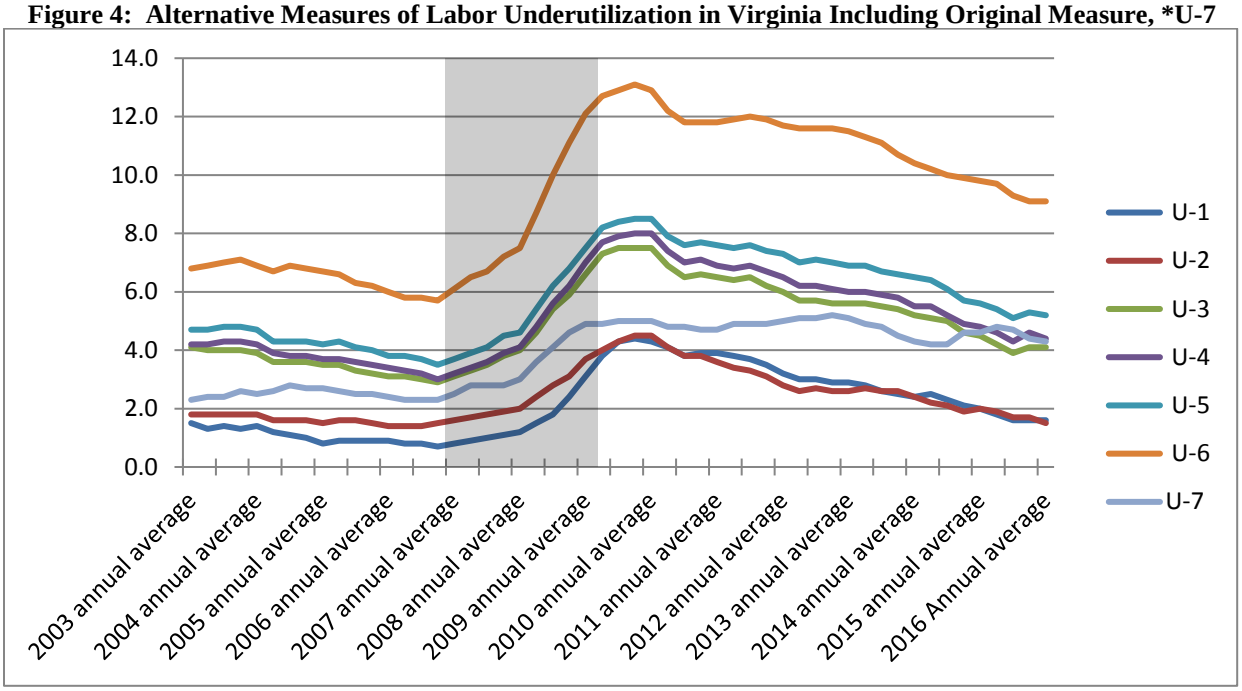
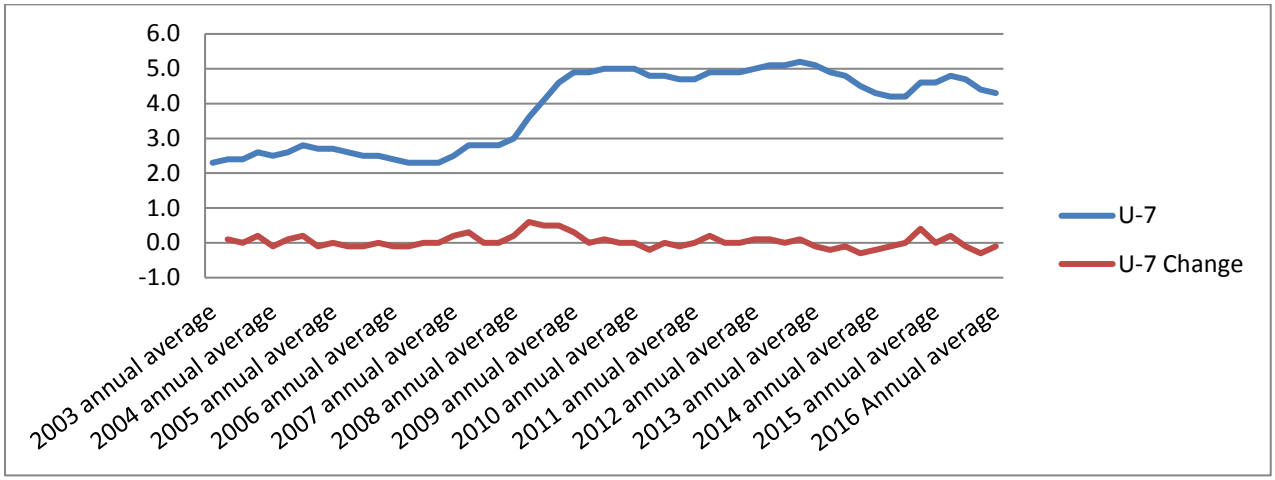


Figure 5: A Closer Look at U-7



Upon analyzing U-7, one key component was missing. Though we had attempted to account for structural movements in and out of the labor market, we had left out one key feature discussed in the literature: the long-term unemployed. No matter which measure is being examined, the length of time an individual is unemployed is always thought of to be a structural issue beyond a certain point. For example, the longer an individual is unemployed, the greater the likelihood that their skills will erode or they will simply choose to exit the labor force. For this reason, we decided to add to U-7 a measure of the long-term unemployed, specifically the number of unemployment insurance (UI) benefit exhaustions. The number of exhaustions and the exhaustion rate are available on a quarterly basis at both the national and state level from the Department of Labor and is simply the number of claimants drawing the final payment of their original entitlement for a given period (Department of Labor, ETA5159).[34]

Including the number of UI exhaustions serves another purpose beyond measuring long-term unemployment. As discussed in the existing literature, there is reason to suggest that benefits have an effect on an individual's behavior. For example, Hagerdorn et al (2013) state that unemployment benefits are an implicit tax on market work, which subsidizes unemployment and discourages labor supply. While the mechanics of this argument are subject to doubt[35], the idea that unemployment benefits impact the labor market cannot be denied. Furthermore, changes to UI can easily be viewed indirectly or directly as a structural component of the labor market. Indirectly, the idea of some sort of government assistance factors into an individual's cost/benefit analysis for whether or not to remain in the labor force. Directly, unemployment benefits are an attempt to alleviate issues related to unemployment. While these issues could be frictional, cyclical, or structural, it is too difficult to separate. The inclusion of the number of exhaustees gives us the following new measure:

$$\text{U-7X} = (d + a + j)/(c + d + j)$$

Where j = the number of UI exhaustees

From this measure, we found that logically, the populations of discouraged workers and UI exhaustees may have significant overlap. For instance, after exhausting UI benefits, one may logically become discouraged if he or she does not find employment. We therefore derived the following adjustment:

$$\text{U-7X} = (d + a + [j - d])/(c + d + [j - d])$$

[34] UI data available from the DOL website at https://www.ows.doleta.gov/unemploy/content/data.asp.

[35] One particular reason to doubt such a claim is that for unemployment benefits to have a real and lasting impact on an individual's "decision" to remain unemployed, the benefits must be approximately equal to any potential earnings.

Next, the positive and negative values of "d" (in both the numerator and denominator) algebraically cancel out. We also decided to adjust the population of the denominator to include all marginally attached workers (as opposed to just discouraged) plus the civilian labor force. Because exhaustees is a population that could include individuals from any number of labor market sub-groups as defined by BLS, including all marginally attached (the largest possible group of individuals not in the BLS definition of the civilian labor force) in the denominator also erases the need to include exhaustees on its own. We therefore get the following final model:

(1) U-7X $= (a + j)/(c + m)$

Where: a = involuntary part-time workers; j = exhaustees; c = civilian labor force; m = marginally attached workers

As stated at the outset of this paper, we offer *two* unique models for structural unemployment. The second model follows much of the theoretical logic mentioned above, but makes two slight adjustments. First, it adds back into the numerator discouraged workers *"d."* This is because we believe strongly that this group's inclusion is vital to a thorough understanding of structural employment. The second adjustment is done to work around the arithmetic eliminations discussed above. Rather than using the number of UI exhaustees, we instead use the exhaustion rate, "*ExRate."* This gives us our second proposed model for structural unemployment:

(2) U-7XR = $(\frac{d+a}{c+m}) * ExRate$

According to the Department of Labor, the exhaustion rate is computed by dividing average monthly exhaustions by the average monthly first payments.[36] The denominator is lagged by six months to allow for the normal flow of claimants through the program. Maintaining the logic that UI exhaustion is an appropriate proxy for both the long-term unemployed and structural attempts to actively alter structural unemployment, using the exhaustion rate should be appropriate as well, at face value. However, using the exhaustion rate presents several other benefits in addition. At this point, we have explained that exhaustees are an important component of structural unemployment. Because first time payments are included in the calculation of the exhaustion rate, the variable becomes more representative of the full claimant process.

Another benefit of the exhaustion rate is that it has been used as a proxy for reemployment.[37] To be sure, it is a far from perfect measure. Nevertheless, it does bolster the usefulness of the exhaustion rate measure in our model, as it allows us to include a partial measurement of reemployment without further complicating our measure. Reemployment rates would be useful to measures of structural unemployment, as increased rates of reemployment could suggest a labor force adjusting to structural changes in the economy. As such, if the exhaustion rate is high (low rate of reemployment), we could assume that the labor force has not yet adjusted to the structural change. By multiplying this variable to our original model of U-7, this relationship comes into view in a statistically significant way.

By multiplying the exhaustion rate rather than adding the number of exhaustions, we allow for a more complex interaction of our variables than purely additive equations allow. While this does add a small degree of complexity to the model and how it is interpreted, we believe that it allows for more useful inferences to be drawn. Using the logic of reemployment outlined above, multiplication gives the variable more weight in the model, than would addition. For example, if the exhaustion rate is low then the structural unemployment is kept low as a result, adjusting only somewhat mutedly to the level change in the other components. In this scenario, reemployment is relatively high, and, thus, we would expect changes in structural unemployment to be muted.

One potential criticism of model U-7XR is that in multiplying U-7 by the exhaustion rate, we are artificially lowering and smoothing the data. While this critique is not without mathematical merit, we do not view the measure as artificial. First, for the reasons mentioned above, the use of the exhaustion rate as a measure is

[36] A full definition can be found in the quarterly Unemployment Insurance Data Summary reports on the Department of Labor website at https://oui.doleta.gov/unemploy/content/data_stats/datasum16/DataSum_2016_1.pdf.

[37] The Employment and Training Administration at the Department of Labor has been developing a reemployment measure to assess progress for the Government Performance and Result Act. Before developing their own unique measures, the exhaustion rate was used as a proxy for reemployment. Generally (1 – exhaustion rate) is used, and, on average, accounts for 83% of the unadjusted reemployment rates. For a complete discussion, see the discussion on the DOL website at https://www.ows.doleta.gov/unemploy/reemploypilot.asp.

justified. Were we to add this variable to U-7, the measure would only be altered by an insignificant level, essentially eliminating the variable from the measurement. Finally, while our original intention was not to normalize our measurement of structural unemployment, the practice is not without justification in econometrics. Normalized data allows for ease of use in statistical models, altering only interpretation of the results. We therefore view U-7XR not as an artificial transformation, but a refinement of our original model.

A Quick Note on Data Transformations

Before analyzing our models, it is necessary to briefly explain the data transformation. As mentioned before, the alternative measures of labor underutilization and their underlying components are provided quarterly by BLS. In order to account for the relatively small sample size, the numbers are presented at the state level on a four quarter moving average. This also removes seasonality. For national figures, the alternative measures are presented without the underlying level estimates. That data is presented monthly, from which we took a quarterly average. With this quarterly average, we then computed a four quarter moving average so the data would match with state-level figures. Because data was being converted to a moving average which eliminates seasonality, unadjusted national data was used. Similarly, the UI data is presented on a quarterly basis, and had to be converted to a four quarter moving average.

The idea of converting all figures into a four quarter moving average may seem problematic for some. For example, it can be said that taking an average of an average is a poor measurement. Furthermore, it can make issues such as time periods more complex as an anomaly in quarter one would necessarily impact quarters two, three, and four. Relatedly, drawing inferences and placing movements into proper historical context requires extra thought. However, we feel that the potential complications are acceptable. As discussed previously, the four quarter moving average eliminates seasonality. In addition, the foundational measurements utilized in our model are only available in that format, so adjusting other figures to the same format is necessary to ensure time periods align. Finally, utilizing a four quarter moving average allows our models to be slightly less susceptible to sudden shocks, which is desirable for an analysis of structural change.

Once all variables are transformed, our three measurements are available from the annual average of 2003 (quarters one through four) to the third Quarter of 2016 (Quarter four 2015 through Quarter three 2016). This results in 52 observations for each model. Ultimately, eight other states and the national figures were added that include an array of employment and labor force patterns, various economies, a sample of different geographic regions, and unemployment rates above and below the national average. These states include West Virginia, California, Washington, Oregon, Texas, Pennsylvania, North Dakota, and Wyoming. In total, we have 520 observations over almost 13 years. At this time, the data availability for the alternative measures prevents us from going further back in history.

TESTING THE HYPOTHESES

As a quick review, our hypotheses are as follows:

H_1: $0 < SU < U\text{-}3$

H_2: The slope of the SU trend line should be minimally positive over an indefinite period of time

H_3: SU should behave differently across different state and regional economies

In order to test the above hypotheses, we have developed the following measures of structural unemployment:

(1) $U\text{-}7X = (a + j)/(c + m)$

(2) $U\text{-}7XR = (\frac{d+a}{c+m}) * ExRate$

Figure 6 displays all of the aforementioned models U-7, U-7X, and U-7XR for Virginia, along with the official total unemployment rate, U-3. As expected, measures U-7 and U-7X behave largely the same, often differing by only a slim margin. As outlined in the previous section, this is largely because U-7X is an additive model compared with U-7, and should therefore only see a difference in magnitude and not in structure. Because model U-7X is theoretically more complete, we use that to further test our hypotheses. In this section, we examine how each model performs separately.

Looking first at Model (1) (U-7X) in **Figure 6**, we see that SU often behaves in direct contrast to total unemployment, U-3. For example, between 2003 and 2005, only total unemployment decreased, while structural unemployment increased. During the shock of the Great Recession, though both measures increased, structural

unemployment increased at a much quicker rate. This gives some concern as we have stated that structural unemployment should be relatively slow moving. After the recession, as total unemployment exhibits a clear downward trend, structural unemployment is largely void of any trend. This is more in line with our theoretical foundation.

What is particularly troubling with Model (1) is the seemingly chaotic behavior. For example, structural unemployment is often subject to drastic changes both up and down with no clear trend. This suggests that we fail to confirm H_2. Furthermore, in the fourth quarter of 2015 and third quarter of 2016, we see not only a convergence between structural and total unemployment, but a brief period where structural unemployment is actually above total unemployment. Aysun et al (2014) address this very issue in their argument against NAIRU and smoothing filters for measures of structural unemployment. They argue that such models only represent long-run averages of total unemployment, allowing instances such as this. While this is a valid criticism, it is also worth noting that due to the relatively small sample size of this data at the state level we could be seeing nothing more than an empirical anomaly, or outlier. That being said, we cannot safely confirm H_1 for Model (1). Before turning to the third hypothesis, we next see how the second model compares to Model (1).

Again looking at **Figure 6**, Model (2) (U-7XR) performs much more in line with how we would expect structural unemployment to behave. On the one hand, it remains relatively small and consistent, varying from approximately one to 2.5 percent. Contrastingly, total unemployment saw its lowest rate in this period of just below three percent when structural unemployment was also at its lowest. This provides evidence to confirm H_1. As with all measures of unemployment, Model (2) increases immediately during the Great recession, though it exhibits a slight downward trend in the years since. At this point, we fail to reject the null hypothesis for H_1 using Model (1), while safely rejecting the null for Model (2).

Turning to our test of the second hypothesis, we look again at **Figure 6**. Looking at the graph of both models, we are visually able to confirm the second hypothesis. During the recession of 2008/09, both measures so a drastic increase along with total unemployment. However, more than six years out from the end of the recession, as most indicators have returned to their normal rates, both U-7X and U-7XR remain well above their pre-recession levels. Looking back at **Figure 2** we see that every current measure of unemployment has either returned to pre-recession levels, or maintains a significant and pronounced downward trend. Contrastingly, both structural unemployment levels not only remain above earlier points, but also lack any clear negative slope. Following the logic set out in our discussion of the hypotheses, the Great Recession provided the structural shock while the changing technologies of new economic policies, hiring practices, automation, and new attitudes of the labor market are resulting in a new base level of structural unemployment. Though these rates may still fall and settle, they show no clear indication of returning to previous levels.

In order to examine how the models perform against H_3, we included nine economies with which to compare Virginia. The first is the national data. We then include Pennsylvania, West Virginia, Texas, California, North Dakota, Oregon, Washington, and Wyoming. We feel that these states represent vastly different regions of the country, as well as largely different economies and labor forces.**Figure 7** reports total unemployment and Models (1) and (2) (U-7X and U-7XR respectively) for each state mentioned and the country as a whole. Largely all of the inferences drawn from Virginia hold across all of the states. Model 1 shows convergence with total unemployment in six states, with Pennsylvania and Texas being very close towards the end of the series. What is interesting is that this convergence occurs at different points across different states and sometimes at multiple points. Interestingly, Virginia appears to be the only state where total unemployment is actually below structural unemployment for multiple consecutive time periods. From this, we can conclude that Model 1 fails to reject the null hypotheses of H_1 and H_2.

As with Model (1), the conclusions drawn about Model (2) from **Figure 6** hold across all states in **Figure 7**. What is particularly interesting and promising, however, is the evidence in favor of H_3. While nearly all states exhibit very similar downward trends in total unemployment after the Great Recession, the story for structural unemployment is much more unique. For example, North Dakota and West Virginia seem to have no positive or negative trend, while exhibiting more fluctuation over time (albeit small in magnitude). Contrastingly, California, Texas, Wyoming, and Washington have very steadily declined, with only Wyoming and North Dakota increasing structural unemployment in recent quarters.

CONCLUSIONS AND DISCUSSIONS

To conclude, we believe that it is time for economists to reconsider structural unemployment. Though the existing literature is extensive, it is largely held back by three factors. One is the reliance on traditional understandings of structural unemployment, particularly the supremacy of mismatch theory. Second, much of the literature suffers from model misspecification. Often scholars use total unemployment as the dependent variable, equating any change from structural forces with changes in structural unemployment. By not attempting to disentangle structural unemployment from its cyclical and frictional counterparts, economists are unable to draw proper inferences. Finally, among the work that does attempt to measure structural unemployment, they often rely on overly complex statistical techniques, inhibiting the ability to draw proper inferences.

We have argued that structural unemployment is best understood as a complex function of labor supply, labor demand, and idiosyncratic perceptions of individuals in the labor market. Though we allow theoretically for complex interactions, we propose two simple models that we feel appropriately model structural unemployment at the state level. Though there are potential issues with sample size and they do not behave as hypothesized, we conclude that our models can stand as proxies for structural unemployment. That being said, further analysis is needed to address the issues mentioned in the previous section.

Our hope is to utilize our two models of structural unemployment to re-ignite the debate in the literature and among state labor market institutions (LMI). We believe that state LMI agencies and partners can benefit from a measurement and subsequent analysis of structural unemployment. Such a focus allows for a more thorough understanding of local economies, as well as address what portion unemployment can potentially be alleviated through policy. In the future, we hope to continue to build upon this analysis by putting our models through more rigorous tests and directly comparing them to competing measures. However, we rely on fellow scholars and economists to continue this worthwhile discussion and propose new understandings and measurements of such an elusive concept.

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APPENDIX

Table I: Key Concepts

Term	Definition
Civilian Labor Force	Persons 16 years of age and older residing in the 50 states and D.C. who are either employed or unemployed.
Discouraged Workers	A subset of marginally attached workers, these individuals report not looking for work specifically because they: 1) believe no job is available to them in their line of work or area; 2) had previously been unable to find work; 3) lack the necessary schooling, training, skills or experience; 4) employers think they are too young or old; 5) they face some other type of discrimination.
Marginally Attached Workers	Individuals who are without jobs and not currently looking for work (not counted as unemployed), but who have demonstrated some degree of labor force attachment. Specifically, they must indicate that they currently want a job, have looked for work in the past 12 months, and are available for work.
Part-time for Economic Reasons	Also referred to as "involuntary part-time." Individuals who gave an economic reason for working 1 to 34 hours during the reference week. Economic reasons include slack work or unfavorable business conditions, inability to find full-time work, and seasonal declines in demand. Those who usually work part time must also indicate that they wants and are available for full-time work to be classified as on part-time for economic reasons.
Unemployed	All persons who had no employment during the reference week, were available for work, except temporary illness, and had made specific efforts to find employment sometime during the 4-week period ending with the reference week. Persons who were waiting to be recalled to a job from which they had been laid off need not have been looking for work to be classified as unemployed.
Unemployment (Reasons)	(1) Job losers comprising persons on temporary layoff expecting to return in 6 months and permanent job losers; (2) Job leavers who quit or otherwise terminate employment voluntarily and begin looking for work; (3) Persons who complete temporary jobs; (4) Reentrants who previously worked but were out of the labor force prior to beginning their job search; (5) New entrants who have never worked.

Source: Bureau of Labor Statistics, https://www.bls.gov/cps/documentation.htm#concepts.

Table II: Alternative Measures of Labor Underutilization

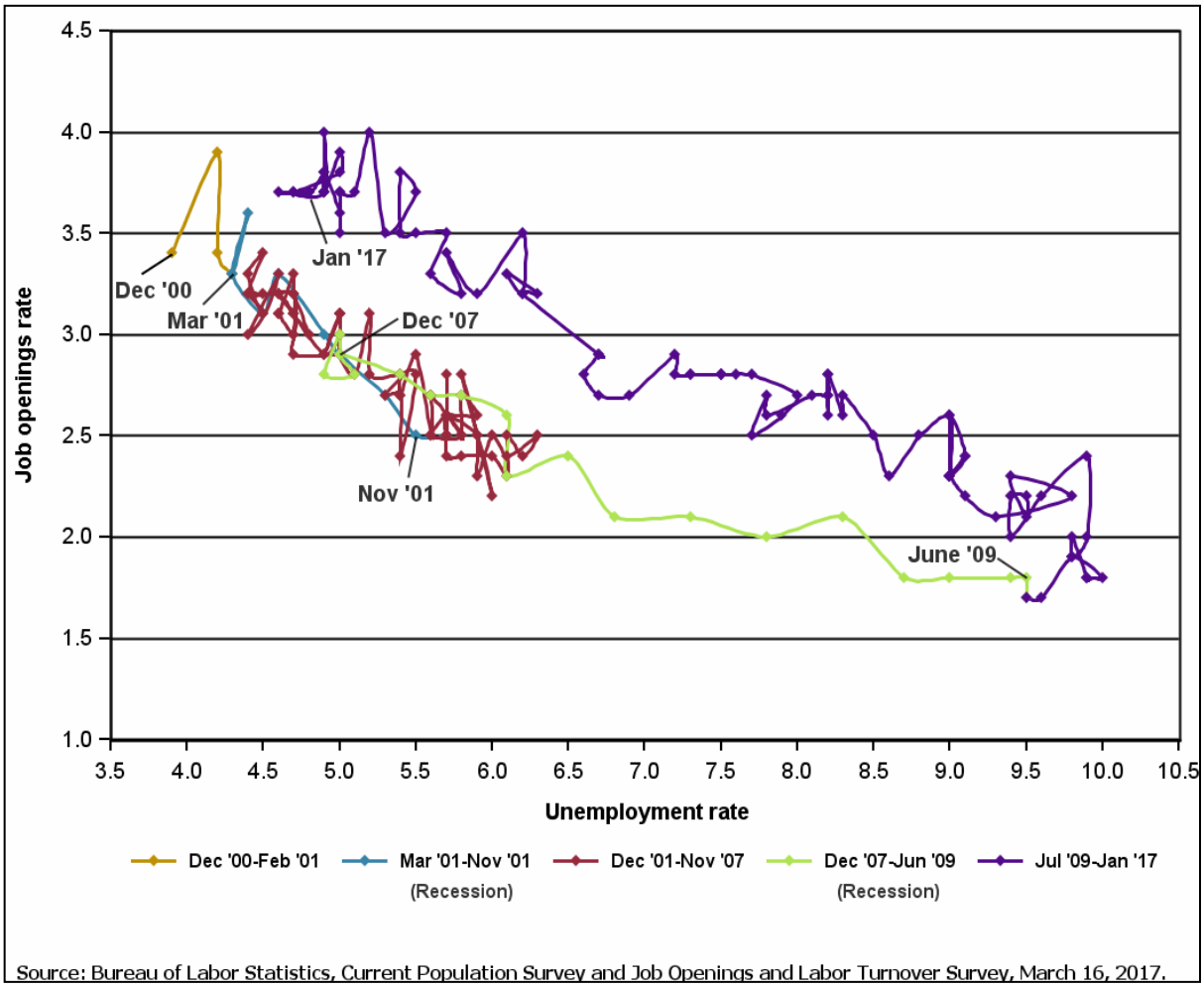
Alternative Measure	Components and Calculation of Rates
U-1	Persons unemployed 15 weeks or longer, as a percent of the civilian labor force.
U-2	Job losers and persons who completed temporary jobs, as a percent of the civilian labor force.
U-3 *Official Unemployment	Total unemployed, as a percent of the civilian labor force. This is the definition used for the official unemployment rate.
U-4	Total unemployed plus discouraged workers, as a percent of the civilian labor force plus discouraged workers.
U-5	Total unemployed, plus discouraged workers, plus all other marginally attached workers, as a percent of the civilian labor force plus all marginally attached workers.
U-6	Total unemployed, plus all marginally attached workers, plus total employed part-time for economic reasons, as a percent of the civilian labor force plus all marginally attached workers.

Source: Bureau of Labor Statistics, https://www.bls.gov/lau/stalt.htm.

Table III: Alternative Measures of Labor Underutilization in Virginia Before, During, and After the Great Recession

Alternative Measure	Unemployment Rate Before the Recession	Unemployment in the Last Quarter of the Recession	Rate of Increase During Recession	Unemployment Rate as of 4th Quarter 2016	Rate of Decrease Post-Recession
U-1	0.7	3.8	443%	1.6	-58%
U-2	1.5	4.0	167%	1.5	-63%
U-3	2.9	7.3	152%	4.1	-44%
U-4	3.0	7.7	157%	4.4	-43%
U-5	3.5	8.2	134%	5.2	-37%
U-6	5.7	12.7	123%	9.1	-28%

Figure 1: The Beveridge Curve in Practice



Source: Bureau of Labor Statistics, Current Population Survey and Job Openings and Labor Turnover Survey, March 16, 2017.

Note: In this example the purple lines show an outward shift from the recession (Green line) suggesting a shift in structural unemployment.

Figure 2: Alternative Measures of Labor Underutilization in Virginia

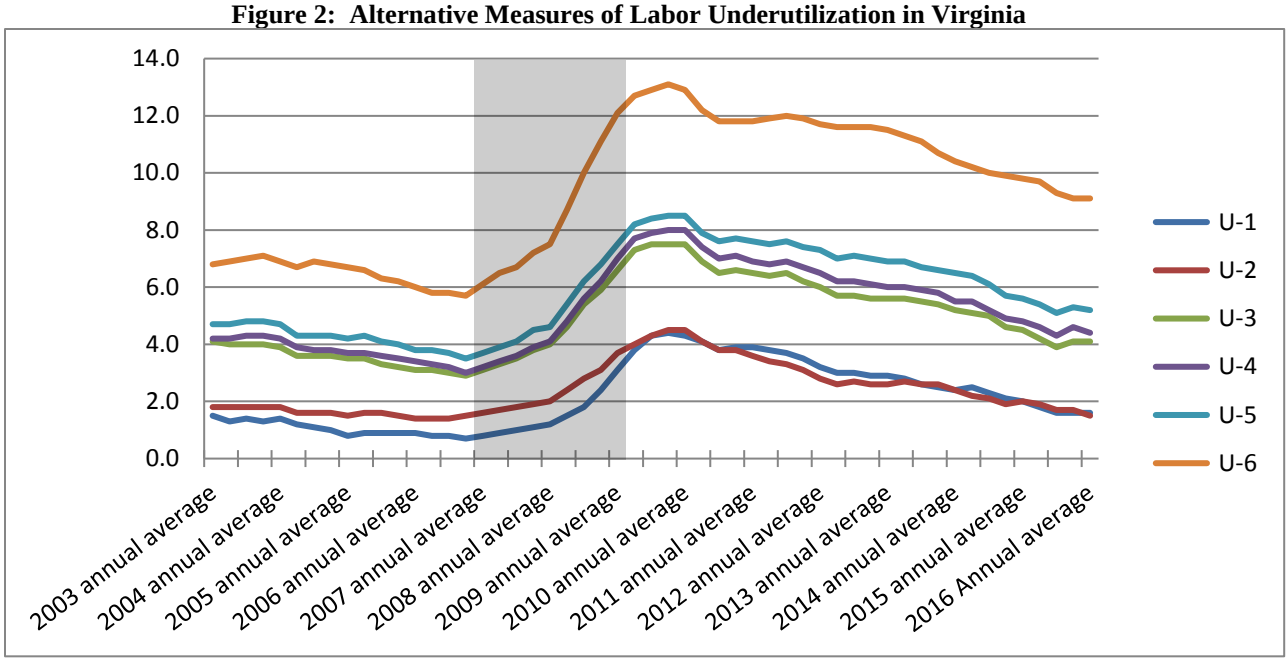


Figure 3: Differences from Official Unemployment Rate, U-3, in Virginia

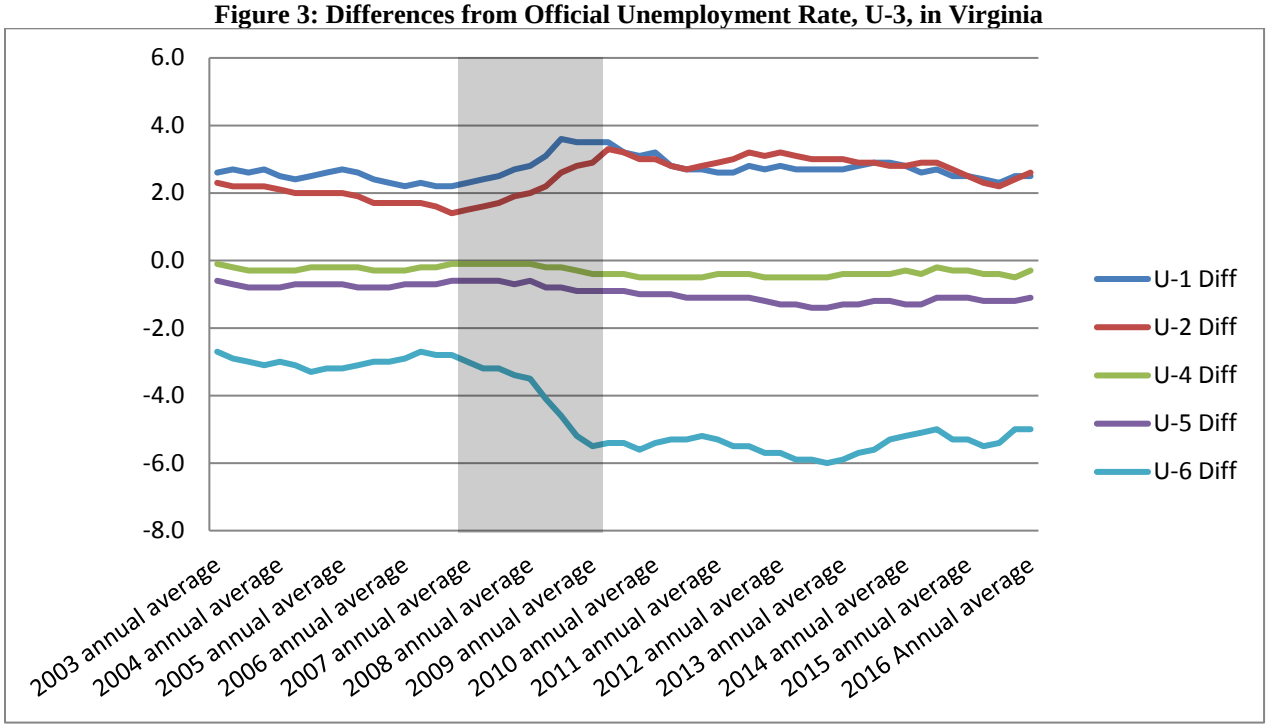


Figure 6: Comparison of U-7 Models in Virginia

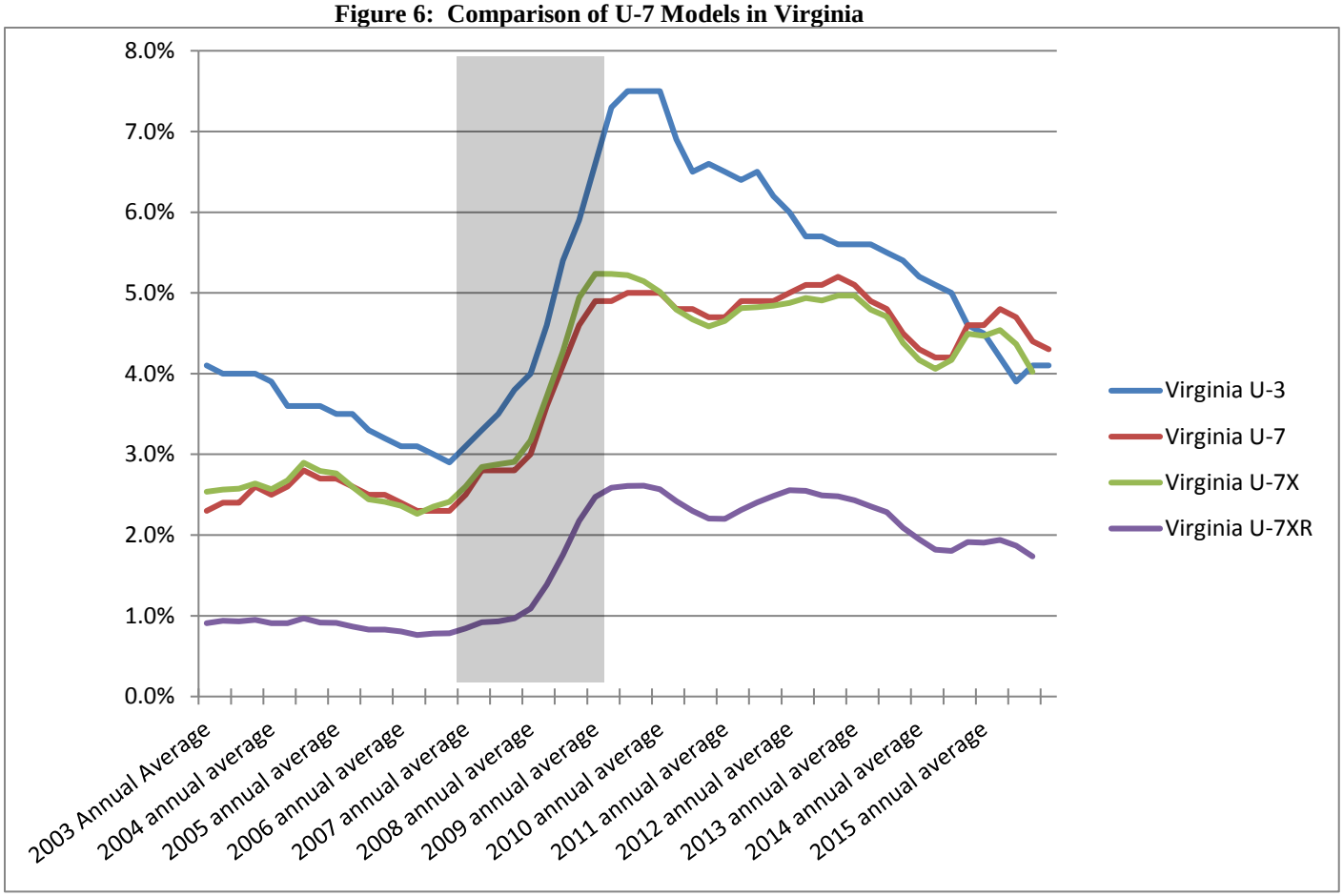
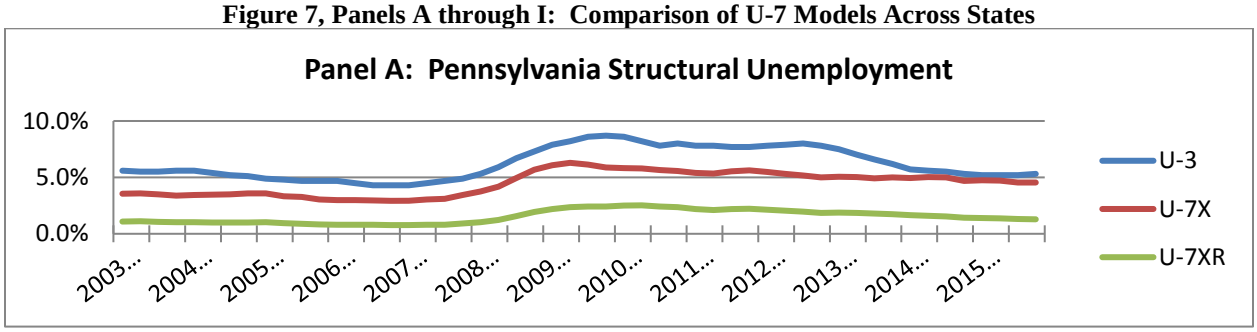
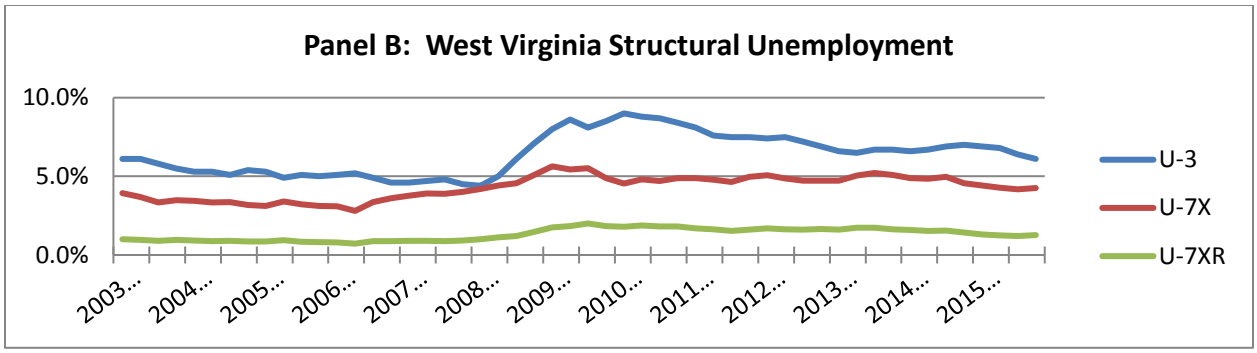
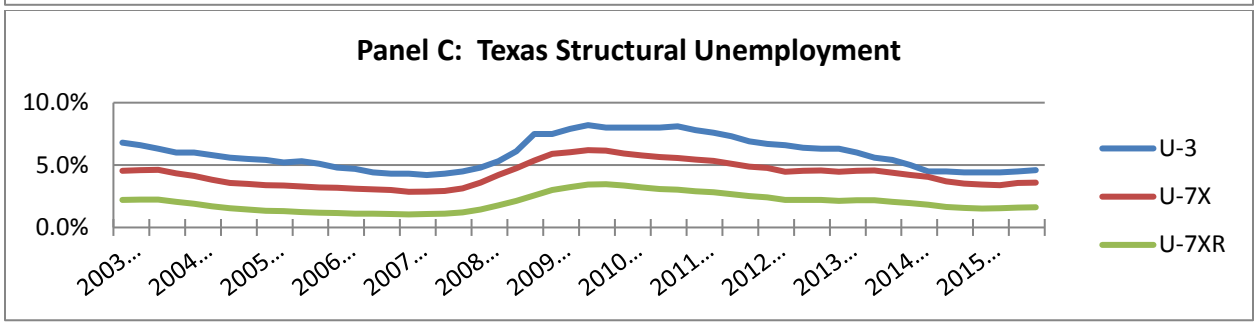
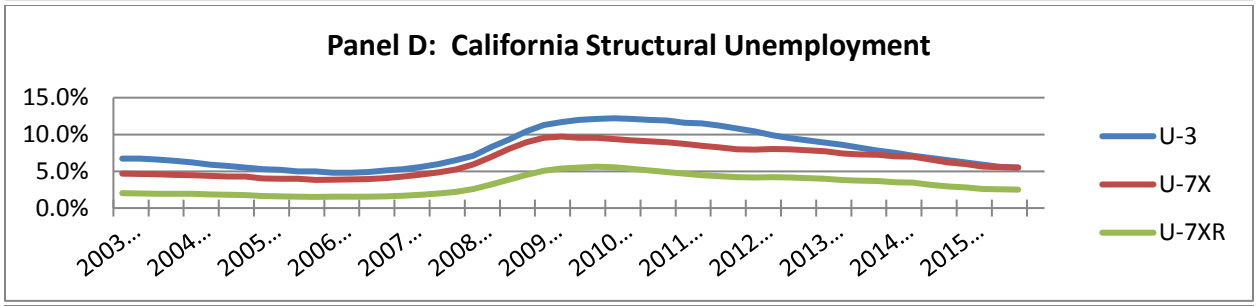


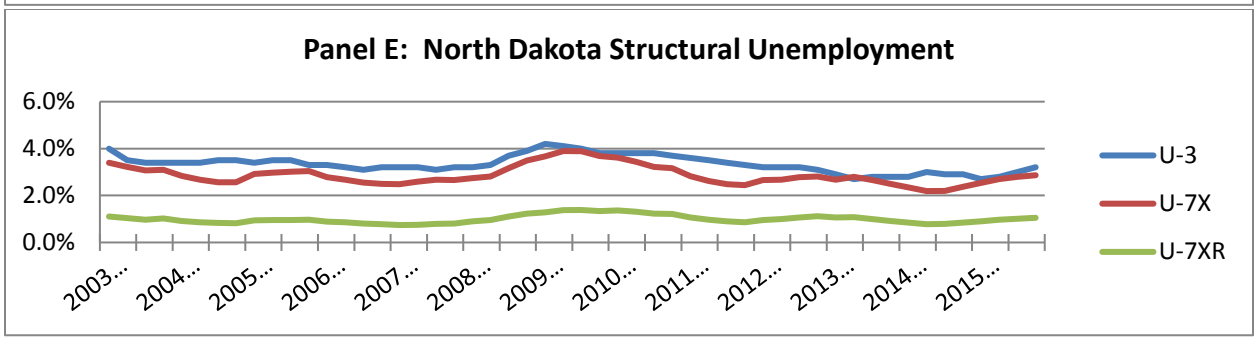
Figure 7, Panels A through I: Comparison of U-7 Models Across States

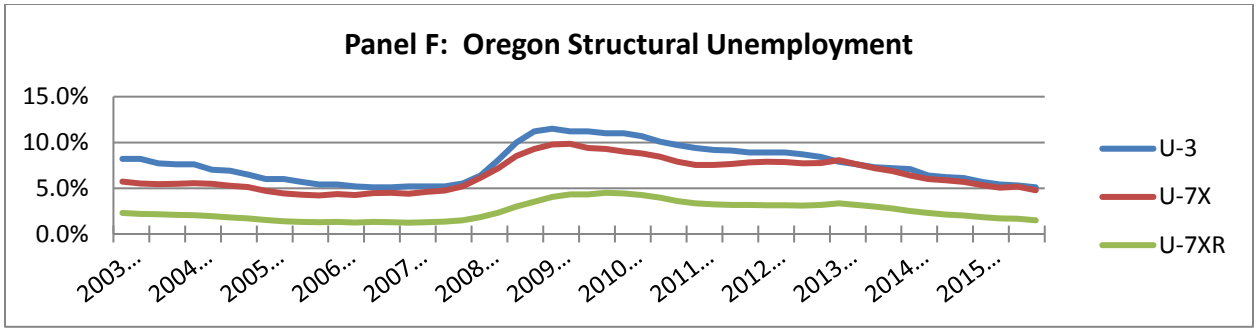


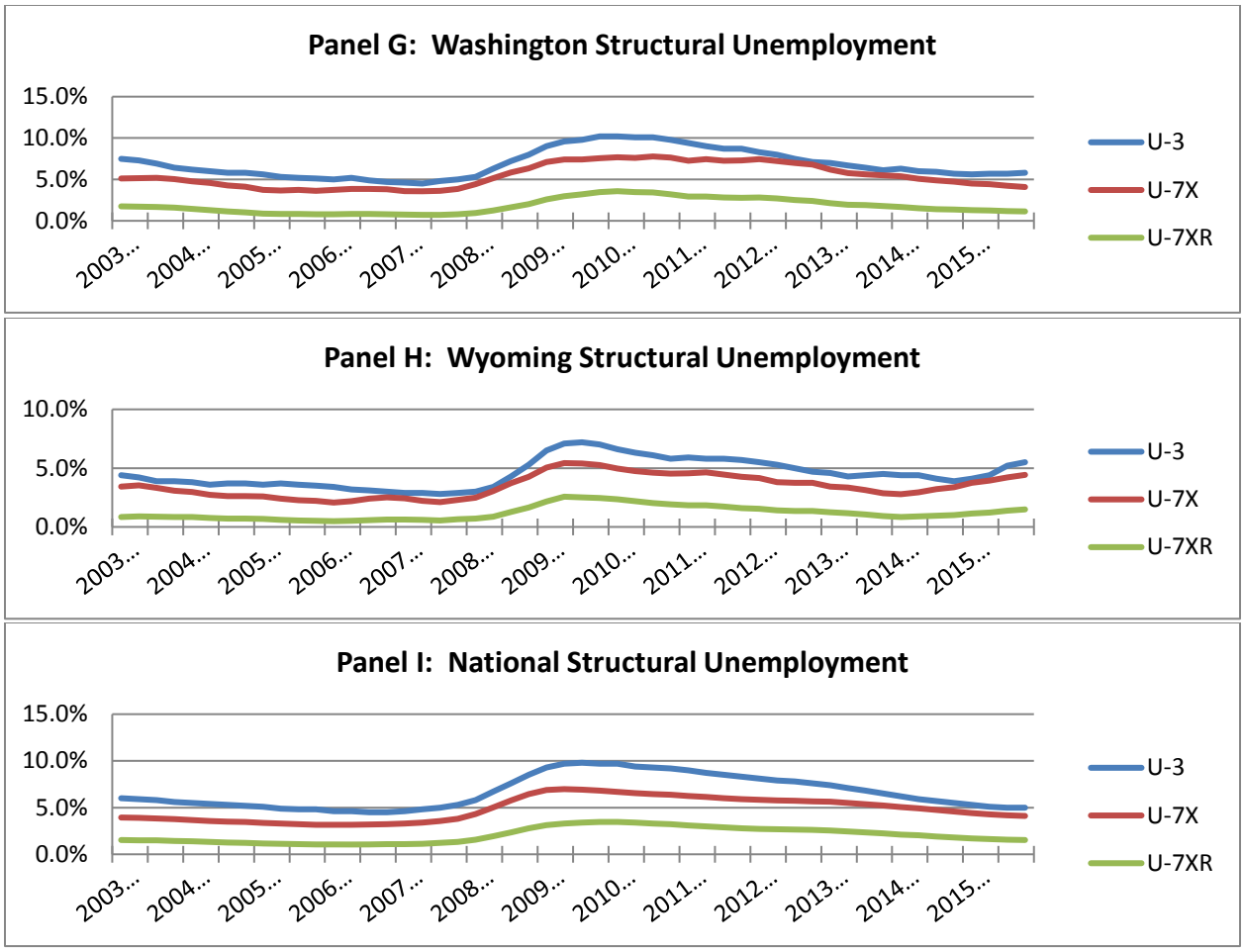

Panel B: West Virginia Structural Unemployment
10.0%
5.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR


Panel C: Texas Structural Unemployment
10.0%
5.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR


Panel D: California Structural Unemployment
15.0%
10.0%
5.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR


Panel E: North Dakota Structural Unemployment
6.0%
4.0%
2.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR


Panel F: Oregon Structural Unemployment
15.0%
10.0%
5.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR


Panel G: Washington Structural Unemployment
15.0%
10.0%
5.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR
Panel H: Wyoming Structural Unemployment
10.0%
5.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR
Panel I: National Structural Unemployment
15.0%
10.0%
5.0%
0.0%
2003...
2004...
2005...
2006...
2007...
2008...
2009...
2010...
2011...
2012...
2013...
2014...
2015...
U-3
U-7X
U-7XR

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