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Unemployment Rates During the Not-So-Great Recovery: How Much is Structural versus Cyclical?

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UNEMPLOYMENT RATES DURING THE NOT-SO-GREAT RECOVERY: HOW MUCH IS STRUCTURAL VERSUS CYCLICAL?

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Abstract

This paper presents evidence that the majority of the high post-recession unemployment rates is the result of an increase in the natural rate, rather than cyclical deviations from it. Moreover, I discuss the likely causes of the recent increases in the natural rate. Since most of the theorized causes of increases appear transitory in nature, I expect that the natural rate will soon decline, followed closely by a decrease in actual unemployment rates.
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Chapter 1

Introduction

Recently, there has been much debate in the economics literature regarding structural shifts in the U.S. labor market. The existence of a larger structural component also implies a higher natural rate of unemployment and, similarly, a higher non-accelerating inflation rate of unemployment (NAIRU).\(^1\) Such changes can subsequently result in prolonged increases in the actual unemployment rate. This debate persists due to the fact that it is difficult to disentangle the cyclical unemployment rate from the structural component.

Given the difficulty in estimating the natural rate, there is much controversy surrounding its level and whether it has changed. On one side of the debate, Federal Reserve chairman Ben Bernanke has publicly stated that he believes the natural rate remains around 5.5%. In fact, at the 2012 annual monetary policy symposium, Bernanke remarked,

\(^1\)These terms are fairly substitutable in the current literature so I will be using them interchangeably throughout the remainder of this thesis. Other terms that are equivalent are equilibrium unemployment rate and unemployment rate at full employment.
“I see little evidence of substantial structural change in recent years … Following every previous U.S. recession since World War II, the unemployment rate has returned close to its pre-recession level.” (Spencer, 2012)

In recent testimony before Congress, Bernanke restated the point that the current U.S. unemployment rate is substantially above the target natural rate:

“Despite these gains, the jobs situation is far from satisfactory, as the unemployment rate remains well above its longer-run normal level, and rates of underemployment and long-term unemployment are still much too high.” (Testimony of Ben Bernanke, 2013)

Indeed, the Federal Reserve’s official predictions lie between 5.2% and 6.0%, thereby explaining the Chairman’s estimates (Federal Reserve Bank, 2013).

At the other end of the spectrum, Pimco co-CIOs Mohamed El-Erian and Bill Gross predict a natural rate of approximately 7% (Kennedy, Matthews, & Zumbrun, 2012). To help put the wide scope of these estimates into perspective, the standard deviation of the unemployment rate since 1948 has only been 1.6 percentage points whereas expert estimates of the natural rate range from 5.2% to 7%.

Correctly estimating the natural rate, or at least the structural component of unemployment, is essential from a policy perspective since only
cyclical factors of unemployment respond to short-run fiscal and monetary policies. Hence, having an accurate unemployment rate target for the central bank is crucial for the development of counter-cyclical policies. Without such a target, policy makers would not be able to formulate appropriate monetary and fiscal stimuli effectively. If the Federal Reserve is aiming for a significantly lower unemployment rate than the natural rate, most macroeconomic models suggest that this will produce higher inflation rates. Paraphrasing ideas found originally in Keynes (1923), we can reach full employment by expanding the money supply, but if the central bank expands it by too much, inflation results. Indeed, Stiglitz (1997) found that keeping the unemployment rate as much as one percentage below the NAIRU for one year will result in inflation rate increases of between 0.3 and 0.6 percentage points.

The goal of this thesis is to assess how much, if any, of the higher post-recession unemployment rate is due to a permanently higher natural rate. To do this, I follow the sectoral variance approach, first proposed by Lilien (1982), to estimate a natural rate series using national time series. I then expand the analysis by using state-level panels, and state-level time series regressions. I also briefly analyze explanations that focus on a Beveridge curve approach regarding movements in the natural rate. Looking at outcomes from these different methodologies, this thesis will evaluate whether and how this recession and its subsequent recovery are different from other previous post World War II events. In the latter portion of this analysis, I discuss the three primary factors that economists have offered as explanation for a higher natural rate: mismatch, unemployment insurance exten-
sions, and uncertainty. Ultimately, I determine that the natural rate rose substantially over the recent recession and is beginning to decrease again. This will result in lower actual unemployment rates going forward.

This thesis proceeds as follows: first I present background information as to why this debate has arisen and, in the process, elaborate on the concept of the natural rate. Next, I present an in depth literature review of the preceding methodologies followed by a theoretical investigation into the parameters that affect the unemployment rate. Lastly, I include an empirical specification and discuss the explanations, conclusions, and limitations of my results.
Chapter 2

Background

Relative to the three most recent recessions of 1981, 1990, and 2001, unemployment rates rose sharply throughout the Great Recession in the U.S. The increase from a low of 4.4% in May 2007 to a high of 10.0% in October 2009\(^2\) surprised many economists: the peak unemployment rate was significantly higher than they had predicted. Perhaps most famously, Larry Summers, the former Director of President Obama’s National Economic Council and, until this fall, the leading candidate for the Chairman of the Federal Reserve, forecasted that unemployment rates would peak at 8.5% (Geraghty, 2009). Trying to find the source of such a serious underprediction, I regressed the change in the unemployment rate on real GDP growth from 1948 to 2007, using annual data. The point estimate forecast for 2008 from this regression is 6.1% assuming the realized subsequent decline in GDP of 0.3%. Extending this process to 2009, with GDP decreasing by an additional

\(^2\)Note that the National Bureau of Economic Research (NBER) dated the recession as lasting from December 2007 to June 2009.
2.8% (few expected the recession to be that severe), the unemployment rate forecast would have been 8.6%, thereby matching Summers’ result. Since the standard error of regression (SER) is 0.5 percentage points, the actual unemployment rate peak is almost three standard deviations away from the 2008 prediction. This suggests a breakdown or structural break in Okun’s Law, which is perhaps indicative of instability in other long-held relationships as well. One conclusion may be that we have entered a “new regime” and that this brave new world is fundamentally different from our previous experience. If this is the case, then it will become harder to forecast economic variables with any useful accuracy and find stable economic relationships for the post 2007 period.

Figure 1 hints at the presence of such a structural break: the 2007-2009 recession initially appeared similar, if not milder, than the two Great Moderation recessions of 1990 and 2001. Moreover, there was certainly no indication that this downturn would resemble the most severe post-World War II (Volcker) recession of 1981, which is included for comparison. However, this changed in September 2008 with the bankruptcy of the Lehman Brothers investment bank, at which point U.S. unemployment increased rapidly. Only then did it become evident that we were in the midst of something much more serious. Although the 1981 recession was severe, the recovery from the monetary contraction was relatively quick. Pre-recession employment levels were reached in less than 30 months. In stark contrast, more than four years after the end of the Great Recession, current employment levels have still not returned to those seen in December 2007 (Figure 1).

The unemployment rate has remained stubbornly high for this stage of
the recovery; it has declined by only 2.5 percentage points during the four plus years since the end of the recession in June 2009. Moreover, the anemic rate of increase in employment has barely outpaced labor force growth over the last two years. Given this lackluster increase in employment, it is not altogether surprising that the unemployment rate has still not declined to its pre-recession level. Clearly, this recovery from a financial crisis is very different in terms of labor market movements in the unemployment rate and job creation.

The picture gets worse once you consider the long-term unemployed. These are individuals who have been unemployed for more than half a year, the time by which unemployment insurance benefits are terminated during normal economic times. Their numbers have been significantly higher by historical standards. Figure 2a displays a time series plot of the long-term unemployment rate (the number of people who are long-term

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3The maximum duration of unemployment insurance benefits has been extended to as long as 99 weeks multiple times during and after the recent recession.
unemployed as a percentage of the total labor force) since 1948. Figure 2b shows long-term unemployment as a percentage of total unemployment. Both figures indicate a recent and unusually large increase in long-term unemployment, both in absolute and percentage terms, relative to the last 60 years.

The unemployment rate for labor force participants in this category reached a high of 4.2% in April 2010 (Figure 2a), a full six months after the unemployment rate peaked. This compares to the previous maxima of 1.6% in the aftermath of the 1990 recession and 2.4% following the 1981 recession. Additionally, over a three year period (December 2010 to November 2012), individuals who had been unemployed for 27 weeks or more made up more than 40% of all those unemployed (Figure 2b). This is a much larger share compared to the previous postwar peaks: the percent of long-term unemployed to the total was 25.7%, 21.5%, and 22.7% following the 1981, 1990, and 2001 recessions, respectively. This means that this ratio was almost twice as high after this recession which serves as a potential explanation for fundamental changes in employability during the current recovery period. Levine (2013) attributes this phenomenon to a
loss of employee-employer relations that may induce a positive feedback loop as workers remain unemployed for a more extensive period of time. The longer people experience spells of unemployment, the more their useful work skills decline. Such depreciation of human capital makes these workers even less desirable to potential employers and thereby keeps them unemployed for longer. This downward spiral can continue to the point where gainful employment for many long-term unemployed becomes increasingly improbable.

The unemployment rate will decrease if employment growth outpaces labor force growth. Hence, if discouraged workers leave the labor force, it is possible for the unemployment rate to decline without any increase in the actual number of individuals employed. To eliminate this so-called “discouraged worker effect” from distorting the labor market picture, Figure 3 presents a time series plot of the employment to population ratio, with teenagers broken out separately. Although both the overall population and teenagers saw a sharp decline in this ratio during the recession, teenagers were clearly hit harder.

The teenage employment to population ratio dropped from 37.4% in June 2006 to 25.2% in May 2011 (Figure 3). This represents a record low for the postwar period. Moreover, after this large decline within a relatively short timeframe, the ratio has remained around 26% without any indication of a return to previous levels in the near future. Compared to the three prior recessions, this is atypical given how far into the recovery we are. This trend decline is significant since, as mentioned above, extended periods of unemployment lead to a depreciation of skills and a probable de-
increase in future employment options. One plausible explanation as to why teenagers are most affected is that many teenage workers tend to work in entry-level service jobs which become increasingly redundant during economic downturns and their aftermaths. Another possibility is that older workers have displaced these teenagers. Although there was a significant fall recently in teenage employment, there has also been a downward trend since 1982 (see the dashed trend line in Figure 3) which could explain part of this steep decline, but not the bulk of it.

Even more alarming than these employment incongruities in themselves is that real Gross Domestic Product (GDP) had returned to its pre-recession level by the second quarter of 2011 while the unemployment rate, as discussed above, has not. Historically, GDP growth and unemployment rate

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4 This topic will be discussed in further detail in the hysteresis paragraph of the literature review.

5 Note that this does not project normal growth of GDP forward beyond the onset of the recession; it just indicates we have reached where we were in 2005. Furthermore, note that per capita GDP has not returned to its pre-recession level. For that matter, it has not even reached its 2005 level, almost turning this past 10 years into a “lost decade.”
changes have moved according to a relatively tight relationship described by Okun’s Law which has a correlation coefficient of 0.87. Hence, it is odd that an increase in the growth of real output has not led to a greater decline in the national unemployment rate (Figure 4).

In Figure 4, blue points represent values for the period 2007-2012, inclusive. Red points are annual values for the period 1948 to 2006. The fitted green line displays the historical relationship between the change in the unemployment rate and growth in real GDP for the United States prior to the first year of the Great Recession. The orange regression line represents the fitted values for the Great Recession and subsequent “Not-So-Great recovery”. This relationship appears much steeper than that for the previous period. This suggests a structural break: to reduce the unemployment rate by one percentage point now requires real GDP to grow by less than the amount needed in the past. This also indicates that if real GDP growth falls by one percentage point, the unemployment rate will increase by more than
Background

it would have done previously. This explains why many econometricians under-predicted the unemployment rate peak, because they did not have the data we now have from which they could have determined that this fundamental relationship had changed.

Although there are only a few points making up the “new trend” sample, they display a strong divergence from the historical correlation and, therefore, indicate an inherent breakdown in Okun’s Law. I performed a Chow test to ensure that the coefficients are indeed different. With an F-statistic of 2.76, it rejected the null hypothesis at the 5% significance level, thereby confirming that a statistically significant structural break did occur. One plausible explanation for this anomaly is that productivity has increased. If this is the case, fewer people are now needed to produce a given level of output. So for the same output, unemployment would now be even higher than expected given the decline in GDP.

These examples reinforce the notion that this recession and recovery have been, and continue to be, very different from previous experiences. One reason for this is that a recovery from a monetary contraction, as in the 1981 Volker recession, and indeed most post-World War II recessions, is unlike a recovery from a financial crisis (Reinhart and Rogoff, 2008). In addition, the anomalously high and persistent unemployment rate and breakdowns in commonly-accepted economic relationships suggest that the unemployment rate may now contain a larger structural component that may persist post-recovery. If this is the case, then the labor market consequences

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6Note that some economists believe that the decline in the unemployment rate observed during the first quarter of 2011 has brought the unemployment and output gaps back in line with the historical Okun’s Law relationship (Daly, Hobijn, Sahin, & Valletta, 2012).
of the recent recession and recovery may need to be remedied in a different fashion. Since short-run stabilization policies are not designed to alleviate structural unemployment and can be extremely costly if misapplied, this possibility has important policy implications.

If the unemployment rate is below the natural rate for an extended period of time, this can lead to higher inflation. Figure 5a displays the movements in the inflation rate and the unemployment rate-NAIRU gap since 1948. Note that when the gap is high, either in the positive or negative direction, the inflation rate is greatly affected. This lends emphasis to the fact that this natural rate topic is important from the perspective of maintaining a stable inflation rate. Figure 5b relates the information in Figure 5a back to the Phillips curve, changing the left hand axis to the change in inflation rather than inflation itself.\(^7\) This figure displays the clear negative relationship between cyclical unemployment and the change in inflation; during expansions, the cyclical unemployment gap is negative and inflation increases whereas during downturns, for example during the Volker Recession, cyclical unemployment greatly increases while inflation decreases (Figure 5b).

To assist in the understanding of the natural rate, the following section (2.1) will cover its initial derivation. Section 2.2 will consider more recent adaptations and improvements that make it a more accurate and reliable measure.

\(^7\)If there are “static expectations”, with inflationary expectations able to be measured by the previous period’s inflation rate, then the left hand side variable of the expectations-augmented Phillips curve would be the change in the inflation rate.
2.1 The “Optimal” Unemployment Rate as Derived from the Original Phillips Curve

In 1958, A. W. Phillips derived the Phillips curve which inversely relates the unemployment rate and nominal wage growth. In other words, there is a widely-accepted view of a correlation between a low unemployment rate and a high rate of inflation\(^8\) and vice versa. This implicit short-run tradeoff makes the Federal Reserve’s job of keeping both inflation and the unemployment rate low\(^9\) a challenging balancing act.

Assuming static expectations, the original Phillips curve can be represented as follows:

\[
w_t = -b (U - \bar{U}) + v\]  \hspace{1cm} (1a)

where nominal wage growth \((w_t)\) is a negative function of cyclical unemployment, \((U - \bar{U})\), and supply shocks and other shocks to the market, \(v\).

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\(^8\)I assume some price mark-up occurs.
\(^9\)The Federal Reserve’s stated objectives are ”maximum employment, stable prices, and moderate long-term interest rates” according to public law for Congress §225a (http://www.law.cornell.edu/uscode/text/12/225a)
Cyclical unemployment is the gap between the actual unemployment rate, \( U \), and the natural rate of unemployment, \( \bar{U} \).

One Keynesian-type interpretation is that when this measure is positive, there are more workers willing to work at the prevailing wage than there are jobs available ("wait unemployment"). In this framework, the Federal Reserve can affect the unemployment rate and, therefore, the amount of cyclical unemployment. This is done through stimulatory monetary and fiscal policies that increase aggregate demand and, hence, the amount of jobs available. The structural component of unemployment, or the natural rate, on the other hand, is the equilibrium result determined by real supply and demand factors in the labor market. As will be discussed in greater detail in the theory of unemployment section, these factors adjust with real wages, rather than nominal wages and, hence, federal stimuli do not affect their long-run values. In other words, the central bank can influence cyclical unemployment, but it has no control of structural unemployment. This relationship reinforces the importance of having a solid numerical estimate of the natural rate: it is only when the Federal Reserve has such knowledge that it can implement economic policy measures which minimize cyclical unemployment without overshooting and expending unnecessary funds.

Not only does Equation 1a offer valuable insights into the different components of the unemployment rate, but it also reinforces the notion that wages and, hence, inflation theoretically increases if the unemployment rate remains too far below the natural rate. In this scenario, the U.S. would have consistently negative cyclical unemployment. Given the negative relationship between cyclical unemployment and prices, a persistent nega-
tive gap should lead to greater wage and price inflation, assuming that this long-held relationship persists.

During the 1970s, however, inflation was not a great concern because, in accordance with the classical theory of money neutrality, people assumed that real wages would remain constant or only grow at the rate of productivity increases as nominal wages increased with the prices of goods. As a result, the published “optimal” rate of inflation hovered between 3% and 4%, with a desired unemployment rate of 4%. For instance, in response to recessionary fears, the Humphrey-Hawkins Full Employment Act was signed into law by President Carter in 1978. It set a numerical unemployment rate target of 3% for persons over 20 years of age and an inflation target of 4% (Humphrey Hawkins Full Employment Act, 1978). To put these values into perspective, the current Federal Reserve target is 2% inflation. One reason why the target is not zero is that the Consumer Price Index (CPI) tends to be overstated due to the substitution and quality biases (Boskin, Dulberger, Gordon, Griliches, & Jorgenson, 1998). Additionally, inflation has beneficial buffering qualities: employers and policy makers can use it to effectively reduce real wages without decreasing nominal wages and thereby upsetting the general workforce. This effect occurs due to the idea of money illusion in which people tend to think of currency in nominal, rather than real, terms (Fisher, 1928; 108). Hence, if inflation increased without corresponding nominal wages movements, real purchasing power per hour worked would decrease without workers taking much note.

In the late 1960s, Phillips curve theory, as initially posited without in-
flationary expectations, began to break down. In fact, Edmund Phelps and Milton Friedman independently challenged its theoretical underpinnings in subsequent years (Phelps, 1967; Friedman, 1968). It was their works which resulted in the currently accepted relationship between the acceleration in inflation and cyclical unemployment, without forcing the condition of static expectations. Friedman (1968) argued that the original relationship would not hold and, therefore, would not remain an effective tool in influencing the economy unless the central bank was able to increase inflation by more than expectations each time it tried to stimulate the economy. Friedman reasoned that workers and firms would build inflationary expectations into their contracts. In essence, employers would raise prices in accordance with their inflation forecasts or expectations. As such, money neutrality would swing into effect and no employment gains would result unless the Federal Reserve had raised inflation by more than expected; to be effective as an economic policy tool, wage inflation and inflationary expectations would have to lag actual inflation in perpetuity. Theoretically, this inherently necessitates ever higher inflation to create employment gains.

The stagflation of the 1960s and 1970s is a prime example of this occurring. The Federal Reserve attempted to reduce unemployment by increasing inflation, but agents on both sides of the market saw through this and the U.S. ended up with extremely high inflation rates and very little economic growth (Kollewe, 2011). All in all, the Phillips curve became re-branded as the Expectations-Augmented Phillips curve (EAPC) and had the following slightly modified equation:
\[ \pi = \pi^e - b (U - \overline{U}) + \nu \]  

(1b)

The only difference from Equation 1a is that price expectations, \( \pi^e \), are now built in. Assuming static expectations and subtracting the lagged inflation rate from both sides:

\[ \Delta \pi = -b (U - \overline{U}) + \nu \]  

(1c)

Both Friedman and Phelps greatly contributed to macroeconomic theory and have since been award Nobel Prizes in Economics for their works. The new “ideal” unemployment rate, or the natural rate which Friedman introduced, will be discussed in the following section.

### 2.2 Friedman’s Natural Rate and the NAIRU

Friedman found supportive evidence that inflation accelerates before full employment is reached. Therefore, he posited that we should strive for the lowest unemployment rate that does not result in a spiraling upward rate of inflation; in his 1968 paper, he introduced the concept of a natural rate:

“At any moment of time, there is some level of unemployment which has the property that it is consistent with equilibrium in the structure of real wages … The ‘natural rate of unemployment’ … is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is embedded in them the actual structural characteristics
of the labour and commodity markets, including market imperfections, stochastic variability in demands and supplies, the costs of gathering information about job vacancies, and labor availabilities, the costs of mobility, and so on.” (Friedman, 1968).

Essentially, unemployment is a phenomenon that can be understood within a general equilibrium model, provided that the model is suitably extended. This implies that there is only one equilibrium level of output and employment at a given moment in time, given a specific set of input parameters that affect labor demand and supply. Furthermore, by defining it as an equilibrium, Friedman suggests that the long-term unemployment rate is not a constant, and can therefore change if the labor demand and supply curves affecting the input parameters shift. I will address these two points in further detail in the theory of unemployment section.

The natural rate is the rate of unemployment that remains after business cycle fluctuations, termed cyclical unemployment, are considered. Friedman used it as a way to distinguish between cyclical changes that monetary policy can affect, and structural changes that it cannot. Essentially, it can be viewed as the long-run unemployment rate that the economy reaches once it is in a resting equilibrium. As such, it is the unemployment that results from all sources except fluctuations in aggregate demand. Rather than labeling it a “natural” rate, many econometricians prefer to call it the NAIRU because this term does not imply that any unemployment is acceptable. This being said, the official definition of the NAIRU is the equilibrium unemployment rate at which the change in inflation is zero (Hoover, 2012;
As mentioned previously, however, the two are approximately synonymous in practice. The Congressional Budget Office (CBO), the United States’ most cited source of NAIRU estimates, calculates an average NAIRU of 5.62% over 1948-2006 (Figure 6).

Figure 6 shows estimates of both the short-term and long-term NAIRUs. The major difference between the two estimates is that the CBO adjusts the second for structural factors that are likely only temporarily boosting the natural rate. The Federal Reserve appear to be operating under the assumption that the NAIRU has not changed, even in the short-term.

Next, I will discuss the components of the natural rate. In itself, the natural rate of unemployment contains both a frictional as well as a structural component. Frictional “wait” unemployment is the unemployment that remains even when the economy is at the business cycle peak (Hoover, 2012; 451). This is the job-search unemployment that occurs due to people looking for desirable work; even in good times, there are people transition-
ing between jobs or searching for ones that may be a better fit. Structural unemployment, on the other hand, is caused by labor market rigidities in the form of skills mismatches (Hoover, 2012; 468). It is the unemployment that arises when there is a fundamental disparity between the skills workers who are actively seeking work possess and those that firms with open positions want. Hence, it is affected by labor market inefficiencies, such as imperfect information, as well as any underlying changes in the skill set demanded by employers or offered by job seekers. The recent recession may have impacted these noncyclical factors, causing an inherent increase in the natural rate.
Chapter 3

Literature Review

Some economists do not believe that a NAIRU even exists (see Eisner 1994; Galbraith 1995). For instance, in a 1994 Los Angeles Times article, Robert Eisner, past president of the American Economic Association, wrote:

“But this is a doctrine with little or no consistent factual support. Unemployment in the United States has bounced all around its so-called natural rate with no indications of permanently accelerating inflation from our episodes of low unemployment.” (Eisner, 1994).

Other econometricians support this view: they do not find any significant correlation between the unemployment-NAIRU gap and persistent inflation. While acknowledging that there is a relationship in the short-term (as Figure 5a shows), they do not feel that a large gap will result with a long spell of higher inflation. John Kenneth Galbraith, who served as an economic advisor for four U.S. presidents, was likewise skeptical of natural
rate theory. In his 1995 article he wrote:

“That 5.5 to 6 percent consensus is easily explained: it’s where the actual unemployment rate is. And that has usually been true: the estimated NAIRU tracks actual unemployment. When unemployment goes up, conservative economists raise their NAIRU. When it falls, they predict inflation, and if inflation doesn’t happen they cut their estimated NAIRU. There is a long and not-very-reputable literature of such estimates – you can look it up. In fact, this little corner of the professional record is embarrassing.” (Galbraith, 1995).

These two prominent economists hold views that resonate with very classical economics; in classical models, one is always at the intersection of the labor demand and labor supply curves. If this is the case, there is no cyclical unemployment, and the natural rate should perfectly track the actual unemployment rate.

Hyper-classical theorists extend this theory to the extremes with some even believing that the Great Depression should really have been called the Great Vacation. They claim that the unemployed were choosing leisure rather than accepting the real wages that prevailed in the market which, presumably, represented the real value of their labor at the time. In fact, while not quite as extreme, Keynes believed it should have been terms the Great Misunderstanding. Real wages rose significantly as a result of prices falling after a large contraction in the money supply. This increase was only partly counteracted by decreases in workers’ nominal wages. Only
seeing the cuts in their nominal wages and not realizing the increase in their purchasing power, workers began withholding their supply of labor by incorrectly assuming their nominal wage cuts signified a reduction in their living standards (Williams, 2012). In reality, however, more workers were being involuntarily laid-off than voluntarily quitting.

Lilien (1982; 791) offers a possible explanation for holding this viewpoint, “[s]ince the widespread acceptance of the natural rate hypothesis, economists have come to view cyclical unemployment as deviations of unemployment from some relatively stable natural rate.” The key point here is that these economists view the NAIRU as being stable. This is further confirmed by the CBO’s calculations of the natural rate, with it barely fluctuating over time (Figure 6). While there are many who support this commonly-held view, “[t]here is nothing in this literature to suggest that the equilibrium unemployment will be time invariant.” (Lilien, 1982; 791)

There are others who believe that most or all of the observed patterns in the higher unemployment rate are only cyclical. Lazaer and Spletzer (2012) recognize that mismatch increased during the recent recession but believe that it has already retreated at the same rate. For their empirical specification, they constructed a measure of industry mismatch by calculating the unemployment-vacancy gap as a percentage of those employed in the industry as a whole. This allowed them to decompose the unemployment rate into its structural and cyclical components based upon industry makeup. They determined that the patterns observed were “consistent with unemployment being caused by cyclic phenomena that are more pronounced during the current recession than in prior recessions” (Lazaer and
Spletzer, 2012; 2). Furthermore, they felt that the time for the unemployment rate to increase from 4.4% in the Spring of 2007 to 10.0% in October of 2009 was not enough for any permanent structural change to occur. They conclude their paper with the prediction that the U.S. unemployment rate will soon decrease to around 5%, the long-run natural rate, as the remaining cyclical unemployment fades away (Lazaer and Spletzer, 2012).

In a recent economic letter from the Federal Reserve Bank of San Francisco, Valletta and Kuang (2010b) lent additional support to Lazaer and Spletzer’s findings through the use of slightly different processes. They first looked at recent outward shifts in the Beveridge curve, which will be discussed in greater detail toward the end of this literature review. Secondly, and similarly to Lilien (1982), they used a dispersion approach; they took weighted standard deviations of payroll employment across industries as well as across states. Their rationality for this was that sustained increases in the NAIRU are predicated on sector-level labor supply and demand imbalances. They found huge spikes in the dispersion of unemployment rates and attributed this to a 1.25 or less percentage point increase in the NAIRU. Having said this, they believe that these effects are likely transitory rather than permanent. In fact, they claim that the variation of employment gains and losses across sectors has almost returned to its pre-recession level (Valletta and Kuang, 2010b). Conceptually linking this information back to Figure 6, they would recognize the past existence of the short-run (orange) line but feel we are already back on the long-run (navy) line. To them, there has been very little imbalance in the pace of employment growth. Furthermore, they feel that the recent peak in dispersion was
similar to the peak attained during the Volcker recession of the early 1980s, which neither contained a permanent nor large structural component (Valletta and Kuang, 2010b). Furthermore, the observed unemployment rate and the NAIRU dropped to low levels during the subsequent early to mid 1980s recovery (Figure 1 and Figure 6). Keep in mind, however, that although these econometricians believe most of the unemployment rate hike was attributable to cyclical factors, other research indicates that cyclical changes may evolve into structural unemployment in the longer term due to skills and relationships worsening as time spent unemployed lengthens (see DeLong 2010; Levine 2013).

Although hotly contested, many economists use the principle of path dependence (also termed hysteresis) to argue against there being no shifts in structural unemployment, as the above econometricians claim. In major contrast to the above views, this theory allows for a time-variant NAIRU and even gives reasons as to why this is a more likely representation of real life (Ball and Mankiw, 2002). In physics, hysteresis is defined as the failure of an object to return to its original steady state after being affected by an external force, even ex-post the force’s removal (Ikhouane and Rodellar, 2007; 20). In other words, it is the dependence of a system on not only its current surroundings, but also on its past environment. This serves to suggest that the system, the NAIRU in this case, has more than one internal state which changes over time. In particular, Blanchard and Summers (1986), among others (see Layard, Nickell, & Jackman 1991, page 109-12; Ball 2009), have suggested that this concept applies to the labor market.
By the above definition, the natural rate is dependent not only on current labor market conditions but also on the past unemployment rate. Blanchard and Summers (1986) lent empirical support to this in their paper analyzing the increases in the European natural rate following the disinflationary recession of the early 1980s. They found that the unemployment rate becomes permanently higher after substantial negative shocks to the economy. Note that this theory relies on the fact that inflationary expectations are sticky due to wage rigidities and other labor market imperfections. One potential explanation for this, put forward by Layard, Nickell, and Jackman (1991; 109-12), is that workers lose human capital by remaining unemployed and, hence, become less attractive to potential employers the longer this remains the case. This means that there remains a lasting impact on the NAIRU even after the initial shock that caused the downturn in employment disappears. The intuition behind this claim is that the NAIRU remains higher due to the simple fact that workers are no longer as employable as they were pre-recession; sustained unemployment decreases both the market and job-searching skills of the unemployed population (Stiglitz, 1997).

Those that do believe the NAIRU permanently changes calculate it using a variety of different methods. Recall that a practical estimation of the natural rate is difficult due to the many shocks that could influence it as well as the uncertainty as to how much it changes over time. Hall (1979) proposed a theoretical estimation approach that estimates the natural rate through finding the intersection between the job finding and job separation curves. In his model, the unemployment rate is made up of those searching
divided by the amount in the labor force as a whole:

\[ U = \frac{s}{s + f} \]  \hspace{1cm} (2a)

Hence:

\[ U = \frac{1}{1 + \frac{f}{s}} \]  \hspace{1cm} (2b)

In these equations, \( s \) represents the proportion of people actively looking for work (the job searching rate) and \( f \) represents the job finding rate. As both equations suggest, a training scheme, teaching people how to apply for jobs or interview better, would increase the job finding rate and, hence, lower the overall unemployment rate. A more generous unemployment insurance (UI) plan, on the other hand, would increase the job separation rate as well as discourage workers from searching for employment as fervently. Both of these would work in the same, albeit negative, direction, resulting in a higher unemployment rate.

There have also been previous papers that estimate and forecast the natural rate using a Phillips curve approach. However, using this method is extremely imprecise, involving standard errors of up to two percentage points. Since the NAIRU has historically only fluctuated between 5.0% and 6.3% (Figure 6), these huge error bands make this method impractical in terms of application in the policy space. This is due to the fact that, although it is clearly negative, the Phillips curve relationship is not all that tight, with points varying hugely from the regression line. Staiger, Stock, and Watson (1997) calculate the U.S. NAIRU from an empirical Phillips
curve specification. However, their 95% confidence intervals are so large that even the actual unemployment rate is rarely out of the sampling interval. They attribute part of this variation to not having a perfect measure of inflation available. Regardless of the rationale, this imprecise of an estimate means that this method does not have great practical application.

Since cyclical unemployment is the gap between the actual rate and the natural rate, their results were not hugely useful from a policy perspective. They acknowledged this in their study and were quick to point out that other measures, such as the capacity utilization rate and some monetary aggregates over longer timeframes, are stronger in forecasting inflation. In fact, their research shows that inflation forecasts based on NAIRUs of 4.5, 5.5, and 6.5% are fairly similar due to the limited power of the natural rate in forecasting inflation rates. The authors called attention to this idea by stating,

"[t]he difficulty in estimating the NAIRU and its limited role in forecasting inflation are, of course, interrelated; after all, if the NAIRU played a more important role in forecasting inflation, then its value could be pinned down with greater precision from the data." (Staiger, Stock, and Watson, 1997; 47)

However, they added that while it is important "to recognize the limitations of the Phillips curve . . . knowing that there is an empirical regularity, albeit a noisy one, between the unemployment rate and changes in inflation should suffice" (Staiger, Stock, and Watson, 1997) to affect policy regardless of where the actual NAIRU lies.
Nobel prize winner, Stiglitz preliminarily found a 1.5 percentage point drop in the NAIRU from its 1980 peak until 1996 using the Phillips curve methodology as well (Stiglitz, 1997). He cautioned his readers stating, “the uncertainty surrounding this estimate, both the formal standard errors and the uncertainty over whether we are estimating the correct model, is very large.” (Stiglitz, 1997) It is interesting to note, however, that he attributes this decline to three main forces: changing labor force demographics, productivity growth, and more competitiveness within the labor and product markets. Further, he attributes one third of this change to demographic shifts, particularly that of baby boomers aging, resulting in a greater proportion of adults being in the labor force during the 1990s as compared to before (Stiglitz, 1997). Extending this idea to the modern day, many baby boomers are beginning to retire, leaving a larger proportionate base of teenagers, who have a higher collective natural rate, in the labor force.

Additionally, in a meta-analysis of eight models, all found similar declines in the NAIRU over 1984-1994 using a Phillips curve specification. However, the standard errors were so high on most of them that only three of these could reject a null hypothesis of a constant NAIRU at the 10% significance level (Staiger, Stock, and Watson, 1997); huge standard error bars mean that the significance of any historical changes cannot be detected with confidence. These examples all confirm the point that while this method yields point estimates that vary over time, they are so imprecisely estimated that they are not of much use externally.

An additional issue with the above methodology is that it assumes that the NAIRU is fairly time-invariant and that supply shocks and the natu-
nal rate are uncorrelated (Ball and Mankiw, 2002). To compensate for this, Ball and Mankiw used a time-lagged Phillips curve specification and the Hodrick-Prescott filter method. The Hodrick-Prescott filter essentially consists of a linear time trend which allows the regression coefficient of the trend to gradually change over time (Hodrick and Prescott, 1997). With this method, they were able to evaluate the short-term supply shocks of the 1970s and found that these fluctuations were related to changes in productivity. They concluded that the NAIRU increased in the 1970s, when productivity growth slowed, and vice versa in the 1990s. Similarly to Stiglitz (1997), they attributed the bulk of these changes to demographic shifts as baby boomers moved through the population. To lend additional support to this claim, they calculated a Perry-Weighted unemployment rate which is a weighted-average of the unemployment rate for different demographic groups assuming fixed weights, as if their respective weights at the beginning of the period remained throughout the period. This method allowed them to parse out what would have happened to the natural rate and unemployment rate had the relative proportion of demographic groups remained constant. They further hypothesized that increases in disability insurance as well as changes in incarceration rates affected the natural rate during these time periods. These two changes work in much the same way in that they both serve to remove people with historically higher unemployment rates from the labor force, thereby reducing the overall unemployment rate and underlying NAIRU.

The next approach that has been frequently cited in the literature utilizes the Okun’s law relationship. This relationship, between the NAIRU
and full-employment output as they relate to the actual unemployment and achieved GDP, is central to numerous monetary policy discussions. In the short-run, this relationship displays the labor and product markets’ capabilities of increasing employment growth and output without increasing inflation. In the long-run, it helps us determine the sustainable, equilibrium pace of noninflationary output (Hoover, 2012; 593). While not explicitly stated alongside Figure 4, Okun’s law can be represented by the following equation:

\[(y - y^{pot}) \times 100 = f (U - U)\]  \hspace{1cm} (3)

where \((y - y^{pot})\) is the gap between actual real GDP growth, \(y\), and potential growth if there was full-employment, \(y^{pot}\). On the other side of Equation 3, \(f\) is Okun’s coefficient resulting from a linear regression of the output gap on the amount of cyclical unemployment. As a result, one can calculate a natural rate using full employment output as estimated by the CBO along with the unemployment rate and growth in real GDP from the Federal Reserve Economic Data (FRED). Daly et al. (2012) performed a rudimentary analysis using this methodology. Their results suggest that the natural rate was approximately one percentage point higher than the CBO’s estimate during the recession and immediate aftermath. One potential flaw with this process is that the CBO uses the long-term natural rate to compute its potential output values and, thus, there may exist an endogeneity problem within this model. Another drawback of this approach is that the Okun coefficient may not be stable over time. A larger issue with
this methodology in calculating a natural rate, however, is that it must assume a constant NAIRU, otherwise too many variables are changing. In addition, this method does not allow for labor market changes or capital inputs to have any explicit effect on the determination of the natural rate or potential output (Horiguchi, 1992). The solution of the past has been to put in period dummies, which allow the Okun coefficient and the natural rate to change over time, but not so many that the available degrees of freedom are exhausted. This is problematic because different cutoff points tend to drastically affect the regression coefficients. Lilien’s sectoral variation approach, as discussed next, further improves on this by eliminating the need for time dummies at all. To do this, he utilizes Barro’s measure of unanticipated money growth, termed DMR in his paper, as a proxy for time-fixed effects (Lilien, 1982).

Lilien (1982) uses sectoral variation to show that the NAIRU went up in the 1970s. Through this approach, he estimates the degree of structural shifts within the labor market using a measure of the annual dispersion of employment; higher variation is associated with increased mismatch since this indicates people are shifting into new positions in new industries. As I will discuss in the theory of unemployment section, movements between sectors can affect the unemployment rate, especially if geography is involved. Lilien (1982; 777) shows that, particularly in the 1970s, the majority of fluctuations in the unemployment rate were caused by movements in the natural rate: “[a] substantial fraction of cyclical unemployment is better characterized as fluctuations of the frictional or natural rate than as deviations from some relatively stable natural rate.” Furthermore, he deter-
mines that at least 50% of the unemployment fluctuations were a result of the slow adjustment of labor supplied to shifts in employment demand between sectors (Lilien, 1982). This was a fairly novel idea in the early 1980s; Lilien was going against the grain in that most economists of the time were attributing the unemployment rate trends directly to cyclical unemployment resulting from business cycle fluctuations rather than movements in the underlying long-run rate.

Lilien’s (1982) conclusions about monetary policy implications are perhaps even more relevant to the current discussion. Because changes in the NAIRU indicate structural, rather than cyclical, unemployment, he determines that aggregate fiscal and monetary policy would not have been an effective remedy in the 1970s; since inadequate demand was not the underlying issue, the optimal course of action was minimal government stimulus initiatives (Lilien, 1982). I extend his approach to after the Great Recession and analyze the results with the current monetary stimulus plans in mind. If, as Lilien found in the 1970s, shifts in the NAIRU are mostly responsible for the higher-than-previous-recoveries unemployment rate, monetary influxes and increased quantitative easing are not the solution. If this is the case, the unemployment rate should gradually decrease on its own, absent any pushes from the Federal Reserve.

A more modern approach that has recently gained acclaim in the economics literature is determining the natural rate based on movements in the Beveridge curve. The Beveridge curve represents the relationship between the unemployment rate and vacancy rate and serves as a complement to the Phillips curve in analyzing the labor market; the curve appears
to shift over time and these shifts broadly correspond to the pattern of historical Phillips curve shifts (Ball and Mankiw, 2002). Beveridge curve theory will be discussed later in the paper but for the purposes of this literature review, it is imperative to note that movements along the curve tend to be attributable to cyclical unemployment whereas shifts in the curve are representative of increases or decreases in structural unemployment. While this is the case, it has been found that the NAIRU tends to change by approximately half as much as the Beveridge curve shifts out horizontally (see Orphanides and Williams, 2002). Valletta and Kuang (2010b) use a Beveridge curve approach and find a 1.25 percentage point increase in the NAIRU from the middle of the recession to December of 2010. While this is the case, they think this change is transitory and that the natural rate will soon return back to its pre-recession level. They attribute 0.8 percentage points of this increase to unemployment insurance benefit extensions (Valletta and Kuang, 2010b). This appears to be a strongly recurring theme and will be discussed further in the conclusion of this thesis. Daly et al. (2012) found the intersection of the Beveridge curve with the long-run job creation curve. As a result, they determine that the post-recession NAIRU is between 5.5 and 6.6%. Like Valletta and Kuang, they see this as solely a temporary increase and believe that the natural rate will fall back to around 5% as the cyclical recovery proceeds. That being said, they hold a slightly longer-term view in that they feel that it will still likely persist for several years due to remaining slack in the labor market (Daly et al., 2012). These opinions appear to match the CBO projections presented in Figure 6, with the short-run increases slowly fading away by approximately 2018.
Chapter 4

Theory of Unemployment

4.1 The Classical Model

In the classical model, prices and nominal wages are perfectly flexible; they always adjust such that the equilibrium real wage \( \frac{W^*}{P} \) and employment \( L^* \) remain at the point dictated by the intersection of the labor demand and labor supply curves, at least in the long-run. The following three graph framework (Figure 7)\(^\text{10}\) will help to illuminate the theoretical underpinnings of the unemployment rate.

For simplicity’s sake, a closed economy is assumed. Furthermore, all underlying movements in prices, \( P \), can be derived from an IS-LM/AS-AD framework. For the equations that follow, natural logarithms were taken in order to linearize the model: small letters refer to the natural logarithms of variables (i.e. \( a = \ln(A) \)). Figures 7a and 7b represent the labor de-

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\(^{10}\)The bulk of the methodology used, equations, and graphs are from Professor Manfred Keils lecture notes (2013).
mand and labor supply curves with nominal and real wages, respectively, on the Y-axis. Figure 7c is the production function with output being a function of amount of labor input ($L$), capital investment ($K$), and technological progress ($A$). For the purposes of this analysis, the production function will
be of the Cobb-Douglas variety:

\[ Y = AK^\delta L^\gamma \]  

(3a)

In logs:

\[ y = a + \delta k + \gamma l \]  

(3b)

where delta and gamma are elasticities that lie between zero and one.

The bars over \( K \) and \( A \) in Figure 7 indicate that capital investment and technological progress are fixed in the short-run. Since this is the case:

\[ y = cnst + \gamma l \]  

(3c)

where \( cnst = a + \delta k \).

In the “classical” version of this model, there is no cyclical unemployment and unemployment only results when real wages are set above the market-clearing level, causing there to be more job seekers than there are open positions. This “wait unemployment” occurs is when the federal or state minimum wage is set above the equilibrium rate. In this situation, as depicted in Figure 8 below, the real wage rate is set such that there are more people willing to work than the number firms are willing to hire.

First, I present the derivation of the labor demand curve as a means of displaying the parameters it is dependent on.11 Assuming firms are rational and profit-maximizing, they will demand labor only up until the

11Source: Stevenson, Muscaltelli, and Gregory (Chapter 3).
point where the marginal benefits of hiring an additional worker equal the marginal costs of hiring that worker. In the labor market, marginal benefits are the differential output the last added worker produces multiplied by the price the firm can charge for that output. The marginal cost of the last worker is the going wage rate. Hence:

\[ W = P \times \frac{\Delta Y}{\Delta L} \]  

(4a)

Dividing both sides by price:

\[ \frac{W}{P} = \frac{\Delta Y}{\Delta L} \]  

(4b)

with \( \frac{\Delta Y}{\Delta L} \) being the slope of the production function.

In logs, these two equations turn into:

\[ \ln w = \ln p + \ln \left( \frac{\Delta Y}{\Delta L} \right) \]  

(4c)
And:

\[ w - p = \frac{\Delta Y}{\Delta L} \]  \hspace{1cm} (4d)

Equation 4c is plotted in Figure 7a whereas Equation 4d is plotted in panel (b) of the same figure. Because price is only on the Y-axis of Figure 7b, changes in prices cause shifts in the labor demand curve in Figure 7a and movements along the curve in Figure 7b.

To take this one step further, I substitute the actual derivative of the production function in for \(\frac{\Delta Y}{\Delta L}\) of Equation 4b:

\[ \frac{W}{P} = \frac{\Delta Y}{\Delta L} = \gamma AK^\delta L^{\gamma - 1} \]  \hspace{1cm} (5a)

In logs:

\[ w - p = \gamma + a + \delta k + (\gamma - 1) l^D \]  \hspace{1cm} (5b)

I refer to \(l\) as \(l^D\) in this case because, since it was derived from the production function, this quantity of labor represents the amount desired from the firm-side of the market. Assuming gamma is likewise a constant, we now have:

\[ w - p = cnst' + (\gamma - 1) l^D \]  \hspace{1cm} (5c)

Solving for the amount of labor demanded by the firms, \(l^D\), we get:

\[ l^D = cnst'' + \frac{1}{\gamma - 1} (w - p) \]  \hspace{1cm} (5d)
This validates what can be seen in Figure 7b: a decrease in prices results in an upward movement along the labor demand curve. It also serves to confirm what we see in Figure 8: a decrease in prices without a similar decrease in the nominal wage rate induces involuntary “wait” unemployment by decreasing the labor demanded to less than what is supplied; people are willing to work but cannot find employment since there are fewer vacancies at this high of a real wage.

Next, I look at the supply half of the market so that both employers and employees are represented in this model. The labor supply curve is the set of points for which employees maximize utility given a set of possible work and leisure hours, subject to a budget constraint in the form of their annual income inclusive of any non-work income. From this side of the model, the real wage can be defined as the opportunity cost of one hour of leisure time. Essentially, wages are the money one forgoes by choosing to leisure rather than work. As such, the higher the real wage, the more likely one is to choose work over leisure. This is known in the literature as the substitution effect. On the other hand, since leisure is a normal good, a higher income, resulting from a higher wage, incentivizes people to demand more leisure. This effect, working in the opposite direction, is termed the income effect. The substitution effect tends to dominate when wages are lower and the income effect takes over once wages reach a particular height. This switch over point is different for each individual depending on the slope of their utility curves. It is at this height that the labor supply curve becomes backward-bending. In order to simplify my analyses, I assume that people in the market are on the upward-sloping portion of the curve only.
Assume the solution to this particular constraint maximization problem is:

\[ L^S = \left( \frac{W}{P} \right)^\theta \]  

(6a)

In logs:

\[ l^S = \theta (w - p) \]  

(6b)

I now substitute Equation 5c into Equation 6b:

\[ l^S = \theta \left( \text{cnst}' + (\gamma - 1) l^D \right) \]  

(6c)

Since I am viewing this market through a classical lens, the economy is always at the intersection of the labor demand and labor supply curves \((l^S = l^* = l^D)\). As such, I combine the \(l\)'s as like-terms and isolate \(l\):

\[ l \left[ 1 - \theta (\gamma - 1) \right] = \text{cnst}' \times \theta \]  

(7a)

\[ \therefore l = \frac{\text{cnst}' \times \theta}{1 - \theta (\gamma - 1)} = \text{cnst}''' \]  

(7b)

where \(\text{cnst}'''\) is just another constant.

Since all the terms in the fraction are constant, \(l\) is constant in equilibrium as well. In other words, employment in the long-run is constant. Of particular interest is that the equilibrium level of employment is independent of prices. This is not to suggest that it does not attain new stable
values as its underlying parameters change, but that it is solely affected by
the determinants of the labor demand and labor supply functions. From
the above derivation, some of the notable factors include the amounts of
capital stock and technological change, as well as the returns to labor and
capital.

The last step in this analysis results from the fact that we can approxi-
mate the unemployment rate as the difference in the log of the labor force
and the log of employment. This is because changes in variables are almost
equivalent to the difference in natural logs between the two, when values
are small. As such:

\[ U = \frac{LF - L}{LF} \approx \ln f - l \]  

Based on this slight simplification, the unemployment rate is only af-
fected by parameters which affect employment, as discussed in the deriv-
tations above, and those parameters which affect the amount of people in
labor force. This confirms Friedman’s (1968) definition of the natural rate
as being a constant in an equilibrium system given a specific parametric set
of inputs.

### 4.2 The Keynesian Model

In the Keynesian model, on the other hand, wages and prices are sticky
in the short-run. Hence, prices do not adjust right away to ensure that
the market clears and reaches its equilibrium level. It is this above-market-
clearing price that results in cyclical unemployment. Rather than being due to temporary movement between jobs, this kind of unemployment is due to fluctuations in demand. More specifically, it occurs when there is an aggregate demand deficiency. This deficiency leads to a decrease in production and, consequently, fewer employees wanted by firms. In this model, the number of people searching for work exceeds the number of jobs available. So, even if full employment is reached, there still exists unemployment due to the fundamental demand shortage. It is this business cycle unemployment that is theoretically targetable through government intervention; the central bank can influx money into the economy through the purchase of bonds in order to stimulate aggregate demand in the short-run.

To better understand the additional parameter that causes this cyclical unemployment in the Keynesian model, I will make one change to the supply-side of the above framework, while leaving the demand-side as it was. This modification, which Friedman came up with in his derivation of the expectations-augmented Phillips curve, is to replace real wages with expected real wages (Friedman, 1968). Since workers know their nominal wages due to contracts, the only thing that changes in the equation is that prices become expectations of the near-term aggregate price level:

\[ L^S = \left( \frac{W}{P^e} \right)^\theta \]  

(6c)

In logs:

\[ l^S = \theta (w - p^e) \]  

(6d)
The reason that this only affects the supply-side of the labor market is that the price suppliers are concerned about is their product selling price, which they set. Once firm-level supply curves are determined, these can easily be aggregated across firms to result in the aggregate labor demand curve, and hence the market price. The fundamental difference with this model is that employees are concerned with the expected price of the basket of goods they typically purchase, whereas employers are only interested in the price they can get for their product.

Repeating the calculations from the classical section, instead with Equation 6d substituted in for Equation 6b:

\[ l = \text{cnst}' + \frac{\theta}{1 - \theta (\gamma - 1)} \left( p - p^e \right) \quad (9a) \]

\[ \therefore l = l^* + \delta (p - p^e) \quad (9b) \]

where \( l^* \) is the level of equilibrium unemployment if workers have correct expectations, \( (p = p^e) \).

One remaining issue is how to plot the labor demand and new labor supply curve in the same diagram, given that they now depend on real wages and expected real wages, respectively. From Equation 6c:

\[ L^s = \left( \frac{W}{P^e} \right)^\theta = \left( \frac{W}{P} \times \frac{P}{P^e} \right)^\theta \quad (10a) \]

Hence, in logs:

\[ l^s = \theta [(w - p) + (p - p^e)] \quad (10b) \]
Or:

\[(w - p) = - (p - p^e) + \frac{1}{\theta} \times l^S\]  

(10c)

According to Equation 10c, the difference between realized and expected prices, \((p - p^e)\), essentially becomes a shift factor for the new labor supply curve with the real wage on the Y-axis. This means that you can be away from the natural rate only when there are price expectation errors. If actual prices are greater than price expectations, perhaps due to an unanticipated monetary or fiscal shock, the labor supply curve will shift right, thereby reducing the real wage and increasing employment in the market. As such, since the gap between realized prices and price expectations are a function of the gap between the actual money supply and the anticipated money supply, policy makers can affect the unemployment rate through unanticipated monetary shocks to the market. These will reduce cyclical unemployment. A huge take away from this model, and a major consideration for demand policymakers, is that only surprises matter. Relating this back to the purpose of this paper: is it very important to assess whether the persistently higher unemployment rate since the 2006-09 recession is cyclical, and therefore targetable, or not.
Chapter 5

Empirical Specification

5.1 Extension of Lilien’s (1982) model post-recession

As discussed in the theory of unemployment section, shifts in aggregate demand affect the unemployment rate because it takes laid-off workers time to find new jobs. Lilien (1982) determined that the amount of unemployment resulting from employment demand shifts depends on the speed with which workers are able to become reemployed. As such, if they have strong industry attachments, adjustment to sectoral shifts tends to be slow and causes more unemployment before the market is able to reach a new equilibrium (Lilien, 1982). Due to this relationship, he regressed a dispersion measure (sigma) on the aggregate unemployment rate to assess the impact of sectoral shifts on the unemployment rate. It is relevant to extend this approach to today because of the large sectoral shifts that occurred during the Great Recession. For instance, between 2006 and 2010, the government sector’s share of employment increased from 16.1% to 17.3%, an
increase of 7.5%. Over the same period, education and health services’ respective share of aggregate employment increased from 13.1% to 15.1%, an increase of 15.3%. On the other end of the spectrum, manufacturing’s share dropped from 10.4% to 8.9%, a decrease of 14.4% over this short five year span. With the greatest relative employment change, construction employment dropped from 5.6% to 4.2% of total employment, a decrease of 25.0%. This lends support to the idea that this recession was a “Mancession”, with predominantly male-dominated fields hit with the bulk of layoffs. To put these figures into perspective, construction employment has only declined by 5.5% over the previous decade (1996-2006).

The dispersion variable, \( \hat{\sigma} \), was constructed using annual, industry-level data\(^\text{12}\) from the Bureau of Labor Statistic’s Current Population Survey according to the following formula:

\[
\hat{\sigma} = \left[ \sum_{i=1}^{11} \frac{x_{it}}{X_t} \left( \triangle \log x_{it} - \triangle \log X_t \right)^2 \right]^{\frac{1}{2}} \tag{11}
\]

where \( x_{it} \) is industry-level employment in year \( t \), and \( X_t \) is aggregate employment in that same year.

As discussed in the theory of unemployment section, price surprises, a direct result of monetary shocks, impact the unemployment rate. To account for this, Lilien uses Barro’s\(^\text{13}\) measure of unanticipated money policy,

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\(^{12}\)The common 11-industry NAICS classification system was used to disaggregate the data.

\(^{13}\)The DMR series used in Lilien (1982) was updated from Barro (1983). For my replication, I used Barro’s (1983) values of DMR for 1948-1959. This data was pulled from Lucas and Sargent’s (Eds.) “Rational Expectations and Econometric Practice” in Barro’s chapter on “Unanticipated Money Growth”. I then calculated the year-over-year growth of M1 and M2 from the Federal Reserve Bank in St. Louis from 1960-2012. Next, I regressed these
DMR (Lilien, 1982). This value is a residual and, hence, goes to zero when approximating long-run values of the unemployment rate. It is useful to include in the regression framework as a proxy for time-fixed-effects (TFE). Consequently, the regression framework Lilien (1982) used to estimate the unemployment rate, including exogenous variables sigma and DMR, is of the form:

\[ U_t = \beta_0 + \beta_1 \sigma_t - \sum_{i=0}^{k} \gamma_i DMR_{t-i} + \beta_2 U_{t-1} + \beta_3 T + \varepsilon_t \]  

(12)

where \( \varepsilon_t \) is a random disturbance term. A time trend, \( T \), is included in an attempt to capture national trends that may have occurred in the labor market over each period analyzed. Table 1 presents estimates of two versions of Equation 12 over Lilien’s time period (1948-1980) and an extension of his model to the present (1948-2012) using annual\footnote{The data was originally obtained monthly and was aggregated to annual values for use in these regressions.} nonfarm data from the Federal Reserve in St. Louis and Bureau of Labor Statistics (BLS) databases. Table 2 presents four additional specifications for the period 1990-2012, along with the inclusion of a squared time trend. This period is broken out separately in order to make it comparable to the state-level panel and time-series regressions, for which data is only available since 1990. These will be discussed in sections 5.2 and 5.3, respectively.

I apply the Dickey-Fuller unit-root tests on DMR, sigma, and the unemployment rate to ensure their stationarity. I determine the optimal lag growths on two lags of themselves as well as the lagged unemployment rate to arrive at DMR and DMR2, values respectively. The data was originally obtained monthly and was aggregated to annual values for use in these regressions.
length by finding the auto regressive (AR) process of order $p$ that minimizes the Bayesian information criterion (BIC). The null for this test is that the variable of interest follows a unit-root process, thereby having a stochastic trend. Hence, a rejection of the null indicates that the variable is stationary. With one lag, DMR rejected the null at the 1% level with a test-statistic of -4.7. Using two lags, sigma likewise rejected the null with a 1% significance and a test-statistic of -5.9. A Dickey-Fuller test on the unemployment rate suggested that it did not follow a stationary process over 1948 to 2012. However, using an Augmented Dickey-Fuller (ADF) test on 1956 to 2007, I was able to reject the null at the 5% significance level. I believe this is appropriate given that the low rates of the early 1950s and high rates of the recent recession are likely aberrations.

Next, I ran F-tests on sigma and the unemployment rate to determine Granger causality. Since the ADF determined that the unemployment rate was only stationary within a smaller subset of the entire period, I used the change in the unemployment rate rather than the unemployment rate itself. The optimal lag length was determined by finding the AR($p$) that minimized the BIC; five lags for the change in the unemployment rate and two lags for sigma were optimal. In the full time sample, sigma Granger-causes the change in the unemployment rate at the 4.3% significance level, with an F-statistic of 3.3. On the other hand, the F-statistic on the reverse scenario is 2.1 which indicates that sigma does not Granger-cause a change in the unemployment rate at even the 10% level.

In the first two regressions, all estimated betas are of the expected sign and are highly significant, with the exception of DMR and lagged sigma.
Furthermore, they fairly closely replicate the coefficients found by Lilien (1982). The discrepancies found are likely due to Bureau of Labor Statistics (BLS) revisions to employment data. This becomes more evident when the natural rate is calculated and compared to his results; there is only a minor error band between the two. In the second pair of regressions, DMR and its lags are not only statistically insignificant but also of the opposite sign than expected. This may have resulted because, as some modern literature suggests (see Goldfeld, 1976), M2 rather than M1 may be a stronger predictor of modern monetary shocks due to changes in banking culture and money de-

<table>
<thead>
<tr>
<th></th>
<th>1948-1980</th>
<th>1948-2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.182</td>
<td>-0.340</td>
</tr>
<tr>
<td></td>
<td>(0.513)</td>
<td>(0.532)</td>
</tr>
<tr>
<td>$\delta_t$</td>
<td>77.10***</td>
<td>80.39***</td>
</tr>
<tr>
<td></td>
<td>(10.27)</td>
<td>(10.72)</td>
</tr>
<tr>
<td>$\delta_{t-1}$</td>
<td>8.735</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(12.57)</td>
<td></td>
</tr>
<tr>
<td>$DMR_t$</td>
<td>-10.77</td>
<td>-8.137</td>
</tr>
<tr>
<td></td>
<td>(6.847)</td>
<td>(7.219)</td>
</tr>
<tr>
<td>$DMR_{t-1}$</td>
<td>-16.63**</td>
<td>-13.68*</td>
</tr>
<tr>
<td></td>
<td>(7.030)</td>
<td>(7.761)</td>
</tr>
<tr>
<td>$DMR_{t-2}$</td>
<td>1.903</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.747)</td>
<td></td>
</tr>
<tr>
<td>$U_t-1$</td>
<td>0.571***</td>
<td>0.631***</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(0.179)</td>
</tr>
<tr>
<td>Time Trend</td>
<td>0.0589***</td>
<td>0.0415</td>
</tr>
<tr>
<td></td>
<td>(0.0160)</td>
<td>(0.0232)</td>
</tr>
</tbody>
</table>

$R^2$, SE, and LM(1) values are also reported. Standard errors in parentheses.

$^* p < 0.10, ^{**} p < 0.05, ^{***} p < 0.01$
mand instability. In the post war period, M1 money demand over-predicts the demand for money (Goldfeld, 1976). As a result, the growth in M2 will be used in the post-1990 regressions exclusively. I could not use it in these primary four regressions because M2 data from the Federal Reserve is only available from 1959 onwards. It is interesting to note that the long-run \( \delta_t \) is not extremely sensitive to the inclusion of its lag nor on further lags of DMR, as the minor coefficient differences between Regressions 1 and 2 and Regressions 3 and 4 display. Lastly, none of the Breusch-Godfrey serial correlation Lagrange multiplier tests of order one reject the null of there being no auto-correlation. This is important but not unexpected given that the lagged unemployment rate is included in all four of these regressions.

In contrast to the 1948-2012 regressions of Table 1, the signs of all coefficients, including DMR2 and its lags, are of the expected sign in all four of the 1990-2012 regressions. Sigma is also much more significant over this time period. Furthermore, it is interesting to note that the coefficient on sigma is neither greatly impacted by the inclusion of a squared time trend nor the same year DMR2, as seen by the minor coefficient differences between regressions 1 and 2 and regressions 3 and 4, respectively. A large variation in the deviation of the unemployment rate is explained by these models.

In terms of the linear versus squared time trend, I looked at the Akaike information criterion (AIC) for regressions 1 and 2. The AIC is a measure deals with the trade-off between the complexity and the goodness of fit of a model. A smaller AIC is indicative of a higher quality model in terms of there being the least information lost. The AIC of regression 1 is 23.3
compared to 13.1 for regression 2. This suggests that a squared time trend is a better fit for this time period, and is the reason I use it for the remainder of the modeled equations. This is reasonable given that the period started with the 1990 recession and recovery, lead into an expansion, and ended with the Great Recession.

Once again, all the first order Breusch-Godfrey statistics in this set of regressions fail to reject the null of there being no serial correlation. Due to this, I decided against the inclusion of heteroscedasticity-consistent (HAC)
standard errors. Moreover, I dropped $DMR2_t$ after an F-test on the coefficient of $DMR2_t$ in regression 3 resulted in a P-value of 0.68.

In terms of using these specifications to estimate a natural rate series, I use Liliens (1982) methodology:

$$U = \sum_{i=0}^{\infty} \beta_2^i (\beta_0 + \beta_1 \hat{\sigma}_{t-i} + \beta_3 T_{t-i})$$

(13)

Since DMR and the error term are residuals, their infinite sum is zero and this explains why they are excluded from natural rate calculation in Equation 13. Furthermore, note the importance of lags in this equation; past values greatly impact the current ones. While this is true, because $\beta_2$ is between zero and one, the weight of these lags approaches zero after only a couple lags are considered. Using Equation 13 and the coefficients from Table 2 regression 3, I calculate the natural rate since 1992. These values are represented in Table 3 below and as a time series plot in Figure 9.

The natural rate series shows significant movement between 1992 and 2012, tracking the actual unemployment rate reasonably well (Figure 9). More interestingly, these results illuminate the different sources of unemployment. Between 1992 and 1999, there is a fairly wide gap between the unemployment and natural rates, with a maximum gap of 0.7 percentage points (15.2% of the actual unemployment rate) in 1996. These deviations from the NAIRU represent cyclical unemployment which is, therefore, targetable by monetary policy. In stark contrast, over 1999 to 2012, the unemployment rate has tracked the natural rate extremely closely which suggests that real parameters affecting the underlying natural rate were driv-
Extension of Lilien's (1982) model post-recession

ing the changes rather than deviations from it. In fact, the correlation coefficient between these two series is 0.93. As mentioned throughout this paper, it is these structural factors which the central bank cannot affect.

Putting this information in Figure 9 into context of the Fed-accepted CBO estimates from Figure 6, the natural rate estimates predicted by this regression are much higher; rather than hovering around 6% in 2012, my model predicts a NAIRU as high as 8.2%. While this is the case, the natural rate has been trending strongly downward and I imagine that its current high level is purely transitory in nature. Given their recent tight relationship, the actual unemployment rate should fall with it, even absent any
government intervention. Even more interesting is that this figure shows that the actual unemployment rate is already below the natural rate. This suggests that the Federal Reserve should not stimulate aggregate demand further. In fact, a target of 5.5% is much below the current NAIRU and could put the U.S. in risk of increased inflation.

5.2 State-level Panel Estimation

In order to add more than just a period extension to Lilien’s work, I perform a state-level panel with time and state fixed effects to see whether this lends any additional insights. It may be a more accurate specification because at my more disaggregated level, losses in one state will not be simply counteracted by gains in another. For instance, employment in South Dakota increased by 1.7% over 2006-2009 whereas employment in California decreased by 6.3% over the same period. While almost all of the states showed declines during the recession, therefore resulting in less cancelling
out of employment losses with gains, in other periods there were more contrasting trends between state-level employment that a national sigma may not have caught. Moreover, this method will better account for geography-related variation of people transitioning jobs between states. I used the same specification as in Section 5.1 in panel form across states with two-way fixed effects. Additionally, I included interaction terms to allow for the effects of state-level trends. Annual nonfarm employment data from BLS and state unemployment rate data from the Local Area Unemployment Statistics (LAUS) database were used. Since it is only available at the national level, DMR fell out of the regression due to perfect multicollinearity. This is the case because at the entity level there is an exact linear relationship, in that the values are repeated, for each state within a specific year. That being said, it will be included again in the state-level time series of Section 5.3 as a proxy for TFE.

It would appear natural to run the state-level panel regressions using Lilien’s (1982) initial specification starting in 1981. However, I performed a Chow test to test for the presence of a structural break over the entire sample. With an F-statistic of 2.57, it rejects the null hypothesis of stability at the 5% significance level. This means that for my purposes, it is more reasonable to follow a different specification beginning in 1981. However, data limitations make this not feasible at the state-level. As such, I begin the panel estimation in 1990, when state employment figures are first released, and assume that there was a structural break necessitating the use of new coefficients.

The panels with two-way fixed effects and state-specific trends resulted
Empirical Specification

in the coefficient on sigma falling to roughly one sixth its previous level; the TFE absorbed most of its tangible impact. A regression of sigma against the annual time dummies had an R-squared of 43.5%, which explains why sigmas impact fell drastically when TFE were included. This makes sense because, during the midst of a deep recession, one would expect states to have similarly high sigmas within specific years, meaning that there would not exist much state-level variation. It is due to this lack of state-level variation that the coefficient on sigma drops and loses its explanatory power. To adjust for this, I exclude time fixed effects for the remaining two regres-

<table>
<thead>
<tr>
<th>Table 4: Unemployment Rate Panels: 1990-2012</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Constant</td>
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</tr>
<tr>
<td>$\delta_{t-1}$</td>
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</tr>
</tbody>
</table>

| Time Fixed Effects | Yes | Yes | No | No |
| State Fixed Effects| Yes | Yes | Yes | Yes |
| Clustered Errors  | No  | Yes | No | Yes |
| State Trends      | Yes | Yes | Yes | Yes |

| N     | 1008 | 1008 | 1008 | 1008 |
| $R^2$ | 0.956| 0.956| 0.887| 0.887|
| SE    | 0.435| 0.435| 0.689| 0.689|

Standard errors in parentheses.

*p < 0.10, **p < 0.05, ***p < 0.01
sions using the panel specification. This has precedent in the economics literature. For example, in their 1983 paper on surprise monetary shocks, Barro and Gordon omitted country fixed effects due to a similar lack in enough variation across countries (Barro and Gordon, 1983).

5.3 State-level Time Series Regressions

After dropping time fixed effects, the issue then becomes that shocks at the state-level are no longer controlled for over time. As such, this section improves the model by running 48\textsuperscript{15} individual state-level time series regressions, once again including national DMR as a proxy for time fixed effects. This means that I can display state-level NAIRUs over time. These values can also be aggregated to the national level using state labor force weights. This method is less restricting in that it allows betas to vary by state. Presumably this will make the national natural rate calculation more accurate. Again, the same specification is used across all states. Figures 10a-c display the natural rate and actual unemployment rate of the three largest U.S. states (California, Texas, and New York) as measured by their 2012 labor force values. The constructed series at the national level from the 48 state-level is represented in Figure 11.

Figure 10 shows the differences between states in terms of the amount of structural versus cyclical unemployment that make up their respective unemployment rates. The unemployment rates of California and Texas had fairly high cyclical components until the early 2000s, since which point both

\textsuperscript{15}Hawaii and Alaska were excluded because they tend to be anomalous in terms of trending with the rest of the mainland United States.
of their unemployment rates have closely tracked their natural rates. It seems that New York, on the other hand, has had a persistently large cyclical component to its unemployment rate, with significant and consistent deviations from the natural rate over all years in the sample. This may be due to the fact that the labor market in New York is extremely com-
petitive, with more workers willing to work at the going wage than there are jobs available. This suggests that perhaps targeted monetary stimulus in specific states may have greater impact on reducing the national unemployment rate.

Next I aggregate the 48 state-level NAIRUs by their respective labor force counts. In recent research, Campello, Galvao, and Juhl suggest that aggregating lower level data may produce more efficient estimates. In their 2013 working paper, they show that averaging firm-level betas is superior to looking at market betas in aggregate to begin with, assuming certain correlations hold (Campello, Galvao, and Juhl, 2013). They took simple averages in their analysis. However, since the size of the labor force varies so much between states, with California holding roughly 13% of the U.S. population and labor force, I decided to weight by labor force rather than giving each state NAIRU equal weight.

Figure 11 is interesting in that it shows that slightly more cyclical un-
employment may exist than the national-level regression (Figure 9) indicates. It suggests that there was considerable cyclical unemployment in the early 1990s as well as towards the end of the recent recession. One commonality that Figure 9 and Figure 11 share though is that, as of 2012, the unemployment rate has reached the natural equilibrium rate. Additionally, the NAIRU is trending downward. Thus, assuming this trend continues, at least over the next few years, the unemployment rate should fall with it, even without additional fiscal spending.
Chapter 6

Beveridge Curve Theory

The Beveridge curve has been a popular research tool in the recent structural versus cyclical unemployment debate. The curve itself tracks the relationship between the unemployment rate and the vacancy rate over time (Franz, 1992; 3). It is downward sloping because during periods of economic contraction, the unemployment rate increases while the vacancy rate goes down as firms reduce the number of openings and the job search becomes more competitive (Beveridge, 1944). As mentioned briefly in the literature review, movements along the curve are interpreted as cyclical movements in labor demand whereas outward or inward shifts of the curve represent frictional unemployment changes. The second scenario reflects a reduced efficiency in matching workers to jobs. All else equal, a decline in job matching efficiency will raise the structural level of unemployment, and hence the natural rate (Ball and Mankiw, 2002). In other words, for a given level of vacancies, workers have a more difficult time finding a job they desire. From the firms perspective, on the other hand, employers have more
trouble finding suitable workers for each given level of the unemployment rate.

Using data from BLS’ JOLTS, Figure 12 displays the Beveridge curve since December 2000. First, this figure shows that there have been movements along the historically-defined curve, suggestive of some cyclical unemployment. Additionally, structural shifts are evident in that there has been a significant rightward shift. The orange and purple dashed trend lines show the mean relationship before and after August of 2009, respectively. As one can see, the curve appears to have shifted outwards, with a horizontal gap as large as 2.6 percentage points in certain months. This is indicative of structural unemployment changes. While this is the case, past research (see Valletta and Kuang, 2010a) indicates that the NAIRU tends to only move by half as much as the Beveridge curve shifts outward. This means that Figure 12 suggests an approximate maximum of a 1.3 percentage point increase in the natural rate since August 2009. While this is the
case, my linear trend line analysis may be too rudimentary of a methodology. Research by Daly et al. (2012) suggests that horizontal shifts in the Beveridge curve are not uniform, but instead larger at lower levels of the job vacancy rate. Perhaps curved trend lines which are steeper at higher job vacancy rates would better serve to address this point. While not perfect, this figure still brings to light an important point: even though not as extreme of an increase as the sectoral variance approach suggests, this is still more of a NAIRU increase than Bernanke and the Federal Reserve acknowledge.
Chapter 7

Explanations

Both the sectoral variance and Beveridge curve methods point to there being a higher structural rate of unemployment. But why has this change resulted? I will now consider three potential causes common in the recent empirical literature, as well as how they would impact the NAIRU. The first of these is a mismatch between labor demanded and supplied across sectors and geographies. This rationale is predicated on there being imbalances in labor supply and demand across skill sets, industries, and geographies (Daly et al., 2012) which may be due to a shift in the current demographic makeup of the labor force; as baby boomers retire, there is a larger relative proportion of teenagers in the labor force than before.

Similar to the unemployment rate always remaining above zero due to people transitioning between jobs, there must always exist a certain amount of mismatch: the vacancy rate will never fall to zero. Having said that, more mismatch than usual decreases labor market efficiency since it becomes harder for the unemployed to find open positions as well as more
costly for firms to fill vacancies (Daly et al., 2012). Relating this back to the sectoral variance specifications, a large dispersion in employment across sectors is an indication of mismatch in that it suggests an uneven distribution in job gains and losses. This is frequently cited as a key cause of natural rate increases due to the fact that retraining workers for new jobs requires time and money. Due to diverse retraining needs and the relative willingness of the workforce to shift to new industries, each industry-specific demand shift will affect the NAIRU by different amounts. For instance, Barnichon, Elsby, Hobijn, & Aysegül Sahin (2011) propose that the construction industry had the greatest effect in shifting the Beveridge curve during the Great Recession. This all being said, the effects of mismatch are most likely transitory in nature and its current path indicates that it is not likely to have a persisting impact on the NAIRU (Daly et al., 2012). This is further supported by the declining trend of the natural rate in Figures 9 and 12.

Another plausible explanation for the higher natural rate is the extension of unemployment insurance (UI) benefits. As of late 2009, the unemployed were able to remain on UI for 99 weeks. These extensions are likely to reduce job search intensity in that they soften the blow of losing a job and provide a two-year income stream (Chetty, 2008). During the recent recession, unemployment duration approximately doubled (Valletta and Kuang, 2010b). If one assumes this doubling was caused wholly by the benefit extensions, then they increased the unemployment rate by 0.8 percentage points (Daly et al., 2012). As these extension provisions expire, however, this effect is likely to dissipate.
Lastly, I consider the impacts of uncertainty on raising the natural rate. In the more risky post-recession climate, firms are more uncertain about their current and future operating environments. Such uncertainty erodes business confidence and so depresses hiring (Bloom, 2009). Moreover, it may also make firms more selective about filling vacancies and may increase the “contractor” or temporary workforce. These effects both serve to reduce the amount of vacancies posted, thereby shifting the Beveridge curve up for each level of the unemployment rate. Because this uncertain climate is not likely to persist as we climb further out of the recession, its effect on the natural rate is not likely to be long-term.
Chapter 8

Concluding Remarks

This paper analyses whether or not the natural rate of unemployment has risen. Since monetary and fiscal spending are intended only to alleviate cyclical unemployment and can be extremely costly if over-applied, the results of this discussion shed light on how the Federal Reserve should optimally act in the coming months. Although an in-depth review of the value of current specific policies is beyond the scope of this paper, it is still valuable as a tool to better understand general monetary policy implications.

My results suggest that during the post-2001 recession recovery, the unemployment rate contained a markedly higher cyclical component. In stark contrast, the majority of the current high post-recession unemployment rate is structural in nature and could not have been lowered through the increased use of aggregate demand-stimulating policies. Furthermore, it was not until 2008 that there was a cyclical gap at all. This is not to say that these policies did not delay or prevent some of the cyclical unemployment that may have occurred had it been absent. Overall, a low level of demand
in the economy was not the major issue but a shift in “real” factors was, namely a movement in underlying natural rate. As such, monetary policy should not have been the prescribed cure. This is even truer now since the unemployment rate is finally below the natural rate; there remains no further slack in the labor market for these policies to have any tangible effect. Given this current state, further large-scale stimulus are not expected to reduce the unemployment rate further than it would move on its own, as the natural rate slowly comes down. The natural rate is expected to slowly decline given that all its notable causes, as analyzed above, are likely transitory in nature. The current inability of both monetary and fiscal stimuli to reduce structural unemployment does not mean that all policy measures are unhelpful. Directed policies toward reducing job mismatch or retraining those who are part of the long-term unemployed portion of the labor force may be beneficial; the effect of policies like these should be the topic of further research.
Bibliography


Bibliography


