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### Jobs Don't Grow on Trees

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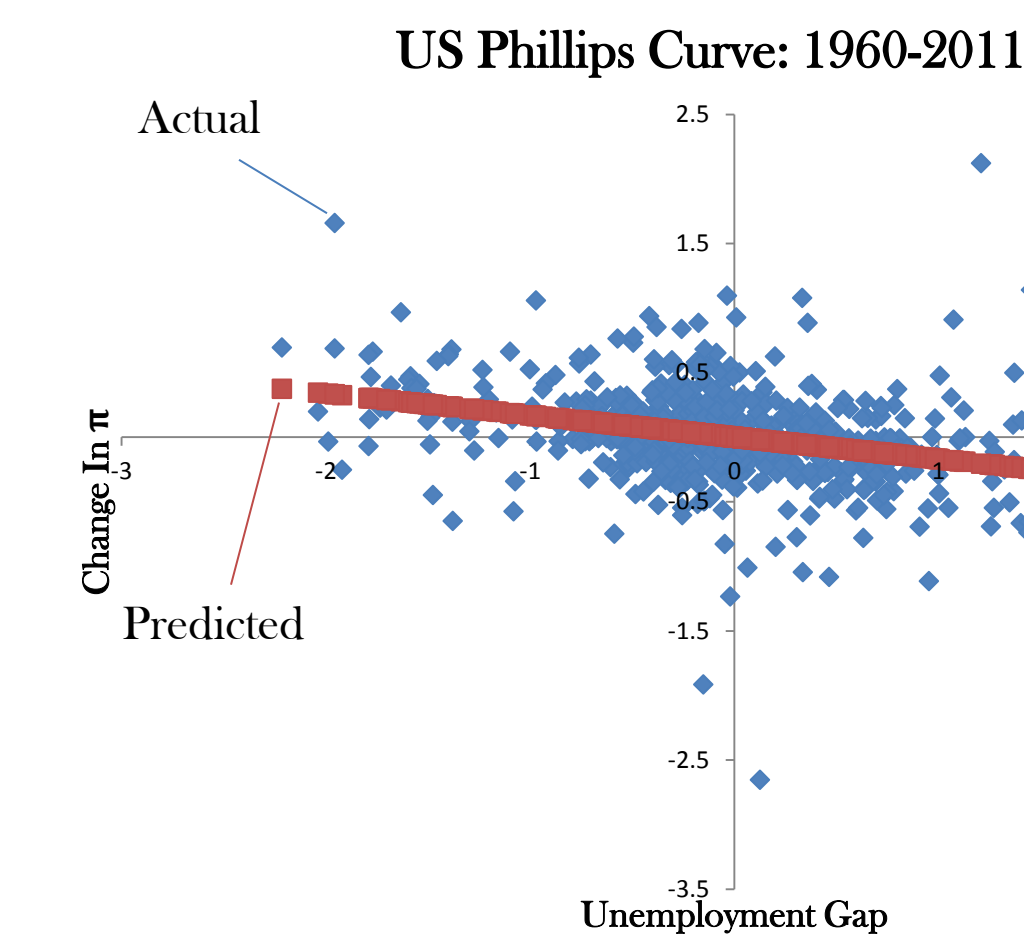
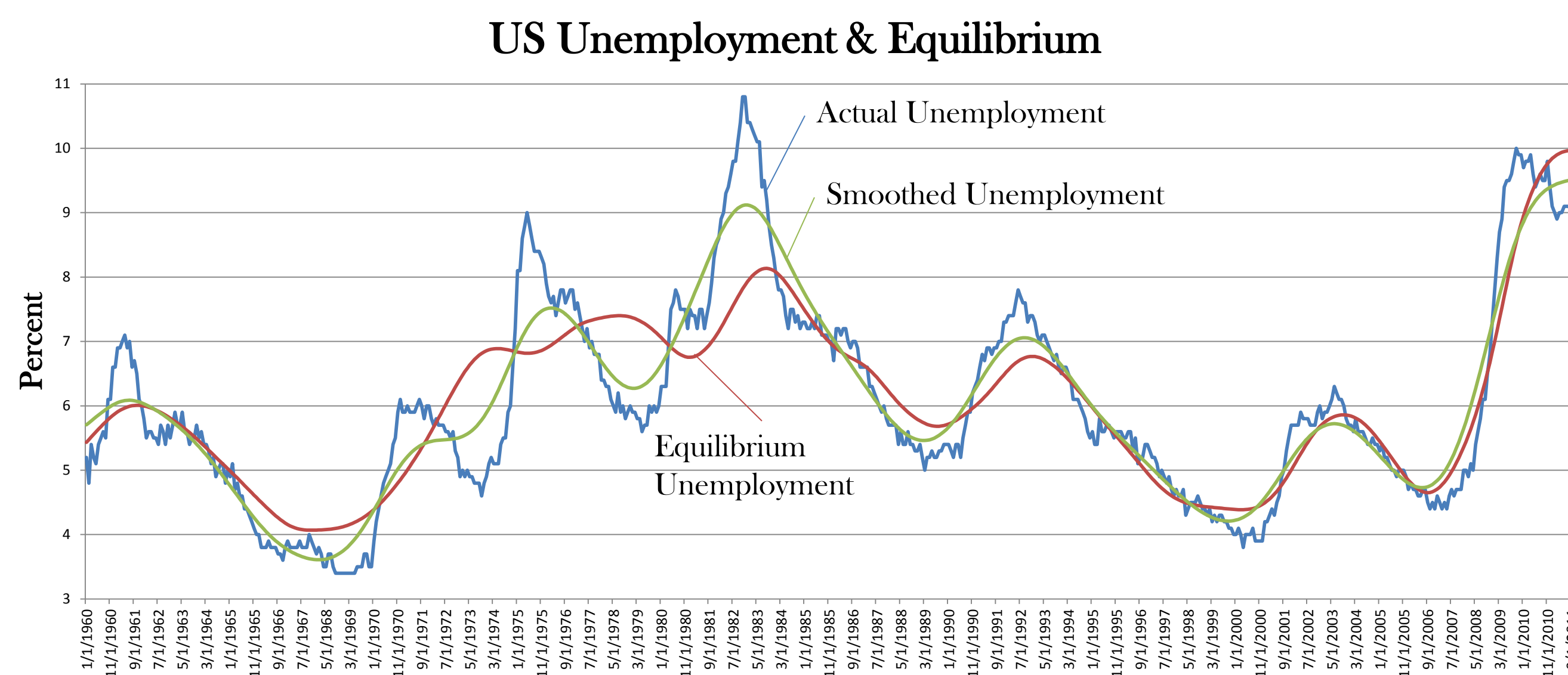
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# Jobs Don't Grow On Trees: Unemployment is *Not* Self-Correcting

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## Introduction:

The majority of macroeconomic models account for unemployment by making these simplifying assumptions:  
1) there is an equilibrium level of unemployment  
2) when the economy is not at that level it will tend towards equilibrium.

Implicit in these models is also the assumption that the actual behavior of unemployment does not affect the equilibrium level. My research joins a growing number of economists in pointing out that such assumptions are not true: the equilibrium *does* depend on past behavior, a trait called **hysteresis**. If unemployment exhibits hysteresis, then the economy is not as self-correcting as many assume.

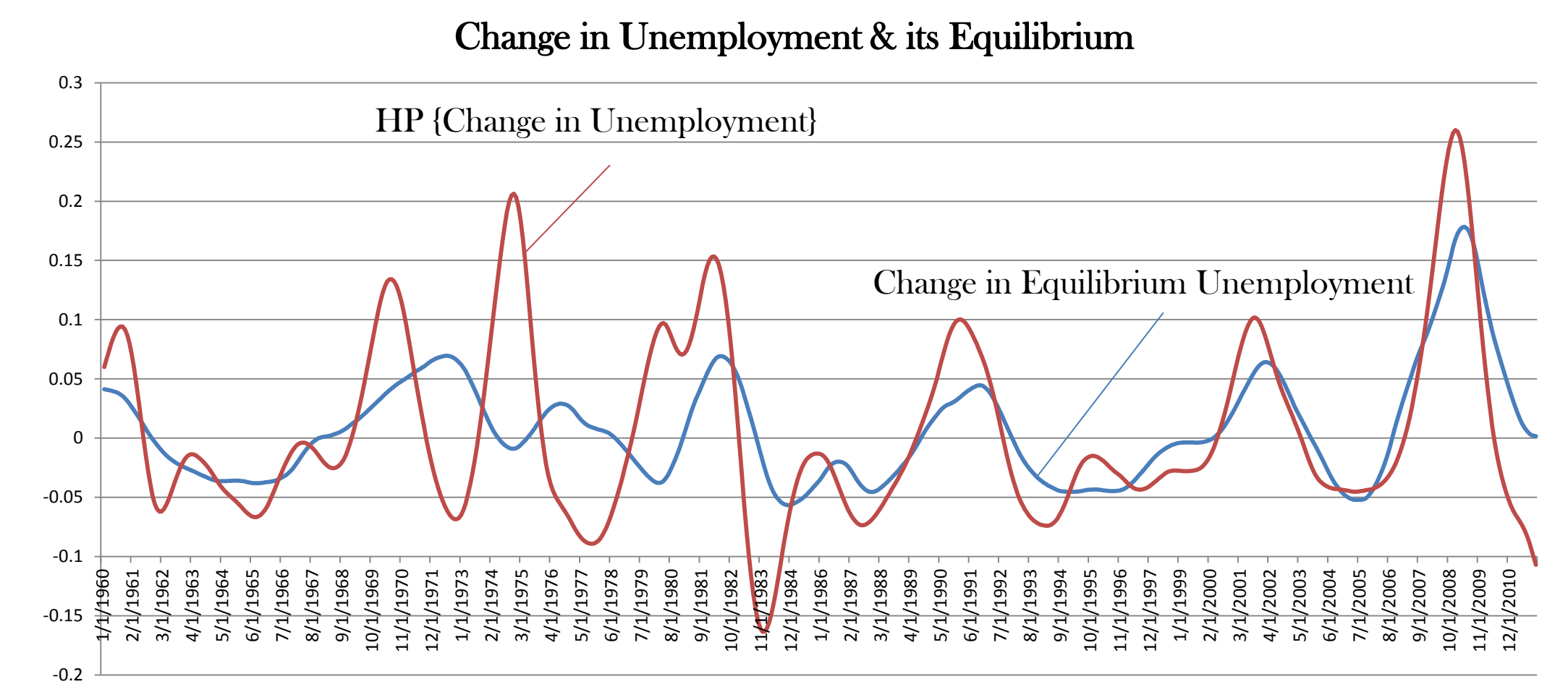
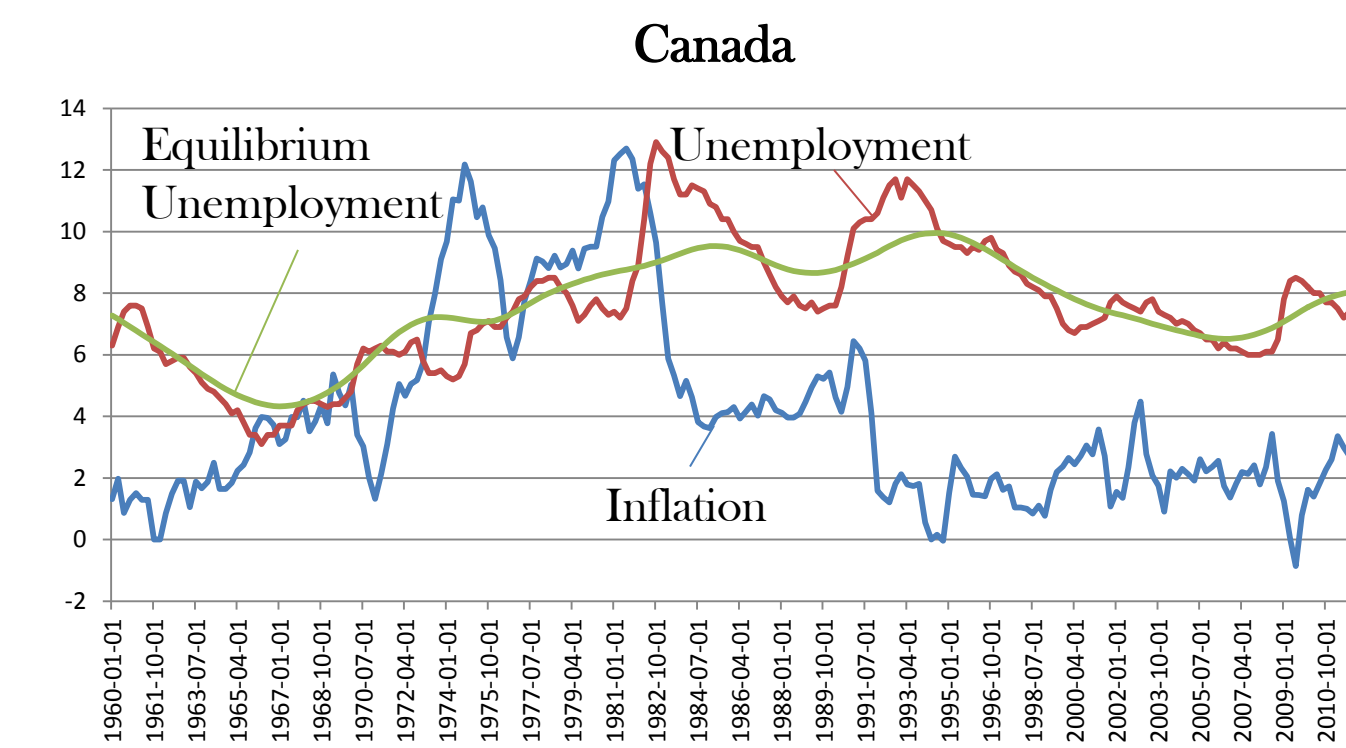
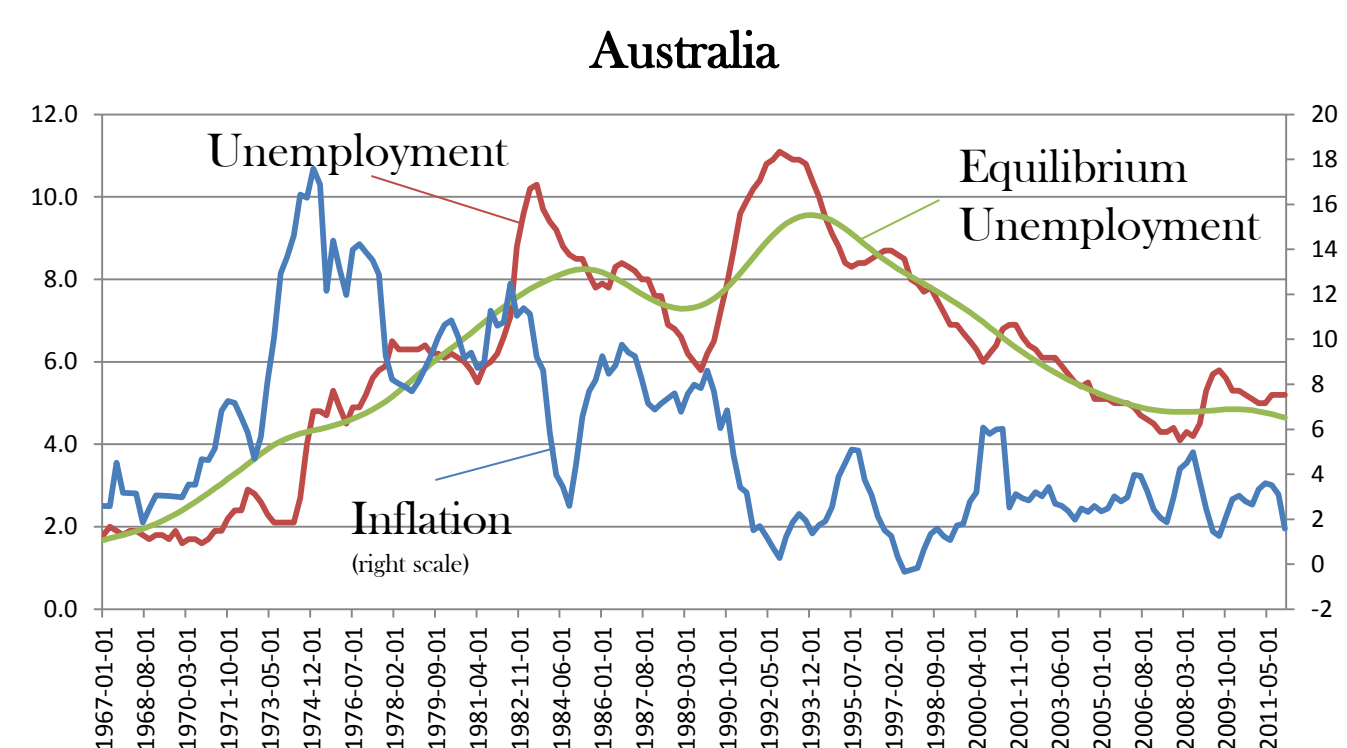
My research considers the Hysteresis Hypothesis by using an iterated version of ordinary least squares to estimate a Phillips curve and construct a series for equilibrium unemployment. Regression analysis shows strong evidence that actual unemployment *does* affect its equilibrium level. I also focus on one of the specific channels through which hysteresis supposedly works, called **ranking**.

The Ranking Hypothesis is the assertion that while unemployed, workers' skills degrade as they lose their connection to the labor market. Since employers know this, they rank their potential new hires based on duration of unemployment. If the Ranking Hypothesis is true, then when average duration of unemployment rises, workers are less hireable and the equilibrium level of unemployment should also rise. Because unemployment therefore affects its equilibrium level, ranking is a theory of hysteresis.

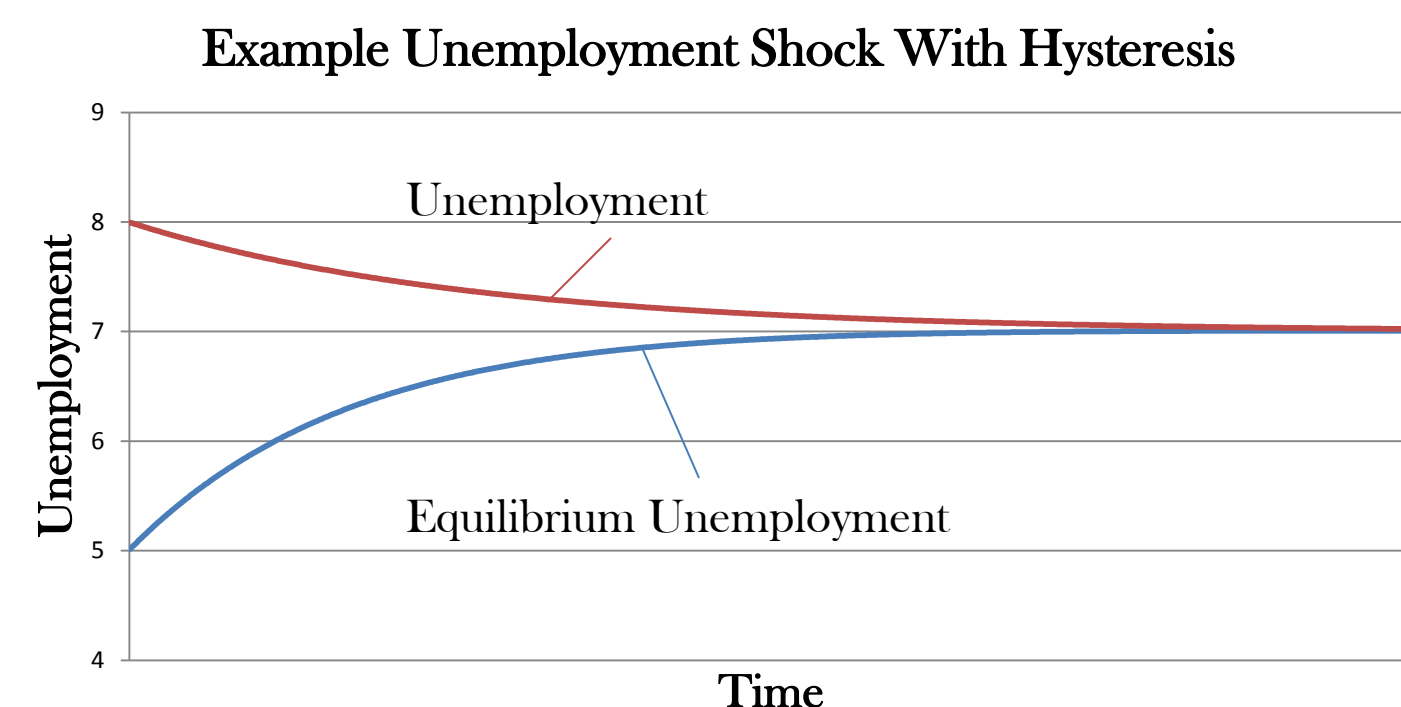
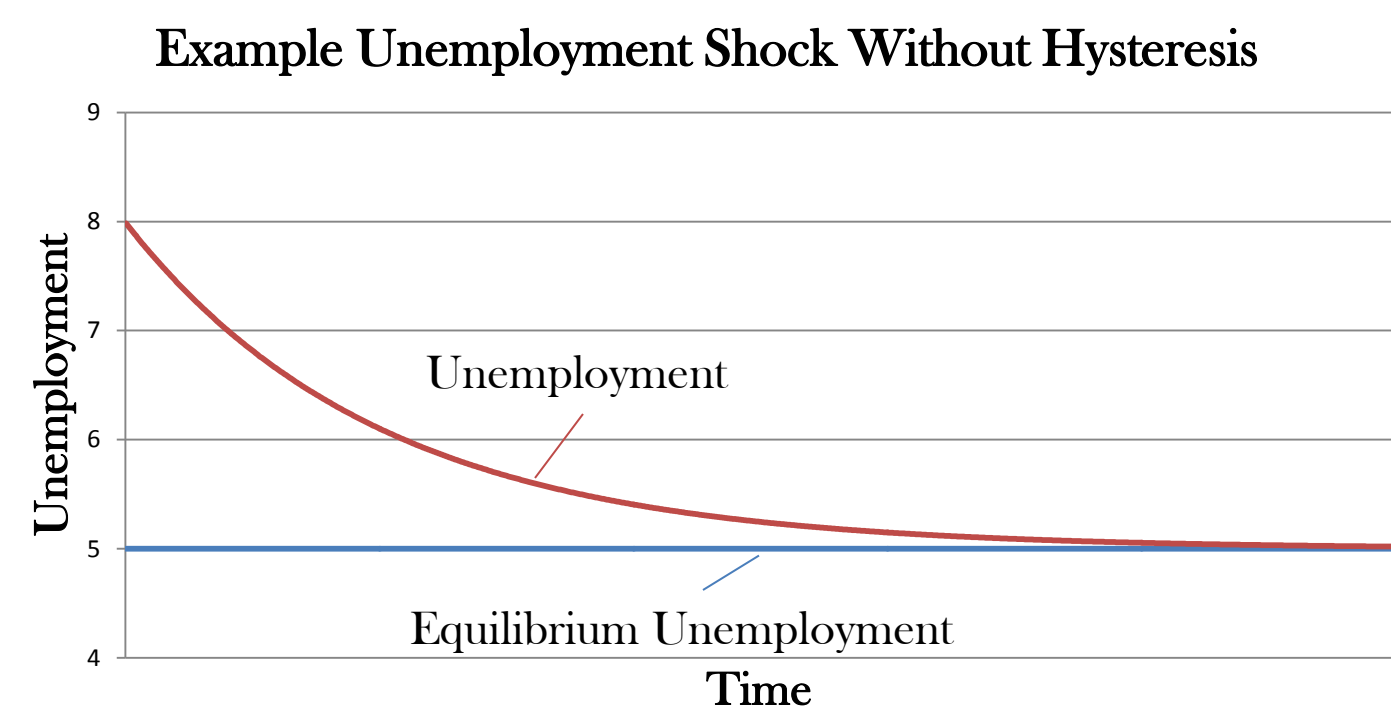
I use a univariate statistical filter and first differences in time series to analyze the timing of changes in unemployment duration and the equilibrium level. I find evidence for the Ranking Hypothesis by confirming one of its unique predictions about the average duration of unemployment after a recession. However, incorrect timing of events provides strong evidence *against* the connection between the Ranking and Hysteresis hypotheses, despite both hypotheses likely being true. This conclusion is strikingly paradoxical and surely must be the topic of future research.

## Research Questions:

- Does unemployment fix itself or does it exhibit Hysteresis?  
–Does equilibrium unemployment depend on historical unemployment? Does changing the unemployment rate change its equilibrium?
- Is there evidence that employers Rank their hiring options by who has been unemployed the least?
- Is there a connection between Ranking and Hysteresis?



Testing Model Predictions with Regressions on US Data						
Theory	Explanatory Variable	Predicted Variable	Coefficient	t-stat	n	R <sup>2</sup>
Ranking	Change in Unemployment	Change in Duration	1.54	18.37	623	0.35
Ranking-Based Hysteresis	Change in Duration	Change in Equilibrium Unemployment	0.16	24.84	623	0.50
Hysteresis	Change in Unemployment	Unemployment	0.37	19.83	623	0.39



Hysteresis means equilibrium unemployment changes in response to changes in actual unemployment. On the left without hysteresis, the equilibrium does not change so unemployment tends back down to a low level. In contrast, on the right hysteresis causes equilibrium to rise and so unemployment only falls slightly. In the hysteresis case, unemployment is permanently higher because of the change in equilibrium.

## A Time Series for Equilibrium Unemployment:

The usual way to study the natural rate is to estimate a Phillips curve with regression equation  
(2)  $\pi_t = \pi_{t-1} + \alpha(U_t - U^*) + \epsilon_t$      $\pi_t$  = % change in the price level between t & t-1  
           $U_t$  = Unemployment and  $U^*$  = Equilibrium Unemployment

Then equilibrium unemployment is given by dividing the regression constant by the coefficient on unemployment. However, this merely gives a *constant* natural rate and the goal is to study the time varying properties of the natural rate, so this method is not used here.

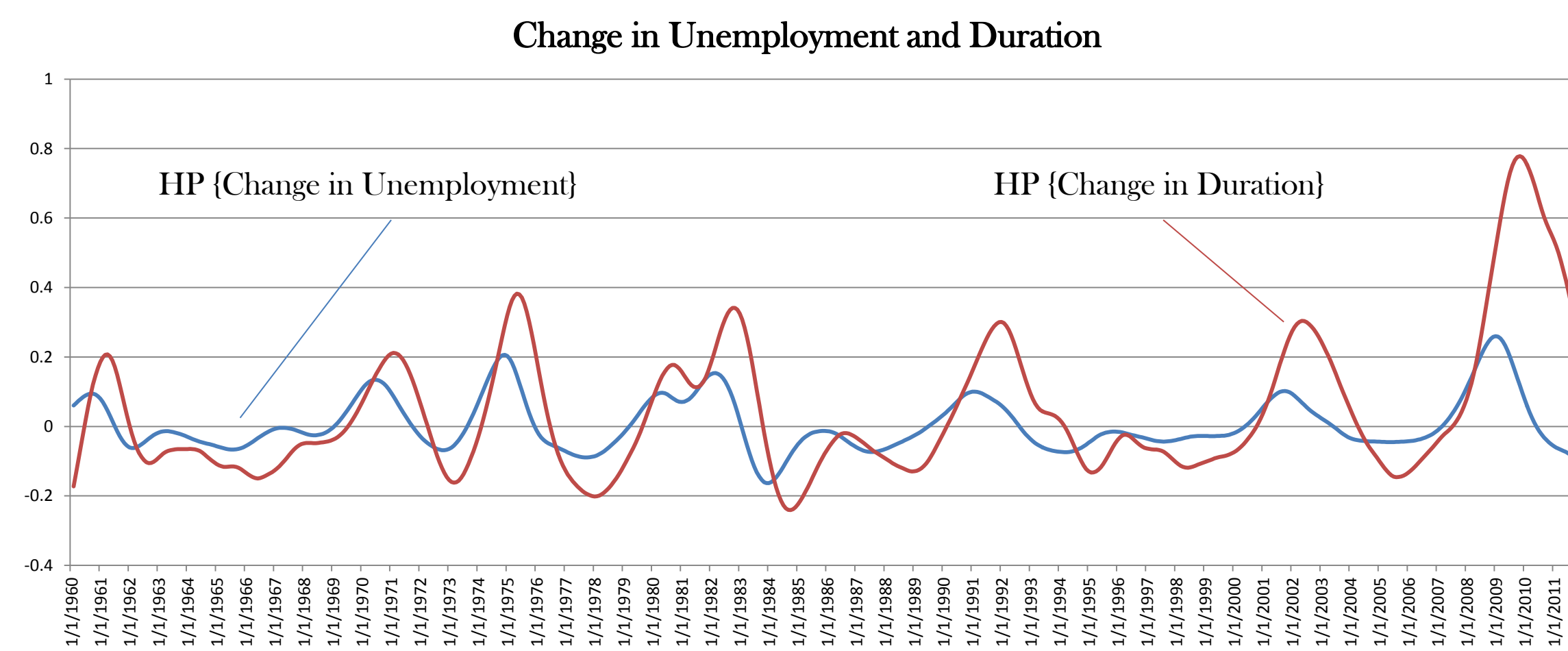
One way of producing a changing  $\{U_t^*\}$  series is to smooth  $\{U_t\}$  with the Hodrick-Prescott (HP) filter. This relies on the idea that  $U_t$  always moves toward  $U^*$  in the long-run, so therefore  $\{U_t^*\}$  should be the trend of  $\{U_t\}$ . This is not the procedure used here since the theory under consideration is that  $U^*$  reacts to  $U$  too instead of just the other way around. Therefore, to estimate a time varying  $\{U_t^*\}$  I follow a procedure similar to Ball and Mankiw (2002), described in the appendix to Ball (2009). The Ball-Mankiw method has five steps:

- Estimate (2) with OLS to obtain the  $\alpha$  coefficient.
- Rearrange (2) to state  $U^* + \frac{\epsilon_t}{\alpha} = U_t - \frac{(\pi_t - \pi_{t+1})}{\alpha}$ , then use  $\{U_t\}$  and  $\{\pi_t - \pi_{t+1}\}$ , along with the  $\alpha$  from step one to construct the right hand side, therefore implicitly constructing  $\{U^* + \frac{\epsilon_t}{\alpha}\}$
- Use the HP filter to extract the trend in  $\{U^* + \frac{\epsilon_t}{\alpha}\}$ , which should be equal to  $\{U_t^*\}$
- Estimate (2) again, but substitute  $\{U_t^*\}$  from 3 for  $U^*$  term, producing an updated  $\alpha$ .
- Return to step three and continue until  $\{U_t^*\}$  and  $\alpha$  do not change.

This recursion produces more accurate estimates of  $\alpha$  and  $\{U_t^*\}$ . It is superior to merely using the HP filter because it takes account of the information in the behavior of inflation. Ball explains, "During a period of falling inflation, for example, the Ball-Mankiw method produces lower  $U^*$  estimates than a univariate smoother, because falling inflation suggests that  $U^*$  is below  $U_t$ ." The results of this procedure are pictured to the right, along with a simple HP filter of  $\{U_t\}$ , and  $\{U_t\}$  itself. The graph shows how the usual HP filter is modified by information on the behavior of inflation.

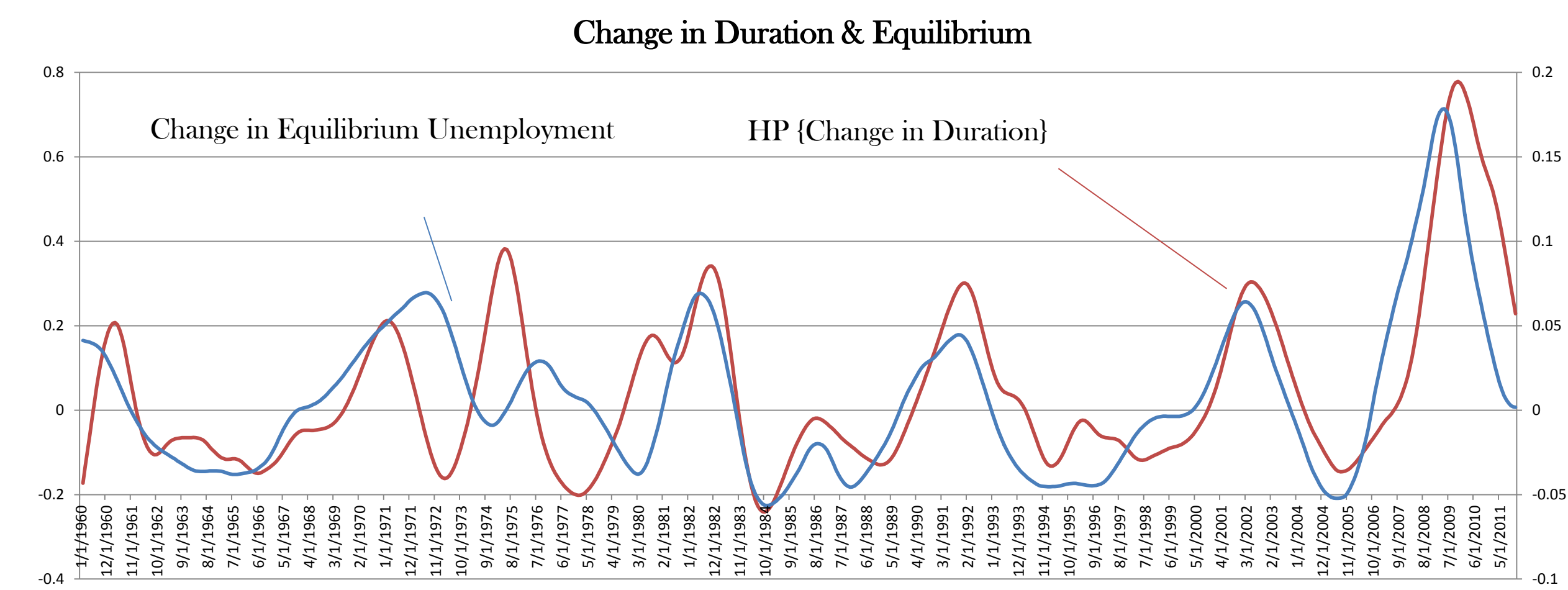
## Ranking:

Do firms rank their potential hires based on their duration of unemployment? If so, one of the telling signs will be the behavior of average duration of unemployment. When a recession ends and hiring starts again, if firms rank then they will hire mainly workers recently unemployed. This means the unemployed will consist largely of those who have been unemployed for a long time - which will be a rise in the average duration of unemployment. So when a recessions starts to end, average duration should continue rising if ranking is true. That is precisely what we see in the chart displaying changes in duration and unemployment. Other than at the end of recessions, we would expect average duration to track unemployment closely - they should move together. That is exactly what we see from the regression in the table above. These two results show the evidence is consistent with ranking.



## Ranking-Hysteresis Link:

Does the composition of the unemployed affect the equilibrium rate? If ranking were true we might expect employers to hire less as the duration of unemployment goes up and potential hires are less desirable. Indeed, they seem to have something to do with each other, as the regression results to the left show their changes are strongly associated in the same direction. But could they merely be counter-cyclical independently? That is, what if there is a third force moving them both in the same direction and no real connection between them? An analysis of the timing shows causation one way or another is not likely. As the chart below shows, in the 70s duration falling meant equilibrium rate falling, but the converse is true after that period. There is no systematic link between changes in duration and changes in equilibrium, so a causal link here is unlikely.



## Conclusions:

### Only Policy Will Fix Unemployment

The most important finding is that unemployment will not fix itself. Because it is path dependent, when unemployment rises so too does its equilibrium level. In other words, if unemployment suddenly adjusts upwards, in the absence of some other shock pushing it down it will tend to stay elevated. This implies that governments must respond strongly to economic downturns or face potential long-term stagnation.

### Hysteresis Is Not Well Understood

More research is needed on the causes of hysteresis: common explanations such as duration and ranking are not sufficient. Duration and equilibrium unemployment are not related in any systematic way, as one would expect if duration caused hysteresis. What is clear is that hysteresis is a property of unemployment; what is not clear is *why*. Understanding the causes of hysteresis is potentially crucial to formulating a policy response to it.