Are Jobless Recoveries in the Rearview Mirror?

Slow Recoveries and the Fed's Policy of Opportunistic Disinflation

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Comments welcome

Abstract

The three recessions in the three decades between 1990 and 2009 were said to be followed by jobless recoveries, as employment continued to fall even after the economy began growing in the recovery. This implies that normal recoveries were followed by abnormally "jobless" recoveries. However, these "jobless" recoveries were actually just slow recoveries, as the recoveries in employment can be predicted using the Okun's relationship relating changes in Real GDP and employment. Output was simply growing to slowly to create enough new jobs to keep unemployment from rising, but there was no structural change that changed the Okun's Law relationship at this time. The recovery periods of the 1930s, despite the massive disruptions and dislocations of the Great Depression, similarly follow an Okun's Law relationship. The modern slow recoveries stem from a change in Fed policy in the 1990s to one of "opportunistic disinflation", where high unemployment is allowed to persist after recessions to ratchet inflation down. This theory is confirmed by the experience after the COVID pandemic, where unprecedented fiscal and monetary stimulus resulting in a rapid recovery that was "jobfull" rather than jobless. Whether jobless recoveries will reappear going forward will depend on whether the Fed returns to its old policy of opportunistic disinflation after the next recession, or if the Fed will engage in sufficient monetary stimulus for a jobfull recovery.

JEL Codes: N12, E32

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1 Introduction

The periods immediately following the 1990-91, 2000-01, and 2007-2009 recessions were said to be "jobless recoveries" (DeNicco and Laincz, 2018). Previous postwar recoveries which had seen rapid recoveries in both output and employment once the trough of the recession was reached. The recoveries from 1990-2015 were different, as can be seen in Figure 1 in the solid, thicker lines. These recessions saw a weak labor market after the trough of the recession, with weak or negative job growth in the first year or two after the recession trough. Unemployment continuing to rise in the earlier phases of the recovery.

This new, puzzling phenomon of jobless recoveries then spawned a large body of work trying to explain why the US was experiencing jobless recoveries. Structural change was a leading explanation (Bernanke, 2003; Groshen and Potter, 2003; Andolfatto and MacDonald, 2006), but a multitude of explanations were put forward. Other explanations include firms overhiring during the boom (Bernanke, 2003), increased benefit costs (Bernanke, 2003), uncertainty (Bernanke, 2003), sectoral shocks (Aaronson et al., 2004; Cui, 2016), job polarization (Jaimovich and Siu, 2020; Gaggl and Kaufmann, 2019; Burger and Schwartz, 2018), large increases in labor productivity (Bernanke, 2003), changing productivity dynamics and overhiring (Gordon and Baily, 1993), increases in temporary employment (Schreft and Singh, 2003), just-in-time employment (Schreft and Singh, 2003; Schreft et al., 2005), increased firing costs (DeNicco, 2015), long-term unemployment (Schreft and Singh, 2003), related to changes engendered by the Great Moderation (Koenders and Rogerson, 2005; Mendez et al., 2016), firms adding to hours rather than employment during a short and shallow recession (Bachmann, 2012), real-wage rigidities (Shimer, 2012), computer adoption (Morin, 2014), unemployment insurance (Mitman and Rabinovich, 2019) and the changing nature of job creation and destruction (Faberman, 2008; Wesselbaum, 2019).[1]

The literature on jobless recoveries largely assumes that the recoveries since the mid-1980s are similar in fundamental ways. The American business cycle did see significant changes starting in the mid-1980s. The later "Great Moderation" period saw milder business cycles, with less volatile

[1]Graetz and Michaels (2017) finds that jobless recoveries are largely a US phenomenon and that other countries have not seen the same emergence of jobless recoveries, despite using similar technologies.

Real GDP growth, and inflation which was lower and more stable (Bernanke, 2004). There is an extensive debate over the sources of the Great Moderation with three primary theories. The first is that the economy just experienced better luck in the latter period, avoiding large shocks, like oil (Nakov and Pescatori, 2010). The other is that monetary policy was conducting in a superior fashion, reducing macroeconomic volatility (Clarida et al., 2000; Boivin and Giannoni, 2006). The behavior of the American macroeconomy also changed around the same time as the Great Moderation began as well (Giannone et al., 2008; Galí and Gambetti, 2009), so there could also be structural changes causing both the Great Moderation and jobless recoveries.

In order to think about whether jobless recoveries came about alongside changes in the structural relationship between employment and GDP growth, the Okun's Law relationship in the US in estimated historically. Using data back to the 19th century, the Okun's Law relationship is shown to be an economically and statistically significant relationship, changing gradually over decades. Even with the huge variations in Real GDP growth and employment in the Great Depression, the Okun's Law relation remains robust. Okun's Law also holds during the "jobless recovery" periods since 1990. To test whether there have been relevant structural changes in the American economy causing recoveries to be jobless, the estimated Okun's Law coefficients are applied to the path of Real GDP growth in the three "jobless recoveries," to produce a predicted path for employment growth. Predicted employment is close to the path of actual employment because these recoveries were not jobless, but just slow (Galí et al., 2012; Ball et al., 2013). Real GDP was growing slowly enough that with productivity growth and new entrants to the labor force, unemployment was still rising.

This then raises a question: Why there were slow recoveries after the 1991, 2001, and 2009 troughs? This is due to a change in Fed policy starting in the 1980s called "opportunistic disinflation." The Fed did not permanently tighten monetary policy, but when recessions occurred, the Fed would then keep monetary policy tighter following recessions to ratchet down inflation. This generated the slower recoveries that were erroneously labeled "jobless." When the COVID pandemic hit, monetary and fiscal policy turned very stimulative, even after the end of the brief recession. This generated a robust recovery, with rapid GDP and employment growth. Structural

factors were not decisive here, but instead policy made the difference. Recoveries need not be jobless. Whether recoveries going forward will be jobless depends on whether the Fed will return to its policy of opportunistic disinflation or will loosen policy sufficiently after the end of the next recession to support a brisk recovery in output and employment. Given that inflation is far above target at the time of writing, a return to a policy of opportunistic disinflation is not an unlikely prospect for the next recovery.

2 Okun's Law

Okun's Law is a rule of thumb that relates Real GDP to the unemployment rate, first proposed in Okun (1962). There has since been a long-standing debate about how well the Okun's Law relationship holds. There are many skeptics (Knotek II, 2007; Basu and Foley, 2013), there are those who find mixed evidence (Lee, 2000), and there are supporters (Ball et al., 2013) of the validity of Okun's Law. Okun's Law has been tested in many countries, with the "law" holding much more strongly in the US than in many countries (Ball et al., 2019), but being a useful relationship nevertheless (Ball et al., 2015). This paper takes a long-term view and examines whether Okun's Law held in any period, going back to the 19th century, Importantly, the periods since the mid-1980s are considered since the Okun's Law benchmark is important to guage whether the structural relationships between the labor market and Real GDP have changed. I find that the Okun's law coefficient remains statistically significant in all periods of study and in all specifications, though the coefficient does change over the course of decades, consistent with other studies (Ismihan, 2016; Grant, 2018).

Okun (1962), in proposing the Okun's Law relationship, outlines potential reasons for deviations from Okun's Law, including changes in the labor force, hours, and productivity. Indeed, while labor input and output should be tightly related, there are many intermediate steps between labor hours and the unemployment rate. Starting with relationship between employment and output. Gordon and Baily (1993) and Gordon (2010) provide a simple decomposition of changes in output into changes in output per hour, aggregate hours per employee, the employment rate, the labor force participation rate, and the working-age population. From changes in employment, we can

further add changes in the labor force which affect both the numerator and denominator of the unemployment rate. As the English saying goes: "There's many a slip 'twixt the cup and the lip." To fix ideas, consider a simple Cobb-Douglas production function $Y = AK^{\alpha}L^{1-\alpha}$. Using a standard calibration of $\alpha = \frac{1}{3}$ and holding productivity and capital fixed, this implies that labor hours and output should have a correlation of 2/3. This is significantly larger than the Okun coefficient on the unemployment rate which tends to be closer to 1/3, showing that the intervening factors are important. Any of these intervening factors could cause a breakdown between output growth and employment, but do not appear to change at business cycle frequencies, allowing the Okun's Law relationship to be strong in US data.[2]

There are two versions of Okun's Law, one relating changes in the unemployment rate to changes in Real GDP and the other relating the level of the unemployment rate to the percent deviation of Real GDP to Potential Real GDP, which is the origin of the output gap concept (Okun, 1962). A regression of the quarterly change in unemployment is run on the quarterly change in real GDP. Assuming a stable labor force, a faster growth rate in GDP will imply more labor demand, which increases employment and decreases unemployment. This implies a negative regression coefficient. The Okun's Law regression should have a positive constant, as positive productivity growth and new investment in capital permits output to grow without increasing employment and reducing unemployment.

2.1 Okun's Law: Employment

One can also perform an Okun's Law regression replacing unemployment with employment. Figure 2 shows the relationship between quarterly percent changes in real GDP and quarterly percent changes in employment.[3] The line of best fit is derived from a regression of employment on real GDP, where E_t is the quarterly log change in log employment and where Y_t is the quarterly log change in real GDP. The estimated equation is:

[2]The importance of these factors in explaining variation in the Okun's Law relationship across countries is explored in Furceri et al. (2020).

[3]See Table 4 for information on sources.

$$E_t = 0.12 + 0.28Y_t + \varepsilon_t. \quad (1)$$

While recessionary periods see declines in GDP with smaller employment declines than would be predicted, there is no tendency for recovery period to deviate systematically from this line of best fit. To see things more clearly, the same figure is updated to show only the period from 1990 onward in Figure 3. The only quarter that appears as particularly jobless is Q4 of 2009, which is early on in the recovery from the Great Recession. Otherwise, the recovery periods from these three recessions appear close to the prediction line. There is no tendency for the relationship between GDP and employment to break down during the recoveries since 1990.

To see if the relationship holds historically, I run the same regression as above of annual growth in employment on annual growth rates of real GDP, which can be seen in Table 1. The regression coefficients for the 1890-1948 period are very similar (0.27 or 0.26 versus 0.28), while those for the 1929-2019 period are higher in magnitude, averaging about 0.5, while statistical significance is strong for all. Again, the relationship between labor markets and output have held strongly for a period of more than a century.

2.2 Estimates of Okun's Law for Unemployment

The following is a reproduction of the equation estimated on quarterly data from 1947 to 1960 by Okun in his 1962 article, "Potential GDP: its Measure and Significance," where ΔU is the quarterly change in the unemployment rate and ΔY is the quarterly change in Real GDP.

$$\Delta U = 0.30 - 0.30\Delta Y (r = .79) \quad (2)$$

This equation implies that when the growth rate of GDP increases by 1%, the unemployment rate falls -0.3%. While this relationship was estimated over less than 15 years of data, I find that the coefficients are similar using annual data from 1890-2013. I run a regression of the annual percent change in the unemployment rate on the annual percent change in Real GDP. As we can see in Table 2, the estimated coefficients range from about 0.3 to 0.4, not far from the original

Okun estimates of -0.3. Similarly, the constants are between 1 and 1.3, the coefficients are not far from Okun's original coefficient of 1.2, once we multiply by four to annualize the coefficient. Again, statistical significance is strong for all the specifications.

2.3 Estimates of Okun's Law using the Output Gap

An alternative method of estimating Okun's Law is using the output gap concept. The concept of Potential GDP was also introduced in Okun's 1962 article, which represents the level of GDP consistent with full employment (or a natural rate of unemployment using a later definition). The output gap ($\tilde{Y}$) is the percent difference between actual output and potential output, which is used as the right-hand side variable in the regressions with the unemployment rate as the left-hand side variable. Using quarterly data from 1953-1960, Okun (1962) found[4] :

$$U = 3.72 + 0.26\tilde{Y} (r = .93). \tag{3}$$

I perform similar regressions using the Congressional Budget Office's estimates or Real Potential GDP, measuring the output gap as the percent difference between Real Potential GDP and Real GDP. The unemployment rate is then regressed on the output gap. Table 3 displays the results for the entire 1948-2019 period, as well as splitting the sample at 1984-5, roughly the start of the Great Moderation and when jobless recoveries begin. The regression coefficients here range from 0.5-0.7, so are a bit higher than Okun's for the 1950s. The intercepts, which can be interpreted as natural unemployment rates, are also higher, from 5-6%, consistent with other natural rate estimates over these periods. The p-values, however, are extremely small: less than one in a million for all specifications, far below the standard thresholds for significance.

2.4 The Great Depression and Jobless Recoveries

Debates about structural change have been popular in recent decades, and theories of slow employment growth during the 1930s abounded as well. Indeed, the first mention of jobless recovery

[4]This coefficient should be negative as there is a negative relationship between the unemployment rate and Real GDP, but Okun preferred to work with positive numbers.

appears to be a 1938 New York Times Article, in the midst of recovery from the Depression ("The Nation," New York Times, 11/27/1938). A popular explanation for the Great Depression and slow employment recovery was technological employment. Industrialization was occurring too rapidly for workers to adjust their skills, and workers were stuck with archaic skills tailored for jobs being destroyed in agriculture. Capital deepening was a related evil in these theories, with capital substituting for labor, foreshadowing modern fears of the detrimental impact of robotization on employment (Woirol, 1996; Morin, 2015). Then as now, structural impediments to recovery were overstated and weak recoveries in demand at the zero-lower bound meant both output and employment recovered slowly. Employment and Real GDP during the Depression are plotted in Figure 4, which shows that employment recovered when GDP recovered and shrank when GDP shrank.

To see if an Okun's Law type relationships still hold in this period, I perform regressions of the percent change in Real GDP on the percent change in Employment for the 1929-1941 Great Depression period. The results are similar to those found above.[5] Next I generate predictions by multiplying the actual path of Real GDP and the regression coefficient to obtain a predicted series for employment. Figure 5 shows the comparison of the actual data and the predictions for employment. Despite the enormous upheaval of the Great Depression, the predictions and the actual data are very close, as will be the case in later periods.

3 Jobless Recoveries or Slow Recoveries?

Given the empirical results above, we can say that the Okun's Law relationship is clear for the US economy. This gives us a baseline to see whether recoveries are jobless or just slow. If these are slow recoveries, then employment should be well explained the employment growth predicted by (slow) Real GDP growth and the estimated Okun's Law relationship for employment. If recoveries are jobless, then these recoveries should see a prediction for employment growth which is lower than what would be predicted by Real GDP growth and an estimated Okun's Law relationship for the period before jobless recoveries arose. A predicted change in employment series is constructed by using the actual changes in Real GDP and the estimated Okun's Law employment regression

[5]This regressions yields an R-squared of 92%. The coefficient on employment is 0.6 with a t-statistic of 10.5.

for the pre-1990 period. The cumulated changes in actual and predicted employment are then compared, as can be seen in Figures 6-8 for the 1990, 2000, and 2007 recessions respectively.[6]

As can be clearly seen, the recoveries are well accounted for by the relationship between GDP and employment in the postwar period, and there is no apparent change in recoveries since 1985. The recovery path that followed the early 1990s recession is almost identical to the prediction. For the recovery from the 2001 Recession, the prediction lines up for the 2001-2003 period, which was when the recovery was supposed to be jobless. For the recovery from the recession that began in 2007, the predicted and actual changes are identical through about 2014, again covering the early "jobless" recovery period. After 2015, the employment recovery exceeds the prediction, so the recovery was actually more "jobfull" than jobless for the remainder of the recovery. For all three period, the "jobless" period immediately after the end of the recessions can be well predicted by the Okun's Law relationship, estimated on data from before the alleged jobless recoveries.

4 Opportunistic Disinflation and Slow Recoveries

One plausible explanation for slow recoveries is a shift at the Fed to a strategy of opportunistic disinflation (Orphanides and Wilcox, 1996; Aksoy et al., 2006; Leigh, 2008). This involves using the reductions in inflation that accompany recessions to generate a lower inflation environment after the recession than what prevailed before. To achieve this, the Fed loosens policy more slowly during the recovery so that the persistently negative output gap can reduce inflation through a Phillips Curve relationship. As Alan Blinder put it, "When I was Vice Chairman of the Fed, I often put it this way: the United States is "one recession away" from price stability" (Blinder, 1997, p. 6). This can be justified through a central bank with a long-term inflation target which is lower than its intermediate-term inflation target, so that recessionary disinflation allows for a gradual transition to the long-term inflation target. Bunzel and Enders (2010) finds that this opportunistic disinflation begins roughly in 1984, and DeNicco and Laincz (2014) find that recoveries of unemployment are slower at roughly the same time. This is consistent with jobless recoveries following after recession

[6] Given that the trough in employment lags the trough in GDP, the series are each normalized to 100 in the quarter after the trough of the recession.

after the mid-1980s.

Alan Greenspan was the chair of the Federal Reserve from 1987 to 2006, and so he presided over two recessions which were followed by jobless recoveries, with his term ending just a year before the start of the 2007-2009 recession. Greenspan, like his predecessor Volcker, saw inflation as a central concern of monetary policy. Greenspan's aversion to inflation was even more pronounced than his predecessor, as he expressed a desire for an inflation rate of zero (Murray, 1989). Indeed, Greenspan even saw zero-inflation as being neessary for the maximum growth portion of the Fed's mandate Rasche et al. (2006). Monetary policy played a major role in the recession (Walsh, 1993) and indeed, the slow recovery coincided with a significant disinflation (Goodfriend, 2002). The slow recovery after the 2007-2009 recession, when monetary policy was constrained by the zero-lower bound, similarly saw tight monetary conditions, which were not present in periods when monetary policy could have accelerated the recovery. However, it can be argued that after 2009, the disinflation was more strongly related to constraints on monetary policy from the zero-lower bound (as well as inadequate fiscal stimulus), rather than a policy of opportunistic disinflation.

The behavior of inflation following recessions is consistent with a shift towards opportunistic disinflation since the mid-1980s. I use the price index of core personal consumer expenditures, with inflation being the percent difference between the current price level and the price level of a year before. Inflation during the recovery from the 1960-1 recession averaged 2.4%, after the 1970 recession averaged 3.9%, after the 1974-5 recession averaged 6.9%, after the 1980 recession averaged 9.2%. After rising during most of the postwar[7], inflation then fell during each recovery. Inflation averaged 4% during the recovery from 1982-1990, 2.1% during the recovery from 1991-2001, 1.9% during the 2002-07 recovery, and 1.6% during the recovery from 2009 to 2019. Employment growth was slow in these recoveries not due to structural or supply-side reasons, but due to a change in monetary policy which resulted in a slower recovery in demand than in prior recoveries.

[7]The PCE price level is only available starting in 1959.

4.1 The COVID recession and recovery

In the wake of the COVID-19 pandemic, governments across the world enaged in massive monetary and fiscal stimulus programs to address the public health emergency and to mitigate the economic effects of the pandemic (Chen et al., 2021). The USA was no exception. Indeed, the United States federal government engaged in an unprecedented fiscal stimulus in peactime, pumping trillions of dollars in the US economy. Even before the fiscal authorities reacted, the Fed engaged in a large monetary stimulus. Determined not to repeat the mistakes the Fed had made in being too timid after the Global Financial Crisis in the late 2000s, Chair Powell and the Federal Open Market Committee pulled out all the stops (Fleming et al., 2020). The Fed resurrected many of the policies it had taken in response to the Great Recession: quantitative easing, a sharp reduction in the discount rate, a zero interest rate policy (ZIRP), expanded repo operations, as well as many credit facilities to support commercial paper and money markets (Cetorelli et al., 2020; Cachanosky et al., 2021). To ease strain in the corporate bond market, the Fed also began to purchase corporate bonds directly, and provided support for municipal bonds through a new facility (Bordo and Duca, 2021, 2022). This made the 2020 recession the shortest recession in US history, lasting from February to April 2020.

Importantly for this study, fiscal, and monetary stimulus continue well after the recession ended. The American Recovery Plan (ARP) included almost $2 trillion in fiscal outlays, and, when added to the previous spending package in fall 2020, brings the total deficit to about 14% of GDP for 2021 as a whole (Posen, 2021). The Fed kept interest rates at zero until March 2022, two years into the pandemic, at which point the unemployment rate had fallen from a peak of 14.7% down to 3.6%. This was as low as unemployment got in the decades of the 2010s, and just a tenth of a percent higher than the lowest unemployment rate even experienced in the US economy since the 1960s.

As can be seen in Figure 1 with the thicker, dashed line, the recovery from the 2020 recession was in a class by itself among post-recession recoveries, seeing much more rapid employment growth. In the face of this stimulus, none of the structural factors that generated jobless recoveries in the past seem to have mattered in the face of this stimulus. All that it took for a "jobfull" recovery

was sufficient stimulus to generate a strong recovery. This is in a sharp contrast with the recoveries from 1990-2015, which were some of the weakest among all postwar recoveries, and saw insufficient stimulus during the recovery periods.

5 Conclusion

Okun's Law is one of the most robust relationships in the American economy, and the relationship has held in the U.S. economy since at least the 1890s. The relationship holds whether estimated between the level of the output gap and the unemployment rate, between change in the unemployment rate and changes in Real GDP, or between employment and Real GDP. Similar results can be found for the relationship between Real GDP and employment as well. These results hold whether in the postwar or during the massive upheaval of the Great Depression. While recent recessions have been alleged to be jobless, as was the Great Depression, relationships between employment and GDP remain stable for all the allegedly jobless recoveries. While employment rose slowly during the jobless recoveries, this can be explained by increased productivity and an increased capital stock which allowed for more production with fewer employees. Employment during these joblesss recoveries can be well explained by a simple linear prediction based on postwar correlation between output and employment. The same is true for the Great Depression.

These recoveries, both in the 1930s and since 1984, have been relatively slow recoveries. The recovery from the Great Depression took at least eight years and was interrupted by the recession of 1937-1938. One could even argue that full recovery was not complete before war began in December 1941. This period shares with the recovery since 2007 the problem of the zero-lower bound which constrains monetary policy. The inability of monetary policy to accelerate these recovery can help explain why they were so slow. This leaves the recoveries from the recessions of the early 1990s and early 2000s as puzzling however. The Greenspan Fed's policy of opportunistic disinflation can explain these slow recoveries, as the Federal Reserve loosened policy more slowly and thus slowed the speed of the recovery to lower inflationary expectations. However, since the 2020 COVID recession, both fiscal and monetary policy remained highly stimulative well after the end of the recession. Unsurprisingly, the recovery in employment was much stronger from the 2020

recession than it was from any other postwar recovery. The most recent recovery was jobfull, not jobless. Given that structural factors no longer prevent jobless recoveries, and interest rates are now far above zero, whether jobless recoveries will reoccur will depend on the conduct of policy going forward. If the Fed returns to a policy of opportunistic disinflation, then jobless recoveries will return. Jobfull recoveries can become the new normal if sufficient stimulus is applied in future recoveries.

6 Figures and Graphs

Table 1: Okun's Law Regression: Percent Change in Employment on Percent Change in Real GDP

	Employment	Employment	Employment	Employment	Employment
Kuznets Real GDP (1890-1929)	0.273 [7.31]******				
NIPA Real GDP (1929-1948)		0.260 [3.07]**			
NIPA Real GDP (1949-2019)			0.485 [9.66]******		
NIPA Real GDP (1949-1984)				0.423 [6.22]******	
NIPA Real GDP (1985-2019)					0.702 [8.80]******
Constant	0.949 [3.69]***	0.324 [0.39]	-0.103 [0.54]	0.126 [0.41]	-0.678 [2.84]**
R^2	0.59	0.36	0.57	0.53	0.70
N	39	19	71	36	35

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$; ***** $p < 0.00001$; ****** $p <$ 01.0e-06

Notes: Simple OLS Regression of Annual Percent Change in Employment on Annual Percent Change in Real GDP. T-statistics in brackets.

Table 2: Okun's Law Regression: Percent Change in Unemployment Rate on Percent Change in Real GDP

	Weir U-Rate (1890-1929)	Weir U-Rate (1929-1990)	BLS U-Rate (1949-1984)	BLS U-Rate (1985-2019)	BLS U-Rate (1949-2019)
Kendrick Real GDP (1890-1929)	-0.297 [7.41]******				
NIPA Real GDP (1929-1990)		-0.335 [11.75]******			
NIPA Real GDP (1949-1984)			-0.409 [11.64]******		
NIPA Real GDP (1985-2019)				-0.428 [6.14]******	
NIPA Real GDP (1949-2019)					-0.385 [11.13]******
Constant	1.013 [3.95]***	1.215 [6.47]******	1.559 [9.93]******	1.012 [4.85]****	1.190 [9.02]******
R^2	0.60	0.70	0.80	0.53	0.64
N	39	61	36	35	71

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$; ***** $p < 0.00001$; ****** $p <$ 01.0e-06

Notes: Simple OLS Regression of Annual Percent Change in the Unemployment Rate (in percentage point terms) on Annual Percent Change in Real GDP. T-statistics in brackets.

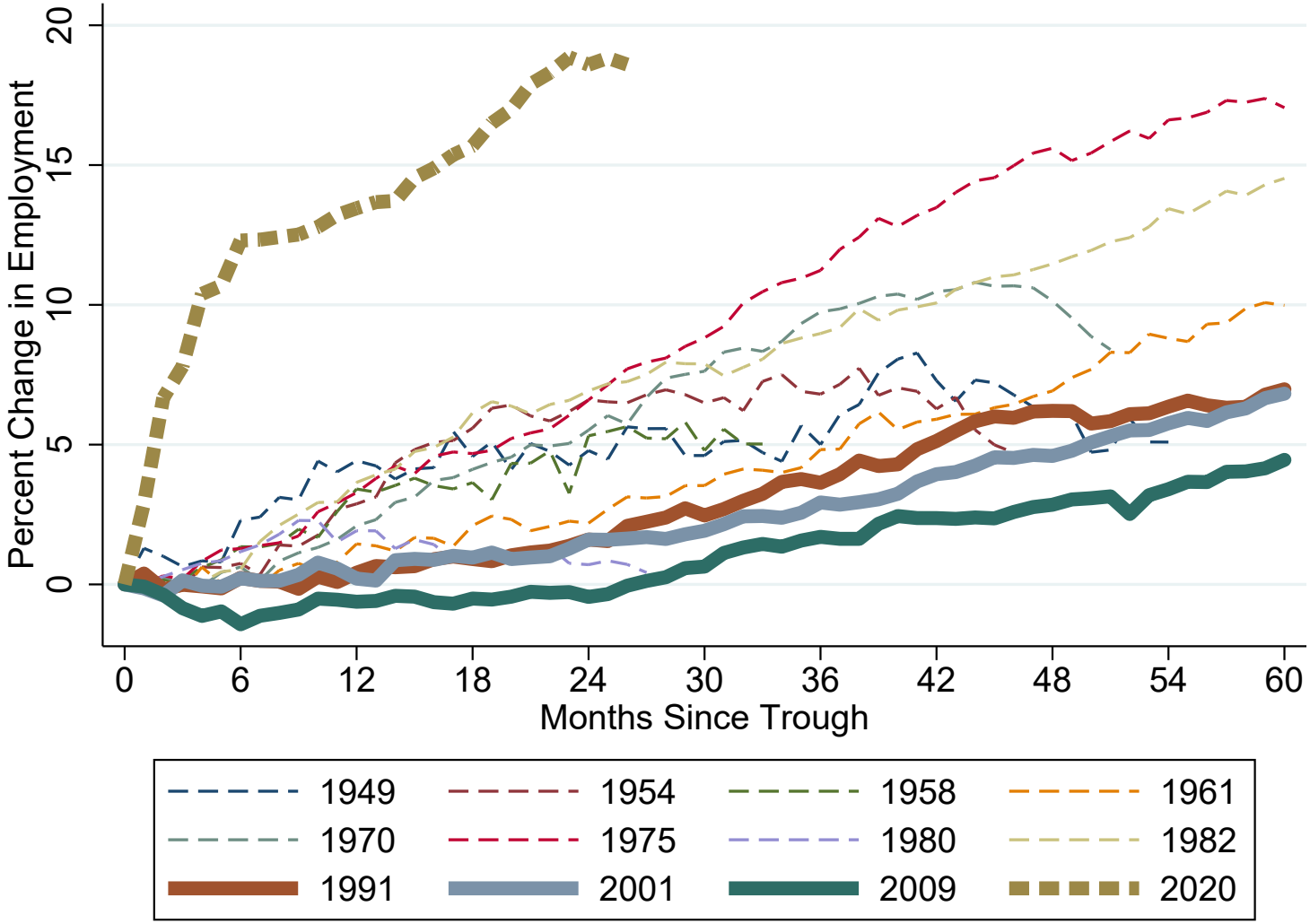
Table 3: Okun's Law Regression: Unemployment Rate on CBO Output Gap

	BLS Unemployment Rate (1948-2019)	BLS Unemployment Rate (1948-1984)	BLS Unemployment Rate (1985-2019)
CBO Output Gap	-0.560	-0.545	-0.736
	[24.79]*******	[21.95]*******	[16.24]******
Constant	5.423	5.671	4.934
	[96.26]*******	[81.36]*******	[51.38]******
R^2	0.69	0.77	0.66
N	284	144	140

* $p < 0.01$; ** $p < 0.001$; *** $p < 0.0001$; **** $p < 0.00001$; ***** $p <$ 01.0e-06; ****** $p <$ 01.0e-07; ******* $p <$ 01.0e-08

Notes: Simple OLS Regression of the Unemployment Rate on the Real Output Gap (in percent). T-statistics in brackets.

Figure 1: Postwar Employment Recoveries



Notes: Monthly Cumulative Percent Change in Employment since NBER Recession Trough

Figure 2: Quarterly Change in Real GDP and Employment, 1949-2019

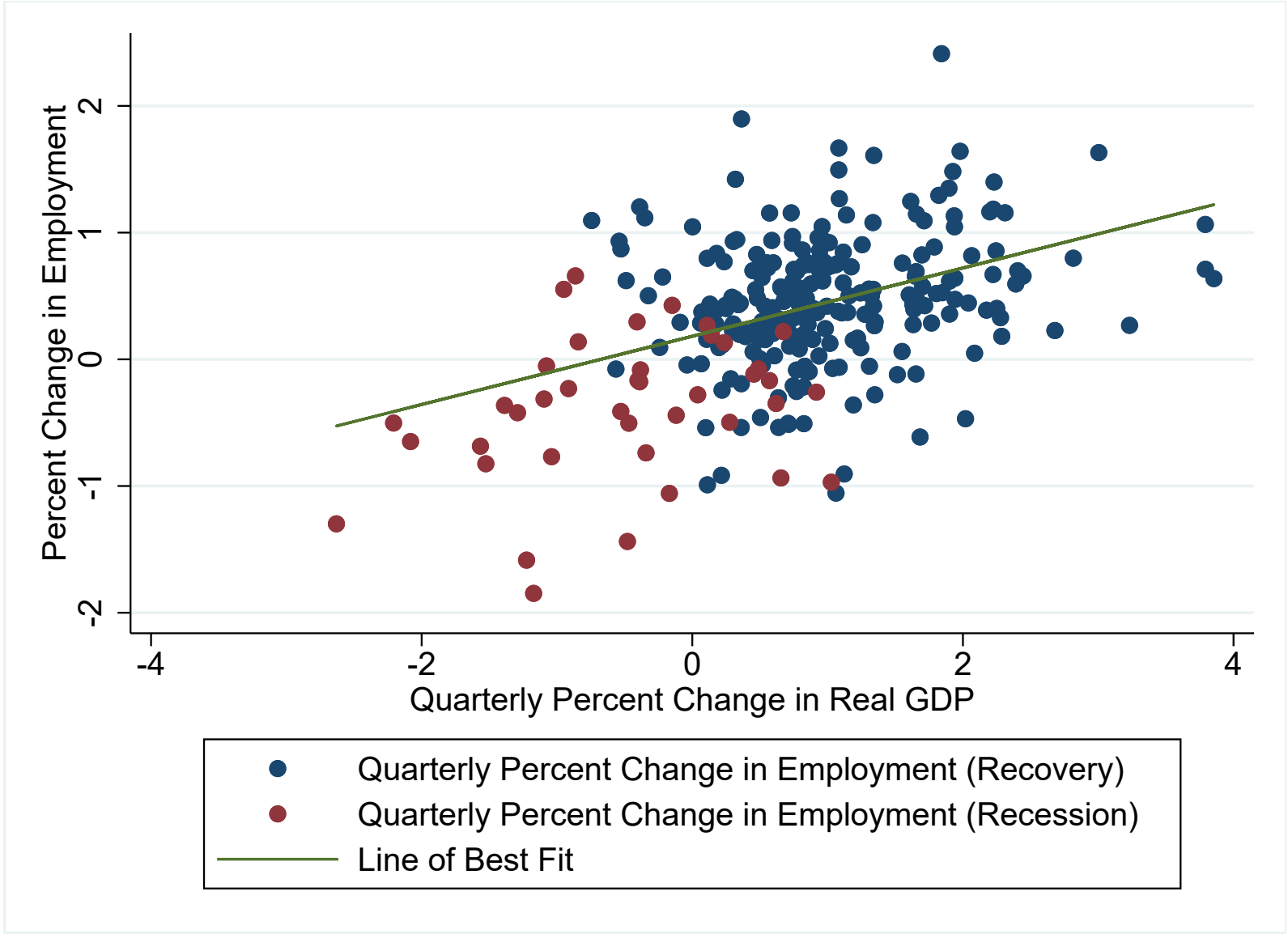


Figure 3: Quarterly Change in Real GDP and Employment, 1990-2019

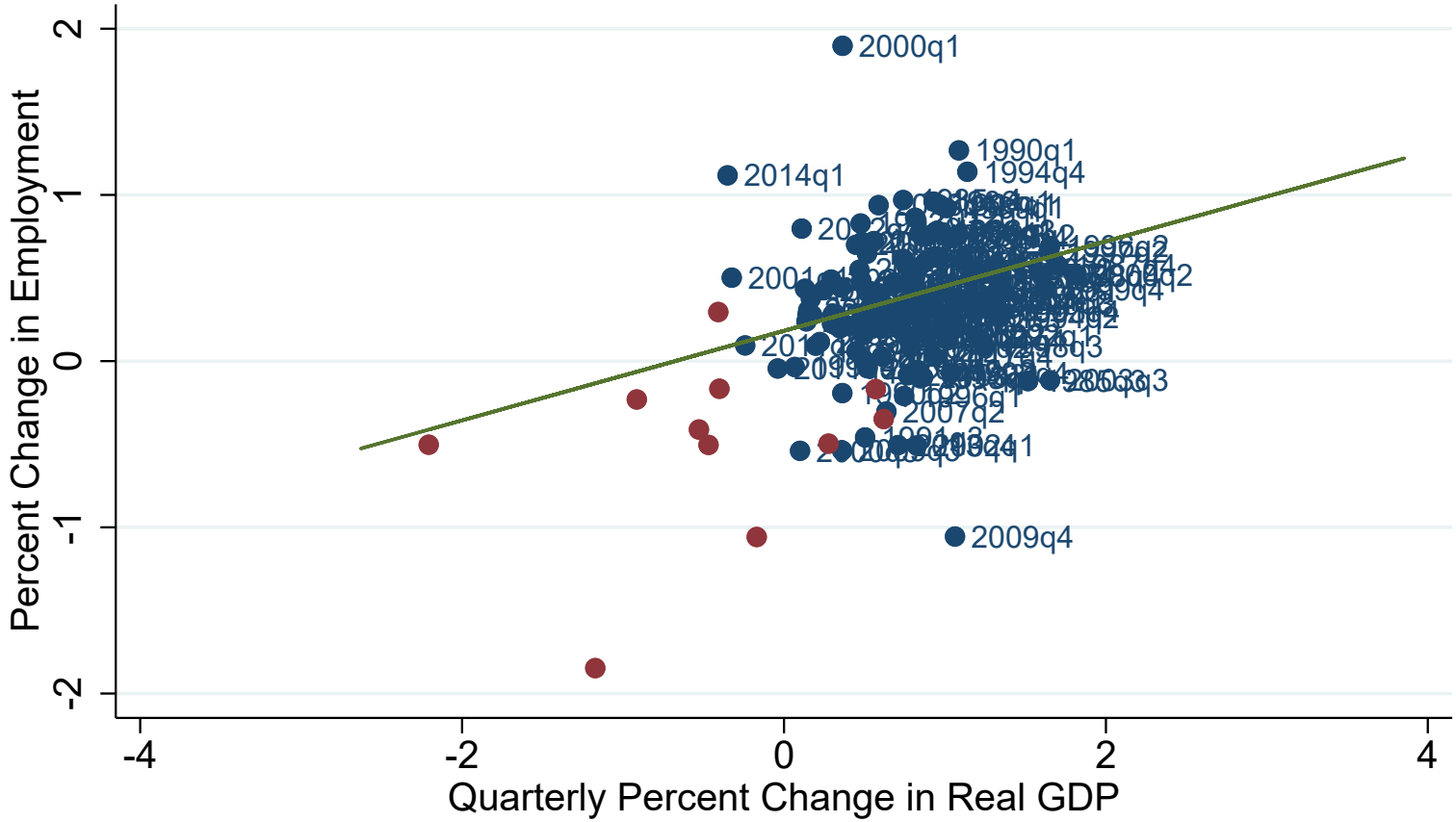


Figure 4: Employment and Real GDP during the Great Depression: 1929-1941

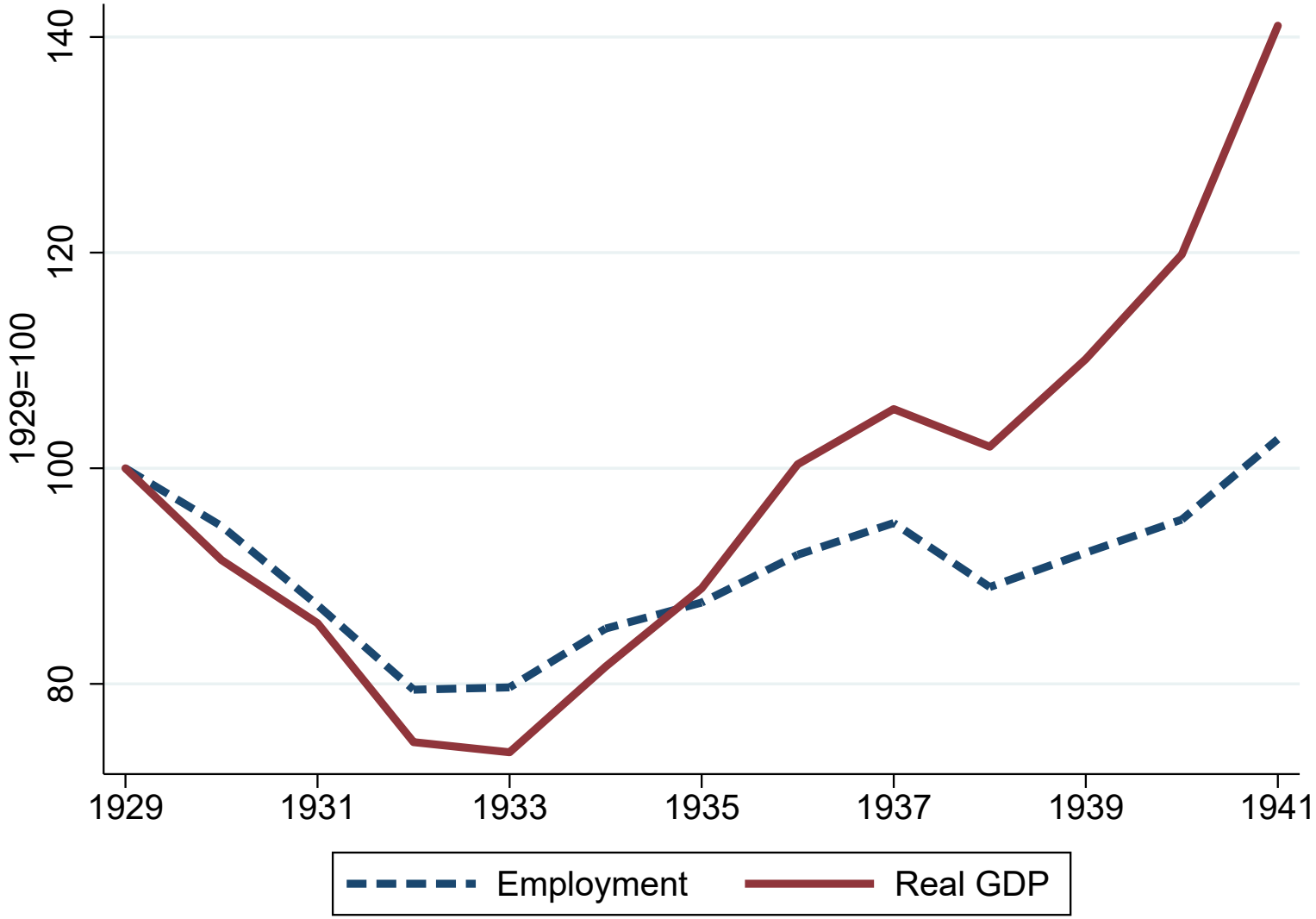
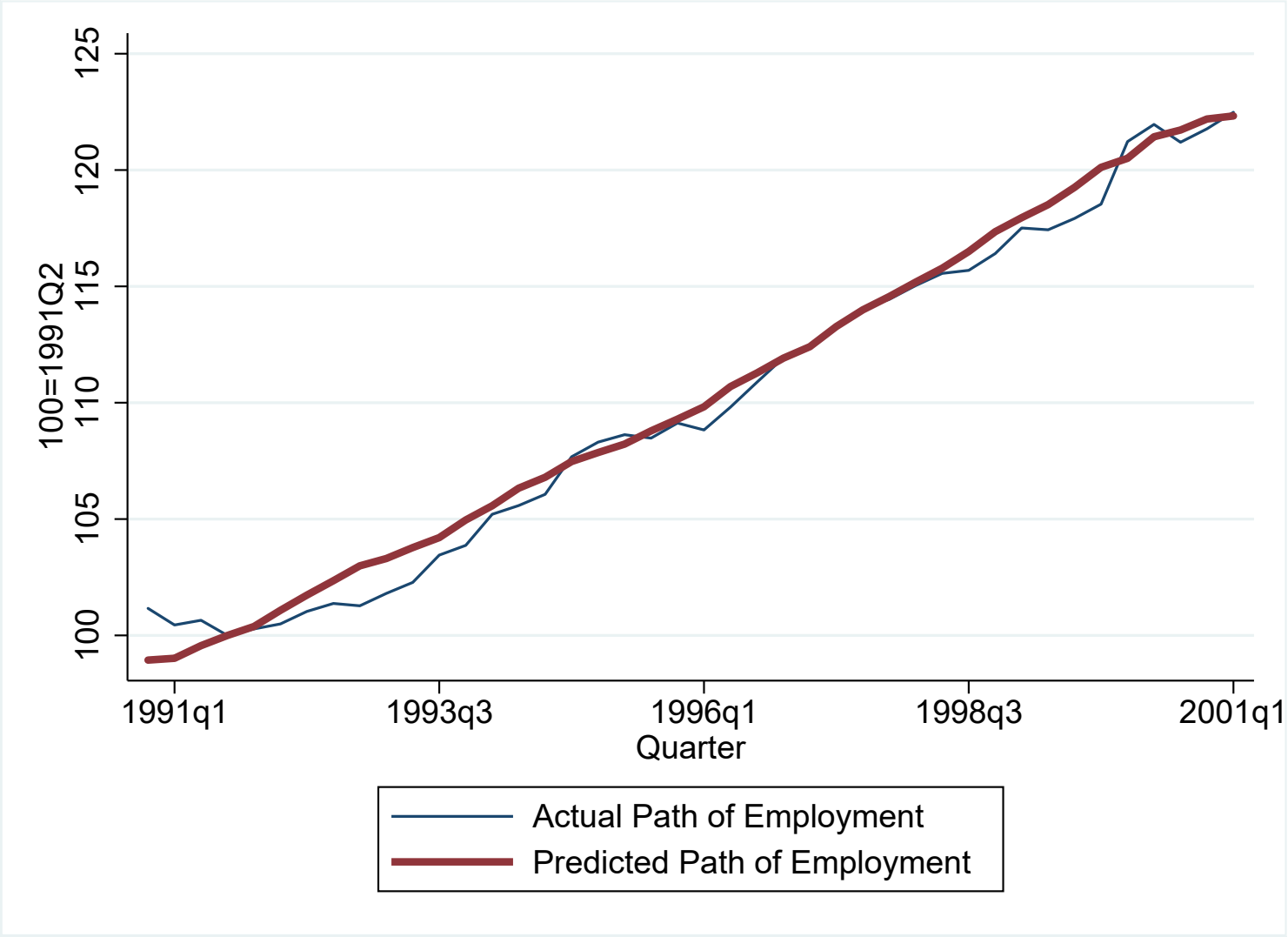


Figure 5: Percent Changes in Total Employment and Predicted Changes in Total Employment: 1929-1941

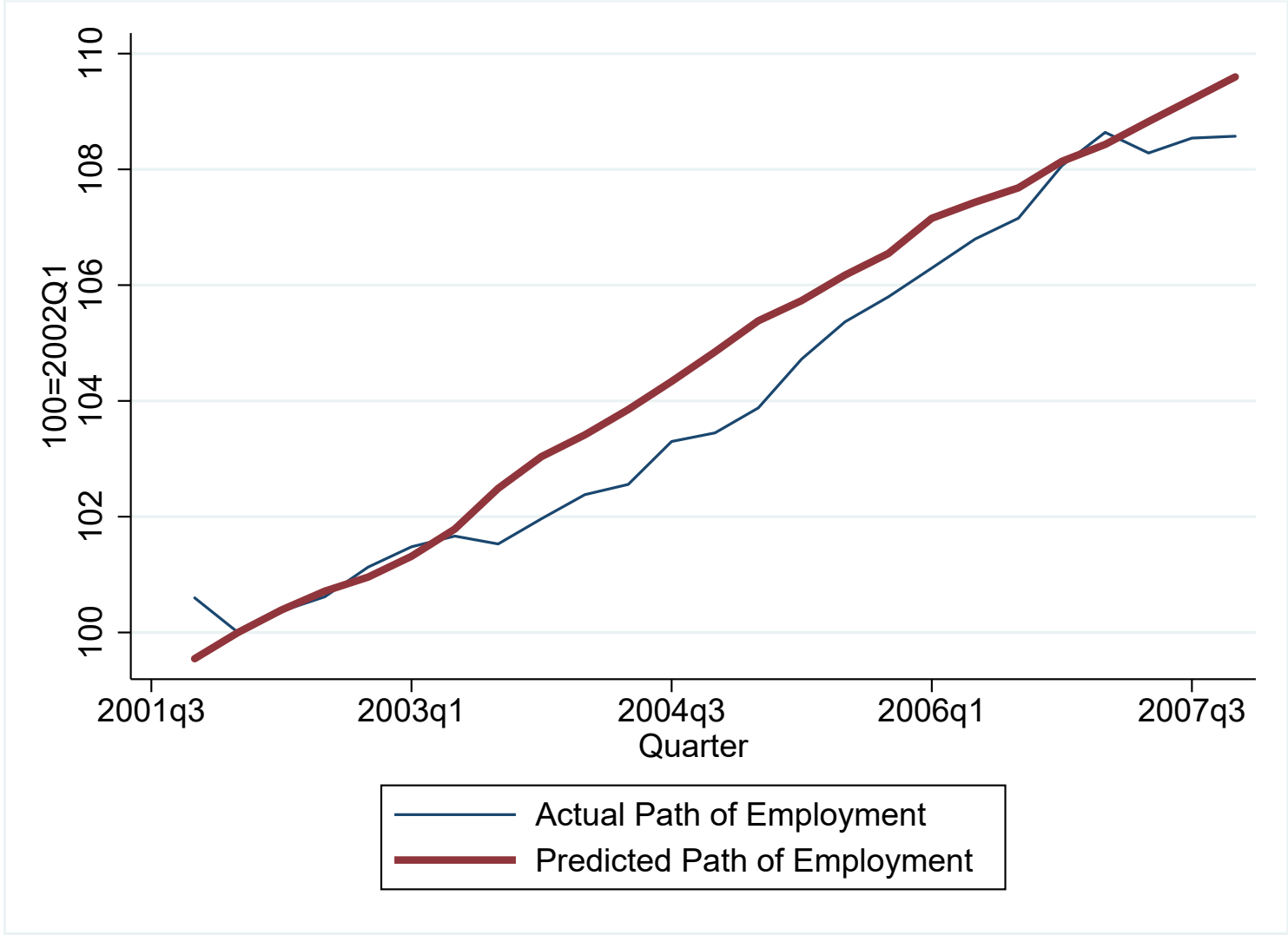
Notes: See text for explanation.

Figure 6: Okun's Law Prediction for Recovery from 1991 Business Cycle Trough



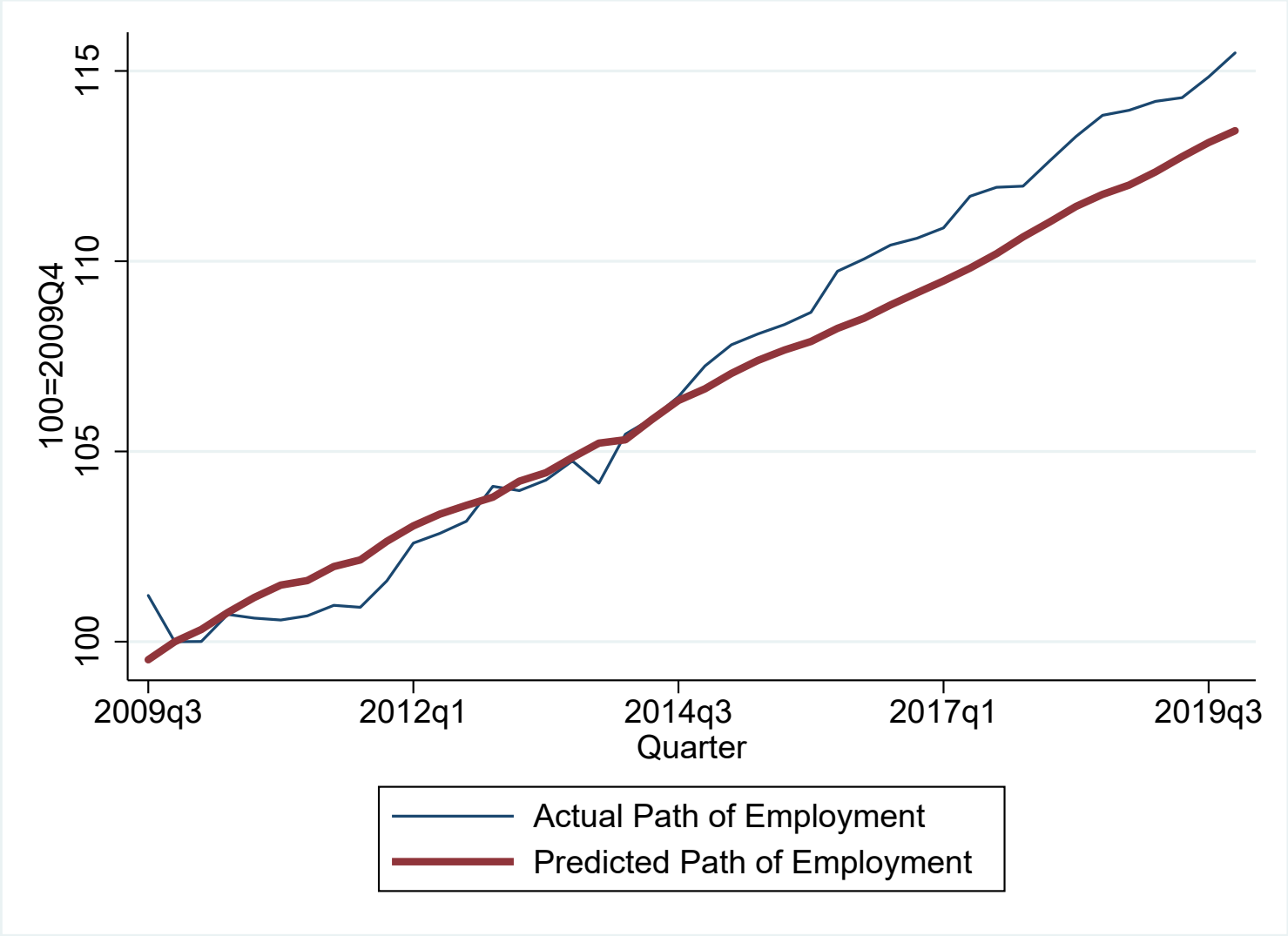
Notes: Employment Prediction based on Estimated Okun's Law Relationship of Quarterly Employment Growth on Quarterly Real GDP Growth.

Figure 7: Okun's Law Prediction for Recovery from 2001 Business Cycle Trough



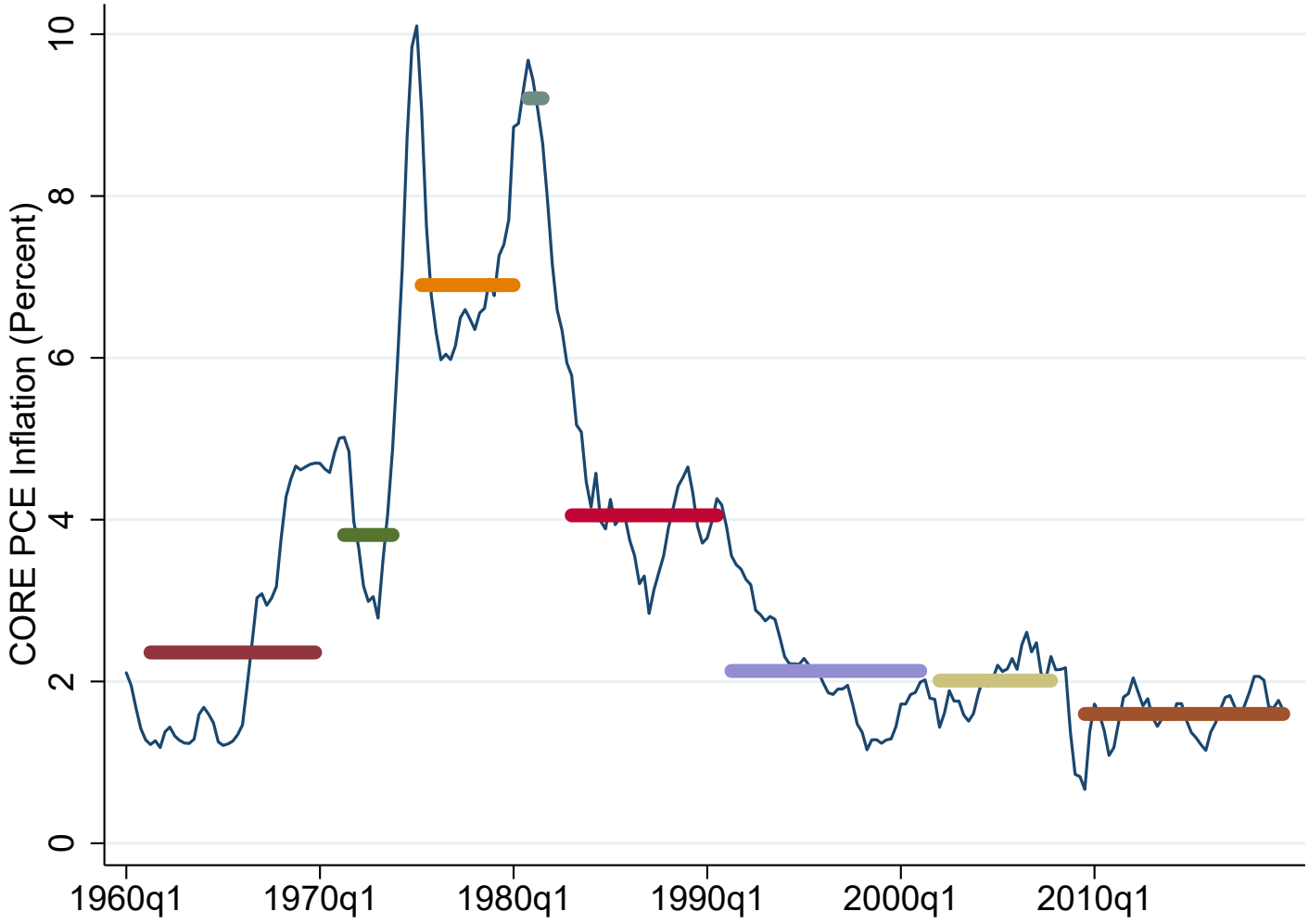
Notes: Employment Prediction based on Estimated Okun's Law Relationship of Quarterly Employment Growth on Quarterly Real GDP Growth.

Figure 8: Okun's Law Prediction for Recovery from 2009 Business Cycle Trough



Notes: Employment Prediction based on Estimated Okun's Law Relationship of Quarterly Employment Growth on Quarterly Real GDP Growth.

Figure 9: Inflation and Average Inflation during Recoveries: 1960-2015



Notes: Horizontal lines are average inflation during this recovery period. Inflation is annual percent change in the Chained Personal Consumption Expenditures Price Index. Recoveries dated using NBER Recovery dates.

7 Appendix

Table 4: Sources

Series	Units	Year Begin	Year End	FRED code	Source
Unemployment Rate	Percent	1890	1990		Weir (1992)
Employment	Thousands	1929	1947		Lebergott (1964)
Employment Level	Thousands	1948	2022	CE16OV	BLS
Unemployment Rate	Percent	1948	1948	UNRATE	BLS
Real GDP	1929=100	1869	1957		Kendrick (1961)
Real GDP (Quarterly)	Chained 2012 Dollars (Billions)	1947	2022	GDPC1	BEA NIPA
Real GDP (Annual)	Chained 2012 Dollars (Billions)	1929	2021	GDPCA	BEA NIPA
Real Potential GDP	Chained 2012 Dollars (Billions)	1949	2032	GDPPOT	CBO
NBER Recession Indicators	Binary Indicator	1854	2022	USREC	NBER
PCE Price Index	Index 2012=100, Chained	1959	2022	PCEPI	BEA

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